NSF Award in Social, Behavioral and Economic Sciences

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- Project: CAREER: Integrating Grammatical and Psycholinguistic Approaches to Phonological Processes in Speech Production
- Start Date: September 1, 2009
- Total Award Amount: $429,999

How the results of this project will benefit society:
This project integrates the perspective of two research traditions (formal linguistics and psycholinguistics) to build a stronger theoretical framework for understanding how we produce speech. The framework will be used to model two distinct types of experimental data. Analysis of patterns of speech errors within this new framework can serve as the basis for future research into speech production disorders, for example, those of stroke victims. Additional studies will also use this general framework to help understand how bilingual speakers manage multiple sound systems during speech production. Such research is a critical part of understanding human language in an increasingly multilingual, interconnected world.

To make the framework maximally accessible to the research community, a set of flexible, user-friendly, open-source applications will be made publicly available over the internet. These applications will include a set of laboratory assignments to help educators bring these tools into the classroom.

The problem the project is trying to solve:
Formal linguistic research in the domain of phonology has constructed rich mathematical theories to precisely characterize the systematic patterns of sounds observed in human languages. However, such theories have largely ignored how humans process sounds in real time. For example, when a speaker decides to produce a particular sequence of sounds, how does he plan out the sequence of movements of his lips and tongue to produce the appropriate sounds? These questions have been the focus of research in psycholinguistics, where detailed experimentation has led to sophisticated, but largely qualitative, theories of human sound processing.

How this project will work:
To bring together these two traditions, the project will develop a new theoretical framework, Gradient Harmonic Grammar. This builds on the recently-developed Harmonic Grammar, which is a numerical, constraint-based theory of sound structure. The project will extend this theory by incorporating gradience—non-categorical variation in representational and processing mechanisms—which is a central concept in psycholinguistics. Gradient Harmonic Grammar will be tested via a set of quantitative models that examine experimental data from careful, error-free speech and speech containing mispronunciations. The framework and computational tools will then be extended to model the gradient interaction of multiple sound systems in bilingual speakers.

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