

Introduction

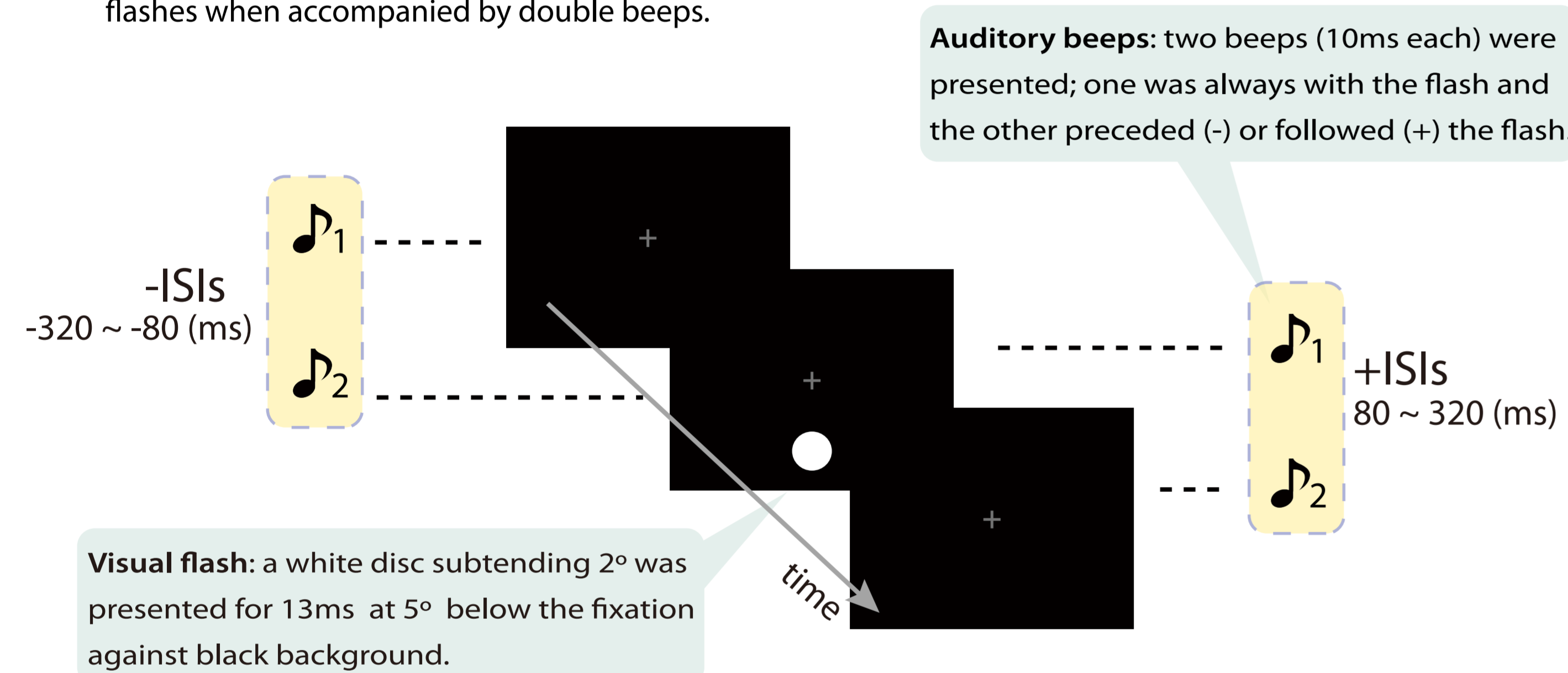
It has been suggested that individuals with schizophrenia (SZs) show impairment in temporal processing of multisensory information [1, 2]. However, the source of the deficit has not been specified since multiple factors are intermingled in most of the previous studies. We investigated whether SZs show perceptual impairment in temporal aspects of audiovisual integration compared to normal controls (NCs) while controlling other factors by utilizing sound-induced flash illusion (SIFI) paradigm [3].

Stimulus interval manipulation

Methods

Stimulus presentation

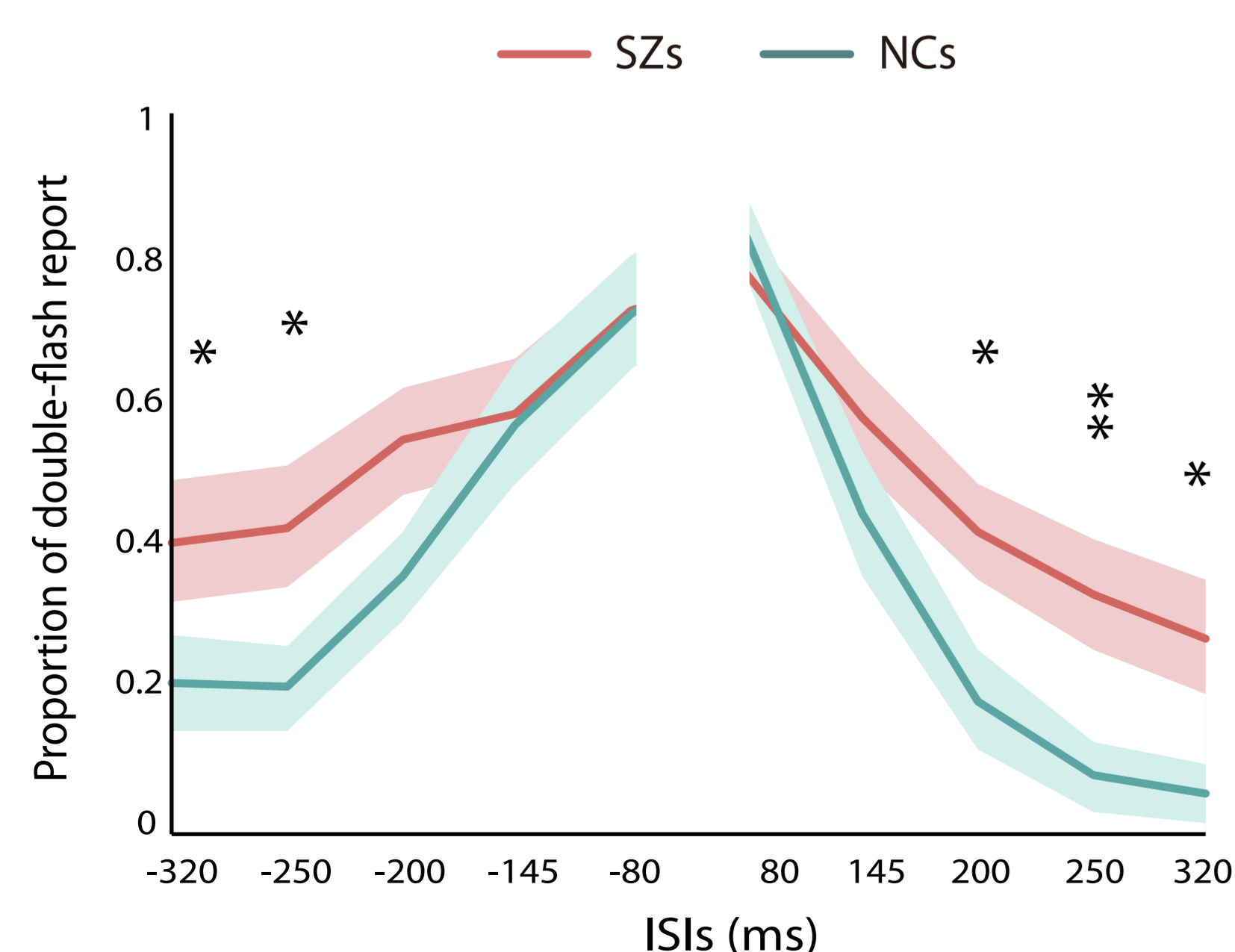
Sound-induced flash illusion:
a visual illusion that single flash is perceived as double flashes when accompanied by double beeps.



Analyses

Main analysis
Proportion of trials perceiving double flashes for each ISI level was calculated. For statistical analysis, mixed ANOVA was conducted for two conditions (-/+) (within factor: ISIs, between factor: group). Then, proportion for each ISI was compared via independent T-test.

Results



For + condition, there were significant main effects of ISI ($F(2.5, 99.63)=60.56, p<.001$) and group ($F(1, 39)=4.59, p<.05$). Also, there was a significant interaction (ISI*group; $F(2.5, 99.63)=3.703, p<.05$).

Results showed that proportion of double-flash report decreased with longer ISIs in both groups.

Notably, SZs' illusory perception of SIFI lasted with longer ISIs (over 200ms) unlike NCs reporting double flashes only in short ISIs.

Demographic and clinical data

	SZs (N=22)	NCs (N=19)
Age (years)	37.1 (2.6)	35.2 (2.45)
Gender (female %)	68%	65%
Education (years)	13.8 (0.38)	15.5 (0.75)
BDI-II	10.68 (1.65)	8.31 (1.71)
DOI (days)	9.26 (1.55)	-
PANSS (total) ^[4]	66.04 (3.98)	-
Positive	9 (0.95)	-
Negative	14.36 (1.08)	-
Disorganized	5.5 (0.4)	-
Excited	6.22 (0.69)	-
Depressed	7.27 (0.41)	-
Antipsychotic dosage (CPZE)	1652.07 (663.58)	-

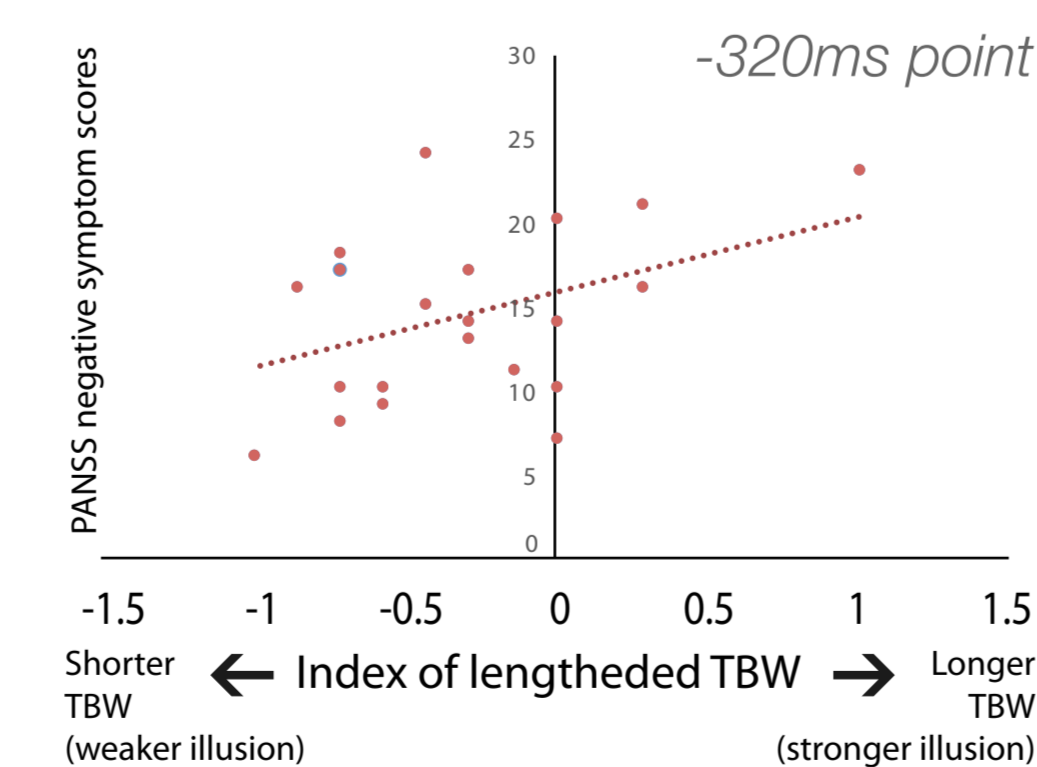
BDI-II: Beck's depression inventory-II DOI: Duration of Illness
PANSS: Positive and Negative Syndrome Scale CPZE: Chlorpromazine equivalent

Task

Participants were asked to report the number of perceived flashes.

Index of lengthened temporal binding window (TBW)

For SZs, proportion for the shortest ISI (i.e. +/- 80ms each) was subtracted from one for each ISI level. This difference was referred as index of lengthened TBW. A regression analysis was performed between this index and PANSS scores.



SZs' individual lengthened TBW index showed marginally significant positive correlation with negative symptoms ($r=0.41, p=.057$). It suggests that SZs who have longer TBW tend to have higher negative symptoms scores.

Summary

The results suggest that SZs have lengthened TBW and it is related to negative symptoms. It can be also interpreted as they tend to integrate irrelevant inputs (i.e. auditory beeps) into relevant ones (i.e. visual flash), that is, they are less likely to inhibit irrelevant inputs. → Next research question

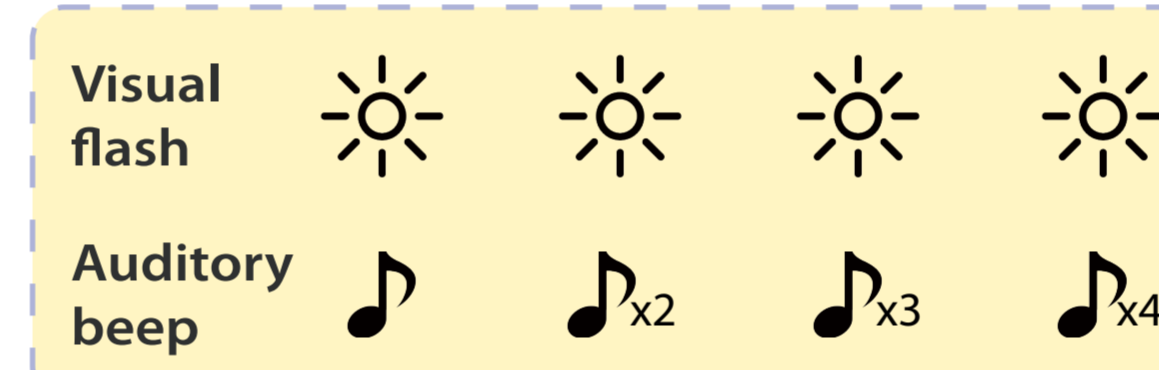
Stimulus number manipulation

Methods

Stimulus conditions

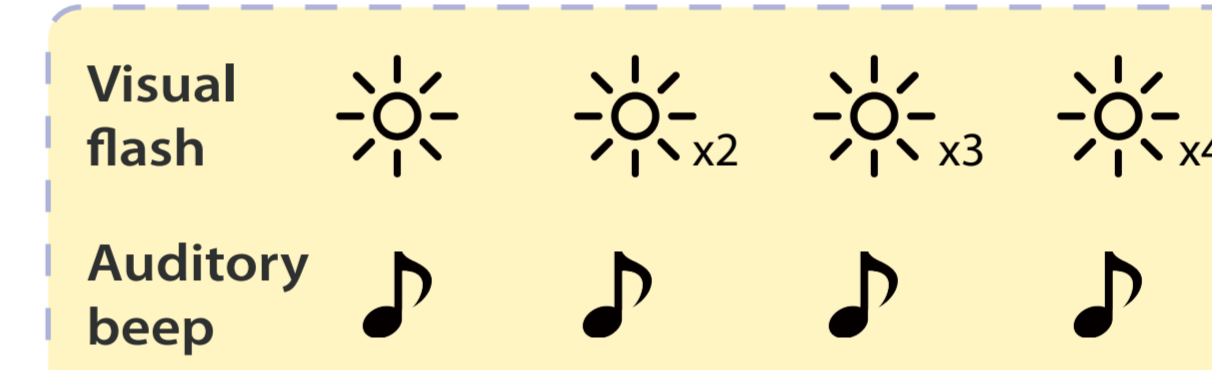
1 Magnified SIFI

To examine whether higher number of sounds induce stronger illusions.



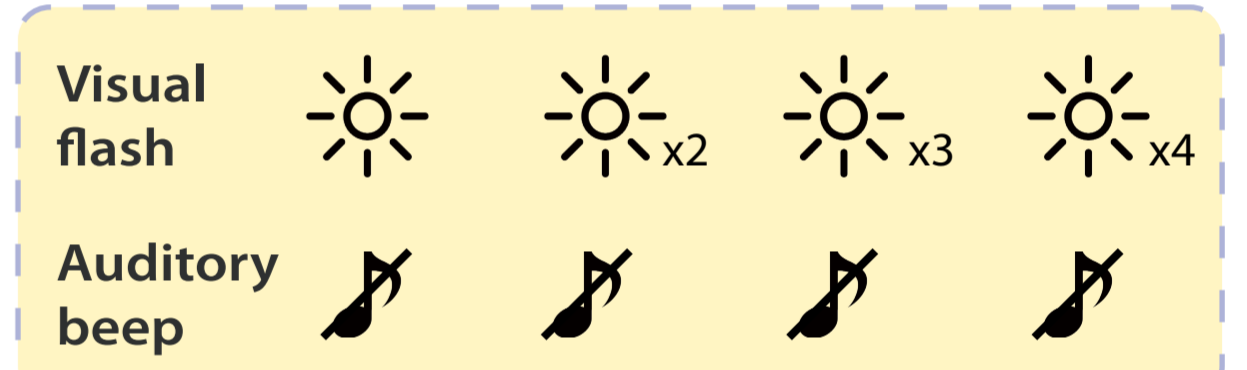
2 Auditory bias

To examine whether single beep makes multiple flashes to be perceived as less number of flashes than physical ones.



3 Visual discrimination

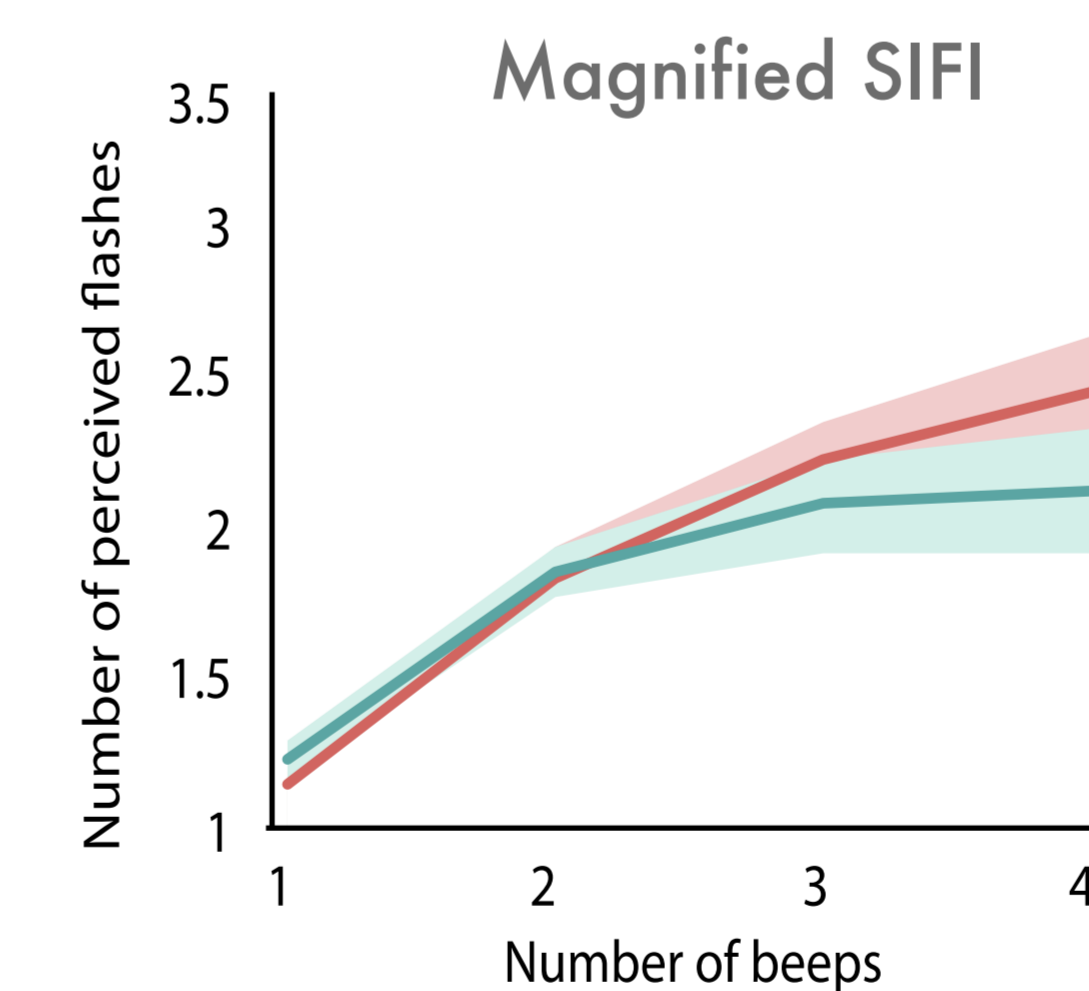
To examine whether participants discriminate physical flashes properly.



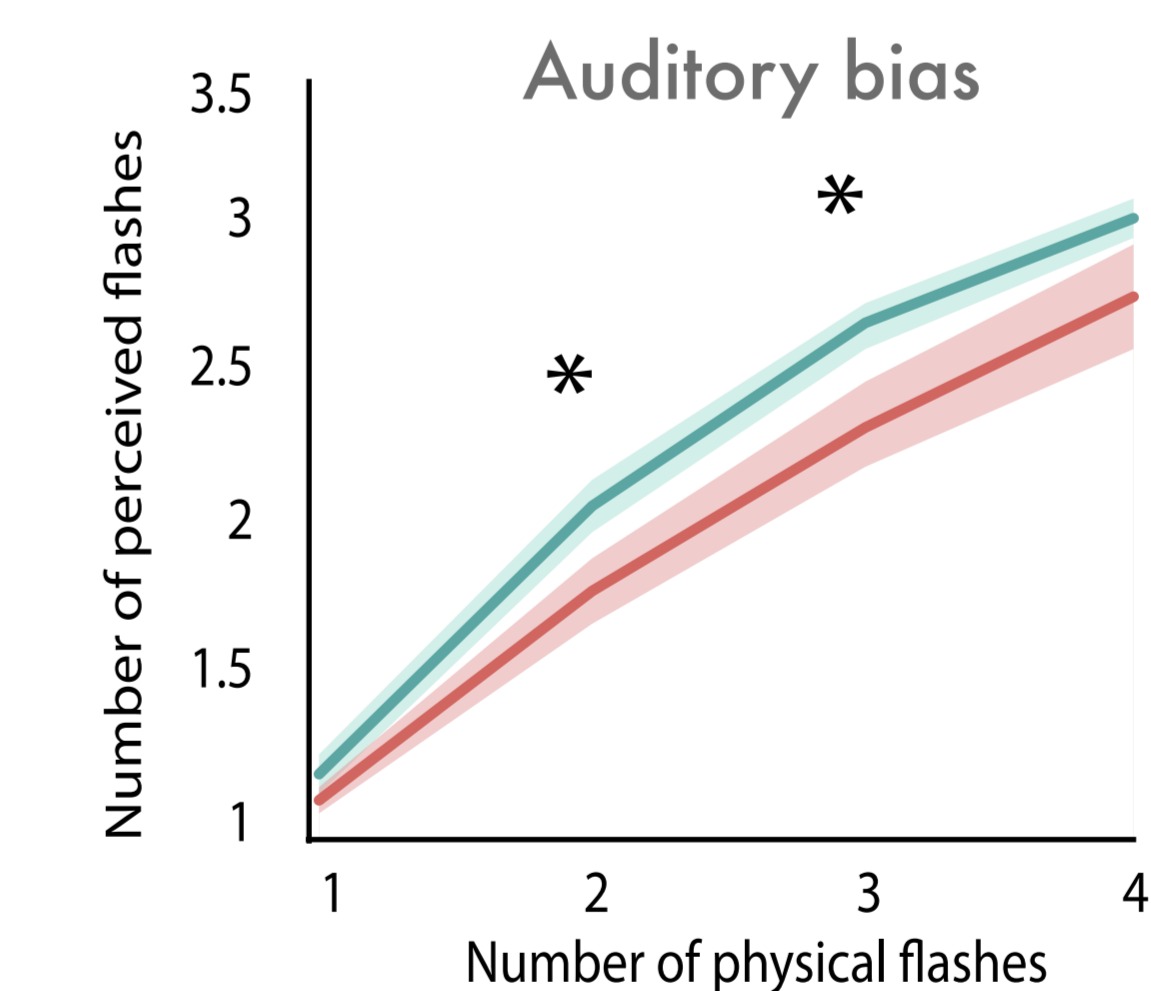
Task

Participants were asked to report the number of perceived flashes.

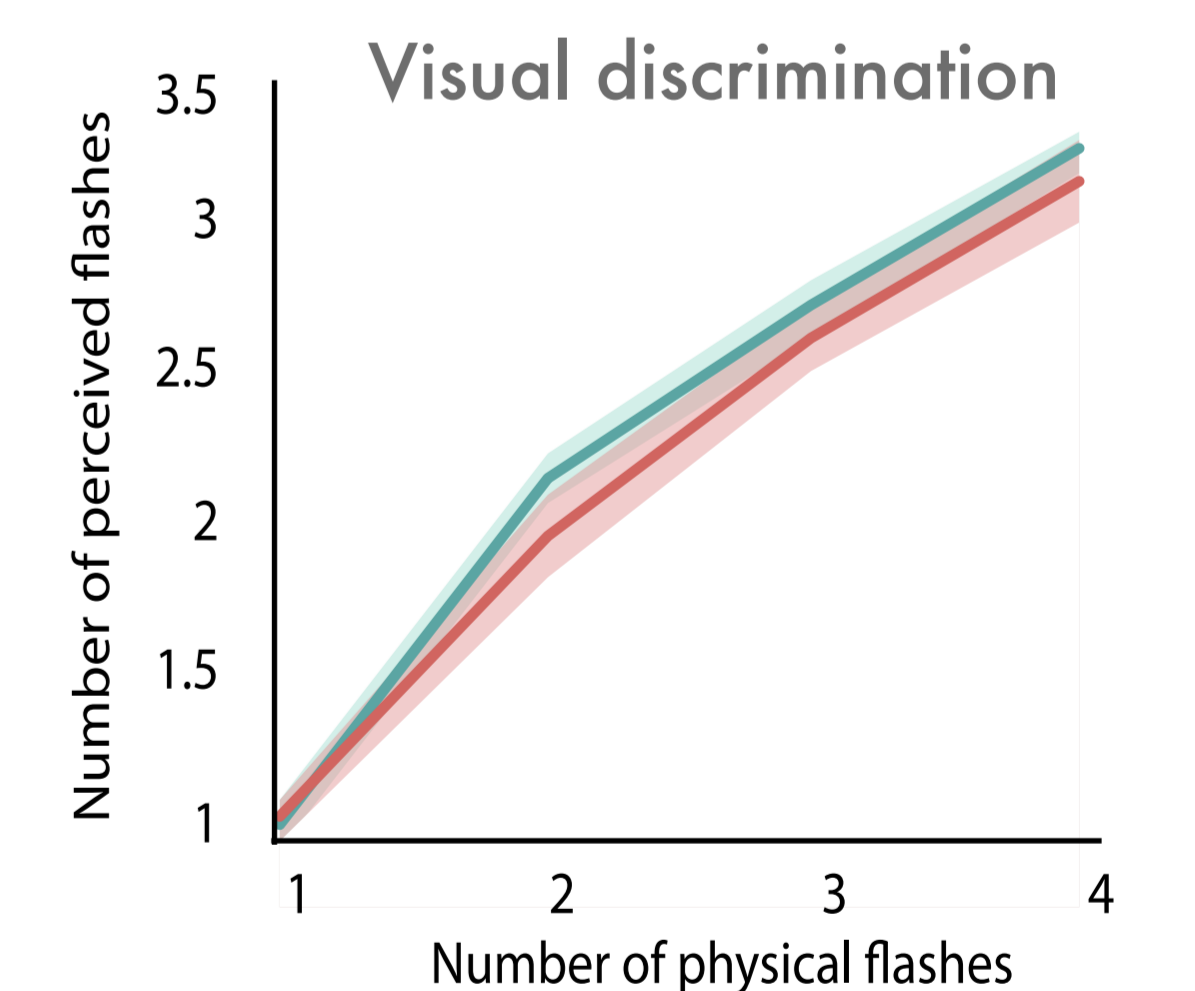
Results



There was significant main effect of number of beeps ($F(1.38, 53.9)=62.09, p<.001$) but neither main effect of group nor interaction was statistically significant. However, SZs tend to perceive higher number of illusory flashes when the number of beeps increases.



There was significant main effect of number of physical flashes ($F(1.75, 73.06)=243.108, p<.001$) and interaction ($F(1, 39)=4.11, p<.05$). SZs perceived less number of flashes, suggesting they are more likely to be influenced by the sounds than NCs.



There was significant main effect of number of beeps ($F(2.95, 114.91)=347.281, p<.001$). Both groups discriminated the number of visual flashes properly. It suggests that group differences in the previous tasks did not arise from poor visual discrimination of SZs.

Conclusion

These results demonstrate that SZs have differential patterns of audiovisual integration from those of NCs. It is presumably based on the perceptually lengthened TBW and related to negative symptoms of SZs. Also, SZs are less likely to inhibit irrelevant inputs (i.e. auditory beeps) when they integrate multisensory information.

References

- [1] de Gelder et al. (2003). Schizophr Res., 59(2).
- [2] Foucher et al. (2007). Schizophr Res., 97(1).
- [3] Shams et al. (2000). Nature, 408(6814).
- [4] Wallwork et al. (2012). Schizophr Res., 137(1).