An attempt to quantify temporal ventriloquism in audio-visual synchrony perception

Irene A. Kuling*, Rob L. J. van Eijk, James F. Juola, Armin Kohlrausch
Eindhoven University of Technology, Department of Human-Technology Interaction

The integration of visual and auditory inputs in the human brain requires that the components are perceived in temporal proxim-ity. In this research we explored the possibility to quantify the compensation ability of the human brain for temporal discrepan-cies in external stimuli, using a paradigm from rhythm perception.

Results

Unimodal markers & unimodal target

- No temporal bias and a high accuracy in same modality conditions.
- Systematic temporal biases (25-30 ms) in opposite modality conditions.

Audio-visual markers & visual target

The effect of auditory components on the perceived temporal occurrence of visual components is structurally dependent on the SOA in the markers, as is expected within the concept of temporal ventrilo-quism.

Discussion

The adaptive method of rhythm perception seems to be suitable to quantify temporal ventriloquism. Some interesting observations can be made;

- Fitting the data with a simple cubic function gives a reasonable fit.
- Comparing the extreme values of the cubic fit with a synchronous judgment curve of an earlier synchrony judgment experiment with the same stimuli (data reploted from Kuling et al., 2011), an equal asymmetry is found (28% on both sides).

Using an adapted version of the model used by Maij et al. (2009, see formula) results in even better fits. This model combines the influence of the temporal position of the tone on the judged temporal position of the flash with the probability of the flash and tone being considered to arise from the same event. The black curve is obtained, when all four parameters a-d are optimized. For the red curve the probability function (parameters b and c) is derived from the synchrony curves in a SJ3 task with the same stimuli (from Kuling et al., 2011), so that only two parameters a and d are optimized.

\[ y = (a \cdot t + d) \cdot e^{-\frac{(t-b)^2}{2c^2}} \]