

Space, time and motion in a multisensory world

Monday, September 23, 2024 9:18 AM (18 minutes)

The present doctoral thesis aims at investigating how humans represent space, time, and motion through auditory and visual sensory modalities. It has been demonstrated that hearing prevails in representing the time domain and vision in representing the space domain. Given this strong link between sensory modality and domain of representation, one objective of this thesis is to deepen the knowledge of the neural organization of multisensory spatio-temporal skills in healthy adults. In addition, by using blindness as a model to unravel the role of vision in the development of spatio-temporal abilities, this thesis explores the interaction of space and time in the acoustic motion perception of early blind individuals. This interaction was also investigated by questioning how the brain processes spatio-temporal cues of external events when it comes to manually intercepting moving objects with one hand.

Studies of the present dissertation indicate the following results:

- i) the early cortical modulation of sensory areas depends on the domain of representation to process, with auditory areas mainly involved in the multisensory processing of temporal inputs, and visual areas of spatial inputs; the neural modulation of visual areas for the spatial domain is also influenced by the kind of spatial layout representing multisensory stimuli.
- ii) the lack of visual experience in the first years of life influences the ability to process the speed of moving sounds by altering how blind individuals make use of the sounds' temporal features.
- iii) people manually intercepting a moving object take into consideration the item's spatio-temporal cues, by adjusting their interceptive movements according to the object's speed.

Finally, in light of the above results, this dissertation incorporates the development of a novel portable device, named MultiTab, for the behavioral evaluation of the processing of space, time, and motor responses, through the visual and acoustic sensory modality.

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