

- [Brain Activity in Colored-hearing by Listening to Music: An fMRI Study](#)

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Objective

The phenomenon of colored-hearing could yield clues to not only the neurocognitive mechanism of inter-modality but also to art and entertainment by applying the interaction between music and color. In this study, we observed the brain activity in colored-hearing synesthetes while listening to music by using fMRI. We compared the activity of colored-hearing and non-colored-hearing subjects, and analyzed the relationship between the common areas of only the colored-hearing synesthetes and the regions of color perception.

Method

Two colored-hearing subjects and 11 non-colored-hearing subjects participated in this study. Both colored-hearing subjects were musicians and they could see colors equivalent to musical tonalities, whereas none of the non-colored-hearing subjects were musicians. The design of the experiment was a block design, and the stimuli used were music as the task and beep sounds as the control task. All the subjects listened with open eyes and closed eyes.

Results

We acquired images of the brain activity of each colored-hearing subject and of the combined non-colored-hearing subjects when listening to music. From these images, we found that only the colored-hearing synesthetes activated the fusiform gyrus and the superior frontal gyrus.

Subsequently, we compared only the colored-hearing synesthetes and the regions of color perception (V4, V8, V4a, and V4v) researched in previous studies. In the analysis, both the colored-hearing subjects activated regions V4, V8, and V4a on the left and V4, V8, and V4v on the right and left. These results indicate that there is a new V4 complex (V4/V8 together with V4v) related to colored-hearing as well as the known V4 complex (V4/V8 together with V4a).

Conclusion

From these results, we suggest that colored-hearing subjects actually perceive colors when listening to music and that they experience a direct interaction between the acoustic and visual sense. This appears to be neuroscientific proof that colored-hearing synesthetes have a specific ability.