

# Top-down influences on memory- and response-related activity for sound location.



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# What and where in the human auditory system: not such a new concept!

- Deutsch, D. and Roll, P.L., (1976). Separate "what" and "where" decision mechanisms in processing a dichotic tonal sequence, *J Exp Psychol Hum Percept Perform*, 2, 23-29.



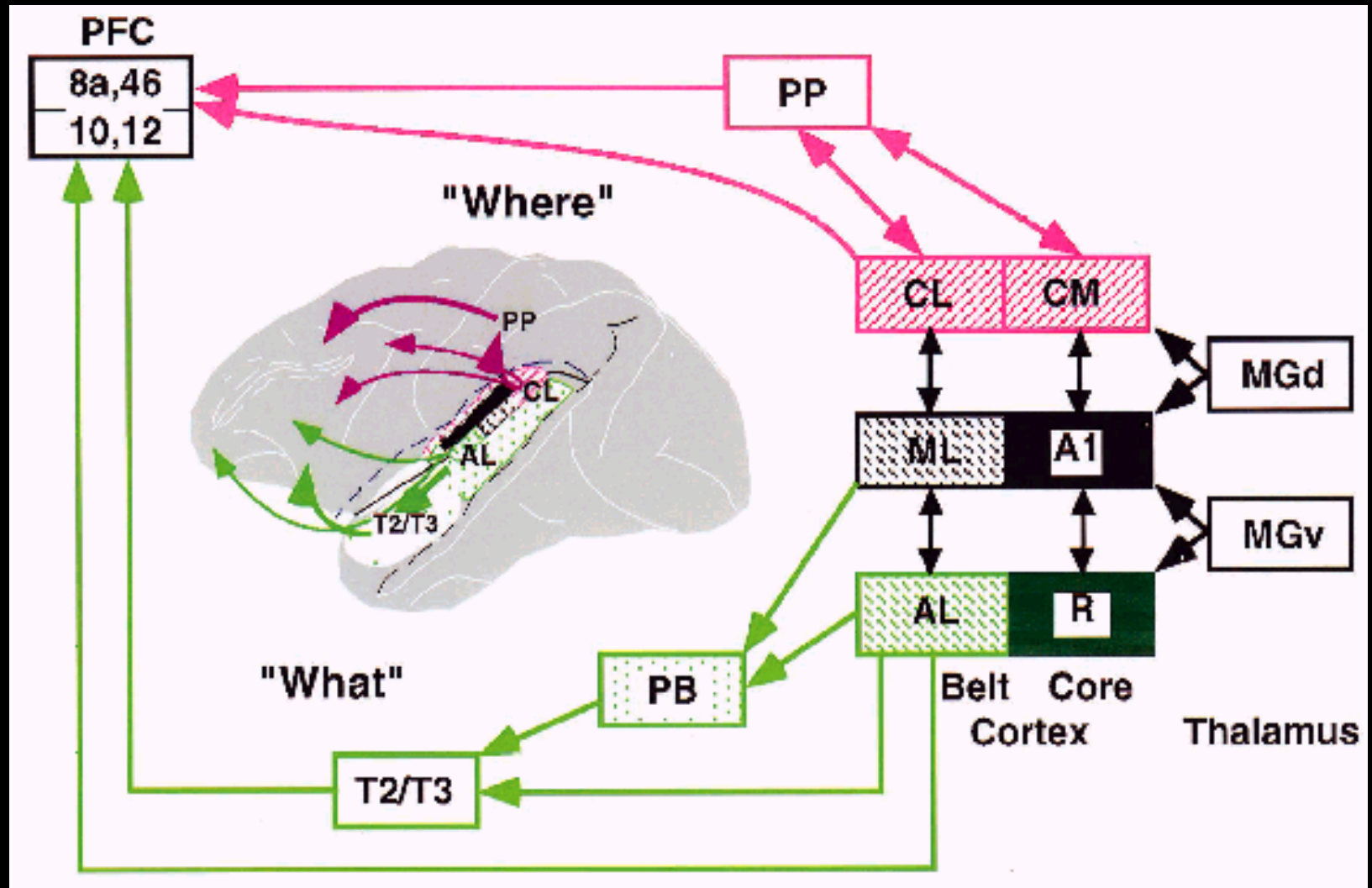
# What and where in the human auditory system: not such a new concept!

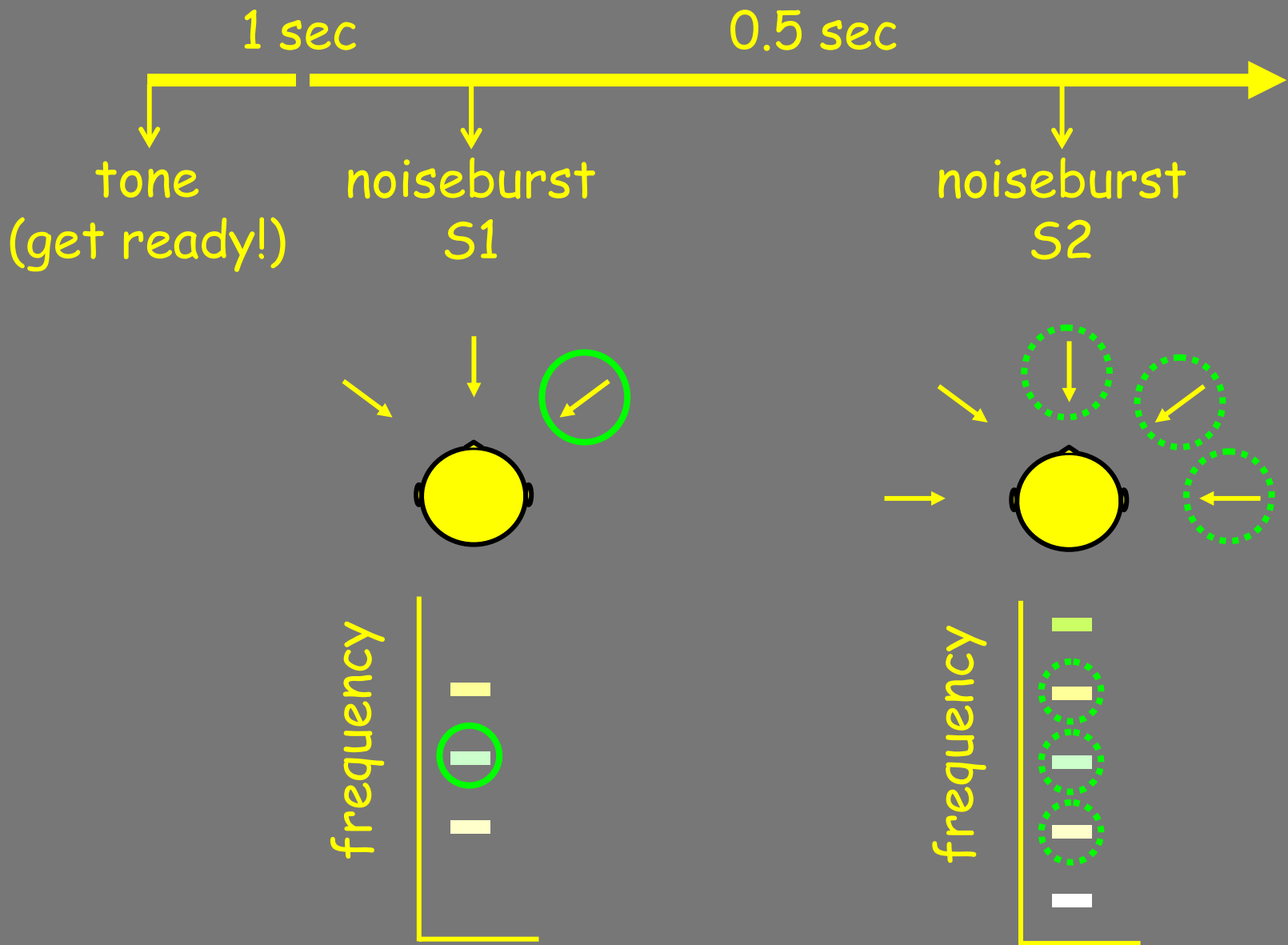
- Bregman, A.S. and Steiger, H., (1980). Auditory streaming and vertical localization: interdependence of "what" and "where" decisions in audition, *Percept Psychophys*, 28, 539-46.

"... Stream organization is implicated in the ability to separately localize concurrent sources of sound. This suggests that "what" and "where" decisions are highly interactive and that neurological evidence suggesting separate pathways for these decisions must be interpreted with caution."

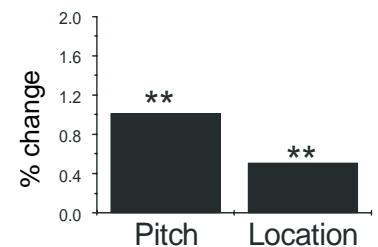
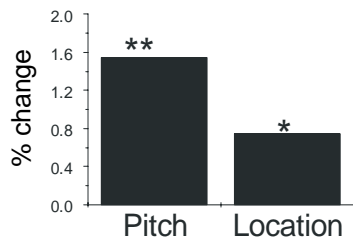
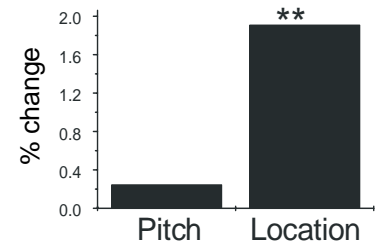
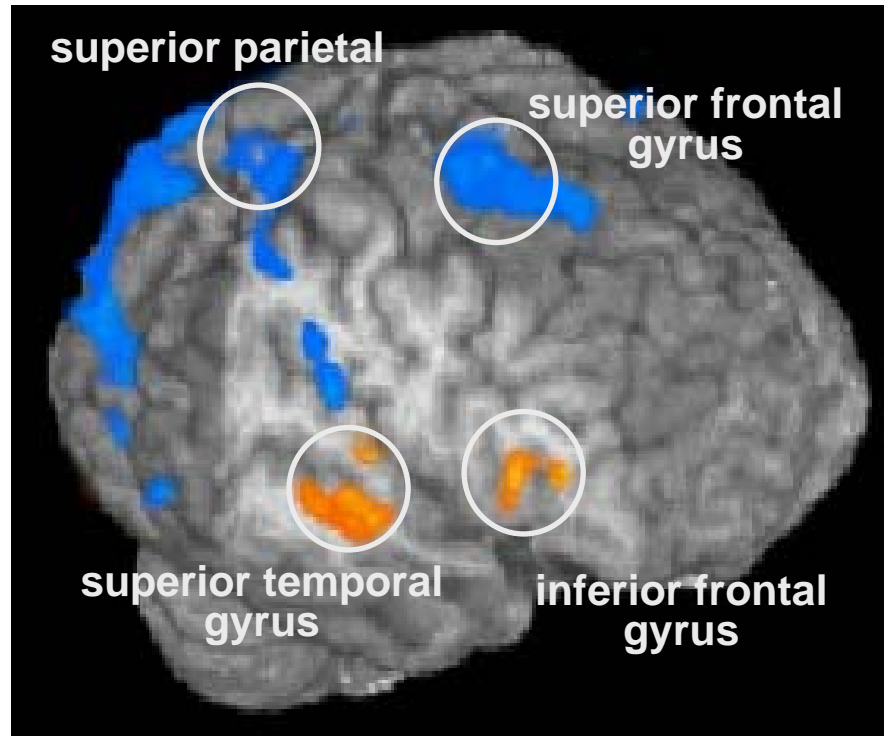
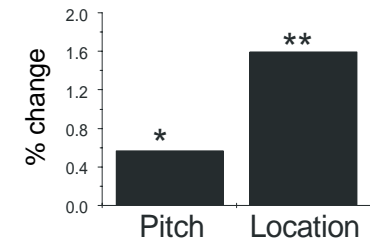


# Division of labor in auditory scene analysis





# 'What', 'where' in the human brain



Location > Pitch  Pitch > Location

# Two functional accounts for the where pathway

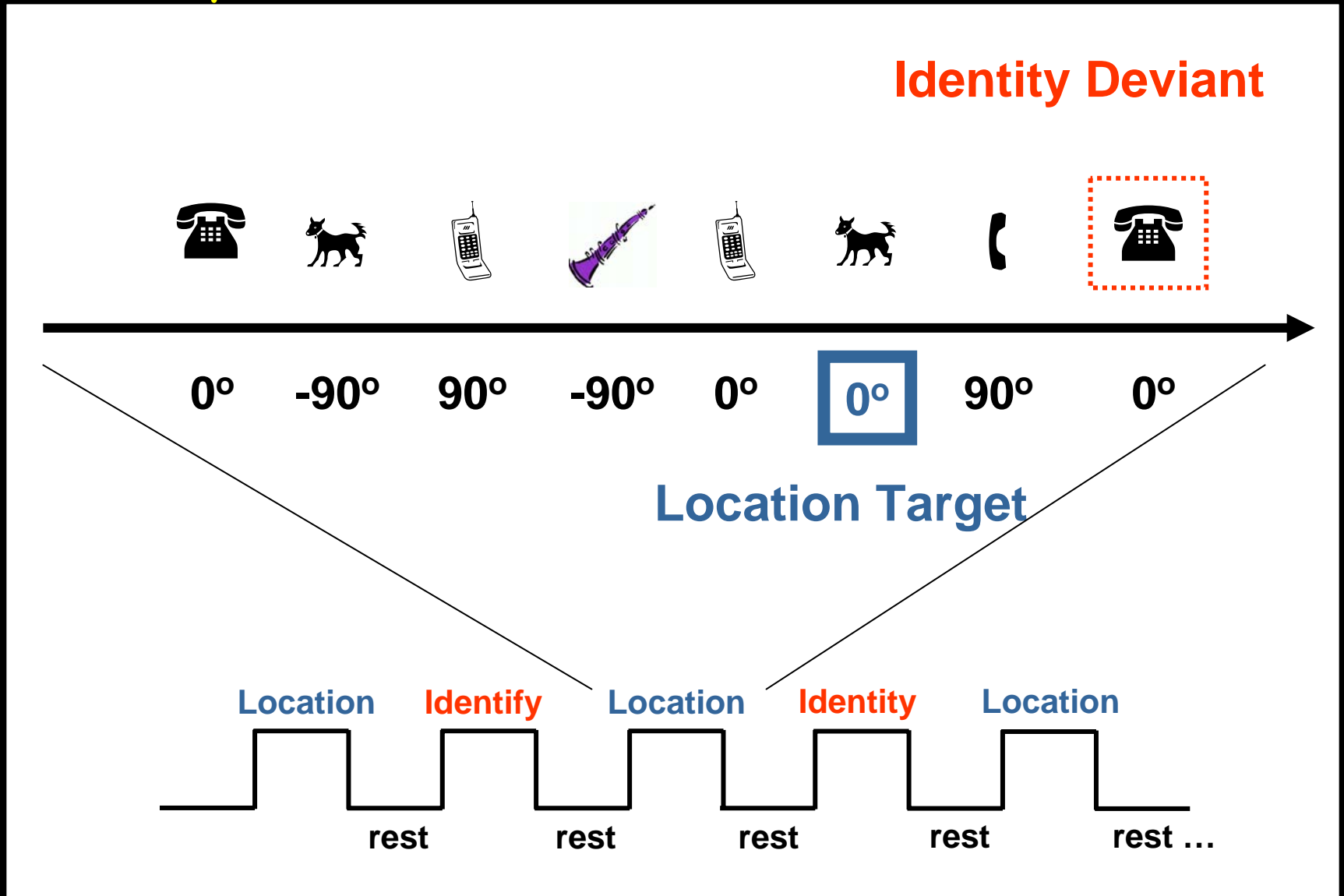
- **Memory account**
  - enhanced activity in parietal cortex indexes processing sound location and working memory for sound location.
- **Sensory-motor account**
  - activation in parietal cortex indexes sensory-motor integration and occurs primarily when judgment about sound location requires a motor response.
  - passive listening (no response required) is usually not sufficient to generate reliable activation in parietal cortex.



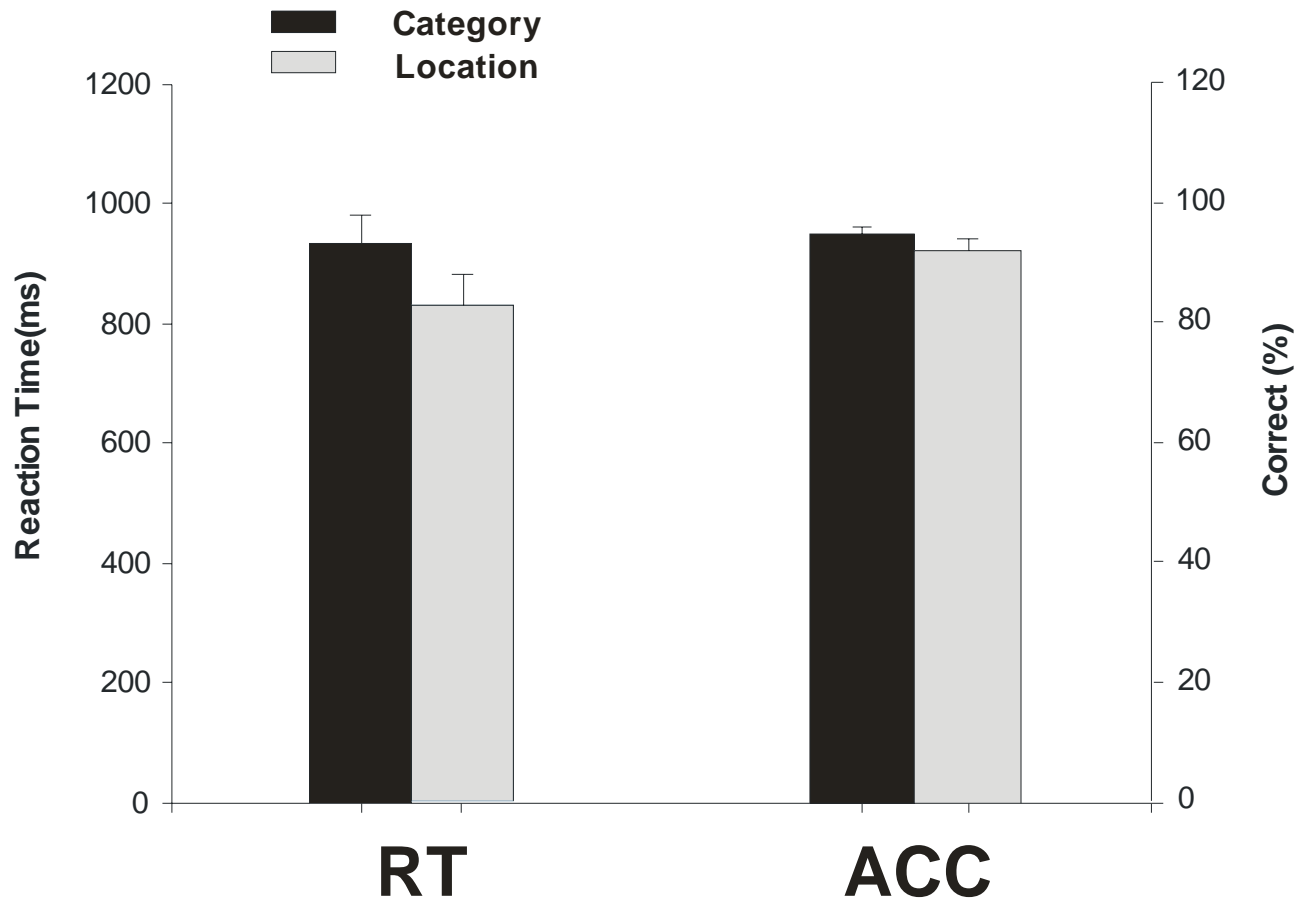
# Testing the sensory motor and memory account of sound location

- Working memory for sound identity and sound location
- Manipulating response mode and working memory load for sound location
- Adaptation for sound location during passive listening (i.e., no response required)

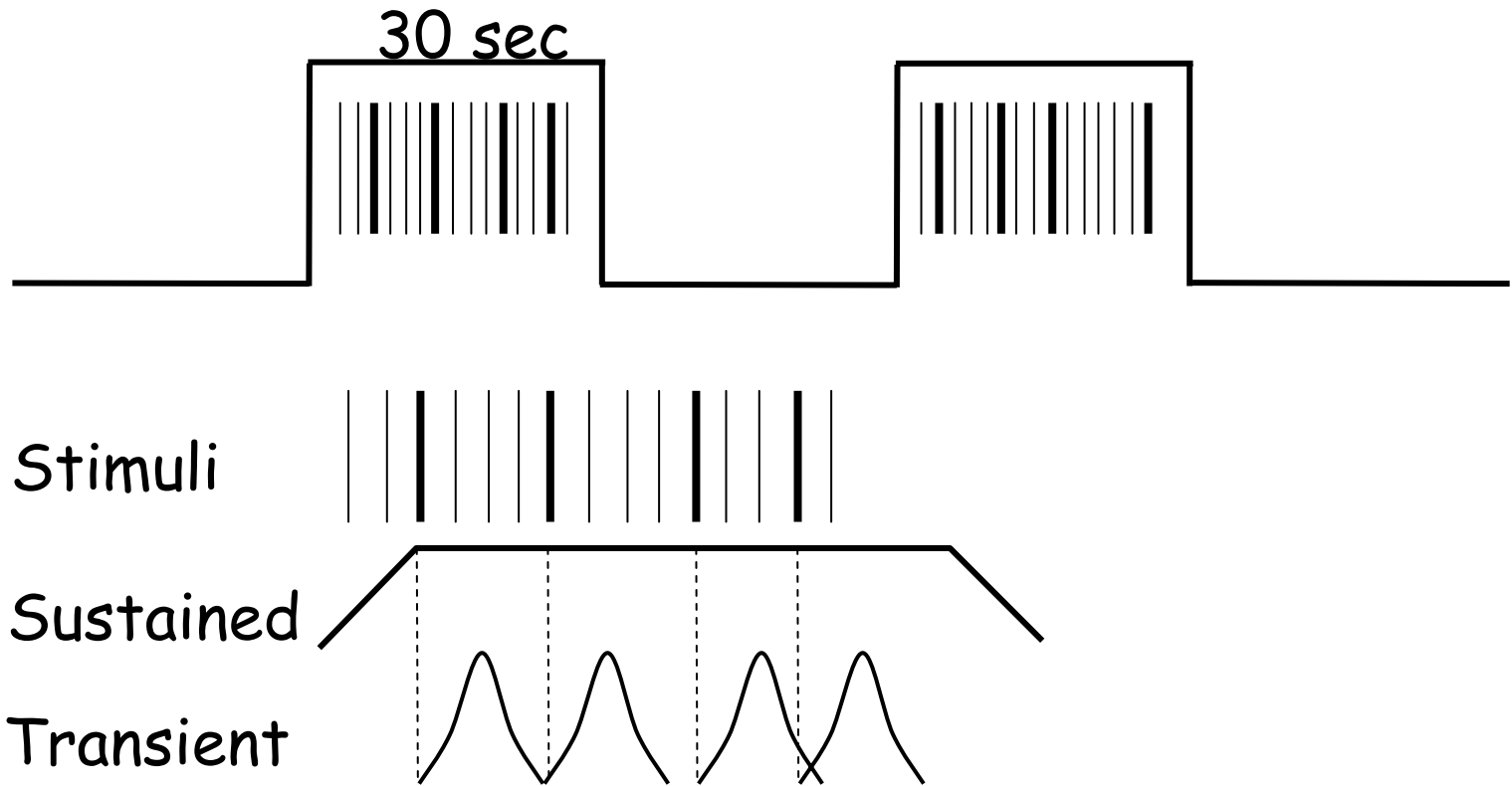
# Mixed block and event-related analysis during an auditory n-back task



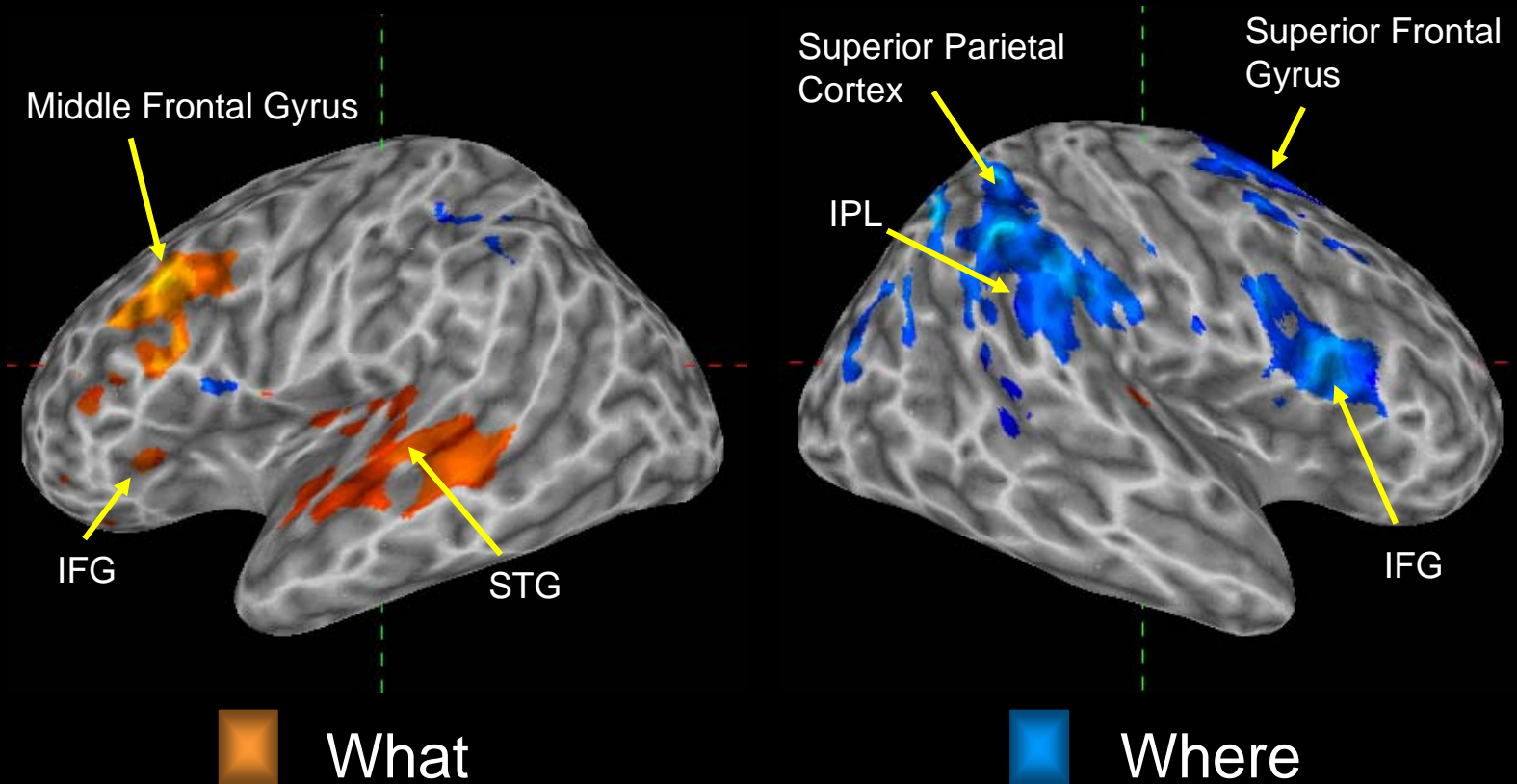
# Behavioral Data



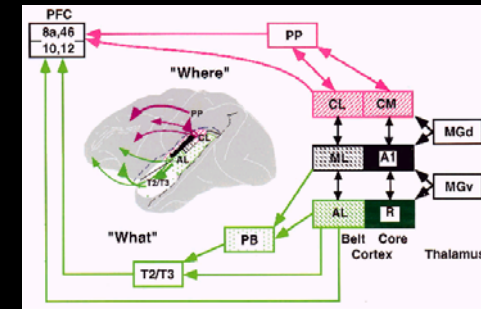
# fMRI Analysis



# What and Where Contrast: Sustained Activity



# In summary



- The ventral and dorsal streams are not unitary phenomena, but rather both involve several nodes that play different roles in sound identification and sound location, respectively.
  - Parietal cortex is involved in monitoring sound location not just target processing and/or goal-directed action.
- The results from this experimental series are consistent with the memory-account and provide little support for the sensory-motor account.

# Acknowledgments

- Stephen Arnott
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