

## The association between audio-visual spatial integration and hallucinations in Schizophrenia

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It has been suggested that patients with schizophrenia (SZs) show impairment in multisensory integration (De Gelder et al., 2003; Stevenson et al., 2017; Williams et al., 2010). A work in our group examined the audio-visual temporal integration with sound-induced flash illusion and found a lengthened temporal binding window for the bisensory information in SZs (Kim et al., IMRF 2017). The present study investigated the audio-visual spatial integration in schizophrenia by using the ventriloquist illusion paradigm. Ventriloquist illusion indicates biased perception of the spatial position of an auditory stimulus toward the position of a temporally synchronized visual stimulus. A group of 22 SZs and a group of 22 healthy controls performed an auditory localization task when a beep sounded with or without a synchronized LED flash. Eight loudspeakers with attached LEDs were arranged in a semicircular array, half of which were on the left, and the other half were on the right side of the central fixation LED. Each loudspeaker was 14-deg away from its adjacent one. The audio-visual stimuli were presented 0-deg, 14-deg or 28-deg apart. The ventriloquist effect was defined as the ratio of biased sound localization towards the visual stimulus to the spatial disparity between audio-visual stimuli. Following the experiment, SZs were given a structured psychiatric interview to assess the severity of positive and negative symptoms with SAPS and SANS respectively. Results showed a typical ventriloquist effect in both groups with no statistically significant difference. However, in SZs, the ventriloquist effect showed a negative correlation with the severity of visual hallucinations, and a marginally significant negative correlation with the global ratings of hallucinations. There was no correlation between hallucinations and unisensory auditory localization performance. These results demonstrate that hallucinations were implicated in reduced audio-visual spatial integration, which might be related to impaired multisensory processing, not unisensory processing.

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