## Conceptual foundations for modeling the evolution of vowel systems in phylogeny, ontogeny, and language speciation

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Understanding the evolution of vowel systems in phylogeny, ontogeny, and language speciation is essential for understanding the capacity for phonological abstraction and the role that the phonological grammar plays in the emergence and dissolution of word forms in the lexicons of languages over the course of human history as well as in the lexicons of individuals over the lifespan. Given the scope and complexity of the phenomena, modeling is crucial to sharpening our understanding, and it is critical to move beyond models that are based on simplifying assumptions that run contrary to important observable behavior. For example, Labov's "incrementation model" of sound change assumes that vocal tract size and shape effects are "eliminated" by an automatic "normalization" process that is distinct from the perceptual processing of socially conditioned variation in vowel quality. In this presentation, we argue that body size types, age, gender, and so on are socially interpreted categories and that learning the culture-specific social interpretations of categories that are based on natural variation in vocal tract size and shape plays a crucial role in the emergence of vowel systems during early infancy. That is, we propose a conceptual framework for modeling the evolution of vowel systems based on the following guiding proposition: during ontogeny, vowel systems emerge as a set of culture-specific mappings that infants use to relate sensory space representations of vocalizations from different talkers with affective and affiliative information. Moreover, these mappings facilitate the emergence of sound categories, which in turn act as the building blocks of an emerging lexicon. In this light, the affiliative aspects of the evolution of vowel systems in ontogeny are central to understanding the evolution of vowel systems in phylogeny and language speciation.