37th European Conference on Visual Perception – August,2014 (SRB)

Spatial Limits for Audiovisual Unity Assumption

[1,2,5]Carlos Silva; [2,3,5]Sandra Mouta; [3,4,5]Jorge Santos; [1,2]José Creissac
[1]Departamento de Informática, University of Minho / [2]INESC TEC, Portugal / [3]Centro Algoritmi, Universidade do Minho / [4]Escola de Psicologia, Universidade do Minho/ [5]Centro de Computação Gráfica
carlos.cl.silva@gmail.com

Introduction

The study of multisensory perception has always been concerned with this fundamental question: how do the sense organs cooperate in order to form a coherent depiction of the world? One widely accepted hypothesis is referred to as the *unity assumption* and uses the concept of "amodal properties": properties that are not captured by a specific sensorial organ, such as *temporal coincidence*, *spatial coincidence*, *motion vector coincidence, and causal determination*. This hypothesis states that the more information on amodal properties different signals share, the more likely it is that we perceive them as originating from a common source or object (Welch, 1999). We can think of this as a correspondence problem where causation is inferred from the correlation of different amodal properties – among them the signals spatial correlation.

Temporal coincidence has been the preferable amodal property to manipulate in unity assumption studies (Vatakis and Spence, 2007; Parise, Spence and Ernst, 2012) and the studies that manipulate spatial coincidence often use misaligned stimuli in order to check for crossmodal effects as the ventriloquism effect (Hairston et al., 2003), thus bypassing a more inquisitive look on conditions where different modalities stimuli are co-located. There's still a lack of knowledge in the literature about how and how much spatial coincidence helps in the correct binding of two signals of different modalities.

Experimental Goal

The main goal of this experiment is to accurately define absolute spatial thresholds for a correct unity judgment between an auditory and a visual stimulus. Furthermore, we also want to explore if those limits are dependent or independent from the stimuli distance .

Method

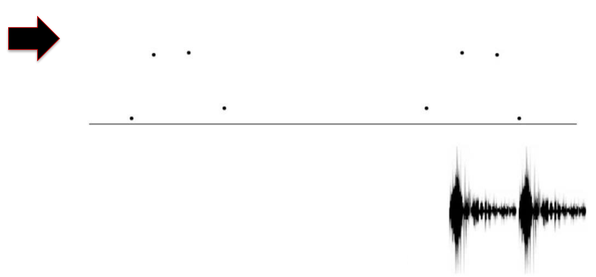
Participants: 3 Participants with normal or corrected vision and normal hearing;

Visual Stimuli: Virtual room with two point-light walkers (PLWs) located in a plane fronto-parallel to the observer. The distance between the PLWs was variable but equally distant from the center of projection. The PLWs were animated with a walking pattern, but with the translational component removed.

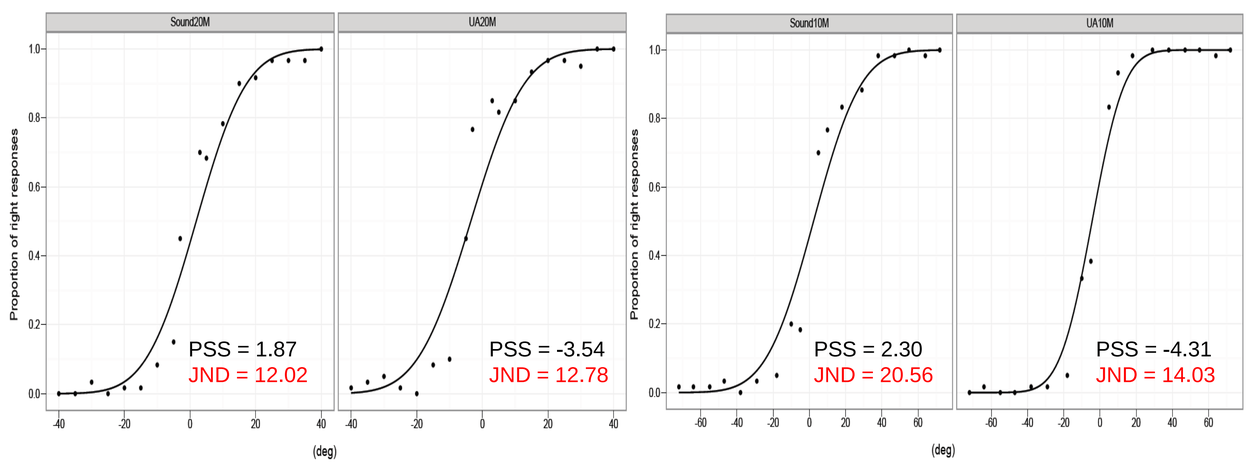
Auditory Stimuli: Auralized step sounds in synchrony and co-located with one of the PLW.

Conditions: 2 conditions regarding the modality (one audiovisual, one auditory); 3 conditions regarding stimuli distance (20 meters; 10 meters; 10 meters with same angular disparity).

Procedure: The participant was seated and aligned with the projections' centre of a 2.80x2.10m projection screen. The participant's head is on a chin-rest in order to prevent lateral movements. In each trial of the audiovisual condition, two PLWs were presented equally distant from the projection's centre but with variable distance between them, and the sound step of only one of the PLWs was presented. Participants were instructed to indicate which PLW (right or left) was emitting the step sounds.



Results



Discussion

- We successfully measure the spatial JNDs for a correct binding of two different modalities signals belonging to the same audiovisual event;
- Lower JNDs for audiovisual presentations (however, see 20m condition), meaning that spatial coincidence between two signals of different modalities helps to the precision on this task;
- The JNDs are lower for audiovisual presentations at closer distances, a result that requires further inquiring.

References

Hairston, W. D., Wallace, M. T., Vaughan, J. W., Stein, B. E., Norris, J. L., & Schirillo, J. A. (2003). Visual localization ability influences cross-modal bias. *Journal of cognitive neuroscience*, *15*(1), 20-29.

Parise, C. V., Spence, C., & Ernst, M. O. (2012). When correlation implies causation in multisensory integration. *Current Biology*, 22(1), 46-49.

Vatakis, A., & Spence, C. (2007). Crossmodal binding: Evaluating the "unity assumption" using audiovisual speech stimuli. *Perception & Psychophysics*,*69*(5), 744-756.

Welch, R. B. (1999). Meaning, attention, and the "unity assumption" in the intersensory bias of spatial and temporal perceptions. *Advances in psychology*,*129*, 371-387.

NORTE-07-0162-FEDER-000076-cave@CCG; EXPL/MHC-PCN/0162/2013, SFRH/BPD/ 63393/2009; FCOMP-01-0124-FEDER-022674; PEst-OE/EEI/UI0319/2014; FCOMP-01-0124-FEDER-037281; PEst-C/EEI/LA0014/2013