HARVARD UNIVERSITY
Division of Medical Sciences
at Harvard Medical School

Administrative Offices

260 Longwood Avenue
Boston, MA 02115

(617) 432-0162
FAX: (617) 432-2644

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FINAL PH.D. EXAMINATION

Kevin Jing Poh Woods

Speech and Hearing Bioscience and Technology

DISSERTATION TITLE: New roles for attention and memory in the cocktail party problem

SEMINAR: Thursday, December 14, 2017, 10 AM
Massachusetts Institute of Technology
Department of Brain and Cognitive Sciences
Room 46-3189
43 Vassar Street
Cambridge MA 02139

EXAMINATION: Thursday, December 14, 2017, 11 AM
Massachusetts Institute of Technology
Department of Brain and Cognitive Sciences
Room 46-3189
43 Vassar Street
Cambridge MA 02139

EXAMINERS: Dr. Barbara Shinn-Cunningham
Dr. Lorella Battelli
Dr. Aniruddh Patel, Tufts University

CHAIRPERSON: Dr. Satrajit Ghosh

ADVISOR: Dr. Josh McDermott
New roles for attention and memory in the cocktail party problem

A dissertation presented

by

Kevin Jing Poh Woods

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New roles for attention and memory in the cocktail party problem

Abstract

Listening to one sound source among many (‘the cocktail party problem’) is particularly difficult when competing sources are similar and change over time. Such sources may not have consistent features (e.g., high vs. low pitch) that easily distinguish them and promote separation, but attention and memory may help. This thesis demonstrates novel behavioral phenomena reflecting mechanisms of dynamic attention and rapid memory formation that can aid scene analysis under these challenging conditions.

A first set of experiments demonstrates that human listeners can use a moving locus of attention to follow sound sources that change over time, and do not need consistent distinguishing features (e.g., ‘the higher-pitched voice’) to select sources with attention. An experimental paradigm is introduced to study auditory attentive tracking, and is used to reveal some of its characteristics. A second set of experiments demonstrates that human listeners can rapidly learn to use recurring structure for scene analysis. This kind of learning does not require acoustic repetition, and can rely instead on abstract structure (e.g., the ‘shape’ of a source’s trajectory through a feature space). The rapidity of learning made it desirable to run short experiments with large numbers of participants in order to observe learning as it occurred, but since this was impractical in the lab, we developed methods to obtain reliable data via web-based auditory psychophysics. A core component of this was a screening task to ensure that online participants are wearing headphones rather than listening in free field. These new methods and tools were validated with behavioral experiments and have been made publicly available.