To integrate the unknown: touching your lips, hearing your tongue, seeing my voice
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To integrate the unknown:
touching your lips, hearing your tongue, seeing my voice

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Introduction

Seeing the speaker’s articulatory gestures significantly enhances auditory speech perception. A key issue is whether cross-modal speech interactions only depend on well-known auditory and visual modalities or, rather, might also be triggered by other sensory sources less common in speech communication but likely to exist in the listener’s motor knowledge. The present electroencephalographic (EEG) and functional magnetic resonance imaging (fMRI) studies investigate cross-modal interactions between auditory, haptic, visuo-facial and visuo-lingual speech signals during the perception of our own productions or/and those of other speakers.

EEG: early integration and predictability of speech stimuli during audio-visual (AV: familiar modality) and audio-haptic (AH: unfamiliar modality) perception

Hyp: N1/P2 amplitude reduction and latency facilitation for both AV and AH modalities compared to auditory-only speech

Methods: 16 participants
80 trials per modality and per syllable (/pa/, /ta/, /ka/)
3 conditions: Audio (A), Audio-Visual (AV) & Audio-Haptic (AH)
live dyadic interactions

IMRI: neural correlates of audio-visual-lingual (unfamiliar modality) and audio-visuo-facial (familiar modality) speech perception

Hyp: natural temporal relationships of visuo-labial and visuo-lingual signals lead to the integration of auditory and visual speech signals

Method: 12 participants
24 trials per modality (/pa/, /ta/, /ka/syllables)
5 conditions: Audio (A), Visual-lips (VL), Visual-tongue (VT), Audio-visual-lips (AVL) & Audio-visual-tongue (AVT)
passive fMRI session using sparse sampling.

Analysis by modality:
- VL ≠ VT: auditory and visual cortices.
- VT: motor, premotor cortices and parts of the sensorimotor cortex.

Conjunction:
Motor + pSTS/STG are activated for all conditions and both lips and tongue movements.

EEG: mechanisms of early integration during the sight and listening of our own productions or those of somebody else

Hyp: modulation of the amplitude and/or latency of N1/P2 related to a possible self-influence during AV integration process

Method: 17 participants
72 trials per modality and speaker (self, other)
4 conditions (Audio (A), Visual (V), Audio-visual (AV), AV incongruent (AVI)) related to our own speech gestures or those of somebody else.

Altogether our results provide evidence for multisensory interactions between auditory speech signals and their haptic, visuo-facial or visuo-lingual speech correlates. They further emphasize the multimodal nature of speech perception and demonstrate that multisensory speech perception is partly driven by sensory predictability and by the listener’s knowledge of speech production.

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