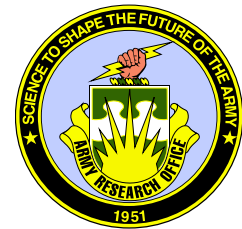




Silent spatialized communication

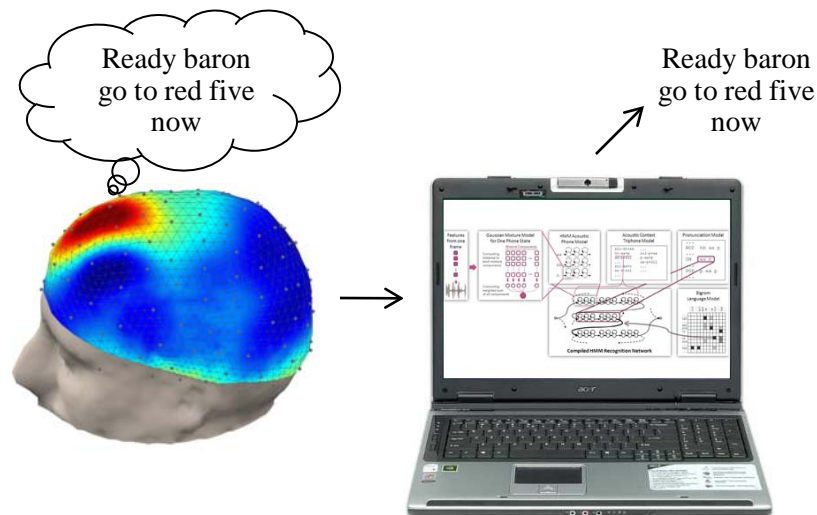
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Objectives

- Use electroencephalographic (EEG) signals to recognize imagined speech and to discern intended direction
- Develop neuroscientific and signal-processing framework for understanding brain function during multi-tasking
- Target system for communicating silently to an intended recipient or target



Objective Approach

- EEG signal classification experiments provide filters which help one recognize imagined speech and intended direction
- Feedback experiments use the filters to train the thinker and improve filtering
- Filter outputs provide real-time input to automatic recognition systems
- Work with MRI and MEG strengthens neuroscientific framework

Status

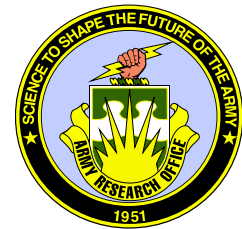
- EEG classification experiments on imagined speech production show that one can extract linguistic information from single trials
- Classification work on intended direction shows single-trial left/right discrimination
- Experiments with magnetoencephalography (MEG) show it can discern real and imagined movement signals



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- **Progress on this year's objectives**

- Year one milestones (June 30, 2009) are classifying small sets of imagined words using EEG and discerning attended direction in 360° ; subject turns on intended loudspeaker using EEG.
- Progress on imagined speech includes offline classification of syllables and speech rhythm in single trials using EEG. Current work uses sentences with a small set of systematically-varied words.
- Progress on intended direction includes offline classification of left/right directions in single trials using EEG. Current experiments extend the result to the forward/back dimension.
- Progress with MEG includes classification of intended movement.

- **Research plan for the next 12 months**

- Install dedicated high-density EEG systems for classification and real-time feedback experiments concerning imagined speech and intended direction, respectively.
- Show feasibility of real-time processing of EEG for discerning imagined speech, intended direction.
- Perform MEG and MRI studies of imagined speech.
- Extend experimental paradigms to virtual environment and telepresence applications.

- **Long term objectives (demonstrations)**

- Develop neuroscientific and signal-processing foundations for understanding imagined speech production and direction intention and, more generally, brain activity during multi-tasking
- Develop EEG brain-computer interface (BCI) sensitive to imagined speech and intended direction
- Develop virtual environment and telepresence applications for the EEG BCI