Perceived (in)congruency of audiovisual stimuli consisting of Gabor patches and AM- and FM-tones

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Abstract of Dissertation

Until now, numerous studies have used stimuli containing Gabor patches and modulated tones to examine how auditory and visual information is combined and processed. The current study uses such stimuli and investigates the roles of their physical parameters in defining perceived congruency.

In the past, the congruency between a Gabor patch and a tone was often determined by matching the spatial frequency of a patch and a carrier or modulation frequency of a tone. However, it is yet unknown whether this crossmodal correspondence has an effect on (in)congruency in the case of dynamic (flickering or drifting) Gabor patches. Besides, in cases when modulated tones are used (AM or FM), the choice of modulation type often remains unsupported by empirical data, as no comparative studies for AM- and FM-tones in the context of their effect on audiovisual (in)congruency were conducted. Therefore, the objectives of the current study were: (1) to investigate the perceived congruency in relatively long stimuli (2 seconds) consisting of a Gabor patch and a modulated tone; (2) to compare the perceived congruency of such stimuli with an AM-tone and an FM-tone; (3) to investigate the effect of static (spatial frequency of the patch and the carrier frequency of the tone) and dynamic or temporal parameters on perceived congruency to define the most prominent factors for congruency in such stimuli.

The present research examined Gabor patches of various spatial frequencies (2-10 cpd) with flickering or drifting gratings in combinations with AM- or FM-tones of 0.5 - 4 Hz modulation, and 500-, 1000- and 2000-Hz carrier frequencies. Data were collected through experiments in which combinations of a Gabor patch and a tone were rated on a scale from 1 (incongruent) to 7 (congruent). The results showed, first, that stimuli with a flickering Gabor patch and an AM-tone showed significantly higher perceived congruency compared to stimuli with an FM-tone. Besides, the effect was especially strong in stimuli in which the patch-flicker frequency and the tone-modulation frequency were (almost) similar. Second, the dynamic parameters, such as the flickering (temporal) frequency of the patch and the modulation frequency of the tone, played a prominent role in defining perceived congruency, while static parameters had little or no effect. These findings were confirmed for stimuli of different duration (1 - 4 seconds).

The results suggest that the temporal similarity between auditory and visual components plays a prominent role in defining audiovisual (in)congruency. Additionally, the similarity in the dynamics of auditory and visual components can further enhance congruency. The crossmodal matching of the visual component's spatial frequency and the auditory frequencies, on the other hand, has no measurable effect on the (in)congruency of dynamic stimuli.