Temporal and identity prediction in visual-auditory events
van Laarhoven, Thijs; Stekelenburg, J.J.; Vroomen, J.

Document version:
Publisher's PDF, also known as Version of record

Publication date:
2017

Link to publication

Citation for published version (APA):
Temporal and identity prediction in visual-auditory events: Electrophysiological evidence from stimulus omissions

Thijs van Laarhoven, Jeroen Stekelenburg & Jean Vroomen

Introduction

A rare omission of a sound that is predictable by anticipatory visual information or self-generated motion induces an early negative omission response at around 45-100 ms (oN1) and subsequent mid- and late latency omission responses (oN2, oP3) in the EEG during the period of silence where the sound was expected.\(^1\),\(^2\)

It was previously suggested that such omission responses are primarily driven by the identity of the anticipated sound.\(^3\) Here, we examined the role of temporal prediction in the evocation of the auditory oN1, oN2 and oP3.

Methods

Participants
N = 27 (23 female, all neurotypical)
Mean age 19.93 (SD = 2.40)

Stimuli

Hand clap video + sound of a hand clap or 100 different environmental sounds (e.g. a doorbell or a car horn)

Experimental conditions

1. NATURAL timing of hand clap sound
2. RANDOM-TIMING of hand clap sound
   -250 to 320 ms relative to visual onset
3. RANDOM-IDENTITY of 100 different environmental sounds with natural timing

88% regular visual-auditory trials 1232 / condition
12% sound omission (silent) trials 168 / condition \(^3\)

A video of an actor performing a single hand clap (Figure 1) containing reliable anticipatory information about both the identity and onset of the sound served as a reference condition.

In two additional conditions, we varied either the auditory onset (relative to the visual onset) or the identity of the sound across trials in order to hamper temporal and identity predictions.

Regular visual-auditory trials were interspersed with unpredictable sound omissions. Neural activity associated with visual-to-auditory predictions was acquired from these silent trials.

Results

A video of an actor performing a single hand clap (Figure 1) containing reliable anticipatory information about both the identity and onset of the sound served as a reference condition.

In two additional conditions, we varied either the auditory onset (relative to the visual onset) or the identity of the sound across trials in order to hamper temporal and identity predictions.

Regular visual-auditory trials were interspersed with unpredictable sound omissions. Neural activity associated with visual-to-auditory predictions was acquired from these silent trials.

Conclusions

Relative to a natural context with correct auditory timing and identity, the oN1 and subsequent oN2 and oP3 components were abolished when either the timing or the identity of the sound could not be predicted reliably from the video.

This indicates that precise predictions of timing and identity are both essential elements for inducing an oN1, oN2 and oP3.

References


Contact Information

Thijs van Laarhoven
th.vanlaarhoven@tilburguniversity.edu
linkedin.com/in/tvanlaarhoven