

# The shape of vocal communication

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## **Abstract:**

Vocal communication is the adaptive coordination of the vocal apparatus, muscles, the nervous system, and social interaction. Therefore, understanding how vocal behavior changes across development and social context requires a system-level understanding of the interaction between all the elements of the vocal system. Yet, there is no theoretical framework in which to understand how the components of vocal systems come to assemble themselves during development. In this talk, I will introduce three system-level models that are helping us to understand the vocal communication process. I will use developmental, behavioral and neural data from marmoset monkeys to illustrate the validity of our models. Firstly, I will explain how marmosets vocally interact with each other using turn-taking. I will show that marmoset vocal turn-taking follows a coupled oscillator dynamics that can be modeled by a stochastic differential equation. The equations simulate the activity of different brain areas. Changes in the strength of the interaction between these brain areas explain the developmental changes in marmoset turn-taking. Secondly, I will discuss how we can incorporate changes in vocal apparatus, muscles, the nervous system, and social interaction in a single framework using a quantitative version of the Waddington's landscape. Finally, I will show that we can make precise predictions of the vocal development trajectories by understanding the biological constraints of the developmental landscape.