

Anticolors: Behavioral and neural correlates of the conscious experience of a color-grapheme synesthete

Nathan Witthoft & Jonathan Winawer

E-mail: witthoft@MIT.EDU

Department of Brain & Cognitive Sciences, MIT, Cambridge, Mass. USA

Previous work with a color-grapheme synesthete, AED, presented behavioral evidence showing that the letter to color pairings in synesthesia could be both learned and involve low level visual mechanisms ordinarily thought to be insulated from long term memory (Witthoft & Winawer, Cortex, in press). Here we present some new findings with this same subject. First we found that the vividness of AED's synesthetic colors varies in a systematic way depending on the real hue of a particular letter or number. As the hue of the stimulus is shifted around the color circle away from the hue of AED's photism, the vividness declines, and AED's synesthesia is abolished entirely when the hue of the stimulus is roughly 180 degrees from the hue of the synesthetic color. We refer to these colors which eliminate AED's subjective experience of synesthesia as anticolors. This finding led to two experiments which provide objective evidence of this phenomena. In the first we used a variant of the Stroop task to show that as has been demonstrated for other synesthetes, AED takes longer to name the hue of a stimulus, when the hue is inconsistent with the hue evoked by her synesthesia. However, when we split the inconsistent hues into two sets, one which evoked synesthesia and one which did not, we found that the effect of interference was significantly reduced when AED did not experience a photism. This suggests that the interference produced in the Stroop task is separable into two components, one cognitive and one perceptual. In a second experiment, we took advantage of the variation in AED's subjective ratings of the vividness of her synesthesia to examine its neural substrates. First, we found that in both right and left V4, the BOLD activity was positively and linearly related to AED's subjective ratings, suggesting a tight coupling between activity in this early visual area and her conscious experience. We also found that when defining color areas as regions that responded more to colored symbols than to grey symbols (neither of which produce synesthesia in AED), there was significantly more BOLD activation in response to grey letters which do produce the perceptual experience of synesthesia in AED than to letters presented in anticolors which do not.