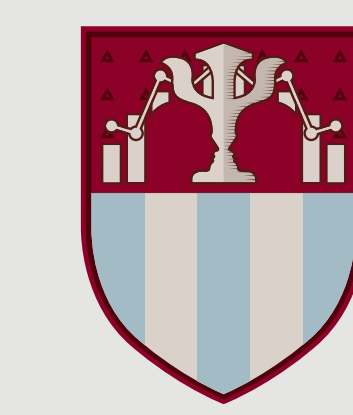


The association between audio-visual spatial integration and hallucinations in Schizophrenia

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Introduction It has been suggested that patients with schizophrenia (SZs) show impairment in multisensory integration [1, 2]. 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 [3]. The present study investigated the audio-visual spatial integration in schizophrenia by using the ventriloquist illusion paradigm [4].

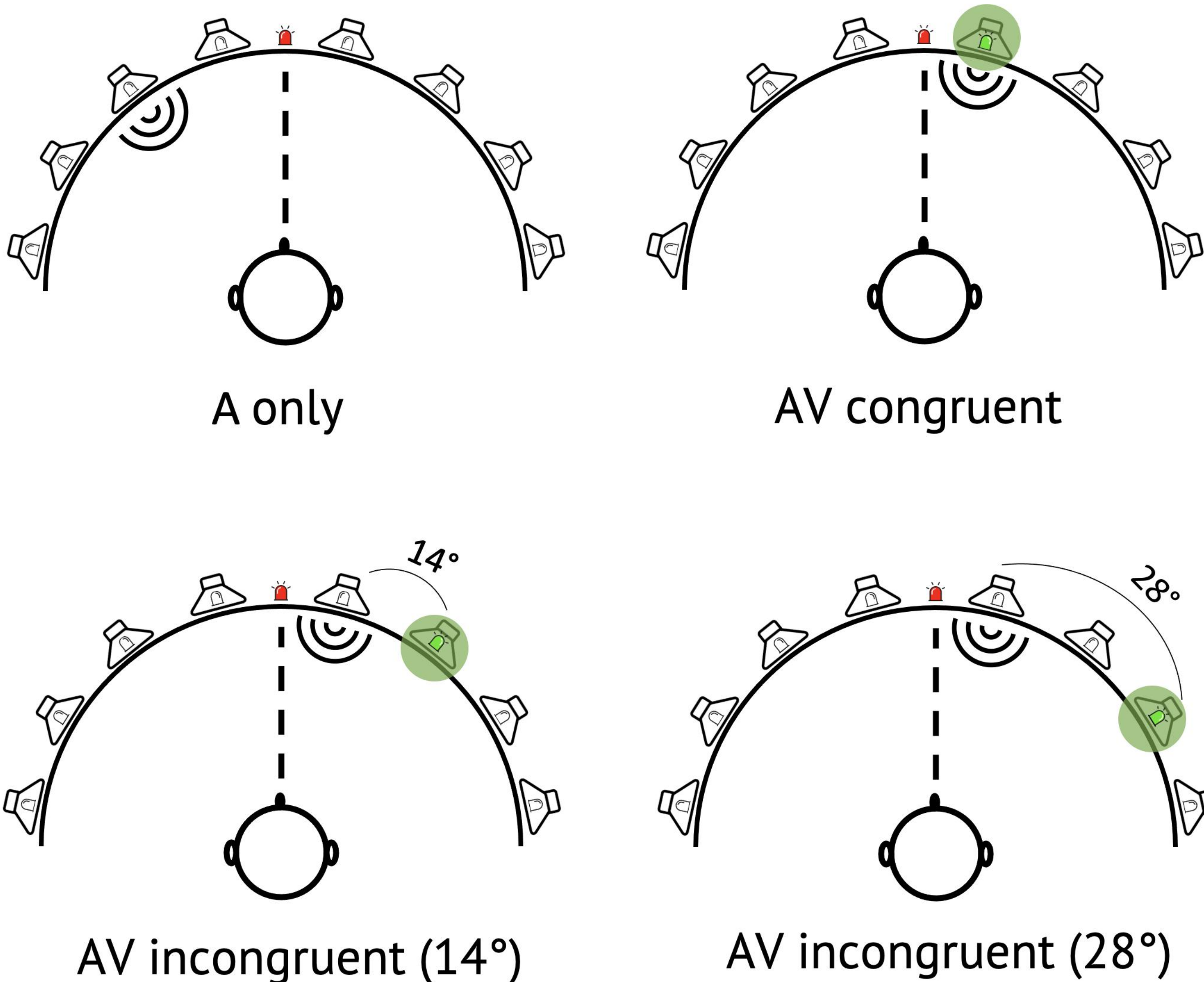
Methods

Participants

- 22 Schizophrenia patients (SZs) from rehabilitation centers and 22 Healthy Control (HCs)
- SZ group had an interview to evaluate symptom by using Scale for Assessment of Negative Symptoms (SANS) & Scale for Assessment of Positive Symptoms (SAPS).
- HC group filled in self-report questionnaires, Schizotypal Personality Questionnaire (SPQ).

	SZ (N = 22)	HC (N=22)
Age (years)	44.55 (10.97)	40.08 (12.75)
Gender	12M / 10F	8M / 14F
Education (years)	13.09 (2.00)	16.52 (3.35)
BPRS	27.23 (15.07)	-
SANS	38.50 (17.97)	-
SAPS	29.82 (14.92)	-
SPQ	-	6.00 (6.03)
Chlorpromazine equivalent dose (mg/day)	255.92 (134.59)	-
Duration of illness (years)	14.3 (9.64)	-

Auditory localization task



Stimuli

- green LED light for visual stimuli
- 1000Hz beep for auditory stimuli
- both stimuli were presented for 15ms

Conditions

- 1) A only condition: only an auditory stimulus presented
- 2) AV congruent condition: audio-visual stimuli presented simultaneously on a same location
- 3) AV incongruent condition: audio-visual stimuli presented simultaneously different locations (spatial disparity btwn stimuli: 14 or 28°)

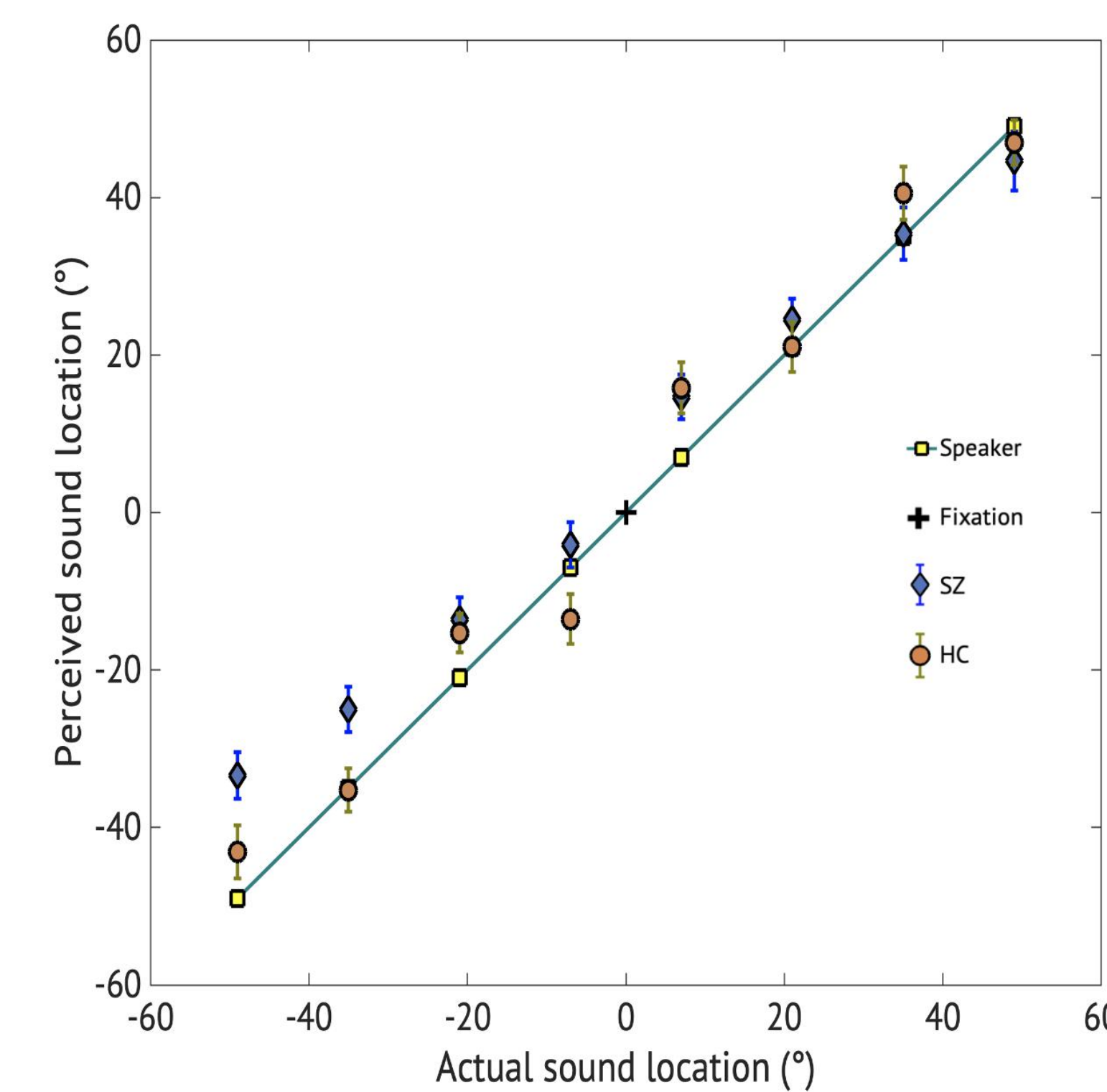
- 26 combinations X 15 trials = 630 trials

Procedures

- Participants fixated center-red LED point during the experiment.
- Participants responded by indicating their perceived sound location using a rotating handle bar.

Results

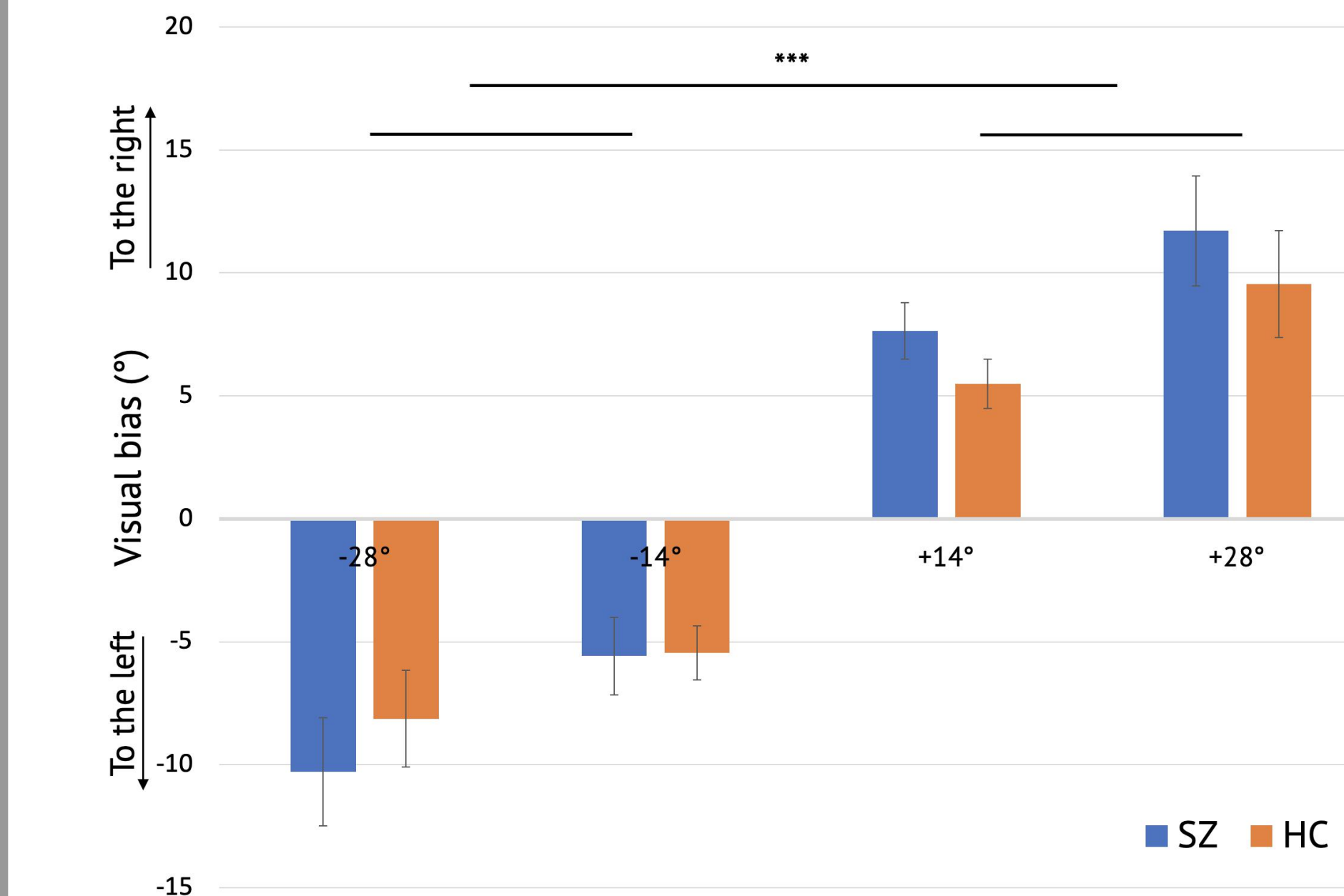
A only condition



- Both groups showed good sound localization ability in A only condition (SZ : $r = .997$ and HC : $r = .989$).
- The main effect of group was not significant statistically ($F(1, 7) = 2.314, p = .172$).

AV conditions

- There was no significant difference in eccentricity (central vs. peripheral) in both groups (SZ : $t(21) = -.724, p = .477$, HC : $t(21) = 1.692, p = .105$).
- Therefore, data across all the location were collapsed.



- Only the main effect of location (-28, -14, +14 and +28°) was significant $F(1.155, 48.494) = 48.860, p < .000$.
- Both groups showed biases as a function of spatial disparity which indicates audiovisual spatial integration in the ventriloquist paradigm.

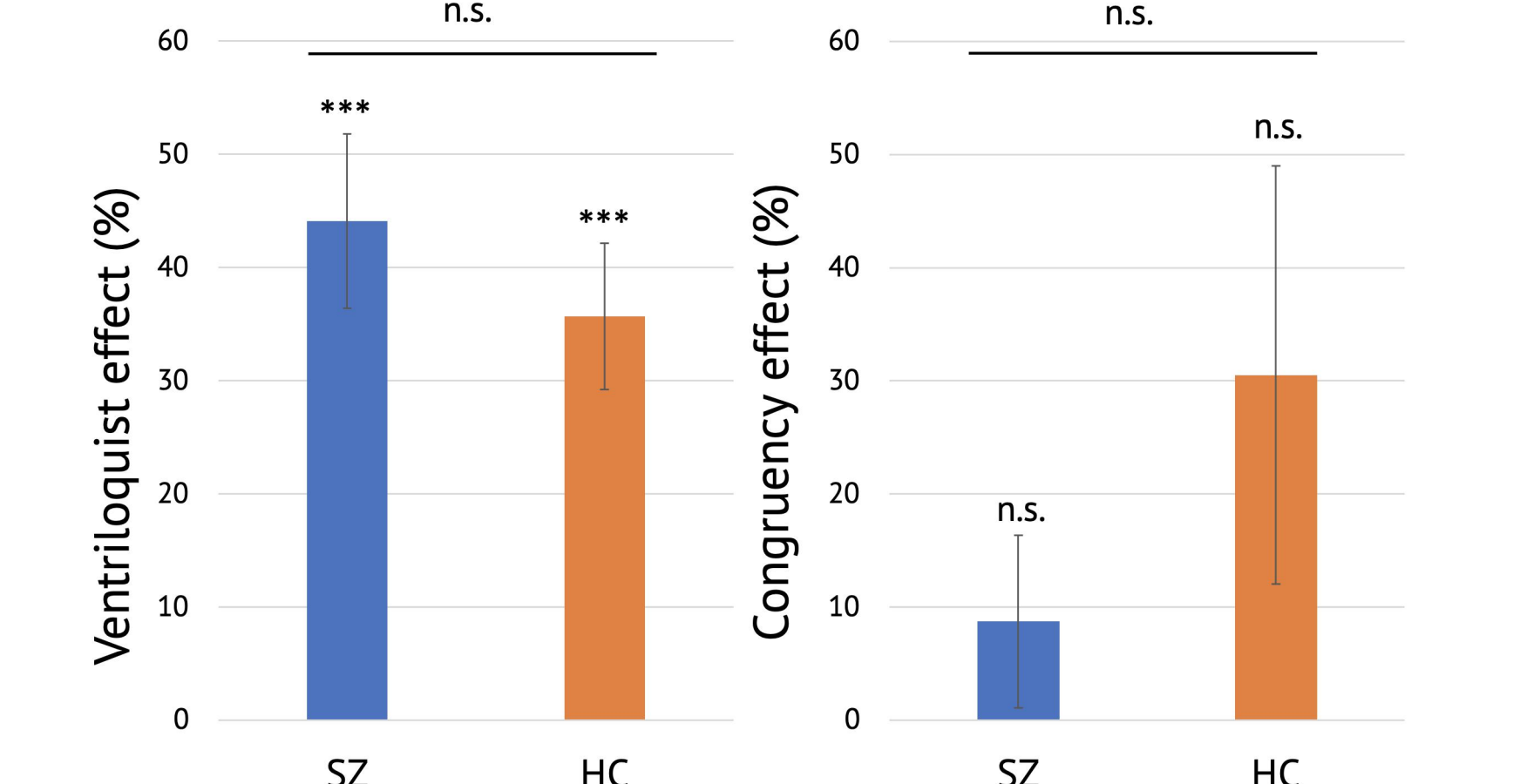
- To investigate audiovisual spatial integration, 2 indices were used:

$$1) \text{Ventriloquist effect (VE, \%)} = \frac{\text{Visual bias (}^\circ\text{)}}{\text{AV disparity}} \times 100$$

- the relative proportion of perceived bias toward visual stimulus.

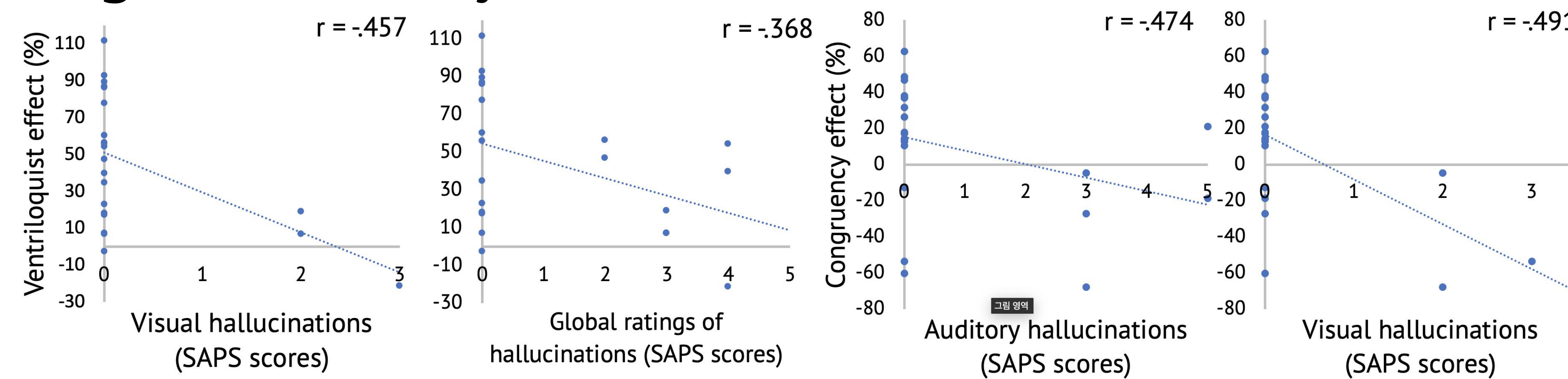
$$2) \text{Congruency effect (CE, \%)} = \frac{SD_{A \text{ only}} - SD_{AV \text{ congruent}}}{SD_{AV \text{ congruent}}} \times 100$$

- a lower variability in congruent multisensory stimuli implies multisensory enhancement.

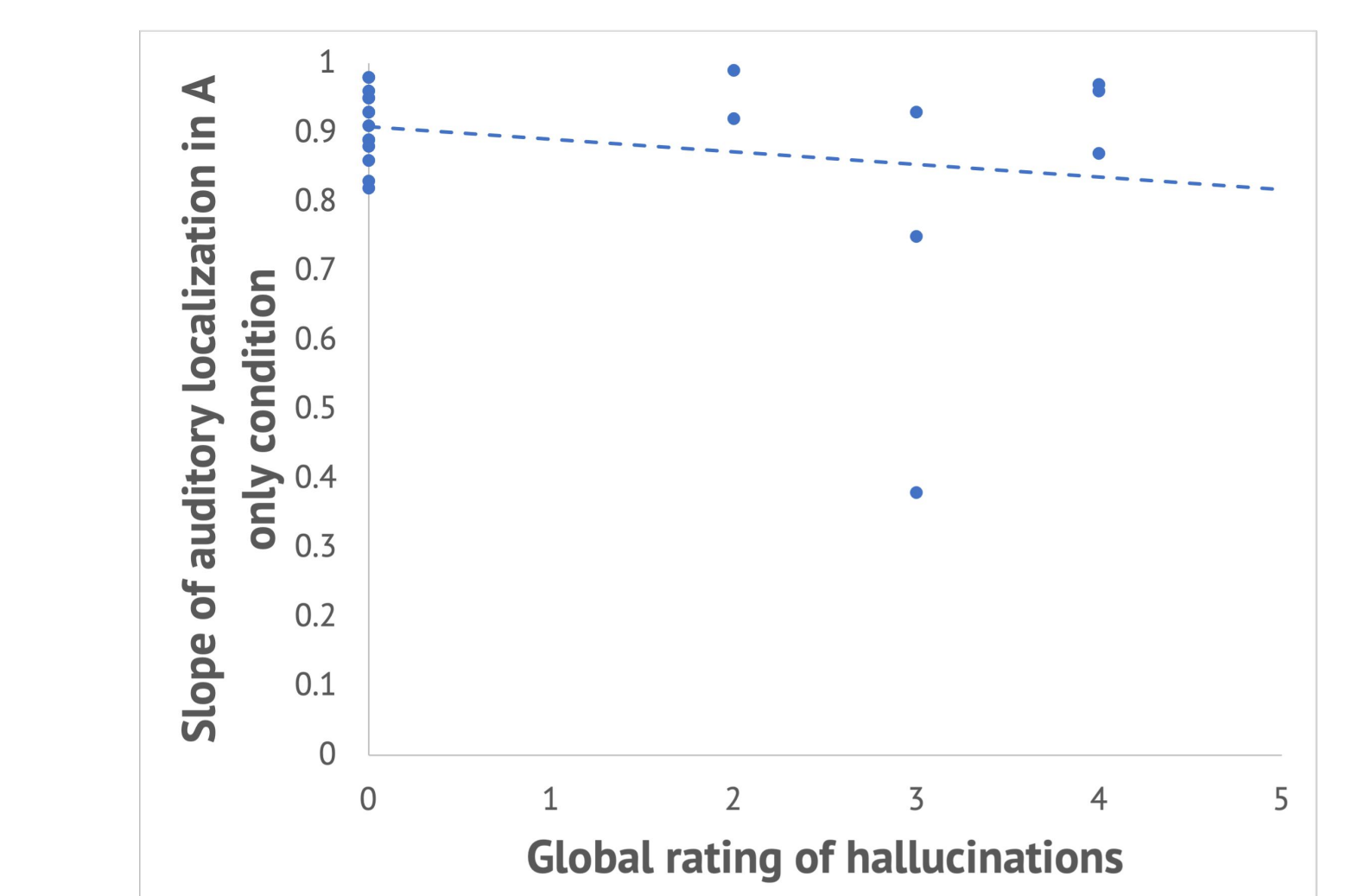


- Both groups showed Ventriloquist effect, but not Congruent effect. (Ventriloquist effect; SZ: $t(21) = 5.720, p < .001$, HC: $t(21) = 5.512, p < .001$). (Congruent effect; SZ: $t(21) = 1.147, p = .264$, HC: $t(21) = 1.652, p = .113$).
- No group difference of both effects ($t(42) = -.836, p = .408$, $t(42) = 1.093, p = .280$, respectively).

Regression Analysis



- In SZs, both multisensory integration indices were correlated with severity of symptoms of schizophrenia.
- Ventriloquist effect had negative correlation with Visual hallucinations ($r = -.457, p = .032$), and marginal negative correlation with Global ratings of hallucinations ($r = -.368, p = .058$).
- Congruency effect had negative correlation with Auditory hallucinations and Visual hallucinations ($r = -.424, p = .049$, and $r = -.491, p = .020$, respectively).
- No correlation between either index and schizotypal features was found.



- Auditory localization ability was calculated by slope from perceived responses in 8-speaker locations in A only condition.
- No correlation was found between hallucinations and auditory localization ability ($r = -.229, p = .306$).

Conclusion These results demonstrate that hallucinations were implicated in reduced audio-visual spatial integration, which might be related to impaired multisensory processing, not unisensory processing.

References

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