

Multimodal Similarity

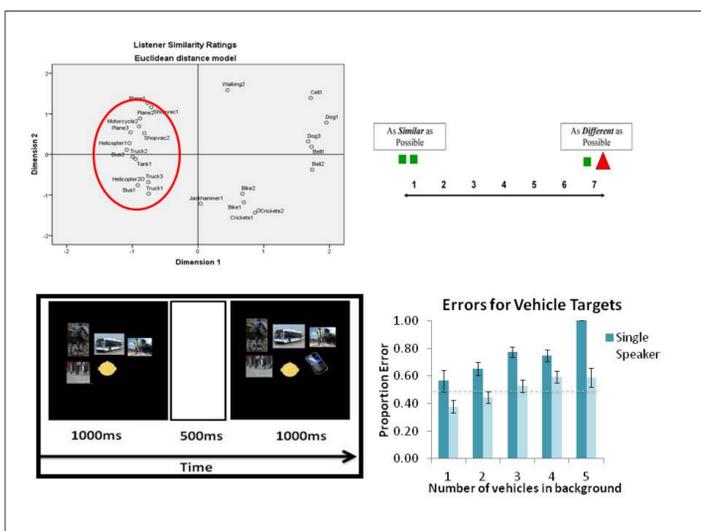


S&T Campaign: Human Sciences
Human-System Integration

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Research Objective

- Discover fundamental principles underlying multimodal perception based on similarity relationships between stimulus features and their environmental context.
- Provides objective framework for understanding perception of complex multimodal events in naturalistic environments



Recent research has demonstrated a direct link between the similarity among complex sources and the likelihood of detection.

Challenges

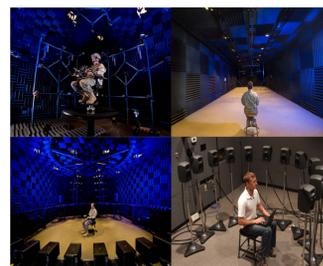
- Adaptation of existing behavioral methods and models for complex and dynamic multimodal events
- Modeling similarity in terms of physical and psychological feature descriptions.
- Extending traditional psychophysical and statistical approaches to characterize, multidimensional perceptual events
- Developing novel statistical approaches to describe changes in perception over time



Bias in audio/tactile localization experiment conducted at ARL while collecting simultaneous EEG.

ARL Facilities and Capabilities Available to Support Collaborative Research

- The Environment for Auditory Research (EAR), located at APG, MD, contains a number of highly reconfigurable indoor and outdoor research spaces, specialized for modeling and simulating complex real-world-relevant environments.



Configurability is ideal for investigation of complex multimodal events including: audition, vision and tactile interactions.

- Unique ARL expertise includes:
 - Modeling and simulation of complex auditory and visual scenes
 - Analysis and modeling of perception for complex events
 - Multimodal transfer of perceptual learning
- Currently developing novel applications of multivariate methods for defining multidimensional similarity.
 - Similarity metrics could enable predictive performance models for detection, identification, or localization.
- Select recent publications:
 - Dickerson, K., & Gaston, J. R. (2014). Did you hear that? The role of stimulus similarity and uncertainty in auditory change deafness. *Frontiers in psychology*, 5.
 - Sherwin, J. & Gaston, J. (2013). Soldiers and marksmen under fire: neural correlates of small arms fire localization. *Frontiers in Human Neuroscience*, 7(67), 1-14
 - Gaston, J.R. & Letowski, T. R. (2012). Listener perception of single-shot small arms fire. *Noise Control Engineering Journal*, 60 (3)
 - Hipp, D., Dickerson, K., Moser, A., & Gerhardstein, P. (2014). Age-related changes in visual contour integration: Implications for physiology from psychophysics. *Developmental Psychobiology*, 56, 1390-1405.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Additional expertise needed for modeling and analysis behaviorally-relevant characteristics of multimodal environments
- Additional expertise needed for model-based simulation of complex, real-world multimodal scenes
- Validated real-world multimodal stimulus sets over short and long time scales
- Flexible, multimodal stimulation capabilities that can be deployed in real-world environments