Seeds of change? Adaptation during language processing and production

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> *All is in flux, nothing stays still.*
> [Heraclitus, as quoted by Plato in Cratylus 402a]

Language exhibits large amounts of variability. The linguistic realization of the same meaning varies across languages, across speakers within a language, and within speakers of a language across time. This variability is central to many branches of the linguistic sciences—albeit at very different time scales (e.g., typology, historical linguistics, sociolinguistics, and psycholinguistics).

In this talk, I aim to illustrate some of the far-reaching consequences and functions of variability during language processing and production, i.e., at the scale of milliseconds. I present studies from my lab that highlight how listeners and speakers navigate this variability, by adapting their interpretations and productions. Critical to understanding how this is achieved, I argue, is the notion of inference under uncertainty. Listeners need to infer linguistic categories (phonemes, words, syntactic structures) incrementally from noisy and ambiguous input. Key to this are generative models of the input, i.e. processes that create probabilistic mappings from categories to input. However, talkers differ in how they map linguistic categories onto the speech signal. Listeners thus *also* need to infer which generative model to use to interpret the input at any given moment.

In the first part of the talk, I show how listeners seem to overcome this challenge by adapting to changes in the statistics of the input, exhibiting remarkable flexibility (although within bounds defined by their prior language experience). Time permitting I present both studies on adaptation to changes in the statistics of known categories and studies on the acquisition of novel (dialectal) categories. In the second half of the talk, I focus on language production and how speakers contribute to robust communication. I show that speakers seem to conduct inferences about the communicative consequences of their articulations, and that they adapt their productions based on causal inferences about the perceived communicative success of previous productions.

Understanding these adaptive processes in both comprehension and production can shed light on how variability in the input can spread across speakers and language communities.

Selected relevant readings from my lab

Buz, E., Tanenhaus, M. K., and Jaeger, T. F. 2016. Dynamically adapted context-specific hyper-articulation: Feedback from interlocutors affects speakers' subsequent pronunciations. *Journal of Memory and Language 89*, 68-86. [10.1016/j.jml.2015.12.009]

Kleinschmidt, D. and Jaeger, T. F. 2015. Robust speech perception: Recognizing the familiar, generalizing to the similar, and adapting to the novel. *Psychological Review 122(2)*, 148-203. [10.1037/a0038695]

Qian, T., Jaeger, T. F., and Aslin, R. 2016. Incremental implicit learning of bundles of statistical patterns. *Cognition 157,* 156-173. [10.1016/j.cognition.2016.09.002]

Weatherholtz, K., Campell-Kibler, K., and Jaeger, T. F. 2014. Socially-mediated syntactic Alignment. *Language Variation and Change 26(3)*, 387-420.