Functional brain correlates of object perception in synesthetic and non-synesthetic twins

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In the Synesthesia and Autism Twin Study (SATS), functional magnetic resonance imaging (fMRI) is used both to investigate synesthesia itself, and to investigate proposed links between synesthesia and autism spectrum condition. Besides co-occurring more often than expected, the two conditions independently share perceptual features, for example in increased sensory responsivity. Given this apparent link between synesthesia and autism, theoretical proposals addressing perceptual differences in one condition could be relevant to understanding the other[1].

In autism, a class of such proposals have hypothesized a reduced top-down (relative to bottom-up) influence on perceptual inference[2]. Such a reduced influence might be observed in a decreased downregulation of neural activation in response to expected sensory input, which in turn could be a relevant mechanism in explaining autistic features like increased sensory responsivity. Hypotheses of reduced top-down influence could therefore be relevant for corresponding perceptual features in synesthesia as well.

In autism, one process where potential differences in top-down influence have been studied is in object perception. A prior fMRI study[3] hypothesized that existing object representations, triggered by recognizable object stimuli, would not as strongly contribute to the suppression of bottom-up activation in the primary visual cortices as in neurotypicals. Interestingly, in autism, recognizable objects (when compared to abstract, less complex objects) rather led to stronger activation higher up in the visual perception hierarchy. One interpretation of this result is that

abstract objects, like recognizable objects, also triggered existing object representations, and that this effect was stronger in neurotypicals. This interpretation would imply that another between-group comparison also could be informative, such as one contrasting perception of abstract objects with random non-objects.

Using the same object perception paradigm as previously in autism, we will apply this analysis to synesthesia. In SATS, there is fMRI data from 58 twin pairs. A subset of 17 pairs are twins who are grapheme-color synesthesia discordant (7 monozygotic and 10 dizygotic, age m = 22.44, n = 32 female and n = 2 male). Functional correlates of object perception will be compared between twins with grapheme-color synesthesia compared to co-twins without. Results from the analysis will be presented at the symposium.

[1]Angeletos Chrysaitis, Seriès (2023) Neurosci Biobehav Rev.
[2]van Leeuwen et al. (2020) Cogn Neuropsychol.
[3]Sapey-Triomphe et al. (2020) Neuroimage Clin.