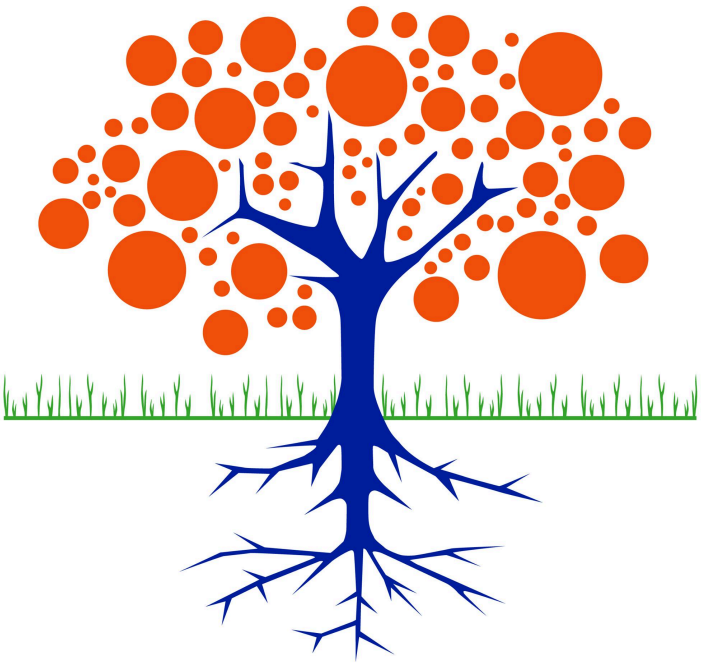


CUNY 2016

29th Annual CUNY Conference on Human Sentence Processing

March 3-5, 2016

TABLE OF CONTENTS

Jerrold J. Katz Young Scholar Award	3
Special Session	5
Sponsors	6
Invited Speakers	7
Program at-a-glance	9
Full Program	10
Poster Sessions	16
Paper abstracts	31
Poster Session 1 abstracts	66
Poster Session 2 abstracts	127
Poster Session 3 abstracts	187
Author Index	248

GENERAL INFORMATION

Event Dates:
Wednesday, March 2nd - Saturday, March 5th, 2016

Meeting Site:
Hilton University of Florida Conference Center
1714 SW 34th Street
Gainesville, FL 32607
P: 352-371-3600

Website: **cuny2016.lin.ufl.edu**

Registration/Check-in:
Please register/check-in at the CUNY Registration Desk, located in the UF Hilton lobby (see map), to receive your name badge and conference materials. Registration includes the CUNY Welcome Reception ("Icebreaker"), breakfast, and morning and afternoon refreshments.

CUNY Registration Desk hours:
Wednesday, March 2nd, 3:00pm-7:00pm (Please check-in at the CUNY registration desk before attending the Welcome Reception to receive your name badge)

Thursday, March 3rd, 7:00am-6:30pm

Friday, March 4th, 7:30am-6:30pm

Saturday, March 5th, 7:30am-6:30pm

Information table:
A CUNY information table will be located in the UF Hilton lobby next to the CUNY Registration Desk, and will be staffed from 7am to 6:30pm daily. Please see the assistants at this table for information about, for instance, local stores and restaurant, lost & found, bus transportation, or if you need to contact one of the organizers.

Transportation and Parking:

Parking:
There is no charge for self-parking at the UF Hilton, even if you aren't a guest of the hotel. If you aren't staying at the UF Hilton, you will be responsible for your own transportation to and from the conference.

Gainesville Airport Shuttle:
The UF Hilton provides a shuttle between 7:00am and 10:00pm. Please call the Hilton to make your shuttle reservation. You will need to provide the hotel with your name, date, arrival/departure time, flight number and contact phone number so they can schedule the shuttle for you.

Wi-Fi
Complimentary Wi-Fi is available in the meeting space. Please connect using the following instructions:

1. Connect to the Wireless Network: **HHonors**
2. Enter the coupon/promotion code: **CUNY2016**

Conference Special Events and Meals:

Wednesday, March 2nd

CUNY Welcome Reception ("Icebreaker"), 5:00pm-7:00pm (Included with registration)
Florida Room (Inside Albert's Restaurant at the UF Hilton, see map)
1714 SW 34th Street, Gainesville, FL 32607

Help us kick off the 29th Annual CUNY Conference with hors d 'oeuvres and network with your colleagues. Please check-in at the CUNY Registration Desk prior to the Welcome Reception to receive your name badge.

Friday, March 4th

CUNY Banquet, 7:00pm – 9:00pm ($50 pre-registration required)
The Warehouse Restaurant
502 S Main St, Gainesville, FL 32601
Complimentary bus transportation will be provided and will leave the UF Hilton starting at 6:30pm.

Enjoy dinner and an evening of live entertainment from the local band, The Savants of Soul. Complimentary bus transportation will be provided to and from the dinner for those who registered for the Banquet. If you would like to add the Banquet to your registration for yourself or a guest, please visit the CUNY registration desk before Friday to pay the $50 Banquet fee.

Thursday, March 3rd -Saturday, March 5th

Breakfast, 8:00am-9:00am
Breakfast is included in the registration and will be provided everyday outside the Century Ballroom at the UF Hilton Conference Center.

Lunch, 12:45pm-3:15pm
Lunch will be on your own. Lunch options include the following:
- Hilton lunch buffet inside Albert's Restaurant
- Local Food Trucks located just outside the Hilton Conference Center
- Off-site Dining options at your discretion (see information table for suggestions)

Poster Session Set-up and Take-down:

Poster sessions will be held Thursday-Saturday from 12:45pm-3:15pm. Presenters of odd-numbered posters will need to be present at their poster from 1:15-2:15pm; Presenters of even-numbered posters will need to be present 2:15-3:15pm. Poster boards and push pins will be provided to hang your poster. Each poster board will be numbered – please refer to the poster session schedule in the program for your poster number. Please hang your poster by 12:45 pm on the day you are scheduled, and remove the poster by the end of that day.

Contacts:

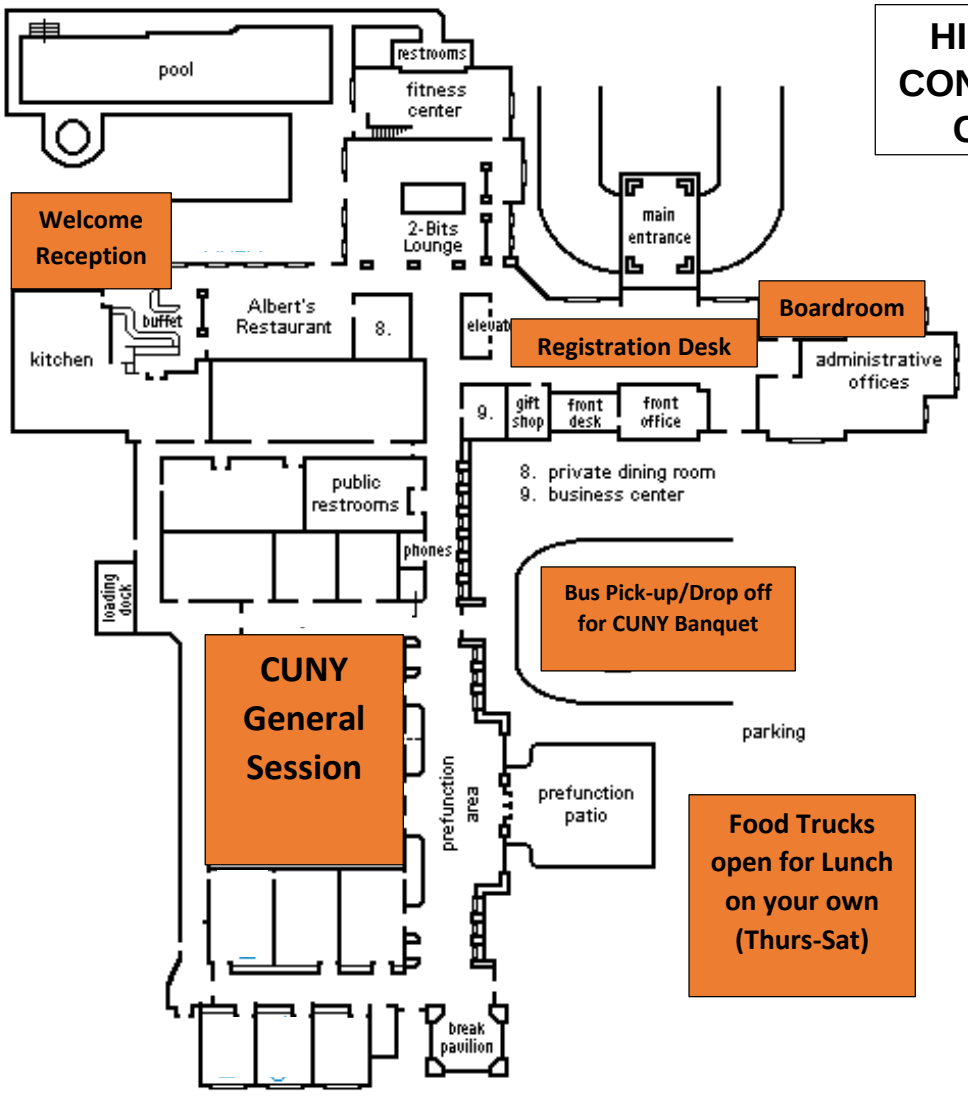
For questions about program content:

Edith Kaan, Chair, CUNY Organizing Committee
Email: cuny2016@lin.ufl.edu

For questions about registration and logistics:

Jenn Walker, Meeting Planner
Mobile: (352) 682-5416
Email: jwalker@dce.ufl.edu

CONFERENCE MAP



Jerrold J. Katz Young Scholar Award

Named in memory of our friend and distinguished colleague, the Jerrold J. Katz Young Scholar Award recognizes the paper or poster presented at the Annual CUNY Conference on Human Sentence Processing that best exhibits the qualities of intellectual rigor, creativity, and independence of thought exemplified in Professor Katz's life and work.

Any first author of a presentation, who is pre-doctoral or up to three years post-PhD, and who is not yet tenured, will be eligible for consideration. The amount of the award is $500.

Previous Recipients

Dan Parker (University of Maryland) for his paper entitled "Time heals semantic illusions, but not syntactic illusions", presented at the 27th Annual CUNY Conference on Human Sentence Processing, Columbus, OH, March **2014**. Parker's co-authors were Colin Phillips and Alan Du.

Chigusa Kurumada (Stanford University) for her paper entitled "Comprehension and acquisition of contrastive prosody: Rational inference helps adults and children cope with noisy input", presented at the 26th Annual CUNY Conference on Human Sentence Processing, Columbia, SC, March **2013**. Kurumada's co-authors were Meredith Brown and Michael Tanenhaus (University of Rochester)

Jana Häussler (University of Potsdam) for her paper entitled "Locality and anti-locality effects in German: Insights from relative clauses," presented at the 25th Annual CUNY Conference on Human Sentence Processing, New York NY, March **2012**. Häussler's co-author was Markus Bader (Goethe Universität, Frankfurt am Main).

Sol Lago and Wing Yee Chow (University of Maryland, College Park), jointly, for their paper entitled "Word frequency affects pronouns and antecedents identically: Distributional evidence," presented at the 24th Annual CUNY Conference on Human Sentence Processing, Palo Alto, CA, March **2011**. Lago and Chow's co-author was Colin Phillips.

Adriana Hanulíková (Max Planck Institute for Psycholinguistics) for her paper entitled "When grammatical errors do not matter: An ERP study on the effect of foreign-accent on syntactic processing," presented at the 23rd Annual CUNY Conference on Human Sentence Processing, New York NY, March **2010**. Hanulíková's coauthors were Merel van Goch and Petra van Alphen.

Adrian Staub (University of Massachusetts, Amherst) for his paper entitled "The timing of garden path effects on eye movements: Structural and lexical factors," presented at the 22nd Annual CUNY Conference on Human Sentence Processing, Davis CA, March **2009**.

Gunnar Jacob (University of Dundee) for his paper entitled "An inter-lingual garden-path? L1 interference in L2 syntactic processing," presented at the 21st Annual CUNY Conference on Human Sentence Processing, Chapel Hill NC, March **2008**. Jacob's coauthor was Roger P.G. van Gompel.

T. Florian Jaeger (University of Rochester) and **Neal Snider** (Stanford University), jointly, for their paper entitled “Implicit learning and syntactic persistence: Surprisal and cumulativity,” presented at the 20th Annual CUNY Conference on Human Sentence Processing, La Jolla, CA, March **2007**.

Scott Jackson (University of Arizona), for his paper entitled “Prosody and logical scope in English,” presented at the 19th Annual CUNY Conference on Human Sentence Processing, New York, NY, March **2006**.

Sachiko Aoshima (American University), for her paper entitled “The source of the bias for longer filler-gap dependencies in Japanese,” presented at the 18th Annual CUNY Conference on Human Sentence Processing, Tucson, AZ, March–April **2005**.

Andrew Nevins (Massachusetts Institute of Technology), for his paper entitled “Syntactic and semantic predictors of tense: An ERP investigation of Hindi,” presented at the 17th Annual CUNY Conference on Human Sentence Processing, College Park, MD, March **2004**. Nevins’s coauthors were Colin Phillips and David Poeppel.

Britta Stolterfoht (Max Planck Institute of Cognitive Neuroscience), for her poster entitled “The difference between the processing of implicit prosody and focus structure during reading: Evidence from brain-related potentials,” presented at the 16th Annual CUNY Conference on Human Sentence Processing, Cambridge, MA, March **2003**. Stolterfoht’s coauthors were Angela D. Friederici, Kai Alter, and Anita Steube.

John Hale (Johns Hopkins University), for his paper entitled “The information conveyed by words in sentences,” presented at the 15th Annual CUNY Conference on Human Sentence Processing, New York, NY, March **2002**.

Award Fund

To make a contribution to the Jerrold J. Katz Fund, please send a check made out to “CUNY Graduate Center (Sentence Processing Conference)” to the address shown below. It would be helpful if you were to write “Jerrold J. Katz Fund” in the memo line of the check.

Dianne Bradley (Katz Award Fund)
Ph.D. Program in Linguistics
CUNY Graduate Center
365 Fifth Avenue
New York, NY 10016-4309

Back to Table of Contents

Special Session

The topic of the CUNY 2016 special session is Language Variation within and across Speakers.

Language processing models of bilinguals, heritage speakers, and second-language learners have been primarily defined as being different from the monolingual native, "invariant" case, abstracting away from the fact that language variation is prominent even within so-called monolingual native speakers of a language. Given the importance and ubiquity of language variation, this phenomenon can no longer be ignored in psycholinguistics. However, language variation is a challenge for acquisition and processing models. How do listeners/readers realize that different utterances are different ways of saying the same thing, rather than different things? How do speakers/listeners determine which option is more appropriate or relevant?

The aim of the special session of the 2016 CUNY conference is:

- (a) to increase awareness among psycholinguists regarding language variation and its challenges for psycholinguistic research;
- (b) to give an interdisciplinary view of language variation by including sociolinguistic and corpus linguistic perspectives; and
- (c) to give an overview of the state-of-the-art psycholinguistic research on language variation in bilinguals, and to show how this research can inform psycholinguistic research on language variation in general.

The special session will bring together six prominent researchers from around the world and with diverse backgrounds to consider these issues:

- **Douglas Biber**, Northern Arizona University
- **Hélène Blondeau**, University of Florida
- **Cynthia G. Clopper**, The Ohio State University
- **Paola Dussias**, The Pennsylvania State University
- **Maria Polinsky**, University of Maryland
- **Guillaume Thierry**, Bangor University

We would like to thank the National Science Foundation and UF's Center for Humanities and the Public Sphere for sponsoring the Special Session.

Back to Table of Contents

Sponsors

We acknowledge the following sponsors for their generous support of the 29th Annual CUNY Conference on Human Sentence Processing:

National Science Foundation
http://www.nsf.gov/

Evelyn F. and William L. McKnight Brain Institute of the University of Florida
http://mbi.ufl.edu/

John Benjamins Publishing Company
https://www.benjamins.com/#home

SR Research
http://sr-research.com/

ANT-Neuro
http://www.ant-neuro.com

UF Center of the Humanities and the Public Sphere
http://www.humanities.ufl.edu/

UF College of Liberal Arts and Sciences
http://www.clas.ufl.edu/

UF Department of Anthropology (Elling Eide Endownment)
http://anthro.ufl.edu/

UF Department of Electrical and Computer Engineering
http://www.ece.ufl.edu/

UF Department of Languages, Literatures and Cultures
http://www.languages.ufl.edu/

UF Department of Linguistics
http://lin.ufl.edu/

UF English Language Institute
http://www.eli.ufl.edu/

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UF Spanish and Portuguese Studies
http://spanishandportuguese.ufl.edu/

CUNY Graduate Center
http://www.gc.cuny.edu/Page-Elements/Academics-Research-Centers-Initiatives/Doctoral-Programs/Linguistics

Back to Table of Contents

Invited Speakers

Douglas Biber is Regents' Professor of English (Applied Linguistics) at Northern Arizona University. His research efforts have focused on corpus linguistics, English grammar, and register variation (in English and cross-linguistic; synchronic and diachronic). He is widely known for his work on the corpus-based *Longman Grammar of Spoken and Written English* (1999) and for the development of 'Multi-Dimensional Analysis' (a research approach for the study of register variation), described in earlier books published by Cambridge University Press (1988, 1995, 1998). More recently he has co-authored a textbook on *Register, Genre, and Style* (Cambridge, 2009), co-edited the new *Cambridge Handbook of English Corpus Linguistics,* and co-authored a research monograph on *Grammatical complexity in academic English: Linguistic change in writing* (Cambridge, in press).

Hélène Blondeau is an Associate Professor in the Department of Languages, Literatures and Cultures at the University of Florida. As a sociolinguist who specializes in language variation and change in situations of language contact her research has focused on the Québec sociolinguistic dynamics. She has examined linguistic change at the individual and community level with regard to morphosyntactic and sociophonetic variables in Montreal French from an apparent-time and real-time perspective. She is currently involved in a major collaborative research project on French in North America funded by the SSHRC *Le francais à la mesure d'un Continent*.

Cynthia G. Clopper is an Associate Professor in the Department of Linguistics and an Associate Director of the Center for Cognitive and Brain Sciences at the Ohio State University. She received her Ph.D. in Linguistics and Cognitive Science from Indiana University and spent one year as a postdoctoral researcher in Psychology at Indiana University and one year as a postdoctoral fellow in Linguistics at Northwestern University, both funded by the National Institutes of Health, before joining the faculty at Ohio State. Her major areas of expertise are phonetics, speech perception, sociophonetics, and laboratory phonology. Dr. Clopper's current research projects examine the relationships between linguistic and indexical sources of variation in speech processing, the effects of experience on the perceptual classification of regional dialects, and regional prosodic variation in American English.

Paola (Giuli) Dussias is Professor of Spanish, Linguistics and Psychology, and Head of the Department of Spanish, Italian and Portuguese at Penn State University. The goal of her work is to employ bilingualism as a tool to uncover important aspects of language function that may be otherwise obscured or difficult to study when examining the behavior of individuals who speak one language. Her work takes a cross-disciplinary approach to bilingual sentence processing using converging methodological tools from linguistics, experimental psycholinguistics, and cognitive neuroscience to examine the way in which bilingual readers and speakers negotiate the presence of two languages in a single mind. Two primary areas of her research are cross-

linguistic effects in bilingual sentence comprehension, and the processing of code-switched sentences. Her work has been supported by grants from the National Science Foundation and the National Institutes of Health.

Maria Polinsky is a Professor of Linguistics at the University of Maryland. Her work is at the intersection of theoretical syntax and study of cross-linguistic variation in sentence structure. She is interested in the ways linguistic theory can be used as a roadmap for understanding how people process language and for obtaining meaningful results that feed back into theory. She specializes in Austronesian and languages of the Caucasus, and has a particular interest in heritage languages. She also studies long-distance dependencies, case assignment, and control/raising.

Guillaume Thierry is Professor of Cognitive Neuroscience and Deputy Head of College for Research at Bangor University (UK). He studies language comprehension in the auditory and visual modalities, and mainly the processing of meaning by the human brain, i.e., semantic access. Since he started his career at Bangor University in 2000, Professor Thierry has investigated a range of themes, such as verbal/non-verbal dissociations, visual object recognition, colour perception, functional cerebral asymmetry, language-emotion interactions, language development, developmental dyslexia and bilingualism. Since 2005, Prof. Thierry's has received funding form the BBSRC, the ESRC, the AHRC, the European Research Council, and the British Academy to investigate the integration of meaning in infants and adults at lexical, syntactic, and conceptual levels, using behavioural measurements, event-related brain potentials eye-tracking and functional neuroimaging, looking at differences between sensory modalities, different languages in bilinguals, and coding system (verbal / nonverbal). Prof. Thierry's core research question is how the human brain crystallises knowledge and builds up a meaningful representation of the world around it. He now focuses on linguistic relativity and the philosophical question of mental freedom. Since 2010, his applied work has also taken him on the path of knowledge transfer to public audiences and professional bodies in domains such as Health & Safety, Environmental Protection, and Global Well-Being by means of public lectures, workshop and immersive theatrical events (*Cognisens*, *Cerebellium*).

Back to Table of Contents

Program-at-a-glance

Wednesday, March 2

8:30 am - 5:30 pm	Pre-CUNY workshop on Event structure; Hilton Garden Inn
5-7pm	Welcome reception (“Ice breaker”), Albert's Restaurant (Hilton Conference center)

Thursday, March 3

8:00 am – 9:00 am	Breakfast; Welcome
9:00 am – 10:45 am	**Session 1**
10:45 am – 11:15 pm	Break
11:15 am – 12:45 pm	**Session 2**
12:45 pm – 3:15 pm	Poster session 1; lunch break
3:15 pm – 4:15 pm	**Session 3**
4:15 pm – 4:45 pm	Break
4:45 pm – 6:30 pm	**Session 4**

Friday, March 4

8:00 am – 9:00 am	Breakfast
9:00 am – 10:45 am	**Sesson 5**
10:45 am – 11:15 am	Break
11:15 am – 12:45 pm	**Session 6**
12:45 pm – 3:15 pm	Poster session 2; lunch break
3:15 pm – 4:15 pm	**Session 7**
4:15 pm – 4:45 pm	Break
4:45 pm – 6:30 pm	**Session 8**
7:00 pm – 9:00 pm	Conference Dinner

Saturday, March 5

8:00 am – 9:00 am	Breakfast
9:00 am – 10:45 am	**Session 9**
10:45 am – 11:15 am	Break
11:15 am – 12:45 pm	**Session 10**
12:45 pm – 3:15 pm	Poster session 3; lunch break
3:15 pm – 4:15 pm	**Session 11**
4:15 pm – 4:45 pm	Break
4:45 pm – 6:30 pm	**Session 12**

Back to Table of Contents

Full Program

Wednesday March 2

8:30am-5:30pm	Pre-CUNY workshop on Event structure (Hilton Garden Inn, this is NOT the CUNY hotel!)
3-7pm	CUNY registration desk open
5-7pm	CUNY welcome reception (Ice breaker), Florida Room (inside Albert's Restaurant)

Presentations related to the special session on Language Variation within and across Speakers are marked with a *
Invited presentations related to the special session are marked with **

Thursday March 3

7am	Registration desk opens	
8-9am	Breakfast	
8:45-9:00am	Welcome (Fiona McLaughlin, Chair UF Linguistics; Kent Fuchs, President University of Florida; Edith Kaan, chair CUNY 2016)	
Session 1 (Chair: Shari Speer)		
9-9:45am	The effects of linguistic and social sources of variation on speech processing**	Cynthia Clopper
9:45-10:15am	Limits on maintaining perceptual information in accented speech processing*	Zachary Burchill, Linda Liu, Kodi Weatherholtz and T. Florian Jaeger
10:15-10:45am	Relative difficulty of understanding foreign accents as a marker of proficiency*	Shiri Lev-Ari, Marieke van Heugten and Sharon Peperkamp
10:45-11:15am	Break	
Session 2 (Chair: Elsi Kaiser)		
11:15-11:45am	The English can't *stand* the bottle like the Dutch: ERPs show language effects on the nonverbal perception of object position	Geertje van Bergen and Monique Flecken
11:45-12:15pm	Print exposure modulates reliance on linguistic context for pronoun comprehension*	Iris Strangmann, Rebecca Nappa and Jennifer E. Arnold
12:15-12:45pm	The moral dimension of implicit verb causality	Laura Niemi, Joshua Hartshorne, Tobias Gerstenberg and Liane Young

Thursday March 3

12:45–3:15pm	Poster session 1 and Lunch break (lunch on your own) 1:15–2:15 odd numbered posters 2:15– 3:15 even numbered posters	
Session 3 (Flash Talks, Chair: Theres Grüter)		
3:15–3:30pm	Adjunct control interpretation in four year olds is colored by the task	Juliana Gerard, Jeffrey Lidz, Shalom Zuckerman and Manuela Pinto
3:30–3:45pm	German relative clauses: The missing-VP effect in double and triple embeddings	Daniela Mertzen, Lena Jäger and Shravan Vasishth
3:45–4:00pm	Gender agreement attraction in Russian: novel patterns in comprehension	Anton Malko and Natalia Slioussar
4:00–4:15pm	L2 learners need more time to predict*	Nicholas Feroce, Patricia Aziz, Eunjin Chun and Edith Kaan
4:15–4:45pm	Break	
Session 4 (Chair: Arielle Borovsky)		
4:45–5:15pm	Novelty of discourse referents promotes heuristics in children's syntactic processing	Yi Ting Huang, Lauren Abadie, Alison Arnold and Erin Hollister
5:15–5:45pm	Interpretation of null and overt pronouns in Chinese	Aili Zhang and Nayoung Kwon
5:45–6:30pm	The unspeakable languages of the human mind**	Guillaume Thierry

Back to Table of Contents

Friday March 4

8am	Registration desk opens	
8-9am	Breakfast (& business meeting for CUNY organizers)	
Session 5 (Chair: Jorge Valdés Kroff)		
9-9:45am	The changing L1: How bilingualism affects syntactic processing in the native language**	Giuli Dussias
9:45-10:15am	Linguistic experience (L1 vs. L2) shapes sentence formulation*	Agnieszka Konopka and Tess Forest
10:15-10:45am	In language change, processing effects precede loss in production*	Björn Lundquist, Yulia Rodina, Irina Sekerina and Marit Westergaard
10:45-11:15am	Announcements/ Break	
Session 6 (Chair: Darren Tanner)		
11:15-11:45am	EEG correlates of syntactic expectation reflect both word-to-word and hierarchical dependencies	Jonathan Brennan, Max Cantor, Rachael Eby and John Hale
11:45-12:15pm	Lexical predictions and the structure of semantic memory: EEG evidence from case changes	Shota Momma, Yingyi Luo, Hiromu Sakai, Ellen Lau and Colin Phillips
12:15-12:45pm	Early predictability and delayed integration effects in reading: Neural and behavioral evidence	Trevor Brothers, Tamara Swaab and Matt Traxler
12:45-3:15pm	Poster session 2 and Lunch break (lunch on your own) 1:15-2:15 odd numbered posters 2:15- 3:15 even numbered posters	
Session 7 (Chair: Roger Levy)		
3:15-3:45pm	Memory-based limits on surprisal-based syntactic adaptation	Les Sikos, Hannah Martin, Laura Fitzgerald and Dan Grodner
3:45-4:15pm	The Priming of Basic Combinatory Responses in MEG	Esti Blanco-Elorrieta, Victor Ferreira, Paul Del Prato and Liina Pylkkänen
4:15-4:45pm	A meta-analysis of syntactic priming in language production	Kyle Mahowald, Ariel James, Richard Futrell and Edward Gibson
4:45-5:15pm	Break	

Friday March 4

Session 8 (Chair: Ratree Wayland)		
5:15-6:00pm	Language variation and the role of individuals in community changes: The sociolinguistic making of Montreal French**	Hélène Blondeau
7:00-9:00pm	Conference dinner at The Warehouse, downtown Gainesville (Transportation provided)	

Back to Table of Contents

Saturday March 5

8am	Registration desk opens	
8-9am	Breakfast	
Session 9 (Chair: Steffi Wulff)		
9-9:45am	What does it take to be a native speaker?**	Maria Polinsky
9:45-10:15am	Register variation as a mediating factor for linguistic processing**	Douglas Biber
10:15-10:45am	Bottom-up adaptation of online pragmatic inferences to variability of speakers*	Rachel Ryskin, Chigusa Kurumada and Sarah Brown-Schmidt
10:45-11:15am	Break	
Session 10 (Chair: Matt Wagers)		
11:15-11:45am	Obligatory and optional focus association in sentence processing	Barbara Tomaszewicz and Roumyana Pancheva
11:45-12:15pm	Closest conjunct agreement in English: A comparison with number attraction	Lap-Ching Keung and Adrian Staub
12:15-12:45pm	Attraction and similarity-based interference in object gender agreement	Sandra Villata and Julie Franck
12:45-3:15pm	Poster session 3 and Lunch break (lunch on your own) 1:15-2:15 odd numbered posters 2:15- 3:15 even numbered posters	
Session 11 (Chair: Jennifer Arnold)		
3:15-3:45pm	On the comprehension of referring expressions: the role of coordination in conversation	Delphine Dahan, Michael Coffel and Devin Barney
3:45-4:15pm	I see what you meant to say: Effects of plausibility and speaker certainty on processing of repair disfluencies	Matthew Lowder and Fernanda Ferreira
4:15-4:45pm	Input complexity and rule induction. An entropy model	Silvia Radulescu, Frank Wijnen and Sergey Avrutin

Saturday March 5

4:45-5:15pm	Break	
Session 12 (Chair: Eleonora Rossi)		
5:15-5:45pm	Executive-function skills support sentence processing: Evidence from adult learners	Lucia Pozzan, Morgan Berman and John Trueswell
5:45-6:30pm	Comprehenders infer influences of discourse intent and speaker knowledge state on linguistic form*	Mark Myslín, Roger Levy and Andrew Kehler

Back to Table of Contents

Poster session 1 (Thursday March 3; 1:15-3:15pm)

	Session Day	Title	Authors
1	Thursday	A constraint on the online empty pronoun resolution in Japanese	Tomohiro Fujii, Hajime Ono and Masaya Yoshida
2	Thursday	A Gradient Symbolic Computation model of incremental processing	Pyeong Whan Cho, Matthew Goldrick and Paul Smolensky
3	Thursday	A new model for processing antecedent-ellipsis mismatches	Dan Parker
4	Thursday	A rating study of frozen scope in the VP-internal locative alternation*	Sarah Kresh
5	Thursday	Accessibility as a cross-linguistic mechanism of pronoun use: Evidence from Cantonese	Heeju Hwang
6	Thursday	Adaptation of gap predictions in filler-gap dependency processing	Emily Atkinson and Akira Omaki
7	Thursday	Agreement Attraction in NP ellipsis	Nayoun Kim, Laurel Brehm and Masaya Yoshida
8	Thursday	Agreement attraction in person is symmetric	Anna Laurinavichyute and Shravan Vasishth
9	Thursday	All by myself or Obama's elf? The influence of social network size on speech perception*	Shiri Lev-Ari
10	Thursday	Alpha power decreases during center embedding in natural stimuli	Marten van Schijndel and William Schuler
11	Thursday	An asymmetry of agreement attraction provides evidence for self-organized parsing	Garrett Smith, Julie Franck and Whitney Tabor
12	Thursday	An ERP preliminary analysis of the Person Split in Italian	Paolo Lorusso, Anna Dora Manca, Ludovico Franco and Mirko Grimaldi
13	Thursday	Aspect attrition in Russian-German bilingual speakers	Olga Dragoy, Ekaterina Virfel, Anna Yurchenko and Roelien Bastiaanse

Poster session 1 (Thursday March 3; 1:15-3:15pm)

14	Thursday	Attraction interference effects of number in pronominal resolution processing in Brazilian Portuguese	Michele Alves
15	Thursday	Bayesian Pronoun Interpretation in Mandarin Chinese	Meilin Zhan, Roger Levy and Andrew Kehler
16	Thursday	Bilingual language control in perception vs. action: MEG reveals comprehension control mechanisms in anterior cingulate cortex and domain-general control of production in dorsolateral prefrontal cortex*	Esti Blanco-Elorrieta and Liina Pylkkänen
17	Thursday	Can measures of processing complexity predict progressive aphasia from speech?	Kathleen C. Fraser, Marten van Schijndel, Naida Graham, Elizabeth Rochon and Sandra Black
18	Thursday	Children's incremental interpretation of grammatical aspect	Laura Wagner, Shari Speer and Faith Stagge
19	Thursday	Cognitive-control effects on the kindergarten path: Separating correlation from causation	Yi Ting Huang, Juliana Gerard, Nina Hsu, Alix Kowalski and Jared Novick
20	Thursday	Comparative ellipsis has an object bias, though subjects are more frequent	Katy Carlson, Benjamin Lee, Sarah Nelson and Blake Clark
21	Thursday	Comparing On-line and Off-line Comprehension of Non-canonical Sentences in L1 Adults, L1 Children and L2 Children – Evidence from an Eye-tracking Study	Valentina Cristante and Sarah Schimke
22	Thursday	Complexity effects in sluicing and sprouting	Kathleen Hall and Masaya Yoshida
23	Thursday	Comprehenders reason about competing causal sources of binomial ordering	Mark Myslín, Emily Morgan and Roger Levy
24	Thursday	Comprehension Priming Evidence for Elliptical Structures	Julian Grove, Emily Hanink and Ming Xiang

Poster session 1 (Thursday March 3; 1:15-3:15pm)

25	Thursday	Computation of Agreement is Verb-Centric Regardless of Word Order	Caroline Andrews and Brian Dillon
26	Thursday	Connecting verbs to syntax: Modifying verb bias	Yi Lin and Cynthia Fisher
27	Thursday	Constraints on adaptation to syntactic variability between and within speakers*	Rachel Ryskin, Zhenghan Qi, Melissa Duff and Sarah Brown-Schmidt
28	Thursday	Correlate not optional: PP sprouting in 'much less' ellipsis.	Jesse Harris and Katy Carlson
29	Thursday	Crosslinguistic activation of referential bias in Korean-English bilinguals*	Hyunwoo Kim and Theres Grüter
30	Thursday	Cross-linguistic variation in sensitivity to grammatical errors: evidence from multilingual speakers*	Sol Lago, Anna Stutter and Claudia Felser
31	Thursday	Cute little puppies and nice cold beers: Rethinking the role of prenominal adjectives	Michael Ramscar, Melody Dye, Petar Milin, and Richard Futrell
32	Thursday	Dependency resolution difficulty increases with distance in Persian complex predicates: Evidence against the expectation-based account	Molood Sadat Safavi, Samar Husain and Shravan Vasishth
33	Thursday	Dialectal adaptation suggests rapid implicit learning of unfamiliar syntactic structures*	Scott Fraundorf, T. Florian Jaeger and Michael Tanenhaus
34	Thursday	Differences in pronoun comprehension between native and non-native speakers: Evidence from implicit causality/consequentiality verbs*	Wei Cheng and Amit Almor
35	Thursday	Differential ERPs to local vs. global prediction failures	Giulia Bovolenta, Stephen Politzer-Ahles and E. Matthew Husband
36	Thursday	Discourse attention during utterance planning affects referential form choice*	Sandra Zerkle and Jennifer E. Arnold

Poster session 1 (Thursday March 3; 1:15-3:15pm)

37	Thursday	Dissociating retrieval interference and reanalysis in agreement comprehension: ERP evidence	Darren Tanner, Sarah Grey, Erika Exton and Janet van Hell
38	Thursday	Distributing events across intervals explains difficulties in aspectual processing	David Townsend, Froogh Aziz and Kerry McDermott
39	Thursday	D-linking and working memory: New evidence from Spanish	Alex Stiller and Grant Goodall
40	Thursday	Do code-switches lead to increased difficulty in comprehension? Examining the cognitive processes that integrate different forms of unexpectancy*	Jorge Valdes Kroff, Patricia Roman, Javier Solivan, Maya Waide and Paola Dussias
41	Thursday	Does syntactic flexibility in production facilitate or inhibit planning?*	Guillermo Montero-Melis, Esteban Buz and T. Florian Jaeger
42	Thursday	Does visual cognitive control engagement help listeners tidy up the garden-path?	Nina Hsu, Ashley Thomas and Jared Novick
43	Thursday	Downstream repetition effects reveal a lack of episodic traces for predictable words	Joost Rommers and Kara D. Federmeier
44	Thursday	Effects of definiteness and wh type on filler-gap dependency	Rebecca Tollan and Daphna Heller
45	Thursday	Effects of Inference Relations and unique Identifiability on Referent Management	Andreas Brocher and Klaus von Heusinger
46	Thursday	Experimental evidence that "weak definite" noun phrases are not interpreted as generics	Thaís M. M. de Sá, Greg N. Carlson, Maria Luiza Cunha Lima and Michael K. Tanenhaus
47	Thursday	Exploring the effects of Theory of Mind and Shared Information in Perspective-Taking	Xiaobei Zheng, Irene Symeonidou and Richard Breheny
48	Thursday	Eye-tracking evidence for active gap-filling regardless of dependency length	Wing-Yee Chow, Yangzi Zhou and Rosanna Todd

Poster session 1 (Thursday March 3; 1:15-3:15pm)

49	Thursday	Facilitatory intrusion effects in subject-verb honorific agreement in Korean	Nayoung Kwon and Patrick Sturt
50	Thursday	Felicity Condition and Children's Knowledge of Restrictive Focus	Yi-ching Su
51	Thursday	Foreign accent affects pragmatic inferences*	Sarah Fairchild and Anna Papafragou
52	Thursday	Forward perceptual spans as informationally equivalent across languages	Daniel Tucker and Klinton Bicknell
53	Thursday	French object relatives: evidence against DLT but not entirely explained by frequency	Céline Pozniak, Barbara Hemforth and Anne Abeillé
54	Thursday	Frequency-(in)dependent regularization in language production and cultural transmission*	Emily Morgan and Roger Levy
55	Thursday	Gender and discourse-based differences in processing Spanish copulas*	Sara Sánchez-Alonso, Ashwini Deo and María Piñango
56	Thursday	Grammaticality illusions are conditioned by lexical item-specific grammatical properties	Jérémy Pasquereau and Brian Dillon
57	Thursday	Korean L2 learners' structural priming mediated by speakers with different English accents*	Eunjin Chun, Julia Barrow and Edith Kaan
58	Thursday	Linear proximity effects in Hindi reciprocal resolution	Samar Husain and Dave Kush
59	Thursday	Split intransitivity modulates look-ahead effects in sentence planning	Shota Momma, L. Robert Slevc and Colin Phillips
60	Thursday	Using grammatical features to forecast incoming structure: The processing of across-the-board extraction	Patrick Sturt and Andrea E. Martin

Poster session 2 (Friday March 4; 1:15-3:15pm)

	Session	Title	Authors
1	Friday	Exploring memory and processing through a gold standard annotation of Dundee	Cory Shain, Marten van Schijndel, Edward Gibson and William Schuler
2	Friday	High or low motor: a norming study for verbs.	Julie Carranza, Michael Kaschak, Arielle Borovsky and Edward Bernat
3	Friday	Incremental interpretation and its disruption by negative arguments	Jakub Dotlacil and Arnout Koornneef
4	Friday	Incremental interpretation in cases of individual/degree polysemy	Margaret Grant, Sonia Michniewicz and Jessica Rett
5	Friday	Individual differences in predictive processing: Evidence from subject filled-gap effects in native and non-native speakers of English*	Adrienne Johnson, Robert Fiorentino and Alison Gabriele
6	Friday	Inferring individuals' scalar thresholds: What counts as tall for you?*	Eva Wittenberg, David Barner and Roger Levy
7	Friday	Informational focus in Spanish pronoun resolution: answering the QUD	Alyssa Ibarra and Jeff Runner
8	Friday	Interactions between Reading Skills and Lexical Properties on On-line Sentence Reading	Tao Gong, Dave Braze, Jim Magnuson, Einar Mencl, Whitney Tabor, Julie Van Dyke and Donald Shankweiler
9	Friday	Intraspeaker priming of sociolinguistic variation: cognitive and linguistic complexity*	Meredith Tamminga
10	Friday	Intrusive reflexive binding inside a fronted wh-predicate	Akira Omaki, Zoe Ovans and Brian Dillon
11	Friday	Investigating the modulatory effect of expectations on memory retrieval during sentence comprehension	Luca Campanelli, Julie Van Dyke and Klara Marton
12	Friday	Learning a talker or learning an accent: cross-talker generalization of phonetic adjustment to foreign-accented speech*	Xin Xie and Emily Myers

Poster session 2 (Friday March 4; 1:15-3:15pm)

13	Friday	Length effects in an OV language with Differential Object Marking and mixed head direction	Pegah Faghiri and Barbara Hemforth
14	Friday	Like water off a duck's back: How listeners react to and recover from referential infelicity	Agatha Rodrigues, Raheleh Saryazdi and Craig Chambers
15	Friday	Limited Reactivation of Syntactic Structure in Noun Phrase Ellipsis	Chelsea Miller and Matt Wagers
16	Friday	Linear order and syntactic structure in sentence priming	Hezekiah Akiva Bacovcin and Meredith Tamminga
17	Friday	Listening through voices: Infant statistical word segmentation across multiple speakers*	Casey Lew-Williams and Katharine Graf Estes
18	Friday	Locality effects for adverbials: A case of Japanese adverbial NPIs	Kentaro Nakatani
19	Friday	Long-term syntactic adaptation for relative clause attachment preferences: Evidence from ERPs	Trevor Brothers, Tamara Swaab and Matt Traxler
20	Friday	Low predictability: An empirical comparison of paradigms used for sentence comprehension	Christine Ankener, Mirjana Sekicki and Maria Staudte
21	Friday	Structural constraints strongly determine the attachment of temporal adverbs	Nicoletta Biondo, Francesco Vespignani and Brian Dillon
22	Friday	Mandarin Chinese and a Southwestern Mandarin Dialect Display Different Typological Properties in Describing Different-trajectory Caused Motion Events.*	Jing Paul
23	Friday	Mandarin relative clause processing or the joy of replication	Céline Pozniak and Barbara Hemforth
24	Friday	Markedness matters: An event related potentials study of gender, number, and person agreement in Spanish	José Alemán Bañon and Jason Rothman

Poster session 2 (Friday March 4; 1:15-3:15pm)

25	Friday	Metaphor out of School: Electrophysiological Correlates of Metaphor processing in Lower and Higher Literates*	Simona Di Paola, Paolo Canal, Irene Ricci, Chiara Bertini, Pier Marco Bertinetto, Andrea Moro and Valentina Bambini
26	Friday	Minding the gap: The parser avoids relative clause analyses whenever it can	Francesca Foppolo, Carlo Cecchetto, Caterina Donati, Vincenzo Moscati and Adrian Staub
27	Friday	Misrepresentations of plurality in late processing: evidence from self-paced reading	Jack Dempsey, Kiel Christianson and Darren Tanner
28	Friday	Morphological antecedents of individual variability in agreement comprehension: ERP evidence	Darren Tanner, Nyssa Z. Bulkes, Kailen Shantz, Chase Krebs, Andrew Armstrong and Amalia Reyes
29	Friday	Modality general and specific brain responses during reference resolution	Christian Brodbeck, Laura Gwilliams and Liina Pylkkänen
30	Friday	Morphosyntactic and semantic prediction in L1 and L2 speakers of German	Courtney Johnson Fowler and Carrie Jackson
31	Friday	Native English speakers' structural alignment with foreign-accented speech*	Eunjin Chun, Julia Barrow and Edith Kaan
32	Friday	Neural basis for goal-oriented conversation*	Masako Hirotani, Takahiko Koike, Shuntaro Okazaki, Motofumi Sumiya, Maho Hashiguchi, Yoshikuni Ito, Douglas Roland and Norihiro Sadato
33	Friday	Neurophysiological responses to mixed noun phrases in speakers who codeswitch and don't codeswitch*	Anne Beatty-Martínez and Giuli Dussias
34	Friday	On the unbalance between subject and object relative clauses in discourse context	Renê Forster and Letícia Maria Sicuro Corrêa
35	Friday	On-line prosessing of bi-aspectual verbs in Czech	Štěpán Matějka, Jan Chromý and Jakub Dotlacil

Poster session 2 (Friday March 4; 1:15-3:15pm)

36	Friday	Oscillatory signatures of morpho-syntactic processing in native and L2 speakers	Yanina Prystauka and Eleonora Rossi
37	Friday	Parallelism guides syntactic prediction for across-the-board extraction	Dan Parker and Liana Abramson
38	Friday	Passive sentences can be predicted by adults	Karin Stromswold, Melinh Lai, Paul de Lacy and Gwendolyn Rehrig
39	Friday	People are better at taking the perspective of non-native speakers*	Shiri Lev-Ari
40	Friday	Person blocking effects in the processing of English reflexives	Shayne Sloggett and Brian Dillon
41	Friday	Phoneme ambiguity is reflected very early in primary auditory cortex	Laura Gwilliams, Tal Linzen, Kyriaki Neophytou, Lena Warnke, David Poeppel and Alec Marantz
42	Friday	Pitch shape modulates the time course of tone vs. pitch accent processing in Mandarin Chinese	Zhaohong Wu and Marta Ortega-Llebaria
43	Friday	Prediction and inhibition of syntactic structure: Evidence from either (of the)… or.	Kelly-Ann Blake, Frederick Gietz and Margaret Grant
44	Friday	Prediction failure blocks the use of local semantic context	Giulia Bovolenta and E. Matthew Husband
45	Friday	Preverbal and clause-final negation in Spanish/Palenquero bilinguals	Lauren Perrotti
46	Friday	Priming of quantifier scope resolution reveals differences between each and every one, but similarities across all	Roman Feiman and Jesse Snedeker
47	Friday	Print exposure modulates effects of repetition priming during sentence reading	Matthew Lowder and Peter Gordon
48	Friday	Prior experience influences predictive processing in novel sentences	Arielle Borovsky

Poster session 2 (Friday March 4; 1:15-3:15pm)

49	Friday	Proactive interference in anaphoric dependency resolution: Evidence from Chinese	Zhong Chen
50	Friday	Processing at least in ignorance contexts is costly: Evidence from eye movements	Stavroula Alexandropoulou, Jakub Dotlačil and Rick Nouwen
51	Friday	Processing code-switching in Algerian bilinguals: Effects of language use, semantic expectancy and cognates	Souad Kheder and Edith Kaan
52	Friday	Processing English Passives: Interaction with Event Structure, but no Evidence for Heuristics	Caterina Laura Paolazzi, Nino Grillo, Artemis Alexiadou and Andrea Santi
53	Friday	Processing Hindi relative clauses: Evidence against expectation-based theories	Samar Husain and Shravan Vasishth
54	Friday	Processing polarity by native speakers and L2 learners: ERP evidence for quantitative differences	Juliane Domke
55	Friday	Processing pronouns: Null vs. Overt in Vietnamese	Binh Ngo and Elsi Kaiser
56	Friday	Pronoun resolution in semantically biased contexts: evidence from heritage Russian	Tanya Ivanova-Sullivan
57	Friday	Pronoun resolution within- and across sentences: Effects of subjecthood and verb bias	Emily Fedele and Elsi Kaiser
58	Friday	What we know about knowing: An ERP study of factive verbs	Einat Shetreet, Jacopo Romoli, Gennaro Chierchia and Gina Kuperberg
59	Friday	Rapid accent adaptation and constraints on cross-talker generalization	Kodi Weatherholtz, Linda Liu and T. Florian Jaeger
60	Friday	Ellipsis with garden-path antecedents in French	Dario Paape, Barbara Hemforth and Shravan Vasishth

Poster session 3 (Saturday March 5; 1:15-3:15)

	Session	Title	Authors
1	Saturday	Agreement attraction is selective: Evidence from eye-tracking	Dan Parker, Michael Shvartsman and Julie Van Dyke
2	Saturday	Differential processing of code-switched speech by Spanish-English bilinguals: The role of exposure*	Jorge Valdes Kroff, Teresa Bajo and Paola Dussias
3	Saturday	Interaction between morphological complexity and rhyme	Hezekiah Akiva Bacovcin, Amy Goodwin Davies, Robert Wilder and David Embick
4	Saturday	Processing of self-repairs in stuttered and non-stuttered speech*	Matthew Lowder, Nathan Maxfield and Fernanda Ferreira
5	Saturday	Quantitative and qualitative differences across individuals in anticipation-driven comprehension*	Hongoak Yun, Dongsu Lee, Yunju Nam, Upyong Hong and Duck Geun Yoo
6	Saturday	Reassessing the poverty of the stimulus in that-trace effects	Bob Frank and Rebecca Marvin
7	Saturday	Reflexive Retrieval in Mandarin Chinese: Evidence against the Local Search Hypothesis	Yuhang Xu and Jeffrey Runner
8	Saturday	Repetition modulates the range of learning in subject-verb agreement	Heidi Lorimor, Nora Adams and Carrie Jackson
9	Saturday	Resolving Quantity and Informativeness implicature in indefinite reference	Till Poppels and Roger Levy
10	Saturday	Resolving the underspecified: Pronominal integration with topicalization and informativity	Daniel Tsz-hin Lee, Chin-Lung Yang and Cecilia Yuet-Hung Chan
11	Saturday	Save the date – Eye Movements during calendar date processing reflect pre-articulatory self-monitoring	Ibolya Kurucz and Johannes Gerwien
12	Saturday	Screening for Alzheimer's with psycholinguistics	Marten van Schijndel and Kathleen C. Fraser

Poster session 3 (Saturday March 5; 1:15-3:15)

13	Saturday	Semantic effects in bivarietal picture naming*	Marie-Anne Morand, Constanze Vorwerg, Holly Branigan and Martin Pickering
14	Saturday	Semantic interference in sentence production in three languages*	Jessica Montag and Maryellen MacDonald
15	Saturday	Semantic predictability affects the production of null pronouns in Spanish	Jennifer E. Arnold, Ana Medina-Fetterman and Natasha Vasquez
16	Saturday	Semantic priming starts in the parafovea: Evidence from survival analysis	Renske S. Hoedemaker and Peter Gordon
17	Saturday	Sentence processing in aphasia: Test-retest reliability and effects of language treatment	Jennifer Mack and Cynthia K. Thompson
18	Saturday	Slow, NOT Shallow Processing of (in)definiteness in L2 English	Hyunah Ahn
19	Saturday	Speaker likeability influences utterance acceptability: Social context modulates tolerance for pragmatic violations in adults	Les Sikos, Minjae Kim and Daniel Grodner
20	Saturday	Similar words compete, but only when they're from the same category	Shota Momma, Julia Buffinton, L. Robert Slevc and Colin Phillips
21	Saturday	Making the expected less expected: Text movement and discourse	Elsi Kaiser
22	Saturday	Structural priming from errors reflects alignment, not residual activation	L. Robert Slevc
23	Saturday	Subcategorization frame entropy in online verb-learning	Aaron Steven White, Valentine Hacquard, Philip Resnik and Jeffrey Lidz
24	Saturday	Syntactic and pragmatic factors drive asymmetries in online processing of 'only': Evidence from eye-tracking	Pooja Paul, Tanya Levari and Jesse Snedeker

Poster session 3 (Saturday March 5; 1:15-3:15)

25	Saturday	Individual differences in distributional learning and online processing	Jessica Hall, Thomas Farmer and Amanda Owen Van Horne
26	Saturday	The acquisition of focus constructions in Mandarin Chinese	Hui-ching Chen, Stephen Crain and Barbara Höhle
27	Saturday	The binding options of German D-Pronouns	Stefan Hinterwimmer and Andreas Brocher
28	Saturday	The communicative function of German noun classification	Melody Dye, Petar Milin, Christian Adam, Richard Futrell and Michael Ramscar
29	Saturday	The contribution of verbs and conceptual representations to grammatical function assignment in Korean sentence processing	Gyu-ho Shin and Hyunwoo Kim
30	Saturday	The discourse history: When does the past influence the present?	Si On Yoon and Sarah Brown-Schmidt
31	Saturday	The effect of prominence on antecedent retrieval: new SAT evidence	Dave Kush and Julie Van Dyke
32	Saturday	The effect of verbal aspect and verb type on the salience of discourse entities	Meghan Salomon and Gregory Ward
33	Saturday	The effects of contextual predictability and parafoveal preview on word recognition during reading: A comparison between older and young adults	Wonil Choi, Matthew Lowder, Fernanda Ferreira, Tamara Swaab and John Henderson
34	Saturday	The eLAN as an attentional efficiency-dependent modulation of the domain-general N100	Christopher Barkley, Robert Kluender and Marta Kutas
35	Saturday	The good, the bad, and the ugly: Incremental interpretation of evaluative adjectives	Robert Redford and Craig Chambers

Poster session 3 (Saturday March 5; 1:15-3:15)

36	Saturday	The morphosyntactic representation of language varieties: Bivarietal syntactic priming	Janine Lüthi, Constanze Vorwerg, Martin Pickering and Holly Branigan
37	Saturday	The magnitude of syntactic self- and comprehension-to-production priming*	Cassandra L. Jacobs and Duane Watson
38	Saturday	The processing of garden-path sentences by Spanish-English bilinguals: a visual word study*	Carla Contemori, Lucia Pozzan, Phillip Galinsky and Giuli Dussias
39	Saturday	The processing of third person singular -s by African American English speaking second graders: an auditory ERP study*	J. Michael Terry, Erik Thomas, Sandra C. Jackson and Masako Hirotani
40	Saturday	The prosody of (Pseudo)Relatives and Production Planning	Nino Grillo and Giuseppina Turco
41	Saturday	The role of language dominance on early bilinguals' syntactic analysis*	Sendy Caffarra, Horacio Barber, Nicola Molinaro and Manuel Carreiras
42	Saturday	The role of retrieval interference in recovery from ungrammaticality	Patrick Sturt and Nayoung Kwon
43	Saturday	The role of Tagalog verbal agreement in processing wh-dependencies	Jed Pizarro-Guevara and Matt Wagers
44	Saturday	The syntax of null objects: evidence from inter-speaker variation*	Kyeong-min Kim, Chung-hye Han and Keir Moulton
45	Saturday	Three wh-words are better than two (when violating the Superiority Condition)	Lauren Ackerman and Masaya Yoshida
46	Saturday	Toward a comprehensive view of structural priming: What gets primed when	Jayden Ziegler and Jesse Snedeker
47	Saturday	Trait vividness and task demands shape online engagement of semantic processes in sentence and word comprehension*	Cybelle Smith and Kara D. Federmeier

Poster session 3 (Saturday March 5; 1:15-3:15)

48	Saturday	Tuning in: adaptation to mispronunciation in foreign-accented sentence comprehension*	Eric Pelzl, Taomei Guo and Ellen Lau
49	Saturday	Understanding contextual effects during the real-time comprehension of verbal irony*	Rachel Adler, Jared Novick and Yi Ting Huang
50	Saturday	Use of contextual information to facilitate semantic processing in reading and listening by lower literate adults	Shukhan Ng, Brennan R. Payne, Elizabeth A. L. Stine-Morrow and Kara D. Federmeier
51	Saturday	Using event-related potentials to examine individual differences in the processing of pronominal reference*	Robert Fiorentino, Alison Gabriele and Lauren Covey
52	Saturday	Validating a new tool to explore psycholinguistic processing in infancy	Ryan Peters, Emanuel Boutzoukas, Ken McRae and Arielle Borovsky
53	Saturday	Variation in prosodic planning among individuals and across languages*	Benjamin Swets, Caterina Petrone, Susanne Fuchs and Jelena Krivokapić
54	Saturday	Variation in sentence processing strategies between bilingual groups: On-line and off-line pronoun interpretation*	Amy Bustin
55	Saturday	Variation in the German sentence 'forefield': the impact of visual context for the evaluation of verb-second (V2) violations*	Heike Wiese, Juliane Burmester and Isabell Wartenburger
56	Saturday	Verb position predicts processing difficulty in a flexible SOV language	Savithry Namboodiripad and Grant Goodall
57	Saturday	Verb transitivity effects: Commas aren't the cause	Trevor Brothers and Matt Traxler
58	Saturday	Word learning in linguistic context: Processing and memory effects	Yi Ting Huang and Alison Arnold
59	Saturday	Topic-hood differently affects processing Japanese repeated names and pronouns	Shinichi Shoji, Stanley Dubinsky and Amit Almor

Paper Abstracts

The effects of linguistic and social sources of variation on speech processing

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The speech signal is highly variable and the realization of individual segments and words is affected by linguistic factors (such as lexical frequency, neighborhood density, and semantic predictability) and social factors (such as gender, dialect, and speaking style). This abundant variation must be effectively and efficiently handled for speech processing to be successful. Decades of speech perception research has demonstrated the significant impact of these sources of variation on lexical processing: high frequency words are more intelligible than low frequency words (Howes, 1957), familiar talkers are more intelligible than unfamiliar talkers (Nygaard & Pisoni, 1998), and familiar dialects are more intelligible than unfamiliar dialects (Labov & Ash, 1997). However, most of this work has examined these sources of variation independently from one another. One major strand of ongoing research in my laboratory takes a broader perspective and explores the combined effects of these various linguistic and social sources of variability on lexical activation, recognition, and encoding.

The results reveal complex patterns of processing costs and benefits associated with lexical competition, previous exposure to variation, experimental context, and task demands. For example, in a cross-modal lexical decision task, more lexical competition and more previous exposure to dialect variation reduce both facilitation for matching prime-target pairs and inhibition for minimally-paired primes and targets, suggesting that multi-dialectal participants adopt a delayed processing strategy resulting in a similar delay to that observed for words with many lexical competitors. By contrast, in a recognition memory task in noise, the local dialect leads to stronger repetition memory and lexical competition effects than a non-local dialect for both local and non-local listeners, suggesting that all listeners may have expectations about the type of speech they are likely to hear in a university laboratory (i.e., the local dialect).

Similarly, in a word recognition task in noise, regional dialect and speaking style effects on intelligibility emerge for female talkers but not for male talkers. This gender difference is echoed in a cross-modal lexical decision task in which primes produced by male talkers in plain lab speech lead to slower lexical decisions for unrelated targets than primes produced by female talkers or in clear lab speech. Together, these two sets of results suggest lexical processing costs associated with phonetically-reduced speech in plain lab styles and from male talkers (Bradlow et al., 1996; Byrd, 1994). However, phonetic reduction cannot fully explain these results because the effects of lexical frequency differ depending on the nature of the task: phonetically-reduced high-frequency words are more intelligible in noise, but lead to slower lexical decisions to unrelated targets, relative to low-frequency primes. These results thus further suggest that listener have expectations about the type of speech they are likely to hear in an experimental setting (i.e., high frequency words, reduced speech from men but not women).

The overall effects of these linguistic and social sources of variability on lexical processing are consistent with exemplar-based models in which linguistic, social, and contextual factors jointly contribute to lexical processing and representation. However, although exemplar models can straightforwardly account for lexical frequency and talker or dialect familiarity effects, these models must be elaborated to account for the interactions of these effects with experimental context and listener expectations about the task. Further, the differences we have observed across tasks suggest that task demands, including the presence vs. absence of noise and the nature of the required response (e.g., speeded vs. not), may play a critical role in how linguistic and social variation impacts lexical processing. Extension of this work to more ecologically valid tasks, including processing of units longer than a single word, is essential for understanding the effects of variation on speech processing.

Back to Thursday March 3

Limits on maintaining perceptual information in accented speech processing

Zachary Burchill, Linda Liu, Kodi Weatherholtz, T. Florian Jaeger
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Understanding speech is one of the biggest computational challenges the brain has to face: it must compress a high dimensional perceptual signal into increasingly abstract representations (such as sentences and meanings) before memory limitations degrade the original percept. Although these limitations have long been thought to strongly constrain language, **recent work suggests listeners maintain lower-level perceptual information** for periods of time (for review, see Dahan, 2010). New studies have found that perceptual information can be maintained for at least 6-8 syllables, the longest durations tested (Stostak & Pitt, 2013; Bicknell et al., 2014). A downside to these paradigms is that they use a large number of repetitions of the same item with different acoustic realizations. This raises the possibility that subjects are using experiment-specific strategies, leaving open the question of **whether everyday language comprehension actually involves maintaining perceptual information**.

We address this question using a novel paradigm to study how listeners process foreign accented speech. Mitterer & McQueen (2009) demonstrate that pairing accented speech with subtitles helps second language learners better comprehend novel accented sentences. In our experiment, we manipulate the delay between text and audio to test whether **native** listeners maintain enough perceptual information for **delayed subtitles to have similar effects**.

Native speakers of American English (n=93, balanced across 3 conditions) participated in a **web-based exposure-test paradigm** on Amazon Mechanical Turk. During **exposure,** subjects heard 42 sentences from a male talker with a heavy Indian English accent. These sentences were selected from a web-based philosophy course from the Indian University of Technology Madras. Subjects in the *subtitle-present* condition heard each sentence and saw its transcription simultaneously, while subjects in the *subtitle-after* condition saw its transcription only after hearing the sentence. In the *subtitle-absent* condition, subjects were not provided with transcriptions. During **test,** subjects transcribed 14 novel sentences from the same talker. Transcription accuracy was coded by transcription of keywords throughout each sentence.

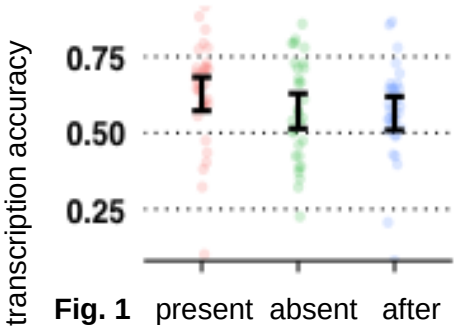

Fig. 1

If top-down information from subtitles supports improved comprehension of foreign accented speech, then subjects should transcribe more words correctly in the *subtitle-present* condition than the *subtitle-absent* condition. If acoustic information can be maintained and then later integrated with top-down subtitle information, then listeners in the *subtitle-after* condition should also transcribe more words correctly than the *subtitle-absent* condition.

Mixed logit regression that accounted for differences in audio equipment, prior accent familiarity, and language background confirmed our first prediction (**Fig. 1**): subjects in the *subtitle-present* condition correctly transcribed more words than those in the *subtitle-absent* condition (β=0.29, $p<0.03$). This suggests that concurrent subtitles do improve native listeners' accent comprehension. However, performance in the *subtitle-after* condition was indistinguishable from the *subtitle-absent* condition ($p>0.31$). The mean number of words between keywords being spoken and subtitle presentation was approximately 12, which is beyond the 6-8 syllable limit investigated in Bicknell et al. (2014). These results suggest that perceptual information is not maintained for this duration, but leaves open the possibility that less delayed information could still bolster comprehension. **The ease at which the delay may be manipulated** and the **lack of item repetitions** mark this paradigm as being a fruitful step in investigating perceptual maintenance in everyday speech.

Citations: Bicknell, Tanenhaus & Jaeger. *CUNY*. 2014. Dahan, D. *Curr Dir Psychol Sci*. 2010. Szostak & Pitt. *Atten Percept Psychophys.* 2013. Mitterer. & McQueen. *PLoS One.* 2009.

Back to Thursday March 3

Relative difficulty of understanding foreign accents as a marker of proficiency

Shiri Lev-Ari (Max Planck Inst. for Psycholinguistics, The Netherlands), Marieke van Heugten (SUNY Buffalo, USA) & Sharon Peperkamp (ENS-PSL Research Uni. /EHESS /CNRS, France)
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Foreign-accented speech is generally harder to understand than native-accented speech (Munro & Derwing, 1995). This difficulty is reduced for non-native listeners who share their first language with the non-native speaker (Bent & Bradlow, 2003). It is currently unclear, however, how non-native listeners deal with foreign-accented speech produced by speakers of a *different* language background. At first sight, one may assume that they would find foreign-accented speech even harder to understand, similar to the way that they suffer more from adverse listening conditions in general. In contrast, we hypothesize that the relative difficulty of processing foreign-accented speech is a consequence of gaining proficiency in the language, since it is only after listeners acquire the phonological categories that they become sensitive to deviations from the norm. Following this reasoning, experiencing greater relative difficulty with foreign-accented speech is in fact a marker of language proficiency.

To test this hypothesis, we taught 99 native French speakers a small vocabulary of Dutch. Participants learned either only 12 words with limited exposure (10-minute session), simulating very low proficiency, or a larger vocabulary of 30 words with greater exposure to each word (one hour session), simulating higher proficiency. Stimuli in both conditions were produced by native Dutch speakers. At test, participants heard the learned words as well as filler words, and had to indicate for each word whether or not it was a word that they had learned. Crucially, half of the test items were produced by novel native Dutch speakers, and half were produced by non-native speakers of Dutch (of a variety of non-French language backgrounds).

A logistic mixed model analysis over accuracy in recognizing words that all participants learned revealed an effect of speaker, such that participants were more accurate when words were produced by native rather than non-native speakers. Importantly, however, this effect was modulated by an interaction between proficiency and speaker, such that those in the higher proficiency condition showed a greater reduction in word recognition when listening to foreign-accented speakers. These results reveal that proficiency predicts the native speaker advantage and thus support the hypothesis that the relative difficulty of understanding non-native speakers is a by-product of becoming proficient in the language.

So far we defined proficiency as larger vocabulary size and greater exposure, but proficiency can also be defined in terms of higher accuracy. Would this latter measure of proficiency also be associated with a greater native speaker advantage? Correlating participants' overall d' prime scores with the difference between their d' primes for the native and the non-native speakers revealed that this is indeed the case – the better participants performed overall, the more they showed superior performance with native than with non-native speakers.

Taken together, this study shows that the relative difficulty of listening to non-native is a by-product of gaining proficiency in the language. The more listeners acquire a language, the more sensitive they become to deviations from normative productions, and therefore, the harder it becomes to understand non-native speakers compared with native speakers. These results thus contribute to our understanding of how phonological categories are acquired during L2 learning.

Back to Thursday March 3

The English can't *stand* the bottle like the Dutch: ERPs show language effects on the nonverbal perception of object position

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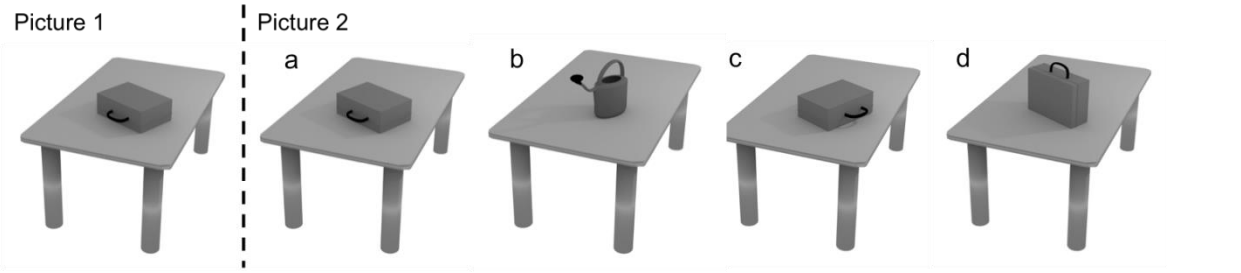
Previous research shows that linguistic labels (colours, objects) affect nonverbal perception, as reflected in modulations of perceptual and attentional ERP components (e.g., P1, N1, P300; Thierry et al. 2009; Boutonnet et al. 2013). In this study, we go beyond terminology to examine how perception is influenced by argument features encoded in verbs. In Dutch, locations of objects are described with posture verbs (*staan/liggen* 'stand/lie', e.g. *'het kopje staat/ligt/*is op de tafel'*), encoding the position of the object relative to its surface (Lemmens 2002). In contrast, position is not obligatorily encoded in English (*'the cup is on the table'*). Here, we ask, whether this language difference is reflected in object perception, by recording ERPs in English and Dutch native speakers during a picture-matching task.

Dutch (N=28) and English (N=26) participants saw sequentially presented pairs of pictures (N=400), each showing an object on a surface (e.g., a suitcase on a table). Each object (N=10) was systematically manipulated across two spatial dimensions, i.e., rotated 90 degrees along the horizontal or the vertical axis. The former manipulation reflects the spatial orientation that is obligatorily encoded in the verb in Dutch (position, encoded with *staan* or *liggen*), but not in English. Subjects were instructed to press a button only when they saw a *different object* in the second picture. We used an oddball design with four conditions: (a) Object Match (frequent condition, 70% of trials), (b) Object Mismatch (response oddball, 10%), (c) Orientation Mismatch (control distracter oddball, 10%), and (d) Position Mismatch (critical distracter oddball, 10%) (see Figure).



ERPs were time-locked to the onset of the second picture. In the P300 time window (300-700ms), associated with task-relevant attention, we found a large positivity for the response condition, and P300 modulations for the two distracter oddballs in both groups, suggesting that attention was devoted equally to the task. Yet, analyses revealed a significant Language by Condition interaction on amplitudes of an early component associated with automatic and prelexical perceptual discrimination processes (the Deviant Related Negativity (DRN) or N1, 120-200ms; cf. Boutonnet et al., 2013): Whereas an enhanced DRN was obtained for the response condition in both groups, Position Mismatch oddballs elicited a (central-parietal) DRN modulation only in Dutch participants.

In sum, Dutch speakers displayed increased selective attention to verbally encoded object features, before this information can be accessed lexically. This adds to the evidence that language affects our perception of the world, even in entirely nonverbal task settings.

Back to Thursday March 3

Print exposure modulates reliance on linguistic context for pronoun comprehension

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A critical question for psycholinguistic models concerns the role of the input. Does individual variation in type of linguistic exposure affect adults' processing strategies? We know that input affects language development (e.g., Rowe, 2012, *Child Dev.*) and reading proficiency (Stanovich & West, 1989, *Reading Research*), but less is known about how it affects spoken language processing. We tested the hypothesis that pronoun comprehension mechanisms are shaped by the input, specifically exposure to written language.

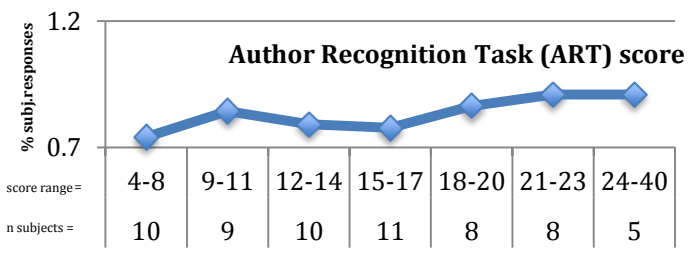
Pronouns like *he* and *she* are ambiguous, e.g. in *Jill went skiing with Sue. She fell down*, the pronoun could refer to either character. Adults follow several heuristics to interpret pronoun, including a bias toward linguistically prominent character, e.g. the subject, topic, focus, or more expected character (e.g., Kaiser, 2011, *LCP*). They also follow social cues such as eye gaze and pointing (Nappa & Arnold, 2014, *Cog. Psych.*). Yet an unsolved puzzle is how competing constraints are integrated, and why interpretation varies across individuals and situations.

We addressed this question by testing the hypothesis that individuals differ in their reliance on linguistic vs. social cues. Specifically, usage of the subject bias (e.g., preference for Jill) may depend on the degree of exposure to written language. Subject prominence correlates with evidence that reference to subjects is predictable, i.e. that speakers to continue talking about the entity in subject position (Brennan, 1995, *Language and Cognitive Processes*; Givon, 1983, *Topicality*), although not necessary with a pronoun (Kehler & Rohde, 2013, *Theor. Lx.).*). Learning that subjects are predictable should be supported by written texts, which are more thematically organized, decontextualized, and complex than spoken language.

We tested ambiguous pronoun interpretation using Nappa and Arnold's video task. 61 adult participants watched a female speaker tell a story about two same-gender characters, e.g. *Puppy is reading with Panda Bear. He wants the black book.* Each puppet sat on a table in front of the speaker, and at the pronoun, the speaker gazed at either 1) the subject, 2) a neutral point (the book), or 3) the nonsubject. The next screen asked "who wants the black book?" Fillers included other question types. If speakers rely on the linguistic context, they should choose the subject character (Puppy) in all conditions. If they rely on gaze, they should choose the gazed-at character, and perform at chance in the gaze-at-object condition.

We tested individual differences in print exposure using the Author Recognition Task (Stanovich & West, 1989), which is a proxy for exposure to written material, and correlates with measures of reading performance (Moore & Gordon, 2015, *Behavioral Research*). To rule out other sources of variation, we tested two dimensions that did not affect pronoun comprehension: working memory (Automated Operation Span Task; Unsworth, Heitz, Schrock and Engle, 2005), and theory of mind, (Eyes in the Mind task, Baron-Cohen et al., 2001). Group results revealed sensitivity to both the subject-bias and gaze: participants chose the subject 93% in the gaze-at-subject condition, 87% in the neutral condition, and 67% in the gaze-at-nonsubject condition. But critically, **the likelihood of choosing the subject was higher for participants with higher ART scores.** Mixed-effects models revealed main effects of the gaze and ART score, no interaction. That is, print exposure increased reliance on linguistic prominence. The figure shows avg. subject responses across all conditions.

Empirically, this study shows that written language experience modulates spoken language processing, identifying one source of variation in pronoun comprehension. Theoretically, this supports models in which the input shapes language processing mechanisms.



Back to Thursday March 3

The moral dimension of implicit verb causality

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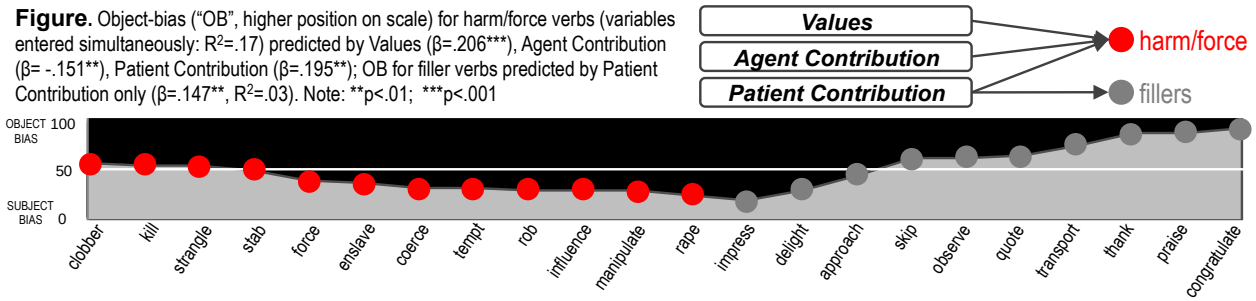
How much of sentence meaning is lexically encoded, and how much is inferred from extralinguistic factors (world knowledge, beliefs, values)? The answer to this question has far-reaching implications for both theory (*what is the structure of the linguistic system?*) and practice (*which statements can be expected to convey what to whom?*). An informative test case is implicit causality [1-5] – the phenomenon that listeners have strong, predictable expectations about the explanations for certain events. For instance, listeners expect *Mary frightened John because…* to continue with information about Mary, and *Mary feared John because…* to continue with information about John. Are these biases driven by semantic structure and lexical entailments [2-3], or are they the result of richer inferences [4-5]? Prior work has focused on conventionalized word meanings and widely-held world knowledge. We address the question by looking at individual differences in beliefs about agents and patients, and moral values.

We examined verbs conveying morally relevant negative events involving harm and force. In social psychology, individual differences in moral values have been found to predict the degree to which individuals attribute moral responsibility for violence to the perpetrator or the victim [6]. If implicit causality depends on lexical entailments alone, it should be unrelated to such nuances in values and beliefs about the causal structure of the world.

Experiments. In two studies (total N = 1496), participants selected a pronoun referring to the subject or object for prompts in the format: "{Subject name} {verbed} {Object name} because..." We tested "harm/force" verbs (e.g., *stabbed, killed, coerced,* see Figure) and a range of filler verbs. Participants' moral values were measured with the 30-item Moral Values Questionnaire [7]. In both studies, greater endorsement of values that prohibit transgressions outside the agent-harms-patient framework (linked to blame of victims in prior work [6]) predicted object-bias for harm/force verbs, but not filler verbs (see **Figure**). In Study 1, we also re-presented the events (without "because") and measured perceptions of agents' necessity and sufficiency, and patients' capacities to control, allow, and deserve events, finding that object-bias for harm/force verbs was more likely for participants who rated agents lower in necessity and sufficiency (Agent Contribution), and patients higher in their capacities to control, allow and deserve events (Patient Contribution; see **Figure**).

Conclusions. The more participants believed patients probably deserved to be harmed/forced, and, the more participants endorsed moral values linked to blame of victims [6], the more likely they were to show an implicit causality object-bias for events of harm/force. Findings indicate that current theories of language representation and causal processing should take into account individual differences. Variability in implicit causality responses for morally relevant events, in particular, may stem from presuppositions encoded in verb semantics that entail a prior event in which the patient triggered the harm/force event.

Figure. Object-bias ("OB", higher position on scale) for harm/force verbs (variables entered simultaneously: R^2=.17) predicted by Values (β=.206***), Agent Contribution (β= -.151**), Patient Contribution (β=.195**); OB for filler verbs predicted by Patient Contribution only (β=.147**, R^2=.03). Note: **p<.01; ***p<.001



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Back to Thursday March 3

Adjunct control interpretation in four year olds is colored by the task

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Previous research on children's interpretations of PRO in adjunct clauses has observed non-adultlike behavior for (1)[1-6], and argued that children's knowledge is not adultlike.

(1) John$_i$ bumped Mary$_j$ after PRO$_{i/*j/*k}$ tripping on the sidewalk.

A number of different tasks have been used to investigate adjunct control in children, but the primary focus has been on which non-adultlike grammar can best capture the data, rather than on extragrammatical processes that might contribute to this variation.

In this paper, we use a new task[7] that has been used to show improved performance for children on passive sentences and Principle B effects[8], and find that with this task, children's performance also improves for sentences with adjunct control. These results suggest that children's knowledge of adjunct control is adultlike, but has been obscured by the tasks used in previous studies.

We tested 32 four year olds (4;0-5;3, m=4;8.5) on a coloring task to probe for specific interpretations of sentences with adjunct control. Children were presented with sequences of pictures; for example, of Diego and Dora each hugging a teddy bear, followed by Dora fanning Diego (Fig.1). The actions in the picture were introduced (2), followed by a preamble to balance the salience of both characters (3) and the test sentence (4), with emphasis on the color:

(2) In this picture we have Dora fanning Diego, but first there's Dora hugging a bear, and there's Diego hugging a bear too.
(3) So here's how we should color this picture of Diego and Dora:
(4) Dora fanned Diego after hugging the *brown* bear.

Children were also presented with filler sentences with an overt pronoun (5):

(5) a. subject pronoun: Dora fanned Diego after she hugged the *brown* bear.
b. object pronoun: Dora fanned Diego after he hugged the *brown* bear.

The pictures were presented on a touchscreen PC, with a row of colored squares, and during training children were instructed to "tap the color, and then tap the thing." Character name and position on the screen were counterbalanced across items, and characters were chosen at equal rates in both the test and filler items. No child had a character bias.

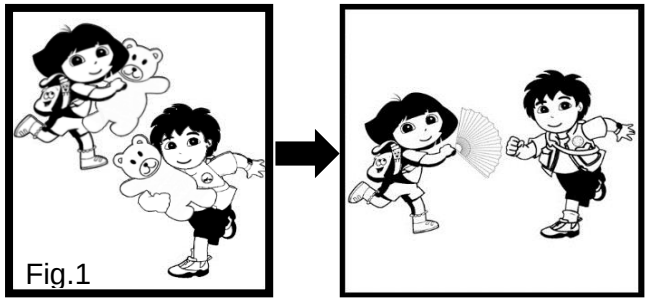
Fig.1

Children exhibited ceiling accuracy for the filler items (95.8% correct for both 5a and 5b), and filled in the correct item for the test sentences 81.6% of the time – significantly above chance accuracy (t=7.9, p<.001), but less accurate than the filler items in (5) (both t's = 3.46, p=.001).

While previous studies used tasks with a more explicit choice between multiple interpretations, the current task involves a more natural context (coloring), with a more direct final measure of interpretation. As a result, children's interpretations of sentences with adjunct control were overwhelmingly adultlike, supporting the conclusion that their grammars are adultlike. Nonetheless, children did occasionally make some errors. Future research will investigate the role that memory and processing considerations play in predicting these errors.

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Back to Thursday March 3

German Relative Clauses: The missing-VP effect in double and triple embeddings

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Sentences with a double center embedding that are lacking the second VP such as 'The patient the nurse the clinic had hired ~~admitted~~ met Jack' have been argued to yield an illusion of grammaticality[1,2]. In SVO languages like English and French, these sentences are surprisingly often misjudged as grammatical[2,3,4] and even cause a facilitation of processing[5,6]. This grammaticality illusion has been attributed to working memory overload in doubly center-embedded relative clauses[2]. Research on German and Dutch, however, showed that in SOV languages, a missing VP does not lead to facilitation but to a slowdown in processing[5,6,cf.7]. The difference between SVO and SOV languages has been attributed to the higher exposure to structures imposing high memory demands in verb-final languages. Due to this higher exposure, the German parser may cope better with double embeddings. Under this interpretation, the data from SOV languages is compatible with a memory-based account of relative clause processing.

In two self-paced reading experiments, we investigated the hypothesis that the lack of a grammaticality illusion in German can be attributed to the German parser being more adapted to memory-straining structures. We hypothesized that if the cross-linguistic pattern of relative clause processing can be explained by memory limitations, it should be possible to increase memory demands up to a point where even in an SOV language a grammaticality illusion is caused. To this end, we created materials with triple center embeddings with or without the second VP missing and compared them with double center embedding conditions.

a) 3 emb., +VP2	Der Hase,	den der	Fuchs,	den der	Hund,	den der Jäger	sah,	jagte,	biss,	erreichte	**das**	**Versteck**	...
	The rabbit	that the	fox	that the	dog	that the hunter	saw	chased	bit	reached	the	den	...
b) 3 emb., - VP2	Der Hase,	den der	Fuchs,	den der	Hund,	den der Jäger	sah,	jagte,	~~biss~~,	erreichte	**das**	**Versteck**	...
	The rabbit	that the	fox	that the	dog	that the hunter	saw	chased	~~bit~~	reached	the	den	...
c) 2 emb., +VP2	Der Hase,	den der	Fuchs,	den der	Hund			jagte,	biss,	erreichte	**das**	**Versteck**	...
	The rabbit	that the	fox	that the	dog			chased	bit	reached	the	den	...
d) 2 emb., - VP2	Der Hase,	den der	Fuchs,	den der	Hund			jagte,	~~biss~~,	erreichte	**das**	**Versteck**	...
	The rabbit	that the	fox	that the	dog			chased	~~bit~~	reached	the	den	...

The same 48 items were presented in both experiments, but in Exp. 1 (N=40), each sentence was followed by a comprehension question whereas in Exp. 2 (N=40), a grammaticality judgment was required. Under a working memory account of relative clause processing, we expected *i)* to replicate the slowdown due to a missing VP in the double embeddings[5] and *ii)* an interaction between number of embeddings and grammaticality: in triple embeddings, the missing VP should lead to a reduced sensitivity to the ungrammaticality resulting in either a speed-up as in SVO languages or at least to a smaller slowdown than in the double embeddings.

Linear mixed models showed that, in both experiments, reading times at the region where it becomes clear that a VP is missing (the NP "das Versteck") were significantly longer in missing VP sentences (*Exp1*: *t=6.5; Exp2: t=11.5*). In contrast to the prediction of the working memory account, this effect was not modulated by an interaction with number of embeddings. Analysis of the grammaticality judgments showed that independently of the number of embeddings, the ungrammatical conditions were misjudged as grammatical in approx. 50% of the trials whereas approx. 90% of the grammatical sentences were judged correctly (*z=-17.7; p<0.0001*).

To summarize, we replicated the findings of an *increased* processing difficulty due to a missing VP in German[5,6] and showed that the grammaticality illusion examined here cannot be elicited by increasing memory demands. In line with results by [6], we conclude that the missing-VP effect is not likely to be caused by memory limitations, but may rather be a language-specific phenomenon subject to further investigation.

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Back to Thursday March 3

Gender agreement attraction in Russian: novel patterns in comprehension

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Attraction effects in sentences with number agreement violations (e.g. "[The key]$_{HEAD}$ to [the cabinets]$_{ATTRACTOR}$ are rusty") have been found to be asymmetric: the predicate is read faster in SgPlPl vs. SgPlSg sentences, but not in PlSgSg vs. PlPlSg ones (the letters stand for the number of the head, attractor, predicate) [1,2]. This asymmetry is traditionally explained by the properties of the attractor (e.g. Pl is considered more 'distractive'). We report results from three comprehension experiments on subject-predicate *gender* agreement attraction in Russian, which suggest that this asymmetry is best explained by the properties of the head noun.

In our study attraction effects were observed for attractors of all three genders (M, F, N), but only when the head noun was F or N; no attraction effects were observed for M heads. This suggests that features of the head noun are at least partly responsible for agreement attraction asymmetry. We could say that M head nouns (in our experiments) or Pl head nouns (in number research) are more robust, less likely to be erroneously ignored during agreement processing.

In our study, self-paced reading task was used in all experiments. Target sentences followed the scheme in (1); the subject NP included two nouns: head and attractor, embedded inside a PP complement. Two factors were manipulated: grammaticality (gender match between the predicate and the head) and NP gender match (gender match between the head and the attractor). An example is given in (2). The predicate marked gender on both the copula and the adjective/participle. The head NP was nominative. The attractor NP was accusative, and we chose nouns for which accusative coincides with nominative because this is known to boost attraction. Targets were embedded among grammatical filler items. One third of sentences were followed by forced choice comprehension questions. In each experiment, we looked at a subset of possible head/attractor gender combinations.

(1) *NP$_{HEAD}$ – P – NP$_{ATTR}$ – was – Adj/Part – four additional words*

(2) *Recept na porošok / maz' byl mjatym / byla mjatoj… (iz-za sil'nogo volnenija pacienta).*
'prescription$_M$ for powder$_M$ / ointment$_F$ was$_M$ crumpled$_M$ / was$_F$ crumpled$_F$… (due to patient's extreme nervousness)'.

Exp.1 (N = 40). Gender combinations (head, attractor, predicate): MMM, MFM, MMF, MFF; MMM, MNM, MMN, MNN; FFF, FMF, FFM, FMM; NNN, NMN, NNM, NMM. Reading times were analyzed using RM ANOVAs; for all reported significant differences, $p < 0.05$ for F1 and F2. We found a classical attraction profile in the sentences with F or N heads and M attractors: there were significantly smaller delays on the predicate in FMM and NMM ungrammatical sentences as compared to FFM and NNM ones. The main effect of grammaticality and the interaction of grammaticality and gender match (i.e. attraction) were significant in the spillover region. But there was no attraction in the sentences with M heads and F or N attractors: all ungrammatical conditions caused similar delays, and only the main effect of grammaticality was significant.

Exp.2 (N = 32). To confirm that the lack of attraction with M heads was not artifactual, we looked at the sentences with different lexical items. Gender combinations: MMM, MFM, MMF, MFF and MMM, MNM, MMN, MNN. The results were essentially the same as in Exp. 1.

Exp.3 (N = 36). Gender combinations: NNN, NNF, NMN, NMM, NFN, NFF; FFF, FFN, FMF, FMM, FNF, FNN. Classical attraction pattern was found for both head genders: significantly smaller delays on the predicate in NFF vs. NNF; NMM vs. NNM; FMM vs. FFM and FNN vs. FFN. The main effect of grammaticality and the interaction of grammaticality and gender match (i.e. attraction) were statistically significant in the spillover region.

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Back to Thursday March 3

L2 learners need more time to predict

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The idea that people are actively predicting as they read or listen to sentences in their first language (L1) has gained an increasing amount of attention in recent years (for an overview, see Van Petten & Luka, 2012). Research has also shown that second-language (L2) learners do not predict to the same extent as native speakers (Grüter et al., in press; for an overview, see Kaan, 2014). One suggestion as to the underlying cause of this difference is that L2 learners lack the processing resources, and not necessarily the knowledge, to anticipate upcoming information. As a result, L2 learners may not have enough time to accumulate the information necessary to predict ahead of what is being presented in real time.

In order to test the effect of timing on predictive abilities in L2 learners, we recorded event-related potentials (ERPs) from native English speakers (n=15) and intermediate-advanced Spanish learners of English (n=11) while they silently read sentences word-by-word. A total of 144 experimental sentences were intermixed with 144 filler items. The experimental sentences were either highly semantically constraining toward a particular word (high-cloze, e.g. “The barber cut my hair but…”) or weakly constraining (low-cloze, e.g. “I don’t like my hair but…”). Importantly, the presentation of the critical word (“hair”) was sometimes delayed by 300 ms (cf. Besson et al., 1997). ERPs were time-locked to the onset of the critical word and were analyzed using a 2(cloze) x 2(delay) x 3(laterality) x 3(anteriority) repeated measures factorial ANOVA. Native English speakers showed an N400 effect at the non-predicted critical word in the low-cloze contexts versus the highly expected word in the high-cloze contexts. This N400 effect did not differ in amplitude between the delay and no-delay conditions. The L2 learners, on the other hand, showed no N400 effect for the low-cloze versus high-cloze contexts in the no-delay condition. In the delay condition, the N400 was larger for the low-cloze than the high-cloze contexts. Prior to the experiment, participants also completed a variety of individual difference measures, including a pro-active/reactive control task (AXCPT), a lexical decision task (LexTale), and digit span. Native speakers did not show any correlations between the N400 effect and the offline tasks. The L2 learners showed a positive correlation between the pro-active control task and the N400 effect. This shows that the better that the L2 learner was at making use of a predictive cue, the larger the difference in N400 amplitudes was between high and low-cloze contexts.

These findings suggest that the delayed presentation of a critical word allowed L2 learners to not only have activated the linguistic input, but also have combined it in a timely manner so as to predict the upcoming words in the high-cloze sentences. The native speakers showed a larger N400 for low-cloze than high-cloze sentences (consistent with previous research), but this effect did not differ between the delay and no-delay conditions. Overall, a delay paradigm can be used to better examine how timing of linguistic input impacts processing for different individuals.

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Back to Thursday March 3

Novelty of discourse referents promotes heuristics in children's syntactic processing

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Syntactic processing in adults is highly interactive, rapidly recruiting linguistic (e.g., verb biases) and non-linguistic cues (e.g., number of referents in discourse). In contrast, children build structures with the former, but often ignore the latter (Trueswell et al., 1999; Choi & Trueswell, 2010). This suggests that syntactic processing may begin as a modular system. Yet, the evidence to date has largely examined sensitivity to discourse cues when they conflict with initial misinterpretations (e.g., using 2-referent context to override location interpretation of "*Put the frog on the napkin...*"), but children have substantial difficulties with syntactic revision. Thus, it remains unclear whether failures to recruit non-linguistic cues reflect architectural constraints limiting sensitivity to discourse or more general challenges with overcoming misinterpretations. Critically, if syntactic processing is interactive from the start, then discourse effects may be revealed in the *initial* structures built. In SVO languages, children often interpret utterances using an agent-first bias, leading to successful comprehension of actives, but misinterpretation of passives (Bever, 1970). Prior research suggests that this bias is weakened then NP1s are pronouns ("*it*") compared to full nouns ("*the seal*") (Huang et al., 2013). The current study examines whether this effect is driven by the discourse status of NP1s (new or given referents).

Five-year-olds acted out active/passive sentences using object sets involving expressed items, paired with likely agents and themes. In Experiment 1 (n=61), discourse status was manipulated via NP1 expressions: full nouns (which often refer to new referents) vs. pronouns (which often refer to given referents). Experiment 2 (n=40) focused on pronoun NP1s, but varied discourse status via prior sentences that promoted co-referencing with unmentioned ("*it*" refers to neither seals) or mentioned referents ("*it*" refers to gray seal). Experiment 3 (n=40) focused on full NP1s, but decreased the novelty of known words by including novel words ("*blicket*"). Within experiments, independent norming verified the perceived discourse status of NP1s. Critically, if discourse cues impacts initial syntactic structures, then contexts that strengthen the agent-first bias may lead to higher accuracy with actives (consistent with bias) relative to passives (which requires revision). Differences may diminish in contexts that weaken this bias.

Actions were coded based on correct role assignment of expressed NPs ("*the seal*") and selection of plausible referents for pronouns/novel nouns ("*it*"/"*blicket*"). Across all experiments, NP1 status x construction interactions were found (all p's < .05). When NP1s were full nouns (Experiment 1), passives were less accurate than actives (45% vs. 65%), but no difference was found for pronouns (59% vs. 61%). Similarly, when pronoun NP1s co-referenced unmentioned referents (Experiment 2), passives were less accurate than actives (54% vs. 88%), but no difference was found for mentioned referents (93% vs. 82%). Finally, when NP1s were novel words (Experiment 3), passives were less accurate than actives (39% vs. 86%), but no difference was found for known words (73% vs. 66%). These findings are the first to illustrate children's sensitivity to discourse cues when building syntactic structures. In particular, when NP1s are perceived to be novel, the agent-first bias is recruited to facilitate immediate role assignment, thus decreasing the memory demands associated with incremental interpretation. This work demonstrates that syntactic processing is highly interactive throughout development.

NP1 status		Sentences (passive / active) – NP1 in **bold**
E 1	Full noun	**The seal** is eaten by / eating it.
	Pronoun	**It** is eaten by/eating the seal.
E 2	Unmentioned	(The gray seal and the white seal swim.) **It** is pushed by / pushing the white seal.
	Mentioned	(The gray seal swims.) **It** is pushed by / pushing the white seal.
E 3	Novel word	**The blicket** will be eaten by / eating the seal.
	Known word	**The seal** will be eaten by / eating the blicket.

Back to Thursday March 3

Input complexity and rule induction. An entropy model

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In language acquisition, children manage impressively fast to infer generalized rules from a limited set of linguistic items, and apply those rules to novel strings. This study investigates what triggers and what limits the inductive leap from memorizing specific items to extracting abstract rules that apply productively beyond those items. Our new entropy model predicts that *generalization is a cognitive mechanism that results from the interaction of input complexity (entropy) and brain's limited processing and memory capacity (i.e. limited channel capacity)*.

It was argued that children detect patterns in auditory input, like phonotactic information (Chambers, Onishi & Fisher, 2003), and word boundaries (Saffran, Aslin & Newport, 1996) by statistical learning. Statistical learning deals with computing probabilities that specific items co-occur in the input, and it cannot account for abstractions beyond those items. Previous studies (Gómez & Gerken, 2000) drew a distinction between abstractions based on specific items (e.g. *ba* follows *ba*) and category-based abstractions (generalizing beyond specific items, e.g. Noun-Verb constructions). An algebraic system was proposed (Marcus, Vijayan, Rao & Vishton, 1999) to account for extracting rules that apply to categories, such as "the first item is the same as the third item" (*li_na_li*). This system addresses abstractions to novel items, but it does not explain how humans tune into such rules, and what the factors (if any) in the input are that facilitate or impede this process. Our entropy model addresses these questions and bridges the gap between previous findings, thus unifying them under one consistent account. According to our model, less complexity in the input facilitates memorization of specific items, which allows for abstractions based on those items, while a higher input complexity that overloads the channel capacity drives the tendency to make category-based generalizations (i.e. reduce the number of features that items can be coded for, and group them in abstract categories and acquire relations between these categories).

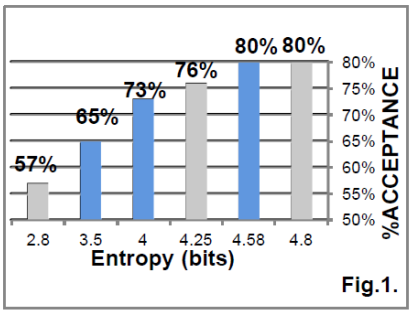

Fig.1.

In our first experiment we exposed adults to 3-syllable AAB strings that implemented a miniature artificial grammar to probe the effect of *input complexity* on rule induction. We manipulated two factors (number of syllables and their frequency) and we used *entropy* (a function of the two factors) as a measure of complexity (calculated in *bits*), to design three experimental conditions: low entropy - 3.5 bits (4×6 As/4×6 Bs), medium entropy – 4 bits (2×12 As/2×12 Bs), and high entropy – 4.58 bits (1×24 As/1×24 Bs). Participants gave grammaticality judgments on 4 types of test strings: grammatical trained AAB strings, grammatical AAB strings with new syllables, ungrammatical new A_1A_2B strings (three different syllables), and ungrammatical A_1A_2B strings with trained syllables. In a second experiment we exposed adults to a similar AAB grammar, but the three conditions had other degrees of *entropy*: 2.8 bits (4×7 As/4×7 Bs), 4.25 bits (2×14 As/2×14 Bs), and 4.8 bits (1×28 As/1×28 Bs). Participants were tested on the same types of test strings as in the first experiment. As predicted, the results of the first experiment showed that the higher the input complexity, the higher the tendency to abstract away from specific items and make a category-based generalization (i.e. accept new AAB strings). The same *effect of input complexity* on rule induction was replicated in the second experiment. When put together, the results from both experiments are in line with the predictions of our model: they show a progressively increasing tendency of generalizing beyond specific items, as the entropy increases (Fig.1). Unlike previous findings, this model also gives a quantitative measure for the likelihood of making generalizations in different ranges of input complexity. To further test our model and its domain generality, similar studies will be run with infants, and also using visual input.

Back to Saturday March 5

The unspeakable languages of the human mind

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In this talk I will review evidence from several studies using event-related brain potentials and eye tracking to illustrate the formidable diversity of our language representations and the spectacular level of unconscious interactivity manifested by the human verbal brain. For instance, I will show how bilingual adults access the native translation of second language words spontaneously and unconsciously (Thierry & Wu, 2007; Wu et al., 2013); that they access phonological forms preferentially to orthographic ones (Wu & Thierry, 2010), and that they unknowingly stop accessing these representations when second language words are unpleasant (Wu & Thierry, 2012). Even more surprising, bilinguals speak two languages at once, although we can only hear one, that is, they unconsciously access the sound of words in their native language while speaking in their second (Spalek et al., 2014). When faced with language switches, bilinguals cannot help but processing the meanings of words in both their languages (Hoshino & Thierry, 2012), even if they are instructed to ignore one of them (Martin et al., 2009). More surprising still, cross-language effects extend to the domain of syntax: Welsh-English bilinguals spontaneously apply the word order of Welsh in an all-in-English context (Sanoudaki & Thierry, 2015) and they transfer to English a morpho-phonological transformation rule of Welsh that is entirely alien to English (Vaughan-Evans et al., 2014)! And there is more: Language-cognition interactions extend well beyond the realm of tasks and contexts where language is involved, offering spectacular linguistic relativity effects. Beyond effects on colour perception (Thierry et al., 2009) and object categorisation (Boutonnet et al., 2013), language context leads to radical and unconscious shifts in the behaviour of bilingual individuals. For instance, we found evidence for deep language-emotion interactions leading to different appreciations of factual information, depending on the language in which information is presented (Ellis et al., 2015). Yet, perhaps worryingly, bilinguals engaging in a gambling task for money take more risk when receiving verbal feedback in their native as compared to their second language (Gao et al., 2015). Taken together these findings reveal unsuspected levels of automaticity in language and unsuspected levels of cognitive diversity linked to language variations within and between individuals. We can only understand the nature of our mind in a conscious fashion, yet a great part of what defines us and our understanding of the world comes from language. This realization calls for a reconsideration of the way in which we conceptualise cognitive operations classically regarded as volitional.

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Back to Thursday March 3

The changing L1: How bilingualism affects syntactic processing in the native language

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One of the most significant discoveries about bilingualism is that both languages are active when bilinguals listen to speech and read words in either one of their languages, and when they plan speech in each of the two languages (e.g., Kroll et al., 2006; Marian & Spivey 2003). The parallel activation of the two languages has been observed even when bilinguals are unaware of them. Bilingualism affects not only the activation of the two languages, but also the way in which each of the two languages is processed, suggesting a language system that is highly adaptive. The effects of this parallel activation on processing have been observed at every level of language use, in the phonology, in the lexicon, and the grammar.

In the area of syntactic processing, the vast majority of studies have mainly focused on questions concerning the influence of the first language on the processing of the second language. There is now compelling evidence from the literature on syntactic priming (e.g., Hartsuiker & Pickering 2008; Hartsuiker, Pickering, & Veltkamp 2004; Weber & Indefrey, 2009) for overlapping syntactic systems between the L1 and the L2, and for the claim that at least some syntactic information is shared between a bilingual's languages with similar syntactic structures. One important question is whether knowledge of a second language affects the processing of the native language.

In this talk I will discuss the consequences of bilingualism on the native language, focusing primarily on syntactic and morpho-syntactic processing. One significant insight from the L2 acquisition work is that prolonged naturalistic exposure can have profound effects on how a second language is processed, reversing processing strategies that result from transfer of L1 information or causing shifts in L2 processing strategies from lexically driven to structurally driven (Pliatsikas & Marinis 2013). Given this evidence, an important aspect of the comparison between L2 and L1 speaker performance is to consider how variable immersion experience might affect L1 processing. I will consider evidence in bilinguals who have been immersed in the L2 for an extended period of time, and also in relation of the observed effects on L1 during a brief and temporary period of exposure to L2 sentences. What this work suggests is that the bilingual's two languages are open to each other in a way that demonstrates a high level of plasticity, even among late L2 learners, and even for structures that might have been considered relatively immutable once the native language is acquired.

Back to Friday March 4

LINGUISTIC EXPERIENCE (L1 vs. L2) SHAPES SENTENCE FORMULATION

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Message and sentence formulation are incremental, but to what extent is incrementality shaped by speakers' experience with the target language? In L1, the timecourse of formulation for simple sentences (e.g., *The truck is towing the car*) can vary: before speakers start linguistic encoding of the first character ("*The truck…*"), they may have encoded only a small unit of the preverbal message (*truck*) or a larger unit that includes relational information between event characters (*truck-towing-car*). Variability can be due to subtle changes in the ease of linguistic encoding (Konopka & Meyer, 2014). Here, we tested how the timecourse of formulation differs across speakers who *generally* have either more experience or less experience with the target language (L1 vs. L2). Specifically, which processes present the largest bottleneck in L2?

In 3 experiments, eye-tracked Dutch speakers fluent in English described pictured events in L1 (Dutch) and L2 (English) with active and passive sentences in two counterbalanced blocks (40 new target pictures per block, presented among fillers). Proficiency was assessed with a language questionnaire and vocabulary test (http://lextale.com). Exp.1 (n=32) established baseline L1-L2 differences in formulation, and Exp.2 and 3 (n=48, 32) tested whether these differences were tied to the ease of encoding two types of content words: words expressing non-relational information produced early in the sentence (subject characters: *truck*) and words expressing relational information produced after sentence subjects (actions: *towing*). To selectively facilitate encoding of characters and actions, speakers received a preview of half the agent names (Exp.2) and verbs (Exp.3) they could use in target descriptions in each block.

Results. Production was easier in L1: in all Exps., there were fewer active descriptions in L1 than L2 (.86 vs. .89) and active descriptions had shorter onsets in L1 than L2 (1825 vs. 2038 ms). L1-L2 differences in structure choice decreased with increasing L2 proficiency. Eye movements in L1 and L2 active sentences were compared with Growth Curve Analyses (Mirman, 2014) in early and late time windows (0-400ms, 400ms-speech onset).

Exp.1. Speakers distributed their gaze between agents and patients in L1 and L2 before 400 ms; they then began fixating the agent preferentially after 400ms in L1 but only after 600ms in L2. This *late* gaze shift to the agent shows a later onset of *linguistic* encoding of the agent in L2, leaving a broader early window where speakers attended to both characters.

Exp.2 (agent name preview). Do speakers delay linguistic encoding in L2 because the first content word (*truck*) is harder to produce in L2 than in L1? On this account, familiarity with agent names should reduce the early L1-L2 gaze difference. Instead, when speakers used previewed agent names, there was still a *later* gaze shift to the agent in L2 than L1 after 400ms.

Exp.3 (verb preview). Do speakers delay linguistic encoding in L2 because they prefer to first encode a larger preverbal message (*truck-towing-car*)? On this account, facilitating encoding of information beyond the sentence subject (*towing*) should reduce the early L1-L2 gaze difference. Indeed, when using previewed verbs, speakers directed their gaze to agents *earlier* in L2 than L1, even in the first time window (0-400ms). Thus, reducing the costs of verb encoding reduced the amount of time that speakers attended to both characters early in the formulation process in L2. This suggests that early formulation is more sensitive to relational information in L2, as is expected if speakers encoded a preverbal message consisting of information about *two* characters before starting linguistic encoding of the first character.

Conclusions. Linguistic experience can influence incrementality from the earliest stages of formulation: the scope of early planning is broader in L2 than L1 (Exp.1), as confirmed by stronger modulation of early eye movements by factors influencing the ease of encoding relational than non-relational information (Exp.3 vs. 2). Thus speakers may start linguistic encoding before having encoded a full message when using their native language, but are more likely to first encode a larger message when using a language they have less experience with.

Back to Friday March 4

Executive function skills support sentence processing: Evidence from adult learners

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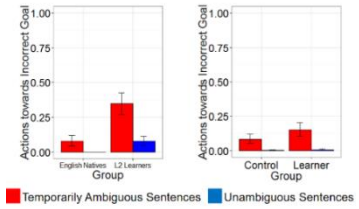
In order to acquire the grammar of a first (L1) or a second (L2) language, learners must be able to parse and assign meaningful analyses to the input, and occasionally revise initial mis-parses. But revision is difficult for (child) language learners, learners, and associated with high variability among individuals, with potential important consequences on language learning. Here we ask whether difficulties with revision are a general characteristic of language learners' performance and whether individual differences in revision abilities are associated with domain-general executive function (EF) skills. Across two visual-world ("put-task") studies, adult participants heard temporarily ambiguous and unambiguous sentences (e.g., *Put the frog (that's) on the napkin onto the box*) and carried out corresponding actions.

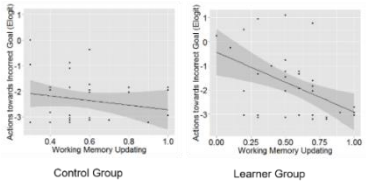
In **Study 1**, we explored whether difficulties revising initial parsing commitments previously documented in child learners similarly characterize the processing profiles of adult L2 learners. We find that, similarly to child L1-learners, adult learners of English (N=33) display particular difficulties revising initial interpretations of temporarily ambiguous sentences, as indicated by offline (**Figure 1, left panel**) and online (not shown) performance. Thus revision of parsing commitments appears to be difficult for language learners, regardless of cognitive maturity. We propose that difficulties with revision might result from reduced availability of cognitive resources: in child language learners, difficulties with revision might be particularly pronounced because of cognitive immaturity, while in adult learners they might stem from cognitive overload, as processing of a non-dominant language and sentence revision recruit and tax the same cognitive resources. To test this hypothesis, **Study 2** explores (a) whether failure to perform sentence revision can be induced in monolingual English speakers when they process sentences containing newly learned vocabulary items and (b) whether individual differences in revision abilities correlate with differences in EF skills. One group of speakers (the learner group, N=38) performed a "put-task" in which sentences contained previously taught novel nouns (e.g., *Put the dax (that's) on the blick onto the maipen*), while a group of speakers (the control group, N=37) performed the same task with English words. The groups were also administered a battery of EF tasks. We predicted that the learner group would display selective difficulties with sentences that require revision of initial interpretations. Additionally, we predicted that, at the individual level, difficulties with revision of initial interpretations would correlate with EF skills, and that this link might be stronger for the learner group. This is because, to the extent that sentence revision in a non-dominant language places a high burden on EF skills, high EF-skill learners should have enough remaining resources to perform revision, while low EF-skill individuals are expected to fail to revise. Offline (**Figure 1, right panel**) and online (not shown) patterns of revision indicate that the learner group show increased processing difficulties as compared to the control group, but that this pattern is restricted to sentences requiring revision (Ambiguity by Group interaction, p=.03). In addition, while an overall correlation emerged between participants' offline and online processing performance and measures of EF skills (r = -.38, p < .001; r = -.32, p = .002, respectively), this correlation was driven by the L2-learner group (**Figure 2**).

Figure 1



Together these results indicate that difficulties revising initial interpretative commitments characterize language learners' performance regardless of cognitive maturity, and that domain-general EF skills support sentence processing in language learners.

Figure 2



Back to Saturday March 5

EEG correlates of syntactic expectation reflect both word-to-word and hierarchical dependencies

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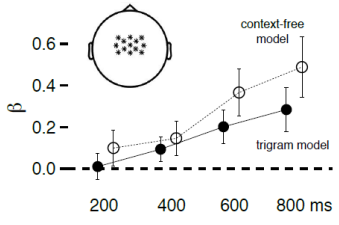
Introduction: Rapidly deployed predictions about upcoming words and phrases are key to efficient language comprehension (e.g. Federmeier, 2007; Hagoort & Indefrey 2014). This study tests what sort of information guides these expectations.

Word-category expectations modulate ERP components including the ELAN (a left anterior negativity between 100-300 ms after stimulus onset) and P600 (a centro-posterior positivity beginning ~500 ms; e.g. Friederici, 2002). While some studies have shown rapid sensitivity to expectations that reflect hierarchical structure (e.g. Xiang et al., 2012), others suggest that only superficial word-to-word dependencies matter (Frank et al., 2015). This debate connects with whether every-day language processing requires the brain to compute detailed syntactic representations, or whether superficial "good enough" representations are sufficient. Using electroencephalography and a passive story-listening task, we test whether EEG signals are sensitive to expectations based on word-to-word and/or hierarchical dependencies.

Methods: 19 participants listened to a 12 m segment of a popular children's story and completed a short comprehension questionnaire. EEG data were collected at 500 Hz with 61 active electrodes and referenced to linked mastoids. Data were filtered from 0.5 – 40 Hz, epoched from -.1 – 1 s around the onset of each word, and baseline corrected. Epochs with artifacts were visually identified and rejected; eye-movement signals were removed using ICA. Single-trial averages were constructed from three sensor groups (left anterior, central, central-posterior) across four 200 ms time-windows centered at 200, 400, 600, and 800 ms.

Expectations given the left-context were estimated using "surprisal": the log-reciprocal of the probability of the next word (Hale, 2001). Probabilities were derived from two language models: (1) A trigram Markov Model defined over part-of-speech tags fit using OpenGRM on the text of the entire story (chapter headings removed), and (2) a context-free grammar using the EarleyX parser (Luong et al., 2013) with rules from Stanford parser output applied to the entire story (Klein & Manning, 2003). Surprisal from these two models loads differentially on to function and content words. To minimize this confound, each word-class was analyzed separately. Surprisals from each model were mean-centered and fit against the single-trial EEG data using mixed-effects regression with control predictors for word length, word frequency, and random intercepts for subjects. Likelihood ratio tests were used to evaluate the contribution from higher order predictors.

Results and Conclusion: For function words, activity in central electrodes was significantly modulated by word-to-word trigram surprisal in from 500 – 700 ms ($\chi^2(1)=5.61$, $p<.05$). Surprisals from a context-free grammar significantly improved upon a model with trigram and control predictors ($\chi^2(1)=7.56$, $p<.01$). The same pattern was found from 700 – 900 ms. These results are shown in the Figure which plots regression weights (β) ± standard error. For content words, activity from central electrodes from 700 – 900 ms correlated negatively with surprisal from the context-free grammar ($\chi^2(1)=4.32$, $p<.05$)**.**



These findings show that on-line indices of syntactic expectations reflect hierarchical structure in addition to word-to-word dependencies.

Back to Friday March 4

Lexical predictions and the structure of semantic memory: EEG evidence from case changes

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In this ERP study we argue for a particular view of lexical-semantic memory retrieval by showing that the same morphosyntactic cue (case marking) has both immediate and delayed impacts on lexical prediction: syntactic category constraints (noun vs. verb) are realized immediately (current study), while thematic constraints (agent vs. patient) are delayed (previous work). N400 amplitude closely tracks the predictability of a word (Kutas & Hillyard, 1984), but many studies have shown that reversing argument roles, which radically changes the predictability of a verb, fails to (immediately) affect the N400 (e.g., Kim & Osterhout, 2005, a.o.). Consistent with this, argument roles can be reversed in Japanese by changing a case marker on a noun from NOM(inative; *-ga*) to ACC(usative; *-o*) or vice versa, but this does not modulate the N400, despite rendering the critical verb implausible, e,g., no N400 effect is observed between *bee-NOM sting* and *bee-ACC sting* (Momma et al., 2015). This invites the conclusion that case cues are simply overridden by a heuristics-based semantic processor (e.g., Ferreira & Patson, 2007). Here we show that a minimal change in a case marker similar to the role reversal cases in Japanese does modulate N400, but only when it induces a change in the expected category of the upcoming word. This contrast is hard to explain under the view that N400 blindness to role reversals simply reflects the heuristic nature of the processor. We instead argue that (i) N400 reflects lexical prediction (Brouwer et al., 2012; Federmeier & Kutas, 2000; Lau et al., 2012), and that (ii) case markers immediately affect lexical prediction to the extent that they provide information about the upcoming word's syntactic category. This reflects the view that lexical prediction is essentially a memory retrieval operation, and case markers are effective for this operation only to the extent that they provide a retrieval cue that is directly usable for searching lexical-semantic memory. We propose that the syntactic category (of the word being predicted) is an integral part of the lexical memory representation and hence is effective as a retrieval cue; in contrary, thematic role (of the word already encountered) is not.

Methods: Native Japanese speakers (n=30) read and judged the naturalness of Japanese sentences with the following beginnings, while EEG was recorded. () = average cloze of target.

(1) *Farmer-NOM field-ACC cultivate… / Farmer-NOM goat-GEN milk…[+match, high] (50%)*
(2) *Farmer-NOM field-GEN cultivate… / Farmer-NOM goat-ACC milk…[-match, high] (0%)*
(3) *Farmer-NOM field-ACC dig … / Farmer-NOM goat-GEN meat … [+match, low] (0%)*
(4) *Farmer-NOM field-GEN dig … / Farmer-NOM goat-ACC meat … [-match, low] (0%)*

NOM-ACC sequences predict verbs and NOM-GEN(itive) sequences predict nouns. Thus, the predicted category matches with the actual category of the critical word in (1&3) but mismatches in (2&4). The critical underlined words in (1-2) are highly associated with the context words, and all sentences remained grammatical at the critical word, due to lower-frequency constructions that allow genitive subjects or adjunct clause. Lexical coherence (high vs. low) was also manipulated to elicit a 'classic' N400 effect, which mainly served as a point of comparison. The key manipulation is (1) vs. (2) (and (3) vs. (4)), which contains the ACC-GEN distinction without any lexical differences.

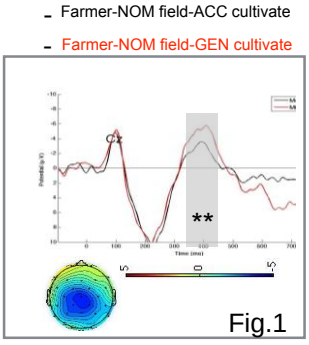

Fig.1

Results: The classic N400 due to lexical coherence manipulation was reliable ($p < 0.001$), and critically, a main effect of category mismatch was also found at overall and midline electrodes ($p < 0.05$), followed by a P600 effect ($p < 0.01$). This suggests that the ACC-GEN distinction affects prediction, unlike the NOM-ACC distinction in role reversal sentences (Momma et al., 2015). In probabilistic terms, both case marker changes strongly affect the likely upcoming word. However, only the ACC-GEN distinction reliably alters the predicted grammatical category and thus affects lexical-semantic memory retrieval, i.e., prediction.

Back to Friday March 4

Early predictability and delayed integration effects in reading: Neural and behavioral evidence

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In addition to identifying individual words, one of the primary tasks in sentence comprehension is to successfully integrate lexical items within the preceding semantic context. Currently, there are two contrasting theories about the time-course of this integration process. According to *serial accounts* such as EZ-Reader 10 (Reichle, Warren & McConnell, 2006), lexical access must be fully complete before contextual integration can begin (Abbott & Staub, 2015). In contrast, *parallel integration models* argue that semantic integration occurs immediately as soon as bottom perceptual information is available, allowing competing lexical candidates being integrated in parallel (Van Petten et. al., 1999; van Den Brink, Brown & Hagoort, 2006).

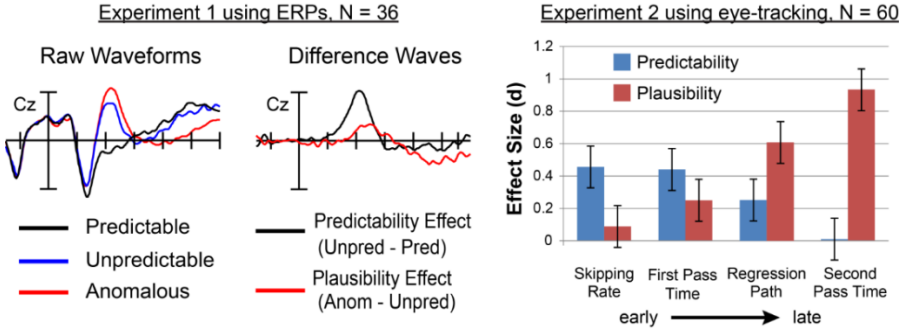
While there is some empirical support for both of these models, a critical issue in previous research has been disentangling the confounding effects of *contextual plausibility* and *lexical predictability*, which may have distinct and dissociable effects on word processing. The aim of the current research was to isolate the effects of predictability and plausibility in order to compare the time-course of these two contextual effects during reading.

1) The cow gave birth to the brown calf in the barn out back. (*Predictable*)
2) Bill went to check on the brown calf in the barn out back. (*Unpredictable*)
3) She had decided to wear the brown calf in the barn out back. (*Anomalous*)

In Experiment 1, participants read sentences like 1-3 above for comprehension while EEG was recorded from the scalp. In contrast to previous studies, the critical words presented in the *unpredictable* and *anomalous* conditions were carefully matched on constraint, cloze probability (0%), and semantic association with the preceding context. On ERPs time-locked to the critical word, we saw effects of both predictability and plausibility on the N400 ($ps < 0.001$). Critically, the effects of plausibility were significantly delayed in time (80-100ms), which is consistent with the predictions of serial models.

In Experiment 2, participants read this same set of sentences for comprehension while their eye-movements were recorded. Similar to the results of Experiment 1, predictable target words showed early benefits on reading measures such as skipping rates (6%, $p < 0.01$), while no skipping differences were observed when comparing Unpredictable and Anomalous targets ($t < 1$, B.F. = 5.7 in favor of null). Instead, we saw effects of integration difficulty mainly on late eye-tracking measures involving re-reading.

Across both of these experiments we observed consistent evidence suggesting that semantic integration does not begin immediately upon encountering a word, but is instead gated or delayed in time, as predicted by serial models such as EZ Reader. Notably, predictive contextual constraints had a much earlier influence on word processing, both neurally and behaviorally, suggesting that lexical pre-activation may influence very early stages of lexical access and selection.



Back to Friday March 4

Memory-based limits on surprisal-based syntactic adaptation

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Comprehenders rapidly adapt expectations to syntactic statistics of particular linguistic environ-ments [1-3]. For instance, [1] showed that repeated exposure to *a priori* unexpected analyses of an ambiguity not only reduced their processing difficulty, but also reversed a garden-path effect: *a priori* expected structures became unexpected. [1-3] argue that this type of distributional learning is error driven, such that more surprising (rare) events lead to faster adaptation. This would allow perceivers to rapidly minimize prediction error in novel and potentially variable communicative situations.

The present study examines whether there are limits to experience-based adaptation. [4-5] argue that many preferences in ambiguity resolution stem from resource-based memory biases favoring a syntactically simpler structure. These biases derive from intrinsic limitations on combinatorial operations during interpretation and thus may persist in the face of repeated evidence. In principle, such a bias may be sufficient to impede learning of a repeated structure.

Here we tested whether memory biases can limit learning in two self-paced reading studies. In Exp1, participants were exposed to reduced- and unreduced-relative clauses (RC) embedded in either a high-bias indirect question (1a) or a low-bias sentential-complement (1b). The high-bias embedding begins with a *wh*-filler that must be associated with a gap. Memory considerations favor positing a gap site as soon as possible, which biases a main verb (MV) analysis of the ambiguous verb (*evaluated*). For the low-bias condition there is no pending *wh*-filler. Corpus searches indicate that RCs modifying embedded subjects are ~4-5 times more likely in environments like (1b) than (1a). Thus, a surprisal-based account predicts that adaptation should be more efficient in (1a) than (1b). Alternatively, a memory bias could make participants less sensitive to statistical evidence in (1a). Results showed that, in the low-bias condition, reading times in the disambiguating region (underlined) exhibited a clear adaptation effect: The effect of ambiguity decreased over the course of the study, replicating [1]. Despite a significantly larger ambiguity effect in the high-bias condition, there was less and significantly slower adaptation in this condition. Importantly, the high-bias condition did elicit reliable adaptation in the post-disambiguating region. Thus it is not the case that high-bias sentences were simply unprocessable (consistent with intuitions).

Exp2 tested whether adaption to RCs made participants less likely to pursue the MV analysis (a garden-path reversal). Participants were trained on either sentences like (1a) or (1b), or sentences that contained MV continuations (2a) or (2b). All four groups were then tested on MV continuations. Participants trained on RC continuations showed a garden-path reversal in the low-bias condition, replicating [1], but no such effect was observed in the high-bias condition.

Across both experiments, participant responses exhibited clear adaptation effects in low-bias conditions, but not in high-bias conditions. These data are at odds with an unboundedly rational surprisal-based learning account, which predicts faster adaptation to the rarer high-bias constructions. Instead, sensitivity to statistical evidence was reduced when it militated against a strong memory bias. Computationally, this pattern can be captured if memory biases cause prior probabilities to overwhelm perfectly rational consideration of statistical evidence.

1a. The dean knew **what** the professor (who was) evaluated <u>by the observer should present</u> during the lecture. (**High-bias, RC continuation**)

1b. The dean knew **that** the professor (who was) evaluated <u>by the observer should talk</u> to a counselor about her complaint. (**Low-bias, RC continuation**)

2a. The dean knew **what** the professor (had) evaluated <u>but the students were never</u> notified about who had assigned their grade. (**High-bias, MV continuation**)

2b. The dean knew **that** the professor (had) evaluated <u>the report but the students</u> were never notified about who had assigned their grade. (**low-bias, MV continuation**)

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Back to Friday March 4

The Priming of Basic Combinatory Responses in MEG

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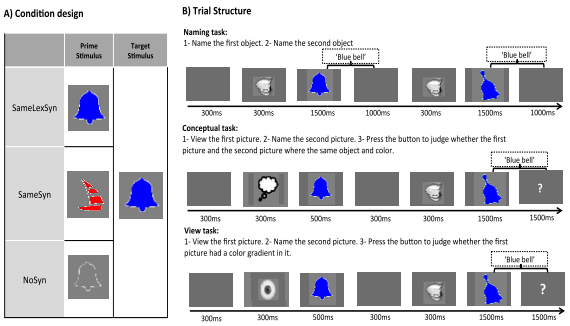
While behavioral research has demonstrated that the processing of syntactic structures can be primed, the computational level of this priming is still unknown. This work exploited recent progress on the neurobiology of basic phrase building and tested whether the brain activities implicated for the simple composition of two words could be primed. In two experiments, magnetoencephalography (MEG) was recorded during a picture naming task where the prime trials were designed to replicate previously reported combinatory effects (Bemis & Pylkkänen, 2011) and target trials to test whether those effects could be primed. On prime trials subjects named either colored objects as adjective-noun combinations, or outlines of objects with single nouns. All target trials involved production of adjective noun combinations as prompted by pictures of colored objects (Fig A). The amount of lexical overlap with the prime varied, such that primes and targets shared i) the structure but no words (SameSyn: *red boat – blue bell*), ii) the structure and all words (SameLexSyn: *blue bell – blue bell*) or iii) the noun but no structure (*bell – blue bell*). Priming was assessed by comparing structure-sharing targets and single word productions. Two control tasks not involving prime naming tested whether any obtained priming effects could be attributable to shared visual or conceptual analysis of the pictures (Fig B).



The manipulation of the primes was successful in eliciting larger activity for adjective-noun productions than single nouns in the left anterior temporal lobe (LATL) and ventromedial prefrontal cortex (vmPFC), replicating prior MEG studies on similar contrasts. Priming of similarly timed activity was observed during target trials in the LATL, but only when the prime and target were lexically identical (SameLexSyn) and only when the prime task was naming. A second experiment tested whether this priming effect may have been triggered by full conceptual identity between prime and target, independent of composition. Under this hypothesis, the same effect should obtain for single concept repetition as in *bell – bell*. Alternatively, the effect may have reflected repetition of the same composed concept, and thus should obtain for *blue bell – blue bell* but not for *bell – bell*. The primary aim of Experiment 2 was to distinguish between these two possibilities with a simple design where full conceptual identity (Same vs. Different) was crossed with Composition (Combinatory vs. Single Noun), yielding four prime target pairs of repeated vs. non-repeated phrases or single words (*bell - bell*, *cup - bell*, *blue bell – blue bell*, *green lamp – blue bell*). Since the relevant LATL priming effect was only observed in the Naming task of Experiment 1, only this task was employed. Should the early priming effect be limited to combinatory productions, we additionally assessed how much lexical overlap was required for its elicitation by including pairs with only a shared noun (*red bell – blue bell*) and only a shared adjective (*blue lamp – blue bell*), resulting in an additional 2 x 2 design within our materials crossing adjective identity (Same vs. Diff) with Noun Identity (Same vs. Diff). Results showed no LATL priming for single word repetition and within the combinatory conditions, priming was observed whenever the initial adjective of the phrase was shared.

In sum, this work revealed that basic combinatory responses in MEG can indeed be primed, though some lexical overlap between prime and target is necessary, suggesting combinatory conceptual, as opposed to syntactic processing. Both our combinatory and priming effects were early, onsetting between 100 and 150ms after picture onset and thus are likely to reflect the very earliest planning stages of a combinatory message.

Back to Friday March 4

A meta-analysis of syntactic priming in language production

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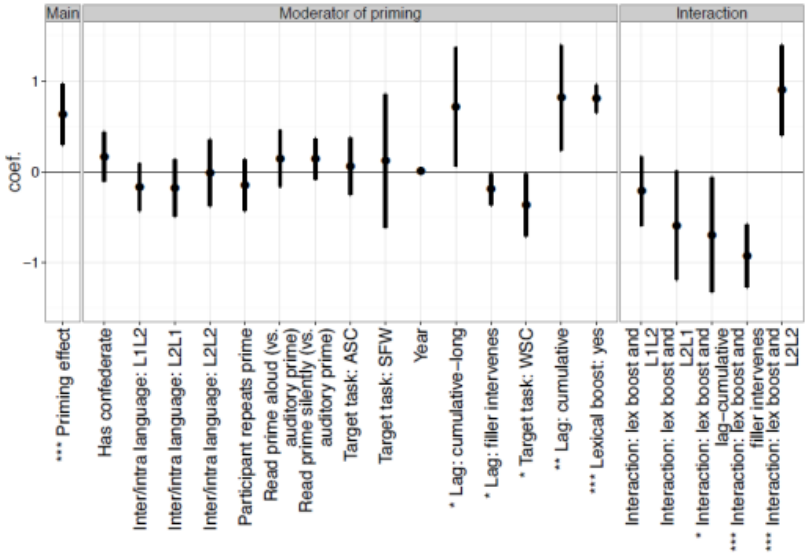
As a major topic of inquiry in sentence processing for the last 30 years, syntactic priming is ripe for a cumulative quantitative analysis to rigorously assess the state of knowledge in the literature, to evaluate the consistency of the results, and to assess possible publication bias. We performed an exhaustive meta-analysis of 71 peer-reviewed journal articles, consisting of 152 unique syntactic priming production experiments, from 1986 through 2013. We found a robust effect of syntactic priming with an average weighted odds ratio of 1.68 when there is no lexical boost and 3.28 when there is. That is, a construction X which occurs 50% of the time in the absence of priming would occur 63% if primed without lexical repetition and 77% of the time if primed with lexical repetition. The syntactic priming effect is robust across several different construction types and languages, and we found strong effects of lexical boost on the size of the priming effect as well as interactions between lexical boost and temporal lag and between lexical boost and whether the priming occurred within or across languages. The size of the priming effect was largely robust to task and modality. The figure below shows estimated model coefficients for the main priming effect (left) as well as moderators of syntactic priming.

We also analyzed the distribution of p-values across experiments to estimate the average statistical power of experiments in our sample and to assess publication bias. Analyzing a subset of experiments in which the primary result is whether a particular structure showed a priming effect, we did not find clear evidence of selective reporting of results and the studies appear moderately well-powered after correcting for publication bias: 77% power.

However, analyzing the experiments that focus not just on whether syntactic priming exists but on how syntactic priming is moderated by other variables (such as repetition of words in prime and target, the modality of the prime, etc.), we found that such studies are, on average, underpowered with estimated average power of 36%. We also obtained raw data from the original authors for 45 of the 71 papers from our sample and used the data to estimate subject and item variation and give recommendations for appropriate sample size for future syntactic priming studies.

We believe this to be the largest formal meta-analysis of a topic in the language sciences. Given intense recent interest in methods in behavioral research, we hope that this work will lead to increased interest in cumulative data analysis in our field.



Back to Friday March 4

Language variation and the role of individuals in community changes: The sociolinguistic making of Montreal French

Hélène Blondeau, University of Florida

Language variation is a multifaceted phenomenon that can be examined from various angles. One of these angles is the relationship between language variation at the individual level and its connection to community trends, an issue that has gained some momentum. This issue will be addressed by looking at cases of morphosyntactic variation in Montreal French, a variety of French that has received a large amount of attention in sociolinguistics.

On one hand, language variation has been one of the central issues in the field of sociolinguistics since its inception. Language variation is considered as a property of the human language, and systematic patterns of variation have been documented based on the quantitative analysis of authentic data collected in natural settings (Labov 2006). Such patterns of variation have emerged from the study of linguistic variables at various levels of the linguistic structure.

On the other hand, the study of language variation directly connects to the broad question of language change, another central issue in the study of human language. As sociolinguists have shown, while a linguistic change necessarily involves variation, the fact that there is variation does not necessarily mean that a change is in progress. Stability or instability of linguistic variables has mainly been observed from the lens of the Labovian apparent time construct. Such approach, which corresponds to cross-sectional studies, is also dominant in other research domains. As a counterpart, real-time study design has recently gained some attention (Sankoff 2005; 2006), and sociolinguists have integrated a productive distinction between trend and panel study offering a new perspective to examine the role of individuals in language variation and their contribution to linguistic changes at the community level..

We will explored this issue by contrasting patterns of morphosyntactic variation that have emerged from the multivariate analysis of authentic Montreal French data collected in natural settings over nearly half a century. This data stems from a new corpus currently collected in Montreal and interrelated corpora collected between 1971 and 1995. Contrasting of the sociolinguistic configuration of morphosyntactic variables will shed light on the role of variability at the individual level (language variation within speaker) and its relation to community trends (language variation across speakers). Such approach will also contribute to disentangle generational, age-grading, and life-span changes as distinct scenarios involving the dynamics of language variation (Wagner 2012).

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Back to Friday March 4

What does it take to be a native speaker?

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Until recently, the bulk of linguistic research has focused on a small set of well-studied languages, where researchers investigate the intuitions and performance of monolingual, young, literate, available (MYLA) speakers: perfect populations for testing. The prominence of data from MYLAs has set expectations concerning the idealized native speaker and such a native-speaker model is often assumed without any discussion. As we expand the empirical coverage of our theories, it is important to be prepared for a noisier, potentially different picture, with speakers less idealized than MYLAs. “Imperfect” speakers are common, appearing as a result of language contact, multilingualism, lack of education, language forgetting, and a host of other factors. Biographical information is not always sufficient to identify them, but failure to recognize non-MYLAs potentially skews the data we collect (Sasse 1992). Thus, identifying and investigating non-MYLAs is an important goal in and of itself which should precede linguistic work in speech communities where only non-MYLAs may be left. In this talk, I present and analyze two structural properties that characterize “imperfect” speakers and force us to reconsider the notion of a native speaker. I will discuss three populations in particular: heritage speakers, older language forgetters, and uneducated monolingual speakers from rural populations. Despite the diversity among these groups, I will show that two recurrent properties can be observed in the language of these non-MYLA populations: (i) reanalysis of ambiguous structures as unambiguous (Tsai et al. 2015; Scontras et al. under review), and (ii) reanalysis of single-valued (underspecified) oppositions as multi-valued (Laleko 2010; Polinsky 2011; Fuchs et al. 2015; Scontras et al. 2015). Both strategies relate to a low tolerance for ambiguity and a higher value placed on processing economy (as opposed to representational economy). Although the two properties discussed here are not exhaustive, establishing them can be a first step toward developing the “imperfect” speaker prototype based on structural rather than demographic criteria. With a better understanding of the profile of non-MYLAs, I will discuss practical issues in methodology, focusing on how best to investigate the grammars of such speakers (Polinsky 2015; Orfitelli & Polinsky in press).

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Back to Saturday March 5

Comprehenders infer influences of discourse intent and speaker knowledge state on linguistic form

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Can the pragmatic impact of a marked syntactic construction be altered as a result of a comprehender's reasoning about the speaker's motivation for using the form? The results of the present study, utilizing the active-passive alternation, provide evidence that it can.

As is well known, a speaker's choice to use a passive (*Brittany was recommended to Charlotte*) instead of an active (*Susan recommended Brittany to Charlotte*) has effects on information structure and subsequent reference: Brittany is more topical in the passive version, which makes it more likely that she will be the referent of a subsequent pronoun. But establishing Brittany as the topic is only one reason the speaker might choose a passive. Another is that she doesn't know who the agent of the event being described is. In this case, a passive may be preferred since it does not require expression of an agent.

This notwithstanding, no theory of information structure nor pronoun interpretation of which we are aware predicts that the effects of the passive on discourse state would depend on a comprehender's reasoning about the speaker's motivation for choosing it. However, explaining-away studies in cognitive science (Gergely et al., 2002) suggest that they could, under the assumption that an ideal, rational comprehender will reason not only about what was said, but also the speaker's motivations for expressing it in a particular way. In particular, it could be that if the speaker's motivation is inferred to be due to her KNOWLEDGE STATE – i.e., her lack of knowledge of the agent – rather than a DISCOURSE INTENT – i.e., an intent to make a referent topical – a comprehender may ascribe less topicality to the subject (*Brittany*). If such explaining-away occurs, we would expect the subject to attract fewer subsequent pronominal references.

We investigate this question using a passage completion paradigm:

1. Daniel rifled through Charlotte's desk until he found the recommendation letter that Paul wrote. He texted his friend: *"Paul recommended Brittany to Charlotte. She* _____*."*
2. Daniel rifled through Charlotte's desk until he found the recommendation letter that Paul wrote. He texted his friend: *"Brittany was recommended to Charlotte. She* _____*."*
3. Daniel rifled through Charlotte's desk until he found the recommendation letter, but he couldn't make out the signature. He texted his friend: *"Brittany was recommended to Charlotte. She* _____*."*

Sixty-five participants were given 24 passages in which a character describes an event for which (s)he either knows who the agent is (1, 2) or does not know (3), and chooses either an active (1) or passive (2, 3) form. Contexts were followed with an ambiguous pronoun prompt that could refer to either the theme (Brittany) or goal (Charlotte). Participants were asked to write a natural completion of the character's utterance. A predicted main effect of PASSIVE was confirmed: participants wrote more theme completions (*She* = Brittany) given a passive prompt than an active prompt (results of maximal mixed-effects logistic regression: $\beta_{\text{Passive}} = 0.35$, $p = 0.0023$), reflecting the impact that the passive has on discourse state. Crucially, however, the availability of an explanation other than DISCOURSE INTENT affected reference: participants used the pronoun to refer to the theme less often when the context indicated that the speaker was unaware of the identity of the agent, hence allowing for the speaker's KNOWLEDGE STATE to explain away her decision to use the passive ($\beta_{\text{Passive:AgentUnknown}} = -0.26$, $p = 0.045$).

In sum, these results provide the first experimental evidence of which we are aware that a comprehender's reasoning about a speaker's motivations can be used to explain away the pragmatic effects on discourse state associated with marked syntactic constructions.

Back to Saturday March 5

Bottom-up adaptation of online pragmatic inferences to variability of speakers

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Recent studies show that listeners cope with variation in pragmatic language use by adapting their expectations; when the speaker is introduced to be abnormal and incapable of informative language use, interpretation of a scalar adjective as indicating contrastive inference is suppressed (Grodner & Sedivy, 2011; Arnold, Hudson-Kam & Tanenhaus, 2007). Yet, this adaptive mechanism is of little use if listeners cannot adapt from bottom-up input because a top-down characterization of speakers is not typically available. In earlier work, we found that *brief* exposure to infelicitous scalars *failed* to reveal adaptation. We hypothesize that, with continuous exposure, listeners can assess pragmatic capabilities of the speaker and adapt their expectations based on the bottom-up evidence alone.

Design: 63 participants (Ps) completed a visual-world eye-tracking study. Ps were randomly assigned to Felicitous-Speaker (FS) or Infelicitous-Speaker (IS) training. 40 test trials, 80 training trials, and 180 fillers were randomly intermingled. *Training trials* differed by condition. On Modified-train trials, instructions contained a scalar (e.g., "Click on the big briefcase"). In the FS condition, the adjective was justified: displays (1a) had a target (big briefcase), and an item in a size contrast with it (small briefcase). In the IS condition, the adjective was over-informative (1c); displays contained a target (big briefcase) and 3 other items. On Non-modified-train trials the instruction never contained a scalar (e.g., "Click on the briefcase"). In the FS condition, no adjective was needed (1 briefcase in scene; 1b); in the IS condition, the adjective was needed but not provided (2 briefcases in scene; 1d). Ps were told to guess if unsure. Fillers had other adjectives (e.g., color, material), used infelicitously in IS. *Test trials* were identical across FS and IS conditions, and used a scalar adjective (e.g., "*Click on the big pickle*"). Displays for half of the test trials included a size contrast (Fig 1e) and the remainder did not (Fig 1f). Interpreted contrastively, scalar adjectives should elicit anticipatory gaze at the target only when the size-contrast item is present (Sedivy et al., 1999).

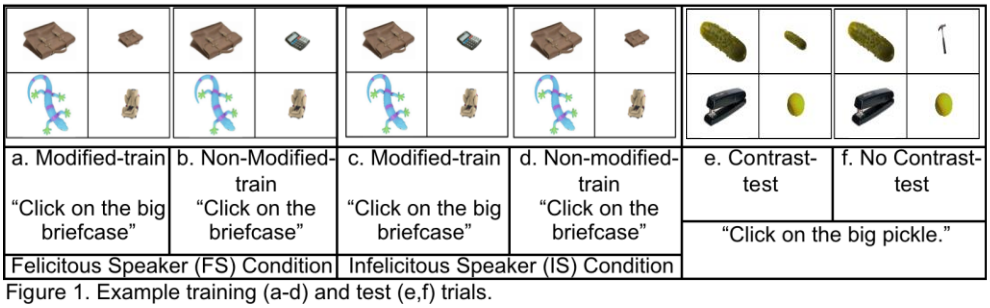

Figure 1. Example training (a-d) and test (e,f) trials.

Results: Eye gaze following the onset of a scalar adjective, e.g. "*big*" at test revealed a large effect of Contrast vs. No Contrast (b=0.17, t=6.07); Ps fixated the target more with a contrast in scene. Critically, the contrast*training interaction (b=-0.12, t=-2.20) was significant. Exposure to an IS reduced (but did not eliminate) anticipatory fixations conditioned on the visual contrast.

Discussion: We present novel evidence of spontaneous attenuation of contrastive interpretations induced by consistent exposure to infelicitous uses of adjectives. This suggests that both top-down (Grodner & Sedivy, 2011) and bottom-up mechanisms for pragmatic adaptation are viable. Yet, contrast-contingent anticipatory gaze did not completely dissipate in the Infelicitous-Speaker condition, despite overwhelming evidence against scalars as a cue (93% infelicitous trials). This persistence might point to contrastive inference as an entrenched step in the processing of scalar adjectives. It may also reflect the strong prior belief that scalar adjectives are, compared to other types of adjectives (e.g., color), unlikely to be over- or under-used (e.g., Tarenskeen, Broersma, Geurts, 2015). Comprehenders thus navigate the variability in pragmatic language use by adapting their online interpretations according to the *types* and *quantity* of evidence in the input.

Back to Saturday March 5

Obligatory and optional focus association in sentence processing

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Background. Formal semantic research on focus has identified two types of focus association: *obligatory* and *optional*. Obligatory focus association is taken to be encoded in the lexical semantics of focus sensitive expressions (*only, even*), whereas optional/free association is a result of the contextual setting of the restrictor of a quantificational operator (*always, most*) (Beaver & Clark 2008). Stolterfoht et al. (2007) and Carlson (2013) showed that *only* facilitates the processing of focus structures during silent reading. When (1) is read without preceding context, the first conjunct receives a wide focus interpretation (in red), and when the processor encounters the ellipsis remnant (in blue), it must revise the focus structure of the first conjunct from wide to matching narrow focus (in green). The presence of *only* in (2) requires narrow focus on its associate (in green), which is congruous with the ellipsis remnant. Revision of the focus structure in (1) vs. (2) was associated with an ERP signature in the Stolterfoht et al. study on German, and with increased reading times in Carlson's self-paced reading study on English.

Only* and *even* vs. *most* and *many. The use of Polish allowed us for a direct comparison between obligatory associating *only* and *even* (Rooth 1985, Tancredi 1990, Krifka 1992, a.o) and optionally associating *many* (Herburger 1997) and *most* (Heim 1999), because (i) case marking indicates that 'sculptors' is the syntactic associate in (2-4), therefore any differences in ellipsis resolution can be attributed to the processing of focus structure alone; (ii) the focus on 'sculptors' in (3) yields a superlative reading that is unavailable in English or German (as indicated by the translation). Pancheva & Tomaszewicz (2012) propose that this reading arises via focus association. In **Experiment I**, we tested whether *only* creates a bias towards a contrast set (Sedivy 2002) detectable with offline measures. The contrastive function of *only* alone could account for the facilitation of ellipsis resolution in prior studies. Participants (*n*=36) were asked to fill in a blank in the position of 'painters' in (1-4). We expected that participants would be biased towards a continuation related to the most recently read phrase (the adverbial). We found this effect in the Baseline and *many* conditions but not with *only* and *most*. In **Experiment II**, self-paced reading (*n*=36), we tested whether *only* and *most* would result in shorter RTs on the ellipsis site than in the Baseline and *many* conditions. We find that both *most* and *many* create an expectation for narrow focus, allowing for easier resolution of ellipsis, as does *only*. The effect is slower with *most* (Word 9) compared to *only/many* (Wd 7-9). In **Experiment III**, we replaced *many* with *even*, which introduces a presupposition of the existence of an alternative set. We predicted that if Experiment II indicates differences between obligatory and optional associators, *only* and *even* should pattern together, and *most* should pattern differently. The results confirm that *even* and *only* create expectations that have an early facilitating effect (Wd 6). *Most* facilitates processing relative to Baseline later (Wd 7).

Conclusion: The results indicate that both *obligatory* vs. *optional* association with focus, and effects having to do with the status of focus alternatives play a role in the online processing of focus structure. Obligatory focus associating expressions like *only* and *even* behave alike in some respects that set them apart from an optionally focus associating expression like *most.*

(1) [Fotografowie ucałowali [rzeźbiarzy]$_F$ na powitanie]$_F$, a nie [malarzy]$_F$ *Polish*
photographers.$_{Nom}$ kissed sculptors.$_{Acc}$ for greeting and not painters.$_{Acc}$
'Photographers kissed sculptors for greeting, and not painters.'

(2) Fotografowie ucałowali ***tylko*** [rzeźbiarzy]$_F$ na powitanie, a nie [malarzy]$_F$
photographers.$_{Nom}$ kissed **only** sculptors.$_{Acc}$ for greeting and not painters.$_{Acc}$

(3) Fotografowie ucałowali ***najwięcej*** [rzeźbiarzy]$_F$ na powitanie, a nie [malarzy]$_F$
photographers.$_{Nom}$ kissed **most** sculptors.$_{Gen}$ or greeting and not painters.$_{Gen}$
'Photographers kissed more sculptors for greeting than anybody else, and not painters.'

(4) Fotografowie ucałowali ***wielu*** [rzeźbiarzy]$_F$ na powitanie, a nie [malarzy]$_F$
photographers.$_{Nom}$ kissed **many** sculptors.$_{Gen}$ for greeting and not painters.$_{Gen}$

Back to Saturday March 5

Closest conjunct agreement in English: A comparison with number attraction

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Hierarchical structure is widely assumed in syntax, and (errors in) agreement computations seem to be sensitive to it. A plural attractor following a singular head noun elicits verb agreement errors like **The key to the locks are*... (e.g., Bock & Miller, 1991), not because the attractor is linearly close to the verb, but because the attractor is hierarchically close to the head (e.g., Franck et al., 2002; cf. Gillespie & Pearlmutter, 2013). But there is one case in English where a noun that is linearly close to the verb does control agreement: when part of a disjunction, e.g., *The key or the locks are*... (Haskell & MacDonald, 2005). When part of a conjunction, however, a plural verb is prescriptively correct, regardless of the number on either noun. In four experiments, we show that 1) in both production and comprehension, linear proximity effects *do* exist in conjunction agreement (evidence for "closest conjunct agreement" with number?), and 2) the mechanism that underlies this "closest conjunct agreement" is distinct from that involved in number attraction.

Expts 1-2 used a speeded two-alternative forced-choice paradigm (2AFC; Staub, 2009), in which participants read preambles presented in RSVP format and chose the agreeing verb form. Expt 1 replicated the linear proximity effect seen with disjunctions and extended it to conjunctions, e.g., **The keys and the lock is*... A singular second noun not infrequently elicited a singular verb, and this was modulated by adjacency, as non-number-marked intervening material reduced the influence of the nearby singular. Expt 2 replicated Franck et al.'s (2002) findings in this paradigm, showing that linear proximity of attractor to verb is not responsible for number attraction.

Expt 3 (2AFC; Fig. 1) directly compared number attraction with conjunction agreement and confirmed a prominent difference between the two: A singular attractor has little to no effect in number attraction, while a singular second conjunct has a sizable effect on agreement. Expt 4 (eye-tracking while reading; Fig. 2) revealed a significant illusion of grammaticality in total time, with a singular second conjunct leading to faster reading times on an ungrammatical singular verb. No such illusion was present with a singular attractor in classic number attraction. In addition, a singular second conjunct induced a significant illusion of *un*grammaticality in first pass, go-past, and total reading times. Notably, such an illusion of ungrammaticality is absent in classic number attraction even when a plural attractor precedes a licit singular verb (Wagers, Lau, & Phillips, 2009).

These results suggest distinct mechanisms for "closest conjunct agreement" and classic number attraction. We follow Haskell & MacDonald (2005) and Marušič, Nevins, & Badecker (2015) in proposing that the critical difference lies in structure: A conjoined subject is not headed by either noun. When none of the nouns preceding the verb is the head of the subject phrase, linear order may play a prominent role in retrieval of the agreement controller.

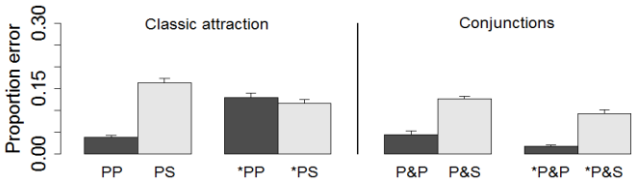

Fig. 1: Error rates from Expt 3 (S=sing, P=plur, &=conjunct) [note high error rate in PP and PS, but critically, there is no effect of a singular attractor]

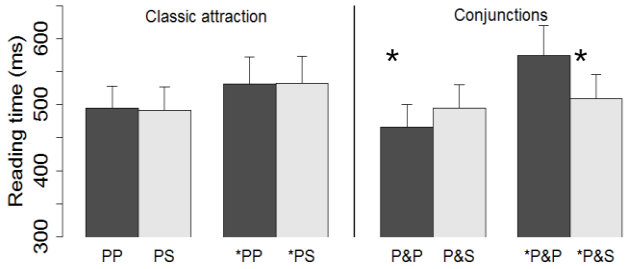

Fig. 2: Total reading times on the critical region [verb and verb+1] from Expt 4 (p<.05)*

Back to Saturday March 5

Attraction and similarity-based interference in object gender agreement

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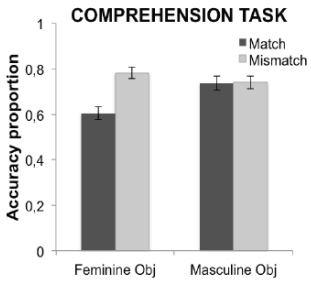
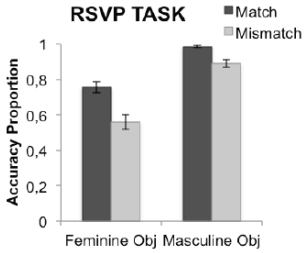
French ORs require gender and number object-verb agreement, manifest on the past participle, when the object has been moved pre-verbally (1). Research on subject-verb agreement in ORs has shown that when the subject and the object mismatch in number, agreement accuracy is lower in production (Bock, Miller 1991; Franck et al. 2010) while reading times at the verb are faster in comprehension (Franck et al. 2015). To account for this apparent contradiction, it has been argued that whereas production requires agreement computation, which is penalized by feature mismatch due to *attraction,* comprehension requires object retrieval, which is facilitated by feature mismatch due to *similarity-based interference* (Franck et al. 2015). However, it remains unclear why subject-verb agreement would cue object retrieval, and why other studies failed to show a mismatch effect in the comprehension of grammatical ORs (Wagers et al. 2009). This study investigates whether the pattern attraction vs. similarity-based interference also arises in the production and comprehension of ORs requiring object agreement in gender.

Two experiments on 85 native French speakers were conducted: (i) a sentence comprehension study combined with self-paced reading measures (SPR), and (ii) a rapid serial visual presentation study (RSVP), a task that gives rise to similar attraction patterns as those found in production (Franck et al. 2015). We manipulated the gender of the object and the gender match between the object and the subject. Thirty-two sets of grammatical sentences were generated (English translations are provided in (1)). Residual log reading times for correct trials and accuracy proportions were analyzed with (generalized) linear mixed-effects models.

(1) a. The waiter-F / that / the dancer-F / has / surprised-F / drank / a cocktail / with alcohol FF
b. The waiter-F / that / the dancer-M / has / surprised-F/ drank / a cocktail / with alcohol FM
c. The waiter-M / that / the dancer-M / has / surprised-M / drank / a cocktail / with alcohol MM
d. The waiter-M / that / the dancer-F / has / surprised-M / drank / a cocktail / with alcohol MF

Sentence comprehension: participants were more accurate in the gender mismatch (FM/MF) than in the gender match conditions (FF/MM) for feminine objects only. **SPR:** an interaction between gender match and object gender was found on the participle, attesting to faster RTs in the gender mismatch condition for feminine objects (FM faster than FF). **RSVP:** two main effects were found showing more agreement errors for mismatching than matching conditions, and for feminine than masculine objects.





Results provide further evidence for a profile of facilitation vs. penalization due to feature mismatch in the processing of ORs with yet another feature, gender, involved in another agreement dependency, object agreement. Participants were more accurate and faster in comprehending ORs when the object and the subject mismatched in gender, especially so when the object was feminine, suggesting that the presence of a feminine marker on the participle provides a better retrieval cue than the default masculine. This finding is in line with studies showing a facilitatory role of feature mismatch in OR processing in children (Adani et al. 2010, Belletti et al. 2012), while it contrasts with the lack of a mismatch effect in English (Wagers et al. 2009), which may therefore either be due to the weakness of agreement cues in that language, or to a lack of power. In contrast to comprehension, participants were less accurate in producing agreement in the presence of gender mismatch, attesting to subject attraction in object-verb agreement, a type of attraction that has seldom been explored (Santesteban et al. 2013). In sum, whereas feature mismatch comes with a cost for agreement computation, it provides disambiguating information for the parser when building the structure of a complex sentence involving movement.

Back to Satuday March 5

On the comprehension of referring expressions: The role of coordination in conversation

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When communicating, people make constant reference to entities in the world. To establish reference, speakers must choose the linguistic expressions to use based with what they believe to be in common ground with their addressee. In a conversation, people may also coordinate the process by which common ground is recruited and updated by seeking or giving explicit evidence, such as confirmations, of such grounding. The present research is concerned with differences that individuals display in their use of coordination devices, and how that use may predict how successful they are in establishing reference.

Building on the seminal work by Krauss and Weinheimer (1966) and Clark and Wilkes-Gibbs (1986), two participants were invited to the lab to perform a matching game. They sat on either side of an opaque barrier and took turns playing the roles of director and matcher, the former instructing the latter which one, out of 16 hard-to-describe shapes, to select. The experiment consisted of 48 such trials, each shape being referred to three times. On each trial, we recorded the number and duration of turns contributed by each participant and the nature of each contribution. Each participant's workspace was video-recorded to later assess whether the matcher selected the intended shape. Departing from past research, participants were recruited from the University of Pennsylvania undergraduate-student population as well as from the Philadelphia community at large, i.e., including people from a variety of education, age, and socio-economic levels.

While student pairs made few matching errors (error rates ranging from 0 to 8%), community members varies widely in how accurately they performed the task (error rates ranging from 12 to 54%). Analyses of the conversations revealed differences in language use as well. Confirming past research involving student participants, reference to the same shape became shorter with repetitions, and equally so whether the participants' roles (as director and matcher) were the same or different between two consecutive instances. This is because, as argued by Clark and colleagues, people use language to ground the expression they have found mutually acceptable on the first instance and can use that experience in subsequent instances. By contrast, among community participants, repetition had no systematic impact on the number of turns or their duration involved in making reference to a specific shape. Analyses of the content of the conversations suggest a possible account. Among students, directors and matchers used language for other purposes than presenting a linguistic formulation to establish reference or evaluating it: Through the frequent use of coordination devices (e.g., confirmation requests, confirmation, reformulation) and project markers (such as 'uh-huh' and 'okay'), they provided each other with ample evidence of their mutual understanding, or lack thereof. When characterized as a group, community participants used these coordinative devices and project markers less often than students did. However, the frequency of use varied widely across individuals, and the less participants used these linguistic devices, the more undetected errors resulted.

These findings indicate greater variability in the strategy people adopt when making reference than past reports have suggested. Evidently, even people with no known or diagnosed language or communication disorder do not recognize the need to coordinate common ground with their conversational partner, a strategy that can prove detrimental to their ability to successfully establish reference. Possible origins for these differences, such as whether or not conversational partners belong to the same community, are being actively investigated in our lab, and preliminary findings will be reported.

Back to Saturday March 5

I see what you meant to say: Effects of plausibility and speaker certainty on processing of repair disfluencies

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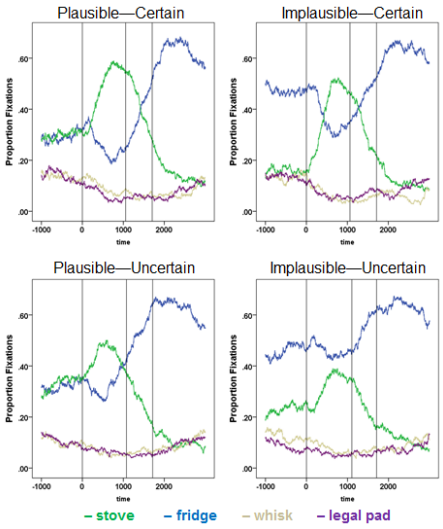
Imagine your friend says to you, "*Could you please put the milk in the stove?*" If we assume that the goal of the listener is not simply to passively decode the linguistic input, but rather to recover the speaker's intended meaning, then it seems likely that the listener will identify "*stove*" as a reparandum and mentally repair it with the more plausible "*fridge*," perhaps even before the speaker realizes the error. This prediction follows directly from Noisy Channel models of language comprehension, which propose that comprehenders weigh the probability of the input against linguistic and contextual knowledge, actively correcting perceived errors. We conducted a visual-world eye-tracking experiment that investigated the extent to which listeners use information about plausibility and speaker certainty during the processing of speech errors.

Participants (n = 32) listened to sentences (see example), in which sentence plausibility and speaker certainty were systematically manipulated. Plausibility was manipulated via a small change to the sentence context (*fish* vs. *milk* in the example), whereas certainty was manipulated via the presence or absence of a filled pause ("uhh") immediately before the reparandum. Note that all conditions were identical from the onset of the reparandum through the rest of the sentence. The visual display was the same across conditions, consisting of four pictures representing the reparandum (e.g., a stove), the repair (e.g., a refrigerator), and two distractor items (e.g., a whisk and a legal pad).

Example item: Mary realized she had left the [fish/milk] on the counter and forgotten to put it in the (uhh) stove, uh I mean the fridge, so she turned around and went back.

In the 1,000 ms before the onset of the reparandum (line at time zero), there was a robust effect of plausibility, such that listeners in the Implausible condition tended to look at the picture they expected to be named (the fridge), rather than the less plausible reparandum (the stove). Listeners in the Plausible condition considered the two pictures equally. Beginning approximately 500 ms after the onset of the reparandum, there was a significant effect of certainty, such that when the speaker was certain, listeners tended to keep looking at the reparandum, but when the speaker was uncertain, listeners shifted their gaze to the repair. This effect of certainty persisted into the second time window, from the onset of "*uh*" (second vertical line) to the onset of the repair (third vertical line). By the time the repair was spoken, there were no significant differences.



Listeners use both contextual knowledge and cues from the speaker to rapidly recover the speaker's intended meaning when he or she makes an error. Plausibility had an early effect, guiding initial predictions about what the speaker was going to say. The certainty with which the speaker uttered the reparandum then influenced how long listeners would continue to consider it before switching to the repair. The combined effect of having an implausible reparandum that was uttered with uncertainty led listeners to commit to the repair early and largely ignore the reparandum. We propose that this occurs because listeners do not passively wait for an explicit signal that an error has occurred; instead, listeners actively model the speakers' communicative intentions, mentally correcting any perceived errors. In addition, these results are strong evidence for the important communicative role of fillers such as "uh", demonstrating that they are effective cues to the listener that the speaker is having trouble producing the intended word.

Back to Saturday March 5

Interpretation of null and overt pronouns in Chinese

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It has been argued that less explicit anaphoric expressions are used to refer to more salient antecedents (Ariel, 1990; Givón, 1983). When applied to pronominals, this predicts that null pronouns (pro) will be favored over overt pronouns when referring to the subject. Previous studies, however, have suggested that different interpretational constraints are at work across languages. For example, in Italian, overt pronouns were more likely to refer to the object than the subject (Carminati, 2002) while in Korean, subject bias was equal between overt pronouns and null pronouns (Kim et al., 2013; Kwon & Polinsky, 2011). The current study investigated the interpretational bias of pro and overt pronouns in Chinese in intra-sentential context based on both offline and online experiments.

In Experiment 1 (n=20), participants were asked to identify a referent for pro and overt pronouns in contextually neutral sentences as in (1). The results showed a main effect of pronominal type, suggesting that pro was more likely to refer to the subject than an overt pronoun ($p < .002$), although they were both subject-biased. Experiment 2 (n=20) employed contextually biased sentences as in (2), crossing the pronominal type and contextual bias. Participants were asked i) to identify a referent for pronominals and ii) to rate the sentences on a naturalness scale of 1 to 5. There was no effect of pronominal type in the identification task but the naturalness rating results showed that sentences were rated to be more natural with overt pronouns than with pro. This was because pro was rated to be significantly less natural than overt pronouns in the object-biased sentences ($p < .05$), while the naturalness ratings were equally high for pro and overt pronouns in the subject-biased sentences. These offline results suggested that in Chinese, pro has a stronger preference to refer to subject than overt pronouns.

Experiment 3 and 4 investigated the pronominal biases during on-line sentence processing using the self-paced reading time method. Employing pro and an overt pronoun as the subject of the embedded clause respectively, Experiment 3 and 4 manipulated the gender of the subject and the object to match or mismatch the gender stereotype of a preceding role noun (e.g., firefighter). A gender mismatch effect was predicted i) at the subject position both in Exp3 and Exp4 as both pro and overt pronoun were subject-biased (Exp1 and 2), and ii) at the object position only in Exp4 as pro was not preferred to refer to the object (Exp2). There was no effect in the subject position in either Exp3 or Exp4. However, in Exp3 (n=22), there was an interaction of the subject and object at the object position ($t = -4.64$) which continued until the end of the sentence. The reading times were such that the object match and mismatch condition only differed for the subject mismatched conditions but did not differ when the subject matched the stereotypical role nouns in the gender feature, suggesting that the parser only attempted to associate the object with pro when its attempts with the subject fails. While in Experiment 4 (n=22), there was a main effect of the object mismatch/match ($t = -2.66$). This suggests that the interpretation of overt pronouns is more sensitive to the object than the pro, potentially confirming the results of the offline study (Exp2). However, the delayed effects in both experiments suggest a possibility that pronoun resolution is not immediate in on-line sentence processing in Chinese at least for the cataphoric dependencies such as the ones employed in the current study.

Overall, these results in Chinese are consistent with the Accessibility theory (Ariel, 1990; Givón, 1983) that less specific anaphoric expressions (e.g., pro) are more favorably used to refer to a more prominent antecedent (e.g., the subject) than more specific anaphoric expressions (e.g., overt pronouns). The online experimental results suggested that interpretation of pronominal elements is rather delayed in Chinese but it is possible that our experimental stimuli could be limited in their interpretations (Huang, 1982; Zhao, 2014). We are currently conducting further experiments with different configurations.

(1) Exp1: Contextually neutral: When Mary called Cathy, Ø/she was in the office.

(2) Exp2: a. subject-biased: When Tom called Mark, Ø/he dialed the wrong number.
b. object-biased: When Tom called Mark, Ø/he answered the phone slowly.

(3) Exp3 (pro) & Exp4 (overt pronoun): Subject match/mismatch ×object match/mismatch
After Ø/he became a firefighter, Sam/Amy generously gave John/Becky a gift.

Back to Thursday March 3

In language change, processing effects precede loss in production

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Languages change gradually over time. One effect of this is that at any one synchronic moment, we find a lot of variation among speakers. This variation can persist for several generations, usually resulting in more categorical grammatical change. Currently, the Norwegian grammatical gender system is undergoing a major change from three genders (Masc, Fem, Neut) to two (Common, Neut). In some dialects, there are no traces left of the old Fem markers (which have been generalized to Masc), while in other dialects, they are still present on nouns, articles, possessors and adjectives (Lødrup 2011; Rodina & Westergaard 2015). In most dialects, only a subset of the feminine markers are used, often with considerable inter- and intra-speaker variation, especially in the younger generations.

We hypothesized that the disappearance of Fem should be reflected in language processing, but it was not clear whether it would be better captured in production or comprehension of the gender markers. Adult L1 speakers of Norwegian (n=44, age 21-59) living in Tromsø were divided into two groups, Fem (F, n=33) and no Fem users (NoF, n=11) based on a control offline production task, and their eye movements were recorded during a Cohort comprehension task in a Visual World Paradigm experiment. There were 4 conditions in which an indefinite article + target noun was paired with distractors: (1) Neut target (N) -- Masc (M) distractors, (2) Fem (F) -- M, (3) M -- F, and (4) M -- N. The combinations (1)-(4) appeared in one experimental condition (only one referent with target gender) and a control condition (two out of four referents with target gender). The stimulus sentences included a target noun preceded by a gender marked indefinite article. The time course analysis revealed that when the target was N (1), both groups fixated the target significantly faster in the experimental condition compared to the control one (125 ms for the F group, 117 ms for NoF group, $t > 2$.) Surprisingly, when either target or distractor was F (2-3), neither group showed any reliable signs of fixating the target faster. Even more surprisingly, only the NoF group showed predictive processing in the M condition (4) with N distractors (115 ms, $t > 2$), but not the F group (15 ms).

To make sure that this unexpected outcome for (2)-(3) is not driven by inconsistent use of the Fem gender in the F group (whose use of Fem could be unstable), we re-ran the experiment with high school students from a small town where Fem indefinite articles are used consistently (n=54, age 16-18). All but one used the Fem indefinite article in the offline production task. Despite this, the results remained the same as for the F group in Exp. 1: a reliable predictive effect for the N target (70 ms, $t > 2$), but no effect for the M or F targets. Thus, although the Fem markers were actively produced by the F users in both experiments, these markers lost their predictive power in comprehension, rendering the F group equivalent to the NoF group.

We hypothesize that when the unambiguous cues of the relevant grammatical feature (i.e., gender) start to disappear during language change, comprehension is affected faster than production: both F and M (the former disappearing, the latter becoming the common gender), lose their predictive power. Change in production is more gradual when F and NoF users coexist in the language community. We speculate that it is not until a stable two-gender system has been established that the default gender (M) will make a similar processing contribution as the marked gender (N). Thus, our data contribute new evidence in favor of the production-comprehension asymmetry found in L1 acquisition (Grimm et al. 2011) and argue against contingencies between gender assignment and predictive gender agreement as has been proposed in recent L2 research (see Hopp 2013). They also suggest that language processing experiments can be an important tool in capturing the characteristics of an ongoing change.

Back to Friday March 3

Register variation as a mediating factor for linguistic processing

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Grammatical analysis of natural texts from different registers provides evidence indicating that the situational context directly shapes linguistic production. Supported by evidence from analyses of large-scale corpora, the present talk argues that language use is mediated by register: that is, differences in mode, interactivity, communicative purpose, and production circumstances have a direct functional influence on linguistic form. Because some of these registers (especially specialist informational written registers) are encountered in adulthood, a major challenge for language learners is developing competence in the production and comprehension of texts that rely on the grammatical forms required for these specialized registers.

Evidence for these claims comes from two major lines of research. The first consists of a series of studies that have applied 'multi-dimensional' (MD) analysis to describe the overall patterns of register variation in a language. Comparing research findings across several different languages (e.g., Spanish, Korean, Somali), these studies have shown that the spoken and written modes differ in their potential for linguistic variation: speech is highly constrained in its typical linguistic characteristics, while writing permits a wide range of linguistic expression, including linguistic styles not attested in speech. This difference is attributed to the differing production circumstances of the two modes: real-time production in speech versus the opportunity for careful revision and editing in writing. As a result, the written mode provides the potential for styles of linguistic expression not found in the spoken mode. In particular, MD analyses have repeatedly shown that language production in the written mode with a highly informational purpose results in a dense use of phrasal complexity features, a grammatical style of discourse unattested in spontaneous spoken registers regardless of the primary communicative purpose.

The second line of research explores patterns of register variation relating to the use of grammatical complexity features in more detail. These corpus-based research findings reveal several strong patterns of use that directly contradict widely-held stereotypes about grammatical complexity, showing that:

- with respect to the use of many types of dependent clauses, conversation is structurally complex and elaborated to an even greater extent than academic writing
- the grammatical complexities of academic writing tend to be phrasal rather than clausal, resulting in a structurally compressed rather than elaborated grammatical style
- these phrasal grammatical complexity features are recent historical innovations in English, both with respect to the historical evolution of individual complexity features, as well as the development of discourse styles that rely on phrasal rather than clausal complexity features
- register factors – especially the production circumstances of the written mode coupled with the communicative purposes of specialist texts -- are the central considerations influencing the use of these phrasal complexity features
- the productive use of these complexity features is developed late in life, over the course of a university education and into professional adulthood beyond

Taken together, these research findings provide strong evidence in support of the general claim that register variation is a crucially important mediating factor that must be considered for a complete understanding of linguistic processing. Natural language occurs as texts from different registers, produced in different situational contexts for different communicative purposes. Corpus evidence shows that these register differences really matter – that language production is influenced by, and perhaps even constrained by, the situational context. Thus, the talk concludes by arguing that linguistic processing is best studied within the context of natural texts from a range of registers.

Back to Saturday March 5

Poster Abstracts

Thursday

A constraint on the online empty pronoun resolution in Japanese

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The pro-drop and strictly head-final property of languages like Japanese gives rise to notorious massive local ambiguity and presents potential challenges to incremental parsing. In (1), the dative argument of a causative verb is left unpronounced (indicated by __).

(1) Taro-ga ___ doku-o nom-ase-ta . . . "Taroo made *someone* drink a poison . . . "
T-NOM poison-ACC drink-CAUSE-PAST

(1) illustrates the following challenges. First, verbs at the end of clauses indicates how many arguments are involved in the clause. Thus, before the verb is encountered, the parser cannot decide whether an argument is missing or not. Second, due to the pro-drop property, even if the missing argument is recognized, there is no clue to decide whether it is a silent pronoun (*pro*) or a gap left by movement of an overt NP (as in relative clauses) (e.g., Miyamoto & Nakamura, 2003). Through a phrase-by-phrase self-paced reading experiment, we show: (A) the parser recognizes a missing argument using the verb's argument structure information. Once the missing argument is recognized, (B) the parser inserts *pro* into the missing argument position, rather than treating it as the result of movement, and (C) the parser launches an active search for the antecedent of *pro*.

In (2a), the 'because'-clause has a missing dative argument. The missing dative NP in the adverbial clause should be interpreted as *pro*, not as a gap, because movement out of an adverbial clause is known to be impossible (Saito, 1985). If the parser initiates a search for the antecedent for a *pro*, the parser would be surprised to find a dative NP (*Jiro-ni*), which seems as if it has moved out of the adverbial clause. Note that a grammatical continuation from such a fragment is totally possible with the dative NP being an argument of the matrix clause. Interestingly, however, many native speakers of Japanese judge sentence fragment like (2a) as unacceptable quite clearly (cf. Saito, 1989). Here the NP immediately after the 'because'-clause happens to bear the same case-marker as the missing argument, hence the Case Matching Effect (CME). No such effect emerges in (2b) where *Jiro* has an accusative case-marker (which is mismatching with the dative case that the missing NP would have). An accusative NP is taken as the antecedent of *pro* and no confusion about the movement occurs.

(2) [Taro-ga __ doku-o noma-se-ta node] {(a). Jiro-ni/ (b). Jiro-o} ...
T-NOM poison-ACC drink-CAUSE-PAST because J-DAT / J-ACC ...

Taking advantage of the CME, we investigated the online reading of sentences like (3). In a 2x2 factorial design, Embedded-Verb (dative verb vs. accusative verb) x Case of the first matrix argument (Dat-NP vs. Acc-NP) were manipulated as independent factors as illustrated in (3). Note, causative verbs in Japanese like *nom-ase-ru* (make someone drink) take a dative argument in addition to an accusative argument.

(3) [Taro-ga doku-o {*noma-se-ta/non-da}-* node] {**Jiro-ni/Jiro-o**} Adv1 Adv2 Verb...
T-NOM poison-ACC drink-CAUSE-PAST/drink-PAST because J-DAT/Jiroo-ACC

We found a significant interaction of Embedded Verb x Case ($t=2.10$, $p<.05$) at the Adv2, the spill-over region, and pair-wise comparisons revealed that Adv2 was read significantly slower in the Dat-Verb/Dat-NP condition than the Dat-Verb/Acc-NP one ($t=2.55$, $p<.02$). No such effects were found in the Acc-Verb conditions. This suggests that, when the verb is a dative verb, the parser recognized that the dative argument is missing and thus launched the active search for its antecedent. The NP encountered after the dative verb is the first NP in the matrix clause *Jiro*. If *Jiro* bears a dative case particle, the parser erroneously concludes that this dative NP is moved out of the adverbial clause, and the parser recognizes that such movement is impossible, resulting in a RT slowdown (CME). When *Jiro* bears accusative, on the other hand, the parser can grammatically link the overt accusative NP and the dative missing argument, and no RT slowdown is observed.

Back to Thursday Poster Schedule

A Gradient Symbolic Computation model of incremental processing

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An incremental processing system must solve two computational problems: (TA) temporary ambiguity and (CD) context dependency. Consider an artificial language, L1 = {[a b], [a c], [d b], [d c]}. A first word input 'a' creates temporary ambiguity and the system needs to keep possible continuations [a b], [a c] until it encounters disambiguating information. Then upon receiving 'b' the system needs to exclude two impossible structures ([d b] and [d c]) given context 'a' so it can choose [a b] over [d b]. Solving these two problems (TA, CD) is a challenge to any sentence processing algorithm, but particularly for neural-network models that utilize highly local constraints; operate over distributed representations; and do not explicitly monitor complete structures. We present a Gradient Symbolic [1] model that meets the challenges, generating trial-level, probabilistic predictions of the time course of structure building.

The proposed model combines two dynamics. The first satisfies a set of local constraints specified by a grammar; this typically results in a blend state within the space of distributed representations of structure. This represents a conjunction of discrete structures favored by the local structural constraints. The second component of the dynamics, quantization, satisfies constraints which penalize blend states. Quantization forces decisions — temporary commitments — to alternative parses; it is scaled by a parameter *q*, the strength of decision-making pressure, which increases during parsing. The activation state performs stochastic gradient ascent, reaching a local maximum of a measure of constraint satisfaction, harmony (see Fig 1). During parsing of 'a b', the harmony surface is dynamically changing as a function of word input and *q*. We argue that the appropriate control of *q* solves the two problems (TA, CD) at once and is critical for successful parsing. Early on, at low *q* values, with 'a' presented, the model handles temporary ambiguity by moving to a blend state in which possible structures [a b] and [a c] are most strongly active. As *q* increases, multiple local maxima and harmony valleys emerge. When the input changes to 'b', [d b] has the same harmony as [a b] but by then the model's stochastic gradient ascent cannot cross the harmony valley between [a b] and [d b] (Fig 1b). Context-dependent processing is achieved by harmony barriers separating context-inappropriate from context-appropriate states.

To test this account, model simulations were given a sentence word by word. At each word, *q* increased linearly to a position-specific maximum, *qMax*. Fig 2 shows the effect of *qMax* on parsing accuracy of 'a b' in L1. Simulations included computational noise (parameter *T*). With small amounts of noise, the model parsed correctly over a wide range of *qMax* (decision-pressure) values. With greater noise, the model made errors. When *qMax* was too small, the model chose [d b]: it failed to reject the context-inappropriate structure after processing the first word. When *qMax* was too high, the model sometimes chose [a c] after 'a' and failed to revise it with 'b' (a kind of garden path effect [2]). A similar result was observed in L2 = {[[a b] c], [[a d] e], [b c]} (Fig 3), where insufficient quantization led to parsing 'a b c' as [[a b] [b c]], an ungrammatical structure (a local coherence effect [3]). Controlling *q* allows our neural network model to solve both temporary ambiguity and context dependency; control failures result in garden-path and local-coherence effects.

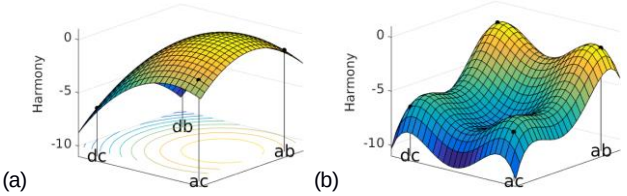

Fig 1. Schematic diagrams of harmony surface.
(a) input word is 'a' and *q* = 0. (b) input word is 'b' and *q* = 4.

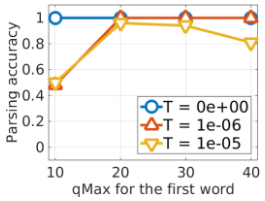

Fig 2. Parsing accuracy on 'a b' in L1 (100 runs each)

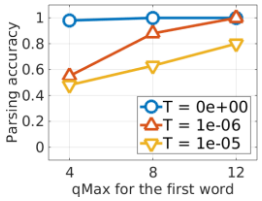

Fig 3. Parsing accuracy on 'a b c' in L2 (100 runs per each)

[1] Smolensky, Goldrick, & Mathis (2014). Cognitive Sci, 38, 1102-1138. [2] Frazier & Rayner (1982). Cognitive Psychol, 14, 178-210. [3] Tabor, Galantucci, & Richardson (2004), J Mem Lang, 50, 355-370.

Back to Thursday Poster Schedule

A new model for processing antecedent-ellipsis mismatches

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Summary. An active question in psycholinguistics is whether or not the parser and grammar are distinct cognitive systems that exploit different rules and representations. Recent evidence for the distinct-systems view comes from cases of ungrammatical but acceptable antecedent-ellipsis mismatches (e.g. voice mismatch: **Tom kicked Bill, and Matt was ~~kicked by Tom~~ too.*). The finding that different types of antecedent-ellipsis mismatches show varying degrees of acceptability has been presented as evidence for use of grammar-independent parsing strategies that restructure a mismatched antecedent to fit the constraints of the ellipsis site [1,2]. I argue that it is unnecessary to rely on a special class of parser-specific rules for antecedent-ellipsis mismatches, and that it is possible to capture the observed acceptability profile under a single-system account in which the constraints on ellipsis are implemented using domain-general memory mechanisms. To support this account, I show using a computational model of cue-based memory retrieval [3] that the observed acceptability profile follows directly from independently motivated properties of working memory, without invoking multiple representational systems. Specifically, the model accurately predicts the observed profile as a consequence of the degree of feature-match between the antecedent and the retrieval cues at the ellipsis site ('probe-to-target similarity').

Existing findings. Ellipsis is ungrammatical when no syntactically matching antecedent is available. However, previous studies have shown that even when a matching antecedent is not available, readers can still resolve ellipsis to varying degrees of acceptability: a passive-active voice mismatch is judged as more acceptable than an active-passive mismatch (1 vs. 2), and a verbal gerund antecedent is judged more acceptable than a nominal gerund antecedent (3 vs. 4) [1,2]. This acceptability profile has led some researchers to suggest that antecedent-ellipsis mismatches should be handled by special, parser-specific heuristics that restructure ungrammatical antecedents [1] or prioritize certain parser states over others [2].

Acceptability profile: passive-active > active-passive // verbal gerund > nominal gerund

1. The dessert was praised by the customer after the critic did already.	(passive-active)
2. The customer praised the dessert after the appetizer was already.	(active-passive)
3. Singing the arias tomorrow night will be difficult, but Maria will.	(verbal gerund)
4. Tomorrow night's singing of the arias will be difficult, but Maria will.	(nominal gerund)

The model. Ellipsis resolution in 1-4 was simulated using the cue-based retrieval model [3, following 6]. In this model, the acceptability profile falls out from the degree of feature match between the antecedent and the retrieval cues at the ellipsis site. Cues were selected based on the independently motivated principle that there is a direct mapping between overt linguistic features and retrieval cues [see 7]. For the active-passive mismatch (2), feature mismatches for voice and morphological requirements on passiviation, combined with additional retrievals for the passivized object at the ellipsis site, increase processing difficulty and lower acceptability relative to the passive-active mismatch (1), which deploys only a voice cue by contrast (acceptability = processing time at ellipsis site [1,2]). For the gerunds, the mismatching NP category feature for the nominal gerund derives the verbal > nominal contrast (3 > 4).

This account of ellipsis mismatches improves empirical coverage: it captures the {passive-active > active-passive} contrast and the finding that verbal gerunds are less acceptable than antecedent-ellipsis matches, which existing accounts [1-2] fail to capture. These results show that antecedent-ellipsis mismatches can be derived without assuming additional grammar-independent parsing strategies.

References. [1] Arregui et al., 2006. [2] Kim et al., 2011. [3] Lewis & Vasishth, 2005. [4] Phillips et al., 2011. [5] Lewis & Phillips, 2015. [6] Martin & McElree, 2008. [7] Van Dyke & McElree, 2011.

Back to Thursday Poster Schedule

A rating study of frozen scope in the VP-internal locative alternation

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In most English sentences with two quantified NP's, quantifier scope is ambiguous, but for variants of the VP-internal locative alternation in which the Locatum surfaces in indirect object position, it has been claimed that a universally quantified Locatum cannot out-scope an existentially quantified **Location**[1]; see (1) and (2).

(1) The workers loaded **a truck** with every box. *a>every, *every>a*
(2) The waiter cleared **a table** of every dish. *a>every, *every>a*
(3) The workers loaded **the truck** with every box. control condition

In a rating study, participants were asked to judge the acceptability of a plural interpretation of the **Location**, on a 7-point scale from *-3: must be singular*, to *0: both interpretations are equally good*, to *3: must be plural*. Experimental items were sentences like (1) and (2), taken from four verb classes, crossing preposition (*with/of*) and the availability of a DO-Locatum PP-variant[2]. Items were normed and counterbalanced for the plausibility of a collective vs. distributed spatial relation between the **Location** and Locatum and rated for ambiguity of PP-attachment (to verb or noun). Experimental items were compared to unambiguous matched control sentences with only one quantifier (ex., (3) is the control for (1)). Presentation was in IBEX, online at IBEX Farm.[3] Each list included 18 experimental items, 18 control items, and 108 assorted fillers.

Data from 50 adult native speakers of English (mean age 43.3) were modeled using cumulative link logistic regression [4]. The analysis picked out condition, plausibility, age, and preposition as contributing to the distribution of ratings. Experimental items were rated higher than control items (p<.001, fig. 1). Distributive-bias items were rated higher than neutral items (p<.001), which were rated higher than collective-bias items (p=.005). Older participants rated items more toward the "frozen" end of the scale (p=.007). Experimental *with*-variants (1) were rated higher than *of*-variants (2), relative to controls (3), and they were more likely to be rated "equally good" (p<.001, fig. 2).

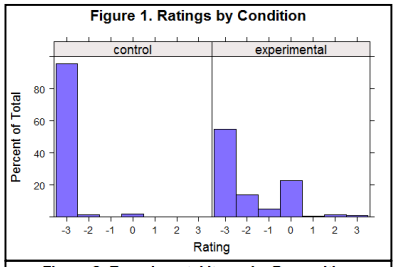

Figure 1. Ratings by Condition

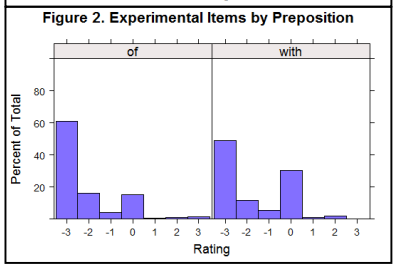

Figure 2. Experimental Items by Preposition

The preposition effect is not predicted by the theory of frozen scope[1], nor is it likely to arise from task-related variability. Rather, it indicates that quantifier scope is not frozen across-the-board for oblique-Locatum variants of the English VP-internal locative alternation. I propose that the syntactic structure of *with*- and *of*-variants differs in a way that predicts this effect and that the possible scope readings for these sentences are analogous to those available for French *avec*-variants (free) and *de*-variants (frozen), respectively. The semblance of frozen scope in *with*-variants is argued to be due to a combination of processing factors (ex., a preference for surface readings of *a…every* quantifier order[5], also seen in participants' ratings of ambiguous filler items) and semantic factors (ex., the holistic affectedness of the Location implied by its promotion[6]).

References: **[1]** Bruening, B. (2001). QR obeys Superiority: Frozen scope and ACD. *Linguistic Inquiry*, *32*(2), 233–273. **[2]** Levin, B. (1993). *English verb classes and alternations: A preliminary investigation*. University of Chicago Press. **[3]** Drummond, A. (n.d.). Ibex 0.3.6 Manual. http://spellout.net/. **[4]** Christensen, R. H. B. (2012). Ordinal—regression models for ordinal data R package version 2012.01-19. Vienna: R Foundation for Statistical Computing. https://cran.r-project.org/. **[5]** Fodor, J. D. (1982). The mental representation of quantifiers. In *Processes, beliefs, and questions* (pp. 129-164). Springer Netherlands. **[6]** Anderson, S. R. (1971). On the role of deep structure in semantic interpretation. *Foundations of Language*, 387-396.

Back to Thursday Poster Schedule

Accessibility as a Cross-linguistic Mechanism of Pronoun Use: Evidence from Cantonese

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INTRODUCTION Pronouns vary across languages in terms of their specification of features. For example, unlike in English, the 3rd person singular pronoun in Cantonese (*keoi*) does not make distinctions over gender and animacy (i.e. *keoi* is used to refer to males, females, animals and inanimate entities). The present research aims to examine the mechanism that underlies speakers' choices of referring expressions (pronouns vs. NPs) cross-linguistically by (a) investigating the production of 3rd person pronoun in Cantonese (Exp. 1), and by (b) evaluating the validity of existing accounts of pronoun production in Cantonese (Exp. 2).

EXPERIMENT 1 Previous research on pronoun production in English has shown that speakers use pronouns more (a) when they refer back to the subject (*subjecthood effect*, e.g. [1] Rohde & Kehler, 2014); (b) when there is a single entity in the discourse (*competition effect*, e.g. [2] Arnold et al., 2007); and (c) when there is only one entity that matches the gender of the pronoun (*gender effect*, e.g. [3] Arnold et al., 2000). In order to see how these factors influence pronoun production in a language with pronouns with different feature specifications than English, we examined Cantonese speakers' referential choices, using a story-completion task ([1,2,3]). Participants (n=25) provided a natural continuation to auditorily presented sentences. The sentences occurred in three conditions: (1) single entity condition (e.g. *the knight walked for an hour*), (2) two-entity, same-gender condition (e.g. *the knight chased the prince*), and (3) two-entity, different-gender condition (e.g. *the knight chased the princess*). Following [3], we analyzed participants' use of pronouns (*keoi*) vs. NPs for the first reference in their response. We observed the subjecthood effect and the competition effect ($p<.001$), but no gender effect. The results suggest that regardless of differences in feature specifications, pronouns are used more often to refer to the subject and a single entity in the discourse cross-linguistically.

EXPERIMENT 2 The subjecthood effect is commonly attributed to the accessibility of the subject. There are, however, at least two accounts for the competition effect; [2] suggests that the effect is because the presence of two characters in the discourse results in competition, restricting each other's availability (*accessibility account*). The competition is stronger when entities share semantic features. However, [1] suggests that the effect is likely because the presence of two characters decreases the likelihood of each character being the topic (*topic account*). Note, however, the competition effect in Cantonese can be also attributed to the need to avoid ambiguity; the 3rd person pronoun does not distinguish gender and animacy in Cantonese. Thus, it is possible that Cantonese speakers use less pronouns to avoid ambiguity (*ambiguity account*). In order to evaluate these different accounts, we manipulated accessibility of two characters (*human-human, human-animal, human-object*) and topichood of the subject via the topic marker (*nei*) in Cantonese (6 conditions in total). According to the accessibility account, pronoun use should increase when the subject is more accessible than the object. The ambiguity account, however, predicts that rates of pronominalization should not differ across conditions. The topic account predicts that the pronoun use should increase when the subject is the topic. Using a story-completion task (n=31), we analyzed participants' use of pronouns (*keoi*) when the first reference refers back to the subject. We found a main effect of accessibility (Fig. 1); participants were more likely to use pronouns when the subject was accessible ($p<.001$). The topic effect, however, was not significant. We suggest that the subjecthood, competition and gender effects can be explained by conceptual accessibility of referents, which is known to play a crucial role in sentence production.

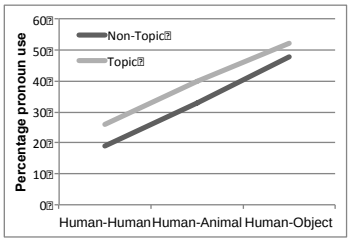

Fig. 1. Pronoun production in Exp. 2

Back to Thursday Poster Schedule

Adaptation of gap predictions in filler-gap dependency processing

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Recent work on syntactic adaptation has demonstrated that biases in ambiguity resolution can be altered by manipulating the probability of the competing structures in the input [1-3]. If the probability of an *a priori* unlikely structure (e.g., reduced relatives) is increased, the prediction error associated with that structure is diminished [1], and processing difficulty is subsequently reduced or eliminated [2]. While this adaptation of syntactic expectations reduces processing difficulty, probabilities may conflict with other constraints. For example, filler-gap dependency processing is argued to be guided by memory constraints that do not apply to ambiguity resolution: fillers (i.e., fronted phrases) are stored in memory until they can be integrated, and the parser is biased to complete the dependency early (e.g., at the verb, as opposed to a later position) [4] in order to reduce the memory burden [5]. Probabilities and memory constraints can be at odds if the distribution of gap locations in the input is skewed in favor of longer dependencies (e.g., PP gaps). When the constraints conflict, the memory-driven bias toward short dependencies may override potential syntactic adaptation effects. Our eye tracking during reading study examines whether active gap filling can be inhibited when statistical information favors PP gaps, and provides novel evidence that the active gap filling bias can be modulated by the probability of gap positions in the input.

Experiment (N=40). Our target sentences consist of a filler-gap dependency with a PP-gap preceded by a direct object NP (1). If the parser actively completes the dependency at the verb, we expect a *filled gap effect* [4,6] on the direct object region: a reading time increase in the NP-fronting condition (1a) compared to the PP-fronting condition (1b). In order to estimate the probability of gaps, we conducted a distributional analysis in the CALLHOME and Switchboard corpora. Of 3787 filler-gap dependencies with object or PP gaps, 78% were object gaps, which is consistent with active gap filling. If probabilities can override the constraints on memory, we hypothesized that the active gap filling bias should be sensitive to the input distribution of gaps. We manipulated exposure to PP gaps to test whether increasing the probability of these gaps leads to decreased expectations for object gaps and associated reduced filled gap effects.

The experiment was a 2 (NP- vs. PP-fronting) x 2 (group: PP gap exposure vs. control) design and consisted of two blocks. In the first block, participants were either exposed to 24 NP-fronting sentences (1a) or 24 fillers. The structure of the second block was identical for both groups: participants read 24 target sentences (1a, 1b) and 48 fillers. No differences between conditions were found in the verb region (i.e., the region before the critical region). In the direct object region, no main effect of fronting type or group was found for first pass time. However, the NP-fronting conditions had longer go-past times than PP-fronting (β=81.2, t=2.16, p<0.05), which suggests that object gaps were predicted only in the NP-fronting condition. Critically, we also observed a significant interaction between fronting type and group (β=-155.7, t=-2.36, p<0.05). Pairwise comparisons indicated that the control group demonstrated filled gap effects (β=160.1, t=3.26, p<0.01), while the group exposed to PP gaps in the first block did not (β=-0.7, t<1, p>0.1). The lack of a filled gap effect in the exposure group suggests that they were no longer actively predicting an object gap. These findings indicate that, whether or not the memory constraint biases the parser toward short dependencies, cumulative distributional information in the input has an impact on the online resolution of filler-gap dependencies.

(1) a. *NP-fronting:* The suitcase **that** the stealthy, wanted thief |$_{V}$ stole |$_{DO}$ the precious jewels |$_{Spillover}$ from __ | was full of sentimental items.
b. *PP-fronting:* The suitcase **from which** the stealthy, wanted thief |$_{V}$ stole |$_{DO}$ the precious jewels |$_{Spillover}$ was | full of sentimental items.

References [1] Jaeger & Snider 2013. *Cognition*. [2] Fine et al. 2013. *PLOS One*. [3] Fine & Jaeger 2013. *CogSci*. [4] Stowe 1986. *LCP*. [5] Gibson 1998. *Cognition*. [6] Wagers & Phillips, 2014. *JEP*.

Back to Thursday Poster Schedule

Agreement Attraction in NP ellipsis

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Ellipsis, as an anaphoric construction, requires accessing and retrieving an antecedent from earlier in the sentence. However, it is not so clear what information is retrieved when ellipsis is processed: A processing strategy might be adopted where only some features of the head are retrieved (Dillon et al., 2013). Given that the head is more prominent than the modifier, as it is the locus of the core meaning of the whole NP, it is plausible to think that the head is primarily retrieved. We used agreement attraction as a lens to examine what is recovered in elided contexts, taking advantage of the finding that an ungrammatical verb following a local noun matching in number is often not perceived as ungrammatical (Wagers et al, 2009). The question is whether agreement attraction occurs to the same degree for elided constituents (1&2a) and unelided ones (1&2b). If the structure of the whole NP is retrieved, including the linear constituent order ([NP Derek's *key* [PP *to the boxes*]]), then a verb might erroneously agree with the local NP (*the boxes*) that has been recovered into the ellipsis site. This would result in such ungrammatical sentences receiving high acceptability ratings. On the other hand, if the antecedent were incompletely recovered then no attraction would occur, and an ungrammatical verb should be treated as fully ungrammatical, receiving low ratings.

Two acceptability rating experiments tested number agreement in NPE (1a; N=48), and anaphoric *one* (2a: N=60) constructions. In all experiments, we manipulated the number of the local NP in the first constituent (box/boxes) and the grammaticality of the verb (is/are). The experiments varied in the structure of the second constituent. In Experiment 1, the second constituent might be elided, as in (1) (Mary's ___/Mary's key to the boxes). In Experiment 2, the second constituent might be replaced with anaphoric *one* as in (2) (Mary's dull one/Mary's dull key to the boxes).

(1)a./b. Derek's [NP key to the boxes] might be on the table and Mary's [NP **ø**]/[Mary's key to the boxes] probably **is**/**are** on the carpet.
(2)a./b Derek's [NP shiny key to the boxes] might be on the table and Mary's [NP dull **one**]/ [Mary's dull key to the boxes] probably **is**/**are** on the carpet.

Experiment 1 demonstrated the critical interaction of local noun number and grammaticality--regardless of ellipsis status ($\chi2(1)=9.767$ $p<0.05$). There was also a main effect of ellipsis ($\chi2(1)=10.434$, $p<0.05$), and an interaction between ellipsis and grammaticality ($\chi2(1)=13.566$, $p<0.05$). Experiment 2 also found the critical interaction between local noun and grammaticality--regardless of anaphoric *one* ($\chi2(1)=3.9431$ $p<0.05$), and again, an interaction between ellipsis and grammaticality ($\chi2(1)=8.088$ $p<0.05$). The increased acceptability in Experiments 1 and 2 indicates agreement attraction effect, suggesting that the information of the antecedent could be retrieved in the similar way.

Taken together, the results of these experiments show that ellipsis involves retrieval of number information, and that the retrieval process is sensitive to the prominence between the head and the intervening PP. Verb-matching local NPs provide an illusion of grammaticality, and this illusion occurs even as a result of elided constituents and anaphoric *one*. This suggests that the parser provides the similar type of structure to the ellipsis site for NP ellipsis and an anaphoric *one*.

Back to Thursday Poster Schedule

Agreement attraction in person is symmetric

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Agreement attraction effects in comprehension were first found in number (Nicol, Forster & Veres, 1997; Pearlmutter, Garnsey & Bock, 1999; Pearlmutter, 2000), and then in gender agreement (Slioussar & Malko, 2015; Tucker et al., 2015), but were never looked for in person agreement. On the one hand, the retrieval interference account as implemented in ACT-R (Lewis & Vasishth, 2005) predicts the same agreement attraction effects for person as for gender and number (at least in the ungrammatical sentences, see Engelmann, Jäger, & Vasishth, 2015), since there is no assumption in the ACT-R model that any particular feature has a special status. On the other hand, the Feature Hierarchy Hypothesis (Carminati, 2005) predicts that the effect size will be either significantly smaller in person than in number or gender agreement attraction, or absent. The reason is that person ranks the highest in the 'cognitive significance' hierarchy (Person > Number > Gender) and should be the most prominent; therefore, all agreement mistakes would be noticed immediately. Within the person domain, 1st and 2nd person are proposed to dominate the 3rd; hence, if there is agreement attraction, 2nd person should be a stronger attractor than the 3rd (parallel to number attraction asymmetry, where a more marked member of the category — plural — is a stronger attractor).

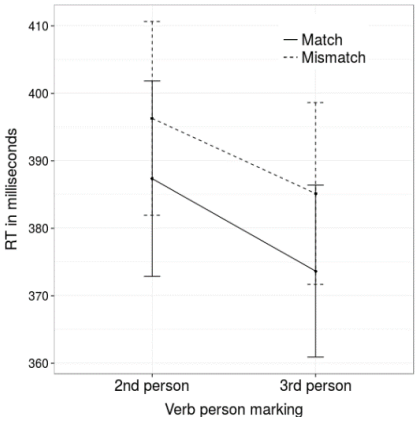
To test the predictions of both accounts, we conducted an SPR experiment in Russian, where verb forms distinguish between 1st, 2nd, and 3rd person singular. We employed a 2x2 design with main factors of verb form (2nd vs. 3rd person endings) and match/mismatch between the verb and the attractor (note that all conditions are ungrammatical):

On, kak i ty / ja, zavtra v bassein ne pojd**esh** v takoj xolod.
He, just as you(match) /I(mismatch), tomorrow to the pool not go-2 in such a cold.
Ty, kak i on / ja, zavtra v bassein ne pojd**et** v takoj xolod.
You, just as he (match)/ I(mismatch), tomorrow to the pool not go-3 in such a cold.

We expected to find the main effect of match (i.e., the agreement attraction effect – a speedup in the match conditions), the main effect of person (a slowdown for 2nd person, since its verb ending is longer), and the interaction between these if 2nd person is a stronger attractor.

There were 32 experimental items and 147 fillers in each of four experimental lists, 75% of all sentences did not contain mistakes. Participants (N=55) were asked comprehension questions for 1/3 of the sentences.

We found only a main effect of match in the region following the verb (Est.=-0.015, SE=.007, t=-2.27). The strong prediction of the Feature Hierarchy Hypothesis was not borne out: the agreement attraction is present, albeit the effect size is small (~10 ms). Again, contrary to the Feature Hierarchy Hypothesis, but in accordance with the predictions of the ACT-R model, there is no evidence that either person is a stronger attractor than the other. Both in number and in gender, attraction effects are asymmetric — feminine and plural are stronger attractors than masculine and singular, respectively — and it is surprising to find symmetric attraction in person. However, the asymmetry in number and gender attraction effects might result from computing of certain syntactic structures (both in number and gender, attractor was mostly a part of the PP), and not from inherent asymmetry of the category members themselves. If it is true, number and gender should exhibit symmetric attraction pattern in the syntactic framework similar to that used in the current experiment.



Back to Thursday Poster Schedule

All by myself or Obama's elf? The influence of social network size on speech perception

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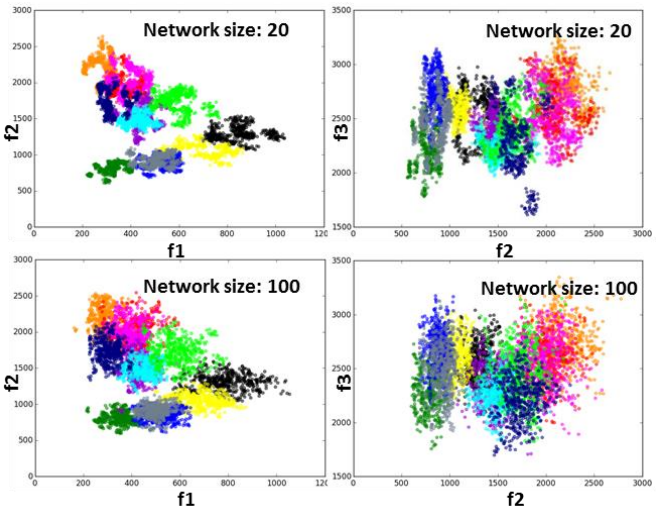
Infants and adults learn new phonological varieties better when exposed to multiple speakers rather than a single speaker during learning (Bradlow & Bent, 2008; Rost & McMurray, 2009, 2010;Lively, Logan & Pisoni, 1993), presumably because such input is more varied. The studies here test (1) whether having a larger social network similarly facilitates phonological performance, and (2) what the underlying mechanism of this effect is.

In Study 1, 60 native Dutch speakers reported all their interactions for one typical week. They were then tested on transcription of *nonwords* in noise, on talker normalization, and on a host of cognitive measures (WM, auditory STM, selective attention, task switching). Results showed that, as predicted, participants with larger social networks were significantly better at speech perception in noise, but they were not better at talker normalization. Crucially, these findings were obtained despite controlling for cognitive skills and for amount of talk, indicating that the effect of social network size on speech perception is not due to differences in cognitive skills among people with different network sizes or to amount of linguistic input.

Study 2 used computational simulations with agent-based models to explore the mechanism underlying the effect of social network size on speech perception. Networks were created by randomly selecting people from a population speaking 12 Dutch vowels with a mean and SD as described in Pols, Tromp & Plomp (1973). During interactions, the agent met with a random member of her network and received one labeled set of formants for each vowel, and stored it. At test, the agent received unlabeled sets of formants from members of the population that are not in her network, and needed to recognize them. Results showed that having a larger social network led to greater accuracy in phoneme categorization. Interestingly, even though larger networks were also associated with greater variability, as reflected in larger category SDs, variability did not predict performance. Instead, as Figure 1 illustrates, the benefit of having a larger network was fully explained by a novel measure of Smooth Sampling, which calculated coverage of central areas and penalized for vowel overlap.



Further simulations that manipulated network properties orthogonally showed that the positive effect of social network size on speech perception is independent of amount of input received but is modulated by the ratio of intra- to inter-individual variability, such that having larger social networks is most helpful when speakers are consistent within themselves, and the population is varied. These results held whether phoneme categorization was carried out by matching to the closest similar stored token or by calculating the token's probability of belonging to each category according to the category's distribution.

Together, these studies show how having a larger social network leads to better speech perception by influencing the distribution of the input, and thus show how aspects of our life-style can influence our linguistic performance.

Back to Thursday Poster Schedule

Alpha power decreases during center embedding in natural stimuli

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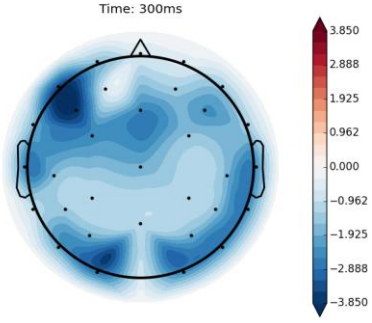
Understanding the role of memory in sentence processing requires clear measures of memory usage. Unfortunately, evaluation of memory effects using reading times is hindered by known frequency confounds. However, decreased EEG oscillations in the alpha band (8–12Hz) have been correlated with attentional focus and memory load [3], and alpha activity has been shown to be relatively uncorrelated with frequency effects [6]. This study uses naturally-occurring narrative sentences to investigate whether decreased power in the alpha band is a reliable indicator of increased linguistic memory load.

Syntactic center-embeddings have long been assumed to create resource demands on linguistic memory [1]. For example, in (1), *both* generates an expectation for *and*, which must be retained until *and* in order to process the conjunction. In (2), *either* generates an expectation of *or*, which must be retained concurrently with the inner expectation of *and*, increasing memory load during the embedded region.

(1) Somehow both [$_1$ the filter is dirty] and the flow decreases . . .

(2) Either [$_1$ both [$_2$ the filter is dirty] and the flow decreases] or . . .

The present study evaluates the effect of this kind of memory usage with a corpus of amateur novels [2], consisting of 32-channel EEG data recorded from 24 subjects as they read 204 narrative sentences using rapid serial visual presentation (RSVP). This use of natural stimuli mitigates the potential for experimentally-constructed stimuli to induce a confound due to unnatural difficulty (lessened ecological validity) compared to naturally-occurring center embeddings. That is, subjects are expected to be less likely to process natural stimuli with non-linguistic heuristics or mechanisms.



10 Hz depth 2 - depth 1 (t-vals)

The sentences from this corpus were automatically parsed and annotated with embedding depths using a left-corner parser [5], and all words were grouped by their corresponding embedding depth. Time-frequency data were extracted from the EEG signals using a Morlet wavelet transform with a resolution of 1 Hz, and the power at 10Hz was averaged over all words in each embedding condition. Singly-embedded alpha power was subtracted from doubly-embedded alpha power and permuted 1000 times with spatio-temporal threshold-free clustering [4] with $p < 0.01$. Alpha power was significantly lower throughout the duration of each deeper word, and seemed especially affected in the left anterior region (figure shows effect 300 ms post onset).

Results Since alpha power reliably decreases as linguistic memory load increases, alpha power may provide a clean measure of linguistic memory load for future psycholinguistic studies.

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Back to Thursday Poster Schedule

An asymmetry of agreement attraction provides evidence for self-organized parsing

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Much work in sentence processing focuses on interference where elements interact in ways inconsistent with a global parse (e.g., participants say "are" rather than "is" after "the key to the cabinets"; Bock & Miller, 1991, Cog.Psych. 23). Cue-based retrieval models (e.g., Lewis & Vasishth, 2005, Cog.Sci. 29) predict such effects by assuming that processing an element (e.g., a verb) that is dependent on a preceding controller (e.g., the subject) prompts a memory search (subject to interference from similar items, e.g "cabinets") for the earlier element, typically combining cues additively. Self-organizing models (e.g., Tabor & Hutchins, 2004, JEP: LMC 30(2); Vosse & Kempen, 2000, Cogn. 75) similarly claim that later elements link up with earlier ones, but via competitive attachment interactions with positive feedback for the better choices. These produce non-additive relationships between cue biases and parse selection probabilities. We present evidence for such non-additivity in acceptability judgments, favoring the self-organizing approach.

With the form A [N1(sg.)] of [N2(pl.)] [is/are]. . . , we manipulated the meaning of the subject NP along a gradient: Containments (a box of apples), Collections (a heap of apples), Measures (a lot of apples), and Quantifiers (many apples), gradually adjusting the relative viability of N1 and N2 as subjects. The PP modifier was present (N2 more viable) or absent (N2 less viable; Length manipulation) with question contexts to ensure felicity.

We constructed a cue-based retrieval model based on Lewis & Vasishth (2005) with the subject viabilities and number match between the verb and N1/N2 as additively combined retrieval cues. The probability of selecting a particular noun as the controller was the relative cue-strength. A sentence was deemed acceptable only if the chosen controller matched the verb's number. The model predicted a cross-over interaction between Verb Number and Subject Viability (making N2 a relatively good subject favored a plural verb, as N2 was always plural), as well as a cross-over interaction between Verb Number and N2 Presence when N1 was viable because just in those conditions, N1 and N2 both attracted some control (Fig. 1). In an acceptability judgment study (64 items; 1–7 Likert scale, 7 = best), we found a significant three-way interaction (mixed model, likelihood ratio test: $\chi 2(3) = 16.86$, $p < .001$). Contrary to the retrieval model's predictions, only the Verb Plural conditions showed an effect of N2 Presence (post hoc ps < .001), but not the Verb Singular conditions (n.s.; Fig. 2).

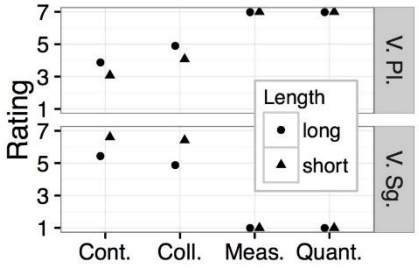

Figure 1. Retrieval model acceptabilities.

We then built a simple self-organizing model which formed one of two structures: either N1 was head, or N2 was. The parameters were identical to the retrieval model, but with competitive parse formation. The model produced the observed interaction between Verb Number and Length (assuming N1 Viable) as follows: When the forces strongly favored N1 as subject (Verb Singular), the feedback quickly drove the model to choose N1, reducing the effect of differences in N2. But when the forces were relatively balanced between N1 and N2 (Verb Plural), the feedback was less potent, and the difference in N2 presence exerted an effect.

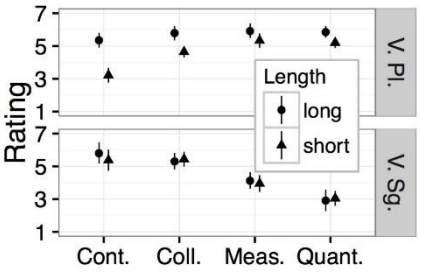

Figure 2. Fitted acceptability ratings (with 95%CI) from human experiment (n = 46).

In fact, if a nonlinear transformation is added to the retrieval model, it also fits the data. The virtue of the self-organizing model is that the nonlinearity arises through the very mechanism (competitive structure formation) that forms parses in the first place.

Back to Thursday Poster Schedule

An ERP preliminary analysis of the Person Split in Italian

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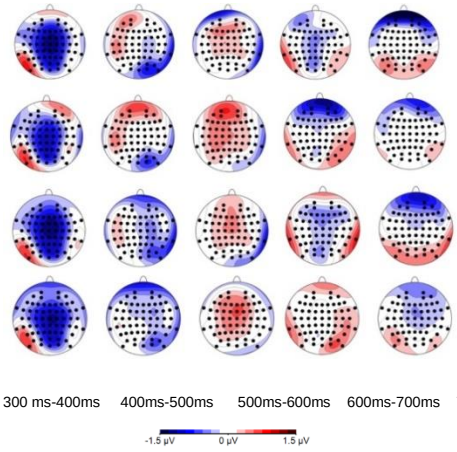
We present the results of an ERP study in which we explored the interaction between the number of person and the gender features in a *person split* agreement configuration in Italian. In the Italian clitic system a person split is found: 3rd person singular clitics, which represent event-anchored participants (Manzini et al.2011), have inflected forms for gender (*lo* for masculine/*la* for feminine), whereas 1st and 2nd person clitics, which represent discourse-anchored participants (speaker and hearer), display syncretic forms (*mi/ti* for both genders). While 1st and 2nd person clitics denoting a feminine referent allow agreement with both feminine and masculine past participle in the proclitic constructions with the present perfect in Italian as in (1), the 3rd person feminine clitics do not (2). 1/2P structures are somewhat 'bigger' than 3P ones (cf. Bianchi 2006): in the case of the *mi/ti* pronouns no case and gender is calculated.

(1)	a.	mi/ti	hanno	vist**a/o**
	pro	me /you (CL acc. fem/masc Sing.) 'They have seen me/you'	have (present 3rd Pl)	seen (P.Participle fem/masc.sing)
(2)	a.	la	hanno	vist**a/*o**
	pro	her (CL acc. fem . sing)	have (Present 3rd Pl)	seen (P.Participle fem.sing)

We explored the agreement processing of gender and person by means of the Event Related Potential (ERP) during a visual word-by-word paradigm. The EEG activity of 20 healthy Italian subjects (n=20, 10 females; 30 yrs ±3) was recorded with an ActiCAP 64Ch system. The experiment consists of 152 sentences in 4 conditions: 1) 1/2 person clitic + masculine past participle (*default gender*); 2) 1/2 person clitic+feminine past participle (*gender ambiguity*); 3) 3rdperson clitic+past participle agreeing (*control*); 4) 3rdperson clitic+past participle non agreeing (*gender agreement violation*). The past participle inflected forms were the target for measuring the brain activity. Repeated-measures ANOVA analyses over nine regions of interest, revealed that the 3rd person gender agreement mismatch elicited a P600 effect in the right hemisphere as Gouvea et al. (2009) found for garden-path. In the N400 time window a main effect of Condition (F>1) and the interaction between Condition and Region, (F(6,114)= 2.030, p=0.30) emerged. The 3rd person conditions showed larger negativities than the 1st/2nd in the fronto-central regions suggesting the recruitment of different neuronal circuits (as in Mancini et al., 2011, Zawiszewski et al. forthcoming) (Fig.1). Our data suggests that a syntactic-semantic effect of the person split encoded in the Italian accusative clitic system seems to intervene in the computation of the agreement dependencies. These results seem to confirm that person split analyses (Manzini et al. 2011) have a neuropsychological reality: the brain response to discourse-related persons (1st and 2nd) is different from event-related referents (3rd persons), at least in these Italian constructions.



Condition 1: Control 1st and 2nd person

Mi/ti hanno guardat**o** (default masculine) / They have seen me /you

Condition 2: Gender ambiguity 1st and 2nd person

Mi/ti hanno guardat**a** (feminine marked) / They have seen me /you

Condition 3: Control 3rd person

L**o** hanno guardat**o** (gender match masculine) /They have seen him

L**a** hanno guardat**a** (gender match femenine) /They have seen her

Condition 4: Gender Violation 3rd person

*L**o** hanno guardat**a** (gender violation masculine) /They have seen him

*L**a** hanno guardat**o** (gender violation femenine) /They have seen her

Fig. 1. *Topographical maps for each conditions at temporal windows under investigation.*

Back to Thursday Poster Schedule

Aspect attrition in Russian-German bilingual speakers

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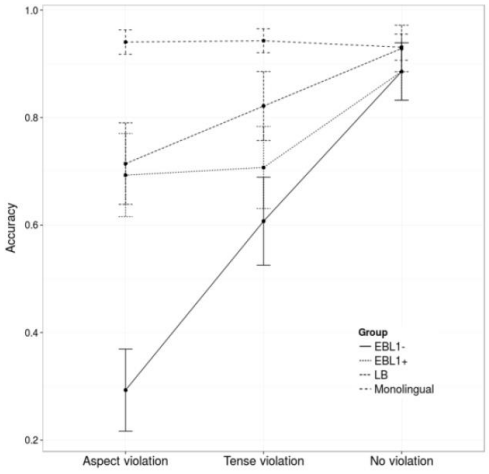
Bilingual speakers display reduced performance on the interpretation and production of verb aspect at the sentence level (Polinsky, 1997, 2006; Silva-Corvalán, 1994). Montrul (2002) suggested that divergence in grammatical resources available for the expression of aspectual oppositions in L1 and L2 is responsible for aspect attrition in L1. We tested this hypothesis in Russian-German bilingual speakers and predicted erosion of aspectual opposition knowledge in L1 (Russian) under the influence of L2 (German), which has no grammaticalized aspect. In contrast, the grammatical category of tense is represented in both languages, and was hypothesized to remain relatively spared. In addition, the modulation of the expected L2 transfer effect by the age of bilingualism onset and the amounts of exposure to L1 was tested.

We recruited 30 adult Russian monolinguals and 30 Russian-German bilinguals: 10 early bilinguals with limited or no L1 input, EBL1-; 10 early bilinguals with substantial L1 input, EBL1+; and 10 late bilinguals with substantial L1 input, LB. Russian sentences with perfective and imperfective verbs in the past tense were presented auditorily in three conditions: with the aspect and the tense of the verb correctly matching the previous context (1), with the aspect of the verb violating the context (2), and with the tense of the verb violating the context (3):

4. (1)Vchera nepreryvno v techenije dvuch chasov Fjodor **pisal** statju o tigrah.
   Yesterday, continuously for two hours, Fedor **was writing** an article about tigers.
1. (2)*Vchera vsego za dva chasa Fjodor **pisal** statju o tigrah.
   *Yesterday, in only two hours, Fedor **was writing** an article about tigers.
1. (3)*Zavtra nepreryvno v techenije dvuch chasov Fjodor **pisal** statju o tigrah.
   *Tomorrow, continuously for two hours, Fedor **was writing** an article about tigers.

Participants had to press the space bar when they detected an error in the sentence. Accuracy was analyzed using a generalized linear mixed-effects modeling with a logit link function in R.



Although the performance of all groups on the correct condition was comparable, the bilinguals showed different degrees of accuracy in identifying both aspect and tense violations. The LB group did not differ from the monolingual group on any measure. The EBL1+ and EBL1- groups showed poorer performance in both violation conditions, compared to the monolingual group; the EBL1- group showed a further decrease in the ability to identify violations, with worse performance on sentences with aspectual mismatches.

The obtained results demonstrate that both Russian aspect and Russian tense are subject to attrition in Russian-German bilingual speakers, and the earlier the onset of age of bilingualism and the less exposure a speaker has to the sociolinguistically subdominant L1, the more affected the adult L1 tense-aspect system is. The impact of attrition is particularly strong for the L1 category of aspect expressed by means of a different linguistic inventory in L2. These findings are consistent with a weak version of the L2 transfer hypothesis: although any category of L1 can be subject to attrition due to sociolinguistic reasons (early bilingualism onset, amount of exposure to L1), the categories differently represented in L1 and L2 are the most vulnerable.

Back to Thursday Poster Schedule

Attraction interference effects of number in pronominal resolution processing in Brazilian Portuguese

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This research aims to investigate whether there are interference effects of structurally unacceptable antecedent candidates in pronominal resolution processing in Brazilian Portuguese. In other words, the question is whether resolution processing of "ele" (*him*) in grammatical sentences like (1) can be influenced by structurally unacceptable antecedents, attractors, like "fazendeiro" (*farmer*), which number-match the pronoun, but cannot be bound to it according to Principle B structural constraints. Examples of the conditions of this present study are the following:

(1) Gram. with attractor: O botânico agradeceu o fazendeiro que leva **ele** para as palestras.
(*The botanist thanked the farmer that take **him** to the lectures.*)
(2) Gram. without[1] attractor: O botânico agradeceu os fazendeiros que levam **ele** para as palestras. (*The botanist thanked the farmers that take **him** to the lectures.*)
(3) Ungram. with attractor: O botânico agradeceu os fazendeiros que levam **eles** para as palestras. (*The botanist thanked the farmers that take **them** to the lectures.*)
(4) Ungram. without attractor: O botânico agradeceu o fazendeiro que leva **eles** para as palestras. (*The botanist thanked the farmer that take **them** to the lectures.*)

According to Chow et al. (2014) both structural constraints and feature matching are equally important throughout pronoun resolution time course. In addition, they showed that due to memory decay, there is also failure in retrieving structurally acceptable antecedents when there is a long linear distance between them and the pronouns. However, differently from English, Brazilian Portuguese is a language with morphological richness; therefore, our hypothesis is that attraction interference effects rather than structural constraints play a major in pronominal resolution processing in Brazilian Portuguese. An eye-tracking (Tobii TX300) experiment was conducted with 24 native speakers of Brazilian Portuguese. The results indicate that at an early processing phase (first fixation duration), there was an effect of interaction between sentence grammaticality and the number features of the attractors (p=0.009**). At a late processing phase (total fixation duration), there was a main effect of sentence grammaticality (p=0.01*) and marginal effects of interaction between grammaticality and other variables such as the number features of the attractors and the linear distance between the structurally acceptable antecedent and the pronoun. The results showed that there are attraction interference effects of number in early and late processing measures. However, the conclusion is that our hypothesis was proved wrong since it seems that both grammaticality and number agreement features are equally important from the beginning until the end of pronominal resolution processing in Brazilian Portuguese; thus, our results provide evidence in favor of Chow et al. (2014).

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Back to Thursday Poster Schedule

[1] We call sentences without attractors those in which the non-structural antecedent candidate does not number-match the pronoun.

Bayesian pronoun interpretation in Mandarin Chinese

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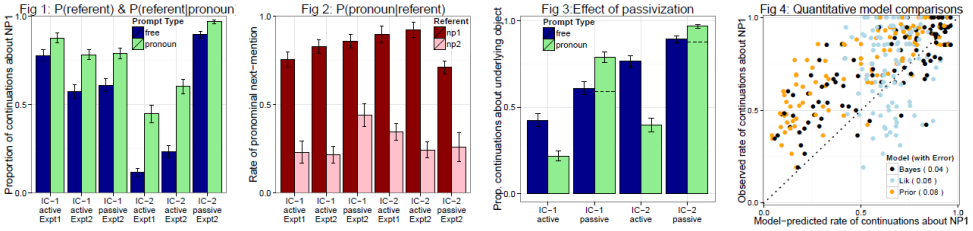
Kehler and Rohde (2013) proposed that listeners, upon encountering a pronoun, reverse-engineer a speaker's referential intentions based on Bayesian principles. In their model, the influence of semantics and knowledge-driven inference (e.g., Hobbs 1979) emerges as effects on the prior (next-mention bias), whereas the influence of syntactic prominence and information structure (e.g., Grosz et al. 1995) emerges as effects on the likelihood (production bias): P(referent|pronoun) ∝ P(pronoun|referent)P(referent). Whereas their model accounts qualitatively and quantitatively for a range of English data, here we present two experiments on Mandarin Chinese that examine the generality of the theory for a language with a different pronominal system and different syntactic-semantic associations than English.

In each experiment, participants completed two-sentence passage by writing a second sentence after a transitive-verb context sentence with two like-gender animate arguments (1).

(1) Meihui (NP1) {dadong-le (IC-1)/ jiegu-le (IC-2)} Jieyi (NP2). (Ta)_____
Meihui {impressed / fired } Jieyi. (She)_____

The Pronoun condition included an overt pronoun in Sentence 2, allowing us to measure empirical pronoun interoperation preferences P(referent|pronoun); The Free condition included no material in Sentence 2, allowing us to estimate the prior next-mention preference P(referent) and the likelihood P(pronoun|referent) that a pronoun is produced given next mention. First-sentence verbs were one of two implicit casualty (IC) classes, allowing us to manipulate the prior, with IC-1 and IC-2 favoring NP1 in the following explanations respectively. Exp.1 asked participants for completions that explain the fist sentence. Completions were hand-annotated for whether the second sentence's first NP referent cornered with NP1 or NP2. Exp. 2 simply asked for natural continuations, and introduced a manipulation between active voice (as in (1)) and passive voice (X V-le Y -> Y bei X V-le). Rohde and Kehler (2014) found English passives had more next-mentions of the underlying subject, but it remains unclear whether and why passivization affects the prior. The Mandarin passive provides a good test case since it conveys affectedness of the underlying object (e.g. LaPolla, 1988), which might be expected to increase its next-mention rate. Crucially, the Bayesian theory predicts that any effect of passivization on next-mention preferences should have a corresponding effect on interpretation preferences.

The Free condition showed expected effects of IC class on the prior probability of next-mention (Fig. 1, blue) and as in English, NP1 (the syntactic subject) is more likely to be realized pronominally (both null and overt pronouns included, Fig. 2), even in the object-biased IC-2 condition. Both of these effects are reflected in Pronoun condition interpretation preferences: NP1 rates are systematically higher than the prior, but shift with it. Passivization increased next-mention rate for the underlying object in the free prompt data (Fig. 3, blue), and this increase is tracked in the corresponding pronoun prompt data (Fig. 3, green; dashed lines indicate next-mention rates that would be predicted using the active-condition next-mention prior). Fig. 4 plots NP1 pronoun interpretation rates against item-specific predictions of both the full Bayesian model and reduced variants with only prior or likelihood components. The x = y dotted line would be perfect model fit; in both experiments, the Bayesian model had the least (mean-squared) error (0.04), indicating both prior and likelihood are important for pronoun interpretation. These results lend both qualitative and quantitative support to a cross-linguistically general Bayesian theory of pronoun interpretation.



Back to Thursday Poster Schedule

Bilingual language control in perception vs. action:
MEG reveals comprehension control mechanisms in anterior cingulate cortex and domain-general control of production in dorsolateral prefrontal cortex

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Introduction: Language-switching is central to bilingual individuals' everyday experience, yet the neural foundations underlying this process remain largely uncharacterized. Is bilingual language control a subdomain of general executive control (Abutalebi et al., 2008) or is it supported by language-specific mechanisms (Calabria et al., 2011)? This fundamental question interacts with another unaddressed basic question of the neurobiology of bilingualism: Does language-switching in comprehension involve similar neural mechanisms as during production? We addressed both questions within the same experiment by asking subjects to either produce or comprehend number words while the language switched between Arabic and English, and by comparing these results to similar tasks where instead of language-switching, the semantic category of the comprehended or produced word was changing.

Methods: 19 Arabic-English bilinguals performed four maximally parallel switching tasks varying in modality (production/comprehension) and switch type (language-switching/category-switching), yielding a 2 x 2 design. In both production tasks, participants named playing-cards for which the color of the suit cued output selection. In language-switching, participants named the numerosity depicted by the card, red suits standing for Arabic and blacks for English. In category-switching, performed in Arabic, red indicated numerosity naming and black suit naming. In the language-switching version of the comprehension tasks, subjects listened to number words in Arabic or English and subsequently indicated whether a visually presented number matched the auditory input. In the category-switching variant, subjects heard number or color words in Arabic and indicated whether a visually presented colored number matched what they had heard. Magnetoencephalography was recorded during all tasks, with analyses focusing on prefrontal and cingulate cortices (PFC/ACC respectively), previously implicated for language selection and switching (Abutalebi & Green, 2007) as well as for general domain cognitive control (Braver, 2012). In production, only data that preceded motion artifacts created by articulations were analyzed.

Results: The comparison between language-switching in production vs. comprehension elicited reliable interactions at 300-700ms in the left ACC and in the PFC bilaterally, the former showing increases for switch over non-switch trials in comprehension and the latter in production. Contrasting language-switching vs. category-switching revealed that the PFC production effect generalizes to category-switching while the ACC comprehension effect did not.

***Conclusion*:** This study demonstrates, for the first time, that the brain areas responsible for language-switching in production and comprehension dissociate even for identical lexical material: while producing switches recruited the dlPFC bilaterally, comprehending them engaged the left ACC. This finding suggests that bilinguals rely on adaptive language control strategies and that the neural involvement during language switching could be extensively influenced by whether the switch is performed or perceived. Additionally, the observed anatomical overlap between language and category switching in production suggests that language control is in fact a subdomain of general executive control in production (Abutalebi et al., 2011; Craik & Bialystok, 2006; Garbin et al., 2010), supporting the basic premise of the so-called bilingual advantage hypothesis (Bialystok et al., 2005) only in this domain. The use of MEG enabled us to obtain the first characterization of the spatio-temporal profile of these effects, establishing that switching processes begin ~400ms after stimulus presentation in both production and comprehension.

Back to Thursday Poster Schedule

Can measures of processing complexity predict progressive aphasia from speech?

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Introduction Primary progressive aphasia (PPA) is a dementia characterized by progres- sive language decline without other notable cognitive impairment. Two main subtypes of PPA are the semantic variant (svPPA) and the nonfluent variant (nfPPA). Patients with svPPA have difficulty recalling words, and while they may produce fluent and grammatically correct sentences, their anomia can lead to speech which is empty of meaning. In contrast, nfPPA patients' speech is effortful, nonfluent, and sometimes agrammatic, while single-word comprehension is spared [1]. However, there can be considerable overlap in symptomology. Previous computational analysis of language in PPA did not uncover syntactic differences between subtypes, nor did it examine word use in context [2]. This study tests *n*-gram probabilities and psycholinguistic measures of processing complexity as possible distinguishing features for control, svPPA, and nfPPA narratives.

Methods Narrative speech was elicited from 11 svPPA subjects, 17 nfPPA subjects, and 23 age- and education-matched controls by asking them to tell the story of Cinderella. The PPA subjects were in the mild stage, with mean mini-mental state examination scores of 24.8 (svPPA) and 25.2 (nfPPA). The data were split 50-50 into a development partition (for exploration) and a test partition (for significance testing). Logistic mixed regression was used to first separate control from PPA narratives and then separate svPPA from nfPPA narratives. The evaluation baseline included a random intercept for each word and the following fixed effects: sentence position, word length, log unigram probability (obtained from SUBTL), and all 2-way interactions.

PPA vs Controls From the baseline, adding 5-gram probability (from Gigaword 4.0) im- proved classification accuracy ($p < 0.001$). Although syntactic surprisal [3] and entropy reduction [4] helped in the development partition, neither improved over 5-grams on test (both $p > 0.1$). Coefficient analysis indicates that PPA subjects use shorter sentences ($p < 0.001$) and more common words ($p < 0.001$) in unusual lexical contexts (low 5-gram probability, $p < 0.001$). Further, PPA narratives involve more short, rare words ($p < 0.001$), which may be driven by the larger proportion of non-word tokens generated by the patient group, including paraphasias and false starts.

svPPA vs nfPPA From the baseline, adding 5-grams improved classification accuracy ($p < 0.001$) as did subsequently adding syntactic surprisal with all 2-way surprisal interactions ($p = 0.012$). Although embedding depth helped during development, it did not help over the surprisal factors on test ($p = 0.33$). Coefficient analysis suggests nfPPA subjects produce longer sentences and tend to use long rare words more frequently (both $p < 0.001$). The production of longer sentences by nfPPA subjects is unexpected, but appears to be due to the higher incidence of repairs and false starts. Narratives from svPPA contain more contextually probable words ($p < 0.001$) and have more common words later in the sentence ($p < 0.003$). The main contribution of syntactic surprisal is an association between rare words and unusual syntax in svPPA ($p = 0.027$), but correcting for multiple comparisons reduces this effect to a non-significant trend.

Conclusion While this study revealed some evidence that metrics such as surprisal and embedding depth may help distinguish between PPA subtypes, the strongest predictors were related to word probability and sentence length. Further work is required to explore whether the surprisingly weak diagnostic utility of the information theoretic metrics reflects true similarities between the subtypes or is due to a lack of statistical power.

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Back to Thursday Poster Schedule

Children's incremental interpretation of grammatical aspect

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Grammatical aspect provides information about the speaker's temporal viewpoint of an event: the imperfective –ing verb form indicates an ongoing viewpoint that focuses on internal stages of the event, while the perfective –ed form indicates a closed viewpoint that focuses on event completion. Adults use aspectual information incrementally during comprehension to rapidly guide their visual attention in a scene. In Stutterheim et al (2012) adults watching a video of a car driving to a barn looked more to the driving event (the moving car) when the event was described with the imperfective and more at the barn (the endpoint) when it was described with the perfective. Previous work has shown that pre-schoolers understand the basic meanings of grammatical aspect (they correctly match imperfective sentences with pictures of incomplete events, and perfective sentences with competed ones (Weist et al., 1991; Wagner, 2010). The current study asks whether children can use this knowledge incrementally during sentence comprehension to guide their attention and scene analysis.

Native English-speaking children and adults (6-7-yrs N=7; 8-10 yrs N=20; 11-12 yrs N=14; Adult N=17) listened to 32 simple directed motion event sentences and then acted the events out using real-world objects (toys). Eye-movements and act-out motions were recorded using an ASL Mobile-Eye XG system. Sentences were of the general form: *The monkey rode/was riding on the truck to the house,* alternating four destinations (*house, tree, etc.)* and four vehicles (*truck, boat, etc.).* Each participant heard half of the sentences with the perfective (*rode)* and half with the imperfective (*was riding);* the order of vehicle and destination PPs was reversed for half of the items. We predicted that PP order and verb aspect would guide scene analysis: Objects mentioned first should be looked to first. In addition, the perfective form should focus participants on the event end, producing earlier looks to and reaches for the destination toys; by contrast, the imperfective form should focus participants on the action, producing earlier looks and reaches to the vehicle toys.

Eye tracking results confirmed predictions for adults: Immediately following the verb, they made significantly more early looks to the vehicles following imperfective *riding* than perfective *rode* ($t(16)=2.7$, $p<.02$) (Fig 1). 8-10 and 11-12 yr-olds looked earlier to the element named in the first than the second PP, but did not show sensitivity to aspect. 6-7-yr-olds showed no sensitivity to either PP order or aspectual markers. Act-out data showed earlier reaches to vehicles following the imperfective for the 8-10 group ($F(1,15)=6.07$, $p=.026$), but no differences for the 6-7 group (Fig 2). Thus, by age 8, children showed an influence of morphology on their immediately post-sentence reaching behavior, suggesting that they may just be half second or so slower to use aspectual verb marking than adults. Ongoing coding of adult and 11-12 yr old choices while enacting the events should cast additional light into the chronology and extent of children's ability to use aspectual information in a rapid, incremental manner.

Fig 1. Adult eye movement results.

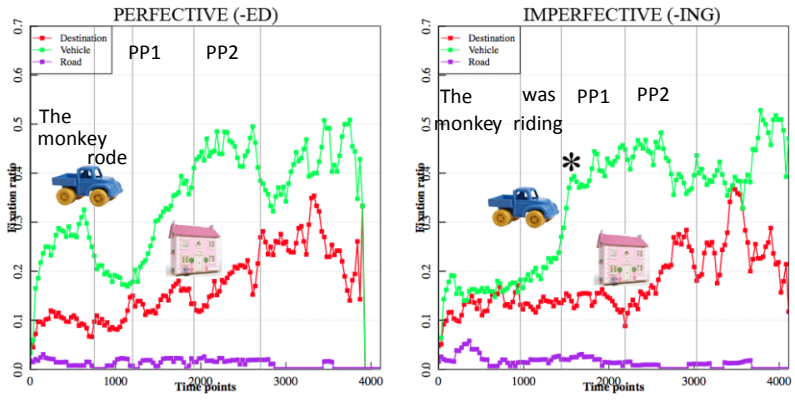
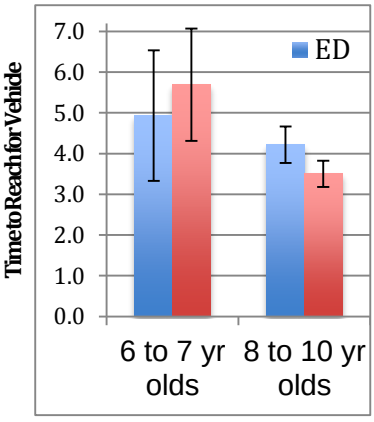


Fig 2. Child reaching time results.



Back to Thursday Poster Schedule

Cognitive-control effects on the kindergarten path: Separating correlation from causation

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Research into the development of real-time comprehension highlights two striking patterns among children.[1] Like adults, they incrementally build syntactic structures using probabilistic cues to guide parsing decisions. Unlike adults, they often fail to revise initial interpretations that conflict with late-arriving linguistic cues. Adults' ability to recover from temporary misinterpretation is modulated by domain-general cognitive control abilities.[2] Thus, children's non-adultlike re-interpretation may be partly due to the protracted maturation of cognitive control systems that detect and resolve information conflict. Consistent with this view, child-to-child variation in cognitive control tasks is associated with syntactic revision,[3] common-ground assessment,[4] and lexical ambiguity resolution.[5] This suggests that relationships between language and cognitive processes may be quite broad throughout development. Nevertheless, the research to date has relied heavily on correlations across disparate tasks; thus it remains unknown if underdeveloped cognitive control is the cause of children's revision challenges, or simply a by-product of individual variation in cognitive development. If cognitive control is a causal factor, then the dynamic engagement of cognitive control should influence their moment-by-moment (re)interpretations.

Five-year-olds (n = 19) carried out instructions that were temporarily Ambiguous (e.g., "*Put the frog on the napkin onto the box*") or Unambiguous (e.g., "…*frog that's on the napkin*…") while eye-moments were monitored. Visual displays featured different-category referents (e.g., frog on a napkin, cat on a sponge) and correct vs. incorrect goals (e.g., empty box vs. napkin). After each sentence, children used a computer mouse to execute the instructions. Critically, intermixed among sentences were child-friendly Stroop trials: pictures of dogs were rapidly named with labels that either matched (No Conflict: blue dog named "*Blue*") or mismatched (Conflict: green dog named "*Brown*") with their fur color.[6] In adults, re-interpretation of ambiguous sentences improves when preceded by Stroop-Conflict, suggesting that cognitive control engagement can facilitate recovery from initial parsing errors.[7] If this relationship holds throughout development, then this effect should also emerge in children. Alternatively, if immature cognitive control resources are easily depleted,[8] then prior conflict detection and cognitive control engagement may instead increase interpretative errors, since children already face substantial difficulties with syntactic revision.

Preliminary analyses confirmed (1) increased latencies to speak and naming errors for Conflict vs. No Conflict Stroop and (2) more correct-goal looks for Unambiguous vs. Ambiguous sentences (p*s* < .05). Critically, prior Stroop type modulated sentence processing ($F = 3.81$, $p = .07$), but this interaction differed from the adult pattern. For Unambiguous sentences, prior conflict led to temporary increases in correct-goal looks, during "*onto the box*." However, for Ambiguous sentences, prior conflict led to sustained *decreases* in correct-goal looks and corresponding *increases* in incorrect-goal looks, lasting beyond sentence offset. Mouse-actions provided additional evidence that prior conflict impedes children's syntactic revision. After Ambiguous sentences, mouse trajectories were pulled towards incorrect goals to a greater extent when sentences were preceded by Conflict vs. No Conflict Stroop ($p = .08$; no effect on Unambiguous sentences: $p > .7$). These results are the first to show that cognitive control plays a causal role in children's (in)ability to revise syntactic misanalysis. Importantly, they illustrate that while cognitive control engagement facilitates revision in adults, the same is not true among less proficient language users. Since children's limited cognitive control can be easily depleted,[8] fewer resources may be available for tackling the challenges associated with comprehension.

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Back to Thursday Poster Schedule

Comparative ellipsis has an object bias, though subjects are more frequent

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Comparative constructions as in (1) have many possible continuations, including bare NPs (a), VP Ellipsis (b), and full clauses (c). In order to explore their processing and use, this project compares interpretation preferences of comparative bare NP ellipsis in written and auditory questionnaires with the frequency of different comparative structures within a dataset from the Corpus of Contemporary American English (COCA). The corpus data shows that bare NPs and VP ellipsis are much more frequent than full sentences, with bare NPs most frequent. Also, bare NPs contrast with the subject of the previous clause in 80% of the corpus examples, but these NPs preferentially contrast with the object in processing. As expectations based on the frequency of prior exposure to these constructions do not explain the processing results, we propose instead that focus structure explain the processing results.

Instances of "more Adverb than" comparatives were extracted from COCA for the top 26 adverbs in that position, skipping 3 with different patterns and eliminating idioms (*more often than not*). Data from 23 remaining adverbs ranged from 914 examples with *often* down to 40 with *broadly*, forming a total set of 4400 examples. These were hand-coded for the category of what followed *than* as well as the sentence role of NPs. Bare NPs after *than* made up 50% of the data, and less than 10% had full clauses. The next most common categories were VP Ellipsis with 18% and embedded clausal ellipsis with 9%. Of the examples with bare NPs (N=2260), over 80% of the NPs had a subject role (contrasting with the previous clause subject) and less than 15% had an object role (the rest were ambiguous/unclassifiable). Looking at all examples with an NP right after *than* (N=3490), almost 90% of the NPs had a subject role (unambiguously so for VP ellipsis, clausal ellipsis, and full sentence examples). These corpus distributions suggest that processors encountering a comparative construction should expect a bare NP over other categories, and given an NP, should more strongly expect it to be a subject.

In Experiment 1 (written questionnaire; N=48), participants chose between disambiguating paraphrases for comparative sentences with bare NPs as in (1a), where all NPs were similar, as well as subject parallel versions (2a) and object parallel versions (2b). The results showed a general object bias, with the neutral condition receiving 35% subject analyses (meaning Sonya called Bella rather than Tasha called Sonya), and significant effects of parallelism (similarity in NP features and form): subject parallelism got 68% subject analyses and object parallelism got 18%.

In Experiment 2 (auditory questionnaire; N=48), bare NP sentences as in 1-2 were produced with accents on the subject or object of the first clause (e.g., *Tasha* or *Bella* in 1). Participants chose between paraphrases after hearing the sentences. The parallelism effect replicated from Experiment 1, and the accent patterns also had significant effects: at each level of parallelism, subject accent raised subject analyses and object accent lowered them. The most subject-biased condition got 79% subject responses and the most object-biased got 8%.

What explains the preferences? Theories of comparative ellipsis propose a complete clause in the syntax even when only an NP is spoken (e.g., Lechner 2004), so structural economy should not favor an object contrast. The frequency of subject NPs in the corpus dataset also fails to explain the processing bias. Since these constructions are contrastive, and overt accent position does affect the preferred contrast, we suggest that the expectation of focus at the end of the first clause accounts for the object bias. Future work on the corpus will look at the prevalence of parallelism between contrastive NPs, as that also affects processing preferences.

1. Tasha called Bella more often than…{a. Sonya / b. Sonya did / c. Sonya called Bella}.
2. a. **Tasha** called him more often than **Sonya**. b. He called **Tasha** more often than **Sonya**.

Back to Thursday Poster Schedule

Comparing On-line and Off-line Comprehension of Non-canonical Sentences in L1 Adults, L1 Children and L2 Children - Evidence from an Eye-tracking Study

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Previous studies on off-line sentence comprehension in children in their first or second language (L1c, L2c) have shown that their performance on non-canonical sentences is cross-linguistically poorer than in L1 adults (L1a) (e.g. Marinis & Saddy, 2013; Rösch & Chondrogianni, 2013; Schulz, 2013; Dittmar, 2008; 2013). It is unknown, however, whether this less successful off-line comprehension is the result of 1) a lack of linguistic knowledge and/or 2) a difficulty in integrating relevant cues due to limited working-memory capacity and slower processing speed (Sekerina et al. 2004) and/or 3) a difficulty in revising initial misanalyses, possibly due to a deficit in inhibitory control when compared to adults (Choi & Trueswell, 2010) Last but not least, 4) the off-line task itself might impose additional cognitive costs. Previous eye-tracking studies have provided some evidence that even if young children were sensitive to grammatical cues during on-line processing, they mostly failed to use them for the final sentence interpretation, presumably due to the additional cognitive costs occurring when faced with the necessity to take an explicit off-line decision (Adani & Fritzsche, 2015; Huang et al. 2014). In view of the child less-efficient executive function system (e.g. Anderson, 2002) (including working memory and inhibitory control) and its possible consequences at the processing level, we monitored eye-movements (on-line task) of L1c and L2c (mean age = 7,3, L2 age of onset = 3-4), as well L1a (henceforth this order) to two pictures while they were listening to A) unambiguous object-first sentences (n = 10, 9,13; *Den Opa hat am Sonntag die Oma liebevoll geküsst*, The grandpa (male-acc., unambig.) has on Sunday the grandma (female-nom., ambig) with love kissed) and B) temporally ambiguous object-first sentences (n = 10, 9, 13; *Die Oma hat am Sonntag der Opa liebevoll geküsst*, The grandma (female-acc., ambig.) has on Sunday the grandpa (male-nom., unambig.) with love kissed) in comparison to canonical SVO sentences. At the end, participants had to choose which of the two pictures corresponded to the sentences (off-line task). Specifically, we asked whether 1) the three groups have linguistic knowledge of the case marking cues and show an on-line reaction to them at all and 2) if there is a reaction, whether its amplitude or timing is different in the three groups, and finally, 3) whether they perform better on-line than off-line. In end-of sentence off-line decisions for A), L1c and L2c performed poorer than the L1a (55%, 30%, 94%). However, eye-gaze data revealed that both child groups were sensitive to *den*, even if at a later point than the L1a, and that at the end they often did not succeed in persevering with this correct analysis and favoured an apparently less costly "agent-first strategy". Concerning B), off-line comprehension was low for all three groups (9%, 13%, 55%). Only the L1a revealed on-line signs of revision from the initial "agent-first" analysis, by reacting to *der*. In sum, our studies show that all groups 1) reveal linguistic knowledge of the disambiguating morphosyntactic cues, as shown by their on-line reaction to the unambiguously marked article, *den*. In B) the weak (L1a) or absent (L1c, L2c) reaction to *der* might not be necessarily interpreted as the result of missing linguistic knowledge of the cue itself, but rather as a combination of children´s difficulty in inhibiting the previous analysis when a cue comes late in the sentence together with the lower frequency of this structure at least in absence of a supporting context (which might also explain that the L1a were garden-pathed as well). As for 2) children were shown to integrate cues slower than adults, and L2c were slower and overall less successful than the L1c. As for 3), L1c and L2c often failed during the off-line task to keep the correct sentence analysis for A) and in inhibiting the previous analysis when the disambiguating cue occurs later in the sentence B). In conclusion, our data suggest that both cL1 and cL2 have more knowledge about case marking than might be concluded from off-line data, but still differ from adults in the speed and degree to which they use this knowledge, both on-line and off-line.

Back to Thursday Poster Schedule

Complexity effects in sluicing and sprouting

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Introduction: Through an eye tracking while reading experiment, we aim to show that length and structural complexity of an antecedent elicits processing difficulty in the processing of sluicing and sprouting sentences. Recent work has addressed the underlying mechanism of antecedent retrieval in ellipsis, in particular investigating whether syntactic structure is copied or re-accessed at the ellipsis site. Previous studies suggest that the complexity of an antecedent does not affect processing of the ellipsis site, lending support to versions of retrieval theories that employ (unconstrained) cue-based models [1], or cost-free copying models [2]. However, there are both mixed results concerning complexity effects in ellipsis processing [2,3], as well as reports of difficulty in interpreting a 'long-distance' reading of wh-adjuncts in sluicing [4].

Ellipsis resolution: We show that processing at an ellipsis site is directly affected by both ellipsis type [5] and the complexity of elided material. During the processing of sluicing and sprouting, the parser must recognize an ellipsis site, access the antecedent, and integrate the antecedent material into the current structure. However, sprouting additionally requires identifying the antecedent of the wh-phrase, as it is not explicit in the antecedent clause., e.g. *John ate **something** but I don't know **what** __* vs. *John ate **Ø** but I don't know **what** __*. Previous work [6] has shown that inferring an unexpressed element in a sprouting construction incurs a cost, which is reflected by longer reading times at or after the wh-phrase. It has furthermore been suggested by [4] that it is difficult to interpret "why" as residing in the matrix clause of an elided bi-clausal structure (e.g., (1b)).

(1)a/b *Susan claimed that John left for some reason, but I don't know*
*[CP **why** [IP John left t]] / ?*[CP **why** [IP Susan claimed [CP that [IP John left t]]]].*

Making use of sluicing and sprouting environments with wh-adjuncts, we investigate the effect of different types of clausal ellipsis and antecedent complexity during processing. We show a processing penalty for sprouting constructions as reported in [6], and more notably, we observe a processing cost at the adjunct wh-phrase when the antecedent is complex.

Experiment: We employed a 2x2 design, and conducted an eye tracking while reading experiment (n = 40), manipulating type of clausal ellipsis (sluicing vs. sprouting) and antecedent complexity (complex vs. simple) (2a-d).

(2)a/b *Bill thinks that Mary, for some reason/after the meeting, quit her job, but I don't know why__ specifically ...*

(2)c/d *Mary, for some reason/after the meeting, quit her job, but I don't know why__ specifically…*

In (2a/b), the potential antecedent for the elided material is bi-clausal, as opposed to a single clause in (2c/d). In (2a/c), the adjunct "for some reason" is serving as the antecedent of "why", whereas in (2b/d) "why" does not have an antecedent.

Results and Discussion: We found that both complexity of the antecedent and type of ellipsis affect processing upon encountering the wh-remnant. First fixation, first pass, and total fixation time all reveal a main effect of ellipsis type, such that sprouting constructions elicit longer fixations at "why" (ff: $X2 = 4.72$, $p<.05$; fp: $X2 = 5.55$, $p<.05$; tft: $X2 = 4.35$, $p<.05$). There was also a main effect of antecedent complexity in total fixation times ($X2 = 5.66$, $p<.05$), such that complex antecedents resulted in longer total fixations at "why". Lastly, we observed a significant interaction in regression path durations ($X2 = 5.55$, $p<.01$), such that processing a simple antecedent in sluicing constructions was much faster than in all other conditions. Thus we conclude that antecedent complexity does indeed affect the processing of ellipsis, although this effect may be obscured by the penalty imposed by sprouting constructions.

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Back to Thursday Poster Schedule

Comprehenders reason about competing causal sources of binomial ordering

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Recent work suggests that comprehenders infer speakers' intended meanings by reasoning about interacting causal influences on speech production choices. Myslín & Levy (2015) showed that comprehenders infer that speakers choose between syntactic alternants, such as the double object construction and prepositional object construction, in order to express a meaning canonically associated with that form (*change of possession*, *change of location*, respectively). But these inferences were attenuated when other factors such as the preference to put short constituents first could 'explain away' the speaker's choice of form, implying that comprehenders infer tradeoffs between causal influences on production choices. Here we ask whether this explaining-away inference holds in a domain *without* canonical form-meaning associations, where comprehenders must additionally infer this mapping on the fly: the ordering of binomial expressions *X and Y* (Benor & Levy, 2006). We show that comprehenders not only infer the semantic constraint (cause-before-effect, powerful-before-weak, etc) influencing ordering, but also that the influence of this factor is modulated by a competing phonological constraint on ordering.

One factor potentially affecting binomial ordering choice is a semantic ICONIC SEQUENCING constraint on expression of cause and effect: causes should precede effects, so that given *slippery and dangerous*, a comprehender should infer that something is dangerous BECAUSE it is slippery more strongly than when given *dangerous and slippery*. But another influence on binomial ordering is a metrical LENGTH constraint stating that short words should precede long words. Thus given a binomial such as *tall and dangerous*, where a short word occurs first, a rational comprehender might explain away the ordering choice as simply resulting from the LENGTH constraint, and infer that ICONIC SEQUENCING is not at play—making her less likely than in the *dangerous and slippery* case to infer that the speaker intended to express causality.

We tested this prediction with 36 items crossing length of a potential cause ("PC"; *slippery, tall*) with the possibility of iconic cause-and-effect ordering with respect to an effect ("E", *dangerous*). Short PCs were monosyllabic, while effects and long PCs were 3-4 syllables:

	PC before E	**PC after E**
Long PC	The slide was slippery and dangerous.	The slide was dangerous and slippery.
Short PC	The slide was tall and dangerous.	The slide was dangerous and tall.

We asked 148 participants whether they thought that E arose BECAUSE of PC using counterfactual questions: *If the slide weren't tall, would it still be dangerous?* We predicted a main effect of ICONIC SEQUENCING: participants should be more likely to infer causality (respond *no*) when PC comes first. This was significant in a maximal mixed-effects logit model of responses ($\beta = 0.12$, $p < 0.01$). Crucially, we also predicted that if comprehenders model the interplay of causal factors governing ordering, this main effect should be attenuated when LENGTH can explain away an ordering choice—in particular, when the potential cause is short and comes first. Consistent with this prediction, we found a significant interaction such that comprehenders were less likely to infer an iconic causal relationship given a phonologically short potential cause ($\beta = -0.07$, $p < 0.05$).

Our results indicate that comprehenders infer intended meanings through sophisticated reasoning about WHY speakers say what they say, considering tradeoffs between such disparate factors as phonology and communicative intent. The results further indicate that this explaining-away inference of meaning is robust to domains with no canonical form-meaning associations, where comprehenders must infer these on the fly. Finally, explaining-away as a comprehension strategy complements similar findings in perceptual and non-linguistic reasoning (Gergely, 2002; Kraljic et al., 2008), promoting domain-general architectures in comprehension.

Back to Thursday Poster Schedule

Comprehension priming evidence for elliptical structures

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It is debated whether or not syntactic structure is necessary to interpret verb-phrase ellipsis (VPE), as various theoretical accounts posit either covert syntactic structure (e.g., Merchant, 2001; Chung et al., 1995), or null anaphora (Hardt, 1993). We present comprehension-priming results which suggest that processing VPE activates syntactic structure.

We implemented a self-paced reading paradigm in which a bi-clausal **Prime** sentence was presented as a separate trial immediately preceding a mono-clausal **Target** trial. The Target always contained a verb that, although strongly biased towards a direct object (DO) continuation (all verbs >60% DO bias from a separate norming study), is continued into a sentential complement (SC), leading to a temporary garden-path ambiguity at the verb and the following noun-phrase. The Prime consisted of two clauses, instantiating 8 conditions (2x4). Factor 1 was **the structure of clause 1** (two levels): (i) an SC structure, or (ii) a DO structure, where clause 1 contained a verb that was also the matrix verb of the target (e.g., 'guarantee' in Table 1). Factor 2 was **the structure of clause 2** (four levels): (i) VPE; (ii) 'Do-it'-anaphora; (iii) a Full Clause replicating the clause 1 structure; or (iv) an Intransitive predicate (see Table 1).

We predict that the the syntactic priming effect from the Prime to the Target should help reduce garden-path difficulty at the Target (Fine et al., 2013), such that RTs at the disambiguating region (i.e., Aux 'was' in the Target) should be faster when the Prime contains an SC structure, compared to when it contains a DO structure. Crucially, if the comprehension of the VPE prime involves retrieval of a syntactic antecedent, we expect a stronger priming effect from the VPE and the Full Clause Primes, since participants are exposed to a SC syntactic structure twice in these Primes (one in each clause); whereas the 'Do-it'-anaphora primes should pattern with the Intransitive primes, producing a weaker priming effect (if any), since 'Do-it'-anaphora has been hypothesized to lack internal structure (Sag and Hankamer, 1976).

Table 1 (item n=32; subj n=90)

Clause 1	Clause 2
Prime: The coach was trusted to **guarantee a victory was on the horizon**,	but in the end he **didn't**.
V NP Pred	but in the end he **didn't do it**.
The coach was trusted to **guarantee a victory** enthusiastically,	but in the end he **guaranteed it** {**was unlikely/with some caution**}.
V NP	but in the end he **seemed unreliable**.
Target: The stock broker **guaranteed a profit was ready to be made**.	
V NP Aux Pred	

On the Target sentence, no effect was found on the critical disambiguating region (Aux 'was'). But on the spill-over region, there is a significant priming effect when the two VPE Primes are compared (mixed-effects model, $p<0.05$). No such priming effect was found for the other three pairs of primes.

The contrast between the VPE and the 'Do-it'-anaphora primes provides strong evidence that VPE resolution involves retrieval of a syntactic antecedent. But, the lack of a priming effect from the two Full Clause primes is unexpected; however, we note a crucial difference between the VPE and the Full Clause primes: the second clause of the VPE primes does not evoke any garden-path difficulty itself, since it is sufficient to simply reuse the correctly parsed/revised structure from the antecedent. The second clause of the Full Clause primes, however, contains a garden-path ambiguity that may require reanalysis. It is possible that the heightened processing complexity in the Full Clause primes interfered with the syntactic priming effect. We are currently running a follow-up experiment to address this issue. In sum, we provide some of the first evidence from comprehension priming for the activation of syntactic structure in the online resolution of ellipsis (see Xiang et al., 2013 for evidence from production priming).

Back to Thursday Poster Schedule

Computation of Agreement is Verb-Centric Regardless of Word Order

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Recent work suggests that agreement processing is a partially retrospective process, wherein reaching an inflected verb triggers a search through memory for the features of the subject[1,2]. The current work asks whether this is because of processes that are initiated any time an inflected verb is encountered or if instead agreement relations are always checked in a retrospective or bottom-up fashion. If an inflected verb acts as a trigger to compute agreement, then we expect the parser to show predictive anticipation of the subject's number features whenever the verb precedes the subject as in (1a). If instead agreement is always computed bottom-up, we do not expect to see evidence of predictive processing when the verb precedes the subject.

Experiment 1: A plural auxiliary and *both* each require that there be matching features later in the string that complete the dependency and each dependency would be satisfied by a plural feature. Experiment 1 used a cloze task on Mechanical Turk to test whether speakers are equally capable of using a plural auxiliary and *both* to predict a plural subject. Of particular interest were continuations with a coordinated subject because coordination allows a NP_{SG} that temporarily appears to violate the featural requirements of a plural auxiliary and *both* while still resulting in a grammatical string, which will be crucial to Experiment 2.

(1a) **Long Form**: {Were/Will} {both/ ∅} the raucous camper...

(b) **Short Form**: {Were/Will} {both/ ∅}...

Results: NP_{SG}s are less predictable after a lone number-marked auxiliary than in the other three conditions. The second conjunct showed high predictability in the +Both conditions.

Condition	*NP_{SG} After Short Form*	*Coordination After Long Form*
Aux +Both	17.1%	93.2%
Aux -Both	3.4%	72.3%
Modal +Both	14.6%	97.2%
Modal - Both	15.6%	0%

Table 1: Cloze Task Continuations

Experiment 2: Prediction manifests in two ways in reading times: (1) a slow down on input that contradicts the prediction and (2) facilitation on input that confirms the prediction[3,4]. Experiment 2 used the sentence manipulation in (2), crossed between (a) a fronted auxiliary plural verb or a modal baseline and (b) the presence or absence of *both*, to see if agreement can show prediction in a verb initial construction. The coordination from Experiment 1 provides a temporary illusion of infelicitous agreement at the first conjunct while maintaining global grammaticality.

(2) /{Were/Will}{both/ ∅} the/ raucous camper/ and the counselor /sing(ing) /on their hike?

Results: There was a significant interaction of AuxiliaryType and *Both* in Total Times at the First Conjunct region (t>2) from a slow down in the Aux-Both condition reflecting the difficulty of integrating the number requirements of the inflected auxiliary with the singular NP. In the second conjunct region there was a significant main effect of +Both in first pass(t>2), indicating facilitation for confirmation of the prediction of coordination.

Condition	*First Conjunct Total Times*	*Second Conjunct First Pass*
Aux +Both	758	481
Aux -Both	855	506
Modal +Both	777	470
Modal -Both	751	523

Table 2: Mean RTs (ms) from Experiment 2

Conclusion: These results indicate that the parser *can* predict phi-features within an agreement relationship provided that the verb precedes the subject. This argues that the crucial trait of agreement processing is that integration of feature values is triggered by the verb, rather than being a solely retrospective process.

References: [1] Wagers, Lau, & Phillips. (2009).*JML*. [2] Allentoff & Lorimor. (2014).*CUNY*. [3] Stowe. (1986).*LCP*. [4] Staub et al. (2006).*JEP*.

Back to Thursday Poster Schedule

Connecting verbs to syntax: Modifying verb bias

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Verbs' probabilistic subcategorization biases guide language comprehension and production in adults and children (Garnsey et al., 1997; Peter et al., 2015; Snedeker & Trueswell, 2004). The sources of these verb biases are controversial. Some argue that verb biases are rooted in verb meaning and event knowledge (Argaman & Pearlmutter, 2002; Hare et al., 2003); such proposals are related to lexical-projectionist accounts of the verb lexicon, on which verbs' semantic representations determine their syntactic privileges (Levin & Rappaport Hovav, 2005; Pinker, 1989). In contrast, others argue that verb biases arise largely through distributional learning about the syntactic behavior of particular verbs (Wonnacott et al., 2008).

Two prior studies suggest that the biases of familiar verbs can be *modified* by new language experience, in adults' written production (Coyle & Kaschak, 2008), and in 5-year-old children's comprehension (Qi et al., 2011). We built on these findings to explore the conditions under which new experience can alter the biases of dative verbs in children and adults. Dative verbs are useful to us in isolating the effects of distributional learning, because these verbs permit two syntactic alternatives that both describe the same transfer-of-possession events (e.g., 'Dora gave Boots the ball' vs. 'Dora gave the ball to Boots').

In two experiments, children and adults described animated videos of transfer events using dative verbs. Experimenters provided sentence stems that participants completed to describe the videos. In t*raining* trials, the stems induced participants to produce double-object datives for one verb (e.g., DO-trained: 'Dora gave Boots…') and prepositional-object datives for another verb (PO-trained: 'Dora showed the ball…'). In later *test* trials, the stems ended at the verb ('Tigger showed …'), leaving participants free to choose either structure. Filler trials involved other verbs and sentence structures. Training stems for the DO- and PO-trained verbs were intermixed; thus any learning measured at test required linking syntactic structures to particular verbs, not abstract syntactic priming.

In Experiment 1, we trained and tested 4-year-olds (N=48) with two verbs (*give, show*); there were 10 training trials and 4 test trials per verb. Children produced significantly more DO descriptions with DO-trained than with PD-trained verbs. This training effect held for both verbs. This is the first evidence for verb-bias modification in preschoolers' language production.

In Experiment 2, we tested adults (N=48) in the same way; the adults were trained and tested with *give* and *show* as in Experiment 1, with *bring* and *hand,* or with *pass* and *send.* This allowed us to examine verb-bias modification across verbs varying in their pre-existing biases from PD-biased to DO-biased (*pass, send, hand, bring, give, show*), as measured via norming experiments and corpus searches. Adults produced significantly more DO descriptions for DO-trained than PD-trained verbs. This training effect held for all 6 verbs.

These results yield new evidence for the role of linguistic experience in creating and adapting verbs' subcategorization biases. In training, participants were induced to produce familiar dative verbs in either double-object or prepositional-dative sentences. This manipulation created a measurable shift in adults' and children's usage of these well-known verbs later in the experiment. Because verbs in different training conditions were interleaved, this shift could not be due to abstract syntactic priming, but must reflect learning about the syntactic behavior of particular words: Thus, within the confines of the task, one familiar dative verb became more likely, and another verb less likely, to be used in the double-object structure. The effect of verb-bias training was strikingly similar for children and adults, suggesting close links between verb learning in childhood, and adaptation to the statistics of language experience in adulthood. What was the nature of the learning in our task? Because the DO and PO dative structures created in training both described the same transfer events, we argue that this is evidence for ongoing learning about the co-occurrences of particular verbs and syntactic structures, independent of differences in the event-dependent meanings of the verbs.

Back to Thursday Poster Schedule

Constraints on adaptation to syntactic variability between and within speakers

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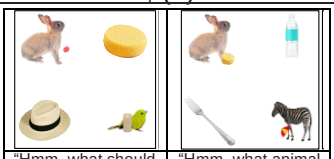
Speakers vary in their tendency to use syntactic structures (e.g., high vs. low attachment) and listeners adapt their on-line expectations during sentence processing to individual speakers' preferences (Kamide, 2012). Verbs vary in their tendency to appear in one structure over another; listeners use these biases to resolve ambiguities on-line (Snedeker & Trueswell, 2004). Two visual-world eye-tracking experiments test the malleability of these biases in PP-attachment ambiguities. We test two hypotheses regarding the learning and use of biases in on-line comprehension: (1) that adults can adapt verb bias representations in response to exposure to verb-structure co-occurrences; (2) that these verb-specific adaptions can be speaker-specific.

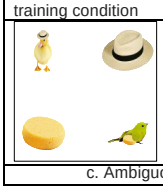


"Hmm, what should you use to hug the bunny? I know! You should hug the bunny with the sponge."

a. Instrument bias training condition

"Hmm, what animal should you hug? I know! You should hug the bunny with the sponge."

b. Modifier bias training condition



"Hmm, what should you do? I know! You should hug the duck with the hat."

c. Ambiguous test trial

Figure 1. Example trials in E1 and E2

Exp1: 60 participants (Ps) followed instructions to manipulate objects. Critical trials contained one of 8 initially equi-biased verbs in a globally ambiguous structure, e.g., "*Hug the duck with the hat"*. 32 test, 64 training, and 64 filler trials were randomly intermixed. Training trials: 4 verbs were paired with a visual context and setup sentence that unambiguously pointed to an *Instrument* interpretation (Fig 1a). The other 4 verbs were paired with a visual context and setup sentence that unambiguously pointed to a *Modifier* interpretation (Fig 1b). Verb-structure pairings were counterbalanced across Ps. **Exp2:** 120 Ps listened to sentences identical to Exp1, but 1/2 of instructions were spoken by a male (A) and 1/2 by a female (B). 4 verbs were instrument-trained for A and modifier-biased for B; vice versa for the other 4 verbs (Fig 2). Speaker-verb bias pairings were counterbalanced across Ps.

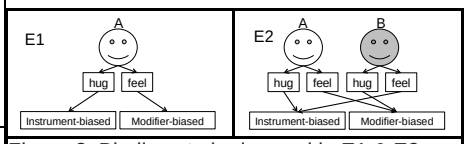
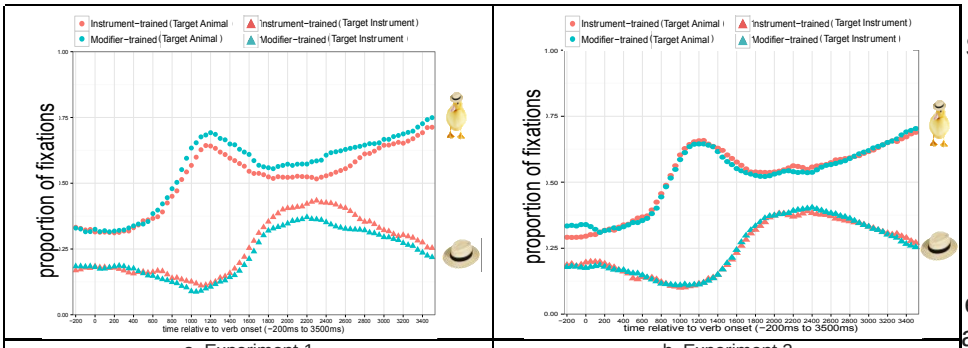


Figure 2. Bindings to be learned in E1 & E2



a. Experiment 1 b. Experiment 2

Figure 3. Timecourse plot of fixations to target animal (e.g., duck) and target instrument (e.g., hat) during test trials.

Results: *E1:* Analysis of eye-gaze after verb onset at test showed a significant training effect on target animal and instrument looks (*ts*>2.80); Ps looked more at the animal (duck) and less at the instrument (hat) when *hug* was modifier- vs. inst-trained (Fig3a). *E2*: Ps did not learn learn speaker- + verb-specific biases (*ts*<1.07*;* Fig3b). **Discussion:** We report novel results that 1) listeners learn new verb biases from exposure to new co-occurrence statistics; 2) listeners do not form speaker+verb-specific biases. Critically, to learn in Exp2, Ps needed to learn talker-verb-structure co-occurrences; these 3-way bindings were apparently not learned, despite successful learning of verb-structure pairings in Exp1 and observed talker-structure learning in the literature (Kamide, 2012). These findings point to the language processing system's impressive ability to adapt to the statistics of the environment, as well as constraints on these adaptive mechanisms. Forming detailed speaker models for every interlocutor may be beyond the limits of memory capacity or create excessive retrieval interference. Thus, listeners must strike a balance between rapid adaptation and generalization.

Back to Thursday Poster Schedule

Correlate not optional: PP sprouting in 'much less' ellipsis.

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Forming a dependency with an implicit or unmentioned entity often comes at a cost, as in bridging inferences (Haviland & Clark, 1974; Burkhardt, 2006). We explored the cost of inferring a contrastive PP (prepositional phrase) in the *much less* construction to evaluate how its dependencies are retrieved and related to each other in real time. In typical *much less* coordination (1a), a remnant (*to her dad*) forms a scalar contrast with an overt matrix correlate (*to her mom*). To fully interpret this ellipsis structure (Harris, to appear), the processor must (P1) find a correlate-remnant pair, and (P2) construct the appropriate scalar relationship between them. As shown in (1b), a correlate ⦸ must sometimes be inferred or "sprouted", on analogy with sluicing in ellipsis (Chung et al., 1995): *John ate ⦸, but I don't know what.* We compare PP sprouting to cases with overt correlates (compatible or incompatible PPs) to assess the relative importance of the two processes (P1, P2) above. If P1 is the processor's first task, sprouting a PP should always be costly. But if P1 is engaged only to form a scalar relation P2, sprouting should be less taxing, since the scale is determined by an entailment between clauses: *not talking* entails *not talking to one's dad*. Here, an incompatible PP should induce a greater penalty than sprouting. Results favor the former possibility, and we posit the Parallel Contrast Principle (2) to explain them.

In a completion study on fragment variants of (3) which were truncated at *much less*, subjects (N=27) supplied PP remnants more often after matrix clauses with a parallel PP correlate (~ 74%), regardless of PP type (compatible or incompatible). Without a correlate, however, PPs were provided, and thus sprouted, in only 4% of trials, consistent with corpus findings (Carlson & Harris, 2015). Different subjects (N=30) rated complete sentences (3) for naturalness on a 7-point scale. Sprouting items (PP remnants without a matrix PP) were rated lower than sentences with compatible PP contrasts, t = -3.45; as expected, this penalty was increased for PP remnants when compared to VP remnants, t = 2.62. There was no penalty for incompatible compared to compatible PP contrasts, and VP remnants were rated as more natural than PP remnants, t = 2.52.

In an eye movement reading study (N=45), there was a general cost for VP remnants on the remnant region in first pass, go-past, and total times (all t's > 2 in LMER models). However, whereas VP remnants elicited numerically longer go-past, second pass, and total reading times after matrix clauses with possible PP correlates, sprouted PP remnants were more costly than VPs (all t's > 2). Further, readers made marginally more regressions out of sprouted remnants, t = 1.72, p = 0.08. The interactions support the Parallel Contrast Principle in that reading was facilitated just in cases where the processor could retrieve a correlate for the remnant from the surface form of the matrix clause. Incompatible PP contrasts did not slow reading over VP controls, although they did elicit longer re-reading times than compatible PP contrasts in the matrix PP region. These results suggest that the dominant online cost of sprouting derives from inferring a correlate, rather than creating the scalar relationship required for interpretation.

As with ellipsis and coordination generally (e.g., Carlson, 2002), the processor relies on parallelism between clauses to process *much less* coordination. And as in sluicing, sprouting is costly (Frazier & Clifton, 1998; Dickey & Bunger, 2011). Thus, locating a correlate for a remnant in clausal ellipsis cannot be circumvented even when doing so could be semantically advantageous, a view compatible with a rapid retrieval process engaged by ellipsis generally (Frazier & Clifton, 2005; Martin & McElree, 2011).

(1) a. M. didn't talk to her mom, much less to her dad. b. M. didn't talk ⦸, much less to her dad.
(2) **Parallel Contrast Principle:** Retrieve a correlate that is parallel in form to the remnant.
(3) John doesn't want to eat out { *No PP:* ⦸ | *Comp.:* on Saturday | *Incomp.:* at a steakhouse},
much less {*PP Remnant:* on Tuesday / *VP Remnant:* go dancing}, so I guess….

Back to Thursday Poster Schedule

Crosslinguistic activation of referential bias in Korean-English bilinguals

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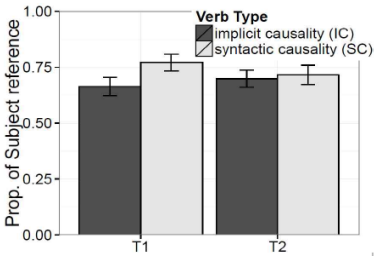
The bilingual mental lexicon contains representations that are at least partially shared at multiple levels (semantic, form) between languages, as seen in non-selective activation, cross-language interaction, and translation priming effects (Dijkstra & van Heuven 2002; Duñabeitia et al. 2010; Gollan et al.1997). These effects have been demonstrated abundantly at the word level, yet less is known about the consequences of cross-language activation at the *word* level on biases in subsequent *sentence* interpretation. In this study, we investigate how referential biases associated with causality verbs in Korean affect Korean-English bilinguals' reference choices in an English sentence completion task, both with and without translation priming.

Verb-based implicit causality (IC) creates biases for who will be mentioned next (Garvey & Caramazza 1974); e.g., *threaten* implies the subject as the cause of the 'threaten' event, and thus the most likely next referent in the discourse. Korean, in addition to IC verbs, has a class of (subject-biased) syntactic causality (SC) verbs, best translated as 'causing X to be Y' (e.g., *Hyesoo-ka Younghee-lul mwusep-keyha-ess-ta*; ~'H. frightened Y.'; Park 2009). IC verbs generally differ in the strength of their referential bias (Ferstl et al. 2011); in Korean, SC verbs show an overall stronger subject bias than (subject-biased) IC verbs (Kim & Greta CUNY 2015). Here we ask whether the stronger subject-bias of Korean SC verbs creates a stronger subject-bias for their English translation equivalents (all IC verbs in English) in Korean-English bilinguals.

Method: 72 Korean learners of English completed a sentence completion task in English, either preceded (translation-first/T1 group, n=36) or followed (T2, n=36) by a translation task. In the completion task, participants read 48 English sentences, including English translation equivalents of Korean SC (k=12) and IC (k=12) verbs, followed by the connective *because* and a blank line, and provided written continuations, which were annotated for the intended reference of the grammatical subject by two independent coders. In the translation task, participants translated the same sentences (without connective or continuation) into Korean.

Predictions: If the stronger subject-bias for Korean SC (vs IC) verbs affects bilinguals' reference choices in English, we expect more reference to the previous subject in continuations following English translation equivalents of Korean SC (vs IC) verbs (main effect of verb type), with a stronger effect in the translation-priming (T1) group (verb type x group interaction).

Results: Mixed-effects logistic regression (lmer) was used to examine the effects of verb type (SC,IC) and task order (T1,T2) on the likelihood of the subject of the completion referring to the previous subject (Fig.). The maximal model revealed a marginally significant interaction (β=-.54, p=.07), and no main effects. Follow-up analyses for each group showed more subject reference for SC vs IC verbs in the T1 (β=.70, p=.03) but not the T2 (β=-.06, p=.87) group.



In the translation task, participants did not always make the specific cross-language associations we expected. In a second analysis, we therefore removed all trials for which participants did not provide a Korean translation with the expected verb type (e.g., when they did not use a SC construction for an item we had put in the SC condition; 22% of data). In this reduced dataset, a main effect of verb type emerged (β=1.12, p=.002), qualified by an interaction (β=-.70, p=.04). Follow-up analyses for each group again showed more subject reference for SC vs IC verbs in the T1 (β=1.52, p<.001) but not the T2 (β=.65, p=.15) group.

These findings provide evidence of cross-language influence of the strength of referential bias in causality verbs, at least when cross-language associations are primed through a preceding translation task. This indicates that cross-linguistic activation at the word level can affect bilinguals' processing at the sentence and discourse level, presumably through the mental models they create as a result of shared representations at a lexical level.

Back to Thursday Poster Schedule

Cross-linguistic variation in sensitivity to grammatical errors: evidence from multilingual speakers

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Do speakers of more than two languages receive a stronger influence of their native (L1) or their second language (L2) when they process a third language (L3)? While some previous studies suggest that an L1 determines the processing of an L3 more strongly than an L2 [1,2,3], other studies report stronger L2 transfer effects [4,5]. We addressed this question by testing two L3 German groups in their sensitivity to errors using a speeded acceptability judgment task (SOA: 500 ms; response deadline: 3 s). We compared two groups of speakers with inverse/mirror L1-L2 distributions: a group with **L1 SPANISH−L2 ENGLISH**, and a group with **L1 ENGLISH−L2 SPANISH**, (*n* = 16 p/group; groups matched for German proficiency and age of acquisition). Our sentences obeyed similar grammatical constraints in German and English, but differed between German and Spanish. We show that speakers with L1 Spanish are worse than speakers with L1 English in detecting German infelicitous sentences. This suggests that speakers' L1 plays a decisive role in their processing of an L3. However, we also find that Spanish native speakers' detection of errors increases with their English proficiency, which suggests that second language exposure can affect L3 processing by improving speakers' sensitivity to grammatical constraints.

Design. We tested L3 speakers' sensitivity to infelicitous German sentences involving possessive (Experiment 1) and null pronouns (Experiment 2). In English (as in German), possessive pronouns need to agree in gender with possessor nouns, and null pronouns are ungrammatical in finite clauses. In contrast, Spanish differs from German because it does not require possessor-possessive gender agreement, and null pronouns can be used in finite clauses. We hypothesized that if speakers' L1 affected L3 processing more than their L2, Spanish natives should be worse at detecting infelicitous sentences than English natives. The converse pattern was expected if learners' L2 prevailed.

Results. We observed clear effects of L1 influence: Spanish natives wrongly accepted infelicitous sentences more often than English natives across experiments (*possessives*: 50% vs. 36%; *null pronouns*: 30% vs. 21%). In addition, we observed an L2 effect with possessive pronouns: Spanish speakers who were highly proficient in English were less likely to make errors than speakers with lower English proficiency (*error rates*: 45% vs. 56%). These results suggest that speakers' L1 strongly shapes their ability to compute agreement in an L3, but that L2 exposure can further impact L3 processing by increasing sensitivity to L3 grammatical constraints.

Experiment 1 (possessives)

Possessor match / Herr Boch$_{possessor}$ untersuchte {**seine** / #**ihre**} Patientin$_{possessee}$ mit dem neuen Gerät.
mismatch *Mr. Boch examined {his / #her} patient$_{fem}$ with the new equipment.*

Experiment 2 (null pronouns)

Pronoun present / Bevor der Arzt mit dem Patienten sprach, hatte {**er** / ***ø**} die Rezepte geschrieben.
omitted *Before the doctor with the patient spoke, had {he / *ø} the prescription written.*

[1] Hermas (2010) ***International Journal of Multilingualism*** **[2] Lozano (2002)** ***Durham Working Papers in Linguistics*** **[3] Na Ranong & Leung (2009)** ***Third Language Acquisition and Universal Grammar*** **[4] Bardel & Falk (2007)** ***Second Language Research*** **[5] Falk & Bardel (2010)** ***Second Language Research.***

Back to Thursday Poster Schedule

Cute Little Puppies and *Nice Cold* Beers: Rethinking the Role of Prenominal Adjectives

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As languages evolve, they adapt particular communicative strategies in response to both social and cognitive pressures, strategies which are then refined over generations of cultural transmission (Tomasello, 2003; Becker et al. 2009). Typological research seeks to establish how languages use different means to nevertheless achieve similar functional ends. Whereas more 'synthetic' languages, like German, rely heavily on morphological devices to convey information, others, like English, leave more to the surrounding context (Lupyan & Dale, 2010).

In previous work, we have found that grammatical gender marking in German serves to modulate the entropy of following nouns, making them more equally predictable in context. This functionality benefits language processing in a number of ways: 1) by helping speakers avoid the peaks in uncertainty that would otherwise occur over nouns, smoothing entropy over the larger sequence (Genzel & Charniak, 2002; Hale, 2003); 2) by reducing competition between nouns that are highly confusable in context; and 3) by facilitating the use of a richer array of lexical items. But what does this mean for languages like English that have dispensed with noun classification? One possibility is that English simply lacks the resources to accomplish the same specificity of expression available in German. Another possibility, explored here, is that rather than employing a rigid grammatical device, English relies on a more graded, semantically transparent method of entropy reduction: namely, prenominal adjectives. Like gender markers, adjectives may act to systematically delimit the space of following nouns. For example, *massive* and *moist* are likely to have markedly different following distributions. Yet even subtle differences, such as that between *great big* and *very big*, could be highly informative in English. To test this proposal, we use tools from information theory to compare gender marking in German (a deterministic system) to prenominal adjective use in English (a probabilistic one).

Consistent with our hypothesis, a comparison of the English ukWaC (Baroni et al., 2009) and German SdeWaC (Faaß & Eckart, 2013) mega-corpora suggests notable cross-linguistic differences: Both the overall proportion of adjectives (t_p = 1992.336; p < .0001) and the probability of a noun being preceded by an adjective (t_p = 85.088; p < .0001) are much higher in English than in German. Thus, while German nouns are significantly more lexically diverse than their English counterparts, precisely the opposite obtains for adjectives. What to make of the traditional assumption that adjectives "add" semantic detail to nouns, or somehow "modify" their semantic content (Kamp & Partee, 1995)? On that account, adjectives should modify high-frequency nouns, which are in greater need of semantic augmentation, more often than low-frequency nouns, which tend to be more specific (Rosch, 1978). However, this is precisely the *opposite* of what we find: Our analysis reveals a robustly negative correlation between a noun's log frequency and its likelihood of being modified. Instead, our investigation indicates that in English, adjectives redistribute the relative entropy of nouns, thus serving to balance the degree to which nouns can be predicted in context: More frequent nouns tend to be preceded by adjectives that are (on average) higher frequency and higher entropy (*edf* = 22.06: F = 32069: p < 0.0001); indeed, a nonlinear interaction between adjective entropy and adjective frequency accounts for fully 94% of the variance in noun frequency (for over 46k noun lemmas).

These analyses suggest that the difference between German and English does not lie in the 'specificity' of expressions, per se, but rather in how specificity is achieved. German uses gender marking to discriminate between likely lexical competitors, and adjectives to make rarer lexical items more predictable in context. By contrast, in English, which largely lacks gender, adjectives assume both roles. While these findings are compatible with discriminative accounts of language processing (Ramscar et al, 2010), they raise questions about the explanatory adequacy of traditional taxonomic theories.

Back to Thursday Poster Schedule

Dependency resolution difficulty increases with distance in Persian complex predicates: Evidence against the expectation-based account

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Processing cost is known to increase with dependency distance. In the context of noun-verb dependencies, the principal explanation for this so-called locality effect is usually ascribed to decay and/or interference of the noun in working memory (Gibson, 2000; Lewis and Vasishth, 2005). However, the expectation-based account (Hale 2001; Levy 2008) predicts that delaying the appearance of a verb renders it more predictable and therefore easier to process. Complex Predicates (CPs) are comprised of a non-verbal element ('noun' in the current study) and a light verb. Through these constructions, we can investigate two opposing accounts of locality and expectation as we delay the occurrence of the light verb.

A previous study (Safavi et al., 2015) on Persian separable CPs investigated whether strengthening the expectation of the light verb can lead to increased processing facilitation. Towards this end, the appearance of the verb was delayed by interposing a relative clause (Expt 1) or a long prepositional phrase (Expt 2). Before the critical region (light or heavy verb), a short PP always appeared. In Expt 2, the type of intervener (PP) across conditions was kept the same, so that the short/long conditions can be more comparable. The motivation for the second experiment was that as working memory is limited, processing different levels of syntactic complexity might have an impact on prediction maintenance. In both experiments, a simple predicate (consisting of a noun and heavy verb) configuration was included with the same distance in order to manipulate the predictability strength. Thus, in each experiment, 32 sets of items were used with a 2x2 design: predictability strength (strong/weak) and distance (short/long). The results showed locality effects in both experiments, and that delaying the verb (predictable or not) did not facilitate processing at the verb.

a(b) Ali **a:rezouyee (**ke besya:r doost-da:sht-am$^{\textbf{Expt.1.b}}$**)** bara:ye **(**doost-e xa:har-e $^{\textbf{Expt.2.b}}$**)** man **kard,**
Ali **wish-INDEF (**that a lot like-1.S.PST$^{\textbf{Expt.1.b}}$**)** for **(**friend-of sister-of$^{\textbf{Expt.2.b}}$**)** me(1.S) **do-PST**,
'Ali **made a wish** (that I liked a lot) for (my sister's friend) /me,…'

c(d) Ali **shokola:ti (**ke besya:r doost-da:sht-am$^{\textbf{Expt.1.b}}$**)** bara:ye **(**doost-e xa:har-e$^{\textbf{Expt.2.b}}$**)** man **xarid**,
Ali **chocolate(INDEF) (**that a lot liked-1.S.PST$^{\textbf{Expt.1.b}}$**)** for **(**friend-of sister-of$^{\textbf{Expt.2.b}}$**)** me(1.S) **buy-PST**,
'Ali **bought a chocolate** (that I liked a lot) for (my sister's friend) /me,…'

In the current study, we attempted to replicate Safavi et al.'s results using Eye-tracking (ET). Such a replication is especially necessary because of the surprising finding in the original studies that goes against a basic prediction of the expectation account. In the first ET experiment, we were able to replicate the locality effects found in the first SPR study, and in the second study, we were able to replicate the (stronger) locality effects found in the second SPR study. A main effect of predictability was found in first-pass reading time ($t= -3.08_{ET1}$; $t=-5.10_{ET2}$), regression path duration ($t=-3.21_{ET1}$; $t=-4.76_{ET2}$), and total reading time ($t=-4.17_{ET1}$; $t=-6.69_{ET2}$): the predictable conditions were read faster. The reason for stronger effects in ET2 can be that processing a single long intervening phrase is probably harder than processing two different phrases (Frazier and Fodor, 1978). If this is correct, then the complexity of the intervener may indeed be a relevant factor in determining whether strong expectation can weaken locality effects. In both experiments, greater verb-argument distances led to slower reading times; strong predictability did not neutralize or attenuate the locality effects. In sum, these studies show strong and unequivocal evidence in favor of working memory accounts of argument-verb dependency resolution, and against the surprisal-based expectation account of Levy (2008).

Back to Thursday Poster Schedule

Dialectal adaptation suggests rapid implicit learning of unfamiliar syntactic structures

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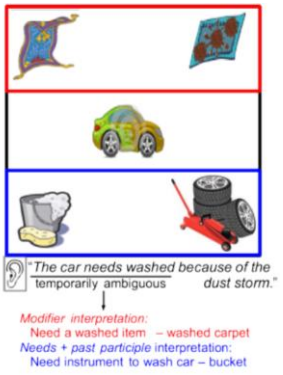
A major challenge in syntactic processing is the variability across dialects, sociolects, and idiolects in the relative frequency of particular syntactic structures and in the use of unique structures. Recent proposals suggest comprehenders cope with variability by implicitly learning the distribution of structures at hand. But the degree to which such learning integrates with prior syntactic knowledge is unclear. Most studies of syntactic adaptation test reading, which might reflect explicit task-specific strategies (e.g., treating unfamiliar structures as "errors"). Further, most work on syntactic adaptation has examined altered frequencies of *known* structures, which do not require new representations, rather than wholly unfamiliar structures.

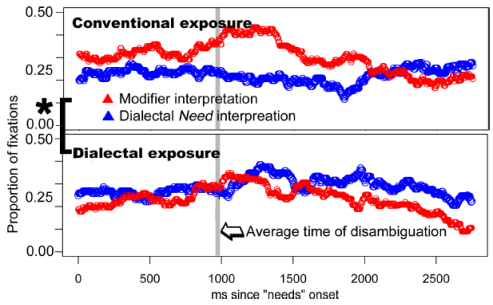
We used the visual world paradigm to test adaptation to dialectal syntax in *spoken* speech. We presented the Dialectal *Need* structure to participants previously unfamiliar with it. In western Pennsylvania, a sentence like (1) means (2). But in Standard American English, the string "*The car needs washed…"* can continue only with the modifier construction (3), creating a garden-path. (No prosodic features distinguish 1 from 3 prior to disambiguation at *because*.)

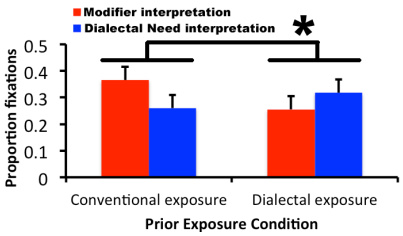
(1) *The car needs washed* because of the dust storm. **(Dialectal *Need*)**
(2) The car needs to be washed because of the dust storm. **(Conventional *Need*)**
(3) *The car needs washed* carpets to attract the highest price. **(Conventional modifier)**



In each trial, subjects (*N*=29) dragged 1 of 4 corner pictures to a central destination. Critical trials used Dialectal *Need* sentences, which required an instrument (blue region; bucket & filler picture) to perform the action named by the participle. But, listeners unfamiliar with Dialectal *Need* should instead fixate the region (red; *washed carpets* and contrasting *dirty carpets*) consistent with the garden-path modifier interpretation (3). By contrast, listeners who understand Dialectal *Need* should consider both possible resolutions of the unfolding string "*The car needs washed…"*

We used an exposure-test paradigm. In phase 1 (exposure), subjects heard either unfamiliar Dialectal *Need* (dialectal exposure condition) or familiar Conventional *Need*, of similar meaning (conventional exposure condition). In phase 2 (test), all subjects heard Dialectal *Need*. Fixation proportions in the test show that, as predicted, conventional-exposure subjects, who were unfamiliar with Dialectal *Need*, largely fixated the garden-path modifier region (red). But, dialectal-exposure subjects, who heard Dialectal *Need* during exposure, now considered both interpretations of "*The car needs washed…*" This cross-over interaction emerged (p<.001) shortly after the word *needs* (0 ms on graph), even *before* disambiguation (vertical bar).





These results suggest that experience with new structures rapidly integrates into syntactic processing: **(1)** Adaptation occurred in *spoken* language processing, less subject to strategy; **(2)** Adaptation occurred even when the new structure was spoken fluently and could not be readily heard as an "error"; and **(3)** Dialectal exposure influenced *expectations* prior to disambiguation, suggesting adaptation does not reflect only re-analysis after a conventional interpretation is impossible.

Back to Thursday Poster Schedule

Differences in pronoun comprehension between native and non-native speakers: Evidence from implicit causality/consequentiality verbs

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According to the Bayesian probabilistic model of pronoun comprehension[1], pronominal reference is mainly affected by two factors: discourse coherence relations and a "pronoun production constraint." Discourse coherence relations determine people's top-down expectations about which referent will be mentioned (regardless of referential form). The pronoun production constraint states that speakers tend to choose pronouns instead of other referential forms to refer to the most salient referent, such as the subject or first-mentioned referent. This constraint indirectly affects pronoun comprehension such that upon encountering the pronoun, comprehenders tend to associate it with the subject or first-mentioned referent. This model of pronoun comprehension has been tested on native speakers[2]. Here we focus on implicit causality/consequentiality verbs to investigate whether L2 speakers' pronoun comprehension is also constrained by the two factors to the same extent.

Implicit causality/consequentiality biases have been argued to universally affect reference comprehension. When the coherence relation between two clauses is *Explanation* as determined by the connector '*because*,' the second clause usually begins with a reference to the entity that causes the event (implicit causality). By contrast, when the coherence relation is *Result* as signaled by the connector '*so*,' the referential biases are towards the entity that bears the result of the event (implicit consequentiality). Many interpersonal verbs show strong implicit causality/consequentiality biases with some having a bias towards NP1 (subject) and some towards NP2 (object).

We conducted two written sentence-completion experiments on Chinese-speaking learners of English at intermediate-advanced levels (E1:*N*=36; E2:*N*=35) and native English speakers (E1:*N*=42; E2:*N*=46). E1 used "because*"* to elicit *Explanation* coherence relations and E2 used *"and as a result"* to elicit *Result* coherence relations. In both experiments, we contrasted NP1-biasing verbs (*N*=16) and NP2-biasing verbs (*N*=16). We also manipulated prompt type so that participants wrote continuations to sentence fragments ending with either a pronoun prompt or a free prompt. A separate translation task confirmed L2 participants' knowledge of relevant verbs. Two coders independently coded responses as referring to NP1, NP2 or neither. Data were analyzed using logit mixed-effects models.

In both experiments, L1 and L2 speakers showed a referential bias towards NP1 following NP1-biasing verbs and NP2 following NP2-biasing verbs. They produced significantly more NP1 references following pronoun than free prompt. Furthermore, in both experiments, there was a three-way interaction between group (L1 vs. L2), verb and prompt. For NP2-biasing verbs, while L1 and L2 speakers showed no referential differences following a free prompt, L2 speakers produced significantly more NP1 references than L1 speakers following a pronoun prompt.

L2 speakers' native-like performance following free prompts indicates that they have the ability to use discourse information to generate expectations about upcoming referents. However, the finding that L2 speakers had more NP1 references following pronoun prompts than L1 speakers indicates that L2 speakers tend to rely more on the pronoun production constraint to resolve pronouns. Taken together, the results show that although the Bayesian probabilistic model of pronoun comprehension[1] applies to both L1 and L2 speakers, the two groups put different weights on different cues when there are multiple sources of information available, which may be due to L2 speakers' reduced ability to process complex information[3].

References

[1]Kehler & Rohde. (2013). *Theoretical Linguistics*. [2]Rohde & Kehler. (2014). *Language, Cognition &Neurosci*. [3]Roberts et al. (2008). *Studies in SLA*.

Back to Thursday Poster Schedule

Differential ERPs to local vs. global prediction failures

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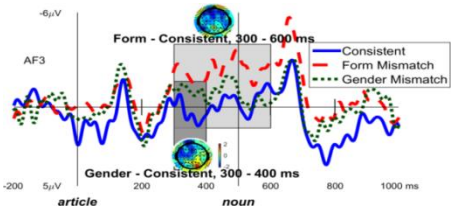
Language comprehension is supported by mechanisms that actively predict upcoming elements. However, little research has distinguished between predictions about *what* element will occur and predictions about *when* that element will occur. To investigate this, we examined evidence for prediction of upcoming nouns on preceding articles in Italian, where an article's form is dependent on two properties: 1) the phonological form of the next word (as manipulated in DeLong et al., 2005), and 2) the gender of the upcoming noun (as manipulated in Otten & Van Berkum, 2008; Wicha, et al., 2004; van Berkum et al., 2005). In high cloze (>40%, mean=79%) sentences, we manipulated the article preceding the sentence-final noun to be Form+Gender Consistent with the predicted noun, or to be Form-Inconsistent or Gender-Inconsistent. We hypothesized that Form-Inconsistent articles merely cue that the next word is not the predicted one, since the predicted noun itself may still eventually occur (for instance if there is an adjective intervening between the determiner and noun, as in English "an airplane" vs. "a big airplane"), so they trigger a local prediction failure, in which case continuing to hold the predicted element in memory may still be beneficial. Gender-Inconsistent articles, however, cue that the predicted word itself is incorrect regardless of when it might occur, triggering a global prediction failure; in this case, the predicted element should be suppressed.

(1) Il rischio maggiore è che dei batteri entrino nella ferita e provochino {**un'**$_{\text{[fem]}}$infezione$_{\text{[fem]}}$ / **una**$_{\text{[fem]}}$ bomba$_{\text{[fem]}}$ / **uno**$_{\text{[masc]}}$ sport$_{\text{[masc]}}$}.
The major risk was that bacteria would enter the wound and cause {an infection (CONSISTENT) / a bomb (FORM-inconsistent) / a sport (GENDER-inconsistent) }.

29 native Italian-speaking participants read 36 critical sentences and 80 fillers for comprehension while EEG was recorded (64-channel Biosemi). Conditions were crossed, such that each article-noun sequence (all four Italian indefinite articles were used) occurred in each condition (across lists). Sentences were presented word-by-word (300 ms on / 200 ms off) and followed by a comprehension question. The reported data patterns were consistent between spatiotemporal clustering and ANOVA time-window analyses.

Sentence-final nouns that mismatched the predicted noun elicited robust N400 effects. Crucially, however, Form-Inconsistent articles (compared to Consistent articles) elicited a broad anterior negativity *before* the noun (300-450ms, Bonferroni p=.042), indicating that participants made lexical predictions online. Surprisingly, gender-Inconsistent articles, on the other hand, elicited no significant effects, although a numerical negative trend, smaller and shorter-lived than the Form effect, is visible in the waveform (300-400ms, Bonferroni p=.218).

Given that sustained anterior negativities are often thought to be related to working memory (e.g. King & Kutas, 1995; Vos et al., 2001) or to revision of expectations (e.g. Baggio et al., 2008; Pijnacker et al., 2011), the results suggest that participants attempted to accommodate previous lexical predictions to Form-Inconsistent articles, given that the prediction may still be valid if, for example, an adjective intervened between the article and the noun to cause the article to take an unexpected phonological form. Such an effect does not arise under Gender mismatch, however, since a Gender-mismatching article is unambiguously and irreparably inconsistent with the expected noun.



Back to Thursday Poster Schedule

Discourse attention during utterance planning affects referential form choice

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Speakers tend to use pronouns and other reduced expressions in order to signal a link with the prior discourse context. In Fig. 1 speakers prefer pronouns or zeros to refer to the subject character; they also weakly prefer reduced forms for the goal (the Duke) more than the source (The Duchess; Rosa & Arnold, CUNY 2015 poster). Yet the effect of the discourse context is not static – repeated names are not ungrammatical, and with the right intonation can even be appropriate. This raises questions about variation in the speaker's use of the discourse context.

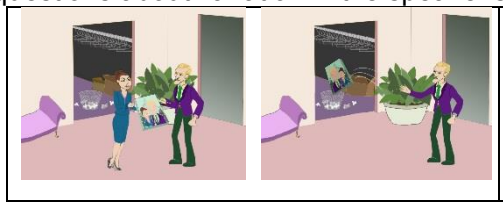


Fig. 1

a) The Duchess handed a painting to The Duke.
b) The Duke received a painting from The Duchess.

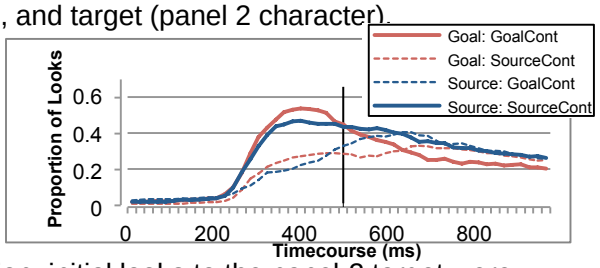
And {Ø / He / The Duke} threw it in the closet.

We used eyetracking to test the relation between a) choice of reduced referential forms and b) variation in attention to the discourse context during utterance planning. Producing a name ("The Duke") allows the speaker to formulate an event description without consideration of its relation to prior events. By contrast, using pronouns or zeros requires the speaker to recognize the link between the two events, and activate the prior context when selecting a referential form.

37 participants viewed panels like in (1), which appeared simultaneously. After 500 msec they heard a recording of a description of panel 1. They continued the story by describing panel 2. The target was either the goal or source character, and we manipulated whether it had been subject in the prior sentence or not.

Reference analysis: Overall reduced references were infrequent (8%). 24 participants only used names (essentially ignoring the story aspect of the task), while only 13 subjects produced any reduced forms at all. For those 13, pronouns/zeros were used more for subjects (40.4%) than nonsubjects (6.8%; $p<.0001$). Although there was a numerical trend toward more reduction for goals than sources, it was not significant in this small sample.

Eyetracking analysis: We analyzed two time regions: 1) Initial looks: the first 700 ms of the trial, i.e. before the first sentence starts, and 2) Sentence 1 looks: the whole first sentence. We examined fixations in three regions: panel 1-goal, panel 1-source, and target (panel 2 character).



Strikingly, participants' initial looks reflected their response plan. In the first 700 ms, participants fixated the character who they would mention in their response. As Fig. 2 shows, early looks to the panel 1 goal were more likely in the goal- than source-continuation condition, and the reverse for looks to the source. Thus, participants' early attention was guided by their plan to mention that character. In addition, initial looks to the panel-2 target were indicative of the participant's referential strategy: the 24 name-users looked at the target more than the 13 who produced some reduced forms (9.1% vs. 1.6%, $p=0.0002$). These early target looks may have occurred because the subject was ignoring the discourse context, instead focusing on the simple task of describing the second picture. In fact, the same pattern predicted trial-level variation for the 13 participants who used some reduced forms: there were more looks to the target during sentence 1 when they were planning a name than a pronoun/zero ($p=0.05$), although this effect only held for non-subject references (subjecthood x reduced use: $p=0.008$).

In sum, different speakers approached our task differently. At trial onset, increased eye gazes to the target reflected a lack of consideration of the panel 1 context, and correlated with the use of names. Thus, variation in attention to the discourse context during utterance planning affects referential form choice.

Back to Thursday Poster Schedule

Dissociating retrieval interference and reanalysis in agreement comprehension: ERP evidence

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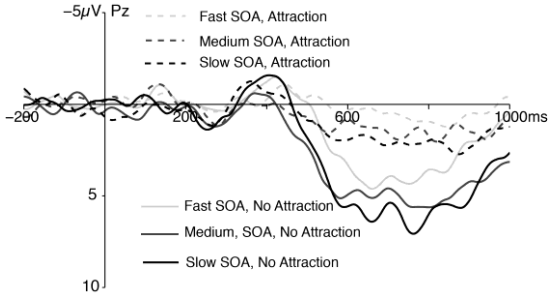
Cue-based retrieval processes play a prominent role in many recent theories of sentence comprehension (e.g., Van Dyke & Johns, 2012). A key feature of cue-based retrieval is that mis-retrievals are possible when multiple items held in memory resonate with one or more of the cues available on the item triggering the retrieval. This sort of retrieval interference is often invoked to explain agreement attraction effects during language comprehension (e.g., Tanner et al., 2014; Wagers et al., 2009). For example, sentences like '*The key to the cabinet were…*' trigger processing difficulty at the ungrammatical verb, whereas sentences like '*The key to the cabinets were…'* trigger comparatively less difficulty because while the head noun (key) is singular in both sentences, the attractor noun in the second sentence (*cabinets*) matches in number with the verb. This reduction in processing difficulty has been observed in self-paced reading and eye-tracking studies (faster reading times) and in recordings of event-related brain potentials (ERPs) with the reduction of P600 effects. Although theoretical accounts of the P600 differ, there is general agreement that it reflects a late process associated with structural or conceptual reanalysis. However, key questions remain about the relationship between the reanalysis processes indexed by P600s and the cue-based retrieval interference that gives rise to agreement attraction. One possibility is that retrieval interference is part of the reanalysis process itself. If they are related processes, factors that impact comprehenders' ability to engage in reanalysis will interact with the observed amount of attraction. That is, reduced ability to engage in reanalysis will result in a reduction of the attraction effect (measured as the difference in P600 magnitude between the sentences with and without attraction). Alternatively, retrieval interference and reanalysis may be separate processes. If they are separate, the reduced ungrammaticality effect seen after plural attractors is a product of retrieval interference having already occurred. In this case, we would expect independent and additive effects of reanalysis difficulty and attraction interference on the P600 effect.

To test these two possibilities, we recorded ERPs while participants (n=118) read sentences in a 2x2 design that crossed the factors of attractor number and verb grammaticality (*The key to the wooden cabinets(s) was/*were…*). We modulated the cognitive resources available for reanalysis by assigning participants to one of three stimulus onset asynchrony (SOA) conditions: 233ms (fast), 450ms (medium), and 650ms (slow). The figure shows ungrammatical minus grammatical difference waves for all three SOA conditions at electrode Pz. As can be seen, in sentences with attraction (that is, with plural attractors), P600 amplitudes were significantly reduced relative to sentences with no attraction interference (that is, with singular attractors). This replicates previous reports of attraction interference with ERPs (Tanner et al., 2014). There was also an effect of SOA: P600 amplitudes decreased approximately linearly with faster SOAs, suggesting that fewer cognitive resources were available for reanalysis when sentences were rapidly presented. Importantly, SOA impacted the Attraction and No Attraction P600 effects equally: there was not even a trend toward an interaction between attraction and SOA ($F < 1$). These findings indicate that reanalysis and retrieval during sentence comprehension are dissociable, and are largely independent and additive processes.



Back to Thursday Poster Schedule

Distributing Events across Intervals Explains Difficulties in Aspectual Processing

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We set out to identify how durative modifiers (*for several years*) and frequency modifiers (*every year*) affect processing by testing the predictions of two hypotheses. Previous studies have not distinguished between these hypotheses and their results are generally consistent with both (Brennan & Pylkkanen, 2008; Pinango et al., 1999, 2006; Todorova et al., 2000; Townsend, 2013). The *quantification hypothesis* (QH) maintains that difficulty in processing aspectual modifiers increases with difficulty in finding and applying a plausible distribution of occasions over time (Deo & Pinango, 2011). Distributing an activity across intervals may require dividing the event into a plausible number of occasions (Deo et al., 2012; Mourelatos, 1988). The *semantic operator hypothesis* (SOH) maintains that processing difficulty occurs when semantic operators resolve mismatches between predicates and modifiers and that frequency modifiers do not require a semantic operator (e.g., Paczynski et al., 2014). We tested and confirmed three predictions of QH.

Prediction 1 concerns the role of pragmatic knowledge (e.g., Dolling, 2003; Jackendoff, 2002). In Townsend & McDermott (CUNY 2015) we reported data demonstrating that pragmatic knowledge immediately affects processing time for durative modifiers: telicity effects on first pass time disappear when we use the situational likelihood of sentences as a covariate.

Prediction 2 concerns the effect of type of telic predicate. QH allows for the availability of a result state interpretation of a telic predicate such as *halted the class* to simplify processing. *Halted the class* produces an interpretation in which the class halts for a period of time (Pinon, 1999). If a result state interpretation is available and if distribution of a state across infinitesimal partitions is cost-free (Deo & Pinango, 2011), the telicity effects that appeared in Townsend & McDermott (CUNY 2015) will not appear with result state predicates. We tested this prediction with new data on the effects of telicity on processing time.

Prediction 3 concerns processing frequency modifiers such as *every year.* These modifiers force a search for the likely number of units in the reference set, i.e., the number of relevant years (Rothstein, 1995). When they modify atelic predicates such as *admired a mountain*, they also force dividing the durative situation into parts (Barner et al., 2008; Wittenberg & Levy, 2015). We tested the prediction that activity predicates increase processing time for frequency modifiers.

A new eye movement study provided data to test Predictions 2 and 3. We measured first pass time and total time as 48 participants read sentences such as *The dean halted a class in Dickson Hall for an hour if there was a fire drill*. The design was 2 Predicate Type [result state / activity (e.g., *halted / attended*)] x 2 Modifier Type [durative / frequency (e.g., *for an hour / every hour*)]. The only significant effect of Predicate Type was that total time on frequency modifiers was longer for activities than for result states, $F1\ (1, 39) = 8.84$, $p < .01$, $F2\ (1, 23) = 4.97$, $p < .05$, confirming Prediction 3. Predicate Type had no effect on first pass time for either modifier or on total time for durative modifiers, all ps $> .05$, confirming Prediction 2. The total time effect for frequency modifiers cannot be due to situational likelihood or sentence acceptability because pretests showed that these properties were not lower for activities than for result states (statistics omitted for space reasons).

The results demonstrate that difficulty in finding and applying a plausible distribution of occasions over time predicts processing difficulty. Pragmatic knowledge (Prediction 1, Townsend & McDermott, CUNY 2015) and the availability of a result state interpretation (Prediction 2) immediately eliminate processing difficulties with durative modifiers. Frequency modifiers increase processing difficulty for activity predicates (Prediction 3) and these effects occur relatively late in processing. We discuss the implications of these results for the SOH.

Back to Thursday Poster Schedule

D-linking and working memory: New evidence from Spanish

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Lexically specified ("D-linked") *wh*-fillers are known to improve the acceptability of gaps within islands (Pesetsky 1987). One prominent type of analysis attributes the effect to working memory: D-linking facilitates reintegration of the filler at the gap site, raising acceptability (e.g. Hofmeister & Sag 2010, Kluender & Kutas 1993).This afccount predicts that gaps in non-islands should also show a D-linking effect, and it has been claimed that they do (Hofmeister 2007, Goodall 2015). There are two possible problems with this evidence, however:

I. Overall results in the literature are mixed, with some studies finding no D-linking effect in non-islands (Alexopoulou & Keller 2013, Sprouse, Caponigro, Greco & Cecchetto 2015).

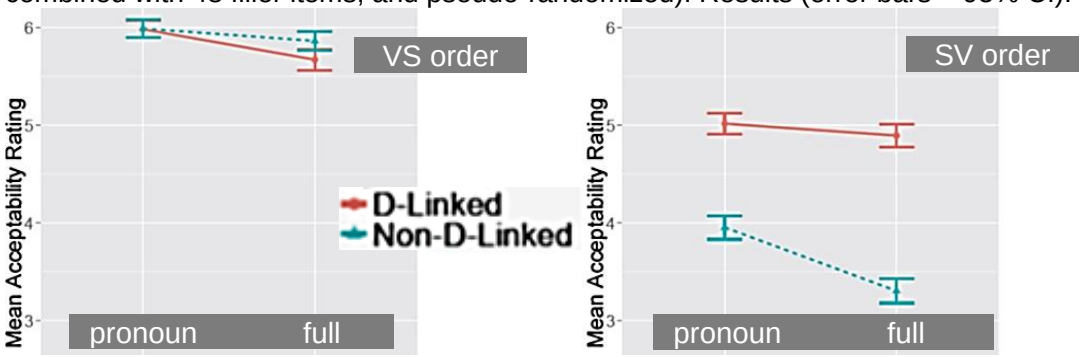
II. In the studies where an effect in non-islands **has** been found, this may be due to the simple presence of a D-linked filler (which might increase acceptability on its own), rather than to the dependency between the filler and the gap.

In this study, we address both of these problems using data from Spanish. We (1) provide new evidence for a D-linking effect in non-islands and (2) show that the effect is attributable to the dependency, not to the simple presence of a D-linked filler.

Experiment: 45 native Spanish-speakers rated sentences on a scale from 1 (worst) to 7 (best). Experimental stimuli were all monoclausal object *wh*-questions which varied by filler type (D-linked vs. bare), by order of subject and verb (VS vs. SV) and by subject type (full DP vs. pronoun), resulting in 8 conditions in total. Sample stimuli with a full DP subject:

(1a) {Qué químico / Qué} usó el científico?(1b) {Qué químico / Qué} el científico usó?
'{What chemical / What} did the scientist use?'

Participants saw 6 tokens of each condition (counterbalanced using a Latin Square design, combined with 48 filler items, and pseudo-randomized). Results (error bars = 95% CI):



In the VS order, there is no significant effect of D-linking, but in the SV order, there is ($p<0.001$).

Returning to points I and II from the introduction, our results show that D-linking:

I. Improves the acceptability of gaps even in non-islands. In Spanish, *wh*-questions with SV order are well known to be degraded (Torrego 1984) but are not a standard island environment, either in structure (no embedded clause) or extraction behavior (adjunct extraction better than argument extraction – the opposite of standard weak islands). Standard grammatical accounts of D-linking (e.g. Szabolcsi & Zwarts 1993) do not predict an effect here, since no Boolean operator intervenes between the *wh*-phrase and the gap.

II. Has no effect on acceptability when there is no filler-gap dependency to resolve. In the VS order, there is only a trivial *wh*-dependency (the filler is followed immediately by the subcategorizing verb), so as expected, there is no D-linking effect. The D-linking effect emerges only when the dependency is non-trivial, as in the SV order, suggesting that the effect is due not to the simple presence of a D-linked filler, but to the ameliorating effect on the dependency.

Together, these findings lend support to the working memory account of D-linking.

Back to Thursday Poster Schedule

Do code-switches lead to increased difficulty in comprehension? Examining the cognitive processes that integrate different forms of unexpectancy

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Psycholinguistic research shows cognitive costs when bilinguals are cued to switch between languages in production (Meuter & Allport, 1999; Guo et al. 2008). However, some bilinguals spontaneously switch languages, known as *code-switching*, even within the same utterance (*pero no tenían el flag out there?* "but don't they have the flag out there?" from Bangor Miami Corpus, Deuchar et al., 2014). Its ubiquity amongst certain bilingual speakers suggests that under some circumstances, switching does not incur a processing cost yet little is known about the cognitive and neural processes that support the integration of code-switched speech in comprehension. Prior research indicates that code-switches may not be as costly when compared to same-language "switches" to synonymous but unexpected words in high-semantic constraining sentences (e.g. *fuego* "fire" v. *blaze* in "The campers built a _____", Moreno et al., 2002).

To further investigate this, we examined the neurophysiological correlates of processing code-switches and unexpected words during sentence comprehension in highly proficient Spanish/English bilinguals using event-related potentials. Twenty-two participants read high-semantic constraint sentences that started in Spanish and in which the semantic expectancy (high vs. low) and the language context (switch vs. non-switch) of the critical word were manipulated.

1) Los jovenes se reunieron para ver el juego de baloncesto y apoyar al _____
"The guys got together to watch a basketball game and to support the _____"

a) equipo (high, non-switch), b) entrenador (low, non-switch), c) team (high, switch), coach (low, switch)

By crossing both factors we can distinguish the costs related to semantic unexpectancy from those related to code-switching (i.e. language unexpectancy) and their interaction.

We compared neural activity at 250-550ms and 550-750ms post critical word to discern the cognitive processes involved in each switch type. As expected, we observed a negative deflection at around 400ms (N400) for low expectancy compared to high expectancy sentences (see Figure 1). However, code-switches elicited a positivity at the early and late time-windows (P300/ LPC complex, see Figure 2), indicating that code-switches do not result in increased difficulty in semantic integration *per se*. Critically, the direct contrast of lexical switches and code-switches revealed an N400 to lexical switches. A novel comparison, the combination of semantic unexpectancy and code-switch compared to semantic unexpectancy without a code-switch shows an N400/LPC complex (see Figure 3). Our results replicate previous studies and demonstrate that code-switches may cause a reduced cost in sentence comprehension compared to same language semantic unexpectancy. In addition, unexpected words that switch languages are associated with greater processing difficulty (N400). This suggests that the reduced cost to code-switches is modulated by semantic fit.

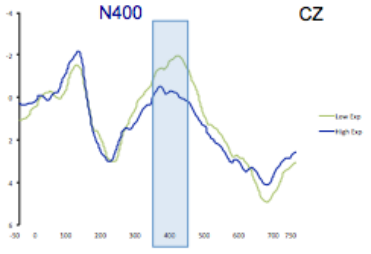

Fig. 1 Semantic expectancy (High v. Low expectancy)

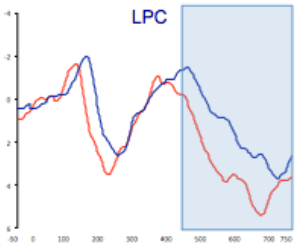

Fig. 2 Code-switching (Switch v. Non-switch)

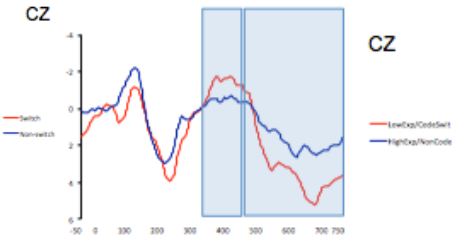

Fig. 3 Unexpected code-switch (Unexpected switch v. Expected non-switch)

Back to Thursday Poster Schedule

Does syntactic flexibility in production facilitate or inhibit planning?

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What factors affect the ease of speech production and are these factors the same across languages? Ferreira (1996) found that English speakers exhibit facilitation in production when producing utterances for which multiple alternative word orders are grammatical. This has been interpreted to argue against competition-based models of production. Recent cross-linguistic work, however, has called into question the universality of this result: in Korean, syntactic flexibility can have a negative effect on sentence planning (Hwang & Kaiser, 2014a). A series of follow-ups contrasting English and Korean support the view that the same factors may affect speech production differently cross-linguistically (Hwang & Kaiser, 2014b, 2015).

We address this question for two relatively unrelated languages that have not yet been studied, Spanish and Swedish. We let speakers of these languages describe the same set of caused motion events (e.g., 'he rolled the tyre into the cave') and measured their degree of disfluency, coding for pauses, retracings and errors. Spanish and Swedish differ in their syntactic variability during the encoding of motion events. Swedish speakers are relatively uniform in how they describe motion events, using the same syntactic frame most of the time. In contrast, Spanish speakers use a wide array of syntactic structures. How is syntactic variability in descriptions related to disfluency?

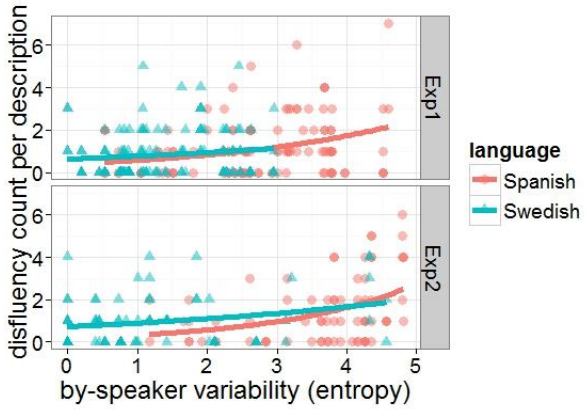

Figure 1 Number of disfluencies per description against by-speaker variability (entropy over syntactic frames), with superimposed poisson regression lines.

Exp1 compared how Spanish speakers (N = 42) and Swedish speakers (N = 41) described 32 video animations depicting caused motion events. Spanish descriptions showed greater variability than Swedish descriptions (entropy over syntactic frames = 4.7 bits vs. 2.4 bits, respectively). Description length measured in words was also greater in Spanish than in Swedish (median length: Sp = 9, Sw = 7 words). Both of these factors were positively correlated with disfluencies, but their effect does not seem to vary across languages (Fig.1). This interpretation was confirmed by preliminary mixed model regression analyses fitted on a subsample of the data.

In **Exp2** Spanish (N = 23) and Swedish speakers (N = 25) described the same events after having judged their respective similarity in a non-verbal task. In both languages this increased syntactic variability (entropy over syntactic frames: Sp = 5.1 bits, Sw = 3.0 bits) and sentence length (median length: Sp = 11, Sw = 8 words) compared to Exp1. As in Exp1, these factors did not differentially affect the degree of disfluencies across languages (Fig.1).

Together these preliminary results suggest that greater syntactic flexibility does not necessarily facilitate production (contra Ferreira, 1996). If anything, the use of more varied structures by a speaker is associated with more disfluency. Further, description length (in words) seems to be positively correlated with disfluency rates. Crucially, the lack of an interaction of any of the predictors with language suggests that the same factors affect production ease in Spanish and Swedish in equivalent ways. This underscores the necessity of comparing a greater sample of languages to draw conclusions about hypothetical universal mechanisms that drive speech production.

Back to Thursday Poster Schedule

Does *visual* cognitive control engagement help listeners tidy up the garden-path?

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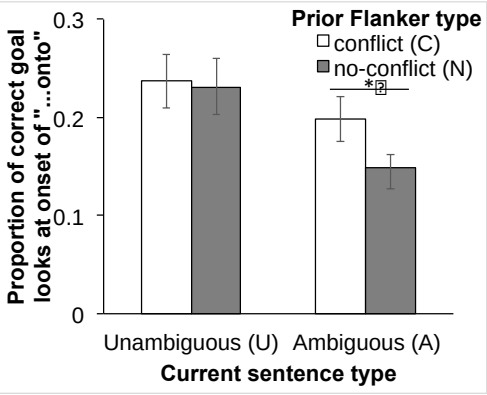
Spoken language unfolds rapidly, yet listeners keep pace by coordinating multiple probabilistic cues to interpretation that guide processing commitments moment-by-moment. Adults are generally successful in understanding linguistic input, but sometimes late-arriving evidence conflicts with early parsing decisions, requiring prompt revision. One view is that the ability to recover from temporary misinterpretation is regulated by domain-general cognitive control procedures that detect interim processing errors, and then adjust behavior to revise according to newer input.[1] One group recently used a novel cross-task paradigm to demonstrate that Stroop-conflict detection, which mobilizes cognitive control functions, subsequently facilitated listeners' incremental re-processing of temporarily ambiguous instructions that were initially misinterpreted.[2] The conclusion was that the cognitive control and language processing connection is not just correlational: there is a *causal* link between domain-general cognitive control engagement and real-time syntactic revision. However, this result might not reflect truly domain-general system interaction, since ambiguity resolution was affected by conflict-detection and cognitive control deployment from another verbal (linguistic) task: Stroop. We test if non-verbal, visual conflict regulates behavior that affects syntactic revision, to determine whether non-linguistic cognitive control mechanisms also impact the language processing system.

Healthy adults (n = 20) did a computer-based drag-and-drop, "Put" eye-tracking task:

1. *Put the frog on the napkin onto the box.* (Ambiguous, A)
2. *Put the frog that's on the napkin onto the box.* (Unambiguous, U)

Visual scenes displayed, e.g., a frog on a napkin, an empty napkin, a box, and a horse, corresponding to contexts supporting the incorrect goal analysis of *"…on the napkin…"* Intermixed among sentences were Flanker trials, a standard measure of non-verbal cognitive control. Subjects indicated the direction of a central arrow flanked by distracting arrows pointing in either the same (no-conflict, ← ← ← ← ←) or opposite direction (conflict, ← ← → ← ←). Conflicting (C) or non-conflicting (N) Flanker trials could precede ambiguous or unambiguous sentences, thus determining the relative impact of non-linguistic conflict-control engagement on subsequent syntactic processing. If non-verbal cognitive control facilitates sentence revision, we expect more looks to the correct goal (e.g., the box) in ambiguous sentences preceded by C vs. N Flanker items. Alternatively, non-linguistic procedures may have no influence, suggesting that cognitive control effects on language processing may be confined to verbal domains.

We confirmed the expected ambiguity effect: from the onset of "*napkin*", subjects fixated on the incorrect goal more during A vs. U sentences (p = .004). However, they recovered reliably earlier when trials followed Flanker-conflict. At the onset of disambiguating information ("*onto*"), we found a marginal Current x Previous Trial-Type interaction: listeners considered the *correct goal more* during A sentences preceded by C vs. N Flanker trials (p = .005, see Figure). Listeners also committed more incorrect-goal errors on A vs. U sentences, but accuracy was reliably higher following C vs. N Flanker trials (p = .004). These on- and off-line results demonstrate that dynamic engagement of even non-verbal cognitive control facilitates recovery from, and actually prevents, syntactic misanalysis, suggesting true domain-general involvement in re-interpretation procedures.



References: [1]Novick et al., 2005, *Cognitive, Affective, and Behavioral Neurosci*, [2]Hsu & Novick, in press, *Psych Science.*

Back to Thursday Poster Schedule

Downstream repetition effects reveal a lack of episodic traces for predictable words

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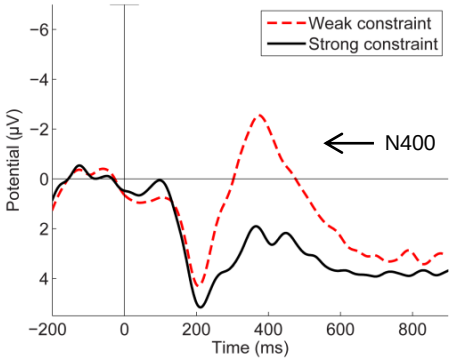
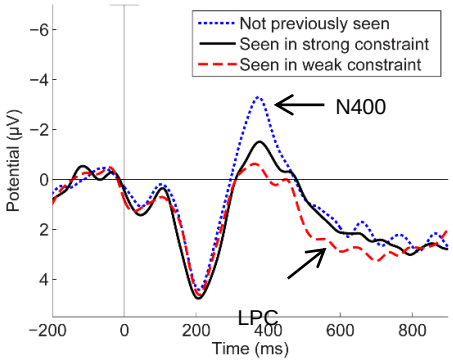
Highly predictable words are easier to process than less predictable words, which may in part be due to prediction. But does predictability have consequences for the quality of the constructed representations? On the one hand, predictability might allow the system to run in a top-down verification mode, at the expense of storing episodic details of the input. On the other hand, predictability may free up resources and allow for deeper processing of the input. Against this background, we used the ERP repetition effect to examine the fate of (un)predictable words in memory. Shallower processing of predictable input should decrease the repetition effect, whereas deeper processing should increase the repetition effect.

Thirty participants read 287 unique sentences for comprehension. The experimental sentences were weakly constraining for the critical word ("It had been several years since they last cleaned the car"; cloze probability 0.01). In the **Seen In Strong Constraint** condition, the critical word had previously been presented in a strongly constraining context ("Alfonso has started biking to work instead of driving his car"; cloze 0.86). In the **Seen In Weak Constraint** condition, the critical word had previously been presented in a weakly constraining context ("Jason tried to make space for others by moving his car"; cloze 0.01). In the **Not Previously Seen** condition, the critical word had not previously been presented. The lag between initial and repeated presentation was three sentences. Fillers ensured that, in total, over 70% of the final words did not constitute a repetition.

Upon initial presentation, words in strongly constraining sentences elicited reduced N400s (see bottom left). Further downstream (see bottom right), the N400 was reliably graded: Not Previously Seen > Seen In Strong Constraint > Seen In Weak Constraint. N400 reductions for repeated words have been associated with a superficial sense of familiarity based on priming. Relative to the Not Previously Seen condition, the late positive component (LPC) was selectively enhanced for repeated words from the Seen In Weak Constraint condition. LPC increases have been taken to reflect recognition based on the retrieval of a prior episode of seeing the word. In sum, previously predictable words elicited a smaller familiarity-based response than previously unpredictable words, and showed no evidence for episodic retrieval.

Thus, the representations formed in supportive constraining contexts seemed to lack episodic traces (or at least these were not retrieved upon repeated presentation), inconsistent with more elaborate processing of the input. This result appears consistent with a top-down verification account, according to which more predictable input is processed less deeply because it confirms what the context had already activated.





Back to Thursday Poster Schedule

Effects of definiteness and *wh* type on filler-gap dependency

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The formation of *wh* dependencies is prohibited in certain configurations, known as syntactic islands [1]. Processing studies have used filled gaps [2] to investigate whether the parser indeed avoids forming a dependency inside islands, often reporting a lack of filled-gap effects [e.g., 3, 4]. However, the non-island baseline may involve a different syntactic structure. Here we exploit the (in)definiteness asymmetry in complex NPs, where the same structure is acceptable with an indefinite (1a) and unacceptable with a definite (1b) [5]. We also investigate *wh* filler types (*who* vs. *which NP;* (2)), given that *which NP* has been argued to ameliorate island effects [6].

Exp1 used a question completion task to test the effect of (in)definiteness and *wh* filler on the acceptability of a gap inside a complex NP**.** Participants created a question after *about* (3) by adding a question mark and/or more words (fragments followed a context story to license *which NP* questions). We reasoned that the likelihood of adding an object (after *about*) indicates the extent to which the gap is unacceptable. Results (n=30) showed a main effect of definiteness, with more objects added to definite than indefinite NPs (13% vs. 3%, p=.01). This supports the claim in the theoretical literature that only definite complex NPs are islands [5], although the contrast was much smaller than expected. There was also a main effect of *wh* filler, with more objects in *who* than *which* questions (9% vs. 6%, p=.037). This is consistent with previous findings that dependencies with *which NP* are more acceptable than with *who* [6]. Interestingly, there was no interaction (p=.76): this is unexpected given claims that *which NP* fillers improve dependencies specifically inside islands, such as the definite (and not indefinite) complex NP island here.

To compare dependency formation inside and outside the island, **Exp2** used the same materials in self-paced reading with two possible filled gaps: the direct object of the verb (Region 1; non-island), and following *about* (Region 2; inside the island) (4). The context rendered questions compatible with a question ending at (*i*) the main verb, (*ii*) *about*, and (*iii*) *with*. Results (n=48) showed that Region 1 was read slower in *which NP* than *who* questions (821ms vs. 792ms, p=.008), consistent with previous findings that *which NP* is more difficult to process than *who* [7,8,9]. More important, Region 2 exhibited the *same* pattern (*which NP*: 1197ms vs. *who*: 1024ms, p=.0001), which is also consistent with Exp1. However, unlike in Exp1, there was no effect of definiteness (and no interaction).

Conclusions. As predicted by claims in syntactic literature [e.g., [5], we found effects of the definite NP island offline (Exp1). However, these effects did not obtain online (Exp2); it is possible that the effect of definiteness on dependency formation was masked by a reverse effect, where increased difficulty of processing definite NPs [10] is manifested at the gap site [11]. Definiteness also did not interact with *wh* type in either task (note that this interaction was also not observed with embedded complex NP questions [12]). We did, however, find a consistent effect of *wh* type: *which NP* led to longer reading times than *who* (Exp2) both outside the complex NP (replicating previous findings [7,8,9]) and inside the NP itself. In terms of the parallel effect of *wh* type found offline (Exp1), therefore, we propose that *which NP* does *not* ameliorate *wh* questions directly. Instead, this is an indirect effect of processing: dependency formation with *which NP* is taken to be more acceptable, because *which NP* poses a higher processing burden and thus creates a greater need to form a dependency as soon as possible.

(1) (a) ***Who did Sharon read [**the** book about _]? (b) Who did Sharon read [**a** book about _]?
(2) **?Which athlete** did Sharon read [**a/the** book about _]?
(3) **{Who/ Which singer}** did Lizzie see **{a/the}** movie about ____
(4) **{Who/which singer}** did Lizzie see [**{a, the}** movie about Elvis Presley] with _ ?

[1] Ross, 1967, MIT thesis. [2] Frazier, 1987, *NLLT*. [3] Stowe, 1986, *LCP*. [4] Bourdages, 1992, *Island constraints.* [5] Davies & Dubinsky, 2003, *NLLT*. [6] Pesetsky, 1987, *The representation of definiteness*. [7] Donkers et al., 2011, *LCP* [8] Avrutin, 2000, *Language & the brain* [9] Goodluck, 2005, *UG and external systems*. [10] Warren & Gibson, 2002, *Cognition*. [11] Van Dyke & McElree, 2006, *JML*. [12] Hofmeister & Sag, 2010, *Language.*

Back to Thursday Poster Schedule

Effects of inference relations and unique identifiability on referent management

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In this study, we investigate to what extent (a) the possibility to infer a referent from context and (b) the possibility to uniquely identify a referent in discourse can affect referent processing. Inferred referents (Prince, 1981), unlike brand-new referents, are pre-activated through a concept in discourse and definite marked noun phrases (NPs), unlike indefinite marked NPs, allow for a referent's unique identifiability (Heim, 2011). We collected event-related brain potentials to investigate the processing of inferred/definite, inferred/indefinite, brand-new/definite, and brand-new/indefinite referents in discourse. Strength of inference was controlled through separate norming. We used 32 German short stories, each consisting of a context sentence (providing an inference relation (1a) or not (1b), see Table), a sentence introducing a subject and an object referent (definite (2a) or indefinite (2b) object NP), and a final sentence providing an ambiguous pronoun (3). Items were presented to 24 participants visually and word for word (300 ms word, 500 ms ISI).

1 a. The **gym** was crowded like always.	
b. The **exhibition** at the museum was crowded like always.	
2 Michael stared at _____	a. **the trainer** at the window.
	b. **a trainer** at the window.
3 When the lights went out, **he** used his cell phone as a flashlight.	

ANOVAs of baseline-corrected ERPs on object referents (e.g., *trainer*) revealed a left-lateralized late positivity (650 ms – 850 ms post noun onset) for all but the brand-new/indefinite referents. This lead to an Information Status (inferred or brand-new) x Definiteness (definite or indefinite) x Hemisphere (left or right) interaction, $F(3,66) = 3.48$, $p = .035$. ERPs on ambiguous pronouns in final sentences yielded an Information Status x Definiteness interaction 250 ms – 400 ms post pronoun onset, $F(1,22) = 6.02$, $p = .023$. This interaction was due to inferred/definite referents eliciting a much larger negativity than inferred/indefinite referents, with no reliable differences between brand-new conditions. While somewhat early, ERPs on the pronoun showed a N400-like posterior distribution.

We propose that differences in late positivity are due to brand-new/indefinite referents being less strongly integrated into the discourse representation than brand-new/definite and inferred referents: Brand-new/indefinite referents serve as genuine introduction of a new referent into discourse without any additional processing, such as the involvement of a uniqueness constraint (unlike definite referents) or the tracking of an inference relation to preceding context (unlike inferred referents). We interpret the N400-like effect on the ambiguous pronoun as evidence for an overall higher level of activation for inferred/definite than inferred/indefinite referents, leading to stronger competition (and larger negativity) with the subject referent for the former than the latter.

To test the competition hypothesis, we conducted a visual world, eye-tracking experiment with only the inferred versions of short stories. Participants (N=32) listened to the short stories, while looking at a screen depicting the subject and object referent as well as a look-away object. We measured and analyzed where participants were looking post pronoun onset by conducting generalized linear regression models with random intercepts and slopes for participants and items. In line with our hypothesis and lasting from 800 ms to 1700 ms post pronoun onset, proportions of looks to the object referent were significantly higher for the inferred/definite than the inferred/indefinite referents ts > 2.4, ps < .02.

Taken together, our data suggest that referents that can be inferred from context and/or be uniquely identified in discourse are integrated into a discourse representation more strongly than referents that can neither be inferred nor be uniquely identified. In addition, within inferred referents, unique identifiability yields (pre-)activation of a specific referent while non-uniqueness yields pre-activation of a role rather than a specific referent. Importantly, when a pronoun is encountered, a specific referent, and not a role, needs to be identified, leading to a processing benefit for inferred/definite over inferred/indefinite referents.

Back to Thursday Poster Schedule

Experimental evidence that "weak definite" noun phrases are not interpreted as generics

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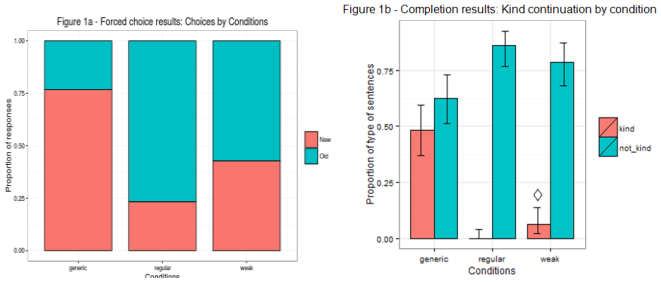
Definite reference has played a central role in linguistics, philosophy of language and psycholinguistics. Modulo some nuanced differences in the treatment of definite reference, there is general agreement that definite noun phrases carry a "familiarity", "uniqueness" or "identifiability" condition; the referent of a definite referring expression should be uniquely identifiable within a referential domain. However, so-called "weak definite" noun phrases such as *the hospital* in (1) violate uniqueness: John and Bill could be going to different hospitals.

(1) *John went to the hospital and so did Bill*.

If we are to maintain the standard view of uniqueness, there must be a principled explanation for weak definites and several have been proposed: (a) they are actually indefinites; (b) they are interpreted as generics (Aguilar-Guevara & Zwarts, 2011, 2013); and most radically, (c) they refer to events in "incorporated" structures (Carlson et al. 2013; Schwartz, 2012). Standard linguistic argumentation, however, has proved insufficient to distinguish among these alternatives. Experimental approaches offer a promising alternative. Klein et al. (2014) ruled out the indefinite hypothesis by showing weak definites are interpreted as referring to more familiar events than indefinites; a person with a stomach ache who goes to *a hospital* compared to *the hospital* is judged to be in the less familiar setting (e.g. more likely to be away from home).

The current experiments were designed to test the hypothesis that weak definites are interpreted as generics. We conducted two experiments in American English with the goal of comparing weak definite, regular definite and definite generic interpretations: Experiment 1 used a forced choice task; Experiment 2 used a completion task. We constructed 54 sentences with an event or activity verbal phrase with an object that could have a weak (18 sentences), generic (18 sentences) or regular interpretation (18 sentences) readings, (2), (3), (4).

(2) Zack listens to the radio when he drives.
(3) First responders rely on the radio whenever there is a disaster.
(4) Noah broke the radio last night.



The generic hypothesis predicts that weak definites and generics should pattern together, whereas the incorporation hypothesis predicts that generics should pattern differently that regular and weak definites. In Experiment 1, 90 Mechanical Turk workers, each read 18 sentences (6 each from the 3 conditions) and judged whether they preferred a continuation that would begin with an anaphoric reference "that N" (e.g., That bathroom…) or introduced a new referent "a N" (e.g., A bathroom…). In Experiment 2, 25 participants wrote a continuation to 12 test sentences, 4 in each condition. The results are presented in Figure 1a and Figure 1b, for the continuation judgment and completion task, respectively. Contrary to the generic hypothesis, the weak definites patterned with the regular definites. Generic definites show a significant preference for a new noun (A N…) continuation, which differs from weak (ß=-1.9284, z=-6.162, p<0.0001) and regular definites. Figure 1b shows the proportion of continuations with kind references, which occurred frequently for generics (e.g. *Karl Benz proposed the truck in 1895. Now trucks are very popular.)* but never for regular definites. The few kind references for weak definites are due to one ambiguous item. In sum, then, there is no evidence that weak definites exhibit the same behavior as generics. These results, when coupled with evidence that both weak definites and indefinite noun phrases have event-like interpretations, support the incorporation hypothesis.

Back to Thursday Poster Schedule

Exploring the effects of Theory of Mind and Shared Information in Perspective-Taking

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In Director tasks, [1-2], participants need to take into account that there is a difference between what they and their interlocutor know. We argue that successful on-line referential decision processes in these tasks need to incorporate a Theory of Mind inference regarding the speaker's ignorance of the private objects' identities. Thus, any cues in the procedure that highlight speaker ignorance should improve performance. To date, no on-line study has tested whether this is so. We also argue that, to the extent that private-view objects' existence is shared information, they are liable to interfere with referential processes on the basis that shared information is prioritised by automatic memory-based mechanisms [3-4]. In both of our experiments, participants undergo Director tasks using grids as in fig. 1. One within-group factor is whether a competitor (a second apple) is in private view or not. In all conditions, the procedure ensures the participant is convinced the Director does not know what kinds of objects are in private view. Our DV is the log odds of looks to target. Our novel procedure includes Phase 1, where the private objects appear to the participant on a second shelf, prior to being placed in the private grid positions by the participant. In this 1st phase, there is scope for interaction about the private objects, without revealing their identities.

In **Experiment 1**, participants answer a question about the superordinate category (e.g., 'Are they fruit?') in Phase 1. In an interactive condition, the Director asks the question that is answered by clicking 'True' or 'False' on the screen (fig. 2a) and also communicated verbally to the Director. For a second group, the same question appears on the screen only to the participant (fig. 2b). Then the Phase 2 procedure is typical: common objects appear, the Director gives an instruction (e.g. 'Move the apple to the bottom middle'), and the next trial begins with a fresh screen. We analyse gaze data in two time windows, 200-500ms and 500-800ms, after noun onset ('apple'). No sig. effects in the first window, but in the second, we find the predicted interaction [F1 (1,38) = 3.796; F2 (1,18) = 4.770]. When speakers manifest ignorance via the question, there is no difference between competitor and no-competitor conditions; when not, there is less target bias in competitor condition (p's < 0.001).

Partly to control for the fact that an interaction takes place in only one condition of Expt. 1, **Experiment 2** has the same procedure except that the superordinate category is chosen and announced prior to the appearance of the private objects. With one group (High Interactive), the Director does this, in a second and third condition, the experiment software does this, displaying the category on screen (fig. 3). For one of the latter groups (Low-Interactive), the participant is aware that the Director also sees the category at this stage. For a control group (Non-Interactive), they know he does not. The second phase of the procedure is as in Expt. 1. We predict an effect of interaction in the opposite direction to Expt 1: when the Director and participant share attention to the private objects in Phase 1, these objects are less easy to ignore when the Director gives an instruction in Phase 2. A 3*2 ANOVA confirms: An interactivity*competitor interaction in both 200-500ms and 500-800ms windows [all F's > 4]. Follow-up analyses show reduced target bias when a competitor is present in High- and Low-Interactive conditions (all p's < 0.01), but not Non-Interactive (all p's > 0.4). Thus, interactivity has a positive effect when it highlights the Director's ignorance of the basic level category of the private objects (Expt. 1). It otherwise has a negative effect when Director and participant share information about private objects prior to instruction (Expt 2).

Fig. 1

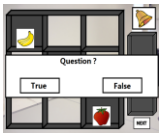

Fig. 2a

Fig. 2b

Fig. 3

[1] Keysar et al. (2000); [2] Hanna et al. (2003); [3] Horton & Gerrig (2005); [4] Horton (2007)

Back to Thursday Poster Schedule

Eye-tracking evidence for active gap-filling regardless of dependency length

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Research in the past 30 years has shown that, upon processing a displaced element (a "filler"), comprehenders posit a gap at the first possible site and without waiting for unambiguous evidence ("active gap-filling") [1-4]. However, recent findings suggest that this may not always be the case. Two self-paced reading studies reported that comprehenders failed to detect the implausibility of a wh-dependency until the gap position was fully disambiguated when the dependency was lengthened [5-6]. If these results hold, they would constitute a clear exception to the long-standing generalization that filler-gap dependencies are processed anticipatorily. Further, they may be taken to suggest that the anticipatory processes involved in computing wh-dependencies are compromised (or inhibited) when the filler has to be maintained in memory for longer, even when the dependency is fully licensed by the grammar (c.f. [1,3-4,7-8]). Given their potentially significant theoretical implications, we attempted to replicate these findings in an eye-tracking study with a larger set of carefully controlled materials. Unlike [5-6], we observed an immediate effect of plausibility across all levels of dependency lengths in multiple eye-tracking measures, which suggests that active gap-filling is at work regardless of dependency lengths.

Following [6], we crossed Plausibility (plausible vs. implausible) with Dependency Length (Short vs. +PP vs. +CP). We used the 24 sets of materials from [6] and constructed another 24 sets to increase statistical power. As illustrated below, the filler ("mixture" or "stream") and the critical verb ("plastered") were intervened by 5 words in the Short conditions; another 5 words were added to increase the distance between them, linearly in the +PP conditions, and linearly and structurally in the +CP conditions. Five words were added at the beginning of sentences in the Short conditions to maintain the same critical verb position. The actual gap always appeared after "with". If comprehenders posit a gap actively regardless of its distance from the filler, then we should see an effect of plausibility at the critical verb across all levels of dependency length.

Results (n=30) showed clear plausibility effects on multiple eye-tracking measures in both the critical and post-critical regions and, crucially, no significant interactions with dependency length in any measure or region (all *p*s > .05). Across all levels of length, comprehenders showed a significantly higher probability of regression and longer regression path and total reading times in the critical region in the implausible than in the plausible sentences (Fig. 1). Such robust sensitivity to the dependency's plausibility at the critical verb suggests that filler-gap dependencies are posited and interpreted actively regardless of dependency lengths.

Short: ***It surprised the hostess that*** the {mixture/stream} which the builder/ skillfully/ plastered/ the cracked basement wall/ with after the safety inspection repaired the cracks …

+PP: The {mixture/stream} which the builder ***with the grey working coverall***/ skillfully/ plastered/ the cracked basement wall/ with after the safety inspection repaired the cracks …

+CP: The {mixture/stream} which ***the friendly hostess described that*** the builder/ skillfully/ plastered/ the cracked basement wall/ with after the safety inspection repaired the cracks …

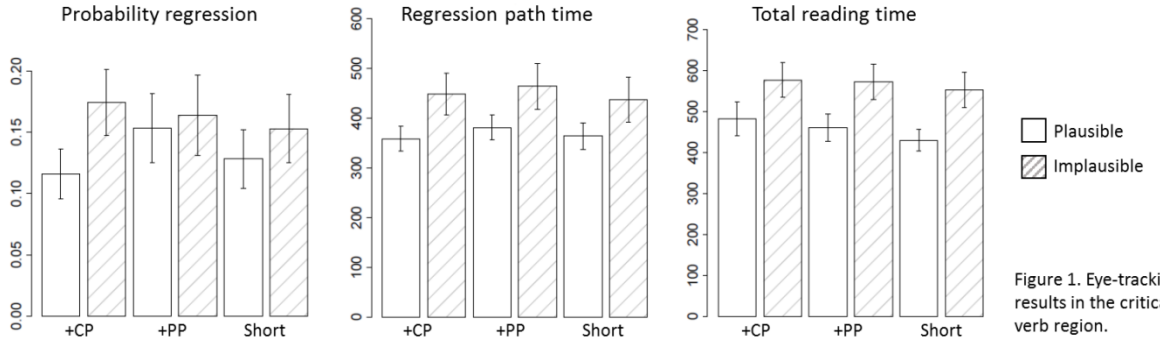

Figure 1. Eye-tracking results in the critical verb region.

References: [1] Stowe (1986). [2] Garnsey et al. (1989). [3] Traxler & Pickering (1996). [4] Omaki et al. (2015). [5] Wagers & Phillips (2009). [6] Wagers & Phillips (2014). [7] McElree & Griffith (1998). [8] Phillips (2006).

Back to Thursday Poster Schedule

Facilitatory intrusion effects in subject-verb honorific agreement in Korean

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Recent studies suggest that the processing of a dependency can be susceptible to facilitatory intrusion effects from structurally illicit but feature-matching attractors, leading to illusions of grammaticality (Pearlmutter et al. 1999; Wagers et al. 2009; Xiang et al. 2009; cf. Sturt 2003). In this study, we investigated whether facilitatory intrusion effects also occur in Korean, a language with almost no verbal agreement (with the exception of honorifics).

In Korean, the honorific marker *-si-* attaches to a verb. While it is optional, if present, it should agree with the verb's subject. Thus, it can occur with people of high social status (e.g., teacher, editor) but not with personal names (e.g., Minji, Tayho), as personal names are not honorifiable in Korean. Three experiments were run with four conditions, varying the honorific features (H: Honorifiable vs. NH: Not-Honorifiable) of the main subject and the embedded subject as in (a-d). The embedded verb is the critical region and was always marked with *-si-.*

In an eye-tracking experiment (n=44; 40 sets of sentences), there was a main effect of the embedded subject in the regression path duration at the critical verb position (t=2.36); the NH embedded subject conditions (b, d) took longer to read than the H embedded subject conditions (a, c), suggesting that the ungrammaticality was correctly detected. At the next word position, however, an interaction of the main and the embedded subject was found (t=2.08) with facilitated reading times for the H-NH (b) condition compared to the NH-NH (d) condition ($p < .001$). The ungrammatical H-NH (b) condition no longer differed from the grammatical conditions (a, c) while the NH-NH (d) continued to incur longer reading times than the grammatical conditions ($p < .01$). At the same position, there was also a main effect of the main subject in the first pass reading times (t=2.53) with shorter reading times for H main subjects (a, b) than for NH main subjects (c, d), suggesting that the facilitatory intrusion effect was not limited to the ungrammatical sentences but affected the grammatical sentences as well. Results from a self-paced reading experiment (n=37) confirmed these results with eased processing difficulty in the H-NH condition compared to the NH-NH condition and overall shorter reading times for the H than for the NH main subject conditions at the critical verb position.

Next, an ERP experiment (n=26; 120 sets) was conducted to examine the neuro-cognitive processes underlying the attraction effect in honorific agreement. A previous ERP study showed that honorific agreement violation in Korean elicited a P600 (Kwon & Sturt, 2015). Accordingly, it was predicted that a P600 would be absent or reduced for the H-NH condition (b) compared to the NH-NH condition (d). The prediction was confirmed. There was a marginal interaction of the main and the embedded subject in an omnibus analysis ($p < .057$). That is, while both the NH-NH (d) ($p < .001$) and the H-NH (b) ($p < .054$) conditions elicited a P600 in comparison to the grammatical conditions, the P600 amplitude was significantly reduced for the H-NH condition (b) compared to the NH-NH condition (d) ($p < .05$), suggesting a facilitatory intrusion effect of the main subject with honorific features in the H-NH condition.

These results suggest i) the subject-verb honorific agreement in Korean is susceptible to facilitatory intrusion effects by structurally illicit but feature-matching attractors, and ii) the intrusion effect is strong such that it can be found even when the main subject did not intervene in the embedded subject-verb dependency either linearly or structurally, and iii) the effect is not limited to ungrammatical sentences but facilitates the processing of already grammatical sentences. Overall, these results suggest that, despite apparently different verbal morphology, similar retrieval mechanisms (e.g., the content-addressable-retrieval: McElree, 2000; Lewis & Vasishth, 2005) underlie the processing of subject-verb agreement across languages.

a. H-H:	Teacher-NOM	[editor-NOM	demo	cd-ACC	listen-si-COMP]	office-to	cd.player brought
b. H-NH:	*Teacher-NOM	[Tayho-NOM	demo	cd-ACC	listen-si-COMP]	office-to	cd.player brought
c. NH-H:	Minji-NOM	[editor-NOM	demo	cd-ACC	listen-si-COMP]	office-to	cd.player brought
d. NH-NH:	*Minji-NOM	[Tayho-NOM	demo	cd-ACC	listen-si-COMP]	office-to	cd.player brought

'Teacher/Minji brought a cd player to the office for the editor/Tayho to listen to a demo cd.'

Back to Thursday Poster Schedule

Felicity Condition and Children's Knowledge of Restrictive Focus

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Previous studies found preschool children show a VP-associated pattern for sentences with pre-subject 'only' in English or *zhiyou* in Mandarin (e.g., Crain et al. 1994; Philip & Lynch 2000; Zhou & Crain 2010), i.e., most children interpret a sentence like 'Only the cat is holding a balloon' as 'The cat is only holding a balloon.' In this study, we show that Mandarin preschool children have the semantic knowledge for the use of pre-subject *zhiyou* 'only', and their non-adult interpretation is due to pragmatic infelicity in the contexts.

We used Truth Value Judgment Task in two conditions—Zhou and Crain's (2010) contexts (Condition A) and our revised contexts (Condition B). The major difference between the two conditions is that in the revised contexts Condition B, the other character in the story explicitly expresses the intention to accomplish the action, whereas the presupposition required for the use of *zhiyou* 'only' is not made clear in Condition A. Half of the test trials were True based on adult judgment (i.e., Adult-True trials), and the other half of the test trials were False based on adult interpretation (i.e., Adult-False trials).

We tested 48 preschool children (age 4;07-6;10), who were randomly assigned to the two conditions. The children in each condition were further divided into two groups—the older group (N=12, age 5;07-6;10) and the younger group (N=12, age 4;07-5;06). For Adult-True trials, the acceptance rates were 23% and 96% for Conditions A and B, respectively, which differs significantly ($p<0.05$). The difference between older and younger groups was not significant in each condition (21% vs. 25% in Condition A, and 96% vs. 96% in Condition B). For Adult-False trials, the rejection rates were 94% and 96% for Conditions A and B, respectively, which did not differ significantly. However, the justification reasons showed that the percentages of VP-association responses were 80% and 17% in Conditions A and B, respectively, which differs significantly ($p<0.05$). The difference between older and younger groups was not significant in each condition (75% vs. 86% in Condition A, and 8% vs. 27% in Condition B). To examine when children can accommodate the pragmatic infelicity, we further tested 14 school-age children (age 8;0-9;08) with Condition A. The results showed that for both Adult-True and Adult-False trials, their accuracy was significantly better than the preschool children, but still significantly worse than that of the preschool children in Condition B.

The results of this study demonstrate that preschool Mandarin-speaking children have adult-like knowledge of sentences with restrictive focus if the felicity condition of the context is satisfied. However, when the context is not felicitous, children's pragmatic accommodation for the use of pre-subject *zhiyou* 'only' gradually develops with age, but is still not adult-like before age 10.

Back to Thursday Poster Schedule

Foreign accent affects pragmatic inferences

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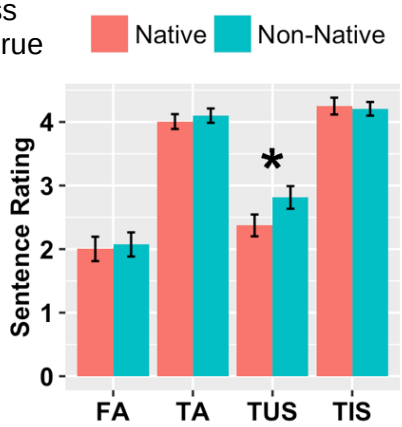
Upon hearing “Some dogs bark,” one infers that *not all* dogs bark, despite the fact that the literal meaning of *some* is ‘at least one and possibly all.’ This inference is prompted by under-informativeness: the speaker used the weaker term in a logical scale (*some*) when s/he could have opted for a stronger alternative (*all*). Because we except our interlocutors to be informative, we infer that the stronger alternative is not true, computing a *scalar implicature* (SI). In the present study, we investigate the flexibility of SI computation. A foreign accent alters syntactic processing by attenuating P600 responses to grammatical violations,[1] but is a foreign accent also capable of altering processing of pragmatic violations, specifically in the case of SI computation? In general, pragmatically infelicitous under-informative sentences (*Some giraffes have long necks*) are treated as more acceptable than patently false sentences, but less acceptable than patently true sentences.[2] We ask whether a foreign accent increases pragmatic tolerance (Exp. 1), either affecting early processing before the SI is computed, or encouraging a later re-analysis of the utterance (Exp. 2).

Exp. 1. English monolinguals (*N*=60) listened to 40 sentences spoken by a female native speaker of English and 40 sentences spoken by a female Mandarin Chinese-accented speaker (order counterbalanced). Sentences were distributed across four within-subjects types: False All (FA - *All women are doctors*), True All (TA - *All snow is cold*), True & Informative Some (TIS - *Some shoes have dogs*), and True & Under-informative Some (TUS - *Some people have noses*). Participants rated how ‘Good’ each sentence was on a 5-point scale. In the critical pragmatically infelicitous TUS condition, a high rating indicates a logical interpretation, whereas a low rating indicates a pragmatic, SI-based interpretation. Ratings for TUS sentences were significantly higher in the Non-Native Speaker condition (p=.002); ratings did not differ for the other three sentence types (all p’s>.1). Thus, hearers were more tolerant of pragmatic infelicities - but not falsehoods – from non-native speakers.



Exp. 2. To test whether a foreign accent disrupts SI computation per se, or encourages later re-analysis of the utterance, we presented participants (*N*=48) with 160 arrays of colored shapes, each followed by a description, e.g., “All of these squares are blue.” On each trial, participants indicated whether the sentence was a ‘Good’ or ‘Bad’ description of the array. Half of the sentences were spoken by a female native speaker of English, and half were spoken by a female Mandarin-Chinese accented speaker. Within-subjects trial types mapped onto those in Exp. 1 (TA, FA, TIS, TUS). On a critical TUS trial, for example, an array with 8 red circles would be followed by the sentence “Some of these circles are red.” A ‘Bad’ response indicates that an SI has been computed. Reaction times (RTs) were analyzed to measure the effects of a foreign accent on the speed of SI computation. However, Speaker Type did not affect RTs (p>.1) or the proportion of ‘Bad’ responses (p>.1) to TUS trials. Thus, while a foreign accent affects the final interpretation of a pragmatically infelicitous under-informative *some* statement, it likely does so at a stage following SI computation.

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Back to Thursday Poster Schedule

Forward perceptual spans as informationally equivalent across languages

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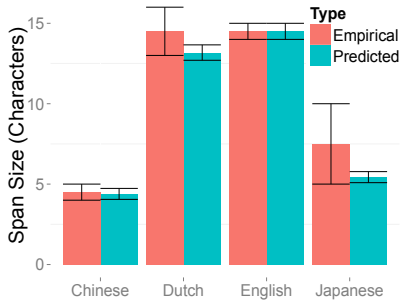
Background. Readers of languages with alphabetic orthographies (e.g., English, Dutch) utilize information from a larger number of upcoming characters on each fixation – have a larger *forward perceptual span* – than readers of non-alphabetic orthographies (e.g., Chinese, Japanese). For example, Chinese readers use information from 4-5 characters at or forward of fixation (Yan et al., 2015), while English readers use information from 13-15 (McConkie & Rayner, 1975; Rayner, 1986). While no formal models exist for these differences, two explanations have been suggested. One possibility is that, since orthographic units in non-alphabetic scripts are more visually complex, the limited visual acuity in the parafovea to discriminate complex characters and segment words may limit perceptual spans in non-alphabetic scripts (Hoosain, 1991; Inhoff & Liu, 1998). A non-mutually-exclusive possibility is that perceptual spans are smaller in non-alphabetic scripts because each character communicates more information (e.g. Rayner, 2014): for example, words are encoded by roughly 2 characters on average in Chinese, and 5 in English. Here, we evaluate the first formal model of how forward perceptual spans differ across languages, instantiating the hypothesis that forward perceptual spans are informationally equivalent across languages.

Methods. This hypothesis predicts that the number of bits encoded on average by the forward perceptual span in English (13-15 characters) should correspond to the number of bits encoded on average by the span in, e.g., Chinese (4-5 characters). However, directly estimating the number of bits encoded by a perceptual span would require a probabilistic language model as good as that of human readers, which does not yet exist. Instead, we instantiate the model by taking the English span as given and used parallel corpora aligned at the document level to determine how many characters of a target language on average contains the same amount of information as 13-15 characters of English. Assuming only that the two documents in a translation-equivalent pair contain the same amount of information, the empirical ratio of characters used in each of the two documents yields an estimate of the ratio of informationally-equivalent characters between the two languages. To obtain confidence intervals on these ratios, we use mixed-effects logistic regression, allowing for overdispersion. We simply multiply these character ratios by the empirical span in English to obtain informationally-equivalent predicted spans in target languages. To make intervals for these predictions that incorporate both empirical uncertainty about the English span size and statistical uncertainty about the character ratios, we form the upper (lower) bound by taking the product of the upper (lower) bound of the English empirical estimate and the upper (lower) bound of a 95% CI on the ratio.

Results. Using this model, we make predictions from English for the three languages whose empirical forward perceptual spans have been estimated with any precision: Chinese (Inhoff & Liu, 1998; Yan et al., 2015), Dutch (Den Buurman et al., 1981), and Japanese (Osaka, 1992). As seen in the figure, the model's predicted intervals are fully consistent with the extant empirical span data for each of these languages. (Intervals on span sizes are limited by experimental designs, not statistical power.)



Conclusions. Existing data are consistent with forward perceptual spans having a constant size in information across languages. This result suggests that cross-language visual complexity differences may not substantially limit how much material is processed per fixation. Additionally, this model provides an estimate for languages with unknown span sizes, even in the presence of lexicalization differences (since it assumes only document-level alignment).

Back to Thursday Poster Schedule

French object relatives: evidence against DLT but not entirely explained by frequency

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The literature in relative clause processing mainly presents differences between subject and object relative clauses (SRs and ORs). In our study, we will also compare two constructions for ORs: one with preverbal subject (ORsnoinv) and one with postverbal subject (ORsinv). Inversion is only possible with nominal subjects, not with pronominal subjects.

(1) **OR with preverbal subject**

Le médecin que l'avocat voit ___.

The doctor thatobj the lawyersubj sees.

OR with postverbal subject

Le médecin que voit ___l'avocat.

The doctor thatobj sees the lawyersubj.

Example (1) shows that the linear distance is shorter in ORsinv , so it should be easier to process than ORsnoinv according to the Dependency Locality Theory, now DLT (Gibson, 2000).

Study 1 We designed an experiment to test linear distance-based theories in French in contexts with high anticipation of restrictive relative clauses.

Experiment We ran a Visual World Eye-Tracking experiment (5 items per condition) with 32 native French speakers. We tested reversible SRs, ORsnoinv, ORsinv (1-3). The participants listened to a sentence while viewing 2 pictures with the same 3 characters each performing different actions. They had to find the correct picture according to the sentence. One picture was only compatible with an SR interpretation, the other one only with an OR interpretation.

1 / French SR	*Please find the right princess, that is to say the beautiful princess* ***that*** $_{subj}$ ***draws the fencer*** *on the picture.*
Prière de trouver la princesse correcte, c'est-à-dire la belle princesse **qui dessine l'escrimeur** sur l'image.	
2 / French OR	*Please find the right princess, that is to say the beautiful princess* ***that*** $_{obj}$ ***the fencer*** $_{subj}$ ***draws*** *on the picture.*
Prière de trouver la princesse correcte, c'est-à-dire la belle princesse **que l'escrimeur dessine** sur l'image.	
3 / French OR with subject inversion	*Please find the right princess, that is to say the beautiful princess* ***that*** $_{obj}$ ***draws the fencer*** $_{subj}$ *on the picture.*
Prière de trouver la princesse correcte, c'est-à-dire la belle princesse **que dessine l'escrimeur** sur l'image.	

Results Mixed linear models showed a significant SR advantage over the two ORs (ps<.01). Participants looked at the right picture in later time windows for ORinv than for ORnoninv (ps<.01), against linear distance accounts. These results seem, however, to go against the intuition that ORinv are relatively frequent in French, but possibly only under specific conditions.

Study 2 We therefore ran a corpus study using the French Treebank (Abeillé et al, 2003) to analyze factors for facilitating inverted and non-inverted RCs.

Corpus study We analyzed a corpus of the two ORs by looking at the semantics of the verb (+/- agentive), the length of the subject and the verb in number of syllables, and the number of arguments in the relative. We analyzed the role of these factors for the choice of the order in the relative using logistic regression models.

Results Logistic regressions show that the two ORs don't differ significantly in frequency, excluding a simple frequency-based explanation (94 ORsnoinv and 90 ORsinv). However, ORsinv are actually preferred over ORsnoinv when the subject is longer, and the verb is shorter and has a non agentive meaning (ps< .01).

Conclusion In our Eye-Tracking experiment, ORsinv were harder to process than ORsnoinv, contradicting the DLT. However, the corpus study showed that general frequency cannot be the factor explaining this contrast. The verb semantics and the length of the subject and verb play a role in the choice of relative. This means that ORsnoinv and ORsinv are not just alternatives but used in specific contexts. The context in the experiment disfavored the use of ORsinv because of the use of agentive verbs. In the right context, ORsinv should even be preferred and acceptability judgment studies on this matter are currently on the way. Our results are highly compatible with semantic/pragmatic accounts in relative clause processing (Mak et al, 2006; Traxler et al, 2002).

Back to Thursday Poster Schedule

Frequency-(in)dependent regularization in language production and cultural transmission

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In cases of variation in language, how do people learn and reproduce probabilistic distributions over linguistic forms? Given a certain amount of variation in their linguistic input, speakers could aim to reproduce the variation exactly (i.e. to *probability match*) or could instead aim to *regularize*—to make their productions more consistent by reproducing the most frequent variant *even more frequently* than it was heard in the input. While we know that people retain detailed statistics about their linguistic input (Levy, 2008; Fine et al., 2013), there is also evidence for regularization in language learning (Hudson Kam & Newport, 2005; Reali & Griffiths, 2009), although the circumstances that lead to regularization versus probability matching are not yet well understood. Recently, Morgan and Levy (2015) found evidence in corpus data that *binomial expressions* of the form "X and Y" are more regularized—i.e. their ordering preferences (e.g. "bread and butter" vs. "butter and bread") are more extreme—the higher their frequency. This finding is puzzling because previous experimental research does not suggest that regularization should be frequency-dependent. Does this corpus data in fact provide evidence for regularization in online language processing, and if so, does speakers' regularization behavior depend on an item's frequency, contrary to previous claims?

We demonstrate that frequency-dependent regularization can arise diachronically through a combination of a frequency-independent synchronic regularization bias and the bottleneck effect of cultural transmission. We simulate diachronic language change using an Iterated Learning Model (Smith, 2009) in which speakers in successive generations iteratively learn binomial expression preferences from the previous generations' productions and then generate their own productions. We augment the standard model with a regularization bias that applies during production. Although the bias itself is frequency-*independent*, frequency-*dependent* regularization emerges from the iterated learning process. For lower frequency items, a tighter bottleneck (fewer productions per generation) favors convergence to the prior, preventing the regularization bias from having a strong effect. With increasing frequency, a wider bottleneck (more productions per generation) increasingly transmits the effects of the regularization bias across generations. Our model thus correctly predicts the qualitative pattern of frequency-dependent regularization (Fig 1), and, moreover, correctly predicts the observed language-wide distribution of preferences in corpus data based on the frequency of those expressions (Fig 2). Our model confirms previous demonstrations of a regularization bias in language learning, but demonstrates that frequency-dependent regularization in a corpus distribution does not imply that frequency influences regularization at the level of individual speakers. Rather, the pattern of frequency-dependent regularization seen in corpus data can arise from the interaction of a frequency-independent bias in online language processing and the bottleneck effect of cultural transmission. We hypothesize that an online regularization bias promotes efficiency in language processing by reducing the choices that must be made, hence reducing the cost of utterance planning.

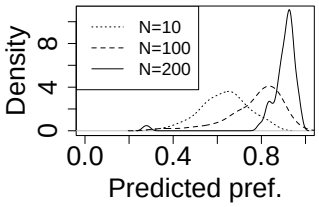

Fig 1. Preferences for a hypothetical binomial, from 0 (always one order) to 1 (always the other), are more extreme (closer to 0 and/or 1) with increasing number of productions per generation *N*.

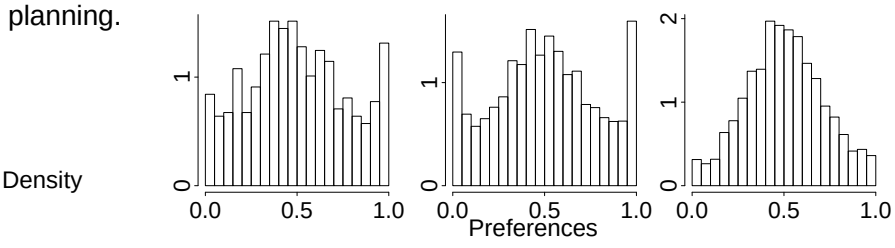

Fig 2. Language-wide distribution of preferences in corpus data (left) and as predicted by a model with (center) and without (right) a regularization bias.

Back to Thursday Poster Schedule

Gender and Discourse-Based Differences in Processing Spanish Copulas

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Background: Spanish copulas *ser* and *estar* (translated as English "be") have distinct distributional patterns. In particular, individual-level adjectival predicates (IL) (*wide, dangerous*) typically appear with *ser*. They are unacceptable with *estar* without a supporting context, e.g., (1) *La carretera ?está ancha*, 'The road ?estar wide.'

Several analyses have been proposed to understand their distribution [1,2,3,4,5]. Maienborn [4] argues that *estar* carries the additional presupposition that the embedded proposition is restricted to a specific discourse situation [4]. Thus, *estar* licensing contexts contrast the discourse situation described by *estar* against *alternative situations*; e.g., the acceptability of (1) improves when it is presented in a context such as (2), which contrasts the discourse situation with alternative situations in which the property of being *wide* may not apply to distinct parts of the Panamerican road.

(2) Context: A journalist is reporting on the Panamerican road. She is now near Lima.
La carretera *está ancha.* 'The road estar wide.'

Hypothesis: The processing cost of *estar* can be modulated by varying contextual support for the specificity presupposition. **Predictions:** Acceptability of [*estar*+IL] will increase if the context supports a link to a particular discourse situation in contrast to alternative situations (supporting context, 'SC'). Acceptability will decrease if the context is neutral with respect to the existence of contrasting situations (neutral context, 'NC').

Materials (2x2 Design) (sentences are presented in English for brevity):

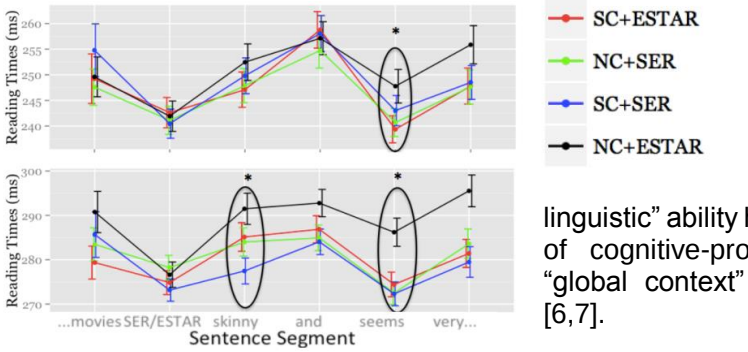
Context	**+**	**Sentence with *ser* or *estar***
SC: Pedro went on a diet for six months.		I saw him yesterday at the movies, (he) SER/ESTAR skinny and seems very happy.
NC: I have met Lucia's husband.		

Study 1: Questionnaire (*n*=40, 150sents). Scoring task. Acceptability scores were significantly higher for [SC+ESTAR] in comparison to [NC+ESTAR] ($p<.001$). In addition, [NC+SER] sentences were rated higher than [SC+SER] ($p<.001$), indicating a preference for *estar* when SC contexts were provided. Fill-in-the-blank task. *Estar* was the preferred choice when participants were presented with SC contexts (mean: 57%) and *ser* was the preferred choice with NC (mean: 89%).

Study 2: Self-paced reading (*n*=61, 180sents). Reading times (RTs) were higher for *estar* sentences when preceded by NC contexts ($p=.0013$). No significant interactions were found for *ser*. Gender differences (Fig.1). Women were faster than men at processing sentences preceded by SC contexts when compared to NC contexts ($p=.02$).

Conclusions. Results show 1) no influence of context type in *ser* sentences (online task), which supports the unmarked character of the copula and 2) *estar* sentences are less accepted/chosen and costlier when preceded by NC. These differences can be due to the accommodation of *estar*'s presupposition that the embedded proposition is linked to a particular discourse situation. 3) Women and men are differentially attuned to the contextual requirements of the copulas, which we relate to differences in accessing of contextual information. This "non-linguistic" ability has been associated with distinct styles of cognitive-processing: preferential attunement to "global context" (women) and "local context" (men) [6,7].

Fig 1. RTs for Men (top) and Women (bottom)



Back to Thursday Poster Schedule

Grammaticality illusions are conditioned by lexical item-specific grammatical properties

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1. Introduction Grammaticality illusions (GI) occur when an ungrammatical sentence appears significantly more acceptable than another corresponding ungrammatical sentence. For instance, the ungrammatical sentence *The authors* [*that* ***no*** *critics recommended*] *have* ***ever*** *received acknowledgment* is judged more acceptable than the same sentence without **no**. Such effects have been argued [1, 2] to support models wherein items in need of licensing (e.g. the NPI *ever*) execute an error-prone search in memory for a licensor. If the incorrect constituent is retrieved during this search (e.g. *no critics*), then the NPI spuriously appears to be licensed. Support for this model comes from [2], who provide evidence that the strength of GIs is modulated by standard memory variables such as recency. In this project, we provide evidence for a novel GI in French de-NP's -- phrases which require a quantifier to be licensed. Our findings suggest that GI are not purely an effect of recency/temporal distance, but rather are critically modulated by a grammatical property of the intrusive licensor: the size of a quantifier's licensing domain.

2. Background In (1) a degree quantifier *beaucoup* or *plein* `many' sits next to its restrictor (as in English). The restrictor, marked with *de* / *d'* (de-NP) needs to be licensed by a quantifier (2). Some quantifiers can Quantify At a Distance (+QAD; e.g. *beaucoup* `many' in (3)); others cannot, and must be strictly local to the de-NP (-QAD; e.g. *plein* `many' in (3)).

(1) Francis a écrit *beaucoup/plein de lettres*.
Francis has written many/many de letters
Francis has written a lot of letters.

(2) *Francis a écrit *de lettres*.

(3) Francis a *beaucoup/*plein* écrit *de lettres*.

3. Does de-NP-licensing show illusory licensing? E1 (n=40, RSVP + speeded acceptability) shows that an intrusive quantifier in an ungrammatical sentence (INT +QAD) significantly improves the acceptability ($z = 3.93$, $p < .001$) of the same sentence with no quantifier (UNGRAM) in (4).

Mean % yes (s.e.)	E1	E2
GRAM+QAD	.94 (.02)	.89 (.02)
INT+QAD	.45 (.05)	.32 (.04)
UNGRAM	.23 (.04)	.20 (.03)
INT-QAD	n.a.	.21 (.04)
GRAM-QAD	n.a.	.90 (.02)

(4)[**GRAM+QAD**] J' ai envoyé [à **beaucoup de** gens] [**des** invitations] pour mon anniversaire.
I have sent to many de people some invitations for my birthday.
I sent birthday invitations to many people.

[**INT+QAD**] J'ai envoyé [à **beaucoup de** gens] [**d'**invitations] pour mon anniversaire.
[**UNGRAM**] J'ai envoyé [$_{goal}$ à **des** gens] [$_{object}$ **d'**invitations] pour mon anniversaire.
[**INT-QAD**] J'ai envoyé [à **plein de** gens] [**d'**invitations] pour mon anniversaire.
[**GRAM-QAD**] J' ai envoyé [à **plein de** gens] [**des** invitations] pour mon anniversaire.

4. Does any quantifier give rise to this illusion? E1's results confirm that de-NP's are subject to illusorily licensing in comprehension, as are NPI's. This can be explained by cue-based parsing models perhaps simply because the intrusive quantifier has been recently processed, and is available to cause interference [1,2]. However, an alternative possibility is that the de-NP GI effect is specifically related to the grammatical possibility of non-local licensing (QAD), rather than simple availability of any intrusive quantifier. We test this in E2 (n=50, RSVP + speeded acceptability) by contrasting +QAD quantifiers that can quantify at a distance and -QAD quantifiers that can only license a strictly-adjacent de-NP. In addition to replicating E1's results, E2's results support the view that GI effects on de-NP licensing are conditioned by the grammatical properties of the intrusive quantifier: a wrongly-positioned +QAD quantifier increased the number of 'grammatical' responses, while a similarly positioned -QAD quantifier did not (interaction of intrusion and QAD ($z = 2.23$, $p < .05$), main effect of the difference between UNGRAM and INT+QAD ($z = 3.44$, $p < .001$), no effect for the difference between UNGRAM and INT-QAD ($z = .46$, $p = .64$)).

References: [1] Vasishth, Brussow, Lewis, and Drenhaus 2008 [2] Parker and Phillips (rev)

Back to Thursday Poster Schedule

Korean L2 learners' structural priming mediated by speakers with different English accents

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Communication Accommodation Theory (CAT) states that language can be used to adjust social distance between interlocutors (Shepard, Giles, & Le Poire, 2001). In support of this theory, native speakers' structural priming has been found to be affected by social factors. For instance, Balcetis and Dale (2005) found that L1 English speakers showed greater syntactic priming when they interacted with a liked partner and less priming while interacting with a disliked partner. Weatherholtz et al. (2014) also found that native English speakers' structural priming can be influenced by social factors such as perceived standardness of the speaker's accent, and perceived similarity to the speaker. Yet, no studies to date have investigated the effect of social factors on L2 structural priming. In this study, we investigated whether structural priming in Korean L2 English is affected by different accents that Korean learners of English may encounter while learning the language (i.e., a native speaker of American English, a Korean speaker of English, and an Indian speaker of English). Based on CAT, overall we predicted Korean L2 English learners may show varying degrees of structural priming depending on their perceived social distance with the speakers. They were expected to show the most syntactic priming when they perceive a shorter social distance, such as Korean accented speech (i.e. the Korean speaker of English), some priming with the Native speaker of American English, and the least priming with the Indian speaker of English.

We recruited fifty Korean learners of English with intermediate to high proficiency who reside in Korea (MELICET: M=27.28, SD=7.03). Participants listened to prime sentences recorded by speakers with different accents (e.g., a Korean speaker of English, an Indian speaker of English and a native speaker of American English). The Korean L2 learners rated the native English speaker's accent as being the most familiar and the Indian speaker's the least familiar, as indicated by a familiarity rating after the prime task. The prime sentences consisted of three different kinds of primes: Double Object construction (DO, e.g., *The girl passes the boy the letter K*), Prepositional Object construction (PO, e.g., *The girl shows the picture to the teacher*) or Intransitive construction (Baseline, e.g., *The girl is laughing*). Participants were asked to repeat the prime and decide if the sentence they just heard was related to the image on the screen by means of a button press. This was followed by target trial, in which the participants were asked to describe a dative event picture using a given subject and verb. We only analyzed target trials for which the prime was repeated correctly.

Logistic mixed-effect models revealed a cumulative structural persistence effect in both the English speaker condition and the Korean speaker condition: the Korean L2 learners' PO production in the target trials significantly increased as they encountered more POs and significantly decreased as they processed more DOs over the course of the experiment. On the other hand, no cumulative persistence effect was observed in the Indian speaker condition.

More importantly, immediate priming effects were found only in the Korean speaker condition: more POs were produced after a PO prime than after a baseline condition (β=1.02, SE=0.49, z=2.09, p=0.036). Also, fewer POs were produced after a DO prime than after a baseline prime, and this effect increased as more DO structures had been encountered (β=-0.20, SE=0.08, z=-2.50, p=.012).

As predicted by our hypothesis, Korean learners of English priming varied by their perceived social distance. Immediate priming and cumulative structural persistence were observed in the Korean speaker condition which may be due to a diminished perceived social distance. We observed cumulative priming in the Native American English Speaker condition but not in the Indian Speaker of English condition as expected under the Communication Accommodation Theory.

Back to Thursday Poster Schedule

Linear proximity effects in Hindi reciprocal resolution

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Prior studies (e.g. [1]) have argued that the early resolution of English direct object reflexives is not subject to (facilitatory) interference from feature-matching distractor NPs in structurally inaccessible positions. These results have prompted some authors to propose that the memory processes that underlie antecedent identification for local anaphors has special access to the local subject [2,3]. We conducted two experiments to determine whether privileged access to the local subject is a general property of all local anaphor resolution, or whether the absence of interference is related to specific properties of the constructions tested in previous research. In particular, we investigate the role of verbal adjacency in guaranteeing access to the subject. Direct object reflexives in English immediately follow their verb, in which position they may enjoy better access to that verb's subject (e.g. if the subject has been recently reactivated [4], or if verbal proximity provides a richer set of cues, such as argument structure, for retrieval). If verbal adjacency drives access to the local subject, we would predict that anaphors that are processed before a verb would not enjoy the same advantage. We test this hypothesis using reciprocal licensing in Hindi, a verb-final language (see [3] for previous work on this topic).

We conducted two self-paced reading experiments (each *n* = 75). Both experiments manipulated plural marking on two NPs that preceded a critical reciprocal: (i) a local subject (*bacce/baccon* 'kid(s)' in 1) that was the only structurally accessible antecedent for the reciprocal, and (ii) a distractor NP (*dost/doston* 'friend(s)') that was not a structurally accessible antecedent for the reciprocal (*ek dusre*). The position of the distractor NP was varied between experiments. In Experiment 1 the distractor was embedded inside an adjunct PP that followed the local subject (example sentence in 1). In this position the distractor was linearly closer to the reciprocal than the local subject. In Experiment 2 the distractor was the subject of a higher clause making it neither linearly nor structurally local to the reciprocal (example sentence in 2).

In **Experiment 1** participants read the critical reciprocal more quickly when the distractor was plural-marked than when it was singular (716ms v. 742ms; t = -2.06). Reading times at the sentence-final verb region were longer when the local subject was not plural marked and the reciprocal therefore lacked an antecedent (1132ms v. 1070ms; t = 2.57). In **Experiment 2** there were no effects at the critical reciprocal, but participants read the post-position following the reciprocal faster when the local subject was plural-marked (616ms v. 665ms; t = 2.13). The presence of a plural-marked distractor did not appear to significantly impact reading times in any critical regions. Our results suggest that in the absence of predicate information, participants attempt to resolve the reciprocal with the closest subject-like NP in the linear string**.** If a distractor is closer than the grammatically accessible NP (as in Experiment 1), the parser may temporarily consider the wrong NP as an antecedent. When this linear strategy produces the incorrect result, however, participants are able to override this result once they receive verbal information.

(1) bacce/on=ne [dost(on) ke aane par] bagice=me ... ***ek dusre*** ke=bare=me baat kii
Kid(s)=erg [friend(s) GEN arriving upon] [garden=in] ... **reciprocal** about chat did.
`The kid(s) chatted about each other in the garden upon the friend's/s' arrival...'

(2) dost/on=ne kahaa ki bacce/on=ne bagice=me ... ***ek dusre*** ke=bare=me baat kii
friend(s)=erg said that kid(s)=erg [garden=in] ... **reciprocal** about chat did.
'The friend(s) said that the kid(s) talked about each other in the garden ...'

[1] Sturt, 2003. *JML*; [2] Dillon et al., 2013. *JML*; [3] Kush & Phillips, 2014. *Frontiers*; [4] King et al., 2012, *CUNY*

Back to Thursday Poster Schedule

Split intransitivity modulates look-ahead effects in sentence planning

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Intransitive verbs can have a sole argument that is an agent (unergative, e.g., *dance*) or a patient (unaccusative, e.g., *fall*). Various linguistic diagnostics have shown that unaccusative subjects are deep objects (Perlmutter, 1978). Here we show that the unaccusative/unergative contrast has clear effects on the time course of planning during sentence production, building on recent evidence that shows a tight coupling between the planning of verbs and deep objects. The current study builds upon recent attempts to resolve a puzzle about the role of verbs in sentence planning. Verbs impose strong constraints on the form and/or meaning of their arguments, and so we might expect them to be planned early during sentence production (e.g., Ferreira, 2000). A key method for examining this issue is the extended picture-word interference task (ePWI), which probes the time course of sentence planning by testing whether associates of downstream words interfere with the utterance of earlier words. However, previous ePWI studies on German (Schriefers et al., 1998) failed to find evidence for this verb 'look-ahead', leading some to conclude that verbs are not necessary for structurally encoding pre-verbal arguments (Allum & Wheeldon, 2007; Iwasaki, 2011). Recent findings on Japanese and English point to a resolution. Using the same ePWI task, Momma et al. (2015) found that verbs in Japanese are planned before the start of two-word OV sentences, but not before the start of SV sentences. An extension of this paradigm to English showed that advance verb planning is specifically triggered by deep objects. In passive sentences, interference from a verb associate delays articulation of the subject. In active sentences, in contrast, interference effects come later, leading to lengthening of the articulation of the subject. Here we show that exactly the same timing contrast is found for unaccusative vs. unergative verbs despite the surface identity.

Method: Participants (n = 18) produced unaccusative (e.g., *The doctor is floating*) and unergative sentences (e.g., *the doctor is sleeping*) given pictures with corresponding events (Fig. 1ab). Distractor verbs were superimposed on the picture with an SOA of -150ms and were sometimes semantically related (as quantified by latent semantic analysis) and sometimes unrelated to the target verb. Related distractor words were re-paired with pictures to create unrelated distractors, such that the sets of related and unrelated distractors were identical. Both the onset of the preverbal noun and the duration of the preverbal nouns were measured. A delay in noun onset due to the semantically related distractor verb is the evidence for verb look-ahead before noun production. In contrast, elongation of the noun duration is the evidence that verbs are selected after nouns have already started to be uttered.

Fig. 1a

Fig. 1b

Results & Conclusion: A delay in onset RT due to semantically related distractors (Onset interference) was found in unaccusative ($p < 0.001$), but not in unergative sentences ($p > 0.6$) (Fig. 2a). In contrast, the duration of preverbal noun phrase production was elongated due to the semantically related distractor (Duration interference) in unergative ($p > 0.01$), but not in unaccusative ($p > 0.6$) sentences (Fig. 2b). This suggests that verbs are planned before subject noun production in unaccusative sentences (onset interference), but during subject noun production in unergative sentences (duration interference). This role-sensitive verb planning accords with linguistic arguments that deep objects have stronger verb dependency than deep subjects (e.g., Kratzer, 1996), and contrasts with radically incremental or highly flexible models in which linguistic dependencies play no role in lexical planning.

Fig.2a

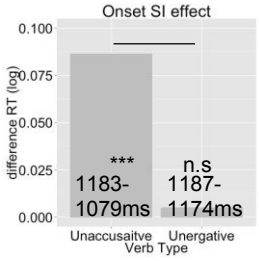
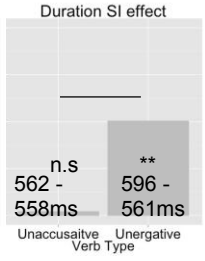


Fig.2b



Back to Thursday Poster Schedule

Using grammatical features to forecast incoming structure: The processing of Across-the-board extraction

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Grammatical features like case often forecast the structure of incoming input. In across-the-board (ATB) extraction, a filler (e.g. *who*) is linked to two separate gaps, each of which is contained in a separate conjunct, as in 1a below (the gaps are labelled G1 and G2).

1a. *The surgeon who James tricked [G1], and/ Richard annoyed [G2],/ scrubbed up for surgery.*

It has been claimed (e.g. Williams, LI,1978[1]) that ATB extraction is degraded when the two gaps have different syntactic functions (as in 1b, where G1 is a subject, while G2 is an object).

1b. *The surgeon who [G1] tricked James, and/ Richard annoyed [G2],/ scrubbed up for surgery.*

The acceptability contrast between 1a and 1b, if genuine, may be due to a grammatical constraint: for example, if case features are passed from both gaps to the relative pronoun, then *who* would simultaneously have to bear nominative and accusative case, leading to ungrammaticality. Alternatively, the contrast may be due to parallelism in processing: it is well-known that a second conjunct is relatively hard to process when its internal structure differs from the first conjunct (Frazier et al, JPR, 2000). Thus, 1b may be degraded because it includes an object relative clause preceded by a subject relative clause.

In Experiment 1, we sought to test (a) whether there is indeed a contrast between 1a and 1b, and (b), whether this contrast can be reduced to parallelism. Conditions 1a,b were combined with 1c,d, which differed from 1a,b in that they did not involve ATB extraction (i.e. the relative pronoun *who* is not shared between the two conjuncts), but involved a similar parallelism contrast, thus controlling for this factor. The design therefore crossed parallelism (1a,c vs. 1b,d) with whether or not the extraction was ATB (1a,b vs. 1c,d). Eye-tracking was used (40 participants; 36 items).

1c. *The surgeon who James tricked [G1], and who/ Richard annoyed [G2],/ scrubbed up ….*

1d. *The surgeon who [G1] tricked James, and who/ Richard annoyed [G2],/ scrubbed up ….*

Analysis of the critical region *Richard annoyed* revealed a highly reliable effect of parallelism ([1a,1c] < [1b,1d]) in multiple eye-movement measures. This was qualified by an interaction with ATB in regression path and total time, such that the reading time penalty for 1b relative to 1a was greater than it was for 1d relative to 1c. Thus, the contrast between 1a and 1b was greater than would have been expected on the basis of parallelism alone.

Experiment 2 tested relative clauses with a greater degree of embedding, as it has been claimed [1] that the acceptability contrast of 1a vs. 1b disappears in embedding environments. Items were similar to 1a-d, except that each relative clause was two clauses deep, with the gap in the lower of the two clauses, as in 2a (other conditions analogous to 1b-d).

2a. *The surgeon who I think tricked James, and you think annoyed Richard, scrubbed up…*

Experiment 2 did not show any evidence of the interaction found in Experiment 1. However, the parallelism effect was also significantly attenuated in Experiment 2 relative to Experiment 1 (experiment x parallelism interaction), and was reliable in fewer measures.

Taken together, the results suggest that the contrast between 1a and 1b is not solely due to parallelism, but may be due to the transmission of incompatible case features to a shared element. The increased structural distance between the relevant elements in Experiment 2 may have degraded processing, affecting both the passing of case features, and the structural activation responsible for the parallelism effect. If either of those explanations were true, it would suggest that while grammatical features play a crucial role in structuring incoming input, the flow or span of such information is limited by as of yet unknown constraints.

Back to Thursday Poster Schedule

Poster Abstracts

Friday

Exploring memory and processing through a gold standard annotation of Dundee

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Theories of sentence processing such as Dependency Locality Theory (DLT) [2] predict memoryrelated processing difficulty proportionate to the number of discourse referents intervening between a noun or finite verb and its backward-looking dependency. This prediction has held in experiments using constructed stimuli [6]. However, naturalistic studies of memory effects [1] using the Dundee eye-tracking corpus [3] have shown negative effects for integration of automatically estimated dependencies when applied broadly, and only weak positive effects (when corrected for multiple trials) when applied more narrowly. One possible explanation for this is that automatically parsed dependencies might introduce bias due to the difficulty of parsing longer sentences, which disproportionately contain long dependencies.

The experiment described here re-evaluates DLT using handcorrected syntactic annotations of the Dundee corpus in an HPSG-like representation [4]. We use this annotation to evaluate DLT as a predictor of first-pass durations over an independently-motivated baseline of memory-independent factors [5].[1] Since human perception generally operates on a logarithmic scale (i.e. Weber-Fechner law) and to maintain comparability to [1], we log-transform the DLT predictor. Results were not significant (see Table 1), showing that the negative effect found by [1] in their initial experimental setup[2] may have been due to automatic parser errors. However, the positive effect predicted by DLT was not observed.

	Effect (ms)	p
DLT (orig)	-0.375	0.643
BothMod	-2.22	0.005

We then evaluate three DLT variants designed to better account for broad-coverage phenomena: VerbMod, CoordMod, and BothMod. VerbMod assigns finite verbs a cost of 2 energy units (not 1) and non-finite verbs a cost of 1 (not 0), since finite verbs might be more difficult to integrate than non-finite because they contain more detail (e.g. tense) to instantiate in working memory (see e.g. [6]). In CoordMod, total cost for coordinates equals that of their heaviest conjunct, and preceding conjuncts are skipped in the calculation of integration costs for discourse referents under coordination, following the notion that each sub-referent of a conjunction is integrated into a conjoined set which is finally integrated at the end of the conjunction. BothMod applies both modifications.

To avoid excessive multiple trials correction, we first test these three (log-transformed) DLT variants on an exploratory set of the Dundee corpus (every 3rd sentence), then evaluate only the version that most improves model fit (BothMod) on the remaining held-out sentences. Contrary to the predictions of DLT, the effect is significant and negative (see Table 1). Thus the negative integration cost observed in previous naturalistic studies cannot simply be reduced to an artifact of automatic parsing.

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Back to Friday Poster Schedule

[1]Sentence position, word length, length of preceding saccade, whether the preceding token was fixated, cumulative 5-gram probability, and total surprisal, with by-subject random slopes for each of these and random intercepts by word.

[2]Using exploratory data, we attempted partial replication of the positive integration cost found by [1] by removing all tokens with an integration cost of 0. The only effect was to further reduce the significance of the predictor.

High or low motor: A norming study for verbs

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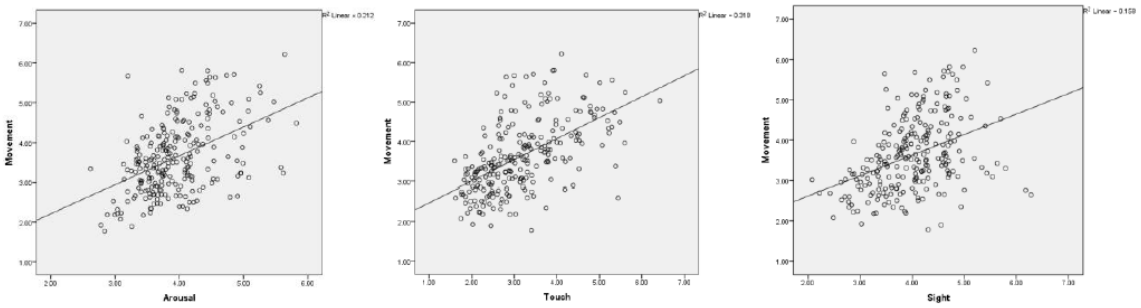
Embodied approaches to language comprehension emphasize the role that systems of perception and action planning play in the comprehension of language (e.g., Fischer & Zwaan, 2008). As part of the exploration of this approach, there has been much interest in the extent to which the motor system is engaged in the comprehension of language about action (e.g., Glenberg & Kaschak, 2002). Stimuli in experiments on this topic are often broken into categories such as “high” and “low” motor activity, or action vs. non-action – where the boundaries between categories may be set uniquely for each study. The current work was aimed at establishing a set of norms that quantify the extent to which verbs are associated with motor activity. Fifty undergraduates participated in the word norming in exchange for course credit. The stimuli consisted of 250 verbs which were rated along dimensions of amount of body movement (*How much bodily movement is involved with this word?*), the strength to which sense modalities were associated with each verb (*To what extent do you experience this word by* _____ , where each of the five senses was inserted) and familiarity. As a validity check, the words were also rated on the ANEW (Wilson, 1988) scales of arousal and valance. Our measures of valance and arousal correlated significantly with the ratings provided in the ANEW (r=0.91 and r=0.50 respectively; p<0.01). Bivariate correlations reveal that “movement” is correlated with familiarity (r=0.164), arousal (r=0.461), touch (r=0.564), sight (r=0.398), concreteness (r=0.228), and imagability (r=0.297) – all *p*-values < .01. Concreteness and imagability correlated with touch (r=0.210, r=0.325, respectively; p<0.01), but not with any of the other sense modalities. These norms, collected on a wide set of verbs, should be useful for researchers interested in examining claims related to embodied approaches to comprehension. For example, our norms will make it possible to treat “motor vs. non-motor” as a continuous variable. This will allow researchers to test more nuanced predictions about the role of the motor system in language processing.



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Back to Friday Poster Schedule

Incremental interpretation and its disruption by negative arguments

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Incremental interpretation often proceeds by continuously constraining the interpretation model. E.g, *John ate a toast* is interpreted incrementally by considering a general constraint first (John exists), and refining this as the sentence proceeds (John ate something, it was a toast). However, not every incremental interpretation can proceed in this monotonic fashion: in *John loves nothing*, the reader would first postulate that John exists and he loves something, only to retract the last information when reading *nothing* (see, e.g., Chater et al., 1998). We report two eye-tracking studies on Dutch that investigated the semantic disruption of monotonic incremental interpretation caused by negative objects.

Eye tracking experiments 1 & 2. In both experiments, test items consisted of short stories, in which the critical sentence had either a negative object, *geen* `no' + noun phrase (NP), or a positive object, *een* `a' + NP (factor: object). The object either preceded or followed the verb in its clause (factor: position). In **exp. 1**, the varying position was achieved by using two types of connectives, *want* and *omdat* `because': the former requires the verb-object order, while the latter requires the object-verb order. In **exp. 2**, the same effect was achieved by using antecedents of conditionals, which allow the verb-first or verb-final order. Finally, since the effects might be subtle, we added another manipulation in **exp. 1**, the presence/absence of memory task (recalling 5-digit sequence backwards). The items (n=32 in each exp.) were pre-tested to ensure that positive arguments were not more plausible than negative arguments when preceded by the verb. (No. of subjects = 40 (exp. 1) / 30 (exp. 2)). An example of the critical sentence in exp. 1:

(1) a…want zij bezoekt meestal geen/een toeristische stad in de zomer
…because she visits mostly no/a tourist town in the summer.
b. …omdat zij meestal **geen/een** toeristische stad **bezoekt** in de zomer.

Both exps revealed a significant object_position interaction in the NP after *geen/een* (*toeristische stad*). The interaction was present in the probability of regression and regression path duration (rpdur). Exp. 1 revealed **increased** regressions/rpdur for negative NP:*want* (the verb precedes the object). This can be seen as a manifestation of semantic disruption: the negative object disrupts the monotonic increase of information but only when it follows the verb, because only then, it has to be retracted that the event introduced by the verb happened. Importantly, exp. 2 revealed exactly **opposite** effects, that is, **decreased** regressions/rpdur after *geen* when the verb preceded the object. The difference cannot be caused by the absence of a memory task in exp. 2 since exp. 1 showed the crucial findings when the memory task was absent. We take our results to show that the disruption of monotonic increase of information interacts with clause types. Exp. 2 used antecedents of conditionals, while exp. 1 used causal relations. The two clause types show opposite entailment patterns -- conditional antecedents are a downward entailing environment, which `flips' entailment compared to an upward-entailing context, used in Exp. 1. Thus, the reversal of entailment also reverses the effect of information disruption.

Back to Friday Poster Schedule

Incremental interpretation in cases of individual/degree polysemy

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Determiner Phrases (DPs) canonically range over individuals, but recent work has suggested that they can, in certain contexts, receive a *degree* interpretation in which they are interpreted as an amount (Brasoveanu, 2009; Rett, 2014). There is, however, disagreement about the nature of this apparent polysemy, in particular which interpretation is primary. Further, it is unknown how degree/individual polysemy is handled by the sentence processor. While some types of polysemy are left underspecified during real-time processing (such as concrete/abstract readings of nouns, e.g. *library* as a building or an organization; Frazier and Rayner, 1990), polysemy that obtains via a lexical rule shows immediate adoption of a noun's primary reading (such as mass/count interpretations of nouns; Frisson and Frazier, 2005). We present the results of rating and eye movement studies of three types of polysemous DPs (plural definites, measure phrases (MPs), and *many*-DPs) in degree (A) and individual (B) contexts. Our results show that the processor immediately adopts either a degree or individual interpretation, leading to processing difficulty if the sentence continuation does not conform to the adopted meaning. Our evidence further suggests that DP types differ in which reading is primary.

Naturalness ratings. A naturalness rating study (N_{subj} = 54) tested item sets like (A) and (B). Throughout, we report *t*-statistics from LMEMs sum-coded fixed effects *Continuation* and *DP Type* as well as random intercepts and slopes for fixed effects. Ratings (1 = *Completely unnatural* to 7 = *Completely natural*) show an interaction such that plural definites were rated as more natural with individual than degree continuations, but MPs were rated as more natural with degree than individual interpretations MPs (interaction $p < .05$ using the anova() function on the LMEM). The ratings for *many*-DPs were surprisingly low for both continuations, but did not differ significantly from each other.

A *John/ assumed/* {*the/four/many*} *pizzas/ would be/* ***enough****/ to feed/ the hungry students.*

B *John/ assumed/* {*the/four/many*} *pizzas/ would be/* ***delicious****/ food for/ the hungry students.*

Eye movements during reading. To test whether the penalty associated with a continuation that mismatches the putative primary interpretation of a DP is present during real-time comprehension, we conducted an eye-movement study (N_{subj}= 31). We focus here on results on the initial continuation region, shown in bold above (see table for means/SEs). In First Pass Time, degree continuations were shorter than individual continuations (*t* = -5.803), attributable to the relative length and frequency of the words in the two regions. Go-Past Time, in addition to the main effect of continuation, showed a significant interaction such that for degree continuations, the longest Go-Past Times were for sentences with definite DPs, while for individual continuations, the longest GP times were for sentences with MPs (interaction $p < .05$).

Our results suggest that some DPs (i.e. plural definites) are assigned an individual interpretation during initial processing, while others (i.e. MPs) are assigned a degree interpretation. These findings constitute novel evidence for immediate processing rather than underspecification in the face of rule- based polysemy. In addition, in the context of a theoretical dispute about which polysemous reading is primary, they provide an interesting nuance: although these three types of DPs are all individual/degree polysemous, they differ in how that polysemy comes about.

	Rating (SE)	FPT	GPT	TT
Deg-Def	6.35 (.09)	420 (20)	542 (31)	654 (49)
Deg-MP	6.53 (.08)	417 (23)	470 (27)	515 (29)
Deg-Many	4.96 (.18)	410 (24)	522 (28)	655 (44)
Ind-Def	6.09 (.10)	466 (26)	642 (28)	717 (39)
Ind-MP	5.35 (.14)	503 (30)	723 (40)	841 (49)
Ind-Many	5.14 (.16)	520 (34)	695 (36)	808 (48)

Back to Friday Poster Schedule

Individual differences in predictive processing: Evidence from subject filled-gap effects in native and non-native speakers of English

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Introduction. The current study examines whether native and non-native speakers of English show evidence of predictive processing in the establishment of wh-dependencies, and investigates the extent to which linguistic and non-linguistic factors modulate prediction (e.g., Grüter et al., 2013; Hopp, 2013; Kaan, 2014). Using self-paced reading, this study examines wh-dependencies in English, focusing on the pre-verbal subject position, as in (1-2). If the parser predictively builds syntactic structure, then in (1b), upon encountering a wh-filler (*who*), the parser will attempt to resolve the *wh*-dependency by predicting a gap at the first possible gap position (*Matt*). Because this position is already filled, a reading time slowdown (*subject filled-gap effect*) is expected at *Matt* in (1b) as compared to (1a).

***Short*-distance dependency**

a. No Gap: The boy asked *if* Matt will see the boss with Susie at the bar.

b. Wh-/Gap: The boy asked *who* Matt will see the boss with ___ at the bar.

***Long*-distance dependency**

a. No Gap: The boy asked *if*, during the office party, Matt will see the boss with Susie at…

b. Wh-/Gap: The boy asked *who*, during the office party, Matt will see the boss with __ at …

While there is ample evidence in the literature of *post-verbal* filled-gap effects (e.g., a reading time slowdown in the direct object position) for both native and non-native speakers (e.g., Aldwayan et al., 2010; Stowe, 1986), there is debate regarding whether such evidence truly reflects predictive processing. That is, post-verbal object filled-gap effects may not reflect the prediction of syntactic structure (positing a gap), but rather the satisfaction of the thematic requirements of the verb (e.g., Pickering & Barry, 1991). Thus, it is critical to examine positions in which predictions can be generated *before* the verb (e.g., Nakano et al., 2002; Omaki et al., 2015). However, subject filled-gap effects are inconsistently found in the literature (e.g., Stowe, 1986). Some researchers have suggested that increasing the distance between the filler and potential subject gap as in (2) may increase the likelihood that subject filled-gap effects will emerge, as the increased distance may, for example, provide additional time for the parser to generate a prediction (e.g., Clifton & Frazier, 1989; Lee, 2004).

Subject Filled-Gap Effects. We tested both native speakers (N=110) and intermediate-to-advanced Korean learners of English (N=100). Proficiency was tested using the University of Michigan CPE exam. Data were analyzed using linear mixed-effects models. No significant differences were found between native and non-native speakers at the critical region. A clear subject filled-gap effect was found in the Short wh- condition (1b), $t(5846) = 2.170$, $p < 0.05$, providing evidence that both English native speakers and Korean learners of English are able to predict syntactic structure to actively resolve wh- dependencies. No effects were found in the long-distance condition for either natives or non-natives, suggesting that the increased distance may have hindered, rather than facilitated, the resolution of the filler-gap dependency (e.g., Gibson,1998).

Individual Differences. All participants also completed tasks measuring language proficiency, processing speed, working memory, and attentional control. Greater attentional control, as measured by the Stroop task, was associated with larger subject filled-gap effects for both populations, with no language group interactions, $t(2914) = 3.032$, $p < 0.01$. Participants who performed better on the Stroop task may be better able to generate and maintain predictions during wh- dependency resolution. These results show that cognitive abilities impacting prediction are qualitatively similar in native and non-native speakers (Kaan, 2014).

Back to Friday Poster Schedule

Inferring individuals' scalar thresholds: What counts as tall *for you?*

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Figure 4

How many tall buildings would you count in Fig.1? Probably two: the distribution of building heights suggests that two buildings meet the SCALAR THRESHOLD (von Stechow 1984,Kennedy 1999, 2007) for *tall*. Lassiter & Goodman (2015) suggest that we compute scalar thresholds through Bayesian inference, updating (i) a context-insensitive uninformative prior on the threshold with (ii) contextual information about the distribution of object measurements on the scalar dimension and (iii) pragmatic inference based on the speaker's choice of relative adjective. But there are individual differences in scales: what counts as tall for you might not count as tall for me, and my knowing this might affect how I interpret your utterances. Here we investigate whether comprehenders represent individual-specific thresholds, and if so, how they draw inferences about them. – In our study, 400 English native speakers encountered an individual, Fiba, about whose scalar thresholds they knew nothing. Fiba introduced subjects to 16 critical-trial displays of 10 randomly ordered objects of three different heights, widths, or sizes. Half of the objects in each display belonged to the largest group, three were medium sized, and two belonged to the smallest group (Fig. 2; participants also saw 48 filler trials). One of each of the small and medium objects was a different color (here, red) than the rest (here, blue). Fiba uttered either a question (*Is there a red tall building?*) or a command (*Click on the red tall building*, Fig.2, Ex.1). In the display, only the blue buildings were tall. Therefore, in the command condition, where Fiba's statement presupposed that the red building was tall, we predicted that subjects should conclude that Fiba's threshold is unusually low. If subjects draw this inference and represent Fiba's individual-specific threshold, it should induce them to count more buildings as tall if we present them with Fig.1 and ask *How many tall buildings would Fiba count here?* in the command condition (Ex.1–2) than in the question condition (Ex.3–4), in which Fiba's questions do not not trigger presuppositions. In the second half of each trial, we did exactly this; our results confirmed the prediction (Fig.3, significant main effect). In addition, we predicted that this effect should be modulated by word order: Whereas *red tall building*, in our display, should point to an empty set without accommodating Fiba's low threshold, *tall red building* could be interpreted as the set of things that are "tall for a red building", which may not require threshold accommodation (In Fig.2, the top-row red building could easily be considered tall relative to the set of red buildings in the display). The latter word order should thus diminish the need for scalar adjustment. Indeed we found that commands with *size–color* adjective order (Ex.2) elicited significantly fewer 3-counts compared to commands with *color–size* adjective order (Ex.1; Fig.3, first two bars). These results suggest that scalar thresholds are computed in a context-dependent way and that people are sensitive to their interlocutors' individual differences, even when transmitted via subtle pragmatic cues like presupposition. Moreover, using this indirectly learned threshold, people adjust their behavior in subsequent categorization tasks, and do so in a way that is robust to the compositionality of adjective ordering.

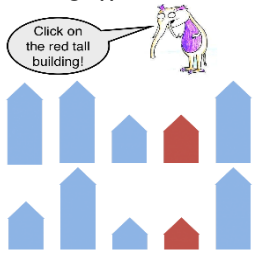

Figure 2

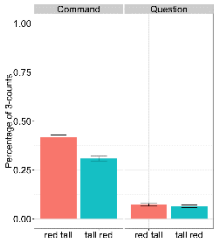

Figure 3

Ex.	Speech act	Adjective order	Fiba's Prompt	Semantic structure
1	Command	color–size	*Click on the red tall building!*	RED(TALL(BUILDING))
2	Command	size–color	*Click on the tall red building!*	TALL(RED(BUILDING))
3	Question	color–size	*Is there a red tall building?*	RED(TALL(BUILDING))
4	Question	size–color	*Is there a tall red building?*	TALL(RED(BUILDING))

Back to Friday Poster Schedule

Informational focus in Spanish pronoun resolution: Answering the QUD

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Information structure in discourse is known to affect pronoun resolution, specifically in respect to the *Topic* and *Focus* status of an antecedent. For example, in English, pronouns are more likely to be used to talk about a discourse topic than they are a noun phrase (NP) that is focused in a cleft construction (Arnold, 1999). This factor interacts with grammatical role, as there is some evidence that a focused object in a cleft does not have enhanced salience (Arnold, 1999) while a focused subject in a cleft does (Cowles et al., 2007). However, when this interaction was tested explicitly with corrective clefts, there was no evidence for focus increasing an NP's salience for pronoun resolution (Kaiser, 2011), leaving open the role of focus on the salience of antecedents. In languages with prodrop, there are two possible proforms that can serve as anaphors: the null and the overt pronoun. The study of information structural effects on pronoun resolution in languages with two pronoun forms is relatively new. Also using clefts, De la Fuente & Hemforth (2013) found that, in Spanish, the saliency of a focused subject is reduced as an antecedent of a null pronoun whereas a focused object increased.

The following study assesses the role of information structure, specifically non-contrastive *Focus*, on the resolution of the null and overt pronoun in Spanish. Non-contrastive focus introduces an NP into the discourse as new information. We manipulate topic and focus in short Spanish dialogues by presenting a question that sets up a focused NP as the answer. This is more in line with answering the Question Under Discussion (QUD; Roberts, 1998; 2002) with the question being explicit in the discourse. We predict that pronoun resolution is contingent on the topic/focus status of the antecedent whereby the focused element is the answer to the QUD. Unlike previous work on focus in Spanish, we hope to bridge the study of information structure and discourse coherence as presented in QUD to shed light on pronoun resolution.

Methods: 40 participants were presented with 24 three-sentence-long dialogues on Amazon's Mechanical Turk crowdsourcing site (www.mturk.com). Sentence 1 introduced a question; Sentence 2 answered the question with either the subject or the object in topic or focus status; Sentence 3 presented a related statement to the action in question and began with either an ambiguous null or overt pronoun. Participants were asked to choose the character the last sentence referred to, thereby revealing their resolution choice. Spanish background and proficiency were assessed by an adapted LEAP-Q (Marian et al., 2007).

Marta: "¿Quién asustó a Eduardo?"/ "¿A quién asustó Roberto?"
Who surprised Eduardo? *Who did Roberto surprise?*

Paula: "Roberto asustó a Eduardo. Él/Ø gritó en voz alta."
Roberto surprised Eduardo. He/Ø shouted loudly.

Results: We fit the data to a general linear mixed model with subject choice as the outcome variable. Fixed effects were pronoun type (overt/null) and Information Structure status of the subject (topic/focus). We found a main effect of information structure with more subject choices than object choices when the subject was in focus position than when in topic position ($p<0.01$). There was no main effect of pronoun type ($p<0.61$), but there was a marginal interaction between pronoun type and info structure ($p=0.1$). Further examination of the interaction revealed that null pronouns favor subject choices regardless of the element in focus, while full pronouns tended to prefer the object when it was focused ($p=.008$).

Discussion: We take these results to show that the two pronoun forms are differentially sensitive to the QUD: the null pronoun favors any element in subject position, while the full pronoun is more sensitive to the noun phrase that is focused; that is, the answer to the question under discussion. Concurrent work on these materials aims to examine the online processing of the dialogues in spoken language to more finely assess the consideration of alternative antecedents as the dialogues unfold.

Back to Friday Poster Schedule

Interactions between reading skills and lexical properties on on-line sentence reading

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Models of eye movement (EM) during reading typically focus on lexical properties (e.g., frequency, length, etc.) as the primary regulators of the eye's progress through text (e.g., [1]). In this study, we consider a participant sample with considerable variation in literacy-related skills [2]. Our focus is not, primarily, on main effects of individual reading skills on EM, nor on main effects of lexical properties, but rather on interactions between these two classes of variables.

Subjects were 46 adults (16 to 24 y.o.), some from adult schools or community colleges and others not enrolled in school at the time of participation. The educational and occupational prospects of many subjects were constrained by their limited literacy skills. All were pre-screened to ensure ability to read simple sentences with comprehension [3]. **Skill measures** included two indicators each of vocabulary (*V*), decoding (*D*), reading comprehension (*RC*), and print experience (*PE*), and one indicator each of visual memory (*VIM*), oral reading fluency (*ORF*), listening comprehension (*LC*), and verbal working memory (*VWM*), each was screened for outliers and standardized. For factors with two indicators, composites were built from averaged Z scores [3]. **Eye movements** were recorded with an Eyelink II device. Analyses are based on 72 normal sentences used as un-manipulated "fillers" within an experimental design. Another 52 sentences with experimental manipulations are not discussed here. Sentences were shown on a computer monitor one at a time, in a monospace font on one line. Subjects read a sentence, clicked a button when done, and answered a comprehension question after 30% of trials. EM data for analysis include 22,597 observations (714 words in 72 sentences read by 44 subjects). **Lexical properties** included: word position in sentence, frequencies and lengths of current, previous, and next words (F_W, L_W, F_{W-1}, L_{W-1}, F_{W+1}, L_{W+1}). We residualized log-frequencies of words against their lengths to remove collinearity [4]. This study focused on two "early" EM measures: first-pass reading time (*RT*) and first-pass regression probability (*RP*) [4].

Results: LME models with crossed random factors (*subject & word nested in sentence*) served to disentangle effects of lexical properties and reading skills on EM. Baseline models with only lexical properties confirmed standard effects of F_W and L_W on EM [4]. Extended models added skill measures and their second order interactions with lexical properties. Four skill measures (D, LC, VIM, VWM) showed robust interactions with L_W (see Table). Visualization of subgroups (quartiles) suggests differences among these interactions. For example, the poorest ¼ of decoders (D) showed the greatest effect of L_W on RT, while the poorest ¾ of comprehenders (LC) were similarly sensitive to L_W. The latter case showed some evidence of non-linearity; readers in the mid-range were most sensitive to L_W.

	Factors	*β*	*SE*	*t / z*	*p<*
RT (linear)	*ORF*	-23.42	8.54	-2.74	.01
	LC : F_W	-3.90	1.30	-3.00	.005
	V : L_W	-2.01	.85	-2.36	.05
	D : L_W	-2.63	.70	-3.75	.001
	LC : L_W	2.38	.59	4.05	.0001
	VIM : L_W	-1.96	.47	-4.16	.0001
	VWM : L_W	2.24	.54	4.17	.0001
RP (logistic)	*ORF*	-.44	.11	-4.16	.0001
	VWM	-.24	.09	-2.68	.01
	VWM : F_W	-.06	.03	-2.41	.05
	LC : L_W	-.03	.01	-2.26	.05
	ORF : L_W	-.04	.02	-2.50	.05
	VWM : L_W	.03	.01	2.48	.05

Conclusion: Better understanding of interactions between individual reading skills and lexical properties should help to constrain theoretical accounts of online reading behavior. For example, where decoding skill exceeds a particular level, we see dramatic reduction in length contingent RT. Such "threshold" levels seem to differ from skill to skill, with only the best comprehenders showing notable reduction in length contingent RT effects. Also, interaction effects seen here are more robust on first-pass reading time than on first-pass regression probability. An additional puzzle is that the same interaction term (e.g., LC:L_W) may carry different signs on RT vs. RP outcomes, suggesting a skill component to RT—RP tradeoffs. All these issues demand additional research with larger samples of diverse populations for clarity.

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Back to Friday Poster Schedule

Intraspeaker priming of sociolinguistic variation: Cognitive and linguistic complexity

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There is growing interest in the cognitive mechanisms underpinning the production of sociolinguistic variation by individual speakers. In this paper I take within-speaker self-priming effects in sociolinguistic variation (tendency to repeat the same variant recently used) as a window on the psycholinguistic processes involved in online sociolinguistic production. This perspective produces evidence for complexity of two types: multiple linguistic variables producing what looks on the surface like one variable, and multiple cognitive mechanisms leading to overall repetitiveness in quantitative patterns of variation. I argue 1) that the well-studied sociolinguistic variables ING (*workin' ~ working*) and TD (*ol' ~ old)* both involve distinct morphological and phonological processes; and 2) that what is usually called "priming" in sociolinguistics actually originates from two cognitive mechanisms: episodic memory for whole words, and repetition priming of affixes stored abstractly in the lexicon.

The data (ING: N=6,613, TD: N=6,188) are coded auditorily from 122 conversational sociolinguistic interviews with white Philadelphians in the Philadelphia Neighborhood Corpus. All reported effects come from logistic mixed effects regression with variant-by-speaker random slopes to account for different baseline rates of variation across speakers. I show that within both variables, words where the variable functions as a verbal suffix (*work-ing, kick-ed*) behave differently from words where the word containing the variable is monomorphemic (*ceiling*, *old*). Variant choice in polymorphemic words does not trigger re-use of the same variant in subsequent monomorphemic words, and vice versa; token pairs where the prime and target are of matched morphological status, however, do show priming. On this basis I argue that variation in the polymorphemic cases involves morphological alternations, while the variation in the monomorphemic cases arises from phonological variation.

I then show that the intraspeaker priming of morphological variation has two characteristics that set it apart from priming of phonological variation: the effect generalizes across different lexical items (use of *–in'* in *working* promotes subsequent use of *–in'* in *talking*) and decays significantly over about a minute. The phonological variables, in contrast, show variant choice facilitation only when the prime and target are the same word, but this lexically-specific effect is much longer-lasting. I suggest that this distinction is attributable to the cognitive origins of persistence for morphological and phonological variables. When the variable is a suffix, the allomorphs (e.g. *–in'* and *–ing*) are stored abstractly in the lexicon and are subject to repetition priming in lexical access, just like non-variable lexical items; this is consistent with demonstrations that suffix repetition induces priming in lexical decision experiments [1, 2]. Phonological variation, however, is retained only as part of episodic memories of the details of specific instances of whole words. The additional operation of episodic memory in morphological variation then gives rise to an observed lexical boost, whereby *workin' workin'* is a stronger effect than *workin' talkin'*.

The multifactorial account of intraspeaker priming in sociolinguistic variation is consistent with experimental results showing distinct roles for episodic and abstract factors in repetition and morphological priming [3, 4]. Pursuing such an account, particularly using conversational data to detect the operation of psycholinguistic processing as a complement to experimental work, promises to advance our understanding of how intraspeaker sociolinguistic variation is represented and produced by speakers at different grammatical levels, and how these differences may interact with memory and speech processing.

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Back to Friday Poster Schedule

Intrusive reflexive binding inside a fronted wh-predicate

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Much work on the real-time interpretation of English reflexives (e.g. *himself,* see (1)) suggests that the initial antecedent search process only retrieves a c-commanding local subject (e.g. *the man*), in accordance with Binding Principles [1-4]. Although antecedent retrieval seems to be primarily guided by structural constraints in many contexts, exceptions to this generalization have been observed [5,7]. For example, in sentences with fronted wh-predicate that contains a reflexive (2), the only grammatically accessible antecedent is the embedded clause subject *Bill* [6]. However, reading time evidence shows that the parser temporarily binds the reflexive with the grammatically inaccessible main clause subject *James* [7]. We propose a new hypothesis that explains these seemingly conflicting findings: Binding Principles guide antecedent retrieval **only when** the subject of the reflexive's local thematic domain has been established. Critically, in (3), the subject of the fronted predicate *how annoyed with himself* appears **after** the predicate; thus, we predict that reflexive binding inside the fronted predicate should be sensitive to the gender of the linearly closest, non-c-commanding antecedent inside the relative clause (e.g., *James* in (3)). The present eye-tracking study confirms this prediction.

1. The man$_1$ who James$_2$ hired was annoyed with himself $_{1 / *2}$.
2. James$_1$/Mary$_1$ predicted **how annoyed with himself** $_{*1 / 2}$ Bill$_2$ would be __ .
3. The mechanic$_1$ that Brianna/James$_2$ hired this year predicted **how annoyed with herself/himself** $_{*1 / *2 / 3}$ the extremely dumb insurance agent$_3$ would be __ …

The eye-tracking during reading experiment (*n*=36) used 24 sentences like (3) with a 2x2 design, which manipulated the gender fit between the reflexive (*himself* vs. *herself*) and N1, i.e., the c-commanding subject (N1: e.g., *mechanic* as a male-biased noun), as well as the gender of the noun that does not c-command the reflexive (N2: e.g., *James* vs. *Brianna*). If the reflexive inside the predicted wh-phrase retrieves the linearly closest noun, then we predict a reading time slowdown at the reflexive region when the gender of N2 mismatches that of the reflexive (e.g., *James-herself*). Alternatively, if the parser retrieves the main clause subject, perhaps due to its c-command relation with the reflexive, then a reading time slowdown is predicted when there is a gender mismatch between N1 and reflexive (e.g., *mechanic-herself*).

Reading time data (Table 1) were log-transformed and analyzed using Linear Mixed Effect models. In the critical region (e.g. *with himself)*, a main effect of N2 gender manipulation was observed in both first pass time (β=-0.07, t= -2.44, $p < 0.05$) and go-past times (β= -0.12, t= -3.28, $p < 0.05$). Go-past times in the spill-over region (*the extremely*) revealed a numerical trend for N1 gender mismatch effect, but this difference was not statistically reliable.

These results suggest that reflexive binding in (3) is only reliably sensitive to a gender match with the linearly closest, but non-c-commanding N2. This lends support to the hypothesis that having a subject noun phrase in the local thematic domain of the reflexive is a pre-requisite for application of Binding Principles, at least in English.

Table1: Gaze duration	*with himself*		*the extremely*	
Conditions:	first pass	go-past	first pass	go-past
N1 match, N2 match	359 (14)	471 (37)	683 (34)	876 (74)
N1 match, N2 mismatch	402 (18)	525 (33)	657 (39)	920 (77)
N1 mismatch, N2 match	376 (18)	453 (25)	689 (26)	934 (81)
N1 mismatch, N2 mismatch	411 (17)	526 (34)	678 (36)	1017 (50)

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Back to Friday Poster Schedule

Investigating the modulatory effect of expectations on memory retrieval during sentence comprehension

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This study focuses on two classes of explanations for processing difficulty in human sentence comprehension: Cue-based retrieval theory (e.g., Lewis, Vasishth, & Van Dyke, 2006) and expectation theory (Hale, 2001; Levy, 2008). According to the cue-based retrieval theory, processing difficulty derives from two sources: time-based decay and memory interference from similar words. The expectation theory characterizes processing difficulty in terms of surprisal (Hale, 2001), which corresponds to the total probability of the predicted sentence constructions that are not consistent with the current word. Overall, the two approaches capture different aspects of processing difficulty: the former a "backward-looking" cost, that is, the cost of retrieving and integrating previously processed material with the incoming words; the latter a "forward-looking" cost, that is, the cost of updating or dropping predictions that are incompatible with the current word (Demberg & Keller, 2008). Many researchers now agree that a model of sentence processing complexity needs to include both memory retrieval and expectation features; however, how these two factors work together remains unclear. The current study examines the joint effects of retrieval interference and expectation, considering the possibility that expectations may diminish the damaging effects of retrieval interference by modulating the availability of the target element.

Method. Memory interference is manipulated using the dual-task self-paced reading paradigm developed by Gordon et al. (2002). Interference is determined by whether words in a memory list learned before reading (e.g., *cheese-yarn-bread*) are plausible objects for the main verb in cleft constructions (1-3). No Load conditions have no memory list, removing the possibility for retrieval interference. Expectation is examined by manipulating the main clause verb's cloze probability, that is, the predictability of the verb in the context of the stimulus sentence. The full design consists of a 2 (Load vs. No Load) × 3 (No Interference-Low Expectation vs. Interference-Low expectation vs. Interference-High Expectation) factorial. The expectation manipulation and the probability of retrieval interference were determined via separate MTurk norming studies.

1. (NoInterf-LowExp) It was the tree / that the person / who moved / to a new town / planted / early that day.
2. (Interf-LowExp) It was the tree / that the person / who moved / to a new town / cut / early that day.
3. (Interf-HighExp) It was the tree / that the lumberjack / who moved / to a new town / cut / early that day.

Results and Discussion. Response accuracy to the comprehension questions (N=36) was above .9 in all conditions and accuracy for recall of the memory list was above .8. For reading time data at the critical sentence region (main verb; e.g., *cut*), no significant effects were found. A different picture emerged at the spillover region (e.g., *early that day*): mixed-effects modeling revealed an effect of Load, such that reading time was shorter for the Load condition as compared to the No Load condition, and a significant interaction between Load and the Interference-Expectation factor. For the No Load condition, post-hoc analysis showed an effect of Expectation but no Interference: reading time was comparable in the NoInterf-LowExp and Interf-LowExp conditions, but faster in the Interf-HighExp condition. For the Load condition, post-hoc analysis revealed effects of both Expectation and Interference, such that reading time was slowest in the Interf-LowExp condition and fastest in the Interf-HighExp condition.

Our results are discussed in relation to a unified theoretical framework in which expectation modulates memory retrieval: retrieving and integrating a word previously processed is easier for highly predictable sentences (sharp expectation) as compared to weakly predictable sentences. We propose that at retrieval the parser prioritizes those elements that more reliably predicted the current state.

Back to Friday Poster Schedule

Learning a talker or learning an accent: Cross-talker generalization of phonetic adjustment to foreign-accented speech

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The present research concerns listeners' adaptation to *phonetic variation* in foreign-accented words and its generalization across talkers. Research on perceptual learning for speech has revealed that native listeners use top-down information to adjust the mapping from speech sounds to phonetic categories. Such phonetic adjustment helps listeners adapt to foreign-accented speech, resulting in improved word recognition. However, evidence for cross-talker generalization of phonetic adjustment for accented speech (both native- and non-native-) has been sparse and results have been mixed. Here we asked what conditions are needed to generate cross-talker generalization, focusing on the perceptual learning of Mandarin-accented productions of word-final voiced stops in English. Native-English listeners were exposed to Mandarin-accented words, produced by a single talker (Experiment 1) or five different talkers (Experiment 2). Each experiment consisted of an exposure phase and a test phase. In each experiment, two groups of native-English listeners were exposed to Mandarin-accented speech in an auditory lexical decision task during the exposure phase. The experimental group heard a set of critical /d/-final words that were unreliably devoiced in the Mandarin-accented speech (/d/-final words, e.g., overload), but the control group instead heard replacement words that did not contain any example of /d/. Following exposure, adaptation to the accent was tested by recognition of novel words in a cross-modal priming task. Crucially, test words were novel words and were produced by a novel Mandarin-accented talker. The number of exposure talkers varied across experiments (Exp. 1: single talker exposure; Exp.2: multiple talker exposure). Accent adaptation was assessed by performance in the cross-modal priming task. We used a 2 Group (Experimental group vs. Control group) X 2 Word Type (/d/-final vs. /t/-final words) X 2 Priming Type (Related vs. Unrelated priming) design. The RT priming magnitude was taken as the adaptation measure. Cross-talker generalization of perceptual learning was indicated by a Group X Word Type interaction (Fig.1). Results indicated that while exposure to a single talker did not improve word recognition of a different talker, multiple talker exposure did allow listeners to retune phonetic categories and generalize this experience across talkers. Further analysis revealed that generalization was modulated by the degree of acoustic similarity between talkers. Implications for general mechanisms of talker generalization in speech adaptation are discussed.

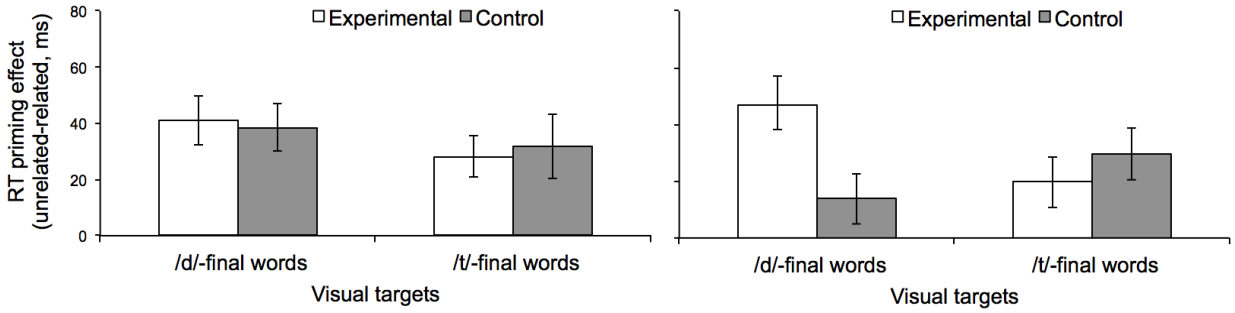

Fig.1. Test results: *single talker → novel talker* condition (Exp.1, left panel) and *multiple talkers → novel talker* condition (Exp.2, right panel). Priming of /d/-final words (RT in *fair-SEED* trials minus RT in *seed-SEED* trials) and /t/-final words (RT in *fair-SEAT* trials minus RT in *seed-SEAT* trials) for participants exposed to critical words (Experimental group) or replacement words (Control group). Error bars represent standard errors of the mean.

Back to Friday Poster Schedule

Length effects in an OV language with Differential Object Marking and mixed head direction

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The "long-before-short" (LbS) preference observed in SOV languages, e.g. Japanese, Persian and Basque, challenges the universality of availability-based theories of word order preferences supported by incremental models of speech production, put forward to account for the "end-weight" preference observed namely in German and English. Based on data from Japanese, Yamashita & Chang (2001) propose a unified but language-specific accessibility-based account for both preferences. Their rationale is that 1) longer constituents are lexically richer and hence more salient than shorter ones, while being more costly to process and plan; 2) language-specific properties may modulate the sensitivity of a production system to conceptual vs. formal factors. With respect to word order, Japanese speakers focus more on conveying meaning than on sequencing forms, contrary to e.g. English speakers, given that Japanese has fewer syntactic constrains (e.g. flexible word order & null pronouns) and that the shift does not occur in the postverbal domain where the verb is shown to exert strong influence.

Recent studies Japanese (Tanaka et al. 2011) and Basque (Ros et al. 2015) reject a conceptual account of LbS in favor of Hawkins' dependency-based distance-minimizing model (1994, 2004), which predicts mirror-image preferences in (strictly) VO and OV languages. Contributing to this discussion, we provide data on Persian, another SOV language with flexible word order and null pronouns, but head-initial in NP, PP and CP. Persian has verbal agreement with subject and Differential Object Marking (realized by *=rā*) triggered by definiteness.

Previous corpus and experimental studies on the relative order between the DO and the IO in the preverbal domain (Faghiri & Samvelian 2014, Faghiri et al. 2014) have found a clear LbS preference, not predicted by Hawkins' model (due to Persian's mixed head direction). Moreover, they show that the effect of length depends on the degree of determination (or definiteness) of the DO: *rā*-marked (definite) DOs prefer OD-OI-V regardless of length, (existential) indefinite DOs prefer OD-OI-V even more with OD≥IO, and bare DOs show a less strong preference for OI-OD-V with OD≥IO. It is argued that these preferences conform to the conceptual account, given that the fact that the effect of length and definiteness converge.

Our data on the relative order between the subject and the DO support these results. Firstly, our corpus data reveal that the degree of definiteness of the DO remains highly relevant: only *rā*-marked DOs occur in OSV order (at the overall rate of 4.6%). Secondly, we manipulated the relative length and animacy (of the subject) following a 2x2 design in a controlled experiment with *rā*-marked animate DOs (20 items, ex.1), using a web-based sentence completion questionnaire (56 participants). We found (cf. Fig.1) a highly significant effect of animacy ($p<.001$), OSV order was more frequent (12% vs. 4.4%) for inanimate subjects (1b) than for animate ones (1a), but no effect of length contrary to dependency-based length-minimizing accounts predictions (e.g. Gibson 2000, Hawkins 2004). Meanwhile, the conceptual hypothesis can provide a satisfactory account of these preferences: 1) animacy is a known conceptual factor to influence ordering preferences (e.g. Branigan & Feleki 1999, Kempen & Harbusch 2004, Branigan et al. 2008); 2) it is highly likely that the joint effect of definiteness and animacy undermines the contribution of length to the conceptual accessibility of the DO.

(1) a. Alireza bačče=rā (ke tab dāsht) bidār-kard
Alireza child=DOM that fever had awake-did
'Alireza woke up the child (who had a fever)'.
b. sarosedā bačče=rā (ke tab dāsht) bidār-kard
noise child=DOM that fever had awake-did
'The noise woke up the child (who had a fever).'

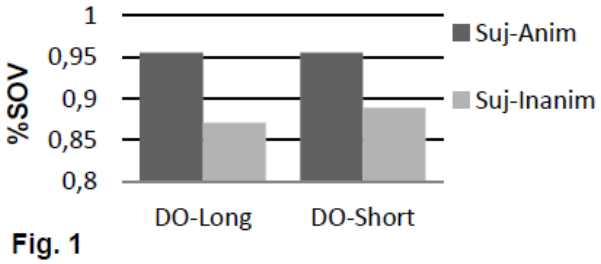

Fig. 1

Back to Friday Poster Schedule

Like water off a duck's back: How listeners react to and recover from referential infelicity

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Speakers sometimes produce overinformative utterances, such as when descriptions contain modifiers that are technically unnecessary for referential success. In the present study we focus on the consequences of referential overspecification for listeners as well as the temporal scope of these processing effects. In particular, we explore the notion of a possible "refractory period" — whether listeners' on-line processing capacities continue to be disrupted for a period of time.

As background, although listeners' sensitivity to overspecification has been clearly established in explicit rating studies (e.g., Davies & Katsos, 2013), comparatively little work has evaluated the sensitivity from the perspective of real-time processing. Additionally, in many of these cases, the focus has either involved syntactically ambiguous post-nominal phrases (e.g., "*Put the apple <u>on the towel</u> in the*…"; Engelhardt et al., 2006) or a class of modifiers whose redundancy is tolerated by listeners (e.g., color; Sedivy et al., 1999, Expt. 1). Thus our first step in the current study was to establish the processing cost entailed by hearing a clearly superfluous prenominal modifier. In a visual world experiment (N = 30), listeners followed instructions such as "*Select the unlocked door*" when the corresponding display contained five objects, including either two contrasting doors (felicitous modifier) or only the target door (superfluous modifier). Gaze patterns were recorded while participants listened to the instructions and selected a display object using a response box (for which the button layout matched the layout of display objects). Saccade latencies showed a clear overspecification penalty whereby identification of the target referent was 157 ms slower with superfluous compared to felicitous modifiers (p = .032). Further, although listeners' corresponding button presses occurred considerably downstream (~1300 ms later, on average), some residue of this penalty was marginally evident in button press latencies (a 237 ms difference: p = .065).

We then examined listeners' processing patterns during a subsequent instruction referring to an object in the same display, with the goal of evaluating how the earlier disruption might affect downstream processing (e.g., "*Now select the wheel*"; with only one wheel present). This is motivated in part by work showing that typical referential processing patterns are suspended when listeners do not expect a speaker to produce pragmatically felicitous descriptions (e.g., knowledge that a speaker has an impairment; Arnold, Kam, & Tanenhaus, 2007; Grodner & Sedivy, 2011). It is therefore plausible that recently experienced pragmatic infelicities could have a lingering impact on the processing of future descriptions (especially those produced by the same speaker). The sensitivity of the measures was first established by checking for known lexical-level effects on the time-course of word recognition (e.g., word frequency and word length). Reliable effects of these variables were indeed detected. However, there was no evidence of any lingering impact from the preceding referential overspecification. Thus, even though the majority of adjectives used would be perceived as highly marked in the condition with superfluous modifiers (e.g., *<u>unlocked</u> door, <u>unlit</u> cigar, <u>intact</u> vase*), their downstream impact is apparently very minimal.

We conclude that the penalties that referential overspecification can entail for real-time processing are readily overcome by listeners, with no apparent adaptation and with "normal" real-time processing resuming with little delay. This outcome highlights listeners' general tolerance to passing pragmatic infelicities, consistent with the idea that listeners carry a strong assumption that communication will be rational unless salient and context-specific information leads them to suppress these expectations in a top-down manner.

Back to Friday Poster Schedule

Limited reactivation of syntactic structure in noun phrase ellipsis

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Introduction. An important question about ellipsis concerns what representations mediate interpretation at sites of ellipsis: is a syntactic representation reactivated [1]? or does a semantic representation suffice [2]? The present study uses Noun Phrase Ellipsis (NPE) to investigate the kind and extent of information reactivated at ellipsis sites. NPE is illustrated by (1).

(1) Mary read John's letter and Sarah read Mark's <letter>.

Based on 3 reading-time experiments, we find that some, but not all, syntactic information is reactivated at the site of ellipsis in NPE.

To test reactivation, a probe is needed to distinguish between what the syntactic and semantic representations contain. We used number features, since these can feed agreement attraction (AA) [3-5], a robust comprehension process sensitive to morphosyntactic information. In AA, an intervening NP - the attractor - agrees with the verb as opposed to the subject NP containing it (e.g., "The key$_{SG}$ to the cabinets$_{PL}$ were$_{PL}$ on the table"). When NPE elides a complex NP, would a plural noun in the antecedent generate attraction following the elided NP? If the antecedent were reactivated fully, then it is predicted to cause attraction; but if it were reactivated only partially (just the head noun), then no attraction is predicted.

Experiment 1. We first created a set of complex NPs that could serve as antecedents for NPE. These included a possessor, and were all of the form: *Name's Noun Prep the Noun,* as in, "Scarlett's memo from the editor," In a self-paced reading experiment, we tested whether these were effective at generating attraction. Materials in a 2x2 design crossed ATTRACTOR NUMBER and GRAMMATICALITY of the agreeing verb, as (2) illustrates (32 items, 32 participants).

(2) a. Scarlett's memo from the editor$_{SG}$ was$_{SG}$/were$_{PL}$ on the table. *Singular Attractor*
b. Scarlett's memo from the editors$_{PL}$ was$_{SG}$/were$_{PL}$ on the table. *Plural Attractor*

In the region after the verb, we found a main effect of grammaticality ($p<.05$) and a significant interaction of ATTRACTOR with GRAMMATICALITY ($p<.01$): ungrammatical, plural attractor sentences were read faster than ungrammatical, singular attractor sentences, a pattern characteristic of AA [4]. These complex NPs do generate agreement attraction.

Experiment 2. After finding that NPE-licensing NPs could generate AA in simple sentences, we then created 2-clause sentences in which these NPs were potential antecedents in the first clause. The singular second clause subject either contained a possessor (triggering NPE) or did not, (3a) v. (3b). The critical verb was either grammatical or ungrammatical.

(3) Ann's memo from the editor/s got lost a. … while Jo's luckily was/were at the office. *NPE*
b. … while Jo luckily was/were at the office. *No NPE*

In the region immediately following the verb, we found *only* a main effect of grammaticality ($p<.001$; 32 items, 63 participants). There were no interactions with attractor number.

Experiment 3. In Experiment 2, we found no AA caused by NPE. However, the syntactic parallelism encouraged by the contrastive connectives may have diminished AA effects. We therefore followed up with temporal subordinators, as (4) illustrates.

(4) Before Harvey's memo from the editor/editors could be found,
Frank's surprisingly was/were being scrutinized by the secretary.

But again, we found only a main effect of grammaticality ($p<.001$; 32 items, 32 participants).

Conclusion. Across both ellipsis experiments (Experiments 2&3), there were significant main effects of grammaticality but no evidence of agreement attraction. We conclude that syntactic information about the head is reactivated, but that such reactivation is not exhaustive—*only* the head noun is reactivated.

References

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Back to Friday Poster Schedule

Linear order and syntactic structure in sentence priming

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Introduction In this paper we report on a series of experiments investigating the interplay between surface and structural properties in sentence priming. Essentially all transformational theories of syntax allow for derivations with intermediate steps, i.e. changes in syntactic structure that are further modified by later changes. Since the later changes manipulate the intermediate structure, the surface form of a sentence may contain only hints of underlying levels. Prior research on this topic, particularly from Bock et al. (1992), has argued that structural priming is primarily sensitive to the surface position of syntactic elements. We investigate this question using data from both production and comprehension priming paradigms across combinations of three syntactic alternations in English: passives, questions, and ditransitives.

Methods Experiment 1 is a production study using a picture description task to assess whether passive questions prime passive declaratives. In critical pairs, participants had to answer a question about one picture in the prime and then describe a different picture in the target using a specified verb. Four different prime types were used, which crossed which argument was questioned (agent/patient) and whether the question was active or passive, which allowed us to dissociate information structural effects from morphosyntactic effects of passivisation. The dependent measure was rate of passive use in target description. Experiment 2 is a comprehension study using a self-paced reading task to investigate how passive ditransitives prime active ditransitives. The dependent measure in experiment 2 was reading time in the second chunk of the target sentence, where the variation in object order occurs. We predicted that actives would be facilitated by passive descriptions with the same argument order, assuming that argument order in the passive is derived from the same order in the underlying active.

	Experiment 1	Experiment 2
Primes	What did the squirrel eat? [Pat. Act.] What was eaten by the squirrel? [Pat. Pass.] What ate the acorn? [Agt. Act.] What was the acorn eaten by? [Agt. Pass.]	(She was) (given it) (on Tuesday) (It was) (given to her) (on Tuesday)
Targets	Picture of baseball breaking a window "break"	(They gave) (him it) (in January) (They gave) (it to him) (in January)

Table 1: Examples of Experimental Items: () indicate chunking for self-paced reading

Results We analysed the data using mixed effects regression. Experiment 1 showed that both passive primes ($p=0.002$) and patient primes ($p=0.024$) facilitated passive descriptions. These results indicate that a sentence's linear order is primable separately from its syntactic structure, which suggests that the results from Bock et al. (1992) need not rule out possible priming of derivational history. For experiment 2, we found that passive sentences where the verb directly preceded the direct object ("She was given it") primed active sentences where the verb directly preceded the direct object ("They gave it to him"), rather than sentences that share the same hierarchical relationship of recipient-over-theme ("They gave him it"). This suggests a prominent role for surface position in self-paced reading.

Conclusions Our current results show that sentence level priming is sensitive to both structural factors as well as local linear relationships. We are currently running experiments in which we modify the self-paced reading paradigm to reduce the linear effect and tap into structural properties.

References: • Bock, Kathryn, Helga Loebell, and Randal Morey. 1992. From conceptual roles to structural relations: bridging the syntactic cleft. *Psychological Review* 99:150–171.

Back to Friday Poster Schedule

Listening through voices: Infant statistical word segmentation across multiple speakers

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Learners can detect structure amid wide variation in their environments. Surface form variation (e.g., in events, words, and grammatical patterns) occurs when the perceptual details of elements in the input are not identical even when they belong to the same category (Goldinger, 1998; Houston & Jusczyk, 2003; Singh et al., 2008). To identify underlying structure, learners must process surface variation in ways that permit the detection of what is consistent, relevant, and meaningful across exemplars. The present research investigates how variation in voice – a pervasive form of variability in natural language environments – affects infants' detection of statistical regularities in fluent speech. Parents, siblings, and other individuals speak to infants, and infants must 'listen through' these voices to find relevant structures. By examining how infants integrate their learning of patterns across voices, this investigation tests whether statistical learning can scale up to support natural language acquisition.

We tested 149 8- and 10-month English-learning infants in four experiments investigating segmentation of frequency-matched 'words' (TP=1.0) vs. 'part-words' (TP=.5) from an artificial language used in previous studies (Aslin et al., 1998). Our main manipulation was whether speech was produced by 8 or 2 female speakers. We found that infants successfully detected statistical regularities that marked word boundaries in a speech stream produced by 8 different speakers (see Fig. 1; note that all effects were carried by the first half of test trials). In Expt. 1, 8- and 10-month-olds recognized statistically defined words produced by a novel female voice during testing. In Expt. 2, 8-month-olds recognized the words produced by a novel male voice that was perceptually distinct from voices in the speech stream. These results suggest that infants' learning of the regularities that determine word boundaries is resilient to surface form variation. However, when the same speech was presented by only 2 female voices in Expt. 3, infants failed to show evidence of successful segmentation. As shown in Fig. 2, increasing infants' exposure to the speech stream by 50% in Expt. 4 yielded the same finding. Thus, the degree of variation in speech affected infants' learning. Infants showed clear evidence of learning with high variation in voice, but no evidence of learning the same linguistic structure produced with low variation in voice. We propose that high variation across voices helps infants detect the invariant underlying structure of syllable patterns in fluent speech.

The ability to process statistical relations in acoustically variable speech is essential for enabling later efficiency in sentence processing, and investigations of how infants overcome signal complexity are needed for evaluating the explanatory power of statistical learning. Our findings indicate that infants successfully perform statistical word segmentation when many (as opposed to few) speakers contribute to the speech signal. Findings will be discussed in the context of models of infant attention and memory.

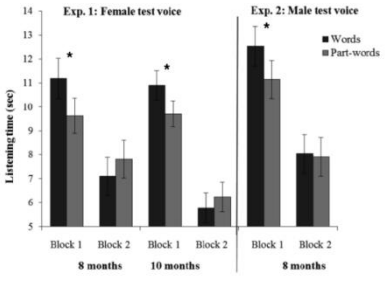

Figure 1. Mean listening time to word and part-word test trials for Experiments 1 and 2, separated by test block. Error bars indicate *SE*s.

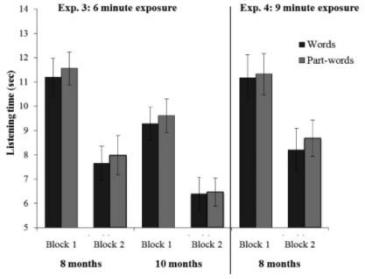

Figure 2. Mean listening time to word and part-word test trials for Experiments 3 and 4, separated by test block. Error bars indicate *SE*s.

Back to Friday Poster Schedule

Locality effects for adverbials: A case of Japanese adverbial NPIs

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Considering the limited capacity of human short-term memory, it is natural to hypothesize that increasing the distance between two words that are in some grammatical relationship would lead to a greater processing cost. Such *locality effects* were initially reported in the studies of English filler-gap integrations (Grodner & Gibson, 2005), while their absence was reported in the studies of head-final languages (Konieczny, 2000; Nakatani & Gibson, 2010; Vasishth & Lewis, 2006). Recently, however, finer-grained experimental manipulations revealed locality effects in thematic integrations in English (Bartek et al., 2011), as well as in relative clause processing in German (Levy & Keller, 2013), and the processing of *wh*-questions (Ono & Nakatani, 2014) and Negative Polarity Items (NPI) in Japanese (Nakatani, 2009, CUNY poster).

This study reports the first evidence for locality effects in the processing of *adverbial dependencies* from a self-paced reading experiment. An advantage of testing adverbial integration is that adverbs are less likely to cause similarity interference compared to nouns.

We adopted Nakatani's (2009) experimental paradigm on nominal NPI-processing. A potential problem of Nakatani's design was that the semantics of the NPI conditions and their control, the nominative conditions, were truth-conditionally in the opposite direction. We managed to control for this and other potential confounds by using *adverbial NPIs*. In Japanese, simply attaching contrastive marker *-wa* may transform a manner adverb into a "near" NPI if the adverb carries a maximally positive connotation ("clearly", "perfectly", "promptly", etc.) (Hara, 2006; Sawada, 2013). For example, manner adverb *hakkirito* "clearly" can be used under either an affirmative or a negative context, but when *-wa* is attached (*hakkirito-wa*), a negative context is strongly expected (otherwise, the sentence would sound very awkward). Taking advantage of this property, we crossed the ***NPI*** factor (with or without *-wa*) and the ***Locality*** factor. (Note: *-wa* merely emphasizes the scope of negation, so truth conditions were kept constant).

–**Nested** x { **NPI** (with *-wa*) or **non-NPI** (without *-wa*) }
producer-ga | ***hakkirito(-wa)*** | *AD-no* | *gakuya-de-no* | *nusumi-o* | ***syoogensi-nakatta*** *node* | ...
producer-NOM | **clearly(-NPI)** | AD-GEN | backstage-GEN | theft-ACC | **testify-neg** CONJ | ...
"The producer did not clearly testify the theft in the dressing room by the assistant director, ... "
–**Local** x { **NPI** (with *-wa*) or **non-NPI** (without *-wa*) }
producer-ga | *AD-no* | *gakuya-de-no* | *nusumi-o* | ***hakkirito(-wa)*** | ***syoogensi-nakatta*** *node* | ...
producer-NOM | AD-GEN | backstage-GEN | theft-ACC | **clearly(-NPI)** | **testify-neg** CONJ | ...

86 native speakers of Japanese participated in a moving-window self-paced reading experiment (16 items; 64 fillers). LMEM analyses of the results revealed main effects of both the Locality factor (t=3.41; Local faster) and the NPI factor (t=-2.26; NPI faster) in the critical region, V-neg-conj (Figure 1). The results from the participants whose comprehension accuracy rates were above the median further showed an interaction between the two factors (t=1.91) such that the shorter distance facilitated the processing of NPI-adverb with greater magnitude. Note that the adverb in question was the only adverb used in each condition. Thus, these locality effects must have been incurred by memory decay (Vasishth & Lewis, 2006) and/or distance-based complexity cost (Gibson, 2000) rather than similarity interference. We will also discuss these speedup effects for local NPI from the perspective of local coherence (Tabor et al., 2004: etc.).

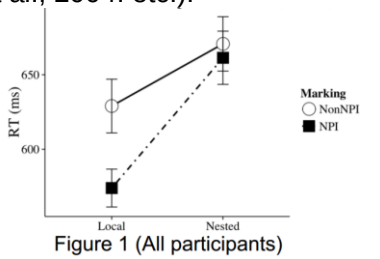

Figure 1 (All participants)

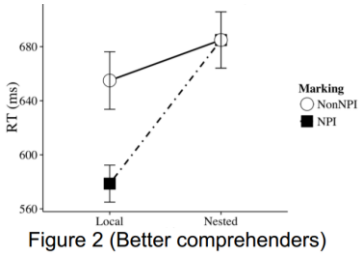

Figure 2 (Better comprehenders)

Back to Friday Poster Schedule

Long-term syntactic adaptation for relative clause attachment preferences: Evidence from ERPs

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Previous studies have shown that readers of English have a "low attachment" bias – preferring to attach a modifying relative clause (RC) to a more recently encountered noun phrase in a sentence. These preferences are exhibited in both offline sentence completion tasks, as well as online reading tasks, in which participants show slower reading times for high-attachment sentences like 3) and 4) below, in comparison to low-attachment sentences like 1) and 2).

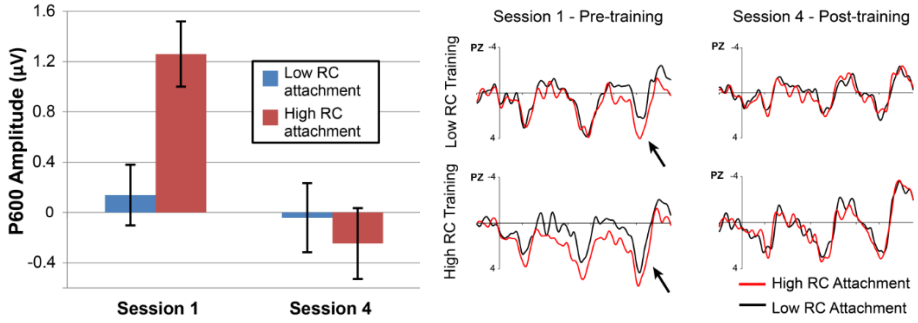
1) Nathan grabbed the soup near the knives that **were** typically sharpened in the kitchen.
2) Nathan grabbed the knives near the soup that **was** typically bubbling in the kitchen.
3) Nathan grabbed the knives near the soup that **were** typically sharpened in the kitchen
4) Nathan grabbed the soup near the knives that **was** typically bubbling in the kitchen.

In previous behavioral work, it has been demonstrated that syntactic parsing preferences can change over time, with readers showing rapid statistical adaptations to novel or dispreferred grammatical structures (Wells, et al., 2009). In the present study we measured neural responses during the comprehension of preferred and dispreferred RC attachment sentences, both before and after a "training session" in which participants were exposed to a large number of sentences with either high or low-attaching relative clauses.

In session 1 (N=36), participants read 40 high-attaching and 40 low-attaching sentences like 1-4 above while EEG was recorded from the scalp. Participants showed larger P600s to the dis-preferred, high-attachment structure both at the critical disambiguating word (***was/were***), and on the following spillover word, (p = 0.03, p < 0.001, respectively).

Participants then received two days of sentence training using a self-paced reading paradigm. Participants were randomly assigned to two groups, one which received high-attachment sentences (160 critical sentences and 160 fillers) and one which received low-attachment sentences. Both groups then returned for another session of EEG recording with a new set of high/low-attachment materials.

Contrary to statistical learning accounts of syntactic adaptation, we observed a complete attenuation of the high vs low-attachment P600 effect in session 4 across **both** training groups, which was driven by reduced P600 amplitudes for high-attachment structures (p < 0.001). This effect resulted in a significant Attachment Site-by-Session interaction on the P600 (p = 0.006), with no main effects of group and no three-way interaction. These ERP differences were not accompanied by differences in question accuracy across sessions. This finding suggests that exposure to a moderate number of dis-preferred high-attaching RCs in session 1 was sufficient to produce long-term syntactic learning effects for both training groups. These results also provide support for *episodic* accounts of grammatical structure learning, in which readers acquire episodic traces for unfamiliar syntactic structures during learning without accompanying costs for alternate syntactic parses (Kaschack & Glenberg, 2004).



Back to Friday Poster Schedule

Low predictability: An empirical comparison of paradigms used for sentence comprehension

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Contexts that constrain upcoming words to some higher or lower extent can be composed differently but are typically all evaluated using cloze-probability (Rayner & Well, 1996). Less predicted words were found to correlate with more negative N400 (e.g., Frank et al., 2015; Kutas & Hillyard, 1984) and longer reading times (Rayner & Well, 1996; Smith & Levy, 2013). Recently, however, it has been suggested that predictability, as in cloze-probability, is only one influence on processing cost (e.g., DeLong et al., 2014). As DeLong et al. show, differences in plausibility of words with similar cloze-probability also affect processing of such words, reflected in different ERP components. This hints at a difference between frequency-based and deeper semantic processing. Moreover, a relatively novel measure, the Index of Cognitive Activity (ICA) capturing pupil jitter, has been linked to cognitive load and predictability (Demberg et al., 2013).

We examined the plausibility effect using different experimental methods. We manipulated plausibility, similar to DeLong et al. (2014), but importantly, we tried to divorce the high plausibility effect from the effects of high cloze-probability and word frequency. Our German stimuli used restrictive (1) and non-restrictive verbs (2) to create low- and no-constraint contexts paired with three nouns of approximately the same frequency. This manipulation resulted in a highly plausible (1a), semi-plausible (1b), and an anomalous object (1c). All three objects are equally unpredictable in the no-constraint context (2). Two offline tests confirmed our manipulation. Target nouns were rated as anomalous (1c), semi- (1b), or highly plausible (1a), while having low cloze-probability (1b & 1c: < .01; 1a: < .20). Even though our manipulation does not entirely exclude the effect of cloze-probability, it may be low enough to not override the plausibility effect.

Example: Die Frau (1) bügelt / (2) beschreibt gleich (a) das T-Shirt / (b) die Socke / (c) den Sessel. *(The woman irons / describes soon the t-shirt / the sock / the armchair.)*

Four online studies tested the stimuli in different modalities, using the reading paradigm (self-paced and eye-tracking), auditory stimulus presentation during a lexical decision task (LDT), and an auditory ICA study. A word less plausible and/or less predicted in a given context is expected to lead to higher cognitive effort, evident in longer reading and reaction times and higher ICA values. Specifically, the no-constraint context (2) makes all target nouns equally plausible and equally unexpected, predicting similar processing cost. In the low-constraint context in (1), in contrast, we expected to see a higher cognitive load for anomalous nouns compared to semi-plausible nouns (1c vs 1b), despite their equally low cloze-probability. This would be consistent with DeLong et al.'s (2014) results. We further predicted that highly plausible nouns would be processed more easily than semi-plausible nouns, in particular since the increase in plausibility is also reflected in a (moderate) increase in cloze-probability.

The self-paced reading study (30 participants) showed no significant results. The disruption effect of the semantic anomaly (1c vs. 2c; 1c vs. 1a/b) was then found in the eye-tracking reading study (24 part.) and the auditory LDT study (24 part.). The ICA study (36 part.) did not include the anomalous object (c). No difference between (1a) and (2a) or between (1a) and (1b) was found in either reading study. However, results from the auditory LDT and the ICA study do confirm the plausibility effect: here (1b) induces higher reaction times and ICA values than (1a).

To conclude, we replicated the effect of plausibility on unexpected nouns found by DeLong et al. (2014). Studies with auditory stimulus presentation further show that different plausibility levels do induce significant changes in cognitive load. However, this effect was not observed in our reading data, potentially because of the overall low cloze-probability in our stimuli. It remains unclear whether the different results across different paradigms can be attributed to the presentation mode (auditory vs. written), measure sensitivity, or different mechanisms involved in processing plausibility as opposed to cloze-based expectancy.

Back to Friday Poster Schedule

Making the expected less expected: Text movement and discourse

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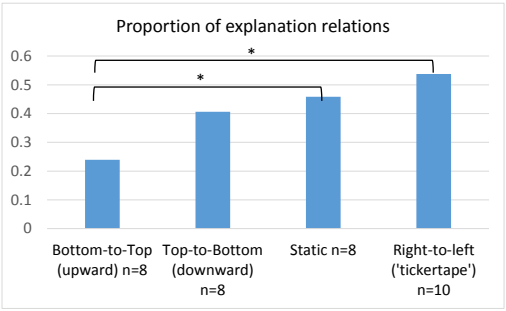
Humans anticipate upcoming linguistic material and track elements' predictability on various levels and using various cues (e.g. Bell et al. 2003, Jaeger 2010, Kamide 2008, Levy 2008). In the domain of discourse, many factors, including verb semantics, prosody and topicality (e.g., Arnold 1998, Kehler et al. 2008), shape expectations about what will happen next. We tested whether people's expectations about upcoming discourse (specifically, semantic relations between sentences) can be influenced by a seemingly unrelated factor: vertical or horizontal motion of the text on the screen. If humans use **a language-based and meaning-based system** where discourse expectations are guided by information grounded in lexical semantics, world knowledge, and linguistic notions like subjecthood, vertical/horizontal text motion should not affect expectations about semantic relations between sentences. However, if the system that generates discourse-level expectations is **permeable and susceptible to influence** from cognitive and perceptual processes unrelated to language, text motion may have an effect.

To explore these options, we used a **sentence-continuation task** to test whether physical motion of text along the horizontal vs. vertical axes influences people's expectations of the semantic coherence relation between a prompt sentence and a subsequent sentence produced by the participant. We used implicit causality (IC) verbs (e.g. *fascinate*, *admire*), because they trigger an expectation that the next sentence is an explanation for the situation in first sentence (e.g. *Mickey fascinated Daisy. He is an amazing storyteller,* Garvey/Caramazza 1974, Rohde 2008, Bott/Solstad 2014). If the motion of the text is *un*expected, will this push people away from the default expectation for explanation relations? (Explanations are often stative and do not have to precede the other event in time. For work on time/space/motion, see Boroditsky 2011.)

In our sentence-continuation task, prompt sentences were (i) **static**, (ii) scrolled from **right-to-left** ('ticker-tape;' *left*-to-*right* is unnatural for English), (iii) moved **upwards** from bottom to top of screen, or (iv) moved **downwards** from top to bottom. Eye-tracking shows humans are better at following horizontal than vertical motion, and better at downward than upward motion (e.g. Ke et al. 2012). The upward/downward asymmetry is attributed to gravity/motion in nature (e.g. Shah/Miyake 2005). The ease of horizontal over vertical is also viewed as adaptive (horizontal motion is more prevalent).The reading direction of English also makes the horizontal axis unmarked, and presumably strengthens the upward/downward asymmetry. From least marked/least unusual, we suggest the conditions are ranked {**static, right-to-left} < downwards < upwards**. *Does unusual upwards motion (and perhaps also downwards motion) lead people to 'expect the unexpected' in terms of coherence, and push them away from the default explanation bias of IC verbs?*



Motion was manipulated between subjects (n=34). Motion speed and static duration was slow enough for reading without rushing. Targets had IC verbs with NP1 (e.g. *Zack infuriated Kristen.*) or NP2 (e.g. *Amy blamed Paul.*) bias. No 'because' connective was given. People wrote continuations in a textbox that appeared mid-screen after the prompt disappeared. We analyzed coherence relations in the continuations using mixed-effects regression.

Upward motion resulted in fewer explanation continuations (and more result continuations) than right-to-left (p<.02) and static/no-motion (p<.05). Downward motion is in-between, and does not differ significantly from other conditions. (As expected, there is no effect of NP1/NP2 verb type.) **In sum,** unexpected/marked text motion (upward) can push people away from the expected coherence relations in an implicit-causality context. This suggests generation of discourse expectations can be influenced by unexpected patterns in the visuo-spatial domain.

Back to Saturday Poster Schedule

Mandarin Chinese and a Southwestern Mandarin Dialect Display Different Typological Properties in Describing Different-trajectory Caused Motion Events

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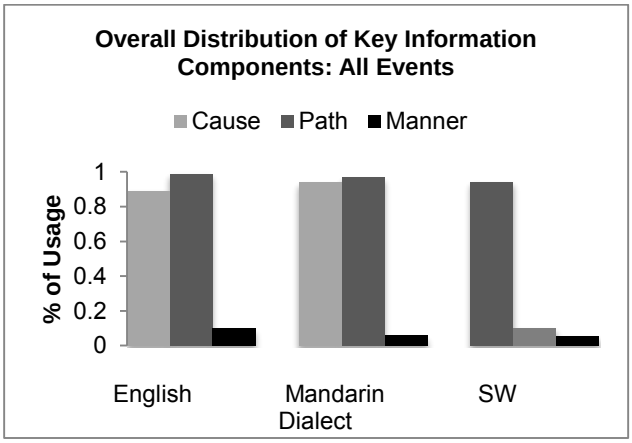
Languages display different typological properties in expressing motion events. In verb-framed (V-framed) languages, the path, i.e., the essential component of a motion event, is encoded in a verb; whereas, the path is encoded in a semantic constitute that is in a subordinate position to the verb in satellite-framed (S-framed) languages (Talmy, 1985). The classification of Chinese under this binary system, however, has provoked much controversy. While Talmy (1985) classifies Mandarin Chinese as strongly S-framed, Slobin (2004, 2006) classifies serial verb languages like Mandarin as equipollently-framed. Recent studies further argue that event types also play an important role in the classification: Mandarin is S-framed in describing voluntary motion events (Ji, Hendriks, & Hickman, 2009), and it is simultaneously V- and S-framed in describing same-trajectory caused motion events (Ji, Hendriks, & Hickmann, 2011). Other than Mandarin, no other Chinese language variety has been investigated along this line. The present study investigated the typological properties of Mandarin and a Southwestern (SW) Mandarin dialect in describing different-trajectory caused motion events, in which the agent (i.e., causer) stays at the original place when the object (i.e., causee) travels to a new locative point.

Examples:
Mandarin:
(1) Agent+BA+Object+Cause+Path+Ground
Tā bǎ xiézi tī dào shuǐ li le. (*pinyin*)
he BA shoe kick arrive water inside PERF
'He kicked the shoe into the water.'
SW Dialect:
(2) Agent+BA+Object+Cause+Ground
tʰa pa xair ʈʂwa sui li ta. (IPA)
he BA shoe kick water inside PERF
'He kicked the shoe into the water.'



Three groups of participants with 15 people in each group participated in the study, including a native English speaker group, a native Mandarin speaker group, and a native SW dialect speaker group. The participants were shown short videos, after which they were asked to verbally describe what happened in the video. The three groups described the videos in English, Mandarin, and the SW dialect, respectively. The results show that Mandarin and English display the same language-specific properties in the salience of the key semantic constituents, i.e., Cause = Path > Manner. However, the SW dialect massively omitted the path information (i.e., Cause > Path = Manner) despite of its similarities to Mandarin in *encoded* path such as employing the Chinese BA construction (see examples 1 & 2). This is the first evidence indicating that the path of motion can only be inferred from the context instead of being linguistically encoded. We propose that Mandarin is satellite-framed with high-path-salience and low-manner-salience, and the SW dialect is satellite-framed with low-path-salience and low-manner-salience, in expressing different-trajectory caused motion events. This study has provided evidence for the necessity of establishing a taxonomy for satellite-framed languages. It also raises important questions with regard to the relationship between the linguistic omission of the path information and our cognitive representations of motion, considering that the path has been considered to be the most crucial semantic constituent of a motion event in both linguistics and psychology.

Back to Friday Poster Schedule

Mandarin relative clause processing or the joy of replication.

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Subject relative clauses (SRs) are considered as being easier to process than object relative clauses (ORs) cross-linguistically. However, Mandarin has been claimed to behave differently, since Hsiao & Gibson (2003) found an OR advantage compatible with linear distance effects as predicted by the Dependency Locality Theory (DLT) (Gibson, 2000). Chen et al. (2011), however, found that SRs are easier to process in Mandarin, in line with frequency/structure based predictions. To explain these diverging results, Vasishth et al. (2013) suggested in a meta-analysis that there may actually be no significant difference at all or just a slight SR advantage possibly because the two effects (frequency/structure and linear distance effects) cancel each other out. Still, this meta-analysis included experiments with known methodological problems (such as contexts allowing for non-RC analysis). Thus, we ran a series of replication of experiments with different groups of participants to test the robustness of the preferences.

Our study We designed an experiment to test frequency/structure based versus linear distance based theories presenting RCs in contexts with very high anticipation of restrictive RCs.

Experiments We ran a Visual World Eye-Tracking experiment (5 items per condition) with 41 native Mandarin Chinese speakers for Exp1, 23 native Mandarin Chinese speakers for Exp2 (both groups living in Paris) and 34 native Mandarin Chinese speakers in China (Nanjing) (Exp3). Exp1 and Exp2 were identical except for the speed of presentation of the auditory material. Presentation was slowed down in Exp1 in order to clearly capture fixation patterns. We sped up the presentation in Exp2 to enhance cognitive load. Exp2 and Exp3 were identical. We tested reversible SRs and ORs (1-2). Participants listened to a sentence while viewing a pair of pictures with the same three characters each performing different actions. The task was to find the correct picture corresponding to the sentence. One of the pictures was only compatible with an SR interpretation, the other one only with an OR interpretation.

1 / Chinese SR 请找出相对应的公主，也就是**画击剑者的**漂亮公主。	Please find correct princess , that is to say **draws fencer$_{obj}$ de** beautiful princess *Please find the correct princess, that is to say the beautiful princess that draws the fencer.*
2 / Chinese OR 请找出相对应的公主，也就是**击剑者画的**漂亮公主。	Please find correct princess , that is to say **fencer$_{subj}$ draws de** beautiful princess *Please find the correct princess, that is to say the beautiful princess that the fencer draws.*

Results Linear mixed models showed no significant difference between SRs and ORs in Exp1 (Figure 1), probably because of the reduced speed of the presentation. Increasing the speed in Exp2 (Figure 2) resulted in a significant SR advantage in Mandarin (ps<.05) but not in Exp3 (Figure 3) where numeric but no significant difference could be established. **Conclusion** In a study with constraining context replicated three times, we find only a slight SR advantage when combining the results from the three experiments (Figure 4). We follow Vasishth et al. 's proposition that RCs processing involves a competition between frequency/structure and linear distance effects, which may cancel each other out. Our results do not show any evidence for an OR preference, disconfirming DLT. The lack of stability of preferences in Mandarin relative clause processing pertains even when using the same paradigm. This shows why it is so important in psycholinguistics to replicate experiments in order to test the robustness of the factors playing a role in sentence processing.

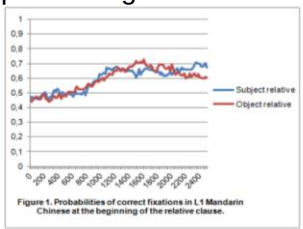

Figure 1. Probabilities of correct fixations in L1 Mandarin Chinese at the beginning of the relative clause.

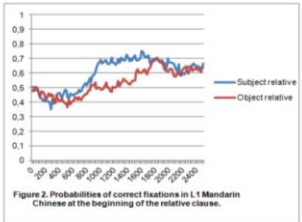

Figure 2. Probabilities of correct fixations in L1 Mandarin Chinese at the beginning of the relative clause.

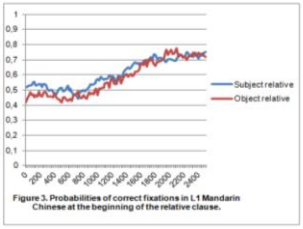

Figure 3. Probabilities of correct fixations in L1 Mandarin Chinese at the beginning of the relative clause.

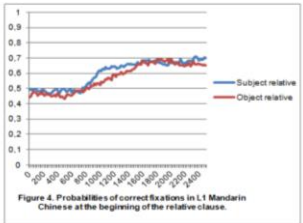

Figure 4. Probabilities of correct fixations in L1 Mandarin Chinese at the beginning of the relative clause.

Back to Friday Poster Schedule

Markedness matters: An event-related potentials study of gender, number, and person agreement in Spanish

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Syntactic features such as gender, number, and person are thought to be asymmetrically represented (Harris, 1991; Harley and Ritter, 2002). For example, in Spanish, feminine and plural are assumed to be marked for gender and number, whereas masculine and singular are argued to lack a number/gender specification. Likewise, the third grammatical person is argued to be unmarked relative to the first and second persons, since it is deprived of a speech role (it refers neither to the speaker nor the addressee). Previous event-related potential (ERP) studies have examined how different linguistic features are recruited online for the purposes of agreement, but no previous study has examined the unique contribution of markedness. In addition, no previous study has compared the three features with the same participants. We used ERP to examine how these markedness relations impact agreement resolution in Spanish. For gender and number, agreement was examined between inanimate nouns and predicative adjectives (see 1-4). Markedness was examined by manipulating the gender of the nouns (half masculine/half feminine) and their number specification (half singular/half plural). For gender, half of the violations involved a masculine adjective in a context that requires a feminine one (see 1). The other half involved the opposite pattern (2). For number, half of the violations involved a singular adjective in a context that requires a plural one (3), and the other half involved the reverse pattern (4). Person agreement was examined between a matrix subject, which could be the first person pronoun or a third person lexical phrase, and the main verb (see 5-6). Half of the violations involved a verb inflected for third person in a context that requires first person (see 5). The other half involved the opposite pattern (6). Subjects read 480 sentences (of which 80 were grammatical distractors) presented word-by-word (450ms on/300ms off).

(1) **Gender: feminine noun**
una catedral que parecía inmensa/*inmenso…
a cathedral-FEM that looked huge-FEM/*MASC

(2) **Gender: masculine noun**
un bosque que parecía seco/*seca…
a forest-MASC that looked dry-MASC/*FEM

(3) **Number: plural noun**
unas calles que parecían sucias/*sucia…
some streets-PL that looked dirty-PL/*SG

(4) **Number: singular noun**
una calle que parecía sucia/*sucias…
a street-SG that looked dirty-SG/*PL

(5) **Person: 1st person pronoun**
yo a menudo chillo/*chilla…
I often scream-1st/*3rd person

(6) **Person: 3rd person pronoun**
la pescadera a menudo chilla/*chillo…
the fishmonger often scream-3rd/*1st person

Results (*n*=27) show that number and gender errors elicited a P600, a component associated with syntactic repair (Barber & Carreiras, 2005). Markedness did not impact the P600 for gender. For number, violations realized on plural adjectives (see 4) showed a larger P600 than the reverse error type (see 3). Person violations yielded a P600 (Mancini et al., 2011), which was larger for violations realized on third person verbs (see 5).

These results suggest that, although the three features are associated with similar processing routines (as reflected by the P600), they are impacted by markedness differently. With respect to the different effects for gender and number, one possibility is that while both masculine and feminine are overtly coded with *–o* and *–a*, singular is not overtly coded with respect to plural *–s*, making violations on plural adjectives more salient (Deutsch and Bentin, 2001). A tentative interpretation for the results of the person conditions is that, upon encountering a first person subject (i.e. marked), activation of the person feature allows the parser to more reliably predict the form of the agreeing verb, which might have facilitated the repair processes associated with the P600, causing attenuation of its amplitude.

Back to Friday Poster Schedule

Metaphor out of School: Electrophysiological Correlates of Metaphor processing in Lower and Higher Literates

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Neurolinguistic research on metaphor processing is mostly carried out on highly educated university students, from Western Educated Industrialized Rich and Developed (WEIRD) countries. However, metaphors are ubiquitous in language use and highly educated subjects represent a small percentage of world population (OECD Indicators, 2012). This makes the generalization of results problematic (e.g. Heinrich et al., 2010). The present study aimed at assessing the role of Education in metaphor processing by describing its neurophysiological correlates in Higher and Lower Literates. We hypothesized that ERPs for metaphors in the higher educated subjects would show the biphasic N400/P600 pattern, respectively linked to lexical access shaped by context and pragmatic interpretation (Weiland et al. 2014). For the lower education group we hypothesized modifications of the biphasic pattern, presumably related to higher efforts in global linguistic processing.

30 Highly educated subjects (mean age: 26; years of education: 19.6) attending university programmes or above and 25 participants with school-leaving certificate (mean age: 23; years of education: 12.64) read metaphorical and literal expressions presented word-by-word on a computer screen while their EEG was recorded from 64 electrodes. ERPs were time-locked to target words. Experimental materials included 80 previously rated novel metaphors in Italian, embedded in a sentence context (e.g. *In important legal trials some lawyers are sharks with no scruples*) and 80 literal counterparts (e.g. *According to the guide in the aquarium those fishes are sharks of great ferocity*), plus a set of 160 filler items.

ANOVAs on individual EEG averages in the N400 and P600 time-windows confirmed the biphasic effect in the Higher Education Group: compared to literal expressions, metaphors elicited more negative ERPs on centro-parietal electrodes [$F(1,26)=16.21$; $p<0.001$] and more positive ERPs on frontal sites [$F(1,26)=5.61$; $p<0.05$]. ANOVAs from the Lower Education Group revealed a remarkably different picture: compared to their literal counterparts, metaphors elicited a more widely distributed N400 [$F(1,22)=7.76$; $p<0.05$] but no P600 effect.

Overall, our data suggest that Education influences metaphor comprehension, reducing the cognitive costs associated to lexical access as indexed by the N400 and favouring later pragmatic interpretation as reflected in the P600. In fact, only participants with higher education showed the biphasic pattern, while lower education subjects exhibited the N400 effect only. Moreover, in the higher education group, the presence of the P600 effect following the N400 component advocates for an interpretive process of metaphor which includes the appreciation of its most pragmatic aspects (e.g. inferential derivation of the speaker's meaning), as supported by evidence from other ERPs studies on pragmatic processing of irony (e.g. Regel et al., 2011). On the other hand, the presence of the N400 effect only in the lower education group suggests considerable cognitive costs associated to lexical retrieval operations. Overall, this study suggests that metaphorical comprehension taxes processing mechanisms differently depending on who receives it and his/her schooling experience.

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Back to Friday Poster Schedule

Minding the gap: The parser avoids relative clause analyses whenever it can

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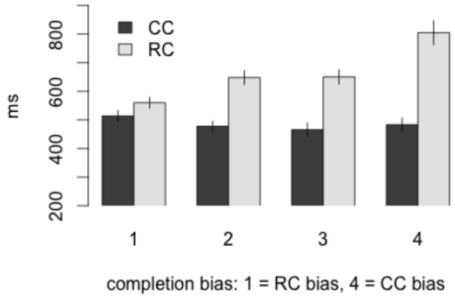
It has been suggested that the parser avoids creating long-distance dependencies whenever possible (the Minimal Chain Principle (MCP); De Vincenzi, 1991). The present study examined processing of sentences that are temporarily ambiguous between a nominal complement clause analysis (CC) and a relative clause (RC) analysis (1a-b). The MCP predicts that the CC analysis should be initially preferred. However, RCs are much more frequent than nominal CCs, which occur with only a restricted set of nouns. Thus, this ambiguity pits a putative structural preference against structural frequency. A self-paced reading study by Chen, Gibson, and Wolf (2005) found that readers adopted the CC analysis, as reading times were inflated on the matrix verb (*will alarm*) in sentences like 1b. In Chen et al., however, the head nouns were generally biased toward CC continuations. The present study tests a wider set of head nouns that range from a CC to an RC bias to determine if, and to what extent, the noun bias modulates parsing preferences and to test if a CC-preference is found even with nouns favoring an RC analysis.

The study included 68 sentence pairs like (1a-b), with two pairs constructed for each of 34 initial nouns (e.g., *announcement*). The sentences were normed for off-line completion preferences using Amazon Mechanical Turk. Subjects (n = 31) were given a sentence up to the point of disambiguation (e.g., *The announcement that the president is considering*…), and asked to provide a sentence completion. There was a unimodal distribution of completion biases across sentences, with a slight overall bias in favor of RCs (mean of .41 CC completions), and substantial item variability (sd = .27). Noun-specific biases were also obtained by counting the number of CC and RC completions in the first 100 unique Google hits for, e.g., *The announcement that*; the mean CC bias was .55 (sd = .34). Completion bias and noun bias were correlated (r = .46). In an eyetracking study (n = 48), each subject read one member of each sentence pair. Mixed-effects models of reading times and regression probabilities showed substantial difficulty in the RC condition on the verb region (*will alarm*), as shown for go-past time in Figure 1. In addition to the significant effect of condition (t = 5.91), there was also a significant interaction between condition and completion bias (t = 3.74); the effect of corpusbased noun bias was not significant in any model. Similar patterns were obtained in other measures, such as the probability of regressing back into the pre-disambiguation region. In sum, difficulty was reduced, but not eliminated, for RC sentences that were RC-biased in the production study; note that the sentences in bias quartile 1 in Figure 1 were completed with RCs an average of 91% of the time.

It appears that the parser does not posit an object RC if a CC analysis is available, even though nominal CCs are relatively infrequent. This is the case even when the RC analysis is preferred in off-line completions, and even when the critical noun is unlikely to occur with a CC. These results are consistent with the MCP, but present a challenge for models that explain parsing preferences by means of general or lexically-specific structural frequencies.



1a) The announcement that the president is considering an intervention will alarm the citizens. (CC) 1b) The announcement that the president is considering ____ will alarm the citizens. (RC)

Figure 1. Mean go-past time (and SE) on verb region ('will alarm') by condition and by completion bias, divided by quartile.

Back to Friday Poster Schedule

Misrepresentations of Plurality in Late Processing: Evidence from Self-Paced Reading

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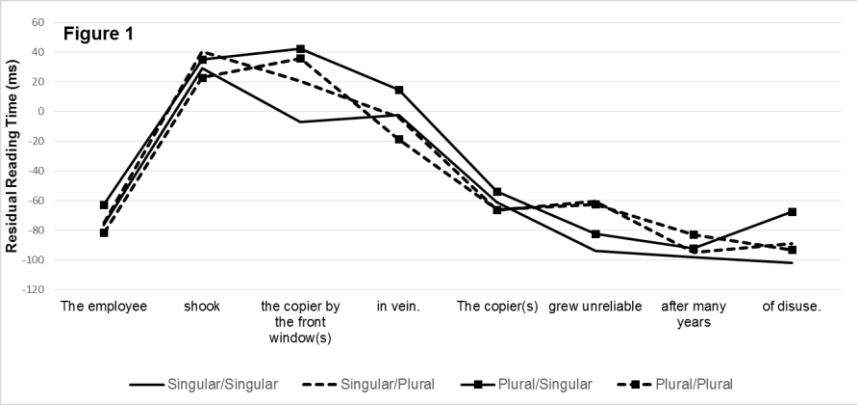
During processing, comprehenders sometimes make initial interpretations of the speaker's linguistic output which are incongruent with the surface syntax, and which can also result in misrepresentations later in processing (Christianson et al., 2001). We investigated whether misrepresentations of number occur in number attraction contexts during comprehension, as recent studies have debated when and whether comprehenders systematically misrepresent the number feature of a complex noun phrase (NP) which has two nouns mismatched in number (e.g., *The key to the cabinets…*). Early studies argued that attraction effects from plural embedded nouns (*cabinets*) can lead to misrepresentations of the head noun's number feature during agreement comprehension (Nicol et al., 1997; Pearlmutter et al., 1999). However, more recent data have argued that, during on-line comprehension, misrepresentations cannot account for attraction at a verb, but rather that agreement attraction is better explained by cue-based memory retrieval mechanisms (Wagers et al., 2009; Tanner et al., 2014). Patson & Husband (2015) probed number representations of attraction phrases both on-line, using self-paced reading, and off-line, using explicit judgments about the head noun's (*key*) numerosity. Their data suggest that whereas retrieval processes may better account for on-line processing at the verb, misrepresentations may arise in very late processing, indexed by a high number of "plural" responses when asked about the numerosity of singular head nouns followed by plural attractors.

We asked whether these results are due to the metalinguistic nature of the off-line questions, or if evidence of late misrepresentation can also be found on-line during more natural language comprehension. We conducted a phrase-by-phrase self-paced reading experiment (n=60), using two-sentence discourses, crossing the factors of attractor number in sentence 1 and the referring subject number in sentence 2: "*The employee / shook / the copier by the front window(s) / in vain. The copier(s) / grew unreliable / after many years / of disuse.*"). We expected, and found, longer reading times following plural referring nouns, as they mismatch in number with the head noun's number feature in sentence 1 (*copier*). However, if number attraction leads to late misrepresentations, we should also find ameliorated number mismatch effects (i.e., faster reading times following the referring noun) for discourses with a plural attractor and plural referring noun, compared to the singular/plural condition, as well as slower reading times for discourses with a plural attractor noun and a singular referring noun compared to the singular/singular condition. The data from the critical region, as seen in the figure, show no interaction between attractor number and referring noun number (Fs<1). Thus, we found no on-line evidence that the number of the head noun of the attraction phrase was misrepresented, even with a late measure of processing – namely, co-reference across sentences in discourse. These results indicate that previous findings of late misrepresentations may be a product of the comprehension questions' explicit metalinguistic nature.



Back to Friday Poster Schedule

Morphological antecedents of individual variability in agreement comprehension: ERP evidence

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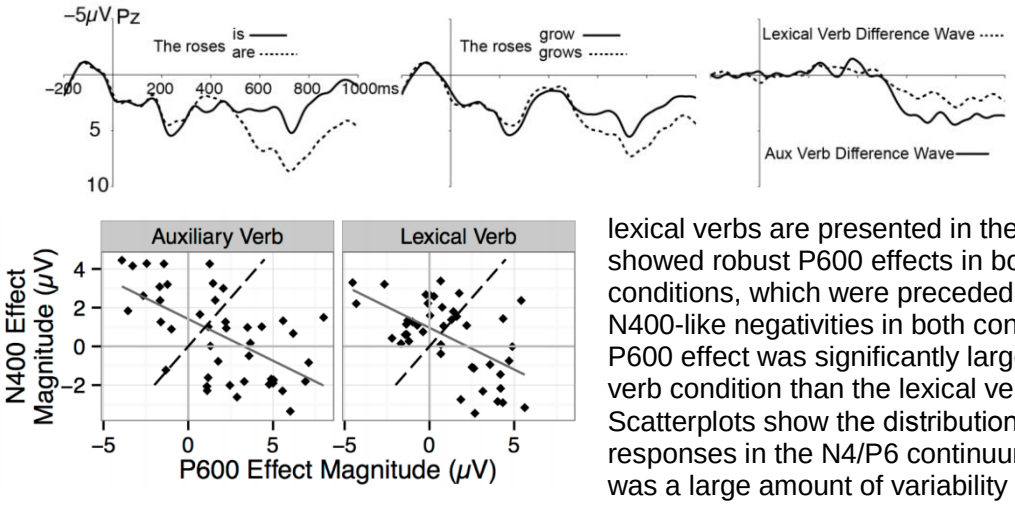
Studies of morphosyntactic processing using event-related brain potentials (ERPs), including studies of grammatical agreement, have most consistently reported P600 effects in response to agreement violations, which is sometimes preceded by a LAN. However, recent research (Tanner & Van Hell, 2014) has shown that this LAN-P600 pattern may in some cases be an artifact of the averaging process used in traditional ERP analyses. In their study, Tanner & Van Hell showed that individuals varied in the quality of their responses to violations of subject-verb agreement: whereas most individuals showed P600 effects, others showed biphasic N400-P600 effects, while others showed sustained negativities. However, questions remain about what linguistic factors allow such variability. For example, some (Molinaro et al., 2015; Tanner et al., 2014; Tanner & Van Hell, 2014) suggest that more variability in this N4-P6 continuum is likely to be found for agreement violations realized with suppletive auxiliary verbs (e.g., *is/are, was/were*), whereas more consistent P600 effects may be found in response to agreement violations realized morphologically on lexical verbs (e.g., *walk/walks*). Molinaro et al. additionally suggest that the complex NP structures used by Tanner and Van Hell may have led to shallower processing due to the distance between the agreement controller and target verb, leading to more N400 responses across individuals.

We directly tested these claims about the effects of morphological realization of agreement on the amount of variability seen in the N4/P6 continuum, and whether similar amounts of variability can be found in simple subject NP contexts. Participants (n=43) read sentences constructed in a 2x2 design, crossing the factors of verb agreement grammaticality (grammatical, ungrammatical) and morphological realization of agreement on the verb (suppletive auxiliary, inflectional marking on lexical verbs) (e.g., *The roses are/*is…* versus *The roses grow/*grows*…). Grand mean results from the two verb type conditions, as well as difference waves contrasting P600 effect magnitudes for the auxiliary and lexical verbs are presented in the waveforms. Analysis showed robust P600 effects in both verb type conditions, which were preceded by small but reliable N400-like negativities in both conditions. Notably the P600 effect was significantly larger in the auxiliary verb condition than the lexical verb condition. Scatterplots show the distribution of individuals' responses in the N4/P6 continuum. As is clear, there was a large amount of variability in the quality of participants' brain responses, similar to earlier reports of variability in more syntactically complex contexts (cf. Tanner & Van Hell, 2014). Those above/to the left of the dashed line show more negativity in their brain response than positivity. Importantly the proportion of negativity versus positivity-dominant responses did not differ across the two verb type conditions. These findings contradict hypotheses that auxiliary verbs in syntactically complex constructions will engender variability, whereas minimal variability (and maximal P600 effects) should be found in simple NP contexts with inflectional marking of agreement. Overall, these results support the proposal that individual variability in the neural mechanisms of morphosyntactic processing is a hallmark of the language processing system.



Back to Friday Poster Schedule

Modality general and specific brain responses during reference resolution

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A fundamental component of language comprehension is referential processing: linking linguistic expressions with the cognitive representations of the entities they refer to. Previous eye tracking [1] and EEG [2] research suggests that resolving reference in a previously seen visual display involves access to modality-specific visual representations. A plausible interpretation of these effects is that language comprehenders use visual short term memory to represent the referential domain. In the present study we asked whether there is a common substrate for reference resolution across visual and auditory referential domains, as opposed to the possibility that reference resolution consists solely in accessing an item in a modality-specific representation. We constructed referential domains in visual and auditory modalities: visual displays containing three objects each, and auditory stimuli consisting of three sounds played sequentially. In each trial, participants were presented with the referential domain, followed by a question about it, presented visually word by word, as illustrated below:

Target words differed in whether they resolved reference or not ("grunt" after a domain with a single grunt vs. two grunts).

Source localized MEG responses indicated increased activation for reference-resolving words as compared to their non-resolving counterparts, after both visual and auditory referential domains, in overlapping areas of the medial parietal lobe, starting around 415 ms (auditory domains) or 485 ms (visual domains). This finding demonstrates that medial parietal cortex is involved in reference resolution regardless of the modality of the referential domain, suggesting a connection between episodic memory and referential language processing. In addition to this modality-general response we also found a modality-specific one: when a noun resolved reference to an auditory object, activation increased in the vicinity of the auditory cortex of the left hemisphere starting around 415 ms. This response has implications for how this modality-specific region is involved in reference resolution. In our paradigm, when a noun did not resolve reference, it was compatible with two auditory objects. One might predict that those two objects should be activated as the set of possible referents, leading to more activation than when a word is compatible with only one representation. However, the response we observed exhibited the opposite pattern: activation was higher when the noun was compatible with only one item. This suggests that auditory cortex is activated once the referent has been found, rather than representing the set of possible referents during the search process. A corresponding effect for the visual modality could not be detected, although this might be due to interference from the response to the visually presented words.

Our results suggest that 400-500 ms after presentation of a reference resolving word the brain accesses a representation of the referent in modality specific regions, while activity in medial parietal cortex reflects reference resolution independently of the modality of the referent, suggesting an involvement in construction of a domain-general discourse model.

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Back to Friday Poster Schedule

Morphosyntactic and semantic prediction in L1 and L2 speakers of German

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Research on prediction in L2 language processing generally shows that L2 speakers can use semantic cues in the input to predict upcoming information in the sentence, but often have difficulty using morphosyntactic cues predictively (e.g., Hopp, 2015; Grüter et al., 2012; Scherag et al., 2004). This contrasts with L1 speakers, who make use of both types of cues to predict (see Huettig, 2015 for review). L2 prediction studies often attribute L2 speakers' inability to use morphosyntactic cues to insufficient knowledge of L2 morphosyntactic features or to the available processing resources associated with language processing (e.g., Grüter et al., in press; Kaan, 2014). In particular, studies show that L2 speakers' unstable gender representations may prevent them from using gender cues predictively (e.g., Hopp, 2013). To test whether L2 speakers could use both semantic and morphosyntactic cues to predict a sentence-final image, we provided speakers with additional gender information on two prime images prior to the presentation of a carrier sentence in which both semantic and gender cues were available to use to predict the sentence-final image.

In Experiment 1, L1 German speakers and advanced L1 English-L2 German speakers completed a primed picture naming task, in which target images were embedded in a visually presented carrier sentence. Prior to reading the carrier sentence, participants saw two images, in which morphosyntactic (i.e., gender) and semantic (i.e., color) congruency between the two images was manipulated, as in 1a-1d. Underneath each image, participants saw a phrase that provided clues to each noun's grammatical gender via a gender-marked indefinite article and the adjective ending on the color adjective (e.g., *eine*$_{\text{-FEM}}$ *braune*$_{\text{-FEM}}$ *Tür*$_{\text{-FEM}}$ 'a brown door'). In this way, conditions varied in the extent to which participants could use both gender and semantic cues in the subsequent carrier sentence (e.g., *Hier ist die*$_{\text{-FEM}}$ *braune*$_{\text{-FEM}}$ *…* 'Here is the brown…'), presented in a word-by-word format, to predict the sentence-final image.

1a. Semantic match/Gender match
eine braune Tür – eine braune Kirche ('a brown door$_{\text{-FEM}}$' – 'a brown church$_{\text{-FEM}}$')

1b. Semantic mismatch/Gender match
eine braune Tür – eine rote Kirche ('a brown door$_{\text{-FEM}}$' – 'a red church$_{\text{-FEM}}$')

1c. Semantic match/Gender mismatch
eine braune Tür – ein brauner Tisch ('a brown door$_{\text{-FEM}}$' – 'a brown table$_{\text{-MASC}}$')

1d. Semantic mismatch/Gender mismatch
eine braune Tür – ein roter Tisch ('a brown door$_{\text{-FEM}}$' – 'a red table$_{\text{-MASC}}$')

Initial analyses revealed main effects for both morphosyntactic and semantic cues, with no interactions between participant group and these two factors. However, subsequent analyses showed that while both L1 speakers and L2 speakers were faster to name the target image when morphosyntactic cues distinguished between the two prime images (L1: $p < .001$; L2: $p = .023$), only the L1 speakers used the semantic cues in the prime images to anticipate the target image (L1: $p = .003$; L2: $p = .526$). As the gender cue was presented earlier in the carrier sentence than the color cue, it is possible that L2 speakers did not have enough processing resources to use the semantic cue in time to predict the final image.

In Experiment 2, L1 German speakers completed a sped-up version of the primed picture naming task (see e.g., Hopp, 2010; McDonald, 2006 for a similar paradigm). Results showed that under increased time pressure, L1 speakers used gender ($p < .001$), but not semantic cues ($p = .715$) to predict the final image. These results mirrored the L2 performance in Experiment 1 and support the hypothesis that resource limitations influence whether a speaker will use a given cue to predict. The present results therefore highlight that the ability to use a given cue predictively exists on a continuum for all speakers, and as such, shows that the underlying mechanisms that drive prediction may not qualitatively differ across populations.

Back to Friday Poster Schedule

Native English speakers' structural alignment with foreign-accented speech

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It is well known that two interlocutors' linguistic behaviors become similar at various linguistic levels (e.g., phonetic, lexical and syntactic level). Such alignment can also be found in "foreign talk" that native English speakers engage in when interacting with English L2 learners. Communication Accommodation Theory (CAT) predicted native language speakers show Downward Convergence (i.e., alignment with non-native speakers) in which they adjust the complexity of their speech to ease non-native speakers' language processing (James, 1993). In this study, we tested the effect of foreign accent on alignment, using a syntactic priming paradigm. Under the Communication Accommodation Theory, we predicted that native English participants would show greater alignment (priming) to foreign-accented speakers.

Forty-one native English speakers performed a picture-description task. On each trial, they saw a picture of an object (e.g., *a desk*) and heard a dative prime sentence, either in a Double Object construction (DO, e.g., *The nurse gives the patient the medicine*) or Prepositional Object construction (PO, e.g., *The nurse gives the medicine to the patient*). Intransitive prime sentences served as Baseline (e.g., *The boy is skiing*). Participants were asked to repeat the prime sentence and decide whether the prime sentence was related to the picture by means of a button press. Subsequently, participants saw a target picture depicting a dative event and were asked to describe the picture by completing a given stem (e.g., *The man gives*…) The prime sentences were spoken by three different speakers: a native speaker of American English, a Korean speaker of English and an Indian speaker of English. Trial presentation was blocked by speaker. After each speaker condition, the participants were asked to rate the strength of the speakers' accent and their familiarity with each accent on a seven-point Likert-scale.

Analysis of the number of PO targets produced showed that Native English participants syntactically aligned strongly with the Indian speaker as well as the native English speaker: priming for DO versus the baseline condition, and for PO versus baseline condition was as strong in the native English condition as in the Indian speaker condition (DO English: β=-1.22, SE=0.4, z=-3.03, p=.002; Indian: β=-1.18, SE=0.31, z=-3.77, p<.001; PO English: β=1.38, SE=0.33, z=4.19, p<.001; Indian: β=1.7, SE=0.31, z=5.47, p<.001). On the other hand, native English participants were significantly primed only for the PO construction (β=2.01, SE=0.37, z=5.41, p<.001) not for the DO construction (β=-0.89, SE=0.49, z=-1.82, p=.07) in the Korean speaker condition, even though the participants did not rate the Korean speaker's (M=5.24) and the Indian speaker's (M=5.51) recordings differently in terms of accentedness (t=-1.51, df=40, p= 0.14). However, their familiarity with Korean accent (M=3.17) and Indian accent (M=3.68) was significantly different (t=-2.07, df=40, p=0.04).

The results of this study did not fully support Communication Accommodation Theory: native English participants aligned *less* to the Korean speaker than to the native American English speaker, but did show strong alignment to the Indian speaker. Though what drives the alignment is yet unclear, this study showed native English speakers' sensitivity to the speakers' accent and the results confirmed that syntactic alignment can be mediated by the speakers' accent (Weatherholtz et al., 2014; Zuengler, 1991).

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Back to Friday Poster Schedule

Neural basis for goal-oriented conversation

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Background. Conversation requires two people to build mental models similar enough to be understood (e.g. Halliday 1975). These models update based on the conversation partners' discourse contributions and progress in any joint task performed (v. Pickering & Garrod 2004). Updates increase the similarity of the speaker's mental models, and increased familiarity with one's partner or the task allows for more efficient updating. **Aims.** The present study identifies conversational features that lead to two speakers' building a "shared" mental model and neural substrates supporting the processes involved. **Methods.** Set-up. Inside MRI scanners, 22 pairs of Japanese speaking participants played collaborative maze games similar to those in Garrod & Anderson (1987). Each player was given a different maze, and some, but not all, information was shared between paired players. The objective was for both players in a pair to reach his or her maze goal as soon as possible. To win, paired players had to reach their maze goals at the same time. Players were given 30 seconds before each of 20 allotted moves, which alternated between players. To be successful, players needed to exchange information effectively and efficiently. Manipulations. A total of four maze games were played by each player on two different experiment days. To investigate partner-specific learning effects, among the four maze games played, each participant played three games with the same partner but the last game with a new one. In addition, to investigate the effects of conversational interaction between the players, in each game, players were given trials where the computer (PC) asked questions about their maze similar to those that occurred in the actual game. Trials with PC questions served as a control when fMRI data were analyzed. Analysis methods for conversation. All player utterances were transcribed and MeCab (morphological analyser for Japanese) was used for corpus analyses. **Results.** Corpus data. Players spoke more on their own turns than on their partner's. Importantly, as participants played more games, the number of "utterance turns" and morae increased. No difference was observed in players' choice of morphemes across four different games, but overlap between the players' consecutive utterances increased in the second game compared to the first game on each of the experiment days. fMRI data. Dorsal Medial Pre-frontal Cortex (DMPFC) and Precuneus/Posterior Cingulate Cortex (PCC) showed increased activation as the participants played more games regardless of whether or not they played the games with the same partners. For the partner-specific learning effects, greater activation was found in the right Cerebellum (7a/6) and the left BA6/BA44. **Discussion.** A mental model for discourse was likely established as the participants played the maze games. This is supported by the increased activation of the theory of mind network consisting of DMPFC and PCC, as well as the corpus data. The corpus analyses showed the overlap of the consecutive utterances by paired players. However, the effect observed in the corpus data was local (i.e. applied to consecutive utterances), as previously reported by Garrod & Doherty (1994), and a short-lived effect of experiment day. The partner-specific activation of the right Cerebellum and the left BA6/BA44 likely played a critical role in predicting the timing of players' utterance turns. This effect was partner-specific probably because it became easier to attend to the same partners and predict the timing of their utterance turns, compared to the unfamiliar partners. The corpus analyses are also consistent with the fMRI findings here. As participants played more games, more utterance turns were observed, probably as a result of their becoming good at predicting utterance turn timing. **Conclusion.** This study identified conversational features during a maze game and their neural substrates. It showed both partner-specific and non-partner specific learning effects when a mental model is established.

Back to Friday Poster Schedule

Neurophysiological responses to mixed noun phrases in speakers who codeswitch and don't codeswitch

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Linguistic prediction allows individuals to link what comprehenders expect to hear with what speakers actually say. The Production-Distribution-Comprehension model (PDC; Gennari & MacDonald, 2009) states that listeners' and readers' sensitivity to distributional patterns in production can constrain the comprehension system. The PDC model inherently predicts variability among speakers who codeswitch and speakers who don't codeswitch. We test this hypothesis at the neural level by examining the relationship between codeswitching production patterns and comprehension difficulty. Because exposure to codeswitching is predicted to impact comprehension, we recruited Spanish-English codeswitchers in the US and non-codeswitchers in Spain who were highly proficient in both languages. We focus on the production and comprehension of mixed noun phrases (mixed NPs; e.g., el_M $fork_M$). Evidence from naturalistic corpora suggests that bilinguals exhibit an overall preference for the masculine determiner (*el*), regardless of the noun's gender in Spanish (Otheguy & Lapidus, 2003). In contrast, switches involving the feminine determiner (*la*) occur less frequently and are restricted to English nouns that are feminine in Spanish. To illustrate, *el*-codeswitches such as (el_M $fork_M$) and (el_M $spoon_F$) are extremely common. To a lesser extent, *la*-codeswitches involving feminine nouns (la_F $spoon_F$) have also been attested in bilingual speech, while those involving masculine nouns (*la_F $fork_M$) have not. We predicted that neurophysiological responses would reflect this asymmetry in codeswitchers but not in non-codeswitchers. Production was examined in a corpus of unscripted, task-oriented dialogues; comprehension was investigated in sentential contexts using event-related potentials. The same groups of bilinguals participated in the production and comprehension studies. As shown in Table 1, results for production show that proportions of noun phrase types (i.e., Spanish, English, or mixed NPs) differed across groups ($X^2(2, N=6691) = 297.28$, $p<.000$). Codeswitchers (N=14) produced more mixed NPs than non-codeswitchers (N=15) and these switches robustly reflected the aforementioned gender asymmetry. The ERP experiment showed that for bilinguals who codeswitch (N=15), switches consistent with attested distributional patterns were easier to process. This is reflected in the N400 response for less frequent compared to more frequent switches (*see* Figure 1). Crucially, no such effects were observed in non-codeswitchers (N=20). Our data suggest that individuals are highly sensitive to the constraints of their interactional context. In this way, converging evidence from codeswitching sheds light on how production choices speakers make can predict comprehension performance.

Table 1. Proportion of Noun Phrase Types

Group	Spanish NPs				English NPs				Mixed NPs			
	M		F		M		F		M-Det		F-Det	
	N	%	N	%	N	%	N	%	N	%	N	%
Non-Codeswitchers	**1194**	34%	**1173**	34%	**542**	16%	**507**	15%	**15**	0%	**3**	0%
Codeswitchers	**1101**	34%	**1015**	31%	**426**	13%	**403**	12%	**303**	9%	**9**	0%

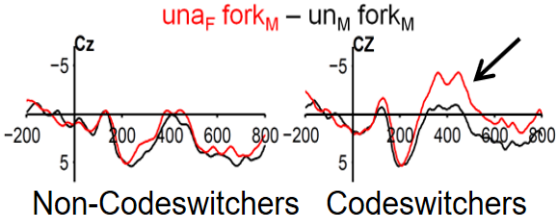

Figure 1: N400 mean amplitude (300-500ms) to English nouns preceded by Spanish determiners (ERP to targets preceded by masculine determiners subtracted (un_M $fork_M$) from ERP to targets preceded by feminine determiners (una_F $fork_M$)).

Back to Friday Poster Schedule

On the unbalance between subject and object relative clauses in discourse context

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The integration of contextual information during the processing of sentences containing subject and object relative clauses (SRs and ORs) is investigated. The unbalance between SRs and ORs has been widely reported, with higher processing costs in the later (Wanner & Maratsos, 1978; King & Just, 1991; King & Kutas, 1995). It is not clear, however, how prevailing this unbalance can be. Two-stage models of sentence processing claim this asymmetry is due to factors inherent to relative clause structures, i.e. to the processing of the internal structural relations of these sentences. One of such accounts postulates, for instance, that an *active-filler* mechanism would attempt to fill the relative clause gap as soon as possible during the parsing of these sentences thereby making SRs less demanding (Clifton & Frazier, 1989; Frazier & Flores d'Arcais, 1989). These accounts predict that the asymmetry between SRs and ORs prevails in any context. There is, nevertheless, evidence that nonstructural factors can also affect the processing of relative clauses. It has been observed, for example, that previous verbal information, in narrative contexts, can trigger a relative clause analysis even when the gender agreement would require a complement clause analysis for a sentence (van Berkum, Hagoort & Brown, 2000). It has also been argued, based on reading times, that the unbalance between SRs and ORs can disappear in narrative contexts in which the referent of the SR and OR is repeatedly associated with the subject function in the previous discursive context (Yang, Mo & Louwerse, 2013). The results suggesting the influence of nonstructural factors on relative clause processing seem to imply that nonsyntactic information plays an important role in the ascription of a structural description to a word sequence. The present work addresses this discussion by investigating the processing cost of relative clauses inserted in short narratives. As in Yang et al. (2013) study, SRs and ORs, such as (1) and (2), were presented preceded by narrative contexts that could either favor a subject or an object relative clause analysis. The *relative clause structure* and the *narrative context* were the independent variables in a 2x2 design. The participants (N=24) read those stories (20 experimental items – 5 for each condition – interleaved with 10 filler stories) while their oculomotor behavior was measured by a 300Hz eye-tracker. The total fixation duration on the relative clause segment (in brackets in the examples) was the dependent variable. In the opposite direction of Yang et al. (2013) results, the only main effect obtained was due to *relative clause structure* ($F(1,23) = 12,4$ $p < .002$): ORs were associated with longer total fixation duration in both contexts. *Narrative context* did not provide a main effect ($F(1,23) = 0,031$ $p > .8$) nor a significant interaction between these variables was obtained ($F(1,23) = 1,95$ $p > .1$). These results suggest that the analysis of ORs is resource demanding no matter the particular context they are inserted in. No evidence was obtained that preempting the activation of the subject of the relative clause can reduce the cost of reactivating the head of an OR. Methodological questions are raised in accounting for the apparently conflicting results. These results are further discussed in the light of current sentence processing models with the aim of reconciling an autonomous parser with the possibility of the thematic relations in ORs being anticipated.

(1) O banqueiro que [irritou o advogado] joga tênis todo sábado.
The banker that irritated the lawyer plays tennis every Saturday.
(2) O banqueiro que [o advogado irritou] joga tênis todo sábado
The banker that the lawyer irritated plays tennis every Saturday.

Back to Friday Poster Schedule

On-line processing of bi-aspectual verbs in Czech

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Introduction: As other Slavic languages, Czech distinguishes both grammatical (perfective and imperfective) and lexical aspect (cf. Schmiedtová – Flecken, 2008). Aside of perfective and imperfective verbs, there is a specific group of so-called bi-aspectual verbs which can be classified as both perfective and imperfective (cf. Veselý, 2008; Zinova et al., 2014 for bi-aspectuality in Russian). To our knowledge, there is no research on on-line processing of bi-aspectual verbs in any Slavic language. In the poster, we will present an experiment on the **on-line processing** of **bi-aspectual verbs** in Czech, or more precisely on aspectual coercion effects in the processing of sentences containing bi-aspectual verbs.

Study: We ran an experiment using the self-paced reading paradigm (participants read a sentence word by word, pressing a button to hide the previous word and reveal the next word; time spent to read each word is recorded). We focused mainly on those bi-aspectual verbs which can be either punctual or iterative, depending on the context (e.g. *vetovat* 'to veto'). The main question was if aspectual coercion (punctual > iterative) takes place if this verb is followed by a *dokud* ('until') clause which should block the punctual interpretation of the verb. As controls, we used durative bi-aspectual and imperfective verbs. All the verbs were transitive, they were in the past tense form and with plural objects. In other words, our experiment tested the compatibility of 3 types of predicates with *dokud*: normal imperfective predicates, bi-aspectual durative, and bi-aspectual punctual/iterative predicates. Furthermore, each predicate was tested in two cases: either on its own, or embedded under *nepřestávat* 'to not stop'. Embedding under *nepřestávat* made the *dokud* clause fully acceptable. For example, sentences with bi-aspectual punctual/iterative predicate were as:

Český premiér	(a) vetoval / (b) nepřestával	vetovat	nekvalitní	zákony,	dokud	
Czech prime-minister	(a) vetoed / (b) not-stopped	to veto	bad	laws	until	
novinář	chválil	jeho	odvahu.			
journalist	praised	his	courage.			

'The Czech prime minister vetoed/didn't stop vetoing bad laws until a journalist praised his courage.'

Our main question was whether the punctual/iterative bi-aspectual verbs do undergo aspectual coercion (i.e. if they are interpreted at first as punctual and then reinterpreted as iterative) or if they are initially underspecified in terms of their lexical aspect. The second question is the difference in processing of the two types of bi-aspectual verbs and "normal" imperfective verbs.

Results and discussion: On the 1st and the 3rd word after *dokud* the verb types interacted with the presence/absence of embedding. The difference of reading times (RTs) between the presence and absence of embedding was significantly greater in punctual predicates compared to imperfective and bi-aspectual durative predicates. Given that increased RTs indicate processing difficulties, we interpret this as showing that readers encounter problems when integrating *dokud* with unembedded **bi-aspectual punctual/iterative predicates**, but not in case with unembedded imperfective and bi-aspectual durative predicates. The results indicate that bi-aspectual verbs are immediately aspectually specified and that aspectual coercion is going on in the sentences with punctual/iterative verbs. The results of our experiment are in contrast to the aspectual underspecification hypothesis which says that semantic aspectual interpretation is not immediately specified during comprehension, as stated by Pickering et al. (2006). Our results are similar to Todorova et al. (2000), Piñango (2006) or Townsend (2013) who also found the effects of aspectual coercion.

Back to Friday Poster Schedule

Parallelism guides syntactic prediction for across-the-board extraction

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Summary. This project investigates the role of syntactic prediction in the processing of sentences with coordinate phrase across-the-board (ATB) extraction. Coordinate phrase ATB extraction involves a single filler that participates in multiple dependencies (e.g., 1a), and is subject to a parallelism constraint, which requires the gap sites to be in syntactically parallel positions. Previous work has shown that comprehenders prefer syntactically parallel coordinates when they are encountered [1] and that they actively search for multiple gap sites in sentences with ATB extraction. However, it remains an open question whether comprehenders can use the parallelism requirement on ATB extraction to generate more fine-grained predictions about the internal structure of upcoming material and restrict the search for multiple gap sites. Here, we present results from self-paced reading that show that the position of the gap site in the first coordinate of an ATB construction fully determines the presence or absence of a filled-gap effect, an index of predictive structure building [3], in the second coordinate. These results imply that comprehenders use parallelism requirements to generate highly detailed predictions about upcoming structure.

Design. We used the filled-gap effect design in (1) to test whether the parser uses the parallelism requirement to predict the position of the gap in the second coordinate (filler = bold; filled-gap region = double underline; gap = underscore). We manipulated the filler category (PP vs. NP), and within the NP-filler category, we manipulated the parallelism of the gap sites (+parallel vs. -parallel). The PP filler in (1a) must be interpreted after the direct object in both coordinates, which allows the direct object in the second coordinate to serve as a baseline for measuring the filled-gap effect in the same regions in (1b-c). The fillers in (1b-c) were always semantically plausible as potential direct objects of the verb to prevent search biases.

Predictions. If parallelism restricts the search for the second gap site, we expect a disruption associated with active gap creation in the filled-gap region (direct object) in (1c) relative to the same regions in (1a and b), i.e., {c} > {a = b}. If parallelism is not used, then we expect disruptions in the filled gap regions in both (1b) and (1c) relative to (1a), since this would be the first position that would allow the filler to be interpreted, i.e., {b = c} > {a}.

(1) a. The chemicals **with which** the technician sprayed the equipment __ and prepared <u>the beakers</u> __ were manufactured in China. (baseline)

b. The chemicals **which** the technician sprayed the equipment with __ and prepared <u>the beakers</u> with __ were manufactured in China. (+parallel)

c. The chemicals **which** the technician sprayed __ and prepared <u>the beakers</u> with __ were manufactured in China. (-parallel)

Results. Reading times showed robust sensitivity to the parallelism requirement. A reading disruption associated with active object gap creation was observed at the filled-gap region in (1c) relative to (1a) ($t = 2.74$), indicating that comprehenders were expecting parallel direct object gap sites. No such effect was observed for the parallel condition (1b) ($t < 1$), indicating that the parser was not expecting a gap site in the direct object position, since this would not be parallel with the first coordinate. Overall, we observed the following pattern at the filled-gap region: {c} > {a = b}, which is expected if parallelism guides prediction.

Conclusion. We argue that these results reflect the use of parallelism requirements to generate fine-grained predictions about the internal structure of upcoming material, such as verb sub-categorization (e.g., spray DP vs. spray DP with DP). More broadly, these results shed light on the contents of syntactic prediction and add to the increasing evidence that the predictive mechanism is flexible and powerful.

References. [1] Frazier et al., 2000. [2] Wagers & Phillips, 2009. [3] Stowe, 1986.

Back to Friday Poster Schedule

Passive Sentences can be Predicted by Adults

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How can adults process sentences as rapidly as they do? One suggestion is that context and frequency heuristics constrain the structures they consider. But what if this information is lacking or misleading, as is the case with passive sentences? Stromswold et al. (under review) found that adults unconsciously know whether sentences are active (1. *the X was pushing the Y*) or passive (2. *the X was pushed by the Y*) prior to the verbal inflection. Stromswold et al. and Rehrig et al. (2015) also found that passive verb stems are significantly longer than active verb stems, with the passive-active difference being greater for verb stems with voiced codas (e.g., *shove* vs. *push*) and continuant codas (e.g., *kiss* vs. *kick*). This gating study investigates whether adults use verb stem duration to predict whether a sentence is active or passive.

Method. A naïve native English speaker said active (1) and passive (2) sentences that contained one of 16 verbs that take the *–ed* passive inflection and are semantically reversible with animate agents and patients. Each verb was paired with two nouns, with each appearing once as a subject and object of an active and a passive sentence, for a total of 32 actives and 32 passives. Sentences were truncated before the inflection (e.g., *the cow was push-*), and 38 participants listened to the truncations and chose if they were fragments of actives or passives.

Results. Participants chose the correct completion for 66% of the sentence fragments, with 25 performing at above chance level and 13 performing at chance level. ANOVAs revealed participants were more accurate on passives than actives ($p < 0.005$) and on verb stems with voiced than unvoiced codas ($p < 0.001$). Syntax and coda voicing interacted ($p = 0.001$), with higher accuracy on actives with unvoiced codas ($p < .0001$, Figure 1). Accuracy was higher for verb stems with non-stop codas than stop codas ($p = 0.008$). Syntax and coda manner of articulation interacted (p = 0.01), with higher accuracy on actives with non-stop codas (p < 0.001, Figure 2). Consistent with participants using verb stem duration to predict upcoming structure, syntax and accuracy interacted ($p < .0005$), with verb stems being 29 ms shorter on participants' correct active trials than their incorrect active trials ($p < .0001$) and 25 ms longer on participants' correct passive trials than their incorrect passive trials ($p < .0001$, Figure 3).

Discussion. These results suggest that when adults hear ambiguous sentence fragments, they can use verb stem duration to predict whether the sentence is active or passive. The ability of adults to use early probabilistic acoustic cues to predict what the syntactic structure of a sentence will be while the sentence is morphosyntactically ambiguous greatly reduces the burden of sentence processing because it means that people can use bottom-up information to constrain the number of parses they build as a sentence unfolds.

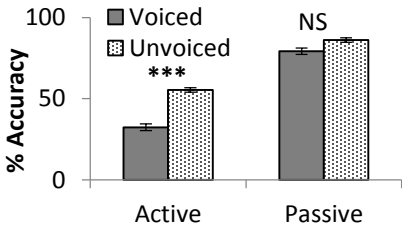

Figure 1. Coda Voicing and Accuracy

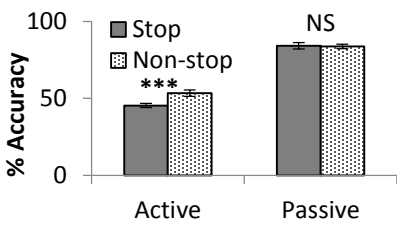

Figure 2. Coda Manner and Accuracy

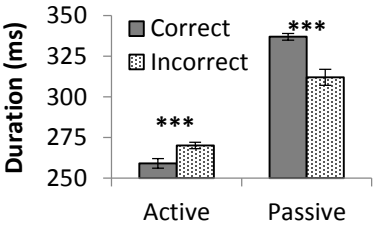

Figure 3. Accuracy and Verb Stem

References

Stromswold, K., Kharkwal, G., Sorkin, J. E., & Zola, S. (under review). Tracking the elusive passive: The processing of spoken passives.
Rehrig, G., Beier, E., Chalmer, E., Schrum, N. & Stromswold, K (2015). Robust acoustic cues indicate upcoming syntactic structure in active and passive sentences. Poster presented at CUNY Sentence Processing Conference

Back to Friday Poster Schedule

People are better at taking the perspective of non-native speakers

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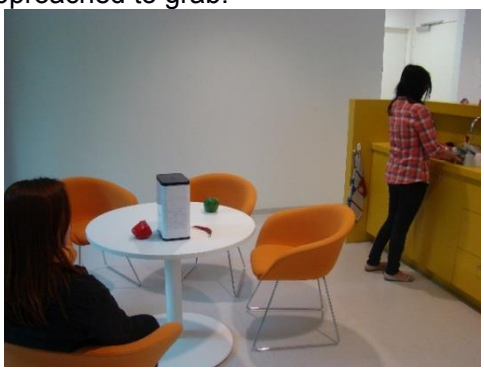
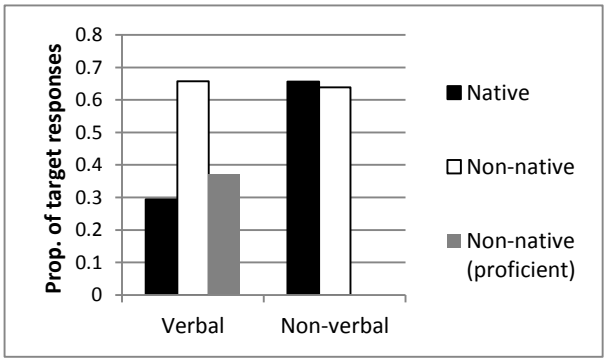
Successful social interaction requires recognizing that others' perspectives may differ from one's own. Yet people sometimes fail to take others' perspective and instead rely on their own (Keysar et al., 2000 but see Brown-Schmidt & Hanna, 2011). Counter-intuitively, there is some evidence to suggest that people are better at taking the perspective of dissimilar others (Savitsky et al., 2011; Todd et al., 2011). Further research shows that when listening to non-native speakers, people increase their reliance on context and on predictive processes - two tendencies that could boost perspective taking – as an adaptive response to the lesser reliability of the language of non-native speakers (Lev-Ari, 2015). We therefore hypothesized that (1) listeners would be better at taking the perspective of non-native than native speakers, and that (2) this advantage would be reduced when processing non-native speakers' nonverbal rather than linguistic behavior, or (3) if the non-native speaker has native-like proficiency.

To test these predictions, 180 participants read a story about a woman cooking at the counter while her friend sits at a table behind her. There were 3 peppers on the table: a green bell pepper, a red chili pepper, and a red bell pepper. Crucially, a tall box hid the red bell pepper from the view of the woman at the counter (see Figure). Therefore, when the cooking woman asks for the *red pepper*, she could only refer to the red chili pepper. The story had 5 versions differing in the identity of the cooking woman: Molly with a Boston accent, Mingying with a Chinese accent, or Mingying with native-like proficiency, and in whether the woman asked her friend for the target object (verbal condition), or approached the table to grab it (non-verbal condition). Participants needed to indicate the object the woman asked for or approached to grab.





Results supported our hypotheses: In the verbal condition, participants were significantly better at taking the perspective of the non-proficient non-native speaker than that of the native speaker or the proficient non-native speaker, with the latter two not being different from one another. In contrast, there was no such difference in the non-verbal condition, leading to a significant Speaker x Behavior interaction. A follow-up experiment, in which all peppers were visible to all, showed no difference in responses with a native and a non-native speaker, indicating the pattern in Experiment 1 is not due to differences in how the term *red pepper* is interpreted when produced by a native vs. a non-native speaker.

These studies thus show that linguistic expectations can influence perspective taking, and thus have implications for interactions between native and non-native speakers.

Back to Friday Poster Schedule

Person blocking effects in the processing of English reflexives

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Reflexive pronouns are usually constrained by Principle A to refer to c-commanding referents within the local clause [1]. A large body of psycholinguistic research has found that this constraint is applied very early in antecedent resolution: Principle A non-conforming referents are not considered when processing reflexives [2-4]. However, recent studies call this generalization into question, finding that ungrammatical reflexives are processed more easily when a feature-matched, non-local referent is present [5,6]. While these effects might be captured with an error-prone retrieval mechanism [7,8,i.a.], we argue instead that an alternative grammatical representation associated with the reflexive form gives rise to a Principle A exempt interpretation. Specifically, we present evidence that sensitivity to Principle A non-conforming referents is constrained by the availability of a logophoric interpretation. Logophors are pronouns which refer to the entity whose speech/thoughts are represented in an utterance (i.e. the perspective center), and are often homophonous with reflexives forms [9,10]. Previous work [11] has found that reflexives are more sensitive to the phi-features of non-local speakers than to those of non-local perceivers, as expected if the reflexive form is being interpreted logophorically. In this study, we test another consequence of logophoricity: person blocking effects. In some languages, non-local interpretations of reflexive forms become unavailable in the presence of 1st/2nd person pronouns (e.g. Mandarin *ziji* [12]). These "person blocking" effects have been explained as a consequence of the logophoric nature of long-distance anaphors: 1st/2nd person pronouns tie an utterance to the perspective of the speaker/addressee, preventing 3rd person referents from acting as perspective centers capable of binding the logophor [13]. If sensitivity to non-local referents arises from a logophoric interpretation, the presence of a 1st person pronoun should attenuate the effect. To test this, we constructed sentences like (1), manipulating the match of a reflexive with local (**embedded:***Name, it, I*) and non-local subjects (**matrix:**±*match*) in a 3×2 design. Context sentences introduced referents which co-varied with the target's embedded subject. We expect reflexives to be sensitive to the matrix subject's gender when the local subject is a poor match, and not first-person.

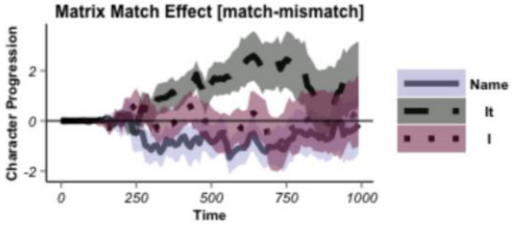
(1) **Context:** { Some movie critics / The salacious tabloid / I } said some very unflattering things about hollywood icons.

Target: The { actress / actor } | said that | { Joanna / it / I } | horribly | misrepresented | herself | in the article | ...

36 items patterned on (1) were included in an eye-tracking while reading study (n=36). In go-past times at the reflexive, mixed effects modeling revealed an interaction of embedded and matrix match (β=135; t=2.13), such that reflexives were read uniformly slowly after *I*, but slowly after *it* only when the matrix subject mismatched the reflexive's gender. A cumulative progression analysis [14] also revealed a significant matrix-match effect (difference between matrix ±*match* conditions) only for *it* sentences: starting at the reflexive, gender-matched matrix subjects only facilitated progression through the sentence when the embedded subject was *it*.

		Embedded Subject		
		Name	*it*	*I*
Matrix	+*match*	375(24)	378(30)	493(46)
	−*match*	362(31)	492(40)	476(40)

Table 1: Go-past reading time at the reflexive region



Combining the results of the present study with those of [12,15], a coherent picture emerges: sensitivity to non-local referents is contingent on the referent being a source of information, and is diminished in the presence of a first-person pronoun. This pattern strongly suggests that a logophoric interpretation of reflexive forms underlies Principle A exempt behavior in comprehension.

References: [1]Chomsky.(1986). [2]Nicol.(1988). [3]Sturt.(2003). [4]Dillon, Mishler, Sloggett & Phillips. (2013). [5]King, Andrews, & Wagers.(2012). [6]Parker & Phillips.(2014). [7]Lewis & Vasishth.(2005). [8]Van Dyke & McElree.(2011). [9]Sells.(1987). [10]Culy.(1997). [11]Sloggett & Dillon.(2015). [12]He & Kaiser.(2012). [13]Huang & Liu.(2001). [14]Kreiner, Sturt, & Garrod.(2008). [15]Kaiser, Runner, Sussman, & Tanenhaus.(2009).

Back to Friday Poster Schedule

Phoneme ambiguity is reflected very early in primary auditory cortex

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***Introduction*:** From an information theoretic perspective, spoken communication is a game of disambiguation. Its success relies upon the integration of incoming information to update best estimates of the message being received. When the identity of a phoneme is uncertain, it is not just preceding context that aids its recognition - context occurring *after* the phoneme is also used to disambiguate. Sherman (1971) and Connine (1991) respectively found that context occurring three words downstream of a missing or ambiguous phoneme successfully aided phoneme (and therefore word) disambiguation:

*The *eel on the car*	**[restore wheel]**	*The *eel on the orange*	**[restore peel]**	(*Sherman, 1971)*
I repaired the _ent in the cadillac	**[perceive dent]**	*I repaired the _ent in the campground*	**[perceive tent]**	*(Connine, 1991)*

These results suggest that perceptual commitment is delayed in the presence of an ambiguous phoneme, such that the percept remains malleable and influenceable by incoming information. Evidence supports that features of a phoneme are recognised ~100 ms after onset in the posterior superior temporal gyrus (pSTG: Chang et al., 2010; Mesgarani et al., 2014). Correspondingly, if phonological ambiguity is encoded in terms of shared/competing phonetic features, activation of pSTG should be modulated as a function of this ambiguity: An increase would suggest that multiple feature detectors are activated simultaneously; reduction would support that detectors favour exemplar phonetic features. As a sentence may not be fully comprehended until disambiguation, crucial to understanding sentential processing is therefore determining how ambiguity is encoded by the system.

***Method*:** 22 native English speakers performed 2AFC consonant identification on consonant-vowel syllables during magnetoencephalography data acquisition. Stimuli were natural speech pairs, digitally morphed to span an 11-step continuum of voice onset times (VOT; p-b, t-d, k-g) and places of articulation (PoA; p-t, t-k).

***Results*:** The behavioural results replicated previous findings: Consonant selection was sharply categorical, and reaction-times increased at the boundary between phonological categories (*Fig. 1A)*. Amplitude of activation in Heschl's gyrus (HG) ~50ms post-onset also increased with proximity to the phoneme boundary for VOT (*Fig. 1B).*

***Conclusion*:** The data show that sensitivity to the phonological ambiguity of a speech sound is reflected in very early activation of HG, suggesting that processing relevant to phonological categorisation may begin earlier than previously considered. Specifically, ambiguous stimuli elicited more activity, indicating that ambiguity is reflected by the simultaneous activation of phonetic feature detectors.

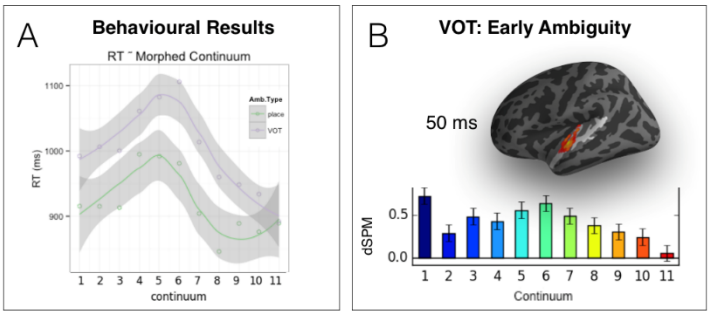

Figure 1. Summary of behavioural and neural results. Higher numbers on the continuum refer to shorter voicing latencies for VOT, and more fronted articulation for PoA. A: Reaction times as a function of the continuum; B: Activity averaged over HG at 50 ms, for VOT continuum.

Back to Friday Poster Schedule

Pitch shape modulates the time course of tone vs. pitch accent processing in Mandarin Chinese

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This study examined the time course of tone vs. pitch accent (PA) processing in Mandarin Chinese spoken language comprehension. In a tone language such as Mandarin Chinese, the same pitch contour conveys information about both lexical meaning via tones (pitch shape) and sentence-level meaning (e.g., focus, or prominence) via PAs (mainly through pitch range). There thus comes the question of which information (tone vs. PA) is processed earlier. Li, Yang, and Hagoort (2008) showed that tone violations elicited an N400 effect 90ms earlier than PA violations during spoken discourse comprehension, which they suggested as evidence for lexical meaning being processed earlier than sentence meaning. However, two issues merit further research. First, they did not control for specific tones (i.e. Tone 1, Tone 2, etc.), leaving open the issue of whether the tone advantage was modulated by tone shape. Second, as they have suggested, there is the need for a gating task to empirically establish the relative moments in time that tone and PA perception take place.

In the present study, we undertook the task suggested by Li et al. and employed the auditory gating paradigm (Grosjean, 1980, 1996), which was run electronically on E-Prime 1.0. Forty native Mandarin Chinese speakers were recruited for the experiment. Experimental items (see examples below) included 12 sets of short conversations consisting of Interlocutor A's question that elicited either a broad or a narrow focus context, and Interlocutor B's response, which included the target word either at the beginning or the end of the sentence. Sentence-initial target words were segmented in 50ms increments starting from its end, and sentence-final target words were segmented from its beginning. Target words were Tone1, Tone2, or Tone4, and received either a correct or an incorrect PA.

A (broad focus context): 他 说 什么？ *"What did he say?"* **B** (target word at the beginning; Tone1): **花** 很 漂亮。 **hua1** hen piaoliang ***flower*** *very* *beautiful* *"**Flowers** are very beautiful."*	**A** (narrow focus context): 他 正在 欣赏 什么？ *"What is he enjoying?"* **B** (target word at the end; Tone4): 他 正在 欣赏 **画**。 ta zhengzai xinshang **hua4** *he* *is* *enjoy* ***picture*** *"He is enjoying **pictures**."*

Linear mixed effects analysis on log-transformed percentage of the target word needed for correct isolation of either tone or PA showed that for sentence-final target words, there was no time advantage of tone vs. PA perception for Tone1 target words, but a significant tone advantage for Tone2 and Tone4 words. For sentence-initial target words, there was no time advantage of tone vs. PA for target words containing Tone1 or Tone4, but there was a significant PA advantage for Tone2 words. These results confirmed our initial hypotheses that tone shape modulates the time course of tone vs. PA processing. Different pitch shapes affect how early tone information is accessed in relation to PA information. In identifying sentence-final accentuated target words of Tone 1, which is a high level tone, participants already have access to the expanded pitch range information (F_0 maxima) from the very first pass. For sentence-final accentuated target words of contour tones (Tone 2 or 4), however, F_0 maxima information is realized later (and especially later for Tone2 words), thus rendering a tone advantage. For sentence-initial accentuated Tone2 target words, F_0 maxima is available in the very first pass, whereas more gates are needed for listeners to perceive a slope in the contour and thus establish the Tone2 identity, rendering a PA advantage. Results in this study provided evidence for parallel processing of tone (lexical) and PA (semantic and pragmatic) information during online spoken language comprehension.

Back to Friday Poster Schedule

Prediction and inhibition of syntactic structure: evidence from *either (of the)… or*.

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The nature of predictions made during real-time sentence comprehension has been a subject of longstanding debate in the psycholinguistics literature. Staub & Clifton (2006) show that the presence of the word *either* enables readers to predict an upcoming disjunction, giving rise to facilitated processing of the disjunction when it arrives. In this study, we ask whether a lexical item (*either*) that is associated with a syntactic structure (a disjunction) facilitates the processing of that structure, even when it is clear that the lexical item cannot actually participate in the structure in that instance. To test our hypothesis, we examine the processing of sentences with *either* used in a partitive construction, e.g., *either of the landscapers…* We present evidence for a brief stage of facilitated processing followed by a later penalty for *either* when it cannot be part of a disjunctive structure.

A Either (of) the landscapers/ will borrow/ a rake/ or the manager$_4$/ will buy$_5$/ one at/ the store.
B (One of) the landscapers/ will borrow/ a rake/ or the manager$_4$/ will buy$_5$/ one at/ the store.

Eye movements during reading. To determine how the presence of a non-participating *either* affects real-time processing, we conducted a study of eye movements during reading (N_{subj} = 43 undergraduate students) manipulating the presence or absence of *either* as well as the structure of the initial DP (plain DP, vs. partitive). See A-B for an example item set. To prevent participants from learning associations over the course of the experiment, we included several distractor sentences with *either* that did not contain a disjunction, and some that included disjunctions of NPs. The pattern of results suggests an initial stage during which the presence of *either*, even in partitive form, facilitates processing of the later disjunction, and a later stage during which the partitive form of *either* gives rise to a processing penalty. Evidence for the initial stage includes Go-Past Time on Region 4 (*or the manager…*), where there was a main effect of the presence/absence of *either* (*t* = -2.983, based on an LMEM with sum-coded fixed effects and random intercepts and slopes for fixed main effects over subject and items) but no significant interaction between the factors. First-Pass Time on this region shows the same pattern (*t* for the main effect of *either* = -2.097). Evidence for the late penalty comes from Go-Past Time on later regions of the sentence, such as Region 6, where there is no longer an effect of *either* and merely a main effect of the presence of a partitive (*t* = -2.148). Second-pass Time on earlier regions of the sentence, such as Region 2, shows an interaction such that non-participating *either* patterns with the *no*-either conditions (interaction *t* = -2.397).

Rating study. In a naturalness rating study (N_{subj} = 54, via AMT) using the same materials, there was an interaction such that sentences with *either* in a partitive construction had the lowest ratings (on a scale from 1 to 7, see table), while sentences with *either* as a part of the disjunction had the highest ratings (*t* = -12.89). This result shows a penalty for the presence of *either* in a partitive structure in readers' ultimate judgments of sentence naturalness.

Our pattern of results is consistent with an interpretation in which part of the facilitation found by Staub & Clifton is due to activation of the disjunctive structure due to its association of the lexical item *either*. However, it is also consistent with an interpretation under which readers make, and then cancel, a prediction of an upcoming disjunctive structure. Such a prediction may linger, giving rise to the initial facilitation that we find. The late penalty for ***either of the…or*** is interpreted as an inhibitory effect of the canceled prediction, showing that readers ultimately disprefer having *either* co-present with a disjunctive structure in which it cannot participate.

	Rating (SE)	GPT, R4	GPT, R5	GPT, R6	SPT, R2
Either the landscapers…	6.47 (.09)	610 (32)	403 (21)	598 (50)	156 (23)
Either of the landscapers…	4.99 (.20)	647 (34)	472 (31)	738 (75)	209 (28)
The landscapers…	6.20 (.11)	705 (40)	429 (25)	432 (76)	180 (32)
One of the landscapers…	6.11 (.11)	708 (31)	454 (25)	585 (61)	160 (25)

Back to Friday Poster Schedule

Prediction failure blocks the use of local semantic context

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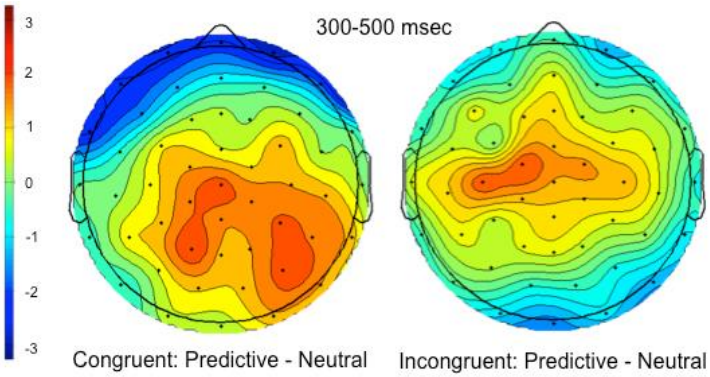
Before the accumulation of recent experimental evidence for predictive mechanisms in language comprehension, prediction was thought to be too prone to failure and perhaps too costly to be of use to the language comprehension system (Gough, Alford, & Holley-Wilcox, 1981; Stanovich & West, 1981, 1983). Semantic context is now widely assumed to trigger predictions for upcoming words (see Kutas, DeLong, & Smith 2011 and Van Petten & Luka 2012 for review); however, questions about the costs of prediction failure and how the comprehension system recovers from such failures have not yet been revisited. We investigated whether recovery from prediction failure is rapid or protracted. A **rapid recovery** mechanism predicts immediate use of local semantic context to facilitate a new word regardless of recent prediction failure. A **protracted recovery** mechanism predicts no use of local semantic context to facilitate a new word following prediction failure.

We investigated these two possibilities via the N400 as an index of lexical access facilitation. We manipulated sentences in Italian with high cloze noun completions (.76 average cloze) in a 2 (article gender congruence) x 2 (adjective predictability) design. Following research manipulating gender agreement as an early cue for prediction failure (Otten & Van Berkum, 2008; Van Berkum, et al., 2005; Wicha, et al., 2004), article gender was manipulated to be either *congruent* or *incongruent* with the expected noun's gender such that an incongruent article unambiguously cued a prediction failure. To manipulate local semantic context, an adjective was inserted between the article and noun that was either *predictive* or *neutral* with respect to the upcoming noun. We recorded EEG from 30 native Italian speakers while they read 40 sentences (10/condition) using word-by-word rapid serial visual presentation (200 fillers). Comprehension questions were asked after each sentence. EEG was acquired on a 64-channel ANT Neuro system. ERPs were timelocked to the noun onset and preprocessing and analysis was done using EEGLAB/ERPLAB in Matlab and R.

Inspection of ERPs elicited by nouns uncovered an N400-like centro-parietal component between 300-500 ms. A quadrant analysis revealed that nouns occurring after predictive adjectives were less negative than after neutral adjectives, but only when article gender was congruent with the predictive context (Posterior ROI: Congruent, Predictive 0.845 □V vs. Neutral 0.023 □V, t=2.650). Nouns occurring after incongruent articles did not significantly differ (Posterior ROI: Incongruent, Predictive -0.102 □V vs. Neutral 0.090 □V, t=-0.619).

These results suggest that prediction failure affects the use of local semantic context, blocking its immediate use in facilitation of an upcoming word. This suggests that recovery from prediction failure is not a rapid, but protracted process. This research supports the idea that there are costs to prediction failure and that the benefits and costs of prediction need to be revisited in our understanding of the role of predictive mechanisms in language comprehension.



Back to Friday Poster Schedule

Preverbal and clause-final negation in Spanish/Palenquero bilinguals

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In some languages, like a creole spoken in San Basilio de Palenque, Colombia known as Palenquero, listeners must wait until the end of the clause to receive negation information (1). This differs from negation structures in English (3) and Spanish (2), where the negator comes before the verb. Negative sentences seem more difficult to process than affirmative sentences because the logical role of the negator must be resolved [1; 2; 4], but this may be modulated by a supportive pragmatic context[3;5]. The present study examined the way bilingual Spanish/Palenquero speakers process both preverbal Spanish negation and clause-final Palenquero negation by comparing within and across languages to determine if clause-final negation causes greater processing challenges as a result of its position in the sentence.

(1) Palenquero: *Ele sé asé kumina gueno nú*$_{NEG}$.
(2) Spanish: *Ella no*$_{NEG}$ *sabe hacer buena comida.*
(3) English: She does not$_{NEG}$ know how to make good food.

38 Spanish/Palenquero bilinguals living in Colombia participated in two experiments. The first was a forced-choice, audio-visual task. Participants saw 36 images of local items and heard a sentence recorded by a native Spanish/Palenquero bilingual. The participants chose whether the auditory stimulus matched the image or not and reaction times were recorded. Half of the stimuli were in Spanish and the other half were in Palenquero. The stimuli were counterbalanced such that half were affirmative phrases and half were negative phrases. In the Spanish sentences, the negation appeared before the verb and in the Palenquero sentences, at the end of the clause. The second experiment was a translation verification task. This was used to determine whether affirmative and negative sentences were correctly comprehended. Participants listened to two sentences and determined whether their meaning was the same. When the sentences differed, one was affirmative and one was negative. Of the 20 sentences, half matched.

As expected, the audio-visual task revealed that in both languages, participants had significantly faster reaction times when stimuli were affirmative (t(981.21)=6.60; p<0.001), regardless of the visual context. Spanish affirmative sentences were responded to faster than Palenquero affirmative sentences (t(547.85)=3.57; p<0.001), but there is no difference in reaction times in responses to negative sentences when comparing the preverbal negation of Spanish and the clause-final negation of Palenquero. Turning to the translation verification task, as expected, participants were more accurate when the sentences matched than when they differed (t(340.51)=3.40; p<0.001), but there was no difference across languages. Participants interpreted negation with equal ease in both preverbal Spanish and clause-final Palenquero contexts.

In sum, Spanish/Palenquero bilinguals are slower at processing negative sentences than affirmative sentences, but they show equal ease in both Spanish and Palenquero, regardless of place of negation. Clause-final negation does not appear to hinder sentence processing any more than preverbal negation.

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Back to Friday Poster Schedule

Priming of quantifier scope resolution reveals differences between each and every one, but similarities across all

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Quantifier words like EACH, EVERY, ALL and THREE specify what relationships hold between the sets of entities, events and properties denoted by other words. When two quantifiers are in the same clause, they create a systematic ambiguity. "*Every kid climbed a tree*" could mean that there was only one tree, climbed by all, or many different trees, as many as one per climbing kid. In the present study, participants chose a picture to indicate their preferred reading of different ambiguous sentences containing each of the four quantifiers above. In Experiment 1, we found large systematic differences in preference between the quantifier words (all *p*s<0.0001). In Experiment 2, we forced the choice of a particular reading of one sentence by showing participants a picture that matched one reading and a picture that mismatched both readings. We then tested how this affected participants' reading preference of a subsequent target sentence, when given an ambiguous choice, as in Experiment 1. We found a priming effect for all quantifiers, but only when the prime and target sentences contained the same quantifier (see Figure 2). For example, ALL-A sentences prime other ALL-A sentences, while EACH-A primes EACH-A, but sentences with EACH do not prime sentences with ALL or vice versa. In Experiment 3, we ask whether the lack of priming across quantifiers could be due to the two sentences sharing one fewer word. We find that changing the verb between the prime and target sentence does not reduce the priming effect. In Experiment 4, we discover one case where there is priming across quantifiers – when one number (e.g. THREE) is in the prime, and a different one (e.g. FOUR) is in the target. We discuss how these findings relate to linguistic theories of quantifier meaning and the division of labor between conceptual content and combinatorial semantics.

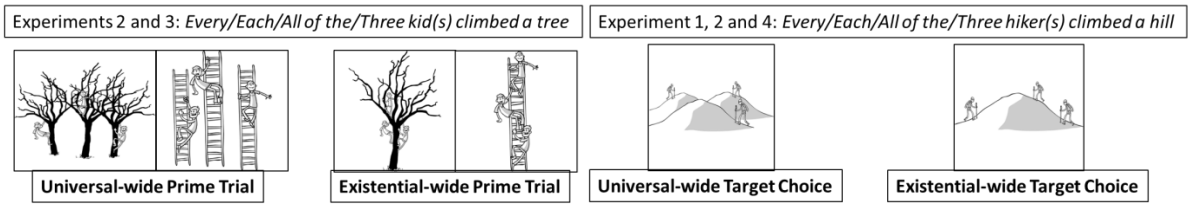

Figure 1. On the left, sample prime sentences and picture pairs. On the right, a sample target sentence and picture pair. Prime trials in Experiment 4 depicted a different number of nouns than in the target. Target trials in Experiment 3 depicted a different verb than in the prime.

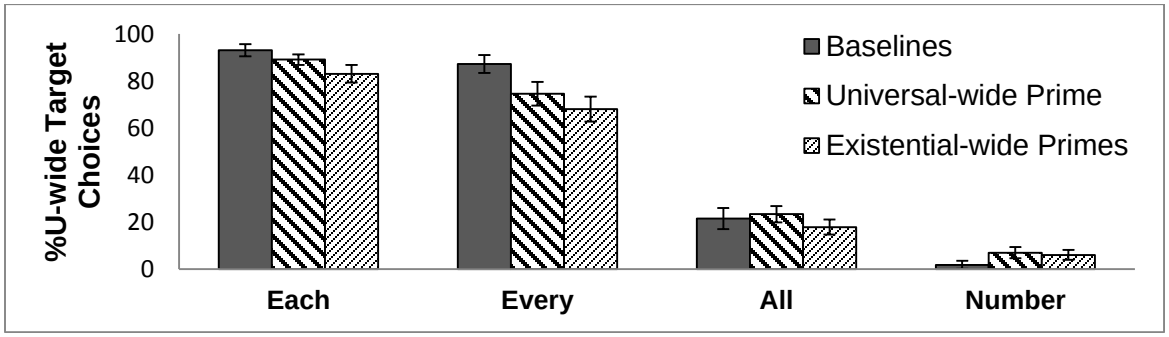

Figure 2: The Within-Quantifier conditions of Experiment 2 alongside the baselines from Experiment 1. Error bars indicate 95% confidence intervals, averaged across items with subjects as the random variable.

Back to Friday Poster Schedule

Print exposure modulates effects of repetition priming during sentence reading

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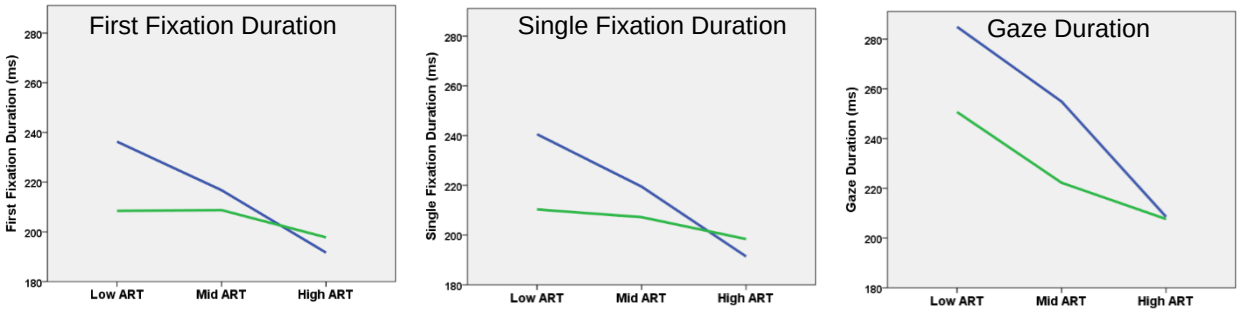
Individual readers vary greatly in the quality of their lexical representations[1] and consequently vary in how quickly and efficiently they can access orthographic and lexical knowledge. This variability may be explained, at least in part, by individual differences in exposure to printed language, as practice at reading promotes the development of stronger reading skills[2]. The current eye-tracking experiment tests the hypothesis that the efficiency of word recognition during reading improves with increases in print exposure by determining whether the magnitude of the repetition priming effect is modulated by individual differences in print exposure. Previous work has shown that repetition facilitates reading times[3-5], and this effect is greater for difficult-to-access words (i.e., larger repetition effects for low-frequency versus high-frequency words)[6]. Readers with low print exposure should have more difficulty in word recognition than those with high print exposure and for that reason should show greater facilitation due to lexical repetition.

Repetition was manipulated across pairs of unrelated sentences that were presented on consecutive trials. The target word was a low-frequency proper name that was either repeated from the previous sentence or new. Items were counterbalanced such that all names served as both prime and target (see example). 48 individuals participated in the eye-tracking experiment and completed the Author Recognition Test[7-9], which served as our measure of print exposure.

Prime: The TV was on all night even though [Selena/Blythe] had fallen asleep very early.
Target: Yesterday morning, I made sure to thank [Selena/Blythe] for the Christmas gift.

Results of linear mixed-effects regression models revealed robust effects of repetition on measures reflecting early stages of word recognition (first fixation duration, single fixation duration, gaze duration), as well as measures reflecting later processing difficulty (proportion of first-pass regressions, regression-path duration). Crucially, the magnitude of the repetition effect was modulated by print exposure, but only for early measures (FFD: $t = 2.45$; SFD: $t = 3.03$; GZD: $t = 2.06$). As shown in the figures below, the repetition effect was most robust for low ART readers and was absent altogether (or numerically reversed) for high ART readers. The results support the notion that repetition priming effects during reading reflect enhanced lexical retrieval processes: Readers with lower levels of print exposure and thus lower-quality lexical representations are the individuals who typically have the most difficulty recognizing words and thus the greatest room to benefit from repetition. Further, the interaction between ART and repetition suggests that print exposure is not just an index of general reading speed, but rather higher levels of print exposure are associated with an enhanced ability to access lexical knowledge and recognize words during reading.



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Back to Friday Poster Schedule

Prior experience influences predictive processing in novel sentences

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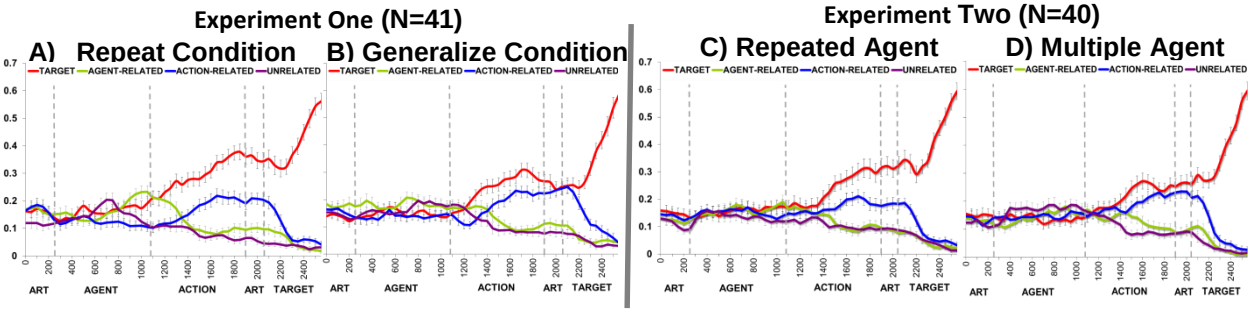
The majority of work on predictive processing in spoken language has, by design, employed materials that describe events that are familiar and easily understood to the majority of listeners. However, everyday spoken language comprehension requires the listener to fluently interpret utterances that accompany unfamiliar situations. How are anticipatory mechanisms of sentence processing deployed in these circumstances? The current project explores this issue by assessing how listeners generalize from prior experience as they interpret novel sentences in an eye-tracked sentence processing task. The amount and structure of the listener's prior experience with similar events is controlled via a learning paradigm where listeners encounter novel connections among agents, actions and objects in a cartoon world.

In experiment one, participants initially heard stories accompanied by pictures portraying two agents (e.g. rabbit, butterfly), who each complete the same two actions (e.g. eating, wearing) and with different objects (e.g., the butterfly eats the *cake* and wears the *hat,* the rabbit eats the *ice cream* and wears the *sunglasses*). All plausible combinations of agent, actions and objects were rotated across versions. To determine if this initial story presentation was sufficient to support subsequent incremental sentence interpretation, we then measured eye-movements to the objects of these novel relationships while participants heard sentences that were either identical to the prior event context like "*The butterfly eats the cake*." (Repeat condition) or depicted a similar agent in the same event like "*The ladybug eats the cake* " (Generalize condition). In addition to the **target picture (CAKE)**, the participants also saw the other four objects that served as **Agent-Related (HAT)**, **Action-Related (ICE CREAM)**, or **Unrelated (SUNGLASSES)** distractors. The results suggested that participants did generate predictive fixations towards the sentence-final theme in the Repeat condition (Fig 1a), but not the Generalize condition (Fig 1b).

The goal of experiment two was to explore how additional training might facilitate generalization of initial event representations. On the one hand, some theoretical accounts of generalization suggest that variability may facilitate generalization of novel syntactic constructions (Gómez, 2002), whereas other proposals suggest that having a high frequency exemplar may support this process (Goldberg et al., 2004). To address these varying accounts, participants received a second exposure to each event via the same learning paradigm where the story was either 1) Repeated with the same agent (Repeated agent condition; *rabbit, butterfly)*, or (2) Repeated with new, but similar agents (Multiple agent condition; *hamster, ant*). In this case, participants showed clear evidence of prediction when the same story was simply repeated with identical agents (Fig 1c), but this predictive effect was not present when multiple agents were presented with the same event.

These findings shed light on the conditions where listeners leverage prior experience while interpreting novel linguistic signals in everyday speech. Specifically, the findings suggest that event generalization during incremental processing is supported by extended experience and that repeated exposure to a single event (rather than exposure to multiple, related events) may be particularly useful in facilitating linguistic processing in novel circumstances.



Back to Friday Poster Schedule

Proactive interference in anaphoric dependency resolution: Evidence from Chinese

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Resolving reflexive-antecedent dependencies requires the parser to consult syntactic constraints like c-command within the binding domain (Sturt 2003; Xiang et al. 2009; Dillon et al. 2013). The retrieval target can also be accessed by matching non-syntactic cues, e.g. gender and animacy (Badecker & Straub 2002; Felser et al. 2009; Cunnings & Felser 2013). Experimental evidence supporting cue-based retrieval (Lewis & Vasishth 2005) often comes from the interference effect, i.e. processing slow-downs if a feature-match distractor is present.

In glossed Chinese examples (a-b), the intervening animate noun 'protester', although locates within an adjunct, causes reading time delay at regions following the non-locally bound reflexive *ziji* 'self' because *ziji* requires an animate antecedent (Chen et al. 2012). This interference effect is retroactive, i.e., distractors come after the antecedent. Recent work by Jäger et al. (2015) provides additional support for cue-based retrieval in Chinese reflexive processing. In their study, participants memorized the order of NP distractors (animate or inanimate) before reading the stimuli sentence. Since distractors appear before the antecedent, the interference effect they found at *ziji* is proactive.

In a self-paced reading experiment (N=60), we placed the distractor and the antecedent within one item sentence and tested both retroactive and proactive interferences. Conditions (a-d) illustrate a 2X2 design in which both the distractor animacy and the linear order of distractor-antecedent are manipulated. We found that the effect of interference type (proactive vs. retroactive) was significant at the word after *ziji*: retroactive conditions (a&b) were read slower than proactive ones (c&d). This result is consistent with what cue-based retrieval models like ACT-R would predict since the activation of antecedent decays when more materials, including the distractor, intervene between the antecedent and the reflexive. Models like ACT-R also predict that resolving the *ziji*-antecedent dependency is subject to interference arising from the matched animacy cue, regardless of its type. The effect of interference emerged two words after *ziji*. Conditions with an animate distractor (b&d) were read slower than those with an inanimate distractor (a&c). Lastly, the interaction between the interference size and the interference type was not statistically significant. It is possible that the stronger activation of retroactive distractors was neutralized when the prominence of distractor played a role (Engelmann et al., submitted), since in the current setting proactive distractors were within a sentence-initial PP.

The results reported add to existing evidence in support of cue-based retrieval in resolving anaphoric dependencies. A feature match (here, animacy) between the distractor and the reflexive *ziji* leads to additional processing difficulties even when the distractor appears first.

(a-b) Retroactive interference; **inanimate | animate distractor**	**Opposition-leader** indicate this-announcement **[**at **protest | protester** out of control time**]** tortured ***ziji*** whole three-days...
	'The opposition leader indicated that this announcement tortured him three whole days when the protest | protester was out of control...'
(c-d) Proactive interference; inanimate | animate distractor	[At **protest | protester** out of control time] **opposition-leader** indicate this-announcement tortured ***ziji*** whole three-days...
	'When the protest | protester was out of control, the opposition leader indicated that this announcement tortured him three whole days...'

Table 1: RTs (ms) and results of statistical analyses (LME) at *ziji* and spillover regions

	a	b	c	d	RT Differences		Significant effect found
ziji	379	369	363	376	b-a: -10	d-c: +13	n.s.
ziji+1	369	401	344	359	b-a: +32	d-c: +15	Interference Type: t = -2.2
ziji+2	358	380	350	381	b-a: +22	d-c: +31	Interference: t = 2.4

Back to Friday Poster Schedule

Processing *at least* in ignorance contexts is costly: Evidence from eye movements

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It is an established fact in the recent semantics/pragmatics literature on numeral modifiers that *at least* gives rise to so-called ignorance inferences, like the following reading of (1): `the speaker is ignorant about the exact number n of movies, i.e., whether $n = 20$ or $n > 20$'.

(1) Sophia watched *at least* 20 movies this year.

There is an ongoing theoretical debate whether these inferences are part of the semantics of *at least* (e.g., Geurts & Nouwen, 2007) or they are derived via a pragmatic mechanism (Büring, 2008; Coppock & Brochhagen, 2013, *i.a.*). Quite some experimental research has been done on this (e.g., Cummins & Katsos, 2010; McNabb & Penka, under review), involving offline tasks indirectly testing for ignorance inferences. Westera & Brasoveanu (2014) is the only online study of ignorance effects (with *at most* & *less than*), studying their context-sensitivity during self-paced reading. **Experiment.** We ran an eye-tracking reading experiment in Dutch (N=30), aiming to directly examine the time course of the ignorance interpretation of a sentence with *at least* manipulating the context. This manipulation was inspired by Breheny et al. (2006), who in a self-paced reading task measured reading times of a scalar term in a context triggering a scalar implicature, and in a context that did not trigger that implicature. They found a slowdown on the scalar term in the former condition, which they associated with implicature generation. A similar effect was found by Panizza et al. (2009), who tested the interpretation of bare numerals with an eye-tracking reading task with a similar context manipulation. In the present study, we had a context forcing an ignorance reading (Ignorance) and one that is compatible with the core meaning of *at least* (e.g., $n \geq 20$), but at odds with an ignorance reading (Authority), see translated item below. These contexts were preceded by the same introductory text (omitted here) and followed by the target sentence (glossed below):

Ignorance context: I'm not completely sure how it is exactly, but I'll tell you what my impression is.
Authority context: I know exactly how it is because he complained about it to me.
Target sentence: He { had to / has } *at least* twenty phone calls in the morning { deal / dealt } with.

We also manipulated the Verb in the target sentence, modal (*had to*) vs. AUX (*has*), to test a prediction by many in the literature, viz. that for ignorance to arise with a modal, *at least* needs to take wide scope (which is presumably costly, cf. Hackl et al., 2012). We had 32 test items and 92 fillers. **Results & Discussion.** Mixed-effects regression analyses revealed no significant effect in the CONTEXT region. There was a main effect of Verb in the VERB up to the last region in various measures (all $p < .05$), which is of little interest, as different words were used in the VERB and the last region. Interestingly, and besides the absence of other effects in AT LEAST, in TWENTY PHONE CALLS there was also a main effect of Context in right bounded, regression path, total reading, and re-reading times, and in re-reading probability (all $p < .05$), with Ignorance contexts being read slower and also more likely to be re-read compared to Authority. This is in line with a pragmatic analysis in which ignorance inferences have to be computed online and are costly, parallel to scalar implicatures. In subsequent analyses we investigated the possibility that the observed Context effects were confounded by the roundness of the numbers used or by their preciseness given the granularity level set by the respective nouns. That is, having an ignorant speaker utter *at least* with a non-round or a precise number, respectively, could be quite unnatural. These new analyses (reference levels: round number & imprecise number) too showed a main effect of Context in multiple measures (all $p < .05$): Ignorance contexts were costly in round and in imprecise numbers. There was no effect of Context in IN THE MORNING. Finally, we found no significant interaction, hence, no evidence indicating that ignorance with modal+*at least* involves an extra (costly) process. **Conclusion:** As in Breheny et al. and Panizza et al., we take the slowdown in Ignorance contexts after AT LEAST to be due to the derivation of a pragmatic inference, that of ignorance here.

Back to Friday Poster Schedule

Processing code-switching in Algerian bilinguals: Effects of language use, semantic expectancy and cognates

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Many studies corroborate the view that bilingual word recognition in sentences is affected by the lexical characteristics, the language used, and the semantic constraint of the preceding context. However, results obtained in studies on code-switching have been inconsistent (Dijkstra, 2007). Green & Wei (2014) hypothesize that different interactional contexts induce different habits of language control processes. It is therefore essential to explore code-switching in different bilingual contexts. This study investigates code-switching in Algerian bilinguals who habitually code-switch. Sixty-eight Algerian Arabic-French bilinguals listened to sentence fragments and named a visual continuation out loud. Participants' speech onset times were recorded. We explored whether a semantic context that is highly predictive of a cognate at the switch point facilitates switching (Altarriba et al., 1996). Sentences could be French only (a, c, e, g), or contained an Algerian Arabic-French switch (b, d, f, h); the context was either highly semantically constraining towards the target word (a, b, e, f) or not (c, d, g, h); and the targets (underscored) were either French cognates (a-d) or control French NPs (e-h).

a) J'ai besoin d'argent, je dois passer aujourd'hui à la banque. (High/Nonswitch/cog)
b) Nɛsħaq ad-drahɛm, lazɛm nʤuz el-yuum ʕla la banque. (High/Switch/cog)
"I need money, I have to go today to the bank."

c) Nous allons voir un ami, ensuite nous passerons à la banque. (Low/Nonswitch/cog)
d) Rana rajħin nʃufu sˁaħbi, min baʕd nʤuzu ʕla la banque. (Low/Switch/cog)
"We will see a friend, and then we will go to the bank."

e) Chaque fois qu'on se lave les dents il faut se rincer la bouche. (High/Nonswitch/Noncog)
f) Kul-ma naɣaslu snaan lazem nʃallu la bouche. (High/Switch/Noncog)
"Every time we wash the teeth we rinse the mouth."

g) Cet enfant n'a pas dormi parce qu'il avait mal à la bouche. (Low/Nonswitch/Noncog)
h) had l'ewled ma rqadsh 3laxatˁerʃ kan ʕendu sˁtˁar fi la bouche. (Low/Switch/Noncog)
"This boy did not sleep because he has pain in the mouth."

Participants were faster to name the target French NPs after a high-constraining than a low-constraining context regardless of the preceding context language. Twenty one bilinguals who frequently code-switched, scoring 6 and above in a scale of 7 on the *"The assessment of code-switching experience survey*" (Blackburn et al., 2011), showed an interaction between semantic constraint and word status of the French NPs: Naming latencies were shorter for cognate than for control targets in the high constraint context suggesting a tendency towards an inhibitory rather than a facilitating effect of cognates. Although naming latencies to French NPs were faster in the non-switching conditions than in the switching conditions, this was not statistically significant. However, there was a significant interaction between switch costs and proficiency in French. High proficiency bilinguals showed switch costs but not low proficiency bilinguals. Contrary to our predictions, due to the presence of cognate inhibition effect in the high constraint context, switch costs may be accentuated. Without considering language use, lexical selection theories based solely on activation-inhibition mechanisms cannot account for differences in naming latencies in these different switching environments. This suggests that regular and habitual code-switching may shape language processing in bilinguals even in cultures in which code-switching is the norm.

Back to Friday Poster Schedule

Processing English passives: Interaction with event structure, but no evidence for heuristics

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The comprehension of passive sentences is considered to be problematic due to a heuristic which assumes an agent-first order (Bever, 1970; Ferreira, 2003). While comprehension accuracy has been found to be lower for passives than actives (Ferreira, 2003), consistent with the heuristic, online reading times have been found to be numerically faster for passives, inconsistent with the heuristic (Carrithers, 1989; Rohde, 2003; Traxler et al., 2014). These studies raise two potentially related concerns: (1) the more obvious concern is the discrepancy between online and offline results; (2) the less obvious one is the potential mixed effects resulting from using a set of predicates that differ in their event structure (e.g. complex events vs. states). Events and states differ in their ability to undergo verbal passivization cross-linguistically. While complex events consistently deliver verbal passives across languages, states generate ambiguous adjectival/verbal passives (English) and either do not form unambiguous verbal passives (object experiencers, Belletti & Rizzi, 1988), or are subject to constraints not applicable to eventive predicates (e.g. subject experiencers in Italian and German). More generally, verbal passivization of a stative predicate has been argued to require coercion to an eventive interpretation (Gehrke & Grillo, 2007/2009; Snyder & Hyams, 2015).The goals of this study were two-fold: (1) we tested whether we could find on-line evidence for heuristic processing with eventive predicates, when controlling for the presence of an auxiliary as a cue to the passive structure (adding a progressive condition; Experiment 1); (2) in the absence of evidence for heuristic processing online or offline in Experiment 1, we tested whether the difficulty of passivization stems from the stative predicates, whose passivization is temporally ambiguous and, when disambiguated (at the by-phrase), potentially costly due to coercion (Experiment 2). *Experiment 1:* 35 native British-speakers participated in a moving-window self-paced word-by-word reading experiment. Experimental items contained only complex event predicates and 3 experimental conditions: A. passive, B. progressive, and C. simple past, e,g. The guitarist *(A) was rejected by/ (B) was rejecting/ (C) rejected* the attractive and talented singer in the hall next to the pub. Each sentence was followed by a verification question. Plausibility of thematic role assignment was controlled by pre-study norming. Analysis: Accuracy and reaction times to comprehension questions and residual logRTs (calculated based on word length and word position) were analysed with a linear mixed effects model (fixed effect: syntax; random effects: subjects and items).
Results: Offline measures did not differ across conditions. Passive sentences were read significantly faster than both types of actives up to the 4th region after the verb (at determiner: t=2.30; conjunction: t=2.86; 2nd adjective: t=2.46; no significant difference after the 4th region).These results do not support heuristic application. The faster reading times are consistent with surprisal models, given the greater morphological marking of the passive structure. *Experiment 2:* 26 native British-speakers participated. Experimental items contained only psych predicates and 2 experimental conditions: A. passive and B. simple past, e.g. The guitarist *(A) was admired by/ (B) admired* the attractive and talented singer for keeping the band focused through the whole tour. Same methods and analysis as Experiment 1. Results: Offline reaction times were significantly slower (t=3.18) and accuracy was significantly lower (t=3.28) after a passive sentence. Online measures revealed that passives were read numerically faster than actives up to the 2nd adjective (the only significant difference being at the determiner, t=3.56), while the pattern was reversed (but not significant) after this region. Discussion: The results do not support heuristic processing of passives, but instead the degree of difficulty in processing passive sentences, both online and offline, varies with the predicate type. The facilitation of processing passives, consistent with surprisal models, disappeared when predicates switched from eventive to stative. Similarly, this relative increase in reading times for statives was accompanied by greater errors offline. States may pose a difficulty in processing passives due to ambiguity, coercing an event, or promoting an unaffected internal argument. Future work will focus on teasing apart these interpretations.

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Back to Friday Poster Schedule

Processing Hindi relative clauses: Evidence against expectation-based theories

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Cross-linguistically, relative clauses (RCs) have been employed to test opposing predictions made by expectation and memory retrieval theories (Gibson, 2000; Jaeger et al., 2015, etc.). So far, no study has investigated *online* processing of Hindi RCs in the context of these opposing predictions. We investigate these predictions in two self-paced reading studies.

Experiment 1 looked at Hindi correlative RCs (1), which have a relative pronoun 'jo' that corefers to *that-NP* (vaha-NP). Crucially, a Hindi treebank based frequency count shows that there is a strong expectation (91.94%) of seeing a *that-NP* given *relpron* 'jo' in such RCs. N=61; Total items=24.

(1) [jo … RC-verb] [vaha-NP … matrix-VP]

We manipulated distance between the relative pronoun 'jo' (*relpron*) and *that-NP*. This distance manipulation (the 'long' condition) was introduced within the RC via additional adverbials that appeared before the RC-verb. Such a distance manipulation is predicted to have no effect at *that-NP* in an expectation-based surprisal theory (Levy, 2008). This is because, according to surprisal theory, for (1) the parser starts to expect a *that-NP* only after reading the RC-verb, i.e., at the end of the RC. In contrast, memory-based theories (Gibson, 2000; Lewis & Vasishth, 2005) predict slower reading time at the critical region i.e. *that-NP,* as distance increases. We found a main effect of distance (t=-2.08), such that there was facilitation at *that-NP* in the 'long' condition compared to 'short' condition. This goes against both expectation and memory retrieval theories. The results show the possibility that facilitation due to syntactic expectation such as *that-NP,* captures processes that are distinct from facilitation effects explained through surprisal theory.

Experiment 2 investigated subject RCs that were either embedded (2) or right-extraposed (3). N=75; Total items=24.

(2) [NP [relpron … RC-verb] … matrix-VP]
(3) [NP … matrix-VP] [relpron … RC-verb]

Previously, Kothari (2010), using an *offline* judgement study, showed a global preference for embedded RCs over right-extraposed RCs in Hindi. This preference pattern is consistent with memory-based theories and can be understood as dependency length minimization between NP and relpron/RC-verb. This contrasts with expectation/frequency-based predictions that favor right-extraposed RCs due to their higher frequency counts in a Hindi treebank (cf. Levy et al., 2012). In Experiment 2, RC type was crossed with RC length ('short' vs 'long') in a 2x2 design. There were fewer adverbials before the RC-verb in the 'short' condition, as compared to the 'long' condition. Our results support memory-based theories. Reading times at the RC-verb showed a main effect of RC type (t=2.11) such that embedded RCs were processed faster than right-extraposed RCs at the RC-verb. Also, long conditions were read faster than short conditions (t=-2.99). In addition, an interaction effect was also found (t=-2.95). Nested contrast shows that the right-extraposed RC is processed faster at the RC-verb only in the 'long' condition compared to 'short' condition, no such difference appears in the embedded RC condition. The results show that high frequency need not always lead to processing facilitation; working-memory constraints cannot always be overridden (Levy & Keller 2013).

Our experimental results cannot be explained by expectation/frequency-based theories. Experiment 1 shows that surprisal does not capture processing facilitation for a highly likely *that-NP* in a correlative RC. Such a facilitation could point to syntactic processes, e.g. reference resolution, outside the purview of the surprisal theory. Additionally, in Experiment 2, an infrequent embedded RC structure was processed faster compared to a more frequent right-extraposed structure. Experiment 2 thus shows that frequency-based familiarity alone cannot always override memory-based constraints (Levy & Keller 2013).

Back to Friday Poster Schedule

Processing polarity by native speakers and L2 learners: ERP evidence for quantitative differences

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In this study we investigated event-related brain responses (ERPs) to violations of German negative and positive polarity items (NPIs and PPIs, respectively) by native speakers and two groups of highly proficient L2 learners with early (0-6 years) and late (9-12 years) age of acquisition (AoA). We aimed to contribute to the current discussion on whether the dissociation between the processing of negative and positive polarity violations is quantitative in nature, e.g. ERP components differ in strength and/or latency (e.g. Saddy et al., 2004); or whether they are rather qualitative, caused by different integration demands as to the language processing system and, hence, determined by the retrieval of different underlying neural mechanisms indicated by distributional differences of the relevant ERP components, as has been argued by Yurchenko et al. (2013). If so, ERP patterns should not only show distributional within-group differences with respect to polarity violation, but also provide divergence across groups, i.e. ERPs by native speakers and L2 learners are likely to reveal different processing patterns across polarity as a function of AoA.

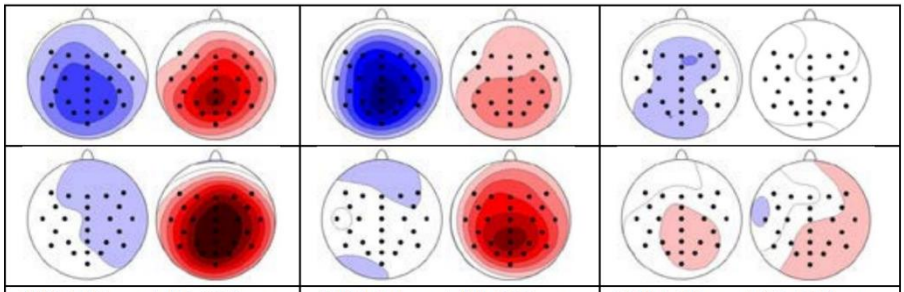

Fig. 1: Difference ERP waves of NPI (upper row) and PPI (lower row) conditions by three groups (control=left, early AoA = middle, late AoA = right); Voltages range from -4 µV (darkblue) to +4 µV (darkred).

As is shown in Fig. 1, ERPs reveal an early negativity by native speakers (n=19) and L2 learners with early AoA (n=18) followed by a late positivity for NPI violations. According to the PPI violations, ERPs of the two groups do not show a significant negativity, whereas they elicit a stronger positivity with respect to the NPI violation for both groups. Late positivities by early L2 learners appear reduced for both polarity violations. ERPs elicited by L2 learners with late AoA (n=14) do not show significant differences between the processing NPI and PPI violations. Globally, statistical results do not reveal any relevant distributional differences with respect to either group, polarity, violation or any of their terms of higher order. The influence of AoA revealed by both ERP correlates, negativity and positivity, predominantly appears in the reduction of strength of the correlates. This impact may be considered rather quantitative, indicating that the activation and retrieval of the corresponding underlying neural mechanisms are less automated with respect to L2. There is no clear indication for qualitative differences, i.e. that activation of neural mechanisms should be of different sources.

This study is the first to present data on L2 polarity processing (NPI and PPI). It further contributes to the recent discussion on whether the underlying neural mechanisms are dissociating quantitatively or qualitatively. Results suggest that the brain responses to non-licensed NPI and PPI processing are not as strongly dissociating as previously assumed (Yurchenko et al., 2013). Rather, differences across polarity indicate variation with respect to context in that the processing of NPIs seems to be semantically more restrictive than the processing of PPIs. This difference appears quantitative rather than qualitative, which is further apparent in L2 processing data, inferring a loss of sensitivity to non-licensed polarity violations as a function of AoA.

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Back to Friday Poster Schedule

Processing pronouns: Null vs. Overt in Vietnamese

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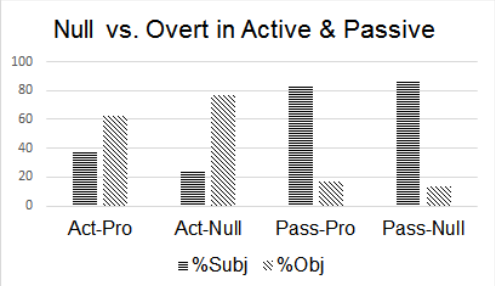
It is often assumed that in languages with null and overt pronouns, nulls tend to refer to *more prominent antecedents* than overt forms (Givón'83; Ariel'90). Some researchers argue for a very syntactic view of prominence, e.g. Carminati'02 claims that Italian null pronouns refer to subjects while overt pronouns refer to entities not in subject position. However, others (Allonso-Ovalle et al'02, Kehler/Rohde'13) claim that *topicality* also matters. We investigated whether interpretation of Vietnamese null/overt pronouns is influenced by subjecthood and/or topichood.

The debate about null vs. overt pronouns is further complicated by the common typological division into (a) *pro-drop languages* (with more verbal morphology, e.g. Italian, Spanish) and (b) *topic-drop languages* (often with limited/no verbal morphology, e.g. Chinese, Japanese, Vietnamese). This dichotomy is potentially misleading since subjecthood and topichood are used to explain the interpretation of null pronouns in both language types. In Spanish, nulls prefer topics (Allonso-Ovalle et al'02). In Japanese, nulls prefer subjects (Ueno/Kehler'10). In Chinese (Yang et al'99), both null and overt can refer to subjects.

We tested null and overt pronouns in Vietnamese, while controlling for verb biases and coherence effects that may have muddied the waters in earlier work. We used passives to mark topicality as they are commonly viewed as marking the promoted element as the topic (English, Kehler/Rohde'13). By comparing the subjects of actives and passives, we can test for effects of topicality while controlling grammatical role. Vietnamese is also typologically interesting because, unlike Chinese and Japanese, Vietnamese overt pronouns are a combination of a kin term+demonstrative (e.g. *English 'he'* = *ông ấy* 'uncle that').

Experiment. Native Vietnamese speakers (n=24) participated in a written sentence completion task. We manipulated **(i)** the form of the pronoun prompt (null/overt; the past-tense morpheme signaled the presence of a preceding null pronoun), and **(ii)** the voice (active/ passive) of the first clause. To control for coherence and to maximize our chances of detecting possible effects of the null/overt distinction, we used the connective 'because' and equi-biased verbs (adapted from Hartshorne/Snedeker'13): Semantically, there should not be a strong preference for either the preceding subject or object to be mentioned next (both are possible).

Active	Ông kĩ sư	cám ơn	ông lái xe	vì	ông ấy / đã …	
	male.engineer	thank	male.driver	because	he / PAST	
	'The engineer thanked the driver because he / PAST …'					
Passive	Ông kĩ sư	được	ông lái xe	cám ơn	vì	ông ấy / đã ...
	Male.engineer	PASS	male.driver	thank	because	he / PAST
	'The engineer was thanked by the driver because he / PAST ...'					



Results: Data were analyzed with mixed-effects regression. The rate of subject continuations shows an effect of voice ($p<.01$), a marginal effect of anaphor ($p=.087$), and a marginal interaction ($p=.052$). In passives, both forms have an equally strong preference for the preceding topicalized subject, indicating that passives are a strong topic-marking device in Vietnamese. In actives, surprisingly, *overt* pronouns refer to subjects more often than nulls ($p<.05$). Our results argue against accounts that assign fully distinct referential behavior to overt and null pronouns. Indeed, it seems both forms generally prefer *theme antecedents* (at least with the verbs we used), but crucially more so with passives than actives ($p<.05$). These findings suggest that the division of labor between null and overt pronouns is less clear than standardly assumed: The forms can overlap in their interpretation.

Back to Friday Poster Schedule

Pronoun resolution in semantically biased contexts: Evidence from heritage Russian

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Pronoun resolution is subject to multiple constraints and requires the integration of different types of information (syntactic, semantic, and discourse-pragmatic). Recent proposals have focused on the role of implicit causality and found that native speakers are sensitive to antecedent biases induced by Implicit Causality (IC) verbs combined with various conjunctions [3,5,6]. At the same time in null subject languages, such as Russian, there could be additional factors that influence pronoun interpretation. A proposal about Italian pronouns that was found to apply to several other null subject languages is Carminati's Position of Antecedent Strategy (PAS) about processing biases: null pronouns refer to preverbal subjects while overt to objects [2]. In studies with bilinguals, differences with the baseline were found mostly with overt pronouns, as bilingualism was suggested to be the trigger [4].

Drawing on earlier accounts of pronoun resolution in IC contexts, I investigate the interaction between antecedent preferences conditioned by IC verbs and preferences with structural basis as predicted by PAS. I compare the interpretation of overt anaphoric pronouns by 28 Russian heritage speakers and 28 monolingual Russian speakers. The former are early bilinguals who were either born in the US to Russian-speaking parents or have moved there before the age of 9. The present study offers an examination of fine-grained interpretation preferences rather than core grammatical constraints in heritage processing.

The experimental method is based on a non-timed hybrid comprehension-production task with IC verbs in the matrix clause and overt anaphoric pronouns in the subordinate clause. The conjunction 'because' was kept constant in all trials for consistency. The participants heard several sentences and were asked to provide their continuation. IC-1 (subject-biased) and IC-2 (object-biased) verbs were varied in Condition 1 and 2, respectively.

Condition 1: Katja **ispugala** Ninu, potomu čto ona….
Katja scared Nina because she….

Condition 2: Maya **pozdravila** Natashu, potomu čto ona…
Maya congratulated Natasha because she

In the first condition IC subject-based bias competes with the structural bias for object referents specified in PAS. In the second condition both types of biases converge on the object.

The results show that both groups provided almost similar number of object antecedents in Condition 2 (heritage speakers 92 %, native speakers 93 %) but differed significantly in Condition 1, in which heritage speakers provided 97 % subject antecedents and the native speakers 87 %. A two-factor ANOVA with group and verb bias indicated that both the main effect of group, F (1, 54) = 5.4, $p < .05$ and the main effect of verb bias, F (1, 54) = 1490.9, $p < .001$, as well as the interaction between these two variables, F (1, 54) = 4.1, $p < .05$ proved reliable. Planned comparisons showed that the heritage group differed from the control group only in Condition 1, t (54) = 3.1, $p < .005$. There was no difference in Condition 2, $t < 0.4$. These findings indicate that for both groups the IC bias had an effect on antecedent assignment but to different degrees. Particularly, in Condition 1 the divergent antecedent choices of the target group seem to be modulated by the semantically-based biases more than in the control group. These biases have shown to exist cross-linguistically [1,3] unlike the structural biases related to the parametric properties of null subject languages. Thus, in the cases of competition between these two types of biases, it may be that bilinguals are more sensitive to the cross-linguistically consistent re-mention biases than to the language-specific biases, which are in contrast with the parametric options in their more dominant language, English.

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Back to Friday Poster Schedule

Pronoun resolution within and across sentences: Effects of subjecthood and verb bias

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Traditional approaches often claim that pronouns refer to subjects and/or topics. These claims are challenged by the view that inferences about coherence relations between sentences are crucial for pronoun interpretation (e.g. Hobbs'79, Kehler'02). Recently, Kehler/Rohde'13 argued for a reconciliation of these views, via a Bayesian approach according to which *both* semantic/coherence effects and subjecthood/topicality contribute to pronoun interpretation. However, they do not investigate the *time course* of these effects. Other work has shown that people react quickly to coherence cues, in particular with implicit causality (IC) verbs, but subjecthood modulates these effects (e.g. Pyykkönen/Järvikivi'10). However, the real-time effects of IC and subjecthood are not fully understood.

We conducted a visual-world eye-tracking study investigating the time course of implicit causality (IC) and subjecthood effects on pronoun interpretation. IC verbs (e.g. Garvey/ Caramazza'74, Hartshorne/Snedeker'12) bias subsequent pronouns towards subjects (NP1 bias, e.g. ***Mary*** *disappointed Lucy because she*) or objects (NP2 bias, e.g. Mary *criticized* ***Lucy*** *because she*), especially with 'because.' According to Rohde'08, the same biases hold in within-sentence contexts (*Clause1 because Clause2.*) and across-sentence contexts with a period/full stop (*Clause1. Clause2.*), as long as the clauses are linked via an explanation relation. However, Miltsakaki'02 claims that, generally, verb effects are weaker in across-sentence contexts, where pronouns favor subjects. We use IC effects in within- vs. across-sentence contexts to test effects of coherence and subjecthood on real-time pronoun comprehension.

Participants (n=20) heard (sequences of) sentences (ex.1,2) while viewing clipart images depicting the two same-gender characters and a mentioned location, as their eye-movements were recorded. We manipulated (i) the type of IC verb in clause 1 (NP1/NP2 biased), (ii) connective type (because/full stop), and (iii) whether the second clause disambiguated the pronoun towards a referent consistent/inconsistent with the IC verb's bias. Target items were selected on the basis of a norming study, to ensure the disambiguations were clear.

(1a) Mary amused$_{NP1}$ Barbara at the beach because she was easily {the funniest comedian around$_{cons}$ // the saddest person around$_{incons}$} *[within-sentence, NP1 biased verb]*
(1b) Mary amused$_{NP1}$ Barbara at the beach. She was easily {the funniest comedian around$_{cons}$ // the saddest person around$_{incons}$} *[across-sentence, NP1 biased verb]*
(2a) Amanda threatened$_{NP2}$ Rebecca in the office because she couldn't continue to {be late to work all the time$_{cons}$ // agree to such tardiness$_{incons}$} *[within-sentence, NP2 biased verb]*
(2b) Amanda threatened$_{NP2}$ Rebecca in the office. She couldn't continue to {be late to work all the time$_{cons}$ // agree to such tardiness$_{incons}$} *[across-sentence, NP2 biased verb]*

Results: IC effects influence eye-movements during pronoun processing, but are modulated by sentence boundaries: Within-sentence conditions show IC effects, starting 600ms after pronoun onset (p's<.05), whereas across-sentence conditions show a subject preference, starting 200ms after pronoun onset (p's<.05), regardless of verb. Furthermore, eye-movements after disambiguation show that shifting attention to a new referent is influenced by subjecthood: In *within-sentence conditions*, verb-based expectations are harder to overcome with subjects than objects: Shifting attention from a subject to an object is harder than vice versa (p's<.05). Furthermore, in *across-sentence conditions*, shifting attention is even harder regardless of verb type (in line with the finding that subjecthood biases emerge more strongly in across-sentence contexts). **As a whole**, we find that IC guides initial considerations of potential antecedents, especially in within-sentence contexts, but subjecthood seems to have a powerful effect later on, especially if people need to revise their expectations about the antecedent. This suggests these two factors may affect different aspects of the reference resolution system.

Back to Friday Poster Schedule

What we know about knowing: An ERP study of factive verbs

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Introduction: *Presuppositions* specify that the content of a sentence should be taken for granted and considered uncontroversial (e.g., [1]). They are reliably associated with particular linguistic expressions, and recent psycholinguistic evidence suggests that some of these expressions can trigger presuppositions during online comprehension (e.g., [2, 3 & 4]). The present study focused on a class of verbs called 'factives' such as *know* or *forget*, which, in contrast to non-factive verbs such as *believe* or *claim*, presuppose the truth of their complements [5]. For example, in sentence (1) below, the verb "realized", but not "speculated", presupposes that the dogs are vicious. We used ERPs to ask whether the presuppositions triggered by factive verbs lead comprehenders to predict upcoming events that presuppose the truth of the preceding event(s) conveyed by the context, and, if so, what the neural consequences are of violating these predictions. There is growing ERP evidence that violations of event structure predictions can trigger prolonged neural processing, as reflected by the late posterior positivity P600 component [6]. Thus, if comprehenders are able to use factive verbs to generate high certainty predictions about upcoming event structures, then incoming words that violate the presupposition, and therefore these predictions, should evoke a larger P600 than incoming words that do not violate the presupposition.

Methods: We used a 2X2 design in which Verb Class (factive/nonfactive) was crossed with Information Expectation (confirmed/disconfirmed) to create four conditions of three-sentence scenarios (e.g. sentence (1)). The second sentence included either a factive or a non-factive verb. The final sentence, which was identical across the four conditions, contained a sentence-medial critical word that either confirmed or disconfirmed the information conveyed by the second sentence. The first and second sentences were each presented as a whole, whereas the third sentence was presented word by word. Twenty-four participants read 152 experimental scenarios (counterbalanced across the four conditions) and 70 fillers, and made plausibility judgments at the end of each scenario. ERPs were time-locked to critical words.

Results: There was a significant interaction between Verb Class and Information Expectation between 500-700ms over parietal and occipital electrode sites. This interaction was driven by a larger late positivity (P600) to critical words that disconfirmed versus confirmed the complements of the factive verbs, but no such effect following the non-factive verbs. There were no differences across the four conditions on the N400 evoked by critical words (between 300-500ms).

Discussion: Comprehenders are able to use factivity as a contextual cue to predict upcoming events that convey the truth of the information given by the context. If the integration of new bottom-up input violates these presupposition-based predictions, this triggers prolonged neural processing. The absence of N400 modulation, however, suggests that these higher-level event structure predictions did not lead to differential pre-activation at the level of semantic features. This study therefore adds to increasing evidence that the P600 effect can be evoked in the absence of an N400 effect to certain types of event structure violations.

Sentence 1: Charlie got three new dogs. He realized/speculated that they were really vicious/harmless. They invariably ***attacked*** anyone they encountered.

[1] Chierchia & McConnell-Ginet, 2000; [2] Schwarz & Tiemann, 2012; [3] Clifton, 2013 [4] Romoli et al., 2015; [5] Kiparsky & Kiparsky, 1970; [6] Kuperberg, 2013; [7] Xiang & Kuperberg, 2015.

Back to Friday Poster Schedule

Rapid accent adaptation and constraints on cross-talker generalization

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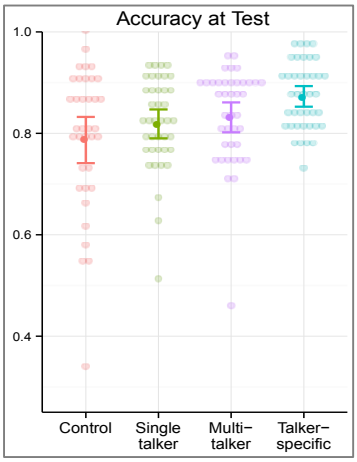
To achieve robust language understanding, listeners must adjust for the fact that the physical realization of speech sounds varies considerably across talkers. One way listeners might cope with this variability is by learning and adjusting for systematic patterns of variation in the environment, e.g. talker-specific idiolectal variation and group-specific accent variation [1, 2]. To the extent that listeners can generalize learning from familiar talkers to new similar talkers, they are able to benefit from prior accent experience when encountering a new talker [3]. We present two experiments that investigated adaptation to foreign-accented speech and the conditions under which adaptation generalizes to new talkers with the same accent.

Method. We used a web-based training-test paradigm modeled on recent lab-based work [1]. Participants transcribed simple sentences, each containing 2-4 keywords (e.g., *A boy fell from the window*) and presented in noise. They were assigned to different *training* conditions (Table). During *test*, all participants heard sentences produced by a Mandarin-accented English talker (one of six different talkers; balanced across lists). The experiment occurred in a single session (15-20 min; cf. multi-day training in [1]). The dependent measure was keyword identification accuracy.

Condition	Training talker
Control	5 native English talkers
Talker-specific	1 accented talker (same as test talker)
Single Talker	1 accented talker (diff. from test talker)
Multi Talker	5 accented talkers

Exp1 (N = 92) demonstrated that our web-based paradigm replicates the basic adaptation effect found in lab-based studies [1], but with less exposure: i.e., that brief exposure to a talker with an unfamiliar accent improves understanding of (novel) sentences produced by that talker (*talker-specific condition*). A mixed logit analysis (with maximal random effects) showed that, as expected, participants who heard foreign-accented talkers were less accurate during the training phase, relative to participants in the control condition (β = -1.5, $p < .001$), but improved over the course of training (β_{Trial} = 0.01, $p < .001$). At test, accuracy was significantly higher in the talker-specific condition, relative to control (β = 0.9, $p < .001$), indicating accent adaptation above and beyond task adaptation. Further, control participants *rapidly* adapted to the accented talker during the test phase (β_{Trial} = 0.05, $p < .001$): After 16 test trials, accuracy was comparable in the control and talker-specific conditions.



Exp2 (N = 156) investigated the conditions under which listeners generalize adaptation to novel talkers. We find cross-talker generalization in *both* the mutli-talker (β = 0.33, $p < 0.05$) and single talker (β = 0.3, $p < 0.05$) training conditions as compared to the control (see Figure). In other words, participants were able to generalize following exposure to only *one* talker (cf. [1], where generalization required multi-talker training).

Conclusion. This study provides further evidence for rapid adaptation to accented speech (e.g., [4]). The effect size for talker-specific adaptation was comparable to previous findings using multi-day accent training [1]—accuracy benefit of ~10% relative to control. This suggests that initial adaptation is robust and not enhanced by additional training (or overnight consolidation). Crucially, results from Exp 2 suggest that multi-talker training is not a necessary condition for talker-independent adaptation (cf. [1]) and that, at least in some cases, single-talker exposure can be sufficient for learning to generalize across talkers, perhaps due to the degree of similarity among talkers.

References: [1] Bradlow, A. & Bent, T. *Cogn*, 2008. [2] Sidaras, S., et al. *JASA*. 2009; [3] Kleinschmidt, D. & Jaeger, T. *PsychReview, 2015;* [4] Clarke, C. & Garrett, M. *JASA*. 2004.

Back to Friday Poster Schedule

Ellipsis with garden-path antecedents in French

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Ellipsis is typically anaphoric, and its interpretation requires access to a suitable antecedent. Adopting the framework of cue-based retrieval parsing (Lewis & Vasishth, 2005), Paape (2015) suggests that the syntactic structures of ellipsis antecedents are stored in working memory as chunks whose activation levels fluctuate over time. Cue-based retrieval parsing predicts that manipulating memory chunks increases their activation, making them easier to retrieve.

It should be possible to boost the activation of a stored antecedent through syntactic reanalysis, which changes the structure of the chunk and thereby 'refreshes' its memory trace. In a self-paced reading study on German sluicing, Paape (2015) found that antecedents that had been reanalyzed (i.e., garden-path antecedents) led to reduced reading times at the ellipsis site, indicating facilitated retrieval and thus supporting the reactivation hypothesis.

In the current study, we attempted to replicate Paape's (2015) finding using eye-tracking, which more closely resembles natural reading. We tested French sentences containing sluicing constructions with temporarily ambiguous antecedents, as shown below.

CONTEXT	The market is known for its large sides of beef which are delivered during the night.									
AMB./ELLIPSIS	*Le boucher*	*sale*	*les*	*tranche,*	*mais*	*les clients*	*se*	*demandent*	*quand,*ELLIPSIS	…
	the butcher	filthy	them	cut.sg	but	the clients	self	ask	when	
UNAMB./ELLIPSIS	*Les bouchers*	*sales*	*les*	*tranchent,*	*mais*	*les clients*	*se*	*demandent*	*quand,*ELLIPSIS	…
	the butchers	filthy.pl	them	cut.pl	but	the clients	self	ask	when	
AMB./CONTROL	*Le boucher*	*sale*	*les*	*tranche,*	*mais*	*les clients*	*en*	*demandent*	*la technique,*	…
	the butcher	filthy	them	cut.sg	but	the clients	of.it	ask	the technique	
UNAMB./CONTROL	*Les bouchers*	*sales*	*les*	*tranchent,*	*mais*	*les clients*	*en*	*demandent*	*la technique,*	…
	the butchers	filthy.pl	them	cut.pl	but	the clients	of.it	ask	the technique	

'The filthy butcher/s cut/s them, but ...' (Preferred reading: 'The butcher/s salt/s the slices, but ...')

Our design used a sequence of three lexically ambiguous words. Here, the word *sale* is ambiguous between the third person singular form of *saler*, 'to salt', and the adjective 'filthy'. The word *les* is either a plural-marked definite article or an object pronoun. Finally, *tranche* could be a singular noun ('slice'), but would need an *-s* suffix to be compatible with the would-be article *les* to yield the reading 'The butcher/s salt/s the slices'. The word *tranche* is thus the point of disambiguation in the ambiguous conditions, where no other morphological markers signal the correct parse. In a pretest, acceptability ratings were lower for ambiguous antecedent clauses than for unambiguous ones, which we took to indicate a garden-path effect. The main experiment used a 2×2 design with the factors ambiguity (yes/no) and ellipsis (yes/no). The two control conditions used non-ellipsis anaphors (*en*, 'of it', in the above example). According to the reactivation hypothesis, processing at the ellipsis site (*quand,* 'when') should be less difficult in the ambiguous condition, where the antecedent has to be reanalyzed at *tranche*, 'cut'.

At the sluicing site, antecedent ambiguity led to higher total reading times ($t = 3.2$) and marginally higher regression path durations ($t = 1.9$) only for ellipsis sentences, contrary to what the reactivation hypothesis predicted. This pattern was not observed in the region right before the ellipsis, excluding differential processing spillover as an explanation. An analysis of fixations made after the ellipsis site had been fixated revealed an effect of ambiguity on re-reading times for the antecedent region ($t = 2.2$), as well as higher re-reading probabilities for the initial noun phrase ($z = 2.6$) and the adjective ($z = 2.3$) in the ambiguous/ellipsis condition only.

Our study yielded no evidence for a reactivation advantage due to reanalysis. The increased re-reading time on the antecedent suggests that subjects did not always resolve the ambiguity in the initial clause – a type of good-enough processing (e.g. Ferreira & Patson, 2007). On such trials, no fully interpreted antecedent will be available upon encountering the ellipsis site, leading to processing difficulty and re-reading of the antecedent clause.

Back to Friday Poster Schedule

Poster Abstracts

Saturday

Agreement attraction is selective: Evidence from eye-tracking

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Summary. Attraction effects provide a useful tool to investigate how we mentally encode and access linguistic structure. A parade case involves agreement attraction, where a speaker fails to notice that a plural-marked verb incorrectly agrees in number with an attractor that is not its syntactic subject (e.g., **The key to the cabinets probably are ...*) [1,2,3,4]. Agreement attraction manifests as eased processing of ungrammatical verbs in the presence of a syntactically inappropriate but number-matching attractor. Existing accounts assume that agreement attraction reflects noisy memory access mechanisms, in which retrieval processes are disrupted by grammatically inappropriate elements. To date, these accounts have assumed that all syntactic features are used (or ignored) equally in retrieval, and predict that attraction effects should generalize across configurations, since the same mechanisms should apply whenever a speaker attempts to license agreement. In contrast, we provide the first parametric variation of the syntactic properties of the attractor, and show that the syntactic position of the attractor modulates the illusion. These findings suggest that agreement attraction is selective and cannot be explained solely as an effect of generalized noise on access mechanisms without a richer theory of cues and memory representations.

Motivation. Subject-verb agreement in English is subject to syntactic and morphological constraints: the verb must agree in number with its syntactic subject. However, little is known about what cues are used to guide retrieval of a subject during argument integration. Attraction effects reveal which items mislead retrieval, and therefore provide a powerful diagnostic of the cues used in retrieval. To assess what cues are used in retrieval, we examined how differences in the syntactic and thematic properties of the attractor would impact susceptibility to attraction.

Design & Results. We tested sentences like (1-4) using eye-tracking while reading (n = 69). In all cases, the target subject was modified by a relative clause that contained the attractor. We parametrically manipulated two features of the attractor: thematic role (agent vs. theme), and syntactic position (subject vs. object). Results revealed main effects of grammaticality, attractor thematic role, and attractor position, a marginal effect of attraction overall, and a marginal interaction of thematic role with attraction (total time at the critical verb). Planned pairwise comparisons revealed a significant attraction effect, but only in the subject, theme condition.

1. The executive that the employee(s) contacted {was | were} ...	(subject, agent)
2. The executive that the employee(s) were contacted by {was | were} ...	(subject, theme)
3. The executive that contacted the employee(s) {was | were} ...	(object, theme)
4. The executive that was contacted by the employee(s) {was | were} ...	(object, agent)

Conclusion. These results suggest that agreement attraction is more selective than previously assumed. They are unexpected under accounts that assign attraction effects to noisy memory access mechanisms [2,3], in the absence of a richer theory of cues and representations. In addition, these results raise the question of why attraction effects were so easy to obtain in previous studies. We suggest that the variability might reflect differences in the argument status of the attractor. In the current study, the attractor occurred as a core argument (e.g., subject, direct object), while it occurred as an oblique argument (e.g. *the key to* ***the cabinets***…) in many previous studies. Interestingly, similar contrasts have been observed for other dependencies, such as thematic binding, which is susceptible to semantic interference effects from oblique arguments, but not from core arguments [5]. These findings support the proposal of cue weighting as determined by an argument hierarchy [as discussed in 5].

References. [1] Clifton et al. 1999. [2] Dillon et al. 2013. [3] Wagers et al., 2009. [4] Pearlmutter et al., 1999. [5] Van Dyke & McElree, 2011.

Back to Saturday Poster Schedule

Differential processing of code-switched speech by Spanish-English bilinguals: The role of exposure

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Bilinguals sometimes engage in code-switching: the fluid alternation between languages in bilingual speech (Poplack, 1980). The specific factors that influence code-switching are varied, yet members of a community of code-switchers are more likely to engage in complex code-switches (e.g. *El niño caught his friend a punto de tocar el blender*, "The boy caught his friend about to touch the blender") as compared to bilinguals who maintain a functional separation between languages. In parallel, psycholinguistic studies on bilingualism increasingly support the hypothesis that a bilinguals' two languages are simultaneously active to varying degrees. Thus, the ability to code-switch suggests that the cognitive architecture that supports production and comprehension is remarkably flexible and adaptive. We therefore ask: will bilinguals who engage in code-switching exhibit differential patterns of comprehension from bilinguals who do not code-switch despite knowledge of the same two languages?

To examine this question, we focus on grammatical gender. In Spanish, speakers use grammatical gender to facilitate comprehension when it is informative (Lew-Williams & Fernald, 2007). Alternatively, corpus studies (e.g. Jake et al., 2002) highlight an article asymmetry in code-switching whereby the Spanish masculine article '*el*' combines with English nouns regardless of the gender of the Spanish translation equivalent (*el juice*, *el blender*, Sp. *el jugo* [masc.], *la licuadora* [fem.]). However, Spanish '*la*' mostly surfaces with English words with feminine Spanish translation equivalents (**la juice*, *la blender*).

We examined the consequences of this asymmetry on comprehension by comparing two groups of Spanish (L1) – English (L2) bilinguals using the visual world paradigm. Both groups are native speakers of Spanish. One group lives in the U.S. (N = 24) and is exposed to Spanish-English code-switches. The other group (N = 28) lives in Granada (Spain) and maintains a strict separation between the two languages. We tested participants in a single block of 60 intra-sentential code-switched sentences in which target items switched from gender-marked Spanish determiners into English nouns, which either matched (e.g. *el* candy Sp. *el caramelo*) or not (*la candy*) and were phonological cohorts (candy/candle). While listening, participants examined a 2-object visual scene in which distractor items differed in grammatical gender from target items. Results reveal key differences between bilingual groups. Specifically, U.S. bilinguals demonstrate differential use of grammatical gender in code-switching, exhibiting a gender effect only for feminine trials and thus reflecting the documented production asymmetry. Granada bilinguals do not show this differential comprehension pattern. Despite switches happening from Spanish (L1) into English (L2), they incur a large cost to integrating code-switched speech, showing no ability to use grammatical gender. We interpret these results as revealing dynamic changes to the comprehension system due to the use of code-switching as a linguistic variety amongst a community of speakers.

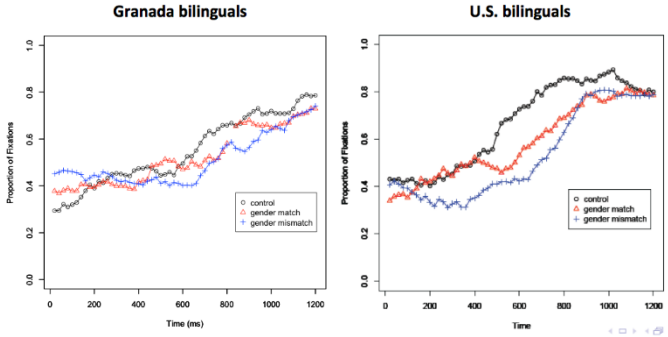

Fig 1. Total looks to target feminine objects from article onset. Control trials do not have a phonological cohort.

Back to Saturday Poster Schedule

Interaction between morphological complexity and rhyme

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Introduction: Using a continuous auditory lexical decision task, we find evidence of facilitatory priming effects between morphologically complex words (e.g. *snow-ed*) and words which rhyme with the stem of the morphologically complex word (e.g. *dough*). The findings provide evidence consistent with morphological decomposition in lexical processing and demonstrate the utility of rhyme prime in probing the structure of the mental lexicon.

Background and Design: Morphological priming for targets preceded by primes sharing a stem (e.g. Marslen-Wilson et al. 1994; Kouider and Dupoux 2009) is typically taken as evidence for decomposition of a morphologically complex word into component stem and affix. However, as hypothetical morphological relationships are often confounded with semantic/phonological factors, morphological priming effects have been attributed to semantic/phonological relatedness between words (e.g. Gonnerman et al. 2007). Rhyme priming (e.g. Slowiaczek et al. 2000) can probe morphological priming as follows: If subjects decompose morphologically complex words (e.g. *snowed* into *snow* + *ed*), then *snowed* should be facilitated by *dough* because *snow* and *dough* rhyme. In using rhyme priming to investigate morphological structure, we avoid semantic confounds and address phonological confounds with control conditions (e.g. *code* and *grove*). These rule out alternative interpretations of the effect that are based on partial rhyme, early obligatory decomposition of words with certain phonological properties, or phonological embedding of the stem. We investigated the interaction of phonological priming and morphological decomposition with monosyllabic words in the following 8 paired conditions:

Experiment 1:

Prime	Target
	1. bare stem (*snow*)
1. rhyme (*dough*)	2. past tense (*snowed*)
2. non-rhyme (*void*)	3. rhyme control (*code*)
	4. decomposition control (*grove*)

Experiment 2:

Prime	Target
1. bare stem (*snow*)	
2. past tense (*snowed*)	1. rhyme (*dough*)
3. rhyme control (*code*)	2. non-rhyme (*void*)
4. decomposition control (*grove*)	

Methods: In both experiments, auditory stimuli were presented to subjects over headphones in a continuous lexical decision task. 16 regular English verbs were used to construct sets of critical items (96 total words). Native speakers of American English were recruited through the university subject pool (Experiment 1: 34 subjects, Experiment 2: 32 subjects to date).

Experiment 1 Results: Using mixed effects models, significant effects are found with the past tense targets ($p<0.001$, predicted effect size (PES)=70ms) and bare stem targets (interaction $p=0.802$, PES=63ms). Rhyme control targets ($p=0.003$) and decomposition control targets ($p<0.001$) have significantly smaller effects. Neither control (rhyme control: $p=0.189$, PES=-3ms; decomposition control: $p=0.390$, PES=15ms) showed significant effects in separate models.

Experiment 2 Results: Using mixed effects models, the rhyme targets show a significant facilitatory effect from the bare stem prime ($p<0.001$,PES=147ms) and the past tense prime ($p=0.047$,44ms) in comparison to the decomposition control. The rhyme control prime showed no significant facilitation in comparison to the decomposition control ($p=0.550$,PES=0ms).

Conclusion: Our results support morphological decomposition during the processing of words. Importantly, the phonological controls demonstrate that phonological overlap/embedding are not sufficient to explain the rhyme priming effect for the stems of morphologically complex words. Taken together, we see that both phonological and semantic factors cannot explain the results. The results are most compatible with theories positing online decomposition. Future work will investigate whether similar effects arise for irregular verbs.

Back to Saturday Poster Schedule

Processing of self-repairs in stuttered and non-stuttered speech

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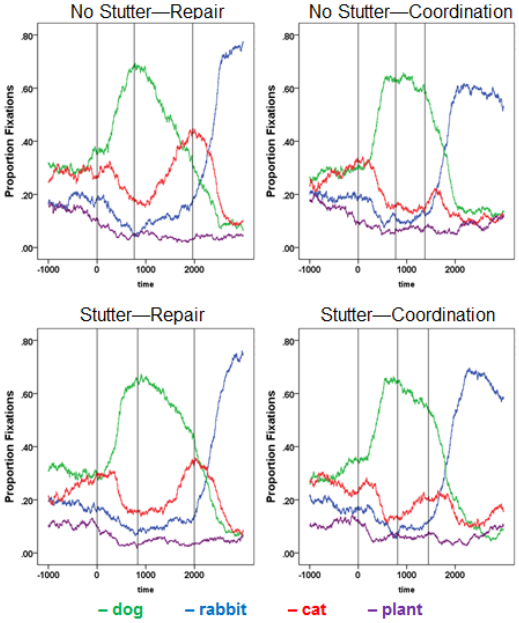
Noisy Channel models of language comprehension propose that listeners combine linguistic input with relevant contextual knowledge in order to recover a speaker's intended meaning when the signal is distorted by environmental noise or speaker error. This account predicts that listeners who encounter a self-repair disfluency (e.g., "*Turn left uh I mean…*") should normally be able to use information about the reparandum ("left") to anticipate the repair ("right") before the repair is spoken. However, this account also predicts that the listener's ability to recover the speaker's meaning depends crucially on the ease with which the listener is able to model the speaker's production system. This suggests that listeners' ability to predict the identity of an upcoming self-repair might be disrupted when the speaker has a fluency disorder (e.g., stuttering) because listeners may have trouble determining whether disfluencies in the utterance signal a self-repair or a more general speech production problem.

In the current visual-world eye-tracking experiment, participants (n = 64) listened to sentences as in the example below. The sentences were recorded by the same speaker twice—once with a moderate stuttering and once without any stuttering (as a result of therapy, the speaker was able to reliably produce speech with versus without fluency controls). Half of the participants heard the sentences with stuttering and half heard the sentences without stuttering. Instances of stuttering only occurred toward the beginning of the sentence, which allowed for the critical words to be spoken identically across conditions. On each trial, the visual display consisted of four pictures representing NP1 (a dog), NP2 (a rabbit), a critical distractor (a cat), and a random distractor (a plant). Offline pretesting showed that the critical distractor was always more plausible than the actual repair.

Mean proportions of fixations to each picture are plotted for the Repair and Coordination conditions. At the onset of the first critical noun (*dog*; line at time zero), all conditions showed similar patterns, with listeners shifting their gaze to the named item. The second line is the mean onset of "*uh*" versus "*and*", at which point listeners were more likely to fixate the critical distractor in the Repair versus the Coordination condition. Importantly, this effect interacted with the speaker manipulation—the effect was larger in the No Stutter condition versus the Stutter condition. The third line is the mean onset of the second noun (*rabbit*), at which point listeners in all conditions shifted their gaze to the named picture. In the NP1 Only and NP2 Only conditions (not plotted here), at the onset of the target noun, listeners shifted their gaze to the named picture.



The results replicate and extend previous work showing that listeners actively predict an upcoming repair when a speaker indicates that he has made an error. Importantly, this effect is reduced when the utterance comes from a speaker who stutters. We propose that this occurs because listeners have difficulty modeling the production system of a speaker who stutters, which supports predictions of Noisy Channel models of language comprehension.

The woman next door went to the animal shelter and brought home _____ even though…

…a dog uh I mean a rabbit…	(Repair)	…a dog…	(NP1 Only)
…a dog and also a rabbit…	(Coordination)	…a rabbit…	(NP2 Only)

Back to Saturday Poster Schedule

Quantitative and qualitative differences across individuals in anticipation-driven comprehension

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Readers' active use of given lexical/structural information and event knowledge elicits anticipatory processing of yet-to-be-encountered information. In this study, we speculated that the goodness for anticipation-driven comprehension might differ as a function of the availability of readers' cognitive resources such as working memory (WM). Using an ERP paradigm, we demonstrated that the differences of readers' WM capacity led to crucial variations on the predicative use of lexical and structural information during sentence comprehension.

For our aim, we used Korean dative sentences. In sentences like (1-2) where recipients appear at R2, themes are highly likely to occur next (80%), indicating that structural expectation associated with words at R3 is extremely high. In contrast, when themes appear at R2, as in sentences like (3-4), verbs (80%), but not recipients (5%), are highly likely to occur next. Thus, readers need to revise their structural expectation in integrating unexpected but grammatically plausible recipients into sentences. The degree of lexical expectation of words at R3 was also manipulated. They were either highly likely (1, 3) or unlikely (2, 4) for given contexts. Readers' WM capacity was measured by using a reading-span task (Daneman & Carpenter, 1980).

We analyzed ERPs recorded at R3, R4, and R5. First, at R3, high WM readers showed the N400 300-400ms post-stimulus onset only when they encountered unexpected words, relative to expected words, in the condition of low role expectation (3-4). Low WM readers showed the N400 in the processing of unexpected words in both when role expectation was high at 300-400ms post-stimulus onset and when it was low at 400-500ms post-stimulus onset. The benefits of high WM capacity led to the faster use of lexical information (Van Petten et al., 1997). Second, at R4 where previously provided arguments continued being integrated, high WM readers showed the anterior positivities aligned with unexpected structures (3-4) emerged 600-700ms post-stimulus onset, but low WM readers showed the N400 at the same time window. This response dichotomy hinted that high WM readers, not low WM readers, actively engaged in the anticipation-driven combinatorial processes in integrating arguments into sentences (c.f., Nakano et al., 2010). Finally, in the processing of sentence-final verbs at R5 where all arguments are completely integrated into sentences, only low WM readers showed the late negativity, known as LPN, occurring 700-800ms post-stimulus onset. Moreover, the deflections for verbs were more negatively-going in the condition of low role expectation than in that of high role expectation. Presumably, the disadvantages of low WM capacity might result in the difficulty in reconstructing previously provided episodic information while they were retrieving argument information and integrating it into contexts (c.f., Meckinger et al., 2007).

In conclusion, our results demonstrated that processing patterns of low WM readers were quantitatively and qualitatively different from those of high WM readers (Tanner, 2013). The lack of WM capacity made readers fall behind in the use of lexical and structural information during sentence processing, in particular, for argument integration.

Role	Word	R1	R2	R3	R4	R5
(1) High	High	*Chelswu-ka* Chelswu-NOM	*wuncensa-eykey* driver-DAT	*chapi-lul* fare-ACC	*emchengnakey* too much	*cipwulhayssta* paid
(2) High	Low		*oyyaswu-eykey* player-DAT	*chapi-lul* fare-ACC		
(3) Low	High	*Chelswuka* Chelswu-NOM	*chapi-lul* fare-ACC	*wuncensa-eykey* driver-DAT	*emchengnakey* too much	*cipwulhayssta* paid
(4) Low	Low		*chapi-lul* fare-ACC	*oyyaswu-eykey* player-DAT		

Back to Saturday Poster Schedule

Reassessing the poverty of the stimulus in *that*-trace effects

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Grammatical parameters have been motivated in part by poverty of the stimulus concerns: if property P is learnable from the primary linguistic data while another correlated property Q is not, a child can establish whether Q holds by determining whether P does. The *null subject parameter* (Rizzi 1982) specifies whether a language permits null subjects, free inversion, and violations of the *that*-trace filter (yes in Spanish, no in English). Phillips (2013) and Chacón et al. (2015) argue that a child cannot directly determine whether the *that*-trace filter is active in her language on the basis of her primary input, given the vanishingly few relevant long-distance dependencies. They conclude that the child depends instead on the indirect learning, using one of the other correlated properties to guide them. However, speakers' judgments about the well-formedness of *that*-trace violations might instead be the result of a more superficial property for which there is abundant evidence: the adjacency of the complementizer *that* and the lexical content that follows a subject gap, namely the finite verb. A learner never experiencing Comp-V sequences might disfavor *that*-trace violating extractions because of the rarity of the offending bigram, while one who frequently experiences such sequences would judge them as acceptable. Interestingly, this account also explains the convergence of properties in Rizzi's parameter: null subjects and free inversion yield examples involving Comp-V sequences, thereby providing the evidential base that would lead to the acceptance of *that*-trace configurations. This account also provides an explanation for the "adverb effect" (Culicover 1993), where the presence of an adverb between Comp and V modulates the acceptability of the extraction: the presence of the adverb eliminates the offending bigram.

To assess the viability of this more superficial approach to learning the *that*-trace filter, we compared the judgments that Chacón et al. (2015) elicited from English and Spanish speakers to the output of two Simple Recurrent Network (SRN) based language models (Elman 1990, Mikolov et al. 2010) trained on the English and Spanish portions of the Europarl corpus (Koehn 2005). Following Lau et al. (2015), we used the syntactic log-odds ratio (SLOR) of a sentence as a measure of the SRN's judgment, as this measure normalizes for sentence length and lexical probabilities. The SRN model replicated the acceptability contrast that Chacón et al. reported for English speakers: examples like (1) with *that*-trace violations receive lower SLOR values than those without ($p<0.01$). In contrast, the Spanish-trained SRN showed no comparable contrast. The English-trained SRN also modeled the pattern observed by Chacón et al. for examples involving the "adverb effect": an adverb immediately following, but not immediately preceding, *that* improves acceptability in En- glish subject questions (2) ($p<0.001$), but both positions of the adverb yield high SLOR values in object questions (3). The SRN showed no such effect for comparable Spanish examples.

We see then that the statistical learning of which SRNs are capable is able to distinguish *that*-trace contexts on the basis of positive data. In the talk we show that SRNs do this while also representing linguistically significant dependencies including agreement and filler-gap dependencies, and permitting the Comp-V sequences found in subject relatives. Though the training regimen and the data exploited here are admittedly not ideal reflections of the child's experience, the fact that any statistical model can succeed in this task means that we must reconsider widely held assumptions about unlearnability. If the form of grammar is to be motivated by learnability concerns, then questions of learnability must be subjected to serious scrutiny.

1. Who did Sonya conclude that *bothers James/James bothers every day in the office?
2. Who did John hope *around lunchtime that/that around lunchtime would dance with Mary?
3. Who did John hope around lunchtime that/that around lunchtime Mary would dance with?

Back to Saturday Poster Schedule

Reflexive retrieval in Mandarin Chinese: Evidence against the Local Search Hypothesis

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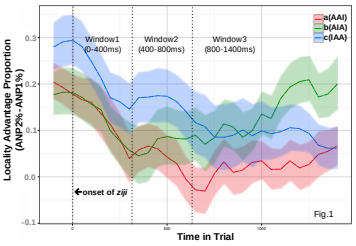
Background: English reflexives must be bound within their immediate clause: "John$_i$ thinks [Tom$_j$ knows [Bill$_k$ likes himself$_{*i/*j/k}$]]." Here, *himself* can only refer to Bill, not Tom or John. However, a parallel example in Mandarin Chinese, "John$_i$ *renwei*(thinks) [Tom$_j$ *zhidao*(knows) [Bill$_k$ *xihuan*(likes) *ziji*$_{i/j/k}$]]." Bill, Tom and John can each be the antecedent of the long distance reflexive *ziji*. Based on the results of a recent MR-SAT study, Dillon et al. (2014) argued that the antecedent search starts locally, only extending long distance when a local antecedent is not possible (*Local Search Hypothesis*). We conducted a visual world eye-tracking study to test this hypothesis in tri-clausal structures and the results suggested that instead of the expected structure-sensitive search, people tended to compare all the potential antecedents in parallel at first, continuously updating their beliefs before making their final choices.

Method: We conducted a visual world eye-tracking study (21 critical conditions+43 fillers; 30 participants) to investigate native Mandarin speakers' *ziji* antecedent retrieval process in tri-clausal structures (NP_1-V_1-NP_2-V_2-NP_3-V_3-*ziji*) manipulating the positions of two animate and one inanimate subject NPs (only animate subject NPs can be the antecedent of *ziji*). The materials were normed separately to insure that both local and long distance binding were possible. For each trial, participants listened to a sentence and clicked on the picture that represented the last word they have heard (See Examples below). A verbal working memory test (Chinese Reading Span Task) was also performed to detect the working memory capacity for each participant.

Results: Target choices indicated a general bias to ultimately choose the more local NP: 53.8% vs. 44.8% in (a), 64.2% vs. 31.4% in (b), and 57.1% vs. 38.6% in (c). However, participants' search patterns showed consideration of both animate NPs initially regardless of condition. In order to see the competition between the two animate NPs during retrieval process, we calculated a Locality Advantage Proportion (LAP) score (ANP_2%-ANP_1%, ANP_2 was always the more local animate NP; see Fig.1) and Elog transformed for analysis. Using LME, we found LAP *decreased* significantly over time in Window1 (from the onset of *ziji* 0-400ms; *p*<.0001), not in Window2 (400-800ms; *p*>.05) and Window3 (800-1400ms; *p*=.15). Critically, if people searched within the local first, we should observe more fixations to the inanimate NP on Condition a (INP in the local clause) than condition c (INP in the matrix clause). However, that was not the case (200-600ms window; a<c: 7.1% vs. 9.3%, *p*>.05). The working memory (WM) score didn't show a significant effect on LAP across the three windows (*p*s>.05), indicating that the pattern we observed here was not specific to people's WM capacity.



Conclusion: The significant decrease in LAP during the early window suggested that, when searching antecedents of *ziji* from working memory, people tended to compare all the potential antecedents in parallel at first, updating their beliefs continuously before making their final choices, a search pattern at odds with the *Local Search Hypothesis*.

Examples:

Task: Pick up the picture that represents the last word you have heard;
Display: A set of images representing three NPs mentioned in the sentence and one distractor;

Conditions: a: Inanimate NP in the local clause (AAI); b: Inanimate NP in the middle clause (AIA); c: Inanimate NP in the matrix clause (IAA)

a	王老师 Teacher Wang	认为 think	张厨师 Chef Zhang	表示 say	那篇报导 the report	在低估 PROG-underestimate	自己 ziji
b	王老师 Teacher Wang	认为 think	那篇报导 the report	表示 say	张厨师 Chef Zhang	在低估 PROG-underestimate	自己 ziji
c	那篇报导 The report	认为 think	王老师 Teacher Wang	表示 say	张厨师 Chef Zhang	在低估 PROG-underestimate	自己 ziji

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Back to Saturday Poster Schedule

Repetition modulates the range of learning in subject-verb agreement

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Previous research has shown that subject-verb (SV) agreement patterns can be shaped by recent experience (Haskell, Thornton, & MacDonald, 2010), lending support to experience-based models of agreement production (e.g., Haskell & MacDonald, 2003). Haskell et al. (2010) showed that exposing participants to plural agreement with collective NP primes increased participants' plural agreement with both collective and non-collective NP targets.

Collective prime: A caravan of buses ***were*** waiting to turn…
Collective target: The class of children…
Non-collective target: The pencil in the gift bags for the organizers…

While their study demonstrated that agreement patterns can be shaped through experience, it is unclear why statistical learning of SV agreement for one construction (collectives) also shaped agreement with non-collective constructions. One possible explanation is that, since Haskell et al. only required participants to provide sentence completions, participants paid less attention to the details of the subject NP than if they had repeated the preamble before completing the sentence, causing them generalize their learning to collectives and non-collective NPs. This raises important questions about the role of attention in how dependencies, such as those between subjects and verbs, are learned (Pacton, Sobaco, & Perruchet, 2015).

In three experiments, we investigated whether using a completion-only paradigm versus having participants retype the preamble (i.e., a preamble-repetition paradigm), would affect: overall patterns of SV agreement, the degree to which SV agreement changed in response to a biasing story, and whether learning would generalize from one construction to another.

In Experiment 1, we replicated and extended Haskell et al.'s (2010) design with 200 participants in a written completion task. In both the completion-only and the preamble-repetition conditions, participants' SV agreement with collective NPs changed as a result of reading a biasing story containing plural vs. neutral verbs paired with collective NP primes. Like Haskell et al. (2010), SV agreement with non-collectives also changed after plural verbs in the completion-only condition. However, in the preamble-repetition condition, there was no change in SV agreement with non-collective NPs. In Experiments 2 and 3, we extended these findings to additional NP constructions. In Experiment 2, 120 participants read a biasing story with preambles containing 'all of the' (AOT) or 'one of the' (OOT) constructions paired with plural or singular verbs, respectively, and we measured whether this affected SV agreement with preambles containing a related—but not identical—construction, namely 'each of the' (EOT). Here too, only participants in the completion-only condition adjusted their agreement patterns on EOT targets to match the AOT and OOT primes; there was no modulation in SV agreement for participants in the preamble-repetition condition. In Experiment 3, 180 participants read a biasing story with preambles containing conjoined NPs paired with either singular or plural verbs, and we measured whether this affected participants' subsequent agreement with other conjoined NP subjects. Here, participants' SV agreement patterns changed in both the preamble-repetition and completion-only conditions.

Taken together, these results support the conclusion from Haskell et al. (2010) that language users adjust their SV agreement based on experience, and that such adjustments can generalize across constructions. We further show that, when participants repeat the preamble, this limits the range of learning in subject-verb agreement, suggesting that attention plays an important role in how participants learn from experience.

Back to Saturday Poster Schedule

Resolving Quantity and Informativeness implicature in indefinite reference

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One central challenge for all theories of conversational implicature (Grice, 1957, 1975) is characterizing the fundamental tension between *Quantity* (Q-)implicatures, in which utterance meaning is refined through exclusion of the meanings of alternative utterances, and *Informativeness* (I-)implicatures, in which utterance meaning is refined by strengthening to the prototypical case (Atlas & Levinson, 1981; Levinson, 2000). A classic illustration of this tension is given in (1) below, roughly following Horn (1984):

(1a) The man injured a child +> the child wasn't his own child. [Q, from alternative *his child*]

(1b) The man broke a finger +> the finger was his own. [I, despite alternative *my finger*]

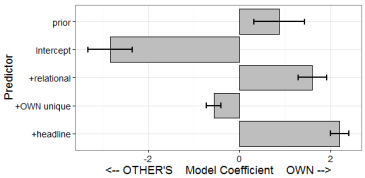
Here we report a systematic investigation of Q/I resolution in semantic underspecification of possession of indefinite direct objects by subjects in simple transitive sentences as in (1). We draw on recent game-theoretic (Degen, Franke, and Jäger, 2013) and Bayesian (Frank and Goodman, 2012) models of conversational implicature to derive five predictions about Q/I resolution in these cases, and test these predictions experimentally using a large-scale forced-choice judgment task and multivariate regression analysis.

Experimental Method: each participant was presented with one prompt of the form "*X V*-ed a *Y*" and asked whether the sentence was about *X*'s own *Y* (OWN judgments) or someone else's *Y* (OTHER'S judgments).

Prediction 1: judgments should track subjective prior probabilities of the respective event types (I-implicature). **Prediction 2:** judgments should be OTHER'S-skewed relative to the prior (Q-implicature). **Prediction 3:** relational nouns whose relations can be satisfied by the other noun should favor OWN judgments. **Prediction 4:** if X possesses only one *Y*, OTHER'S judgments should be favored since the indefinite determiner is infelicitous in cases of referential uniqueness (Hawkins, 1991). **Prediction 5:** lowering the cost of the ambiguous indefinite but not the costs of the fully specified alternatives should favor OWN judgments.

Participants, materials, and procedure: we collected data from 2588 native English speakers recruited via Mechanical Turk, using the method described above. 53 sentence prompts were designed to vary widely in relative OWN/OTHER'S prior probability (Prediction 1), number of relational nouns (Prediction 3), and referential uniqueness on an OWN reading (Prediction 4). To test Prediction 5 each item was presented either as in (1) or in a HEADLINE version ("Man injured child"), which eliminates the need for an overt determiner to encode underspecified possession but not the need for overt material to encode fully-specified possession. Prior probabilities corresponding to each sentence were estimated in a separate norming study based on 4541 judgments from 1258 native English speakers, asking "How likely is an *X* to *V* his/her own *Y* compared to *V*-ing someone else's *Y*."

Results: Mixed logit analysis shows that the collected data generally confirm all our predictions (Fig. 1). There was a numeric trend for OWN interpretation of a prompt to increase with (logit-transformed) prior probability of OWN events as estimated in the norming study, though this trend did not reach significance (p=0.12). The intercept was negative (p<0.001), showing the predicted OTHER'S-skew. OWN interpretations were favored the more relational nouns were included in the prompt (p<0.001), and relationally unique object NPs strongly favored OTHER'S interpretations (p<0.001). Finally, the HEADLINE condition favored OWN interpretation more strongly than the non-headline condition (p<0.001).



Error bars are standard errors.

Conclusion: Indefinite NP objects have long served as classic illustrations of the fundamental Quantity/Informativeness tension in conversational implicature. Here we have shown how they can be used as a rich testbed for multifactorial influences on language understanding. We found clear empirical support for a range of predictions, strengthening the case for the rational- and cooperative-agent models of pragmatic inference from which these predictions were derived.

Back to Saturday Poster Schedule

Resolving the underspecified: Pronominal integration with topicalization and informativity

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Pronoun resolution is processed interactively with a variety of constraints (e.g., Arnold, 1998) and is always framed with the concept of accessibility in mental representation (e.g., Ariel, 2001; Gundel et al., 1993). It has been understood that a referent at subject position is more accessible (e.g., Gordon et al., 1993) and informational new and focused entities have a more accessible cognitive status for pronominal integration (e.g., Almor, 1999). We report two studies investigating in Chinese OSV topicalization construction (1) whether focused referents are more accessible, more importantly (2) whether informational givenness and focus are distinguishable factors in referential processing and (3) whether informativity interacts with syntactic structure.

In **self-paced reading experiment 1** (n=48) with four-sentence passages, cleft structures (i.e., *focused subject/object,* 2nd sentence) in topicalized OSV word order and coherence transitions (i.e., *continue/shift,* 3rd critical sentence) were used in a 2x2 factorial design. **Reading time results** show that coreference to subject and to the topicalized object were generally similar and unexpectedly focused referents were not more accessible than non-focused referents. Moreover, an interaction existed that coreference to the non-focused given referent at subject led to significantly faster reading than to the focused new referent at the topicalized position. Experiment 2 therefore aimed at examining whether givenness or focus would interact with syntactic roles.

2nd sentence	a. **Zhangni$_j$**, shi **Wangjuan$_i$** dashang de. 'It's **Wangjuan$_i$** who beat up **Zhangni$_j$**.' b. Shi **Zhangni$_j$**, **Wangjuan$_i$** dashang le. 'It's **Zhangni$_j$** who **Wangjuan$_i$** beat up.'
3rd sentence	(*continue*) …, **ta** … buhui **zaici da ren $_{(i)}$** …. '…, **she** … will not **beat people again $_{(i)}$** ….' (*shift*) …, **ta** … buhui **zuguai duifang $_{(j)}$** …. '…, **she** … will not **blame her $_{(j)}$** ….'

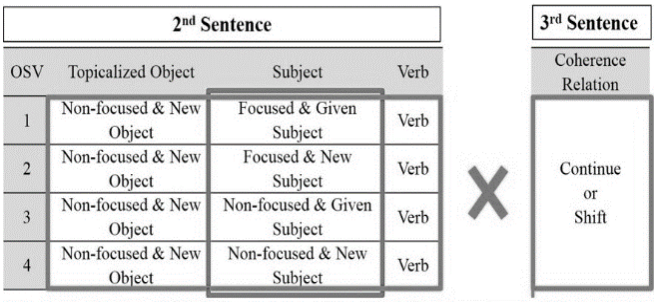

Figure 1. Design of SPR Experiment 2, with informativity and Coherence (the 3rd sentence is the critical region)

In **self-paced reading experiment 2** (n=80) with four-sentence passages, we manipulated the informational givenness (i.e., *given/new*) and focus status (i.e., *focused/non-focused*) of the subject of OSV construction by the use of context and cleft structures at the 1st and 2nd sentences while keeping the topicalized objects constant in terms of informativity (i.e., *non-focused & new*). The design, as shown in Figure 1, also had a factor of coherence relations (i.e., *continue/shift*) at the 3rd (critical) sentence.

Results show that the non-focused given subject referent was more accessible than the non-focused new topicalized object referent. And comparing the four types of subject with different informativity does not show a focus effect. Instead, given referents were always more accessible than new referents. The results reveal the significance of informational givenness in coreference with the OSV word order.

In sum, the dominant subjecthood effect does not always exist, especially in OSV structure where the syntactic topic position may have similar privileged cognitive status as the subject position. We do not find the expected focus effect but discover the distinguishability of focus and givenness as well as the interaction between givenness and syntactic positions in pronominal integration. The results demonstrate the complexity, the multiple-constraints and the interactive nature of referential processing (e.g., Kaiser & Trueswell, 2008).

Back to Saturday Poster Schedule

'Save the date' - Eye movements during calendar date processing reflect pre-articulatory self-monitoring

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Previous speech production studies suggest that our viewing behavior is guided by the need for specific information relevant during conceptualization and encoding processes (cf. Bock et al. 2003). However, to what extent viewing behavior may also reflect information processing during pre-articulatory self-monitoring is an open question (cf. Griffin 2004). To approach this topic we asked Mandarin Chinese and German participants (N=15 in each group) to add a given number of days to a given calendar date (e.g.: "You have an appointment in 5 days. Today is …"). We did not allow our participants to say aloud the result of their calculation, instead they had to verify whether the calendar date they had calculated matched the calendar date on a following visual display (target date). Half of all target dates did not match the correct results of the calculations. Participants gave "yes" or "no" answers. Note that Chinese and German differ with respect to the conventionalized order of day(d), month(m), and year(y) information (German: d-m-y, Chinese: y-m-d). The date given for the calculation task matched the respective conventionalized order in all trials. In addition to the group immanent experimental factor "conventionalized date format" we manipulated the format of the target date using two experimental blocks (N=30 each). In the first block the target date format matched the respective conventionalized date format of our two participant groups. In the second block we exchanged the target date format between groups, yielding a mismatch between the visual sequence of calendar date information and the language-specific conventionalized date format. We measured the sequence of looks to the day, month, and year region of the target date.

Eye tracking data from the first experimental block show a robust left-to-right order of looks in both groups. In the second experimental block we found that after a short adaption phase of about 6 trials the order of looks changed to a robust right-to-left order. Taken together our findings from both participant groups obtained under the match and mismatch condition, thus, strongly suggest that eye movements can be guided by a temporary linguistic representation which results from planning and encoding processes during speech production. We therefore conclude that in addition to the investigation of the conceptualization and formulation processes during language production, eye tracking may also offer new insights into pre-articulatory self-monitoring. Furthermore, the finding that viewing behavior adapts to changes of the spatial location of relevant information underlines that repeated visual search triggered by task demands may be abbreviated by establishing a task-dependent search pattern.

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Back to Saturday Poster Schedule

Screening for Alzheimer's with psycholinguistics

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Introduction Accurate and non-invasive screening for Alzheimer's disease (AD) is critical to allow patients time to plan for the future and access early treatment. The present work studies the effectiveness of well-known psycholinguistic measures at detecting likely cases of AD from narrative speech. Since AD is correlated with memory impairment, this study tests a measure of linguistic memory load (embedding depth) and a measure of changes to working memory load (embedding difference [5]), and since memory impairment can have linguistic consequences this study tests an information-theoretic measure of processing complexity (surprisal).

Methods This study uses the publicly available DementiaBank corpus [1], which contains narrative speech elicited through a picture description task. Subjects with a diagnosis of "Possible" or "Probable" AD were assigned to a single AD group (n=167); healthy, elderly subjects were assigned to a control group (n=98). For this study, half the subjects of each group were included in a development partition for data exploration while the remainder were used for significance testing.

Detecting Alzheimer's Logistic mixed regression was used to detect AD at the word level with a random intercept for each word, by-word random slopes for sentence position, 5-grams (from Gigaword 4.0 [3]), surprisal, embedding depth, and embedding difference, and the following baseline fixed effects: sentence position, word length, unigram frequency (obtained from SUBTL [2]), and all 2-way interactions. Any words absent from SUBTL were removed from the analysis. Adding a fixed effect of 5-grams to the baseline produced significantly better classification ($p < 0.001$) as did the subsequent addition of embedding depth ($p < 0.001$).[1] Surprisal ($p = 0.11$) and embedding difference ($p = 0.23$) failed to improve the model when 5-grams were present.

Coefficient analysis suggests that subjects with AD use shorter sentences ($p < 0.001$), more deeply embedded phrases ($p < 0.001$), and more common words ($p < 0.001$) which tend to be in unusual lexical contexts (lower 5-gram probability, $p < 0.001$). The shorter sentences and more common words suggest an overall reduction in the linguistic complexity of AD speech. The finding that subjects with AD produce deeper embeddings than controls was unexpected since it suggests subjects with AD produce structures with higher memory cost, but the effect seems driven by frequent parentheticals and asides caused by distraction during AD narratives. The low 5-gram probability in the AD group seems to be driven by more telegraphic speech.

While these findings indicate that the impaired memory of AD subjects affects their surface lexical distributions, the weakness of surprisal as a predictor suggests the underlying syntactic distributions are relatively unaffected. Further, the unhelpfulness of embedding difference suggests that updating working memory is not more costly for AD subjects than controls, which implies that the memory difficulties in AD stem from storage or access difficulty.

Results This work shows that psycholinguistic measures of frequency and memory load are robust predictors of AD. They can be easily applied to any linguistic output generated by those suspected of having AD. In practice, these measures may only be applicable to narratives, but since traditional diagnostic tests for AD such as the Wechsler Memory Scale [4] involve narrative components, the measures from this study can cheaply and easily augment other diagnostic data as it is gathered.

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Back to Saturday Poster Schedule

[1] Significance for model improvement comes from ablative ANOVAs between each model and the next simpler one.

Semantic effects in bivarietal picture naming

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Picture-word interference (PWI) is a common paradigm for studying lexical retrieval in word production, which has been used in both mono- and bilingual studies. Language variation, however, has rarely been addressed in lexical-access research. Previous results with two German varieties found no cross-varietal facilitation from meaning-identical distractors, and from first to second variety even interference, but were inconclusive for semantic distractors [1,2]. In German-speaking Switzerland, the majority of people are bivarietal in that they are fluent in both a Swiss dialect and Standard German (SG) - two German varieties that are functionally and linguistically clearly distinct. This diglossic situation lends itself perfectly for conducting psycholinguistic experiments with different language varieties. We conducted two PWI experiments in Bernese German (BG, first variety) and SG to examine the semantic effects within and between varieties as a function of response variety. Semantic effects can be interference or facilitation [3].

Native BG-speaking students named 16 pictures in either BG (Exp.1, n=28) or SG (Exp. 2, n=28) (RESPONSE VARIETY). Written distractors were superimposed simultaneously. Distractors were either semantically related or unrelated to the target name (DISTRACTOR TYPE) and either BG or SG (DISTRACTOR VARIETY). Each picture appeared in every condition. Responses and distractors were matched for word length between conditions. Three items and the data of three participants were excluded from the analysis, as they elicited or produced too many unexpected responses or RT outliers, respectively.

To analyze the overall effects of distractor type and distractor variety and their interaction with the response variety, we pooled the data from both experiments together. A 2x2x2 ANOVA with repeated measures (RESPONSE VARIETY as a between-subjects factor) revealed no significant main effects of DISTRACTOR TYPE or DISTRACTOR VARIETY (Fs<1). The interaction between DISTRACTOR TYPE and DISTRACTOR VARIETY was significant by participants ($F1(1,51)=5.49, p=.023$; $F2(1,24)=4.10, p=.054$), indicating an opposite effect of BG and SG distractors: semantic interference for BG distractors and semantic facilitation for SG distractors. The interaction between DISTRACTOR VARIETY and RESPONSE VARIETY was significant in both analyses ($F1(1,51)=5.51, p=.023$; $F2(1,24)=4.84, p=.038$), with participants being faster in naming pictures with distractors in the response variety. No other interaction was significant (Fs<1).

To analyze the specific effects within each response variety further, we performed separate 2x2 ANOVAs with repeated measures for each experiment. For BG as response variety (Experiment 1), the DISTRACTOR TYPE by DISTRACTOR VARIETY interaction was again significant for participants ($F1(1,26)=5.15, p=.032, \eta^2=.05$; $F2(1,12)=3.69, p=.079, \eta^2=.07$), revealing semantic interference within BG (+19ms), but semantic facilitation from SG distractors (-16ms). For SG as response variety (Experiment 2), there was a main effect of DISTRACTOR VARIETY, significant again for both participants and items ($F1(1,25)=4.36, p=.047, \eta^2=.05$; $F2(1,12)=6.75, p=.023, \eta^2=.13$), indicating a general interference from BG distractors compared to SG distractors (+16ms).

The differential semantic effects of Bernese-German and Standard-German distractors, with opposite directions, suggest that lexical activation spreads across items from both German varieties, but that only BG lexical items enter into lexical competition. According to the "response relevance" hypothesis [4], semantically related distractors that are no context-appropriate responses facilitate naming. Following this line of thought, the semantic facilitation from SG distractors when naming pictures in Bernese can be assumed to reflect activation spreading without response competition. The fact that both semantically related and unrelated Bernese-German distractors interfere with Standard-German object naming indicates that the BG variety needs to be inhibited for SG language production.

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Back to Saturday Poster Schedule

Semantic interference in sentence production in three languages

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Speakers' uses of different syntactic alternations (e.g., active, passive) necessarily affect the distribution of these forms in the language and thus affect language variation. The presence of semantically similar nouns (e.g., *boy, girl*) in an utterance appears to affect rates of both noun omission and use of alternations in structure [1,2], but these phenomena are poorly understood and only omission of agent nouns has been studied. We investigate whether this similarity-based interference is a force in variation in word order and omission of patient NPs (pro-drop) in three languages: English (E), Japanese (J) and Korean (K). J and K are SOV languages with freer word order (scrambling) and freer noun omission (pro-drop) compared to E. Investigations of similarity-based interference in J and K may provide insight that studying E alone may not.

English, Japanese and Korean speakers (all N=24) viewed illustrations with animate agents acting on animate and inanimate patients/themes (Fig 1). Prompts ("Tell me about the girl/ ball,") made the patient/theme given in the discourse, permitting omission of this NP in J and K responses. We coded speakers' responses for structure (active/passive), scrambling in actives in J & K, patient omissions (J & K), and agent omission in passives (the "by-phrase", E, J, K) and in actives (J & K). Many accounts predict more passives with animate patients, but similarity-based interference makes additional predictions: Similarity/animacy should affect patient omission in J and K, with more omissions when both sentence entities are animate (boy/girl) than not (boy/ball), consistent with omission patterns in [1,2]. We predict minimal effects of agent-patient similarity on agent omission because the "tell me about" prompt promotes agent mention, e.g., *The girl is getting kicked by the boy.* Thus, our predictions for noun omission are not about the agent, which becomes the second-mentioned noun in E, J and K passives, but rather about the first noun of the utterance (patient) in pro-drop languages.

Speakers across all languages produced more passives when describing animate entities ($z=3.65$, $p<0.001$, Fig 2), though overall passive rates varied across languages ($z=2.76$, $p < 0.01$), reflecting the disfavoring of passives in Korean [3]. Rates of scrambling in J and K were too low to investigate effects of similarity. There were few effects on agent omission, but there were reliable effects of noun similarity (animacy) on patient omission (Table 1) in J and K (patient omission isn't allowed in E). To our knowledge, this is the first evidence that animacy configurations in an utterance is linked to variation in patient noun omission (pro-drop). We will discuss memory interference in production and its effects on language variation and why we view these results as an effect of agent-patient similarity and not simply patient/theme animacy.

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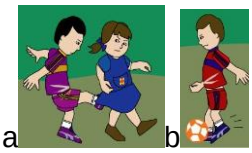
Figure 1: Tsk stimuli. Animate agents acting on animate patients (a) and inanimate themes (b).



a b

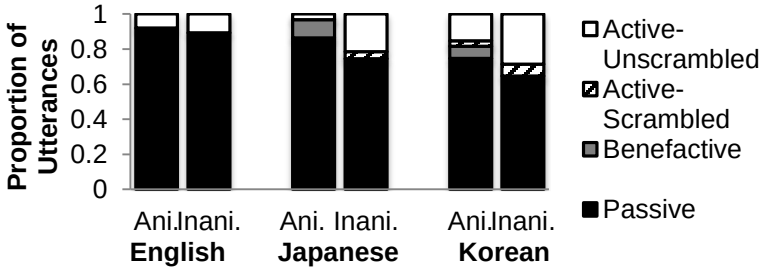


Figure 2: Production responses.

		Patient/Theme Omit	
		Animate	Inanimate
English	Active	-----	-----
	Passive	-----	-----
Japanese	Active	33.3%	33.3%
	Passive	76.6%	56.6%
Korean	Active	20.0%	13.2%
	Passive	34.1%	22.5%

Table 1: Rates of patient/theme omission by target noun animacy, language and sentence structure. Shaded boxes indicate reliable differences.

Back to Saturday Poster Schedule

Semantic predictability affects the production of null pronouns in Spanish

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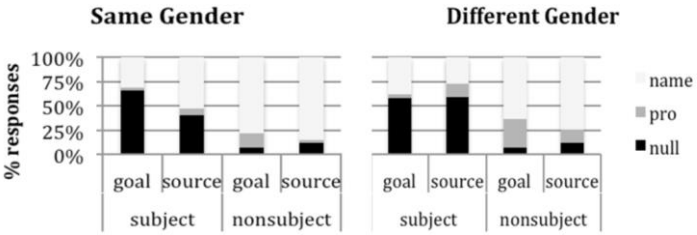
In all languages, speakers/writers are faced with decisions about how to refer. E.g., following *The butler grabbed the fur coat from the maid / El mayordomo agarró el abrigo de piel a la criada*, English speakers prefer pronouns for the prior subject, the butler (e.g., Stevenson et al., 1994), while Spanish or Italian speakers use null subjects, e.g. *Y le vió la etiqueta al abrigo* [And he read the tag on the coat], and overt pronouns are less common. We ask what drives the production of null pronouns in Spanish. In this example, the subject is also the goal of the transfer event, and likely to be mentioned again in a sentence about the following event (Kehler et al., 2008). This predictability may contribute to the butler's salience, and increase null pronoun usage.

Does this semantic predictability matter?

This question is interesting for two reasons. First, null pronoun production is relatively understudied. We know that comprehenders prefer to link null pronouns to prior subjects in Italian (Carminati, 2002), but implicit causality biases can also modulate null pronouns comprehension (Fedele & Kaiser, 2015 CUNY poster). The question here is whether semantic biases also affect production. Critically, this issue is debated in English. Some researchers have argued that only subjecthood and topicality support pronoun use, based on evidence mostly from implicit causality verbs (Fukumura & van Gompel, 2010; Kehler & Rohde, 2013). Kaiser et al. (2011) found that agent/patient roles affected pronoun production in English, but not predictability. By contrast, Rosa & Arnold (2015 CUNY poster) demonstrated that English speakers tend to pronominalize goals (e.g., the butler) more than sources (the maid), while controlling for the subjecthood bias. Does this same bias affect null pronoun production?

Participants in Spanish-speaking countries viewed two-panel stories (see Figure), via Amazon M-Turk. They read a sentence describing the first picture, and continued the story by typing a sentence about the second picture. In half the items the target (the panel 2 character) was the goal of the prior event (as in example above); in half the source (e.g., *El chófer le enseñó a disparar al mayordomo..* [The chauffeur taught the butler how to shoot]. The first sentence had two variants, manipulating whether the target was mentioned as subject or nonsubject (e.g., The chauffeur taught… vs. The butler learned…). The characters had the same gender in 12 items, and different gender in 12 items. We examined the subject noun in the response, coded as null, overt pronoun, or name/description. Here we report % null forms. Only 10% of responses used overt pronouns, and the same patterns obtain if we group all reduced forms (null and overt pronouns) together.



Preliminary data (32 out of 40 participants) revealed a strong preference to use null pronouns for the grammatical subject, as expected. There was also a 3-way interaction (subjecthood x thematic role x gender) reflecting a marginal tendency to use null subject more for goals than sources, but only in the same-gender items. The different-gender context doesn't reduce the ambiguity, but may decrease competition and enhance contribution to the accessibility of the subject (Fukumura et al., 2013). Our findings confirm the subjecthood bias, and also suggest that thematic role bias can play a weak role in null pronoun production.

Back to Saturday Poster Schedule

Semantic priming starts in the parafovea: Evidence from survival analysis

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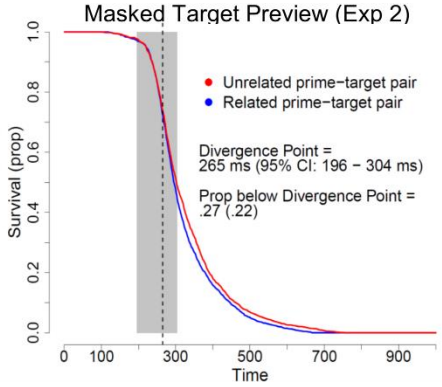
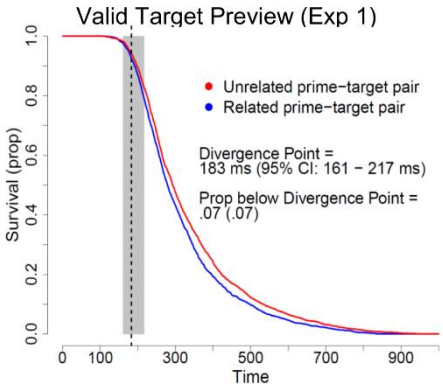
Research on semantic priming during word recognition involves ongoing efforts to distinguish prospective priming processes, those that begin *before* the target word in a prime-target pair is encountered[1,2], from retrospective priming processes that only begin *after* the target word has been encountered[3,4]. Recent applications of survival analysis to fixation durations during reading have provided insight in the time course with which lexical variables (e.g., word frequency) affect reading times[5]. The current study used Reingold and Sheridan's (2014) Confidence Interval Divergence Point Analysis procedure[6] to examine the importance of target word availability to the time course of semantic priming. We presented sequences of four words with experimental prime-target pairs appearing in the first and second position of each set (e.g. “spring summer mustard wolf”), and participants indicated whether a subsequent recognition-memory probe word (e.g., “sky”) had been among the set they had just read. The four words in each set were presented simultaneously, but gaze contingencies were used so that valid parafoveal preview of the target was available while participants fixated the prime in Experiment 1 while, preview of the target was masked in Experiment 2.

Across preview conditions, target words were read faster when preceded by a related compared to an unrelated prime, $F_1(1,58) = 29.3$, $F_2(1,158) = 21.0$. The absolute magnitude of this priming effect was larger when target preview was available compared to when it was not (19 ms vs 10 ms), but the interaction did not reach significance, $F_1(1,58) = 2.6$, $F_2(1,158) = 2.3$. However, survival analyses[6] showed a significant difference in the time course of the semantic priming effect as a function of target preview availability. When the target word was available in parafoveal preview (Exp 1), semantic priming was observed as early as 183 ms after the target was first fixated, and only a small proportion of target reading times (7%) was shorter than the minimum duration required to observe semantic priming. In contrast, when target preview was not available (Exp 2), the priming effect did not emerge until 265 ms after the target was first fixated, and a significantly larger portion (27%) of reading times was shorter than this threshold, t(58) = 4.80.





These findings are consistent with earlier work showing that the rapid influence of a lexical variable (i.e., word frequency) on eye movements during reading depends critically on the parafoveal processing of upcoming words[5], and extends this result to semantic processing of interword relations in the form of priming. Further, the observation that the onset of priming is delayed in cases where the target word is not available until fixation supports the interpretation of semantic priming as a retrospective rather than a prospective effect.

References:

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Back to Saturday Poster Schedule

Sentence processing in aphasia: Test-retest reliability and effects of language treatment

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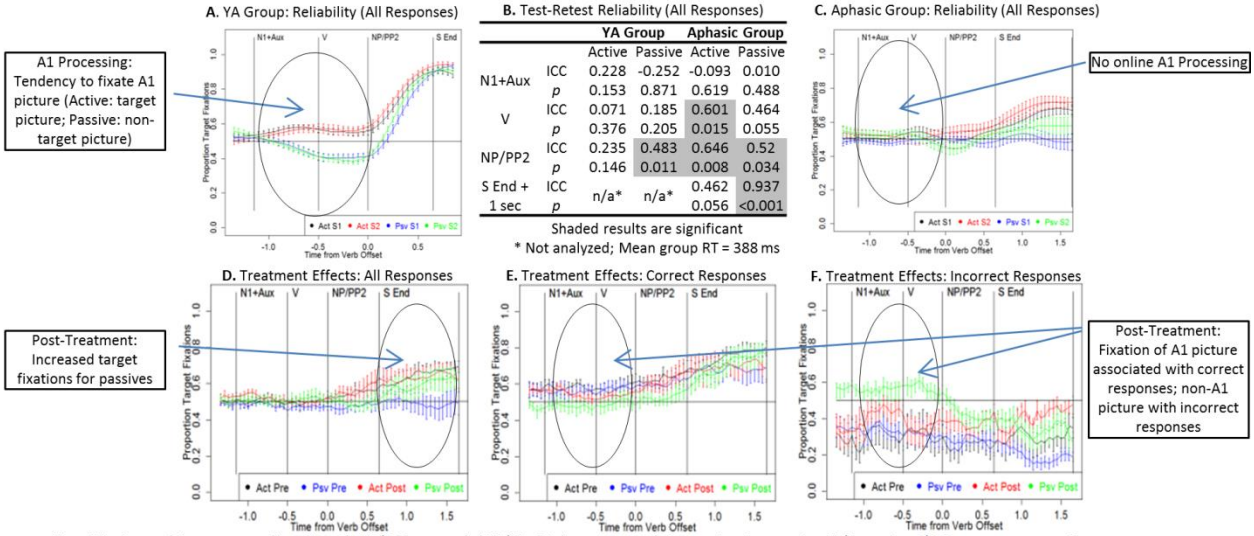
Introduction. People with aphasia often show abnormal online sentence processing, although little is known about how/if processing strategies change with recovery. Establishing stable performance patterns is essential for examining change over time; thus, this study examined the reliability of eye movements in healthy and aphasic listeners.

Methods. E1: Test-retest reliability. 21 unimpaired young adults (YA; M age = 21) and 12 aphasic listeners (M age = 48) performed a sentence-picture matching task twice, about one week apart. Participants heard active and passive sentences (e.g., *The* [$_{N1+Aux}$ *woman was*] [$_{V}$ *lifting/lifted*] [$_{NP/PP2}$ *(by) the man*]; 24 each, within-subjects design; same items across sessions) and selected between two pictures with reversed thematic roles as eye movements were tracked. Intraclass correlations (ICCs) quantified test-retest reliability of the target advantage (i.e., likelihood of fixating the correct picture). **E2: Language recovery.** Seven aphasic individuals from E1 completed a 12-week language treatment program focused on passive sentences. Following treatment, the sentence-picture matching task was administered again on two separate occasions. Changes in accuracy and eye movement patterns were examined using mixed-effects logistic regression.

Results. E1. Eye movement reliability for the YA group was low (ICC<.4) in all regions for both sentence types, with the exception of the NP/PP2 region for passives, which showed moderate reliability (.4<ICC<.58) (Fig A; Table B). However, reliability for the aphasic group was strong for actives (.59<ICC<.75) in the V and NP/PP2 regions and excellent for passives (ICC>.75) at S End (Fig C; Table B). The YA made online agent-first (A1) eye movements (N1 + Aux; V regions) but the aphasic listeners did not. **E2.** Improvement in passive comprehension accuracy (p=.05) and online processing was found, with increased target fixations at S End (Fig. D; p<.05). Post- but not pre-treatment, the aphasic listeners were more accurate when they fixated the A1 picture early in the sentence (V region, p<.01) (Figs E-F).

Discussion. Test-retest reliability was strong-to-excellent in the aphasic listeners, reflecting stable performance patterns. In YA, reliability was lower, due to minimal between-subject variability; however, moderate post-verb reliability for passives suggests stable thematic reanalysis. Language treatment improved offline and online processing of passive sentences and increased accuracy when the A1 picture was fixated early in the sentence, suggesting that aphasic listeners benefit from A1 processing. These findings indicate that language treatment supports the re-emergence of more normal-like processing in aphasia.



		YA Group		Aphasic Group	
		Active	Passive	Active	Passive
N1+Aux	ICC	0.228	-0.252	-0.093	0.010
	p	0.153	0.871	0.619	0.488
V	ICC	0.071	0.185	0.601	0.464
	p	0.376	0.205	0.015	0.055
NP/PP2	ICC	0.235	0.483	0.646	0.52
	p	0.146	0.011	0.008	0.034
S End + 1 sec	ICC	n/a*	n/a*	0.462	0.937
	p			0.056	<0.001

Shaded results are significant
* Not analyzed; Mean group RT = 388 ms

Note: N1 + Aux = subject noun + auxiliary; V = verb; NP/PP2 = postverbal NP/PP; S End = sentence end; Act = active; Psv = passive; S1/2 = session 1/2; Pre = pre-treatment; Post = post-treatment

Back to Saturday Poster Schedule

Slow, NOT Shallow Processing of (in)definiteness in L2 English

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This study shows that second language learners (L2ers) of English with no article system in their first language (Korean) can accommodate first-mention definite NPs as the presupposition of unique referents and use definite articles to predict upcoming linguistic materials.

The existing literature focuses on how L2ers lag behind native speakers (L1ers) both in sentence processing in general[1] and in L2 English article use[2]. However, recent findings in L2 sentence processing cast doubt on the evidence that the claims were based on[3], [4] and L2 English article literature has rarely employed rigorous online methods. Here, we use self-paced reading (SPR) and referent prediction task (RPT) to probe L2 definiteness processing.

In SPR, adapted from [5], the context that presupposes either a unique or non-unique referent is counterbalanced with either a definite or indefinite NP: In the **kitchen**/*appliance store*, Jason checked out **the**/*a* stove very carefully. RT significantly increased when the (in)definiteness of a critical NP mismatched the presupposition in the context (*a stove* in the **kitchen** and **the stove** in the *appliance store*). Interestingly, the effect was observed in the spillover region for L1ers but in the post-spillover region for adv. L2ers. Log-transformed RT residuals were fit with uniqueness and definiteness as fixed effects for their interaction and with subjects and items as random effects (L1: $t = -2.03$ $p=.043$; L2: $t = -2.09$, $p=.036$) in a linear mixed effects regression model. The L1 model had definiteness random slopes for items and the L2 model had uniqueness random slopes for both subjects and items. Inter(mediate) L2ers showed no effects in either region.

RPT employed audio-visual stimuli with a picture (Figure 1) and an incomplete sentence like "The woman wants to buy **the**/*a* …" to see if **the** and *a* will lead to the prediction of a **unique** (red mug) and *non-unique* (one of the glasses) referent respectively.

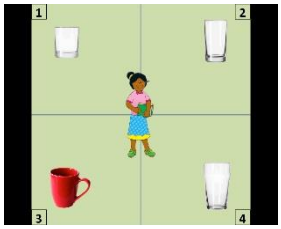
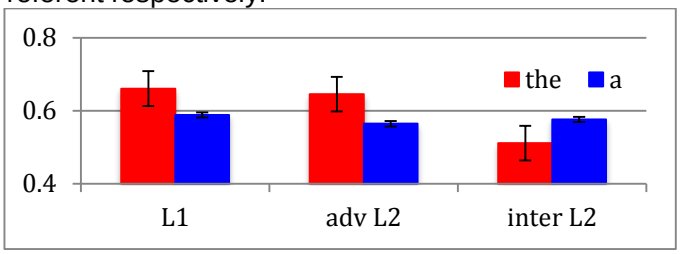
Figure 1 

Figure 2 

Predicting a unique referent was coded as a binary dependent variable in generalized linear mixed effects regression (maximal model: article–a fixed factor; random intercepts/slopes – subjects/items). Figure 2 shows the rate of unique referent prediction by speaker group and article. Both L1ers ($n=34$) and adv. L2ers ($n=42$) chose a unique referent significantly more when given **the** than *a(n)* (L1: $z=-2.06$, $p=.039$; adv L2: $z=-2.62$, $p=.009$). Interestingly, inter. L2ers ($n=27$) chose a unique referent numerically more in the indefinite condition ($z=1.28$, $p=.201$). However, in comparison to L1ers, inter. L2ers predicted unique referents significantly less in the definite condition ($z=-2.91$, $p=.004$) and significantly more in the indefinite condition ($z= 2.68$, $p=.007$). Given the opposite pattern, we argue that inter. L2ers interpret "*a(n)*" as "one" and choose the single/unique referent over one of the multiple/non-unique referents.

In sum, the findings indicate: (1) adv. L2ers' processing of definiteness is not shallower than L1ers, if slow, (2) adv. L2ers can use definiteness to predict unique referents, and (3) L2ers' interpretations of (in)definiteness change as proficiency increases. We argue the slowness of L2 processing not be dismissed as lack of knowledge or incomplete processing.

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Back to Saturday Poster Schedule

Speaker likeability influences utterance acceptability: Social context modulates tolerance for pragmatic violations in adults

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When given a binary sentence-acceptability judgment task (right/wrong, true/false), adults frequently reject pragmatically underinformative statements (UIS) (e.g., *Some elephants are mammals*) while children under 7-years reliably accept them [1]. Based on these results many researchers conclude that children lack the skills or cognitive resources to derive pragmatic meanings at adult-like levels. [2] challenged this conclusion. They proposed that children simply have greater tolerance for pragmatic violations than adults. They found that young children reliably detect violations of informativity when asked to judge the acceptability of UIS on a three-valued scale, even though they did not consider the violations to be grave enough to warrant outright rejection with a binary judgment.

We propose that tolerance to pragmatic infelicity is also a key contributor to variation among adult judgments in binary choice tasks. We tested whether manipulating social context (i.e., perceived speaker likeability) can modulate adult judgments of UIS. In two studies, we manipulated the perceived likeability of the speaker by providing participants with a specific social context (a tutoring situation) and a detailed description of their interlocutor (either a Likeable or Obnoxious or Non-native-English speaking child taking an exam), who made a series of true, false, and UIS about animals. MTurk workers were randomly assigned to a speaker condition. The critical difference between experiments was the number of response options: Exp1 (N=94) was a binary judgment task (i.e., “That’s right”, “Not quite”), Exp2 (N=98) was a ternary judgment task (i.e., “That’s right”, “Not quite”, “That’s wrong”).

Adults can vary in their rates of rejecting UIS both within and across studies. One account suggests that stems from differences in cognitive resources available to compute pragmatic meanings [3]. On this view, manipulating social context should not affect participant judgments more in a binary vs. a ternary judgment task. An alternative account suggests that individuals vary in their willingness to reject UIS outright because unlike patently false or true statements, UIS are neither completely wrong nor completely correct. As such, the binary choice task would impose an artificial dichotomy on participant responses. When forced to select between two bad options, social factors may tip the balance so that participants choose to reject UIS more for less likeable speakers. In contrast, a ternary judgment task should allow participants to clearly indicate that UIS are intermediately acceptable between patently true and false statements. With a more apt response option, participants should not be as affected by speaker likeability.

Results from Exp1 demonstrated that the rate of acceptance of UIS was positively correlated with individuals’ ratings of speaker likeability. When forced to choose between rejection and acceptance, participants were more likely to reject UIS from less likeable speakers. This finding indicates that social context modulates adult comprehenders’ pragmatic judgments: Speaker likeability is thus an important contributor to pragmatic tolerance in adults. The rejectance or acceptance of UIS is not solely dependent on perceivers' cognitive resources or pragmatic skills. In Exp2 most respondents rated UIS as intermediate between true and false statements. In this case, responses were not affected by differences in speaker likeability. In both experiments, judgments for patently true and false statements were unaffected by speaker likeability.

Thus pragmatic tolerance contributes to variability found in adult responses just as with children. This work also indicates that the results of binary judgment tasks, which have been used in dozens of studies to investigate pragmatic processing, should be interpreted with care. When UIS are accepted, researchers have inferred that no pragmatic meaning has been computed. As [2] observed with children and we observed here with adults, participants can judge UIS as acceptable even in situations where they understand UIS are pragmatically inappropriate.

References

[1] Noveck & Reboul, 2009 [2] Katsos & Bishop, 2011 [3] Dieussaert et al., 2011; Marty & Chemla, 2013

Back to Saturday Poster Schedule

Similar words compete, but only when they're from the same category

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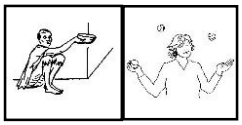
In sentence production, speakers must resolve competition among simultaneously active words, but it is not yet clear if *all* words compete for selection. Dell et al. (2008) argued that syntactic category limits which words compete, explaining why substitution and exchange errors rarely occur between words from different categories. Critically, in the picture-word interference (PWI) task that is typically used to study competition, this predicts that interference from semantic associates should occur only when they share the same category with the target words. However, previous PWI studies have found that semantic similarity causes interference regardless of category overlap (Vigliocco et al., 2005), and category overlap independently causes interference (Pechmann & Zerbst, 2002). These results, however, may reflect factors other than category *per se*. P&Z's stimuli were confounded with imageability (i.e., semanticlly-confounded; Janssen et al., 2010), and Vigliocco et al.'s study had a different number of words in the noun (det + N) vs. verb (V) distractor conditions and furthermore had mismatching conjugation (of Italian 3rd person singular) between the target and distractor verbs (i.e., morpho-phonologically confounded). The underlying challenge is that category is indicated by a word's syntactic environment or its morphological form, and so it is difficult to manipulate category in PWI tasks without introducing semantic/morpho-phonological confounds. Here we introduce a novel *sentence-picture interference (SPI) task*, which allows us to manipulate the category of distractor words independently from their semantics and morpho-phonology. In two experiments, we show that semantic interference occurs only when distractor and target words share the same category.

Exp. 1 elicited verbs. Participants (n=48) read sentences like (1) or (2) to start each trial.

(1) *John told me about the boy's sincere praying*. [noun condition]

(2) *John told me that the boy was sincerely praying*. [verb condition]



In (1), *praying* functions as a (deverbal) noun. In (2), *praying* functions as a verb. Although the noun/verb status of these words is controversial, we chose one of the most uncontroversial environments. On critical trials, one second after the sentence offset, participants saw an action picture that they described in sentential form. In 50 % of the critical trials (=48 trials) the verb of the target utterance was related to the last word in the distractor sentence (e.g., *he is begging,* Fig. 1) and in the other 50% of the critical trials it was unrelated (e.g., *she is juggling*, Fig. 2). On filler trials (= 96 trials) participants read sentences similar to (1) and (2), then, also following a 1-second delay, were signaled to repeat the sentence verbatim. This task ensured that the sentences in the critical trials would be kept active in memory. Speech onset time from the picture onset in the critical trials was measured. **Exp. 2** elicited nouns. Materials and procedures were identical except that participants (n=13, testing ongoing, results already reliable) described pictures with sentences like *his begging is yellow* (related) and *her juggling is red* (unrelated). This was achieved by putting a colored square at the bottom right of each picture, and by telling the participants to imagine themselves being in a world where perceiving action evokes a color.

Results & Conclusion: In Exp.1, verb production was slowed by semantically related distractors only when they functioned as a verb (as in (2); Fig. 3a). In Exp.2, action noun production was slowed by semantically related distractors only when they functioned as a noun (as in (1); Fig 3b). This pattern suggests a pure category constraint in lexical competition. Semantically similar words compete with each other, but only when they share the same category.

Fig. 3a

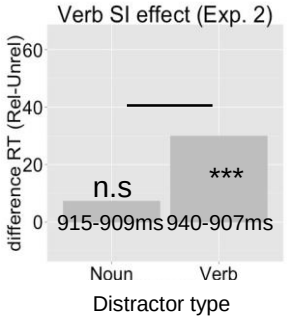
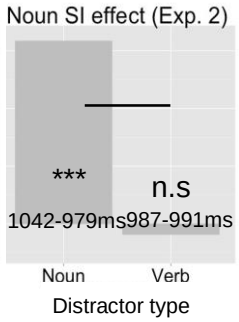


Fig. 3b



Back to Saturday Poster Schedule

Structural constraints strongly determine the attachment of temporal adverbs

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Cue-based models of sentence processing posit that syntactic processing relies on cue-based memory retrieval mechanisms [1]. Evidence for this comes from studies that show cue-dependent retrieval interference in comprehension. For example, [2] provide reading time evidence that processing a filler-gap dependency is more costly when there are multiple candidates in memory that match the semantic cues of the filler. However, different linguistic relations differ in how they weight various retrieval cues in comprehension. In particular, subject-verb agreement is highly sensitive to morphological cues, as evidenced by intrusion effects seen in reading measures [3]. In contrast, syntactic cues strongly dominate antecedent retrieval associated with pronouns [4] and reflexives [5], which show very little interference from grammatically inaccessible elements with appropriate features.

In this study, we investigate the processing of temporal concord, the dependency between the tense morphology of a verb and a temporal adverb such as *last month* in (1):

(1) *The agent (leased$_{(V1:MATCH)}$ /will lease $_{(V1:MISMATCH)}$) the apartment that (was$_{(V2:MATCH)}$ /will be $_{(V2:MISMATCH)}$) renovated to a young couple* | ***last month*** | ***after*** | *several meetings.*

We ask what linguistic cues are weighted in retrieving an attachment site for the adverb. If attaching a temporal adverb into the structure relies on morpho-semantic cues, we expect to see interference from grammatically inaccessible tensed verbs (e.g. *was renovated* in (1)) that match the adverb's features. If instead structural information has priority in selecting an attachment site [6], we predict no interference effects from the grammatically inaccessible verb.

We conducted an eye tracking study (*n*=34), including 24 experimental sentences as in (1) combined with 76 fillers. We manipulated two factors: whether the main verb's (V1) tense features matched the adverb, and whether the tense features of a grammatically inaccessible but linearly closer verb (V2) matched the temporal adverb. If the retrieval of an attachment site for the temporal adverb is strongly guided by morpho-semantic cues, then we predict i) **similarity-based interference** when both V1 and V2 match the temporal features of the adverb [2] and ii) an **illusion of grammaticality** when V1 mismatches the adverb's features, but V2 matches the adverb's features [3]. If instead structure is a strong constraint on adverbial attachment [6], we expect to see only a main effect of feature match with V1.

	first-pass		total time	
	last month	**after**	**last month**	**after**
V1:MAT,V2:MAT	316 (16)	263 (19)	482 (32)	342 (31)
V1:MAT,V2:MIS	309 (15)	243 (14)	454 (33)	340 (28)
V1:MIS,V2:MAT	339 (16)	270 (24)	555 (40)	379 (38)
V1:MIS,V2:MIS	344 (17)	252 (19)	569 (44)	388 (43)

At the adverb region we observed a significant main effect of V1 match [$F_1(1,33) = 4.99$, $p<.05$; $F_2(1,23) = 3.60$, $p = 0.07$] in first-pass measures. We also observed this in total time measures at the adverb region [$F_1(1,33) = 10.99$, $p<.05$; $F_2(1,23) = 10.85$, $p< .05$] and at the spillover region [$F_1(1,33) = 8.95$, $p<.05$; $F_2(1,23) = 4.53$, $p< .05$]. No significant effects were found prior to the critical region (e.g. V2, indirect object). Our results revealed no significant interaction of V1/V2 match.

Despite the numerical trend, we failed to find a significant interference effect on the adverb. However, readers were sensitive to grammaticality (i.e. V1 match). These results offer new evidence for a more fine-grained analysis of the retrieval cues weighted during the processing of different linguistic dependencies, tentatively suggesting that the retrieval of an attachment site for the temporal adverb is guided mainly by structural constraints [6] while the morpho-semantic cues play a smaller role in selecting an attachment site for the adverb. We are currently pursuing further confirmation of this conclusion replicating our first study.

[1] Lewis & Vasishth, 2005. [2] Van Dyke & McElree, 2006. [3] Wagers et al., 2009. [4] Chow et al., 2014. [5] Sturt, 2003. [6] Frazier & Clifton, 1996.

Back to Friday Poster Schedule

Structural priming from errors reflects alignment, not residual activation

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When listeners hear a speaker produce and correct an error, they do not simply "delete" the erroneous material. In fact, hearing partially produced and corrected sentence fragments leads to structural priming: people tend to describe dative-eliciting pictures with double-object datives (DO) after hearing a sentence like *"The mechanic is giving the driver, uh, is recognizing the driver,"* and with prepositional datives (PD) after hearing *"The mechanic is giving the part, uh, is recognizing the part,"* [1,2]. This shows that listeners do not fully discard perceived sentence fragments even when clearly produced in error. One explanation for this priming effect from errors is that corrections imperfectly "overlay" the error, leaving aspects of the original (predicted) structure "visible" to affect interpretation and future production (cf. [3]). A similar account is that the activation or memory trace of a parsed PD or DO structure persists to affect production despite an intervening correction (fitting with residual activation accounts of structural priming, e.g., [4]). Alternatively, priming from corrected errors may reflect *alignment* via error-based learning (e.g., [5]). By this account, priming reflects the utility of learning how a speaker tends to produce sentences even from sentence fragments that were produced in error (cf. [6]).

If structural priming from errors reflects imperfect overlay and/or a persistent memory trace, then more extensive corrections with more explicit error signals (in the examples below, *"uh, I mean, the pitcher..."* vs. just *"uh…"*) should lead to greater overwriting of the error and/or more time for a memory trace to fade. Thus additional repair material should reduce these structural priming effects. In contrast, the alignment account predicts that priming effects from corrected errors should be insensitive to the extent of corrections and to explicitness of error signals. Here, participants (N=42) described dative-eliciting pictures after listening to prime sentences that begin as datives but were corrected (via cross-spliced recordings) to either another dative sentence (A & B) or to a transitive sentence (C & D). Stimuli either did or did not include the material underlined in the examples below, to determine if additional overwriting material and more explicit error signals reduce structural priming from the error. Primes without the underlined material allowed for a replication of [2], where datives corrected to transitives (C and D) produced equally robust priming effects as datives corrected to datives (A and B).

(A) *The pitcher is tossing the catcher...uh, [I mean, the pitcher] is returning the catcher the ball.*
(B) *The pitcher is tossing the ball... uh, [I mean, the pitcher] is returning the ball to the catcher.*
(C) *The pitcher is tossing the catcher...uh, [I mean, the pitcher] is watching the catcher.*
(D) *The pitcher is tossing the ball...uh, [I mean, the pitcher] is watching the ball.*

Because the critical predictions are that the priming effect either will or will not differ as a function of additional repair material (i.e., one account predicts a null effect), analyses relied on Bayes Factors, assessing the strength of evidence in favor of either H1 (a difference) or H0 (no difference) using default priors [7]. Replicating [2], priming effects from datives corrected to datives were no different than from datives corrected to transitives (BF_{01}=5.82; i.e., the observed data are almost 6 times more likely under H0 than H1). Similarly, priming effects from errors with explicit correction signals (*"I mean"*) and more corrected material did not differ from primes with less explicitly signaled errors (*"um"*) and with less correction (BF_{01}=5.60 for primes that were corrected to transitives; BF_{01}=3.99 across all prime types). Priming effects from errors thus appear to be unaffected by the type of error signal or the amount of corrected material, supporting the idea that priming from errors does not reflect residual activation of the error's structure, but rather reflects implicit alignment with the production patterns of another speaker.

[1] Slevc & Ferreira, 2013, JEP:LMC; **[2]** Slevc, CUNY2015; **[3]** Ferreira & Bailey, 2004, TICS; **[4]** Pickering & Branigan, 1998, JML; **[5]** Chang et al., 2006, PsycReview; **[6]** Jaeger & Snider, 2013; Cognition; **[7]** Cauchy prior width = 0.707; JASP software (v. 0.7): Love et al., 2015

Back to Saturday Poster Schedule

Subcategorization frame entropy in online verb learning

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Background. Syntactic bootstrapping approaches to verb learning posit that learners use a verb's subcategorization frame (SCF) distribution to learn its meaning [3]. Thus, they require that this distribution can be inferred from the input. [1] raises a potential problem for syntactic bootstrapping: child-directed speech (CDS) has lower by-verb SCF entropy than adult-directed speech. This suggests that CDS is less likely to provide each verb's full SCF distribution in reasonable samples.

Findings. Here, we show (i) that online verb-learning is actually *improved* by the presentation of lower entropy subcategorization frame distributions when the number of samples presented from that distribution are small and (ii) that higher entropy only matters as sample size grows. This suggests that, rather than being a hindrance, low entropy may be necessary for getting syntactic bootstrapping off the ground, while high entropy feeds later fine-tuning of the learned meanings.

Corpus study. We first show that different utterance contexts in which learners find themselves give rise to different SCF entropy. Verb-SCF pairs were automatically extracted from each transcript in the Gleason corpus [4], which contains dependency-parsed transcripts of both play and dinner contexts for 24 children. A stratified nonparametric bootstrap was used to first match sample size by utterance context via subsampling within child, followed by resampling within child. The by-verb SCF entropy was calculated on each resampled dataset, and a mixed effects zero-inflated gamma (ZIG) model was fit to those entropies with fixed effects for context and random intercepts for child. Both fixed effects components of the ZIG suggest higher entropy in dinner contexts.

Norming task. Our norming task, based on the "one-shot" Human Simulation Paradigm (HSP) [2,6,7] task in [5,8], aims to measure the semantic informativity of particular sentences in CDS. We use this measure in constructing the main study and to establish that item informativity, as opposed to informativity of the whole distribution, is the same across contexts. All sentences containing the 10 most frequent clause-embedding verbs in Gleason were extracted. For each verb and context, 20 sentences were sampled and the verb replaced with a blank. Standard HSP nonce variants were also created. 677 participants were recruited through Amazon Mechanical Turk (AMT) to fill in the blank in each sentence. Logistic mixed models (random inter.: PARTICIPANT and VERB) of response accuracy were constructed; LEXICAL CONTEXT (nonce, real) and TRUE VERB LOG FREQUENCY are significant in LLRTs ($ps < 0.001$), but UTTERANCE CONTEXT (dinner, play) is not.

Main study. Our main study trains participants on a novel verb seen in sets of the above syntactic contexts and afterward asks them to make similarity judgments between the novel verb and known verbs (novel judgments). These judgments are then compared to similarity judgments for the 10 real verbs used to construct the sets (real judgments), made publicly available by [9]. For each sentence from the norming, a nonce verb was inserted in place of the blank. Each verb's sentences were then divided into high and low informativity sets based on norming accuracy (cf. [5,9]) and another norming task. These were further subdivided into large (10) and small (5) sets. 4800 participants were recruited through AMT and shown one condition of the 160 created by crossing UTTERANCE CONTEXT, LEXICAL CONTEXT, VERB, INFORMATIVITY, and SET SIZE. They were then asked to judge the similarity between the trained nonce word and the 31 attitude verbs investigated in [9]. A linear mixed model was fit with correlation between z-scored nonce and real judgments as the dependent variable and the above factors plus TRUE VERB LOG FREQUENCY as predictors. We find (i) in small high informativity sets, play correlations are higher than dinner but get no higher with large sets, and (ii) in large high informativity sets, dinner correlations are higher than play.

Selected references. [1] Buttery & Korhonen 2005. [2] Gillette et al. 1999. [3] Landau & Gleitman 1985. [4] Masur & Gleason 1980. [5] Medina et al. 2011. [6] Papafragou et al. 2007. [7] Snedeker & Gleitman 2004. [8] Trueswell et al. 2013. [9] White et al. 2015.

Back to Saturday Poster Schedule

Syntactic and pragmatic factors driving asymmetries in online processing of 'only'

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Most theoretical accounts of focus-sensitive particles like 'only' acknowledge that their interpretation requires the integration of contextual and linguistic information, but it remains largely unknown how this interaction plays out in real-time. Recent psycholinguistic work in this domain has produced divergent results (see below). Our findings from two Visual World eye-tracking studies (**n = 34, 32**) help resolve this conflict, and confirm the existence of an *adult* processing asymmetry for 'only': sentences such as (1a), where the particle associates with the subject, incurs a higher processing cost than sentences like (1b), where it associates with the direct object. Such an asymmetry is highly unexpected from a theoretical standpoint, and identifying its source has the potential to shed light on the mechanisms underlying the representation and evaluation of focus-alternatives.

Whether 'only' associates with the subject or direct object has consequences for interpretation: given identical discourse context, different inferences arise for (1a) and (1b), as given in (2a), (2b), respectively.

(1) a. *Only [Bill]$_F$ bought some flippers* **(SUBJ-ONLY)** b. *Bill only bought some [flip-flops]$_F$* **(OBJ-ONLY)**
(2) a. *No one else bought what Bill bought.* b. *Bill bought nothing else.*

Kim *et al.* (2008, 2015) report evidence for incremental integration of semantic and pragmatic cues in sentences containing 'only'. They also report a *Previous Mention* effect of 'only': adults make *anticipatory* looks to the target item in the display if it was *mentioned* in the preceding discourse. However, Romoli *et al.* (2014) find no evidence for such early looks in their (subject-)'only' condition. As it stands, it is unclear how to relate these latter divergent results fit in with the incremental processing story supported by Kim *et al*.'s findings.

Current Studies We hypothesized that the syntactic position of 'only' is a predictor of the differential pattern of effects in the Kim *et al.* and Romoli *et al*. studies. To investigate this, our experiments directly manipulated the syntactic position of 'only', keeping constant the visual display (***Fig.1***) and discourse set up (see **(3)**). The critical sentences in the control conditions appeared without 'only'. **Exp 2** differed from **Exp 1** in one respect: **Exp 2** included an additional context sentence, (3b).

(3) SAMPLE DISCOURSE CONTEXT:
a. *Amanda and friends are shopping for a trip to the beach.*
b. *They're looking for flipflops, bathing suits, flippers and an umbrella.* ***(Exp 2)***
c. *Amanda bought some flipflops and an umbrella.*

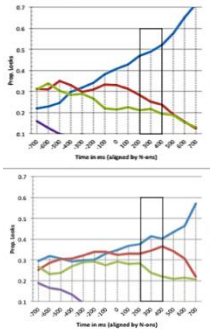

Fig. 1. **Exp 1 - Diff. in Target vs. Cohort Looks in 200ms post-N-onset window in Obj-only (top); Subj-only (bottom) conditions.**

In **Exp 1**, we find a significant interaction driven by greater looks to the target in the object-only condition ($p<0.01$), and conversely, the absence of such looks in the Subject-only condition, relative to their respective controls (***Fig.1***). The first is a replication of the Kim *et al.* pattern, while the latter a replication of the Romoli *et al*. results. Our findings confirm the critical role of the syntactic position of 'only' in driving differential patterns of looks, and helps make sense of the divergent findings from previous studies. Moreover, our results establish the existence of an unexpected online processing asymmetry for 'only': Object-*only* sentences are processed significantly faster than their Subject-*only* counterparts.This asymmetry in turn explains participants' ability to make predictive looks in the former case, but not the latter. Interestingly, the direction of this asymmetry (Subject > Object) parallels a well-known asymmetry in the acquisition of 'only' (Crain et al. 1999, Paterson et al. 2003, 2006, *a.o.*). This opens up the possibility that the adult asymmetry, now confirmed by our findings, shares a causal explanation with the developmental asymmetry. However, no current theory of 'only', or presupposition triggers more generally, readily accounts for the observed asymmetry, and one main goal of our talk will be to propose a possible explanation of this finding in terms of a modified theory of alternatives. Moreover, our finding that looking patterns diverge on the basis of the position of 'only' suggests that the effects reported by Kim *et al.* in connection with 'only', rather than being linked with the lexical item alone, is modulated by its syntactic position as well.

Finally, the Previous Mention effect of '*only*' reported in Kim *et al.*, and replicated in our **Exp 1**, completely *disappears* in the corresponding Object-*only* condition in **Exp 2**, helping us rule out a Recency-based explanation of the Previous Mention effect of 'only'. Taken together, our results support a considerably more nuanced picture of the processing of focus-sensitive operators such as 'only' than previously available, in which pragmatic constraints and syntactic cues interact dynamically with lexically encoded meaning to guide online comprehension.

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Back to Saturday Poster Schedule

Individual Differences in Distributional Learning and Online Processing

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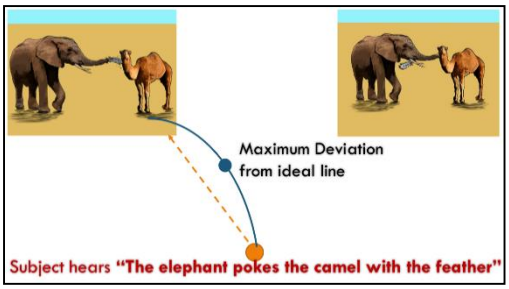
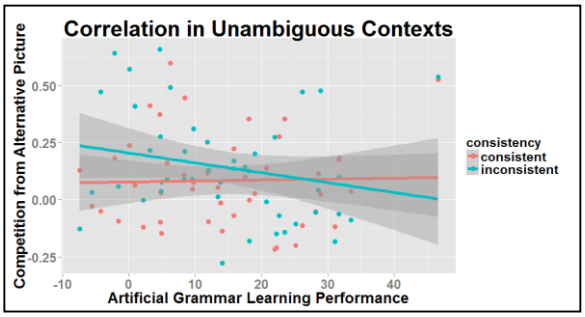
Statistical learning (SL) has been posited as a key mechanism contributing to language learning, but links between individual differences in SL (both adjacent and nonadjacent linear dependencies) and online language processing have been difficult to find.[1] While learning linear dependencies is likely useful for language acquisition/processing, proficiency rests on the ability to understand that words belong to categories (e.g. verbs, nouns), and that those categories—and subcategories—distribute differently across syntactic phrases. People can use distributional properties during acquisition to form categories which allow them to generalize how to use words syntactically.[2] During processing, people can expediate understanding by using distributional information associated with the verb to predict its argument, an effect termed *verb bias*. In Snedeker and Trueswell (2004), adults used verb bias to disambiguate when context could not. In Reeder, Aslin, and Newport (2013), adults formed categories from distributional information in an artificial language after a brief exposure. We adapt tasks from these studies to explore individual differences in the ability of adults to 1) discriminate between two sets of verbs that differ in the probability that they will appear in a syntactic context, and 2) use distributional information to discriminate between grammatical and ungrammatical sentences in a novel linguistic context. Together, these tasks allow us to explore links between learning and processing.

The figure at right illustrates the verb bias task. Participants choose the picture that goes with the sentence with a computer mouse. Sentences were developed from verb and noun norms in Snedeker and Trueswell (2004). Verb bias was measured as the maximum deviation from an imaginary line from start to end point to measure competition from the alternative picture. In some trials, the correct picture is consistent with the interpretation the verb bias predicts; e.g. "poke" predicts a phrase describing an instrument more often than a phrase modifying the object noun, and in others it is inconsistent. We predicted straighter trajectories when the pictured interpretation was consistent with verb bias because of decreased consideration of the alternative.



The SL task was adapted from the Sparse condition in Experiment 3 in Reeder et al (2013). Participants rate the grammaticality of sentences following an exposure phase. To succeed, participants must form grammatical categories. Because distributional information is used to determine bias, we expected SL performance to predict verb bias sensitivity. SL ability was measured through the difference in ratings of grammatical and ungrammatical sentences.



For the 46 adults tested, we found a marginally significant (p=.10) 2-way interaction: when the picture was inconsistent with verb bias, greater SL ability predicted less attraction to the incorrect picture. While unexpected, this finding suggests individuals with greater SL ability are more flexible choosing a less likely interpretation.

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Back to Saturday Poster Schedule

[1] but see Misyak & Christensen 2012 for correclation of SL and offline measure

[2] Ambridge & Lieven, 2011; Ambridge, Pine, & Rowland, 2011, 2012

The acquisition of focus constructions in Mandarin Chinese

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Reasonable consensus has been reached that the semantic function of cleft constructions is to mark focus [1][2]. In producing the cleft sentence, *It is John who ate the banana*, the speaker is taken to assert that no one other than the denotation of the focus element, *John*, ate the banana. A speaker who produces the pseudocleft sentence, *What John ate is the banana*, is taken to assert that John ate the banana, but nothing else. A study by Heizmann (2007) found that 5-year-old English-speaking learning children manifested adult-like performance in responding to the English cleft construction [3]. In contrast to English and other Germanic languages, however, Mandarin Chinese use lexical markers to package information concerning focus [4]. The present study investigated Mandarin-speaking children's comprehension of both kinds of focus constructions, the cleft and the pseudo-cleft.

A speech production task was conducted with 58 5-year-old Mandarin-speaking children, to assess their comprehension of these two types of focus structures [5]. In a third condition, the participants were presented with test sentences that contained a pitch accent on the Subject NP. Each sentence was accompanied by a picture that depicted three distinct agents and three objects (Table 1). The pictures were designed so that participants could correct either the Subject NP or the Object NP, depending on the assignment of the focus element. Participants were expected to use the pitch accent on the Subject NP as the basis of their correction of the test sentences in the Subject accented condition, but they were expected to produce Subject NP corrections in responding to the cleft test sentences, and Object NP corrections in responding to the pseudo-cleft test sentences. A control group of 56 Mandarin-speaking adults was also tested.

There were no between-group differences in the Subject accented condition. However, Mandarin-speaking adults performed significantly better than the child participants in the other two conditions (Fig. 1), and the between-group difference was largest in the pseudo-cleft construction. It is important to note, however, that the adult participants made more errors than anticipated in both the cleft and the pseudo-cleft test conditions (the mean accuracy of adults was 70% in the cleft condition). It is not surprising, therefore, that Mandarin-speaking children experienced even more difficulty with these constructions. The findings of the present study are in striking contrast to those of the Heizmann's (2007), suggesting that the Mandarin Chinese cleft constructions are qualitatively different from the corresponding English constructions [6]. This, in turn, suggests that child language learners find it easier to assign focus using syntactic cues rather than lexical cues.

Fig. 1.

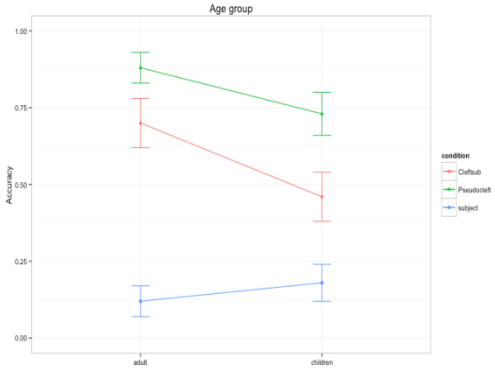

Table 1. Experimental condition:

(1)Subject accented condition:
XIAONIAOF yo pingzi, shi me?
birdy have bottle Aux Question-marker
'The BIRDYF has the bottle, right?'

(2)Cleft subject condition:
Shi XIAONIAOF yo pingzi, shi me?
Aux birdy have bottle Aux Question-marker
'It is the BIRDYF who has the bottle, right?'

(3)Pseudocleft object condition:
Xiaoniao yo de shi PINGZIF, shi me?
Birdy have DE Aux BOTTLEF, Aux Question-marker
'What the birdy has is the bottle, right?'

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Back to Saturday Poster Schedule

The Binding Options of German D-Pronouns

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German demonstrative pronouns (DPros) of the DER/DIE/DAS series have a strong anti-subject bias (Bosch et al. 2007), similarly to DPros in other languages (Kaiser & Trueswell, 2008). This makes DPros markedly different from personal pronouns (PPros), which do prefer grammatical subjects as antecedents. Concerning the binding options of DPros, Wiltschko (1998) has proposed that, unlike PPros, DPros are full DPs with a covert noun phrase and thus subject to Principle C of Binding Theory: They cannot be bound.

We conducted two word-by-word self-paced reading experiments and tested whether DPros are in fact subject to Principle C or, if not, whether they avoid grammatical subjects not only as antecedents in discourse but also as sentence-internal binders. In both experiments, we investigated reading times for the male possessive version of the DPro, DESSEN, and the male possessive version of the PPro, SEINEN. In single sentences, exactly one male and one female human referent were introduced by DPs c-commanding the respective pronoun. Importantly, pronouns could only be interpreted as bound by the male referent, avoiding any ambiguity. In Experiment 1, half of the experimental items had a male subject and a female indirect object and half of the items a female subject and a male indirect object. The pronoun was always contained in a DP that functioned as the direct object. It was therefore c-commanded by both the subject and the indirect object, see (1).

(1) a. Peter bringt Maria **seine/ dessen neue Daten, die schon** lange fällig waren.
Peter brings Maria his (PPro/DPro) new data, which have been overdue for a while.
b. Maria bringt Peter **seine/dessen neue Daten, die schon** lange fällig waren.
Maria brings Peter his (PPro/DPro) new data, which have been overdue for a while.

In Experiment 2, both referents were subjects and, in half of the items, the male referent was the subject of the matrix and the female referent the subject of an embedded clause, with the other half showing the reversed order, see (2). In both experiments, experimental items were interspersed with distractors and fillers (75% of materials). Log-transformed reading times were analyzed for five consecutive words (in bold), starting with the pronoun (DESSEN; SEINEN). Statistical analyses on reading times were conducted using linear mixed effects models with random intercepts and maximal random slopes for participants and items.

(2) a. Peter denkt, dass Maria findet, dass **sein/dessen Ferrari eine gute Investition** war
Peter thinks that Maria finds that his (PPro/DPro) Ferrari was a good investment.
b. Maria denkt, dass Peter findet, dass **sein/dessen Ferrarri eine gute Investition** war
Maria thinks that Peter finds that his (PPro/DPro) Ferrari was a good investment.

In Experiment 1, readers slowed down for sentences with a male subject when the pronoun was a DPro. For sentences with a female subject, no reading time differences between DPro and PPro versions were observed. This lead to a significant Referent Order (male or female subject) x Pronoun Type (PPro or DPro) interaction for words 3 & 4, ts > 1.97, ps < .05. For Experiment 2, having run 43 out of the 48 scheduled participants, we already find a strong reading slow-down for sentences with a male matrix subject and a female embedded subject when the pronoun was a DPro, but not when it was a PPro. For sentences with a female matrix and a male embedded subject, DPro and PPro versions do not show reliable reading time differences. The Referent Order (male or female embedded subject) x Pronoun Type (PPro or DPro) interaction is already statistically marginal for word 5, $t = 1.81$, $p = 0.070$.

Taken together, our data suggest that DPros are not subject to Principle C and, just like PPros, can be bound by c-commanding DPs. Furthermore, our results indicate that DPros do not always avoid grammatical subjects as binders. Rather, being the marked pronoun variant in German, they disallow binding by DPs that are maximally prominent in the sense of asymmetrically c-commanding all other DPs contained in the respective sentence.

Back to Saturday Poster Schedule

The Communicative Function of German Noun Classification

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A central goal of typological research is to characterize linguistic features in terms of both their functional role and their fit to social and cognitive systems. One longstanding puzzle for typologists concerns why certain languages employ grammatical gender, which assigns nouns to distinct classes and marks neighboring words for agreement. From a taxonomic standpoint, gender specification can often appear arbitrary, with little obvious correspondence between the semantic properties of a given referent and its noun class (Vigliocco et al., 2005). Historically, gender has thus been viewed as a useless ornament with little apparent rhyme or reason (Maratsos, 1979). Here, we examine whether an information theoretic perspective might shed some light on the communicative function of noun classification in German.

Languages appear to be organized to maintain stable levels of uncertainty across discourse, making each lexical choice more equally predictable in context, (Genzel & Charniak, 2002; Hale, 2003) and thereby reducing processing difficulties (Tily et al. 2009). When prior context is ignored, uncertainty should be highest at points where a noun occurs, as nouns are the most diverse part of speech. However, by systematically narrowing the set of candidate nouns that can follow (Dahan et al. 2000), gender markers may serve to significantly reduce the lexical access problem. Stated formally, gendered articles should act to smooth potential spikes in uncertainty by redistributing entropy across the marker-noun pairing, thereby helping speakers maintain a more constant entropy rate.

Consistent with this proposal, an analysis of the German mega-corpus Stuttgart deWaC (Faaß & Eckart, 2013) revealed that gender markers systematically reduce nominal entropy across all cases. In theory, this entropy smoothing function should also facilitate the use of a more diverse (and more informative) set of nouns following gender marked determiners. In German, it is possible to test for this by comparing singular nouns, which are marked for gender, with plural nouns, which are not. In line with this thesis, it was found that singular nouns following determiners were significantly more lexically diverse than their plural counterparts.

Finally, for a gender system to be maximally functional, it should reduce the uncertainty of an upcoming noun in context by narrowing the search space of likely candidates. To meet this requirement, such a system should assign different genders to nouns that are both semantically similar and potentially highly confusable in context. High and low-frequency forms will thus pose different challenges in terms of entropy management. To further examine the fine-grained relationship between frequency, semantics, and noun class, we attempted to predict gender sameness for pairs of nouns based on the pair's frequency, pointwise mutual information, and semantic similarity, using a Generalized Additive Model, validated with a bootstrap sampling technique. Gender sameness was predicted by two composite factors: (1) the semantic similarity of the pair modulated by their co-occurrence likelihood ($\chi 2$ = 711.43; $p < 0.0001$); and (2) the frequency of the words in the noun pair ($\chi 2$ = 599.38; $p < 0.0001$). These results suggest systematic trends in noun class assignment: While nouns that are semantically similar tend to belong to the same class, this effect varies with frequency—high-frequency items tend to be distributed across genders, while low-frequency items tend to be clustered within the same gender.

These findings indicate that gender classes in German do not reflect straightforward taxonomic distinctions, but rather reflect a tight 'discriminative' logic (Ramscar et al, 2010), employing a structured system of semantic clusters and contrasts to facilitate lexical understanding. We discuss these findings in relation to rule-based gender classification schemes (Zubin & Köpcke, 1982; Steinmetz, 1986), and in the light of our comparative work on nominal entropy management in English (Ramscar et al., CUNY 2016).

Back to Saturday Poster Schedule

The contribution of verbs and conceptual representations to grammatical function assignment in Korean sentence processing

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Two competing hypotheses contrastively predict the role of verbs in grammatical function (GF) assignment during sentence processing. The lexical hypothesis[1] (LH) assumes that verbs play a crucial role in the assignment of GFs, whereas the structural hypothesis[2] (SH) maintains that GFs are assigned through language users' conceptual representations of an event rather than through verbs. A previous study found that English speakers utilise information of GFs assigned by verbs in sentence comprehension[3] (B&G), attesting to the validity of LH in English. However, the information of verb-based GFs may not be easily available for Korean, a head-final language, since it is a late-arriving cue in this language[4]. A recent study showed that processing patterns in Korean are more compatible with SH than with LH[5]. It is thus predicted that Korean speakers rely less on information of GFs derived from verbs than English speakers do.

The present study tests this prediction by investigating the contribution of information of GFs assigned by verbs or conceptual representations to Korean sentence interpretation in comparison with the results of B&G. A total of 44 Korean native speakers were divided into two groups: Real-verb (RV) and Nonce-verb (NV) groups. Both groups were presented with 16 Korean equivalents of the English sentences in B&G, created by crossing 4 argument structure constructions (transitive, ditransitive, caused-motion, and resultative) with 4 real or nonce verbs, and were asked to sort the sentences into 4 piles according to overall sentence meaning. The results were converted into deviation scores by counting the number of changes for the sorts to be entirely verb- (Vdev) or construction-based (Cdev) ones[3]. On a scale from 0 to 12, Vdev closer to 0 indicated a stronger verb-centred sorting tendency, and Cdev closer to 0 denoted a stronger construction-centred sorting tendency. A hierarchical agglomerative cluster analysis was also conducted to analyse specific tendencies of participants' sortings.

The sorting of RV group was biased more towards verbs but less towards constructions than that of English speakers in B&G. The sorting of NV group, in contrast, was biased towards construction similarity. The clustering analysis further corroborated participants' skewedness of the sorting pursuant to the verb conditions: verb-centred clustering in RV group, and construction-centred clustering in NV group. The strong verb-centredness in RV can be interpreted as participants' focus on the verb themselves, not on the GFs assigned by the verbs, implying their weak reliance on the information of GF derived from verbs for Korean sentence interpretation. Moreover, when verbs could not provide enough clue for efficient sentence processing (NV), participants tended to infer sentential information from incrementally constructed conceptual representations in a sentence. These observations support SH in Korean, which indicates the attenuated role of verbs for assigning GFs at least in Korean sentence processing.

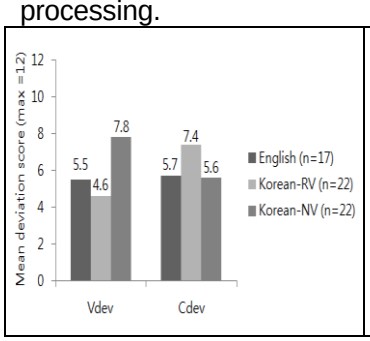
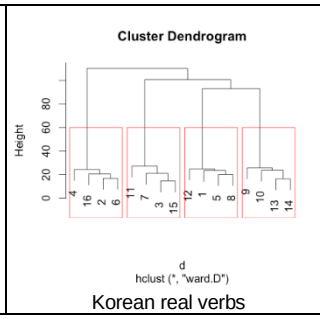
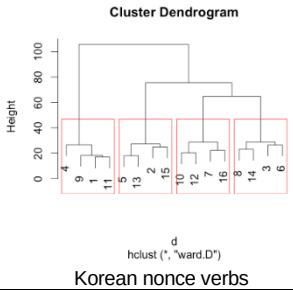


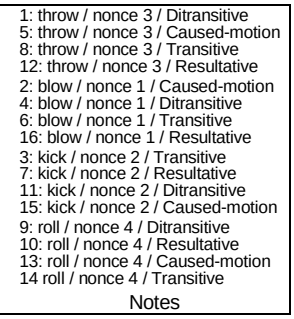
Figure 1



Korean real verbs



Korean nonce verbs



Notes

Figure 2

References: [1] Bock & Levelt (1994), Handbook of Psych.; [2] Bock et al. (2004), The Integ. of Lng, Vision, & Action; [3] Bencini & Goldberg (2000), JML; [4] Choi & Trueswell (2010), JECP; [5] Hwang & Kaiser (2014), JEP:LMC

Back to Saturday Poster Schedule

The discourse history: When does the past influence the present?

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We address the question of how the discourse history shapes conversational language use by leveraging the phenomenon of Lexical Differentiation (Van der Wege, 2009). Lexical differentiation is the tendency of speakers to elaborate referring expressions with modifiers, e.g., "*the striped shirt*", if a different exemplar from the same category had been mentioned in the past, e.g. "*the shirt*". The phenomenon of differentiation shows that speakers are sensitive to the discourse history, but the differentiation rate varies (from ~5% to 25%), and little is known about why speakers choose to differentiate. Two experiments test the hypothesis that the discourse history shapes language use when past contexts are coherently linked to the present context.

Experiment 1: 36 pairs of naïve participants (Ps) completed a referential communication task followed by a memory test. Ps viewed 15-square grids on separate computers. Each square held a picture. On each trial, 4 of the 15 pictures were uncovered (Fig1), and the speaker (S) described 1 object for the listener (L) to click (the target was indicated on S's screen only). Ps completed 8 trials with each grid before moving to a new grid with new pictures. Each set of 8 trials included 1 setup trial, 1 test trial, and 6 interspersed fillers. We manipulated two factors: differentiation (within-Ps) and coherence of the discourse history (between-Ps). In the differentiation condition, the setup trial had a critical setup pair of items from the same category (e.g., yellow and green banana), and S described one of them (e.g., *"Click on the green banana*"). In the non-differentiation condition, the critical setup pair was not presented, and S described a unique item (e.g., *"Click on the ball"*). Test trials were the same across conditions: S described a target (e.g., peeled banana) that—critically—was a new exemplar from the same category as the critical setup pair, but that was unique in the local context. Based on previous findings, we expected speakers to modify their referring expressions, e.g., "*peeled banana"* more when a different exemplar of the category had been referenced before (differentiation condition). The coherence of the discourse context was manipulated based on the perceptual grouping of each set of 8 trials. In the coherent condition (CC), a different background color was used for each set of 8 trials and the 15 pictures remained in fixed grid positions across trials. In the non-coherent condition (NCC), the background was a fixed gray color across all sets and picture position varied. A recognition memory task followed, to probe memory for the pictures.

Experiment 2 was designed to replicate the findings in E1, with two changes: (1) the backgrounds in the CC condition were scenic photographs selected to emphasize the distinction between sets. (2) Relevance was manipulated in a blocked, within-Ps design.

Results: Significant differentiation effects in E1-2 replicated previous findings of more modification in the differentiation vs. non-differentiation condition (E1: 12% increase, z=-3.9, p<.05; E2: 16% increase, z=-5.15, p<.05). The differentiation effect was significantly higher when discourse contexts were coherent (E1: CC 16% vs. NCC 8%, z=-1.86, p=0.06; E2: CC 22% vs. NCC 10%, z=-2.01, p<.05). Memory for past referents was excellent (E1 d'=1.6; E2 d'=1.68). There was no influence of the coherence manipulation on memory for past referents (ps>.05). Thus, failing to differentiate is not due to poor discourse memory.

Conclusions: The discourse history shapes current reference design when the present and past are linked through a coherent discourse context. While contextual coherence increased differentiation, it had no influence on memory. Thus contextual coherence, rather than memory, defines the relevant domain for reference.

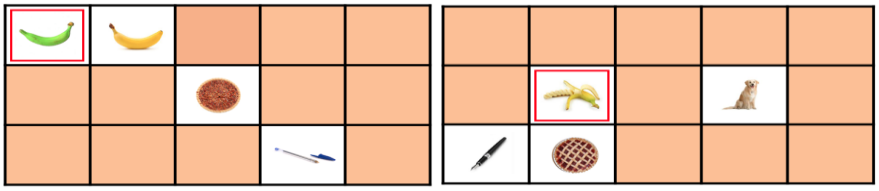

Fig1. E1: example setup (left) and target (right) trials in the Differentiation-Coherent condition.

Back to Saturday Poster Schedule

The effect of prominence on antecedent retrieval: new SAT evidence

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A pronoun must be linked to its antecedent in order to be interpreted. When the antecedent precedes the pronoun in the linguistic context, comprehenders must access a representation of the antecedent NP in memory. In frameworks such as Discourse Prominence Theory [1] antecedent retrieval is modeled as an *iterative search* through a list of NPs in order of their prominence (as modulated by a number of syntactic, semantic, and discourse factors). Such a model predicts an inverse relationship between antecedent prominence and retrieval time: the more prominent an NP, the faster it should be retrieved as an antecedent. Other frameworks model antecedent retrieval as a *cue-based direct-access* retrieval procedure, under which access to an antecedent should proceed in constant time, regardless of prominence. Support for such models comes from [2], which presented evidence that modulating the prominence of an antecedent through clefting affected the *accuracy*, but not the *speed*, of retrieval.

Such a theoretically important finding bears further investigation; in this experiment we used the phrase-by-phrase multiple-response speed-accuracy tradeoff (MR-SAT [2,3]) method to investigate the generality of direct-access antecedent retrieval. We manipulated the prominence of an inanimate NP (*the bouquet*) that could corefer with an object pronoun (*it*) in a subsequent sentence (1). Our prominence manipulation differed from [2] by holding syntactic construction constant across conditions: the NP was either the subject of the main verb (*Prominent*) or the subject of an embedded clause (*Embedded*). We constructed acceptable/unacceptable versions of test sentences by varying the verb that took the pronoun as object. Verbs either expressed an acceptable relation if the pronoun was interpreted as coreferent with the antecedent NP (*watered the bouquet*) or an unacceptable one (*comforted the bouquet*). Test phrases (underlined below) were constructed such that they offered no additional semantic cues for antecedent retrieval (unlike in [2]). Control conditions were designed to reduce the predictability of a pronoun and the unacceptability of specific verbs (2).

After reading each item, participants were prompted to give a series of 17 time-locked judgments about the sentence's acceptability that began prior to the appearance of the underlined phrases in (1) and (2). MR-SAT provides independent estimates of the *asymptotic accuracy* of retrieval (measured in *d'*), as well as its *speed,* which is assessed as the rate of increase in accuracy over a ~5 second post-stimulus interval. If antecedent prominence affects retrieval accuracy, we expected asymptotic *d'* rates to be higher when the antecedent was *Prominent*. If prominence improves speed of retrieval, we predicted that speed parameters (rate or intercept of a fitted exponential model) should differ between conditions. Similar differences should not be observed in the control conditions, where no retrieval is required.

Preliminary Results (n = 8; n = 24 planned) indicate that prominence has a clear effect on participants' accuracy as measured by asymptotic *d'* (*Prominent: d' = 2.69*; *Embedded: d'* = 1.76). This corroborates Foraker & McElree's (2007) contention that prominence directly impacts retrieval accuracy. Similar *d'* differences are not observed between control conditions. At present, results also suggest that the speed of retrieval does not differ with prominence, however the best fitting model of the aggregated data suggests that accuracy rose above chance 90ms sooner (measured by intercept of the fitted exponential functions) when the antecedent was prominent than when it was embedded.

PROMINENT: *The bouquet* that the widow received that morning rested quietly beside the graves.
EMBEDDED: The widow that *the bouquet* was received by rested quietly beside the graves.

(1) After the lengthy eulogies, the funeral director ✓watered/ ✗comforted it tenderly.

(2) After the lengthy eulogies, the funeral director ✗watered/ ✓comforted the mourners tenderly.

[1] Gordon & Hendrick, (1998); [2] Foraker & McElree, (2007); [3] McElree et al., (1993)

Back to Saturday Poster Schedule

The effect of verbal aspect and verb type on the salience of discourse entities

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Previous investigations of utterance interpretation have shown that hearers make use of various semantic features to make predictions about an unfolding discourse, including thematic roles (Kintsch 1994; Kaiser & Trueswell 2004; McNamara & Magliano 2009, *inter alia*). Rohde *et al.* (2006) have shown that both verbal aspect and verb type affect the interpretation of ambiguous pronouns; i.e., with a transfer-of-possession verb in perfective aspect, as in (1), participants were more likely to interpret the pronoun as specifying Robert, suggesting their attention shifted from the AGENT thematic role to the RECIPIENT:

(1) Steve threw a frisbee to Robert. He….

However, when the verb appeared in the imperfective inducing an atelic interpretation (*Steve was throwing a frisbee…*), the effect was reduced, suggesting an inhibition of the attentional shift in thematic role. Thus, just as the occurrence of a transfer verb increases the salience of the RECIPIENT, the presence of imperfective aspect inhibits it.

To investigate whether these effects extend beyond ambiguous pronouns, we manipulated verbal aspect (perfective/imperfective) and verb type (transfer/non-transfer) in a priming task to measure discourse referent salience. 48 sentences were constructed: 24 transfer and 24 non transfer verbs (following Rohde et al. 2006). Each discourse introduced two discourse entities (an AGENT and a RECIPIENT) with an occupation-denoting NP (e.g., *the banker).* Probe words associated with the referents' occupations were generated using Latent Semantic Analysis (Landauer et al. 1998), each with a similarity score of .5 or higher. Each participant read one of the versions in (2), with AGENT and RECIPIENT counterbalanced:

(2) The banker/potter {sent/was sending} a message to the potter/banker.

Participants then performed a lexical decision task in which they distinguished extant words (probes) from non-words. We hypothesized that if a transfer verb in perfective aspect directs participants' attention to the RECIPIENT, they should be faster to identify words associated with that role. We also predicted that this effect would not occur for non-transfer verbs in perfective aspect (e.g. *helped*) given the lack of transfer and the resultant attentional shift. Further, imperfective aspect should also inhibit this attention shift in both transfer and non-transfer sentences (e.g., *was sending, was helping*), as atelic interpretations preserve AGENT salience.

A 2x2 repeated measures ANOVA shows an effect of perfectiveness for transfer verbs, consistent with our hypothesis $F(1,1064)=13.33$, $p<.01$. When presented with transfer verbs in perfective aspect, participants reacted faster (in milliseconds) to probe words related to the RECIPIENT (M=1450, SD=450) than to those related to the AGENT (M=1558, SD=690), indicating that attention shifted to the RECIPIENT, reflecting that role's heightened salience. However, RTs did not vary with non-transfer verbs in perfective (with no effect of occupation on verb type), suggesting attention was not transferred to the RECIPIENT, consistent with Rohde et al. (2006).

Imperfectiveness affected non-transfer verbs, also consistent with our hypothesis $F(1,954)=47.55$, $p<.01$. When presented with non-transfer verbs in the imperfective aspect, participants reacted faster to probe words related to the AGENT (M=1400, SD=399) than to the PATIENT (M=1529, SD=605), indicating that the reader's attention remained with the AGENT. RTs did not vary with transfer verbs in the imperfective, consistent with Rohde *et al*. (2006).

In a follow-up sentence-completion study, we found that participants were more likely to complete a sentence by referencing the RECIPIENT if the sentence contained a transfer verb in the perfective than if it contained a transfer verb in the imperfective, thus confirming the lexical decision data. These studies converge with results found by Rohde *et al.* (2006) by providing evidence that a transfer-of-possession verb in perfective aspect results in a transfer of attention from AGENT to RECIPIENT, and, more generally, that attention to the thematic role and verbal aspect cues drive appropriate and salient lexical activation.

Back to Saturday Poster Schedule

The effects of contextual predictability and parafoveal preview on word recognition during reading: A comparison between older and young adults

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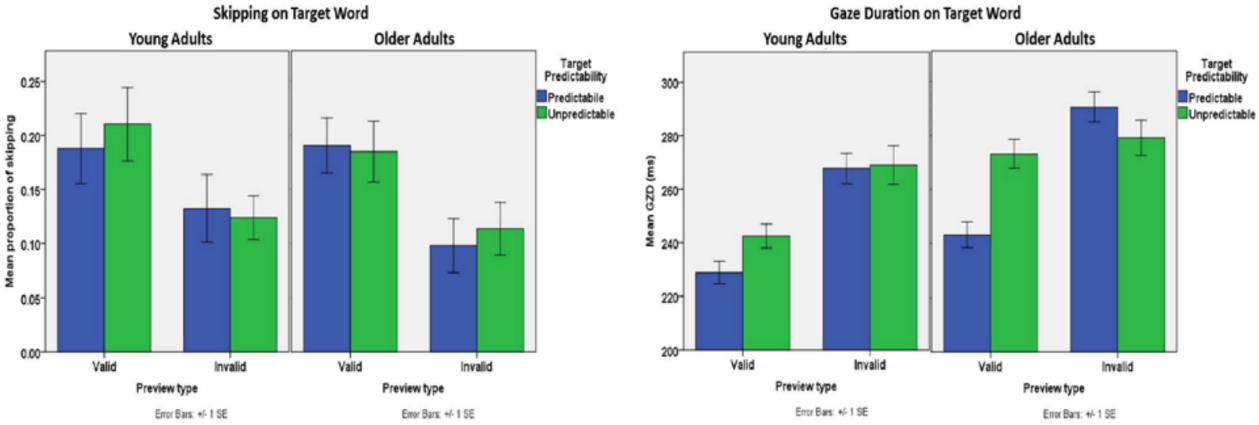
Previous work has found that older adults are more likely than young adults to guess the identity of an upcoming word and skip over it during first-pass reading, which has led to the idea that older adults adopt a "risky reading strategy" (Rayner et al., 2006). This might suggest, then, that older adults should also show larger predictability effects than young adults; however, there is no clear picture that this is the case: Rayner et al. (2006) found no evidence that effects of predictability were modulated by age, whereas Kliegl et al. (2004) found stronger predictability effects for young adults in skipping rates but stronger predictability effects for older adults in number of first-pass fixations. The present study was designed to further examine potential age differences in predictability effects during reading while also investigating the extent to which these effects are modulated by the validity of parafoveal preview information.

Predictability and preview were factorially manipulated as in the example below (materials adapted from Balota et al., 1985). Participants were 24 older adults (mean age = 72) and 24 younger adults (mean age = 21). A saccade across the invisible boundary between the target word and the preceding word triggered the display change from the preview to the target.

The doctor told Fred that his drinking would damage his *liver*:**liver**…[Predictable, Valid preview]
The doctor told Fred that his drinking would damage his *heart*:**heart**…[Unpredictable, Valid preview]
The doctor told Fred that his drinking would damage his *heant*:**liver**…[Predictable, Invalid preview]
The doctor told Fred that his drinking would damage his *livor*:**heart**…[Unpredictable, Invalid preview]

Analysis of skipping rates revealed a main effect of preview condition such that target words were skipped more when preview was valid versus invalid, t = -2.35, p < .05; however, we found no indication of an age effect in skipping rates. Analysis of gaze duration revealed a significant main effect of preview such that reading times were shorter for valid preview versus invalid preview, t = 5.55, p < .0001, as well as a marginally significant main effect of predictability such that reading times were shorter for predictable versus unpredictable words, t = 1.90, p = .058. Most importantly, there was a significant three-way interaction, t = -2.19, p < .05. Post-hoc analyses revealed two findings: 1) older adults showed a larger predictability effect than younger adults only in the valid preview condition, and 2) younger adults showed a larger preview effect than older adults only when the target word was unpredictable. These results demonstrate that older adults utilize sentence context more effectively than younger adults to facilitate target word processing when there is valid preview information in the parafovea, but that older adults' parafoveal processing is disrupted when a target word is unpredictable. These results suggest that older adults' reading strategies are not as risky as others have claimed. Rather, we propose that older adults predict upcoming words in a careful way, combining top-down predictions from the sentence context with bottom-up input from the parafovea to optimize processing.



Back to Saturday Poster Schedule

The eLAN as an attentional efficiency-dependent modulation of the domain-general N100

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Language researchers have long been interested in the nature/extent of the language-system's interfaces with domain-general cognitive systems. The current study was designed to investigate the relationship between language and attention, one that has been largely ignored due to a long-standing emphasis on the language-working memory interface [1]. Here we investigate this relationship using the eLAN, an early (100-300 msec) left anterior negativity, originally elicited in [2] by comparing the bolded "word-category violation" (WCV) to its control, and subsequently interpreted as an index of first-pass structure-building operations [3].

- The man admired {a sketch/*Don's} **OF** sketch the landscape. -

Here we test the hypothesis that, rather than a response indexing linguistic structure-building operations [3] or low-level sensory form-based processing [4], that what has previously been referred to as the eLAN actually indexes attentional processes triggered by linguistic input. Under this view so-called "eLAN effects" elicited in sentence-processing contexts do not reflect *syntactic* nor even *linguistic* processing, but rather modulations of the domain-general N100 response. While we are in broad agreement with the functional interpretation in [4], we feel that it lacks explanatory adequacy [5], an issue we feel an attention-based account can address.

A review of the attention literature is consistent with this interpretation. By hypothesis, WCVs engage the executive attention system as participants monitor for grammaticality, orienting them to these unexpected but task-relevant stimuli [6]. This orienting response leads to selective attention to WCVs, and subsequent enhanced processing that enhances N100 amplitude [7]. The efficiency of these attentional processes is known to be variable across individuals, as demonstrated by variability in performance on the Attention Network Task (ANT) [8], a task that estimates the efficiency of the brain's alerting, orienting, and executive networks [6]. If our hypothesis is correct, we predict that eLAN effects, observed in response to certain types of linguistic input, are dependent on the efficiency of these attention systems, and that the parameters of the eLAN should co-vary with the efficiency of (a subset of) these systems in a manner distinct from any attention-dependent modulations of other linguistic ERP components.

Methods: We recorded ERPs and behavioral responses while 40 subjects completed the ANT and a sentence-processing experiment containing WCVs and their controls (40 per condition), as well as comparisons, similar to those in [1] designed to elicit LAN, N400, and P600 effects.

Results: Behavioral ANT results were consistent with the literature: attentional efficiency across participants was highly variable, and the efficiency of attentional subsystems was not correlated within individuals (all $R^2 < .23$). We first conducted median-split analyses, dividing participants into high and low efficiency (alerting, orienting, and executive) groups (n=20 per group) based on ANT performance, yielding 6 groups in total. Significant modulations of early negativity were observed in two groups only: the low-efficiency orienting group ($p = .01$) and the low-efficiency executive group ($p = .03$). Crucially, while the presence of these effects was dependent on attentional efficiency, LAN, N400, and P600 effects were present in all groups, showing only minimal differences in their physical parameters. Results of a regression-based analysis showed that a model containing *both* orienting ($\beta = -.11$, $t(37) = 1.91$, $p = .047$) and executive ($\beta = -.13$, $t(37) = 2.56$, $p = .014$) efficiency as predictors accounted for a significant portion of variance in the mean amplitude of early negativity ($R^2 = .21$, $F(1,37) = 2.57$, $p = .021$).

Conclusion: These data suggest that what had previously been referred to eLAN effects are reducible to attentional modulations of the domain-general N100. This finding highlights the importance of investigating the actions of multiple cognitive systems during sentence processing and question the notion of a purely "linguistic ERP component."

References: [1] King & Kutas, (1995), [2] Neville et al., (1991), [3] Friederici (2002), [4] Dikker et al., (2009), [5] Chomsky, (1965) [6] Corbetta & Shulman (2002), [7] Hillyard et al., (1973), [8] Fan et al., (2002).

Back to Saturday Poster Schedule

The good, the bad, and the ugly: Incremental interpretation of evaluative adjectives

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In contexts containing multiple same-category examplars, listeners interpret dimensional adjectives in definite NPs (e.g., *the tall glass*) to signal contrast between an intended referent and contextually-present alternatives, in turn enabling incremental interpretation. However, when referential contrast is not present, listeners show a tendency to use a category-based norm as the relevant standard of comparison (Sedivy et al.,1999). One question is the extent to which these effects are tied to gradable adjectives generally, or whether they reflect factors specific to the semantics or pragmatics of dimensional terms. Here we consider the interpretation of modifiers within the same family as dimensional terms, namely gradable evaluative adjectives such as *ugly* and *expensive*.

Expt 1 compared the processing of evaluative descriptions with a baseline condition involving "perceptual" descriptions (involving outwardly-verifiable features, e.g., color). The experiment used a visual world methodology (n = 96) and instructions like *Click on the [ugly/purple] dress* with displays consisting of photographs of four real-world objects. The same image served as the target across adjective conditions, although each participant encountered a given image only once. A second manipulation varied the presence/absence of a contrasting alternative in the display (a pretty/yellow dress). A separately administered task obtained Likert-like ratings about the "fit" between evaluative descriptions and corresponding target images. Data from saccade and mouse click latencies (evaluated using mixed-effect models) showed targets were, not surprisingly, identified more quickly with perceptual compared to evaluative descriptions, presumably reflecting the more subjective character of the latter type. Nonetheless, additional analyses of fixation patterns revealed that, despite their slower overall processing, evaluative adjectives showed evidence of incremental interpretation, with target fixations beginning to increase before the onset of the head noun. More important, there was an interaction with contrast: Whereas the presence of contrast speeded target identification for perceptual descriptions, there was no facilitation for evaluative adjectives (and in fact marginally slower target identification was observed with referential contrast in mouse click latencies). Further, none of the measures showed a relationship between the on-line interpretation of evaluative term and rating scores for descriptive fit, suggesting the respective processing patterns for evaluative terms (including the overall delay) are not explained by the need to access mentally-stored standards.

In **Expt 2** (n = 28) we asked to what extent the observed patterns might be a consequence of distinct pragmatic conditions-of-use. Of particular importance is the possibility that evaluative adjectives might normally be used nonrestrictively, such that their perceived intent is mostly to communicate the speaker's disposition toward a referent, rather than to provide information enabling the actual identification of a referent. On critical trials, visual displays were the same as the two-referent context of Expt 1 but were accompanied by a written description of an overspecified instruction: (two modifiers, e.g., *Click on the [ugly/purple] dress in the top-right corner*.) Participants rated the informativity of the description using a 7-point Likert scale ranging from "too little" to "too much information". Results showed that technically overspecified descriptions containing evaluative adjectives were rated significantly closer to "just right" in terms of amount-of-information than descriptions containing perceptual adjectives (which were rated as more overinformative). This result is consistent with the idea that comprehenders tend to interpret evaluative modifiers as nonrestrictive. This in turn provides a natural account for the lack of a contrast effect and the absence of correlations involving ratings of descriptive fit in Expt 1: listeners tend to interpret the evaluative terms as "side-commentary" and as such do not treat them as directly relevant for identifying or discriminating among referential possibilities in course of real-time referential interpretation.

When considered alongside the more well-known interpretive patterns for dimensional adjectives, the results highlight important ways in which distinct conditions of use can influence the interpretation of semantically-similar kinds of expressions.

Back to Saturday Poster Schedule

The morphosyntactic representation of language varieties: Bivarietal syntactic priming

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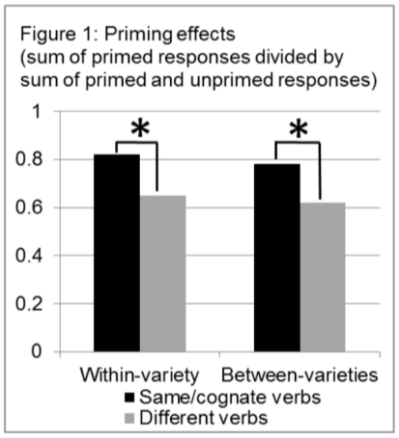
Little is known about lexical and syntactic representations of language varieties, and yet variation is a key feature of language. Regarding language variation, Switzerland presents an intriguing object of investigation. Speakers from the German-speaking part of Switzerland are bivarietal in the sense that they use a dialect and a standard variety of German on a daily basis. These varieties are closely related. They share a large part of grammar and vocabulary, but are still clearly distinguishable. Also, each variety serves a specific function, e.g. formal vs. informal, written vs. spoken modality.

This study aimed at testing whether bivarietal speakers of Bernese and Standard German have separate lemma representations – similar to two different languages – or shared lemma representations. This was examined by means of a structural-repetition priming study with verb phrases. When the verb from the prime sentence is repeated in the target sentence, this usually leads to a boost to priming. This boost is found to be stronger within a language than between (even very closely related) languages (e.g., Mandarin-Cantonese), which is explained by the activation of separate lemmas in different languages (Schoonbaert et al., 2007; Cai et al., 2011). The specific aim of this study was to examine whether the boost to priming is equally strong when priming cognate verbs between varieties (e.g. *backt – bachet*) as when priming same verbs within a variety. This would mean that bivarietal speakers have shared lemma representations. In contrast, if the between-varieties boost differs significantly from the within-variety boost, this would indicate separate lemma representations.

We conducted a syntactic priming experiment with 72 Bernese-Standard German spea-kers. We primed verbs with an accusative object and either a prepositional phrase, e.g. *Der Hund backt eine Torte für den Elefanten* (the dog bakes a cake$_{ACC}$ for the elephant$_{PP}$), or a dative, e.g. *Der Hund backt dem Elefanten eine Torte* (the dog bakes the elephant$_{DAT}$ a cake$_{ACC}$). We manipulated prime variety (Bernese vs. Standard German) and verb relation (same vs. different verb in prime and target) within participants, in order to identify and compare boost effects. The target variety was Bernese German. For the statistical analysis, we used logit mixed effect modeling in R. Following Cai et al. (2011), the dependent variable was defined as whether a response had the same structure as the prime or an alternative one. We incorporated prime variety, verb relation and their interaction as fixed effects, by-item and by-subject random effects and random slopes for verb relation.



There were significantly more same-structure than alternative-structure responses (Estimate=-1.15, *SE*=.11, *z*=-10.78, *p*<.001). We found a main effect of verb relation (Estimate= -1.08, *SE*=.2, *z*=-5.24, *p*<.001). Hence, there was a boost to priming when the verb from the prime sentence was repeated in the target sentence. This effect held both when the prime variety was Bernese German and when it was Standard German (cf. Figure 1). There was, however, no main effect of prime variety and no interaction of prime variety and verb relation.

The results show no significant difference between the boost effect between the varieties and the boost effect within a variety. This implies that bivarietal Bernese-Standard German speakers have shared lemma representations for cognate verbs of these varieties. The results contrast with the findings of studies with bilingual speakers of even very closely related languages. This study yields the first evidence for integrated lemma representations in language varieties and contributes to the development of a psycholinguistics of language variation.

Back to Saturday Poster Schedule

The magnitude of syntactic self- and comprehension-to-production priming

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Speakers who hear a particular syntactic construction are more likely to use that construction in the future. This phenomenon is referred to as syntactic priming, structural priming, or structural persistence (Bock, 1986; Tooley & Bock, 2014). It is clear from the literature that the comprehension of a syntactic structure leads to syntactic priming in production and syntactic priming in comprehension, but it is less clear whether a speaker's prior *production* of a structure also leads to syntactic priming (i.e. self-priming). Many theories predict that speakers prime themselves because they comprehend themselves (Levelt et al., 1999; Jaeger & Snider, 2013). If priming is the product of comprehension, then speakers' prior productions should influence later ones. If, however, their actual productions match their intended productions, no learning may occur (Chang et al., 2006; Jaeger & Snider, 2013). Self-priming might also occur because speakers are biased towards producing previously activated representations (MacDonald, 2013). Some data suggest that speakers do repeat words and syntactic structures more than would be expected by chance, suggesting that speakers might prime themselves (Myslín & Levy, submitted). In this study, we test whether producing a particular form of a syntactic structure has the same effect on syntactic production as hearing it.

In the current study, we equated comprehension and production primes by evaluating the effect of 1 prime from both modalities on subsequent productions. The dative alternation was the structure of interest. A participant could describe a ditransitive event as, "The librarian handed the boy the book" (DO construction) or as "The librarian handed the book to the boy" (PO construction). We recruited 360 native speakers of English on Amazon Mechanical Turk. Individuals received $1 for their participation. The experiment was divided into three stages. In the first production stage, participants provided written descriptions of 7 ditransitive images (plus 10 fillers). In the comprehension stage, participants listened to a single recording of a DO dative and rated how accurate the description was for that image (plus 10 fillers). In the second production stage, participants again described 7 ditransitive images (plus 10 fillers),

We first tested for the influence of the DO prime in the comprehension stage on production choices in the third phase. Speakers were much more likely to use DO structures after having heard a DO structure (intercept = -1.33, $t = -5.88$, $p < .001$; $\beta = 0.25$, $t = 2.65$, $p < .01$). In order to measure self-priming, we first looked at whether and how a speaker's very first syntactic choice within the first production stage (DO, PO, or "other") influenced their second syntactic choice. If speakers prime themselves, then the very first structure produced should be highly influential, and speakers should repeat that structure more than would be expected by chance over the course of the next six trials. Furthermore, there should be a marked increase between Trial 1 and Trial 2, as we see in comprehension-to-production priming. Counter to predictions, speakers did not produce more of their first trial structure over time. Instead, rates of that structure gradually fell over time (intercept = -1.44, $t = -5.76$, $p < .001$; $\beta = -0.12$, $t = -3.04$, $p < .01$).

Altogether, these results do not provide evidence for self-priming. These results are best explained by error-driven learning accounts of language production (e.g. Chang et al., 2006; Jaeger & Snider, 2013) in which speakers' productions do not provide an error signal. Instead, speakers change their productions to match the environment.

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Back to Saturday Poster Schedule

The processing of garden-path sentences by Spanish-English bilinguals: a visual word study

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A central question in psycholinguistic research on L2 sentence processing is how the parser integrates different types of information during sentence comprehension. Previous studies looking at this question have suggested that differences between L2 learners and native speakers may be found in their use of multiple sources of information. In particular, in situations that require increased processing demands, L2 learners may not be able to integrate syntactic and pragmatic/contextual information like native speakers (e.g., Sorace, 2011). Here we investigate this claim by examining how L2 learners resolve PP-attachment ambiguity (e.g., Put the frog on the napkin in the box) and whether they take into account relevant contextual information to aid in the process of ambiguity resolution. Because most of the of work in this research area has focused on reading comprehension (see Trueswell & Pozzan, in press), a second aim of the present study is to investigate the nature of L2 speakers' processing abilities during spoken language comprehension.

Twenty-five English monolinguals and 20 Spanish-English speakers participated in the study. The L2 participants were immersed in the L2 environment and were highly proficient in English. We used similar materials as those used by Trueswell et al. (1999). Eye-movements were recorded while participants looked at pictures presented on a computer screen--that included either one or two referents (e.g., either one or two frogs)--and listened to temporally ambiguous and unambiguous sentences (e.g., Put the frog (that's) on the napkin onto the box). Participants acted out the instructions by dragging the objects on the screen with a mouse, providing a measure of their off-line accuracy.

We measured eye-movements following the onset of the first PP (e.g., on the napkin) in a 5000 ms time-window. The sum of looks to the Incorrect Goal (IG, e.g., the empty napkin) was analyzed using Multi-level mixed logit modeling, with Referent (one frog vs. two frogs) and Ambiguity (ambiguous vs. unambiguous) as within-subjects factors, and Group (L1 vs. L2) as between-subjects factor. We found an interaction between Ambiguity and Group ($p<0.01$), indicating that L2 learners looked more at the IG in both ambiguous conditions ($p<0.01$). However, the effect was mainly driven by the ambiguous condition with one referent (ambiguous, 1 ref: $p < .01$, ambiguous, 2 ref: $p<0.1$). The off-line accuracy results (i.e., the actions performed by dragging the objects with a mouse) showed that the L2 participants performed significantly more incorrect goal actions (e.g., move the frog on the empty napkin and then into the box) than the natives only in the ambiguous context with one referent (Referent*Language Group*Ambiguity: $p<.05$; ambiguous condition, 1 ref: ($p < .001$).

Taken together these results show that although L2 learners experience a processing cost when they reanalyze temporally ambiguous sentences, they can recover from the misanalysis when contextual information (e.g., two frogs) supports the modifier interpretation of the first prepositional phrase.

Figure 1. Mean proportion of looks to the IG. Error bars represent 95% CI

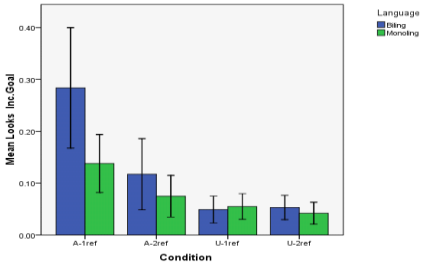
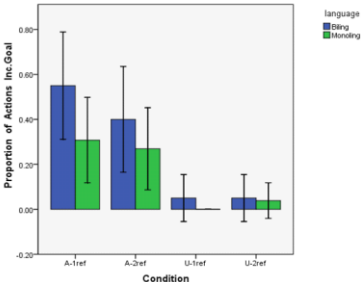


Figure 2. Proportion of actions to the IG.



Back to Saturday Poster Schedule

The processing of third person singular -s by African American English speaking second graders: An auditory ERP study

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Introduction. Subtle differences between standard classroom English (SCE) and African American English (AAE) can introduce obstacles to sentence processing that, in turn, can undermine young AAE speaking students' performance on some standardized tests (e.g. Terry et al. 2010). This study used an auditory ERP method to investigate AAE speaking children's processing of third person singular -s, one such point of divergence between AAE and SCE grammar. The study also included a linguistically controlled math test to show that the linguistic obstacles affecting young AAE speakers' performance can do so in a non-language domain.

Methods. Listening for comprehension, AAE speaking second graders heard sentences in four conditions (see example stimuli below). Two factors were crossed: subject NP type (singular (a/b) vs. plural (c/d)) and verb morphology (presence (a/c) or absence (b/d) of third person singular -s). Test sentence phonology was controlled to prevent bias towards AAE or SCE, and a splicing procedure was used to make all conditions acoustically identical. On a separate day, the same participants were orally administered a math test made up of addition and subtraction problems. Test questions used either a singular subject NP with -s on the verb, a singular subject NP without -s on the verb, or a plural subject NP without -s on the verb.

Results. ERP results showed an interaction between subject NP type and verb morphology. Sentences inconsistent with AAE grammar (a/c) elicited a bilaterally distributed bi-phasic effect with an anterior negativity (300-500ms) followed by a posterior positivity (550-700ms). However, the amplitude of the negativity for singular subject NP sentences (a) was larger than that for those with a plural subject NP (c). In addition, the posterior positivity for the plural subject NP sentences (c) lasted longer than their singular counterpart (a). Math test results were consistent with the ERP results. More questions were answered correctly when they were consistent with AAE grammar (i.e. used sentences like b) than when they were not (i.e. used sentences like a).

Discussion. Similar to previous results in SCE and other languages, the bi-phasic ERP effect found in this study likely reflects a morphosyntactic violation (e.g. Neville et al. 1991, Hagoort et al. 1993, Gunter et al. 2000). Such a violation is consistent with offline studies suggesting that third person -s lies outside of AAE grammar (e.g. Green 2010) and poses processing difficulties for child speakers of the dialect (e.g. Ball 1995, Terry et al. 2010, 2015). The relatively long lasting posterior positivity found in sentences paired with plural subject NPs with third -s (c) may indicate greater cognitive resources are required to repair this type of sentence than its singular NP counterpart (a). A possible explanation for this is that due to their shared phonological shape, third person singular -s and the plural subject marker are likely confused by AAE speaking children (Torrey 1983), which may result in an added repair cost. In line with the ERP findings, the math test results suggest that AAE speaking second graders are able to allocate more resources to answering math questions when they are presented in their native dialect. Details of the test and the correlation between its results and the ERP findings will be presented.

Conclusion. This study provides ERP evidence for a morphosyntactic mismatch between child AAE and SCE grammar. It also shows that the effect of the resulting violation has a significant impact on young AAE speakers' performance in a non-language cognitive domain (math).

Example stimuli (ERPs were time-locked at the right edge of the underlined word)

a) One kid from Durham **eats** chocolate cake. (Singular subject NP, with -s on verb)
b) One kid from Durham **eat** chocolate cake. (Singular subject NP, without -s on verb)
c) Six kids from Durham **eats** chocolate cake. (Plural subject NP, with -s on verb)
d) Six kids from Durham **eat** chocolate cake. (Plural subject NP, without -s on verb)

Back to Saturday Poster Schedule

The prosody of (Pseudo)Relatives and Production Planning

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This study investigates the role played by prosody in the disambiguation of Relative Clauses (RC) and Pseudo Relatives (PR) in Italian. PRs and RCs are string identical but display a very different syntax and semantics. RCs denote property of individuals and are embedded within the NP they modify (1a,c). PRs denote events and occupy a more prominent position within the clause, standing in a sisterhood relation with the 'head NP' (1b). The PR/RC ambiguity is limited to perceptual verbs and disappears under stative verbs (1c,d), which only allow a RC reading.

(1) a. Leo vede [$_{DP}$ la [$_{NP}$ ragazza [$_{RC}$ che balla]]]]
Leo sees the girl that dances.

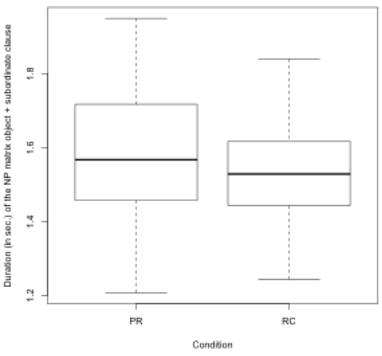
b. Leo [$_{V'}$ vede [PR la ragazza che balla]]
Leo sees the girl dancing

c. Leo ama [$_{DP}$ la [$_{NP}$ ragazza [$_{RC}$ che balla]]]]
Leo loves the girl that dances.

d.*Leo [$_{V'}$ ama [PR la ragazza che balla]]
Leo loves the girl dancing.

The goal of the current study is to investigate: a) Whether (and how) these structural and interpretive differences are encoded at the prosodic level, b) if so, at what point of the speech signal prosodic asymmetries between the two conditions can be observed. In a planned production study with 8 native Italian speakers we manipulated PR availability and compared the prosodic properties of 24 minimal pairs of PR/RC ambiguous (perceptual matrix verb) and 24 unambiguous RC sentences (stative matrix verb). The two sets of target sentences, which differed in the properties of the matrix verb only, were embedded in two types of controlled context-paragraphs designed to elicit PR and RC reading respectively.

Results: On the whole, the acoustic analyses show that compared to the unambiguous RC condition, in the ambiguous PR/RC-condition sentences present wider variation in terms of temporal (duration) and melodic (pitch excursion) properties, as early as at the NP matrix object (e.g. *la ragazza* in (1)). The same prosodic asymmetries are reflected on the respective following subordinate clauses (Fig. 1) (β=-0.04, *SE=0.01*, *t*=-2.74, *p*=.011). Specifically, the disambiguation is primarily encoded by boundary-related phenomena (i.e. shorter stressed and last syllable of the NP in RC), while pitch prominence sometimes plays a role. A tonal boundary at the end of the NP is more likely to occur in the ambiguous PR/RC than the unambiguous RC condition. Furthermore, RC subordinate clauses are more typically produced with faster speech rate than PR-compatible subordinate clauses. The faster rate of the subordinate clause in RC goes along with the presence of a greater pitch range compression.



Discussion: The prosodic asymmetries may be taken to reflect the structural and interpretative differences highlighted above. First, the different levels of duration and accentual prominence relate to the different relations between the embedded clauses and the 'head NP': *embedding* in RCs and sisterhood in PRs. The higher attachment site for CPs in PRs (sister of NP) is reflected by a comparatively longer duration and stronger pitch prominence than in RCs (see Poschmann & Wagner 2015 for similar effects in extraposition). Second, these structural and scope differences seem to have implications for speech planning. With the boundary at the NP of PRs, it is likely that the speaker wishes to signal the 'head NP' be not the internal argument of the matrix verb, but the subject of a complement clause. This early disambiguation would help the hearer to project the correct structure even before hearing the complementizer, which introduces the PR-option, thus avoiding the cost of a potential garden-path and reanalysis. RCs, on the other hand, are integral part of the object NP, i.e. additional material that does not change the relation between the NP and the matrix verb. These findings have implications for predictability-based models of sentence production (Jaeger 2010).

Back to Saturday Poster Schedule

The role of language dominance on early bilinguals' syntactic analysis

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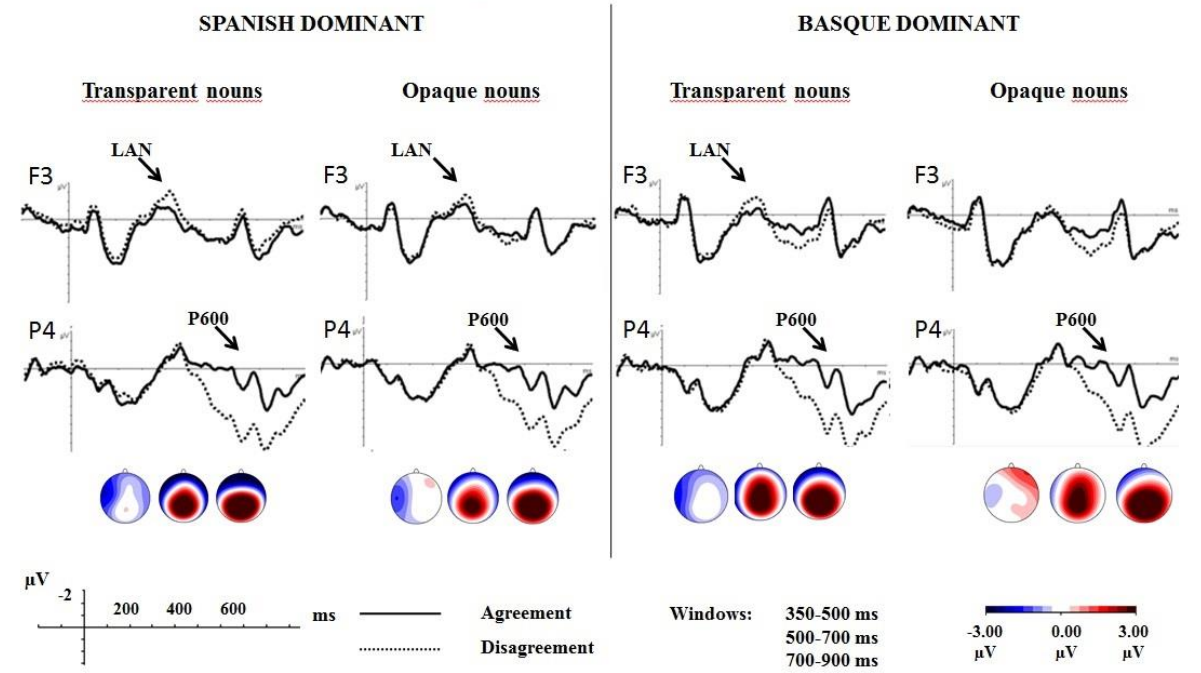
Early bilinguals can achieve high levels of L2 proficiency with a linguistic performance within the native range. The present study argues that even when bilingual acquisition happened early in life and high levels of proficiency are achieved, L2 syntactic analysis can still vary depending on language dominance. We selected 48 highly-proficient early bilinguals of Spanish and Basque (AoA: <4y; global proficiency: 5/5; for both languages), that could be dominant in Basque (i.e., Basque was learnt first and mainly used on a daily basis) or in Spanish (i.e., Spanish was learnt first and mainly used on a daily basis). We hypothesized that Spanish gender agreement processing could vary depending on participants' linguistic profile. Two hundred-forty Spanish sentences could contain article-noun gender agreement violations, where the target noun showed an ending typically associated to a specific gender class (i.e., transparent nouns; e.g., zapato$_M$, shoe) or not (i.e., opaque nouns, e.g., bosque$_M$, forest).

Transparent nouns			Opaque nouns		
Agreement	El zapato le quedaba estrecho.	The$_M$ shoe$_M$ was tight.	**Agreement**	El bosque está lleno de gente.	The$_M$ forest$_M$ is full of people.
Disagreement	La zapato le quedaba estrecho.	The$_F$ shoe$_M$ was tight.	**Disagreement**	La bosque está lleno de gente.	The$_F$ forest$_M$ is full of people.



While the Spanish dominant group processed gender agreement dependencies with no influence of noun transparency (both transparent and opaque nouns elicited a similar LAN-P600 pattern), Basque dominant bilinguals' were affected by formal gender cues. Specifically, transparent nouns showed a LAN-P600 response but opaque nouns showed only a P600 effect. A multiple regression analysis showed that the higher the use of Spanish on a daily basis (and the lower the use of Basque), the bigger the LAN effect with opaque nouns. This suggests that a greater use of Spanish would strengthen the lexical representation of Spanish gender of opaque nouns, facilitating the first stages of syntactic analysis. The present results provide evidence that even when a language is successfully acquired early in life, individual differences can be still appreciated in the early stages of syntactic analysis.

Back to Saturday Poster Schedule

The role of retrieval interference in recovery from ungrammaticality

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In subject-verb number agreement, the processing cost for a mismatching verb is reduced when a distractor phrase matches the verb's number feature (1a) relative to when it does not (1b). Current cue-based retrieval models (e.g. Lewis & Vasishth, 2005) attribute this effect to the occasional mis-retrieval of the matching distractor, leading to a facilitation in the processing of what would otherwise be perceived as an ungrammatical sentence. It is currently unclear whether this facilitation affects an initial retrieval event triggered by the verb, or whether it affects a later retrieval event associated with recovery. Lago et al, JML, 2015 (henceforth [1]) argue for a recovery-based retrieval mechanism, based on a distributional analysis of self-paced reading times, which suggested a late onset of facilitatory interference relative to the onset of the basic grammatical mismatch cost. However [1]'s analysis was based on a spill-over region, making it hard to estimate the onset of facilitation relative to the reader's initial encounter with the (preceding) critical verb. Moreover, [1] used different verb forms for grammatical and ungrammatical conditions, making it hard to estimate the true onset of the grammatical mismatch cost.

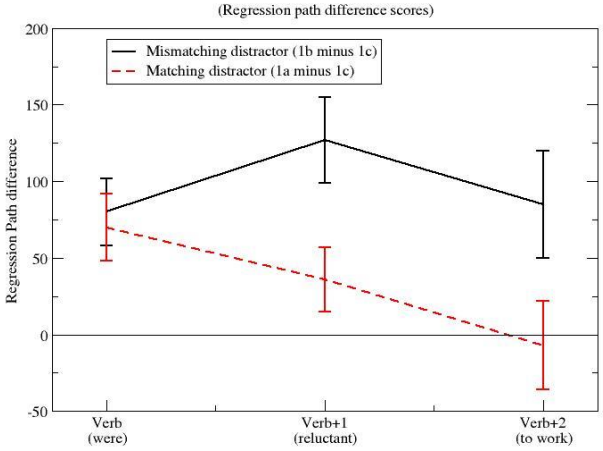
Here, we report an eye-tracking experiment investigating these issues. We used 48 items similar to 1a-c, with 39 participants:

1a. The nurse who the widows relied on definitely/ were/ reluctant/ to work/ long shifts.
1b. The nurse who the widow relied on definitely were/ reluctant/ to work/ long shifts.
1c. The nurses who the widow relied on definitely/ were/ reluctant/ to work/ long shifts.

Items were based on Dillon et al (2013, JML), adapted to have the distractor in subject position, to maximize any intrusion effects, and to have the same verb form across conditions, to allow a reliable measurement of the onset of the grammatical mismatch cost.

The grammatical mismatch cost (i.e. 1c < 1b; 1c < 1a) showed a very early onset, beginning in first-pass measures (e.g. first fixation) on the critical verb. In contrast, the facilitatory intrusion effect (1a < 1b) was reliable in the regions verb+1 and verb+2. Figure 1 shows the magnitude of the grammatical mismatch cost separately for the matching distractor (1a minus 1c), and the mismatching distractor (1b minus 1c), in regression path time, across three regions. There was a large grammatical mismatch cost in the verb region, regardless of the type of distractor. However, as seen on the graph, the matching distractor led to rapid recovery, while the mismatching distractor led to the persistence of difficulty, resulting in an interaction of distractor type (matching vs. mismatching) by region (verb vs. verb+1) in mismatch cost magnitude (p's <.05).

Figure 1: Magnitude of grammatical mismatch cost
(Regression path difference scores)



Overall, the results are consistent with [1]'s claim that facilitatory intrusion in verb-subject agreement is particularly associated with the recovery processes that follow the parser's initial reaction to a mismatching verb-subject dependency; the distractor phrase manipulation affected the persistence of the mismatch cost, rather than its initial magnitude. Future studies should take into account that the possibility that facilitatory intrusion effects in ungrammatical dependencies may reflect recovery-based retrieval, rather than initial dependency formation.

Back to Saturday Poster Schedule

The role of Tagalog verbal agreement in processing WH-dependencies

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It is well-established that parsers attempt to associate WH-phrases to a gap even before there is any direct evidence in the input that signals the gap's position [1]. This is referred to as the Active Filler Strategy (AFS) [2]. While the parser's initial association may be correct, this is not a guarantee: it may turn out to be wrong and need to be revised. Thus, AFS is a systematic risk that parsers take when interpreting filler-gap dependencies (FGDs) in real-time. In this study we ask whether this strategy is realized in Tagalog—a language that is typologically distant from most investigated languages—and whether parsers leverage the special morphological cues provided by its grammar.

Tagalog is a verb-initial Austronesian language spoken in the Philippines. We compare the time-course of FGD-resolution when verbs exhibit agreement with the extracted argument (see Fact #1) and when they do not (see Fact #2). In a Stop Making Sense task [3], we find an earlier onset in rejection rates for an implausible filler with an agreeing verb, relative to a non-agreeing verb. Only later in the sentence when the co-argument occurred do we find a rise in rejection rates for an implausible filler with non-agreeing verbs. Thus Tagalog verbal agreement facilitates FGD-resolution by providing parsers an unambiguous cue to the gap's position. Unlike many better-investigated and typologically distinct languages, Tagalog seems to require unambiguous evidence about the gap's position before interpreting FGDs.

Fact #1: Verbs can be inflected differently depending on whether the verb agrees with its external or internal argument (EA and IA, respectively). If a verb must show inflection, then only the noun with which the verb agrees can undergo extraction. (1) illustrates a plausible extraction of an internal argument: the verb **inom** 'drink' is marked with the affix *-IN-.*

(1) Aling alak ang **INinom** niya kani-kanina lang para pamparelaks …
'Which wine did s/he drink recently to relax …' *Agreeing, Plausible*

Fact #2: Verbs in the recent past (RP) do not exhibit agreement [4]. Both EA- and IA-extractions are generally licit. However, when one of the co-arguments is obligatorily specific (i.e., a pronoun or a proper name), only IA-extraction is licit. Thus, *in*-marked verbs and verbs in RP *can* form a minimal pair—they can both restrict extraction to IAs. (2) illustrates an *implausible* extraction of an argument, coerced to be parsed as the internal argument because of the pronoun *niya* 's/he', with the verb **inom** 'drink' (*KAKA*- is the RP aspectual marker).

(2) Aling babae ang **KAKAinom** lang niya para pamparelaks …
'Which woman did s/he drink recently to relax…' *Non-agreeing, Implausible*

To isolate the contribution of agreement in FGD-resolution, we compared how quickly implausible WH-phrases are detected when verbs bear agreement and when they do not using the SMS paradigm [3]. Participants (n=80) read sentences one word at a time and were instructed to terminate the presentation if the sentence stopped making sense. We crossed AGREEMENT and filler PLAUSIBILITY in a 2 x 2 design (12 items, 60 fillers).

We found that at the V-region, the rates of rejection for implausible fillers were higher than those of plausible fillers (p<.001), especially when the verb exhibited agreement (p=.03). These trends persisted through the V+2-region. Crucially, this region disambiguates RP's intended parse by introducing the co-argument that coerces an illicit IA-extraction interpretation. Rejection rates of implausible fillers converged thereafter (V+3, p=.23; V+4, p=.40*)*.

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Back to Saturday Poster Schedule

The Syntax of Null Objects: Evidence from Inter-speaker Variation

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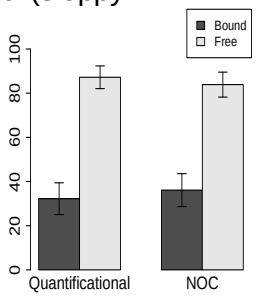
The identity of null objects (NOs) in East Asian languages, as exemplified by the Korean sentence (1), has long been a controversial topic: are they (VP or NP) ellipses [1,2], or are they instances of *pro* [3]? In this paper, we present data that supports the ellipsis approach. Building upon [4], which found inter-speaker variation regarding the availability of quantificational binding of the Korean pronoun *ku* 'he', we examined the acceptability of sloppy identity interpretations of NOs in Korean (e.g. '…, and Ken$_2$ also drank his$_2$ water' in (1)). If sloppy readings are attributed to variable binding of a pronoun [e.g. 5], and if the NOs contain an elided structure that hosts *ku*, the distribution of sloppy readings for the NOs should correlate with that of quantifcational binding of *ku*. Such a correlation, however, is not expected if NOs are null pronouns that do not house elided material (and hence not *ku*), and sloppy readings are resolved by way of pragmatic inference [3]. In a truth-value judgment experiment, we found this correlation, which provides empirical evidence that the NO involves ellipsis rather than a base-generated *pro*.

(1) *Tom$_1$-i ku$_1$-uy mwul-ul masi-ess-ko, Ken$_2$-to* [e] *masi-ess-ta.*
Tom-NOM he-GEN water-ACC drink-PAST-and Ken-also drink-PAST-DECL
(lit.) 'Tom$_1$ drank his$_1$ water, and Ken$_2$ also drank.'

45 Korean native speakers were asked to judge whether a target sentence described a given context truthfully. Each target sentence was either an NO construction (NOC) such as (1) or a sentence with *motwu* 'everyone' as the subject and *ku* as the possessor (e.g. *motwu-ka ku-uy mwul-ul masi-ess-ta*. 'Everyone drank his water'). Each context was biased to either bound or free (referential) interpretation of *ku* in the target sentence. Thus, two factors with two levels each were tested: sentence type (NOC or Quantificational) and context type (Bound or Free).

A clear bimodal distribution was observed in the Quanti.-Bound condition, with only about 30% of the participants accepting the bound reading of *ku*. These results replicate findings in [4] that a stable inter-speaker variation exists regarding the availability of variable binding of *ku*. We found no significant difference in acceptances between the NOC-Bound (sloppy reading) and Quanti.-Bound conditions. Crucially, there was a correlation between the two conditions (r=0.66, p<.001) indicating that an individual speaker's acceptance of the sloppy reading for NOs is predictable from her acceptance of bound variable *ku*. The acceptance rates for NOC-Free (strict reading, e.g. '…, and Ken$_2$ also drank his$_1$ water' in (1)) and Quanti.-Free are uniformly high, which is compatible with the general agreement that *ku* can freely enter into coreference. This strongly supports that the experimental design was appropriate to assess participants' knowledge of anaphora.



Our findings suggest that NOs in Korean are derived by ellipsis, an anaphora that contains hidden internal structure. In a separate experiment comparing the quantificational binding of *ku* and the sloppy reading in the Korean VP *pro*-form *kuleha* 'do so' (e.g. Tim$_1$ drank his$_1$ (=*ku*'s) water, and Ken$_2$ also did so (=*kuleha*-yss*ta*)), we found that while only 40% of the participants accepted bound *ku*, all participants accepted the sloppy reading in the *pro*-VP sentences (p<.001). The uniform treatment of the VP *pro*-form by Korean speakers suggests that the variability we found with NOs cannot be attributed to aspects of the task or to general properties of Korean anaphora. In contrast to the VP *pro*-form, NOs have internal structure. It now remains open whether NOs involve VP- or NP-ellipsis. Does the NO result from the ellipsis of a VP structure that is created after the raising of V to T [1]? Or does an object NP itself undergo ellipsis directly [2]? We leave this issue for future research.

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Back to Saturday Poster Schedule

Three wh-words are better than two (when violating the Superiority Condition)

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Much of the syntax literature notes an amnestying effect of a third wh-word (the so-called "additional wh-effect" [1,2]) in questions that violate the Superiority Condition [3], as in (1) [2,4].

(1) *a/?b. What did who buy { there / where }?

However, psycholinguistics studies have not supported this observation [4,5]. We ask if an additional wh-phrase can ever improve acceptability of multiple-wh-questions, and if so, when. We believe such a study will help to reveal how the constraints that operate during language processing influence the way grammatical violations are comprehended and judged.

(2/3) The maitre d' tried to figure out what who { ordered / served to whom }.

[5] observes that the acceptability of (2), which has a monotransitive verb and two wh-phrases, is indistinguishable from (3), which has a ditransitive verb and three wh-phrases. However, [6] suggests, through an informal acceptability judgment, that the additional wh-effect is apparent in (4), in which only ditransitive verbs are compared.

(4) a/b. You know perfectly well where who { ?put what / *put it }.

Experiment 1: To check whether argument structure plays a role in the amnestying effect of an additional wh-phrase in sentences containing a superiority violation, we compare sentences like (4a/b) to (5a/b), where the additional wh-phrase is an adjunct, as used by [4,5].

(5) a/b. You know perfectly well where who { went when / went ø }.

Two binary forced-choice tasks were conducted, manipulating Argument Structure (Monotransitive (*went*) vs Ditransitive (*put*)) in a 1x2 design. Participants chose between two full sentences corresponding to the (a/b) variants of (4) and (5) (N=40). We find that the third wh-word option was chosen significantly less than chance for monotransitive conditions, at 41% ($p<0.0001$), and significantly more than chance for ditransitive conditions, at 57% ($p<0.0001$). This indicates that ditransitive verbs prefer the additional wh-word, whereas monotransitive verbs prefer two wh-words.

Experiment 2: But could this result be due to contrasting sentences with three elements, one of which is a wh-word (4a) or a proform (4b), in line with [6]? A follow-up study using the same paradigm and stimuli as Exp 1 (N=80), but modified (5) to contrast *went when* with *went then*, rather than just went. The results showed an overall preference for sentences with 3 wh-phrases, regardless of argument structure (i.e., (4a)/(5a) >> (4b)/(5b)) ($p<0.01$). This suggests that a third wh-phrase does improve Superiority violations, at least in contrast to two wh-phrases and a third proform element (argument in (4), adjunct in (5)).

Experiment 3: Finally, we used a 7-point Likert scale rating experiment contrasting Argument Structure (Mono- vs Ditransitive; (5) vs (4)) and Third Argument (Wh-word vs Proform; (1b,4a) vs (1a,4b)) in a 2x2 design (n=100) in order to check whether the additional wh-phrase and the argument structure of the verb impacts the acceptability of the superiority-violation in general or whether amnestying effects can only be detected through forced-choice experiments. We find a significant main effect of Third Argument, with the Wh-word condition more acceptable than the Proform condition ($p<0.0001$). We also find a marginal main effect of Argument Structure, with Ditransitive more acceptable than Monotransitive ($p<0.08$). The effect of Argument structure detected in Experiment 1 may not reach significance here because the forced-choice task used provides more statistical power than Likert rating tasks [7].

The preference for the additional wh-effect in ditransitive verbs suggests that the argument structure of the verb plays a role in the distributions of the additional wh-effect. Moreover, when argument structure is carefully controlled, the additional wh-effect is detectable in acceptability rating tasks, as well. This suggests that argument structure and the number of possible arguments both play a role in the presence and strength of the additional wh-effect.

References: [1] Bolinger, 1978; [2] Kayne, 1983; [3] Chomsky, 1973; [4] Clifton, Faneslow & Frazier, 2006; [5] Fedorenko & Gibson, 2010; [6] Kayne, 2011; [7] Sprouse, Schütze & Almeida, 2013

Back to Saturday Poster Schedule

Toward a comprehensive view of structural priming: What gets primed when

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Background: Structural priming (SP) refers to the tendency to repeat aspects of structure across sentences (Bock, 1986). Although originally argued to be a syntactic phenomenon (ibid.; Bock & Loebell, 1990), SP, at least in production, appears also to be sensitive to semantic representations, specifically thematic roles (Hare & Goldberg [HG], 1999; Chang et al. [CBG], 2003; Salamoura & Williams [SW], 2007; Cai et al. [CPB], 2012; Köhne et al. [KPB], 2014). Nevertheless, these studies all suffer from important limitations, including confounds with animacy (HG/SW/CPB; cf. Bock et al., 1992), morphology (CPB/KPB), and the mass/count distinction (CBG; see Chierchia, 1998), leaving the question open as to whether thematic role ordering can truly be primed at all. To thus better understand when and under what circumstances SP is sensitive, uniquely, to syntactic vs. semantic factors, and thereby provide a clearer picture of the phenomenon more generally, we conducted three experiments.

Methods: In an animation description task on MTurk, Exp. 1 (N=82) investigated thematic priming from locatives (1) to datives (2), thereby avoiding the confounds in previous work. Like the PO dative, both locative forms have NP-PP post-verbal phrase structure. However, they differ from each other in thematic role ordering. Thus, on a thematic account, TF primes ought to elicit more PO targets, which share theme-goal thematic role ordering, relative to GF primes.

(1) load the truck$_{NP}$ with hay$_{PP}$ (=GF) // load hay$_{NP}$ onto the truck$_{PP}$ (=TF)
(2) pass the lady$_{NP}$ a cup$_{NP}$ (=DO) // pass a cup$_{NP}$ to the lady$_{PP}$ (=PO)

On a syntactic account, however, both TF and GF locatives should prime PO datives, given their identical phrase structure, relative to DO primes. Thus, to provide a baseline against which to investigate any purely syntactic priming in Exp. 1, Exp. 2 (N=45) investigated priming from datives to datives (2).

Finally, Exp. 3 (N=36) revisited priming from locatives to locatives (1), following CBG, though without the mass/count confound, to verify locative priming *within* a single construction.

Results: The results of Exp. 1 revealed no effect of thematic role priming from locatives to datives (p=.27), suggesting that thematic roles cannot be primed *across* different constructions, even with the syntax held constant. We did, however, find a significant dative-to-dative priming effect in Exp. 2 (p=.04; Fig. 1). Moreover, comparing the two experiments, participants in Exp. 1 produced a higher proportion of POs overall, following both TF and GF locatives, relative to the proportion of POs following DO primes in Exp. 2 (p=.02; Fig. 1), suggesting that at least syntax can be primed cross-constructionally. Lastly, consistent with previous work, we found a significant locative-to-locative priming effect (p<.001; Fig. 1), suggesting that thematic roles *can* in fact be primed after all, though only within but not across constructions.

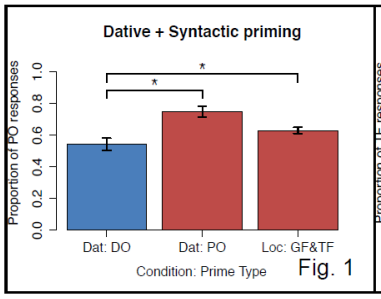

Fig. 1

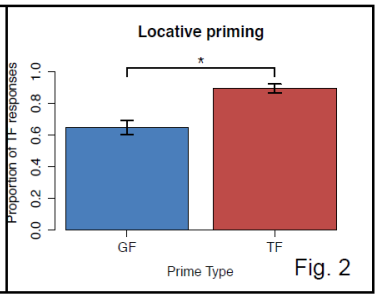

Fig. 2

Conclusions: In three experiments, we found evidence for both purely semantic and purely syntactic priming. However, the environments in which each occurred differed. Specifically, syntactic priming occurred both across and within constructions (locative-to-dative, dative-to-dative), while thematic role priming occurred only within the same construction type (locative-to-locative, dative-to-dative?). These results suggest that prior instances of priming across constructions (e.g., Pappert & Pechmann, 2012) reflect purely syntactic priming rather than the priming of similar thematic role mappings. We will discuss further implications of these findings.

Back to Saturday Poster Schedule

Trait vividness and task demands shape online engagement of semantic processes in sentence and word comprehension

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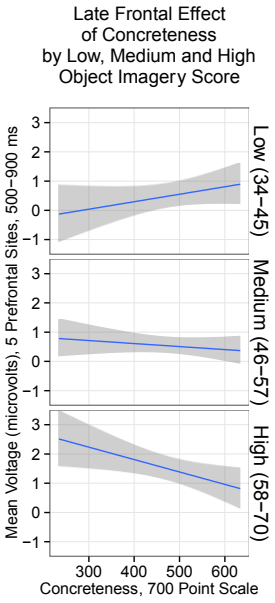
Individuals vary in their tendency to form vivid mental images, with vivid imagers showing enhanced recall for concrete verbal materials. But what effect does trait vividness have on the engagement of semantic processes when reading sentences for comprehension? We asked subjects (N=59) varying in their trait vividness to perform one of two tasks: reading single words and deciding whether they were synonymous to a subsequent probe word (N=27) or, to examine effects of task orientation, reading sentences for comprehension (N=32), where the critical word was second in the sentence (i.e., no build up of context). In each case, the same set of 124 concrete and 124 abstract nouns (length, frequency, familiarity, and N matched) was employed. Event-Related Potentials (ERPs) were recorded during each session, to assess how trait and task conditions impacted ERP components associated with semantic processing. In particular, we wished to explore the effect of trait vividness and task on the ERP concreteness effect, in which more concrete words tend to elicit a more negative N400 (associated with long-term memory access; hence suggesting activation of a richer network of associated semantic information for concrete words [1]) and a sustained frontal negativity, linked to mental imagery [2-5]. Subjects with a greater tendency to form vivid mental images, assessed using the object-spatial imagery questionnaire [6], showed an enhanced concreteness effect (more negativity) at frontal sites at 500-900 ms ($p < .05$), and a numerical trend in the same direction at frontal and central sites at 300-500 ms. This interaction effect is depicted in the figure below: mean voltage at frontal sites (500-900 ms) becomes more negative as the concreteness of the critical noun increases for vivid imagers (bottom) and, to a lesser extent, moderate imagers (middle panel), but not for the least vivid imagers (top). Vivid imagers may thus differentially engage controlled processes associated with mental image generation when reading for comprehension. Our results are consistent with linking the sustained frontal portion of the ERP concreteness effect to mental imagery, as had previously been posited on the basis of task manipulations [3,4]. Task did not modulate the interaction between trait vividness and concreteness or influence the overall size or topology of the concreteness effect. However, we did find evidence for differential semantic engagement between the two tasks. Nouns high in familiarity/frequency elicited a sustained fronto-central negativity when compared to low familiarity/frequency nouns in the synonym judgment task, but not during sentence comprehension, suggesting the synonym judgment task may have elicited an active search for semantic associates that was reduced or absent during sentence comprehension. Specifically, the enhanced negativity may reflect bringing online more semantic information when there are more associated words to activate, as is the case for high frequency / familiarity words. Our findings add to the developing picture of task and trait influences on language comprehension, and speak to the mechanisms by which the same sentence may be experienced differently across individuals.



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Back to Saturday Poster Schedule

Tuning in: adaptation to mispronunciation in foreign-accented sentence comprehension

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Understanding how language comprehension is altered for accented speech has important practical applications, and can also provide unique insights into basic comprehension mechanisms. Previous research has shown that foreign-accented speech can increase the amplitude of N400 responses to unexpected lexical items and eliminate otherwise occurring late positivities to lexical and syntactic errors, and that these effects are modulated over the course of an experiment as listeners adapt to speaker characteristics (Hanulíková et al., 2012; Romero-Rivas, 2015). In this light, we examined how native Mandarin Chinese listeners process phonological errors in foreign-accented speech. Non-native speakers (NNS) are known to have difficulties accurately producing Mandarin lexical tones, which could potentially impact comprehension for native listeners. Our results suggest native listeners adapted to NNS phonological errors over the course of the experiment by increasingly relying on other contextually available cues.

In order to examine phonological responses to both segmental and suprasegmental speech errors, we recruited native speakers of Mandarin Chinese (n=18) for an auditory ERP experiment. We examined early (200-500ms) and late responses (600-900ms) to 240 sentence stimuli, each with four word-level conditions (expected, semantic/rhyme/tone mismatch) and two accent conditions (native, foreign). An example item with word conditions is illustrated in (1).

(1) *Wǒmen jiā zhùde zhè tào __ yào bèi chāi le.* 'The __ our family lives in will be torn down.'

Expected word: *fángzi* 'house' **Semantic mismatch:** *xiōngdi* 'brothers'
Rhyme mismatch: *féngzi* (nonword) **Tone mismatch:** *fàngzi* (nonword)

In the early window, grand average ERPs (Fig. 1a) showed main effects of condition, but no significant interactions with accent. The late window showed strong responses to phonological mismatches, but again no significant interactions with accent. However, we observed that accent critically impacted adaptation effects to phonological mismatches from the first to second half of the experiment on the late positivity. We found a significant interaction between accent and experiment half, and follow-up analyses revealed foreign-accented tone and rhyme mismatches differed significantly from expected words in the first half of the experiment only (Fig. 1b), while for native-accented speech they differed significantly only in the second half (Fig. 1c).

In the context of listener adaptation to individual speaker characteristics, we tentatively interpret these late positivities as indexing listeners' *immediate attempts to repair phonological errors* in nonwords. As listeners adjust to NNS pronunciation deviations (a constant in accented speech), they grow more confident of broader sentence interpretation, and less likely to attempt immediate recovery of any individual word on the basis of specific and less reliable phonological cues. In the case of native-accented speech, adaptation results in greater certainty about NS speech characteristics, thus increasing the informativeness of phonological cues and accommodating immediate lexical repair. In sum, accent plays a clear role in guiding how listeners process pronunciation errors by driving or reducing attempts to recover the intended word.

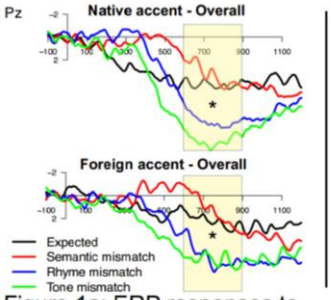

Figure 1a: ERP responses to native/foreign accent overall

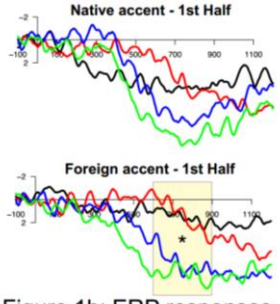

Figure 1b: ERP responses to first half of critical trials

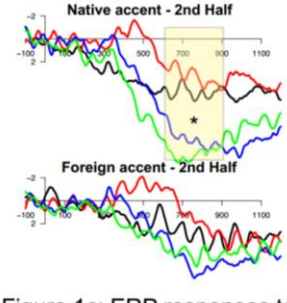

Figure 1c: ERP responses to second half of critical trials

Back to Saturday Poster Schedule

Understanding contextual effects during the real-time comprehension of verbal irony

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Irony is a ubiquitous part of communication. If a speaker says, "*What a fabulous chef Fred is*," one might conclude that he cooks well (literal interpretation). However, if Fred had just burned a meal, one would instead infer that he is a terrible chef (ironic interpretation). While context plays a vital role in inferring irony (e.g., speaker tendencies), it remains unknown how these cues are incorporated with literal meanings. One possibility is that listeners initially analyze the literal meaning before recruiting relevant contextual cues (Late Context Account). Alternatively, salient contextual cues may immediately inform comprehension, particularly when ironic interpretations are conventional (Early Context Account). Since prior studies often provide limited cues to irony (e.g., single sentences without speaker information)[i] and/or use coarse-grain temporal methods (e.g., phrase-level reading times),[ii] these questions remain unresolved.

We tested how context affects subjects' irony interpretation using a visual world eye-tracking paradigm. Contextual cues were provided in a 2 (interpretation: literal vs. ironic) x 2 (adjective: positive vs. negative) design (see table, examples a-d). Two types of irony were compared: conventional *ironic criticisms* (c), and less conventional *ironic compliments* (d). Trials unfolded in two parts. First, 32 subjects heard vignettes describing visually depicted events. For example, Sally baked a beautiful cake while Fred burned a meal. Next, a speaker described a character using an adjective and pronoun. Subjects were told that Literal Lucy always spoke literally, while Ironic Ike always spoke ironically. Target referents were unambiguously identified by pronoun gender, but adjective valence could provide an earlier cue. During semantic analysis, negative adjectives are processed more slowly than positive ones[iii]; so when Literal Lucy speaks, subjects should look to Sally shortly after "*fabulous*" and, with a brief delay, to Fred after "*terrible*." Importantly, when Ironic Ike speaks, fixations will reveal how context informs ironic interpretation. If subjects must first analyze the literal (semantic) meaning, they should first look to literal referents before correct targets, even for conventional ironic criticisms (d). In contrast, if ironic interpretations can be computed immediately via event context and speaker identity, they should look at the target shortly after adjective onset for ironic criticisms. Both accounts predict a delay for less conventional, ironic compliments (b).

We analyzed subjects' proportion of looks to the target and distractor. Before the adjective, looks were evenly split between both characters in all conditions (*p*s > .60). However, in the critical region between adjective and pronoun onset, there was an interpretation x adjective interaction ($p < .001$). In literal conditions, target looks increased after both positive and negative adjectives (66% vs. 61%). Target looks became and stayed above chance (50%) within 150ms after positive adjectives and 500ms after negative adjectives (*p*s < .05). Thus, subjects rapidly used adjectives to identify referents and, as expected, did so more quickly for positive than negative ones. In ironic conditions, target looks increased for conventional criticisms, but remained equivocal for less conventional compliments (60% vs. 49%). Critically, fine-grained analyses revealed that target looks were markedly delayed in *both* cases, and did not exceed chance until 700ms after positive adjectives and 1150ms after negative ones (*p*s < .05). This suggests that even for conventional ironic criticisms, with early and reliable cues (i.e., event before utterance; speaker tendency), ironic interpretations take time to generate. These data support a Late Context Account: subjects first access the literal analysis, which guides use of contextual cues.

	Positive Adjective	Negative Adjective
Literal interpretation	(a) "What a fabulous chef she is."	(c) "What a terrible chef he is."
Ironic interpretation	(d) "What a fabulous chef he is."	(b) "What a terrible chef she is."

References

[i] Ivanko & Pexman (2003) *Discourse Processes* [ii] Schwoebel et al. (2000) *Metaphor & Symbol* [iii] Kuchinke et al. (2005) *NeuroImage*

Back to Saturday Poster Schedule

Use of contextual information to facilitate semantic processing in reading and listening by lower literate adults

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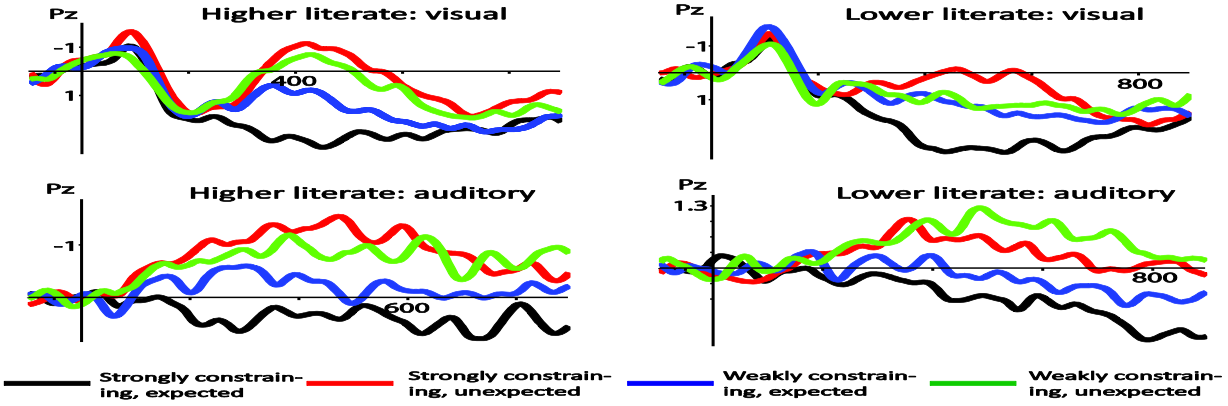
Context can be used to facilitate the processing of upcoming words, and does so through multiple mechanisms, e.g., by supporting decoding and enabling semantic integration, and especially in highly constraining contexts, prediction. Context can be especially helpful for comprehenders who are struggling with decoding (e.g., Perfetti et al., 1979, *M&C*), but literacy skill can alter the availability of particular processing strategies, like prediction (e.g., Mishra et al., 2012, *J Eye Mvmt Res*). In a pair of experiments, we examined context use by adults of varying literacy levels during both reading and listening for comprehension using the same materials. We sought to determine (1) whether decoding difficulties cause readers to rely on context more or, instead, to have more difficulty using context message and (2) whether literacy-based effects on context use in reading generalize to auditory sentence comprehension.

Participants (N=20/group/experiment) were adults (mean age: 45) divided into higher (HL; reading level: 11.6 grade) and lower literacy (LL; reading level: 7.3 grade) groups. Stimuli were strongly and weakly constraining sentences that ended with an expected or unexpected target word (e.g., Strong-constraining: *The prisoners were planning their escape/party.* Weak-constraining: *He slipped and fell on the floor/rock.*). Expected target words in strongly constraining sentences had high cloze (*M*=.85) and were therefore predictable. Expected words in weakly constraining sentences had low to moderate cloze (*M*=.27). Unexpected words in either context had very low cloze (*M*=.01) but were plausible and semantically unrelated to the most expected word. ERPs were recorded for both self-paced word-by-word reading and listening to continuous speech.

HL adults' N400 patterns were graded by cloze in both reading and listening (see figure below) and were similar to those of college-aged adults in previous studies using RSVP reading. This group also showed evidence for predictive processing in reading, with longer reading times to unexpected items as a function of constraint (i.e., depending on whether or not a different word was highly predicted). LL adults showed different N400 patterns in reading and listening: expectancy effects were evident on the N400 in listening but only within strongly constraining, but not weakly constraining, contexts in reading. However, in both modalities, this group failed to show the full range of N400 effects based on cloze, as HL adults did.

High literate readers seem to use similar processing mechanisms when listening to sentences as when reading word-by-word. Lower literate adults show a marked reduction/delay in the use of weak contextual information during reading but can use both strong and weak sentence constraints to facilitate processing during listening. Still, they do not sufficiently benefit from cloze probabilities conditioned by sentence constraints in language comprehension.



Back to Saturday Poster Schedule

Using event-related potentials to examine individual differences in the processing of pronominal reference

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Recent studies have shown variability in the processing of pronominal reference in both ambiguous contexts (David shot at John as he...vs. David shot at Linda as he) and in contexts of 'referential failure' in which there is no gender-matching antecedent within the sentence (The boy thought that she/he....) (Osterhout and Mobley, 1995; Nieuwland and Van Berkum, 2006; Van Berkum and Nieuwland, 2008; Nieuwland, 2014). These contexts have been shown to give rise to a sustained, frontal negative shift (Nref) or a P600 (or both ERP components) depending on both the accompanying behavioral task and individual differences in working memory (e.g. Nieuwland, 2014). For cases of 'referential failure,' it has been proposed that the presence of an explicit acceptability judgment task may give rise to P600s, suggesting attempts at co-reference despite the mismatch in the gender of the pronouns (Osterhout and Mobley, 1995; Nieuwland, 2014). In both ambiguous contexts and contexts of 'referential failure,' high working memory has been associated with Nref, a component that indexes the inability to assign a unique referent, as opposed to P600 (Nieuwland and Van Berkum, 2006; Nieuwland, 2014.

The present study further examines individual differences in pronominal processing, testing both kinds of pronominal contexts, and including a wider range of cognitive measures. Experiment 1 targeted ambiguous pronouns (One/Two referent: Linda/Tyler grabbed Eric because he was falling down the stairs) and Experiment 2 targeted referential failure (One/No Referent: Nicole believe Steven/Alice because he was a very genuine person). Participants included native English speakers (n=33) who completed tests of working memory (counting span, reading span), attentional control (Stroop), and an offline measure assessing the ambiguity of the experimental sentences. In the ERP experiment, participants read 240 sentences (160 targets, 80 fillers) and were asked to respond to fill-in-the-blank recall questions following one third of the stimulus sentences. Results of Experiment 1 for all participants (n=33) showed no significant effect of ambiguity. However, follow-up analyses following Van Berkum and Nieuwland (2008), revealed two distinct groups of participants: Individuals who showed a positivity in the posterior region in the 500-1400 time window (n=18) also showed a significant positivity in the anterior region, revealing a broad positivity which may index revision of the initial reference assignment at the pronoun or analyzing the gender of the pronoun as a grammatical violation. Individuals who did not show a positivity in the posterior region (n=15) showed a sustained frontal negativity in the anterior region (Nref). The size of the Nref was significantly correlated with performance on the counting span task, suggesting in line with previous research that the Nref is larger in individuals with high working memory. Results of Experiment 2 showed a significant positivity in the posterior region in the 500-900 time window, consistent with the P600, suggesting that participants may attempt co-reference even in the absence of an explicit acceptability judgment task. The P600 effect size was significantly positively correlated with the reading span task suggesting that P600 may not necessarily be associated with low working memory (cf. Nieuwland, 2014). Furthermore, additional analyses revealed an emerging trend in which the group differences in Experiment 1 impact the processing of referential failure in Experiment 2: an anterior negativity (Nref) emerges only in the group which yielded an Nref in Experiment 1 suggesting a possible commonality in the processing of pronominal reference across contexts that require a kind of complex inferencing in response to referential difficulty.

Back to Saturday Poster Schedule

Validating a new tool to explore psycholinguistic processing in infancy

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Empirically derived semantic feature production norms have proven useful in exploring psycholinguistic phenomena across the developmental spectrum. The primary goal of this project is to develop and validate a new tool to facilitate infant psycholinguistic research by extending a widely used set of semantic feature production norms (McRae et al., 2005) to cover all items on a popular inventory of early words produced by young children, the MacArthurBates Communicative Developmental Inventory: Words and Sentences (MBCDI, Fenson et al.).

Following the procedures outlined in McRae et al. (2005), we collected feature production norms on 216 concepts from the noun categories of the MBCDI that did not already exist within the existing set of 541 concepts, along with 30 concepts that did appear within the set. We recruited 316 participants via Amazon Mechanical Turk (AMT) and they provided semantic features for a subset of the 246 total concepts, such that at least 30 participants provided ratings for every word, yielding a total set of 82,710 features.

Our initial analytic goals are to validate our norming procedures with respect to the original McRae et al. (2005) norms. We sought to determine if norms digitally collected via AMT can be justifiably combined with the original feature norm set (which were collected via handwritten responses). We therefore compared the set of 30 overlapping concepts from the initial and newly collected sets on a range of measures, described below.

First, we compared whether participants produced a similar breadth and number of responses for the overlapping concepts. There was no significant difference between the original set, (M = 14.2, SD = 3.2) and the new set (M = 12.9, SD = 3.3) in the number of features produced per concept, $t(58) = 1.52$, $p = .13$. Likewise, for the number of participants who produced a feature for a given concept, there was no significant difference between the original (M = 10.6, SD = 5.7) and the new set of concepts (M = 10.0, SD = 5.0), $t(810) = 1.56$, $p = .12$.

Next, we measured the degree of pairwise semantic similarity between the 30 newly collected and 30 original concepts using cosine similarity ratings of vectors for each concept consisting of the production frequency for all possible features (M = .69, SD = .17). We then compared these values with the highest pairwise cosine similarity ratings for each newly collected concept out of comparisons made with the *remaining* set of concepts (M = .49, SD = .14). We found that the 30 newly collected concepts were significantly more similar to the 30 original concepts than they were to any other concept in the combined set, $t(29) = 6.98$, $p < .001$. For 26 of the newly collected concepts, its pair from the set of 30 original concepts was the most similar.

Finally, we asked whether the features produced in the overlapping concepts were similar with respect to the remaining concept sets by measuring a number of network properties for the original and new sets (degree, clustering coefficient and path length) across the entire set of concepts. No network comparisons, explored in a variety of ways, indicated significant difference between the original and new norms.

Together, these comparisons demonstrate a high degree of similarity between the concepts collected in the original and new datasets. Ongoing work seeks to complete feature type classification in accordance with the McRae et al. (2005) dataset. We plan to freely share the combined dataset of 757 concepts with the psycholinguistic community as a means to facilitate psycholinguistic research in infant and child populations that explore a variety of semantic factors on the development of lexical and sentence processing abilities.

Back to Saturday Poster Schedule

Variation in prosodic planning among individuals and across languages

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Previous research (Swets et al., 2007) found that working memory (WM) was associated with the manner in which silent readers in multiple languages package linguistic material together. Specifically, those with high WM were more likely to create larger linguistic packages than those with low WM, which in turn influenced the manner in which they interpreted syntactic ambiguities. One possibility that gained support in subsequent research on language production (Petrone et al., 2011) is that this packaging associated with WM is prosodic in nature. In the current study, we present evidence that the size of prosodic increments during language production, as measured by the occurrence of pauses, is associated with WM and speed of processing. This study adds to the increasing body of literature that seeks to better understand mechanisms of language production by investigating variation in planning tendencies among individuals. In addition, we examined whether pausing tendencies vary across languages.

In our study, 31 German speakers and 32 French speakers described images presented on a computer monitor while their utterances were recorded. The images contained three objects apiece, and a speaker's task was to describe the images in such a way that a person listening to the utterance could follow the instruction to move the described objects (e.g., "The box moves below the train and the mouse moves above the train.") To manipulate sentence complexity (and cognitive load), half of the descriptions required speakers to distinguish between similar looking objects (e.g., a cat with four legs vs. a cat with three legs). In addition to number of pauses, we also measured initiation time, and separately measured WM via a Reading Span task and processing speed via a Letter Comparison task.

Analyses using linear mixed effects models revealed several key findings. First, we found significant cross-linguistic differences in initiation time and number of pauses: French speakers began their speech more quickly, but paused more often than German speakers, suggesting a greater degree of "incremental" planning. Despite these cross-linguistic differences, we nevertheless found evidence across languages that both WM and processing speed explain unique variance in our measure of pause frequency, and do so in the same direction: As WM and processing speed increase, the number of pauses speakers produce per utterance decreases. There is also evidence that both effects are stronger during the high-load, complex sentences. On the other hand, neither WM nor processing speed predicted variability in initiation time. These results lend support to the hypothesis that individual differences in WM and processing speed lead to differences in planning processes, such that higher WM and processing speed support the planning of larger prosodic "chunks". Analyses including data from English speakers and additional speech measures are under way.

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Back to Saturday Poster Schedule

Variation in sentence processing strategies between bilingual groups: On-line and off-line pronoun interpretation

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Pronoun interpretation in anaphora has received considerable attention in second language acquisition. The present study examines online and offline pronoun interpretation for three Spanish/English bilingual groups and two monolingual control groups. Spanish pronouns are thought to be guided by the Position of the Antecedent Strategy (PAS): null pronouns refer to the subject and overt pronouns to the complement (Carminati, 2002; 2005). The Active Filler Strategy (AFS) (Clifton and Frazier, 1989) proposes assignment of English anaphoric pronouns to the syntactically closest referent and English subject assignment strategy claims that overt pronouns are interpreted with subject antecedents (Arnold et al., 2000; Song & Fisher, 2007). Previous research examined first language (L1) interference, near-native late bilinguals parsing (Tsimpli & Sorace, 2006) and pronoun interpretation in bilinguals (Belletti et al. 2007; Wilson et al. 2009; Keating et al. 2011).

This study (*N*=*97*) examined pronoun interpretation for advanced late L1 Spanish/L2 English bilinguals (*n*=22), advanced late L1 English/L2 Spanish bilinguals (*n*=19), and early (heritage) bilinguals (*n*=26) in comparison with Spanish (*n*=17) and English (*n*=13) monolinguals. Language history questionnaires and self-ranked skills measured language abilities. Self-paced reading (SPR) and picture verification tasks (PVT) were completed in Spanish for all participants but the English monolingual group. In the PVT, four lists of 25 target stimuli (20 fillers), manipulating sentence type (forward/backward anaphora) and pronoun type for Spanish (overt/null). Participants read a sentence (e.g. 1a-b) and selected one of three pictures that indicated a subject, object or extrasentential interpretation of the pronoun (Sorace & Filiaci, 2006). Eight SPR lists with 32 target stimuli (e.g. 2a-b) manipulating anaphora type, pronoun type (Spanish only) and forced subject/object agreement (to measure processing costs between conditions) were presented with 50 fillers. While all bilingual groups follow the PAS for null pronouns in the PVT, SPR RTs for early bilinguals and L1 English show on-line processing difficulties. Findings for overt pronouns from both tasks for L1 English and early bilinguals show shorter RTs ($p<.05$) for target regions in sentences following English interpretation strategies, suggesting influence of the AFS on Spanish pronoun interpretation. Results are further discussed with specific attention to bilingual type and cross-linguistic influence on syntactic processing.

Examples

Forward anaphora:

(1a) El abuelo habla con el nieto mientras él/(*pro*) lee un libro. *Spanish overt/(null)*
(1b) The grandfather talks with his grandson while he reads a book. *Eng. monolingual only*

(2a) Backward anaphora\ overt pronoun\ subject interpretation:
Mientras ella compra en la tienda, la chica llama a sus amigas de la escuela.
While she shops in the store, the girl calls her friends from school.
(2b) Backward anaphora\ overt pronoun\ object interpretation:
Mientras ella compra en la tienda, las chicas llaman a su amiga de la escuela.
While she shops in the store, the girls call their friend from school.

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Back to Saturday Poster Schedule

Variation in the German sentence "forefield": The impact of visual context for the evaluation of verb-second (V2) violations

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Over the last decades, new ways of speaking in multilingual urban neighborhoods, in particular in North-Western Europe, have come to the focus as an interesting new empirical domain for research into linguistic variation. Our study examined new word order options described for "Kiezdeutsch", a German example for such a vernacular (cf. Wiese, 2012; te Velde, 2014), which pose a challenge for traditional assumptions of verb-second (V2) as a rigid constraint for German matrix declaratives. While most Kiezdeutsch declaratives adhere to the V2 constraint, several studies also provide evidence for deviations, of the kind illustrated in (1), where two constituents occupy the "forefield", the left-peripheral sentence domain preceding the finite verb:

5. (a) jetzt ich bin 18 (Auer, 2003)
now I am 18
'Now I am 18.'

(b) dann die sind zur Ubahn gerannt (Wiese, 2013)
then they have to subway ran
'Then they ran to the subway.'

While Auer (2003) described such patterns as a conversion to the Subject-Verb-Object (SVO) order, later studies suggested an analysis as verb-third (V3) (Wiese, 2013), given the preservation of the German sentence bracket ("sind … gerannt" in (1b)) (cf. also te Velde, 2013). If this is correct, such examples would be instances of genuine multiple forefields in German that might be motivated by information-structural preferences (Wiese, 2013; Schalowski, to appear): Therein, the left-most element is typically an adverbial (Adv) acting as a framesetter, followed by a subject representing a topic. This order could thus reflect a general preference that we would expect to hold for speakers of other dialects as well, even though it could not be implemented there as easily as in a more dynamic, emerging dialect such as Kiezdeutsch.

To test this, we investigated the evaluation of such V3 sentences by speakers of German without a Kiezdeutsch background in different information-structural contexts: (A) subject as aboutness topic, (B) subject as contrastive topic and (C) subject and verb as discourse-new. Contexts were presented visually in form of subsequently presented pictures of which the third picture depicted the actual scene of the sentence which participants had to judge on a categorical four-choice scale (thumbs-up/down) (see Fig.). 45 participants rated sentences (N=96) of (1) Kiezdeutsch-attested V3 ($AdvSV_{fin}O$), (2) standard German V2 ($AdvV_{fin}SO$), (3) non-canonical German V2 ($OV_{fin}AdvS$), and (4) V3 following a pattern not attested in Kiezdeutsch ($OSV_{fin}Adv$). Ratings indicate that Kiezdeutsch V3 (1) is generally rated worse than V2 (2, 3), but, interestingly, significantly better than unattested V3 (4). All sentences were rated significantly better if the visual context marked the subject as a topic (A, B) compared to discourse-new (C). Testing only Kiezdeutsch V3 (1) in 33 additional participants showed the predicted effect of improved ratings in aboutness topic (A) compared to discourse-new contexts (C), but the contrastive topic context (B) did not reach significance ($p>.05$). We discuss the relevance of these results for our understanding of the V2 constraint in German and the impact of information structure on word order variation.

Fig.: Example of a visual context with the subject as aboutness topic and a Kiezdeutsch V3 sentence 'Then the boy kicks the football.'

Back to Saturday Poster Schedule

Verb position predicts processing difficulty in a flexible SOV language

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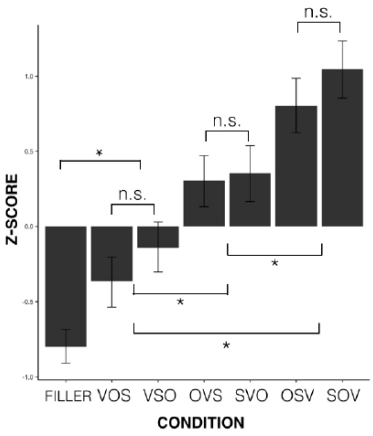
Background: Previous research on processing in flexible SOV languages has shown that non-canonical constituent orders result in processing difficulty (Miyamoto & Takahashi 2001; Weskott & Fanselow 2011). However, most of this research has focused on the position of the arguments rather than the position of the verb. In Malayalam (Dravidian), canonical constituent order is SOV, but each of the six logical orders is grammatical and attested. In isolation, these sentences should result in differential processing difficulty caused by factors such as syntactic dependencies (due to movement from SOV) and the construction of a discourse context (because non-canonical orders are associated with particular discourse contexts; Kaiser & Trueswell 2004). By these criteria, SOV should be easiest to process, but the relative difficulty of the other orders is unknown.

Proposal: Because Malayalam has a default SOV order, does not have subject-verb agreement and has pervasive argument dropping, post-verbal arguments should result in processing difficulty due to reanalysis. For example, with an SVO sentence, the processor could posit a sentence boundary after the subject and verb and then be forced to reanalyze upon encountering the object. Likewise, with a VOS sentence, the processor would posit two sentence boundaries, as V alone and VO are both grammatical utterances. Thus, each post-verbal argument should result in additional processing difficulty, predicting a three-way distinction in which verb-final orders are most easily processed, followed by verb-medial, and then verb-initial. Contrary to what has been assumed until now, then, we predict a sharp, three-way distinction in processing difficulty and acceptability among the six possible orders. Here we test the prediction for acceptability using a formal acceptability experiment.



Experiment: The study employed a one-way design with 6 levels, in which ORDER included each of the 6 logical orders. Each experimental stimulus had three constituents: an animate subject, an inanimate object, and a verb, ensuring that the semantic role of each argument would be unambiguous. Stimuli were distributed among lists pseuorandomly using a Latin Square. Each participant saw 5 tokens of each condition and 40 filler items (10 of very low acceptability). 18 participants (native speakers residing in a Malayalam-speaking region of India) rated these sentences using a 7-point scale.

Results: Results (as z-scores) are presented in the figure (error bars = SE). There was a main effect of ORDER ($p<0.001$). The differences between each of the verb positions were significant as calculated by pairwise t-tests ($p<0.001$ for each). Additionally, pairwise t-tests between the orders within each verb position (SOV and OSV, SVO and OVS, and VSO and VOS) were not significant. The 10 low-acceptability fillers were significantly less acceptable than the verb-initial sentences ($p<0.001$).

Discussion: We found a three-way distinction in which the position of the verb affects acceptability exactly as predicted, supporting the idea that, in flexible SOV languages such as Malayalam, post-verbal arguments result in reanalysis and concomitant processing difficulty. Future work will look more directly at the processing mechanisms involved and explore other factors that may be influencing acceptability.

Back to Saturday Poster Schedule

Verb transitivity effects: Commas aren't the cause

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A critical question for models of sentence parsing is when and how readers use verb-based constraints such as transitivity to guide sentence interpretation. A reliable finding in the eye-tracking literature is that, when an intransitive verb appears in a subordinate clause like ("*After falling…*"), readers experience processing difficulty at a following noun-phrase ("*my dancing partner*") relative to when a transitive verb is used. Currently, there are two theoretical interpretations of this effect. According to one account, the parser cannot use verb subcategorization information immediately, and it incorrectly assigns the following noun-phrase as a direct object of the verb (Mitchell, 1987; van Gompel & Pickering, 2001). On another account, this processing difficulty is not syntactic in nature, and is caused when readers detect a clause boundary that was not signaled by a comma (Staub, 2007).

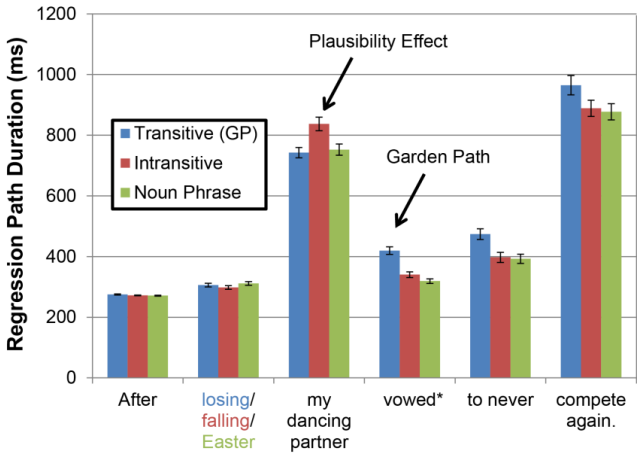
To distinguish between these two theories, we compared reading times for subordinate clauses with transitive or intransitive verbs, while also including a third noun control condition ("*After Easter*") which unambiguously signaled the end of a clause (see examples below).

1. After losing my dancing partner vowed to never compete again. (*transitive*)
2. After falling my dancing partner vowed to never compete again. (*intransitive*)
3. After Easter my dancing partner vowed to never compete again. (*noun control*)

Participants (N = 108) read 16 sentences in each condition, interspersed with 180 unrelated fillers, while their eye-movements were recorded. Contrary to the predictions of the clause boundary account, participants showed processing difficulty at the critical noun phrase ("*my dancing partner*") in the intransitive condition relative to both the transitive and noun conditions (see graph below). These two conditions did not differ reliably from each other, and a similar pattern of effects was observed on first-pass, regression path, and % regression measures.

Notably, it appears that the implausible direct object interpretation did not linger over time. Transitive verb sentences showed robust garden path effects at the disambiguating word ("vowed"), while intransitive sentences showed no clear garden path effects in this region.

These results suggest there are fundamental differences in the way that readers use verb subcategorization and word category information when building syntactic structures. Most critically, it appears that verb sub-categorization information is not available immediately and can only play a role after an implausible analysis has been detected and repaired.



	Transitive	Intransitive	Noun
First-fix.	232 (44)	242 (40)	233 (42)
First-pass	659 (152)	715 (186)	680 (159)
Reg. path	742 (196)	837 (229)	752 (186)
% Reg.	15.2 (13)	21.9 (15)	12.3 (11)

Region 3 Reading times.

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Back to Saturday Poster Schedule

Word learning in linguistic context: Processing and memory effects

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Children exploit relationships among linguistic forms to learn word meanings, a strategy known as syntactic bootstrapping (Gleitman, 1990). For example, they can infer that "*blicket*" in (1b) refers to something large/menacing. However, far less is known about how bootstrapping operates alongside a developing system for real-time comprehension. In the word-learning literature, it is often assumed that children reliably access the same interpretation as adults. Yet, psycholinguistic studies reveal failures to exploit syntactic cues to revise misinterpretation (Trueswell et al., 1999). How do these challenges impact word learning? One possibility is that children disregard cues that occur in complex constructions, focusing on more accessible ones. Alternatively, they may always attempt bootstrapping, but their learning may vary with sentence-processing demands. To distinguish these accounts, we examined interpretation of novel words in active (simple) and passive (complex) sentences (Table 1). Children often interpret utterances with an agent-first bias, leading to high accuracy with actives, but misinterpretation of passives (Bever, 1970). Critically, this bias is weakened when NP1s refer to familiar entities, removing the need for revision and improving passive comprehension (Huang et al., 2013). Thus, if processing demands impact bootstrapping, then learning should be more effective in contexts that do not require revision compared to those that do. If, however, bootstrapping is guided by construction complexity, then learning should always be less effective with passives.

We examined the interpretation of novel words in 5-year-olds (n=40), using measures of (a) on-line sensitivity to syntactic cues, (b) off-line inferences of word meanings, and (c) later recall of word meanings. During the learning phase, children saw videos introducing one familiar object (e.g., seal) and two unfamiliar objects (likely agent/theme). Likely agents acted upon familiar objects (e.g., menacing creature chases seal). Likely themes were acted upon by familiar objects (e.g., seal chases unthreatening creature). After each video, children heard sentences like (1-2) while their eye-movements were measured to a display, featuring the familiar object and the likely agent and theme on either side. Based on prior work (Huang et al., 2013), novel NP1s in (1) were expected to strengthen an agent-first bias. In contrast, known NP1s in (2) were expected to weaken this bias. After each sentence, children were asked to select the novel word. No correction was provided. Finally, after 12 critical trials in the learning phase, children entered the recall phase. They saw likely agents/themes again and were asked to select the novel word.

Processing challenges led to NP1 x construction interactions in on-line sensitivity, off-line interpretation, and recall (all p's < .01). Following linguistic disambiguation, children's fixations converged on correct referents for actives (1-2b) and passives that did not require revision (2a). However, they were equivocal for passives that required revision (1a). This suggests decreased sensitivity to syntactic cues when they conflicted with an agent-first bias. Similar effects were found in off-line interpretation. When revision was not required in (2), passives were as accurate as actives (74% vs. 63%). But when revision was required in (1), passives were less accurate than actives (39% vs. 86%). Finally, processing challenges also interfered with memory for word meanings. Even when off-line interpretations were correct, recall for meanings were at chance for words occurring in passives requiring revision (47%), and were more accurate when revision was not needed (>65% in other conditions). This demonstrates that syntactic bootstrapping depends overcoming the real-time demands of utterance interpretation. Inefficient processing negatively impacts word learning, through interpretive failures and memory interference.

	Condition		Sentence (disambiguation underlined)	Correct interpretation
(1)	Novel NP1	a. Passive	The blicket will be eaten by the seal	"blicket" = likely theme
		b. Active	The blicket will be eating the seal	"blicket" = likely agent
(2)	Novel NP2	a. Passive	The seal will be eaten by the blicket	"blicket" = likely agent
		b. Active	The seal will be eating the blicket	"blicket" = likely theme

Back to Saturday Poster Schedule

Topic-hood differently affects processing Japanese repeated names and pronouns

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This research investigated the Repeated Name Penalty (RNP) and Overt Pronoun Penalty (OPP) in Japanese. The RNP was first reported by Gordon, Grosz and Gilliom (1993), who observed that English sentences with repeated name subject anaphors were read slower than overt pronoun subjects when the antecedents were either the grammatical subject or the first mentioned surface initial noun phrase (NP) of the previous sentence. The OPP was reported in studies of null-subject languages like Spanish (Gelormini-Lezama & Almor, 2011) in which overt pronoun subject anaphors were read slower than null-pronoun subject anaphors for subject antecedents. These effects are not merely a reflection of differences in word count and sentence length because they are eliminated or reversed when the antecedents are objects. However, in most previously tested languages, the grammatical subject of a sentence is typically also its discourse topic. Thus, it remains unclear whether these effects are attributable to the anaphors' subject-hood or to their topic-hood. To address this question we conducted a self-paced reading experiment in Japanese, a language which has overt topic marking (the nominal morpheme *wa*) and a distinct non-topic subject marking (the nominal morpheme *ga*).

Seventy-two native Japanese speakers participated in the experiment. They read two-sentence discourses; the first sentence included an antecedent, and the second sentence contained an anaphor. The antecedents were either subject or object, and the anaphors were either (i) repeated-name non-topic-subject-*ga*, (ii) repeated-name topic-subject-*wa*, (iii) overt-pronoun non-topic-subject-*ga*, (iv) overt-pronoun topic-subject-*wa*, or (v) null-pronoun topic-subject. Our results show that both repeated-name topic-subject anaphors and repeated-name non-topic-subject anaphors exhibit the RNP (β=-0.10, SE=0.038, T=-2.65, p<.01; β=-0.11, SE=0.038, T=-2.84, p<.005) and that both overt-pronoun topic-subject and overt-pronoun non-topic-subject anaphors show the OPP (β=-0.13, SE=0.038, T=-3.44, p<.001; β=0.12, SE=0.038, T=-3.13, p<.002). In other words, the RNP and OPP were detected regardless of the topic-hood of the anaphors. However, detailed examination of the results revealed an interaction between anaphor topic marking, anaphor forms (i.e., repeated names, overt pronouns and null pronouns), and the antecedent's grammatical status. Specifically, repeated-name topic-subject-*wa* anaphors were the only overt anaphors whose reading times were not significantly slower than null pronouns when their antecedents were objects (β=.046, SE=.026, T=1.69, p=.091). In contrast, other overt anaphors were all read significantly slower than null pronouns even when their antecedents were objects.

We attribute this outcome to the discourse function of *wa*, which topicalizes an NP that was previously not the topic. When an antecedent is the subject, it is the discourse topic by default. In this case, it is redundant for *wa* to topicalize the anaphor, and thus the reading of the anaphor with *wa* is slowed. On the other hand, when an antecedent is the object and, thereby, not the default topic, the topic-morpheme *wa* functions to signal a shift of the discourse topic (from the non-antecedent subject NP (default topic) to the antecedent object NP (non-default topic) in the preceding sentence). The anaphors marked with *ga* (i.e., repeated-name non-topic-*ga* and overt-pronoun non-topic-*ga*) were read slower regardless of their antecedents' grammatical status because *ga* does not topicalize an NP. In addition, we found that overt pronouns with *wa* were read more slowly regardless of their antecedents' grammatical status. We attribute this result to the rich semanticity of Japanese overt pronouns, which (more like English nouns than pronouns) contain information that redundantly identifies their antecedents and may override any possible effect of topic-hood. Overall, this research indicates that topic-hood has a distinct role in the RNP over and above subject-hood. In contrast, our results do not support a distinct role for topic-hood in the OPP.

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Back to Saturday Poster Schedule

Oscillatory Signatures of Morpho-Syntactic Processing in Native and L2 Speakers

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Introduction: Traditionally, event related potentials (ERPs) have been used to study the earliest neural signatures of language processing. However, oscillatory neuronal dynamics observed in the human electroencephalogram (EEG) – captured by the time-frequency analysis – might provide additional insight into understanding the neural dynamics that are at play in sentence processing. Studies investigating oscillatory dynamics of morpho-syntactic processing in native speakers (Bastiaansen et al., 2010; Davidson et al., 2007) report power decreases in response to grammatical violations in the 8-30 Hz frequency range. Brain oscillations have been shown to be particularly suitable to capture brain dynamics differences for speakers whose performance is particularly variable, such as bilinguals (Kielar et al., 2014). Analysis of brain oscillations in second language (L2) speakers represents a powerful new way to understand the mechanisms behind the processing of grammatical structures unique to the L2.

Methods: Here we analyzed sensitivity to clitic pronouns in native Spanish speakers (n=19) and advanced English-Spanish bilinguals (n=14). Clitic pronouns have been shown to be particularly taxing to acquire for English late L2 learners of Spanish. However, in a recent ERP study, Rossi et al. (2014) have found that at least a subset of very proficient L2 learners show native like processing of clitic pronouns. Additionally, we measured sensitivity to grammatical gender and number (marked on clitic pronouns), two grammatical features that are also uniquely marked in the L2. EEGs were recorded while participants read Spanish sentences containing pure gender and number, as well as combined gender and number violations on the clitic (e.g.: pure gender(number) violation as in *Antes de comer la manzana, Ana **lo(los)** peló con un cucillo (Before eating the apple, Ana peeled **it** with a knife)*).

Results: For native Spanish speakers there was an overall significant difference ($p<0.05$) in the alpha and beta frequency ranges (8-23 Hz) between correct sentences and sentences with violations at the clitic. Additionally, violation of number agreement elicited power decrease in the theta (6-7 Hz) frequency band. For bilinguals, there were no significant differences. However, similarly to what was found in Rossi et al. (2014), a sub-group of highly proficient L2 speakers (with an overall accuracy on the behavioral task >90%) revealed significant differences in the theta-lower alpha frequency band (5-10 Hz) between processing of correct sentences and sentences with a combined gender and number violation marked on clitic pronouns.

Conclusions: Our results reveal that: 1. time-frequency representations in the alpha–beta frequency bands can be used as a marker of speaker sensitivity to morpho-syntactic violations; 2. the level of proficiency seems to be a plausible predictor of the shift from nonnative to native-like neural patterns of language processing.

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Back to Friday Poster Schedule

Author Index

A

Abadie, Lauren, 42
Abeillé, Anne, 119
Abramson, Liana, 163
Ackerman, Lauren, 232
Adam, Christian, 215
Adams, Nora, 195
Adler, Rachel, 236
Ahn, Hyunah, 205
Alexandropoulou, Stavroula, 176
Alexiadou, Artemis, 178
Almor, Amit, 100, 246
Alves, Michele, 80
Andrews, Caroline, 91
Ankener, Christine, 147
Arnold, Alison, 42, 245
Arnold, Jennifer E., 36, 102, 202
Atkinson, Emily, 72
Avrutin, Sergey, 43
Aziz, Froogh, 104
Aziz, Patricia, 41

B

Bajo, Teresa, 189
Bacovcin, Hezekiah Akiva, 143, 190
Bambini, Valentina, 152
Bañon, José Alemán, 151
Barber, Horacio, 228
Barkley, Christopher, 221
Barner, David, 133
Barney, Devin, 61
Barrow, Julia, 123, 158
Bastiaanse, Roelien, 79
Beatty-Martínez, Anne, 160
Berman, Morgan, 47
Bertini, Chiara, 152
Bertinetto, Pier Marco, 152
Bicknell, Klinton, 118
Biondo, Nicoletta, 208
Black, Sandra, 83
Blake, Kelly-Ann, 169
Blanco-Elorrieta, Esti, 52, 82
Borovsky, Arielle, 129, 174, 239
Boutzoukas, Emanuel, 239
Bovolenta, Giulia, 101, 170
Branigan, Holly, 200, 223
Braze, Dave, 135
Breheny, Richard, 113
Brehm, Laurel, 73
Brennan, Jonathan, 48
Brocher, Andreas, 111, 214
Brodbeck, Christian, 156
Brothers, Trevor, 50, 146, 244
Brown-Schmidt, Sarah, 57, 93, 217
Bulkes, Nyssa Z., 155
Burchill, Zachary, 33
Burmester, Juliane, 242
Bustin, Amy, 241
Buz, Esteban, 107

C

Caffarra, Sendy, 228
Campanelli, Luca, 138
Canal, Paolo, 152
Cantor, Max, 48
Carlson, Greg N., 112
Carlson, Katy, 86, 94
Carreiras, Manuel, 228
Cecchetto, Carlo, 153
Chambers, Craig, 141, 222
Chan, Cecilia Yuet-Hung, 197
Chen, Hui-ching, 213
Chen, Zhong, 175
Cheng, Wei, 100
Chierchia, Gennaro, 184
Cho, Pyeong Whan, 68
Choi, Wonil, 220
Chow, Wing-Yee, 114
Christianson, Kiel, 154
Chromý, Jan, 162
Chun, Eunjin, 41, 123, 158
Clark, Blake, 86
Coffel, Michael, 61
Contemori, Carla, 225
Corrêa, Letícia Maria Scuro, 161
Covey, Lauren, 238
Crain, Stephen, 213
Cristante, Valentina, 87

D

Dahan, Delphine, 61
de Lacy, Paul, 164
de Sá, Thaís M. M., 112
Del Prato, Paul, 52
Dempsey, Jack, 154
Deo, Ashwini, 121
Di Paola, Simona, 152
Dillon, Brian, 91, 122, 137, 166, 208
Domke, Juliane, 180
Donati, Caterina, 153

Dotlačil, Jakub, 130, 162, 176
Dragoy, Olga, 79
Dubinsky, Stanley, 246
Duff, Melissa, 93
Dussias, Paola (Giuli), 45, 106, 160, 189, 225
Dye, Melody, 97, 215

E

Eby, Rachael, 48
Embick, David, 190
Exton, Erika, 103

F

Faghiri, Pegah, 140
Fairchild, Sarah, 117
Farmer, Thomas, 212
Fedele, Emily, 183
Federmeier, Kara D., 109, 234, 237
Feiman, Roman, 172
Felser, Claudia, 96
Feroce, Nicholas, 41
Ferreira, Fernanda, 62, 191, 220
Ferreira, Victor, 52
Fiorentino, Robert, 132, 238
Fisher, Cynthia, 92
Flecken, Monique, 35
Foppolo, Francesca, 153
Forest, Tess, 46
Forster, Renê, 161
Franck, Julie, 60, 77
Franco, Ludovico, 78
Frank, Robert, 193
Fraser, Kathleen C., 83, 199
Fraundorf, Scott, 99
Fuchs, Susanne, 240
Fujii, Tomohiro, 67
Futrell, Richard, 53, 97, 215

G

Gabriele, Alison, 132, 238
Galinsky, Phillip, 225
Gerard, Juliana, 38, 85
Gerstenberg, Tobias, 37
Gerwien, Johannes, 198
Gibson, Edward, 53, 128
Gietz, Frederick, 169
Goldrick, Matthew, 68
Gong, Tao, 135
Goodall, Grant, 105, 243
Goodwin Davies, Amy, 190
Gordon, Peter, 173, 203
Graf Estes, Katharine, 144
Graham, Naida, 83
Grant, Margaret, 131, 169
Grey, Sarah, 103
Grillo, Nino, 178, 227
Grimaldi, Mirko, 78
Grodner, Daniel, 51, 206
Grove, Julian, 90
Grüter, Theres, 95
Guo, Taomei, 235
Gwilliams, Laura, 156, 167

H

Hacquard, Valentine, 210
Hale, John, 48
Hall, Jessica, 212
Hall, Kathleen, 88
Han, Chung-hye, 231
Hanink, Emily, 90
Harris, Jesse, 94
Hartshorne, Joshua, 37
Hashiguchi, Maho, 159
Heller, Daphna, 110
Hemforth, Barbara, 119, 140, 150, 186
Henderson, John, 220
Hinterwimmer, Stefan, 214
Hirotani, Masako, 159, 226
Hoedemaker, Renske S., 203
Höhle, Barbara, 213
Hollister, Erin, 42
Hong, Upyong, 192
Hsu, Nina, 85, 108
Huang, Yi Ting, 42, 85, 236, 245
Husain, Samar, 98, 124, 179
Husband, E. Matthew, 101, 170
Hwang, Heeju, 71

I

Ibarra, Alyssa, 134
Ito, Yoshikuni, 159
Ivanova-Sullivan, Tanya, 182

J

Jäger, Lena, 39
Jaeger, T. Florian, 99, 107, 185
Jackson, Carrie, 157, 195
Jackson, Sandra C., 226

Jacobs, Cassandra L., 224
James, Ariel, 53
Johnson, Adrienne, 132
Johnson Fowler, Courtney, 157

K
Kaan, Edith, 41, 123, 158, 177
Kaiser, Elsi, 148, 181, 183
Kehler, Andrew, 56, 81
Keung, Lap-Ching, 59
Kheder, Souad, 177
Kim, Hyunwoo, 95, 216
Kim, Kyeong-min, 231
Kim, Minjae, 206
Kim, Nayoun, 73
Kluender, Robert, 221
Koike, Takahiko, 159
Konopka, Agnieszka, 46
Koornneef, Arnout, 130
Kowalski, Alix, 85
Krebs, Chase, 155
Kresh, Sarah, 70
Krivokapić, Jelena, 240
Kwon, Nayoung, 63, 115, 229
Kuperberg, Gina, 184
Kurucz, Ibolya, 198
Kurumada, Chigusa, 57
Kush, Dave, 124, 218
Kutas, Marta, 221

L
Lai, Melinh, 164
Lago, Sol, 96
Lau, Ellen, 49, 235
Laurinavichyute, Anna, 74
Lee, Benjamin, 86
Lee, Daniel Tsz-hin, 197
Lee, Dongsu, 192
Lev-Ari, Shiri, 34, 75, 165
Levy, Roger, 56, 81, 89, 120, 133, 196
Lew-Williams, Casey, 144
Lidz, Jeffrey, 38, 210
Lima, Maria Luiza Cunha, 112
Lin, Yi, 92
Linzen, Tal, 167
Liu, Linda, 33, 185
Lorimor, Heidi, 195
Lowder, Matthew, 62, 173, 191, 220
Lundquist, Björn, 64
Luo, Yingyi, 49
Lüthi, Janine, 223

M
MacDonald, Maryellen, 201
Mack, Jennifer E., 204
Mahowald, Kyle, 53
Magnuson, James, 135
Malko, Anton, 40
Marantz, Alec, 167
Martin, Andrea E., 126
Martin, Hannah, 51
Marton, Klara, 138
Marvin, Rebecca, 193
Matějka, Štěpán, 162
Maxfield, Nathan, 191
McDermott, Kerry, 104
McRae, Ken, 239
Medina-Fetterman, Ana, 202
Mencl, Einar, 135
Mertzen, Daniela, 39
Michniewicz, Sonia, 131
Milin, Petar, 97, 215
Miller, Chelsea, 142
Molinaro, Nicola, 228
Momma, Shota, 49, 125, 207
Montag, Jessica, 201
Montero-Melis, Guillermo, 107
Morand, Marie-Anne, 200
Morgan, Emily, 89, 120
Moro, Andrea, 152
Moscati, Vincenzo, 153
Moulton, Keir, 231
Myers, Emily, 139
Myslín, Mark, 56, 89

N
Nakatani, Kentaro, 145
Nam, Yunju, 192
Namboodiripad, Savithry, 243
Nappa, Rebecca, 36
Niemi, Laura, 37
Nelson, Sarah, 86
Neophytou, Kyriaki, 167
Ng, Shukhan, 237
Ngo, Binh, 181
Nouwen, Rick, 176
Novick, Jared, 85, 108, 236

O
Okazaki, Shuntaro, 159
Omaki, Akira, 72, 137
Ono, Hajime, 67
Ortega-Llebaria, Marta, 168
Ovans, Zoe, 137

P
Paape, Dario, 186
Pancheva, Roumyana, 58
Paolazzi, Caterina Laura, 178

Papafragou, Anna, 117
Parker, Dan, 69, 163, 188
Pasquereau, Jérémy, 122
Paul, Jing Z., 149
Paul, Pooja, 211
Payne, Brennan R., 237
Pelzl, Eric, 235
Peperkamp, Sharon, 34
Perrotti, Lauren, 171
Peters, Ryan, 239
Petrone, Caterina, 240
Phillips, Colin, 49, 125, 207
Pickering, Martin, 200, 223
Piñango, María, 121
Pinto, Manuela, 38
Pizarro-Guevara, Jed, 230
Poeppel, David, 167
Politzer-Ahles, Stephen, 101
Poppels, Till, 196
Pozniak, Céline, 119, 150
Pozzan, Lucia, 225
Prystauka, Yanina, 247
Pylkkänen, Liina, 52, 82, 156

Q

Qi, Zhenghan, 93

R

Radulescu, Silvia, 43
Ramscar, Michael, 97, 215
Rehrig, Gwendolyn, 164
Resnik, Philip, 210
Rett, Jessica, 131
Reyes, Amalia, 155
Ricci, Irene, 152
Rochon, Elizabeth, 83
Rodd, Rosanna, 114
Rodina, Yulia, 64
Rodrigues, Agatha, 141
Roland, Douglas, 159
Roman, Patricia, 106
Rommers, Joost, 109
Romoli, Jacopo, 184
Rossi, Eleonora, 247
Rothman, Jason, 151
Runner, Jeffrey, 134, 194
Ryskin, Rachel, 57, 93

S

Sadato, Norihiro, 159
Salomon, Meghan, 219
Safavi, Molood Sadat, 98
Sakai, Hiromu, 49
Sánchez-Alonso, Sara, 121
Santi, Andrea, 178
Saryazdi, Raheleh, 141
Schimke, Sarah, 87
Schuler, William, 76, 128
Sekerina, Irina, 64
Sekicki, Mirjana, 147
Shain, Cory, 128
Shankweiler, Donald, 135
Shantz, Kailen, 155
Shetreet, Einat, 184
Shin, Gyu-ho, 216
Shoji, Shinichi, 246
Shvartsman, Michael, 188
Sikos, Les, 51, 206
Slevc, L. Robert, 125, 207, 209
Slioussar, Natalia, 40
Sloggett, Shayne, 166
Smith, Cybelle, 234
Smith, Garrett, 77
Smolensky, Paul, 68
Snedeker, Jesse, 172, 211, 233
Solivan, Javier, 106
Speer, Shari, 84
Stagge, Faith, 84
Staub, Adrian, 59, 153
Staudte, Maria, 147
Stiller, Alex, 105
Stine-Morrow, Elizabeth A.L., 237
Strangmann, Iris, 36
Stromswold, Karin, 164
Sturt, Patrick, 115, 126, 229
Stutter, Anna, 96
Su, Yi-ching, 116
Sumiya, Motofumi, 159
Swaab, Tamara, 50, 146, 220
Swets, Benjamin, 240
Symeonidou, Irene, 113

T

Tabor, Whitney, 77, 135
Tamminga, Meredith, 136, 143
Tanenhaus, Michael K., 99, 112
Tanner, Darren, 103, 154, 155
Terry, J. Michael, 226
Thomas, Ashley, 108
Thomas, Erik, 226
Thompson, Cynthia K., 204
Tollan, Rebecca, 110
Tomaszewicz, Barbara, 58
Townsend, David, 104
Traxler, Matthew, 50, 146, 244
Trueswell, John, 47
Tucker, Daniel, 118
Turco, Giuseppina, 227

V

van Bergen, Geertje, 35
Van Dyke, Julie, 135, 138, 188, 218
van Hell, Janet, 103
van Heugten, Marieke, 34
Van Horne, Amanda Owen, 212
van Schijndel, Marten, 76, 83, 128, 199
Villata, Sandra, 60
von Heusinger, Klaus, 111
Valdés Kroff, Jorge, 106, 189
Vasishth, Shravan, 39, 74, 98, 179, 186
Vasquez, Natasha, 202
Vespignani, Francesco, 208
Virfel, Ekaterina, 79
Vorwerg, Constanze, 200, 223

W

Wagers, Matt, 142, 230
Wagner, Laura, 84
Waide, Maya, 106
Ward, Gregory, 219
Warnke, Lena, 167
Wartenburger, Isabell, 242
Watson, Duane, 224
Weatherholtz, Kodi, 33, 185
Westergaard, Marit, 64
White, Aaron Steven, 210
Wiese, Heiki, 242
Wijnen, Frank, 43
Wilder, Robert, 190
Wittenberg, Eva, 133
Wu, Zhaohong,168

X

Xiang, Ming, 90
Xie, Xin, 139
Xu, Yuhang, 194

Y

Yang, Chin-Lung, 197
Yoo, Duck Geun, 192
Yoon, Si On, 217
Yoshida, Masaya, 67, 73, 88, 232
Young, Liane, 37
Yun, Hongoak, 192
Yurchenko, Anna, 79

Z

Zhan, Meilin, 81
Zhang, Aili, 63
Zheng, Xiaobei, 113
Zhou, Yangzi, 114
Zerkle, Sandra, 102
Ziegler, Jayden, 233
Zuckerman, Shalom, 38