Speech in the mirror? Neurobiological correlates of self speech perception
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Self-awareness and self-recognition during action observation may partly result from a functional matching between action and perception systems. This perception-action interaction is thought to enhance the integration between sensory inputs and our own sensory-motor knowledge.

We present a combined EEG and fMRI study that examines the impact of self-knowledge on multisensory integration mechanisms during auditory, visual and audio-visual speech perception. Our working hypothesis was that hearing and/or viewing oneself talk might facilitate the bimodal integration process and activate sensory-motor plans to a greater degree than does observing others.

**METHODS**

- **Subjects:**
  - CEU: 18 healthy adults, right-handed native French speakers.
  - FMR: 12 healthy adults, right-handed native French speakers.

- **Task:**
  - Three-alternative forced-choice identification task, with participants instructed to categorize each perceived syllable with their left thumb, after an audio “beep”.
  - Data acquisition: EEG data were continuously recorded from 64 scalp electrodes (international 10–20 system) using the Biosemi EEG system operating at a sampling rate of 256 Hz. External reference electrodes were at the top of the head. The electrooculograms controlling for horizontal (HEOG) and vertical (VEOG) eye movements were recorded using electrodes at the outer canthi of each eye as well as above and below the right eye.

- **Data pre-processing:**
  - (1) Re-referenced offline to the nose;
  - (2) Filtering: 2–30 Hz;
  - (3) Epoching: 100 ms (baseline from 0–50 ms) to the acoustic syllable onset;
  - (4) Artifact rejection: 50 μV

- **Data analysis:**
  - Speaker's effect:
    - Auditory modality (Self, Other)
    - Visual modality (Self, Other),
    - Audio-visual modality (Self, Other, None)

  - Auditory-visual integration:
    - 1st level: Signal type (Bimodal/Sum), Auditory modality (Self, Other), Visual modality (Self, Other)

  - EEG

- **fMRI**

- **Integration (AV ↔ AV)**

  - P2 amplitude : AV ↔ AV (p < .02) => integration

- **Self effect on integration**

  - => Visual-Self: reduced N1 latency (p < .02)

**RESULTS – MODALITY**

- **Modality results:**
  - **Auditory regions:** stronger activity for the auditory condition than the visual only condition
  - **Visual regions:** stronger activity for the visual condition than for the auditory only condition
  - **Greater Activity of the dorsal part of the premotor cortex for visual stimulation (no activation for the auditory only condition)**

- **Self effect:**
  - Stronger activity of the cerebellum, the parahippocampal gyrus and the left inferior frontal gyrus (pars opercularis)
  - Small effect but well test more subjects

1. **In line with previous studies on multimodal speech perception => integration mechanisms of auditory and visual speech signals.**
2. **A visual processing advantage when the perceptual situation involves our own speech production.**
3. **Global coherent activations of the single effects during auditory, visual and audio-visual speech perception.**
4. **These regions are generally responsible for predicting sensory outcomes of action generation.**

Altogether, these results suggest that viewing our own utterances leads to a temporal facilitation of auditory and visual speech integration and processing afferent and efferent signals in sensory-motor areas gives rise to self-awareness during speech perception.

**PHOTOREFERENCE**

Example of self (left) and other (right) modality for use outside.