Action influence on the audio-visual simultaneity perception

Kishore Kumar Jagini <kishore.jagini@iitgn.ac.in>
Meera M Sunny <m.m.sunny@iitgn.ac.in>
Center for Cognitive & Brain Sciences, Indian Institute of Technology Gandhinagar

Introduction

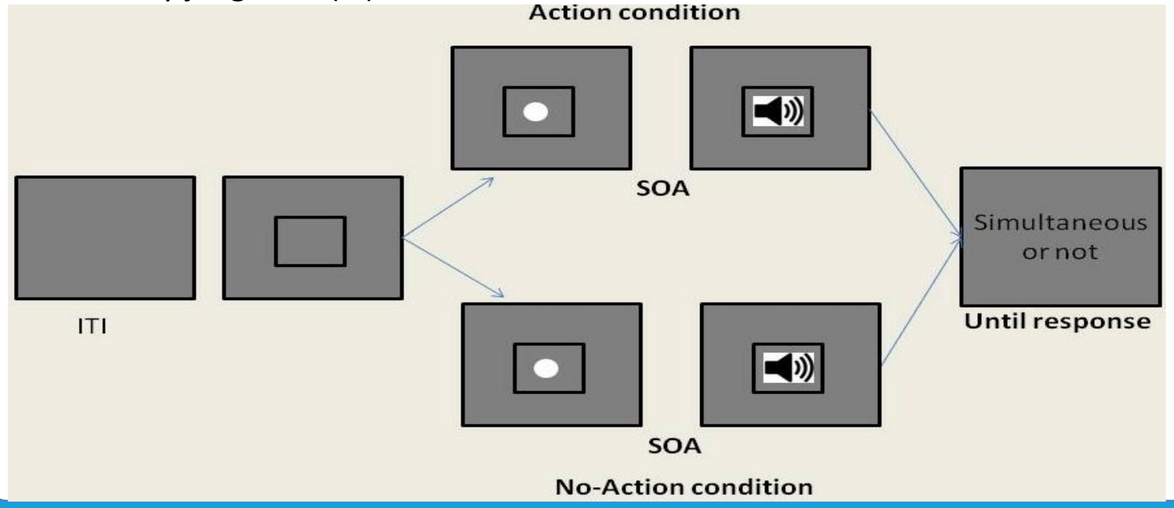
- Despite the fact that our heterogeneous sensory systems differentially process the sensory inputs originating from an event (e.g. , temporal cues processed by vision slower than audition), we perceive the event as simultaneous, most often.
- Our brain achieves this simultaneous perception by having a temporal window within which non-simultaneity is undetected - **"Temporal Binding Window (TBW)"** (Vroomen & Keetles, 2010).
- Our actions can modulate the perception of sensory stimuli. E.g., self-generated auditory stimuli is perceived to be temporally earlier compared with the spontaneously generated stimuli.(Haggard et al., 2002). This is assumed to be due to the pre-activation of cortical areas relevant to the sensory stimuli predicted by action (Waszak et al., 2012). Moreover, this differential temporal processing is dependent on the perceptual reliability of the sensory cue (Wolpe et al., 2013).

How does our action modulate the synchrony perception of multisensory stimuli (i.e. TBW) having relative differences in perceptual reliability?

Methods

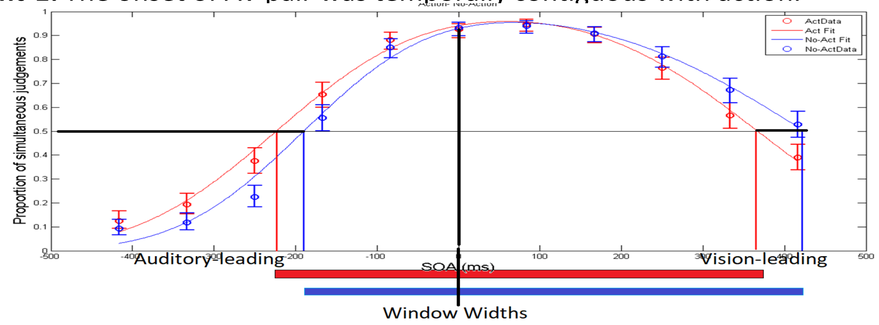
Audio-visual stimuli

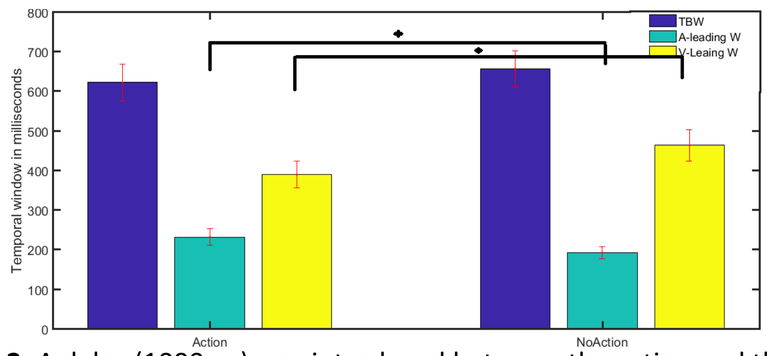
Simultaneity judgment (SJ) task



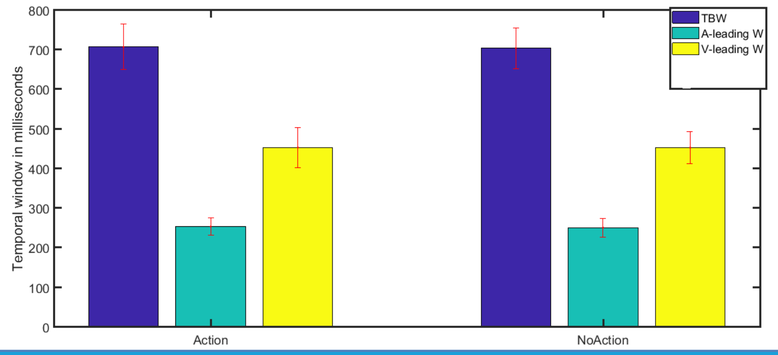
Results

Experiment-1: The onset of AV pair was temporally contiguous with action.





Experiment -2: A delay (1000ms) was introduced between the action and the onset of the AV pair.



Discussion

We found that the time window of auditory-leading trials for action contiguous AV pairs was significantly large compared with the no action condition. In contrast, the reverse pattern was observed for the time window of visual-leading trials

We reasoned that the observed asymmetries could be due to the inherent differences in the perceived reliability of audio-visual cues which resulted in differential perceived temporal shifts towards action. Moreover, this asymmetry might occur only when the relationship between action and AV outcome was time contiguous

References

•Waszak, F., Cardoso-Leite, P., & Hughes, G. (2012). Action effect anticipation: neurophysiological basis and functional consequences. *Neuroscience & Biobehavioral Reviews*, *36*(2), 943-959..

•Wolpe, N., Haggard, P., Siebner, H. R., & Rowe, J. B. (2013). Cue integration and the perception of action in intentional binding. *Experimental brain research*, *229*(3), 467-474.

•Haggard, P., Clark, S., & Kalogeras, J. (2002). Voluntary action and conscious awareness. *Nature neuroscience*, *5*(4), 382-385.