# Training non-synaesthetes to behave like synaesthetes: Implications for the development of synaesthesia

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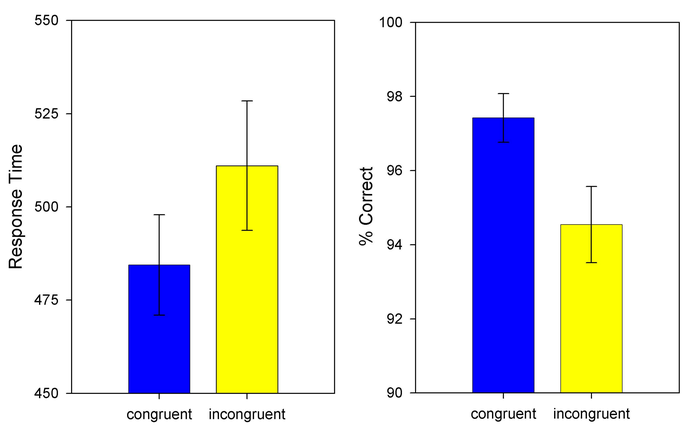
## Introduction

Contemporary accounts of the development of synaesthesia suggest a dominant role for nature and a negligible role for nurture. I have been exploring whether the role of experience has been underestimated. Grapheme-colour synaesthetes experience colour when exposed to familiar alphanumeric characters. In colour naming tasks, synaesthetes are slower to name a colour when it is accompanied by a character that induces an incongruent colour (relative to congruent characters). Two experiments sought to produce similar effects, via training, in non-synaesthetes.

## Experiment 1

During the training phase, 24 participants performed 1400 trials of a colour-naming task in which particular colours were exclusively paired with particular characters (e.g., “red” always **1** , “green” always **2**). Following training, participants performed a colour-naming task in which some colour-character pairings were *congruent* (e.g., **1**, **2**) with the trained pairings and others were *incongruent* (e.g., **1**, **2**). Participants were faster ($t_{23}$ = 2.94, $p$ < .01) and more accurate ($t_{23}$ = 2.51, $p$ < .05) on congruent than incongruent trials (see Fig. 1).

**Figure 1: Familiar Characters**



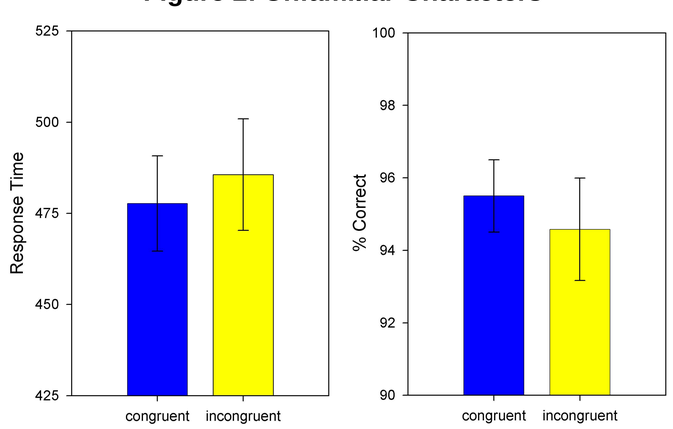

## Experiment 2

One characteristic of synaesthetic behaviour that seems problematic for a purely genetic account is that synaesthetes only experience colours for *familiar* symbols. For example, characters from *unfamiliar* alphabets do not elicit colours. This suggests that synaesthetes must have experience with symbols before those symbols elicit colour experiences. Experiment 2 was designed to test whether it would be more difficult to produce congruency effects in non-synaesthetes when unfamiliar characters were used.

Two characters (one from the Somali and one from the Pollard Miao alphabet) were chosen on the basis of their lack of resemblance to any familiar symbols. They were also matched to the familiar characters used in the first experiment (1, 2) in terms of visual complexity and discriminability:

Experiment 2 was otherwise identical to Experiment 1. However, unlike in Exp. 1, participants were neither faster ($t_{23}$ = 1.28, $p$ > .2) nor more accurate ($t_{23}$ = 0.74, $p$ > .4) on congruent than incongruent trials (Fig. 2).

**Figure 2: Unfamiliar Characters**




## Discussion

Synaesthetic colour naming performance is taken to demonstrate the automaticity of synaesthesia, which is considered consistent with a genetic account of synaesthesia. In Experiment 1, this performance was mimicked in non-synaesthetes after only 1400 training trials, suggesting that colour naming cannot be used as evidence for genetic accounts of synaesthesia.

Only familiar symbols elicit colour experiences in synaesthetes. One possible explanation is that adult synaesthesia is the end-product of the repeated association of meaningful symbols and colours. Consistent with this possibility, Experiments 1 and 2 demonstrated that the rapid acquisition of symbol-colour associations is contingent upon symbol familiarity.

I do not deny a possible genetic basis for synaesthesia. Rather, I suggest that the automaticity demonstrated by adult synaesthetes has been affected by postnatal experience. So I am not arguing that “A” is blue for a particular synaesthete because she was exposed to blue A’s as a child. Consider the following scenario... Synaesthetes’ genetic uniqueness manifests, from an early age, as a hyperactivation of colour processing, which occurs even for non-coloured stimuli. When faced with difficult developmental challenges involving non-coloured stimuli, such as learning written language, synaesthetes tend to use this additional colour information. Repeated consistent use of particular colours with particular graphemes leads to the development of an automatic elicitation of the colours in response to grapheme presentation. Consistent with this view, Riggs and Karwoski (1934, *Brit J Psych*, 25:29-41) reported that the colour associations of child synaesthetes are inconsistent, which is not the case for adult synaesthetes.

An important demonstration of the experience-dependence of synaesthesia was recently reported by Smilek et al. (2003, *Neurocase*, 8:338-342); they describe identical twin sisters, only one of whom is a synaesthete.