

Prosody leaks into the memories of words: Evidence from 1,655 speakers and an account in dynamic field theory

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While the precise extent to which phrasal phonology interacts with word-level phonology is a long-standing issue, it is generally assumed that lexical phonology is at least somewhat independent of phrasal phonology, including intonation. Exemplar theory complicates this division, as phonetically detailed exemplars encode context-dependent prosody in the lexical representation (Pierrehumbert 2016). In line with this prediction, some evidence for the lexical encoding of intonation has been found in German and English, languages in which pitch accents are assigned at the phrasal level (Schweitzer et al. 2015). Schweitzer et al. showed that f_0 contours are more stable in predictable collocations than in unpredictable collocations, suggesting a possible lexicalization of intonation. Recent studies have provided evidence that lexical items come to take on the phonetic characteristics of the prosodic environments in which they are typically produced (e.g., Seyfarth 2014; Sóskuthy & Hay 2017). For example, words that tend to occur in positions of prosodic prominence are produced with longer duration, even in prosodically weak environments.

In this talk, I will report on two recent studies which examined spoken data from 1,655 speakers and simulated how prosodic prominence can shape long-term representations over time. The first study, reported in Tang & Shaw (2021), provides evidence that prosodic prominence can be lexicalised in a typologically different language from English. The results show that intonational context leaves a “prosodic residue” in the lexicon of Mandarin Chinese. Even after controlling for numerous factors, including word frequency and local predictability, our proxy for focus likelihood (informativity) explained significant variation in pitch, duration and intensity across words of Mandarin Chinese. This result suggests that prosodic prominence “leaks” into the lexicon. Accounting for this observation requires phonetically detailed lexical representations alongside grammatical mechanisms for abstracting phonological generalizations at the lexical and phrasal levels. The second study develops a computational model of the leaky prosody facts (Shaw & Tang 2022). Simulations illustrate how changes in long-term lexical representations can emerge under the influence of prosody. We formulate the model at the level of neural dynamics using the framework of Dynamic Field Theory (Schöner & Spencer 2016). DFT has shown success in modelling perception and production as time varying processes, c.f. purely statistical agent-based models (c.f., Harrington & Schiel 2017). Simulation experiments successfully derive the observation that prosodic prominence can shape the long-term representation of words from simple assumptions – i) production inputs come from surface distributions, ii) the lexical, prosodic and phonological inputs can jointly influence the speech target, iii) a flat architecture without the need of modular transformations. Crucially, while the model exhibited a great degree of trial-by-trial variability, small lexical differentiation emerges over time from learning.

Key references: Tang, K., & Shaw, J. A. (2021). Prosody leaks into the memories of words. *Cognition*, 210, 104601. DOI <https://doi.org/10.1016/j.cognition.2021.104601>
Shaw, J. & K. Tang. (2022). A dynamic neural field model of leaky prosody: proof of concept. 2022 Annual Meeting on Phonology, University of California, Los Angeles, USA. URL <https://osf.io/7zbnf/>