



## Personality traits in people with synaesthesia: Do synaesthetes have an atypical personality profile?

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### ABSTRACT

People with synaesthesia not only have – by definition – unusual experiences (e.g., numbers triggering colour), they also have a different cognitive profile (e.g., in terms of their memory and perceptual abilities) and a bias towards certain interests and activities (e.g., towards the arts). However, virtually nothing is known about whether synaesthetes have an atypical personality profile. In this study, a standard measure of personality was administered (Big Five Inventory) along with two questionnaire measures of empathy. Synaesthetes, relative to demographically matched controls, reported higher levels of ‘Openness to Experience’ which is known to be related to imagination and artistic tendencies. They also reported higher levels of ‘Fantasizing’ on one of the empathy measures, which is conceptually related to Openness, although their self-reported empathy did not differ in other respects. In addition, synaesthetes reported lower levels of Agreeableness which we did not predict in advance.

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### 1. Introduction

People with synaesthesia experience the world in unusual ways. Reading words on a page may trigger a sequence of colours in their mind’s eye (Ward, Salih, Li, & Sagiv, 2007), listening to music may trigger a riot of dancing shapes (Mills, Boteler, & Larcombe, 2003), or speaking may trigger an ebb and flow of tastes on the tongue (Jones et al., 2011). More formally, we can define synaesthetic experiences as having a number of key properties: they are elicited by a stimulus, they are automatic, and they typically have percept-like qualities to them (Ward, 2013). Synaesthesia originates from a young age, perhaps even birth, and is durable through the lifespan (Maurer & Mondloch, 2006; Simner, Harrold, Creed, Monro, & Foulkes, 2009). Synaesthesia has a genetic component (Asher et al., 2009) and is associated with structural differences within the brain (Banissy, Stewart, et al., 2012; Rouw & Scholte, 2007). Although it is biological in nature it is not considered as pathological and it may even lead to certain cognitive benefits such

as enhanced memory (Rothen, Meier, & Ward, 2012) and perception (Banissy, Walsh, & Ward, 2009). As such, synaesthesia itself can be regarded as an individual cognitive difference within the ‘normal’ population. The question considered here is: are the atypical experiences of synaesthesia associated with atypical personality profiles?

There are already some grounds to expect that there might be. It has been observed that both the hobbies and occupations of synaesthetes are skewed towards the creative industries, relative to national estimates of numbers employed in that sector, in both Australia (Rich, Bradshaw, & Mattingley, 2005) and the UK (Ward, Thompson-Lake, Ely, & Kaminski, 2008). Moreover, the prevalence of synaesthesia is higher in students in the arts compared to those from other subjects (Rothen & Meier, 2010). Although none of these studies employed conventional questionnaire measures of personality, artistic and creative inclinations are known to be linked to certain personality traits. Amongst the Big Five, Openness to Experience has been particularly linked to artistic inclinations (e.g., Furnham & Chamorro-Premuzic, 2004). In addition, previous findings have linked heightened positive schizotypy (relating to unusual perceptual experiences, hallucinations and magical thinking) to artistic inclinations (Nelson & Rawlings, 2010; Nettle & Clegg, 2006), but not necessarily other aspects of schizotypy. A

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recent questionnaire study of synaesthetes found them to score higher on two sub-scales of a schizotypy measure, the Oxford-Liverpool Inventory of Feelings and Experiences (Mason & Claridge, 2006). Specifically, Banissy, Cassell, et al. (2012) found that synaesthetes scored higher on positive schizotypy (relating to unusual perceptual experiences, hallucinations and magical thinking) and cognitive disorganisation (problems with attention, decision-making and social anxiety) but not introverted anhedonia or impulsive non-conformity. This suggests either that synaesthesia itself gives rise to certain schizotypal traits, or that there is a latent mediating variable that produces these different outcomes.

Aside from schizotypy, the only other known published personality trait measures in synaesthesia relates to empathy. Banissy and Ward (2007) studied a group of synaesthetes who report tactile sensations on their body when watching other people being touched. They speculated that this inter-personal sharing of touch may lead to enhanced empathy and these synaesthetes were indeed found to score higher on one aspect of empathy – the ‘emotional reactivity’ component of the empathy quotient (EQ) questionnaire (Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004). This appears to be particularly true of this type of synaesthesia as Banissy and Ward (2007) noted that there was no difference between grapheme-colour synaesthetes and controls on this measure, although the sample sizes were small. Finally, Amin et al. (2011) also administered the EQ to a small group of synaesthetes who associate genders and personalities to graphemes (e.g., “3 is female and bossy”) – termed personification. As a group, they were found to perform similarly to controls on this measure although specific sub-scales were not considered.

In this study we administered three questionnaires to a large group of synaesthetes who all have, minimally, grapheme-colour synaesthesia. The questionnaires were the Big Five Inventory (BFI, John, Donahue, & Kentle, 1991) and two measures of Empathy, the Inter-Personal Reactivity Index (IRI; Davis, 1980) and the empathy quotient (EQ; Baron-Cohen & Wheelwright, 2004).

## 2. Material and methods

### 2.1. Participants

The participants consisted of a group of grapheme-colour synaesthetes ( $N = 81$ ) and a group of controls ( $N = 112$ ) that were matched for age (synaesthetes = 44.9 years,  $SD = 13.4$ ; controls = 43.8 years,  $SD = 12.0$  years) and sex (synaesthetes = 69F:12M, controls = 96F:16M). The synaesthetes were recruited, by email, from a database of volunteers at the University of Sussex. The controls were recruited, via email, from the student population and via acquaintances.

The synaesthetes had been tested for consistency of their grapheme-colour associations using either an online battery in a single session (Eagleman, Kagan, Nelson, Sagaram, & Sarma, 2007) or using the test–retest method over two sessions separated by at least 2 months (e.g., as in Ward & Simner, 2005). The average consistency score on the online battery was 0.797 ( $SD = .28$ ) in which a lower score is indicative of synaesthesia. Eagleman et al. (2007) report that synaesthetes tend to score <1.0 whereas controls score around 2.0. The average consistency on the test–retest measure was 91.6% ( $SD = 10.9$ ) in which a higher score is indicative of synaesthesia. This value is similar to that reported elsewhere (Ward & Simner, 2005). In addition to grapheme-colour synaesthesia, we had some background information on other types of synaesthesia that were self-reported by this group. Sixty-three synaesthetes reported spatial forms (of one kind or another) and 13 did not; 30 reported visualised music and 50 did not; and 14 reported personification (gender and/or personality associations) and 31

did not. The numbers do not always add up to the sample size as this information was not available for all participants (in particular, we did not ask about personification on the earliest version of our questionnaire).

### 2.2. Materials and procedure

All subjects completed the EQ, IRI, and BFI in that order. Participants were required to give an answer to each question before continuing to the next questionnaire. The survey was conducted online using SurveyMonkey. In addition to completing the questionnaires, participants were also asked their age, sex, and (optionally) their name or participant code. The latter was essential for synaesthetes so that we could link their questionnaire responses with previous data regarding their synaesthesia (e.g., their consistency). Participation was entirely voluntary and they were informed of their right to withdraw. There were no direct incentives for taking part (e.g., money, course credit).

The EQ is a self report measure designed to empirically measure empathy. The scale contains 40 test items and 20 filler items (Baron-Cohen & Wheelwright, 2004). All items are a series of statements and responses are given on a 4 point scale ranging from ‘strongly agree’ to ‘strongly disagree’. Subsequent analyses have revealed three factors based on either 28 questions (Lawrence et al., 2004) or 15 questions (Muncer & Ling, 2006). The three main factors have been termed (i) cognitive empathy, (ii) emotional reactivity and (iii) social skills. Although all items were given, the statistical analyses of our data were based on the best fitting model reported by Muncer and Ling (2006).

The IRI is a 28 item self-report empathy measure (Davis, 1980). It is comprised of four subscales; perspective taking, Fantasizing, empathic concern and personal distress. Each subscale contains seven items which are measured on a five point Likert scale ranging from 0 (“does not describe me well”) to 4 (“describes me very well”). For each subscale, a minimum score of 0 or maximum score of 28 is possible. For three subscales (perspective taking, Fantasizing and empathic concern), higher scores reflect heightened empathy. For the personal distress subscale higher scores are reflective of self-orientated emotional reactivity.

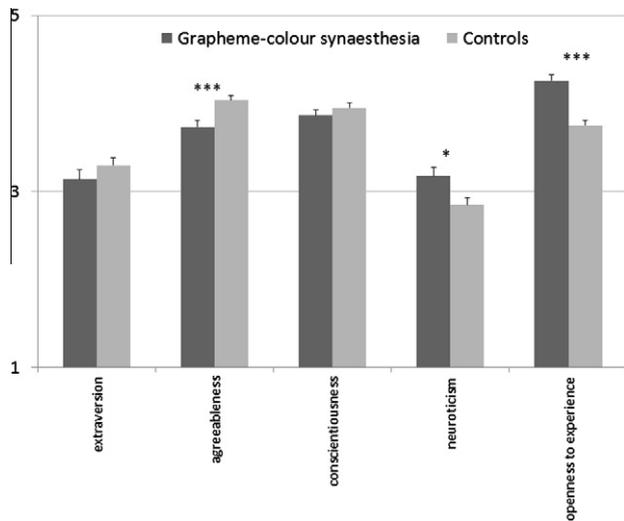
The Big Five Inventory (BFI) is a 44-item scale designed to measure components of the Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness; John et al., 1991). Respondents are asked to indicate on a five point Likert scale the extent to which a series of statements related to each personality trait best describe their own characteristics. Responses are given from 1 (“disagree strongly”) to 5 (“agree strongly”).

The internal consistency of the scores was calculated for each scale, based on the combined group, using Cronbach’s alpha. The coefficients were 0.81 for the EQ, 0.83 for the IRI and 0.73 for the BFI.

## 3. Results

Independent *t*-tests were employed to detect group differences on individual traits. A Bonferroni correction for multiple comparisons was applied to determine the robustness of any significant result ( $p < .01$ , .0125, and .0167 for 5, 4, and 3 comparisons respectively).

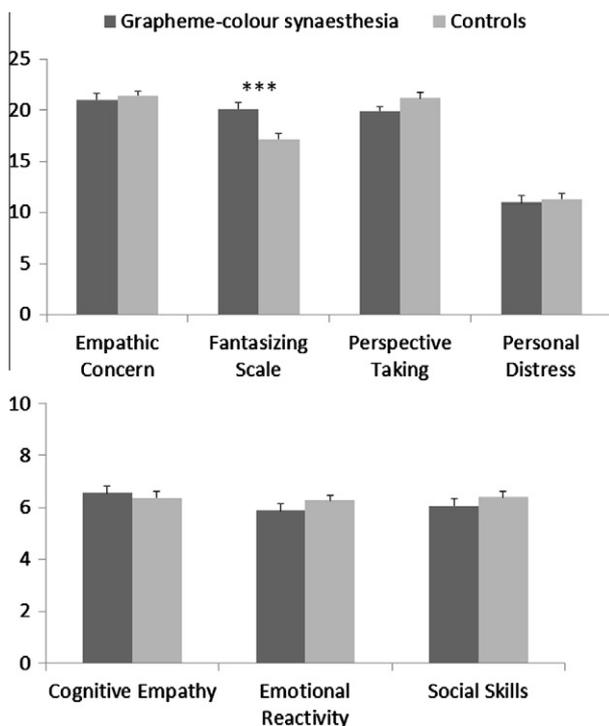
The results for the Big Five measures are shown in Fig. 1. As predicted, the synaesthetes scored significantly higher on the Openness to Experience factor ( $t(191) = 5.61$ ,  $p < .001$ ; Cohen’s  $d = .83$ ). In addition, they scored significantly lower on the Agreeableness dimension ( $t(191) = 3.60$ ,  $p < .001$ ; Cohen’s  $d = .53$ ). Both of these results survive a Bonferroni correction. An additional factor,



**Fig. 1.** Factor scores for synaesthetes and controls on the BFI. Error bars show 1 SEM. On this scale 5 represents strong endorsement of the trait. 1 represents no endorsement of the trait, and 3 represents 'neither agree nor disagree'.

Neuroticism, was found to be significantly higher for synaesthetes but did not survive correction ( $t(191) = 2.57$ ,  $p = .011$ ; Cohen's  $d = .36$ ).

The results for the two empathy questionnaires are shown in Fig. 2. There was only one trait in which synaesthetes differed from controls: synaesthetes scored higher on the Fantasizing Scale of the IRI and this result also survived a Bonferroni correction ( $t(191) = 3.92$ ,  $p < .001$ ; Cohen's  $d = .56$ ). It is to be noted that this scale is conceptually related to the Openness to Experience personality factor (both are related to imagination and exploration of ideas), and they are statistically related too. Both synaesthetes



**Fig. 2.** Factor scores for synaesthetes and controls on the IRI (top) and EQ (bottom). Error bars show 1 SEM. The minimum and maximum scores on the EQ are 0 and 10, and for the IRI are 0 and 28.

and controls show a significant correlation between these two factors (synaesthetes:  $r = .235$ ,  $p = .035$ ; controls:  $r = .199$ ,  $p = .035$ ). In contrast, the conceptual relatedness between Fantasizing and empathy in general has been questioned (Baron-Cohen & Wheelwright, 2004). As such, although synaesthetes appear to differ on several aspects of personality they show an essentially normal pattern on measures of empathy.

Finally, in order to explore further the relationship between presence of synaesthesia and personality, while taking into account the inter-correlations between the self-report measures, we performed a binary logistic regression analysis with group membership (presence/absence of synaesthesia) as a dependent variable and personality measures as predictor variables. A stepwise forward method (Wald) was employed in which the predictor variables were added successively according to the magnitude of their correlation with the dependent variable, and then were successively removed until the predictive ability of the regression model, as indexed by the model chi-square, was not significantly improved. The overall model was significant ( $\chi^2 = 47.92$ ,  $df = 3$ ,  $p < .001$ ,  $-2 \text{Log likelihood} = 229.71$ ) accounting for about 28% of the variance (Nagelkerke  $R^2$ ). Openness to Experience (OR = 1.14, CI = 1.07–1.21,  $p < .001$ ), Agreeableness (OR = .89, CI = .84–0.96,  $p < .001$ ), and Fantasizing (OR = 1.06, CI 1.01–1.13 =  $p < .05$ ) were the only statistically significant predictors. This is entirely in line with the group comparisons.

#### 4. Discussion

This study contrasted the personality profile of a group of people with synaesthesia against age and sex matched controls. As predicted from previous studies suggesting an artistic inclination, synaesthetes were found to score higher on Openness to Experience. They also scored higher on a measure of Fantasizing which can be construed as conceptually related to Openness to Experience and perhaps also to factors such as mental imagery which are also self-reported as being more vivid in synaesthetes (Barnett & Newell, 2007; Price, 2009). Unexpectedly, one other trait was found to differ in synaesthetes relative to controls – Agreeableness was reported to be lower in synaesthetes.

There are several possible ways in which this pattern of association could be linked to a causal mechanism. One possibility is that the same factors (genetic or environmental) that give rise to the development of synaesthesia also give rise to the development of these traits (i.e., a correlated development account). Other possibilities are that synaesthesia itself causes personality to develop in certain ways (i.e., synaesthesia is causal); or that a given personality causes synaesthesia to develop (i.e., personality is causal). Of the three accounts the latter is the least plausible given the rarity of synaesthesia, its emergence in early development and its stability over time. In the absence of a plausible mediating latent variable, we speculate that the presence of synaesthesia causally affects the development of these particular personality traits.

The tendency for synaesthetes to score lower on Agreeableness was not predicted *a priori* and is harder to explain. At the very least, it gives us confidence that our data from this group is not affected by a social desirability bias. It is conceivable that having unusual experiences (and artistic/imaginative inclinations) makes one less cooperative. One study, comparing visual artists against non-artists also reported a similar personality profile to that documented here for synaesthetes: namely lower Agreeableness, higher Openness, higher Neuroticism (which was significant in our study when uncorrected), and higher positive schizotypy (Burch, Pavelis, Hemsley, & Corr, 2006). It is also possible that negative views

and disbelief expressed by others concerning synaesthesia can diminish Agreeableness.

Fantasizing aside, these synaesthetes have an essentially normal profile on empathy measures. This may not apply to other sub-types of synaesthesia not considered here; for instance, interpersonal experiences of touch (Banissy & Ward, 2007). It may also be expected that those that personify graphemes may be more empathic (Amin et al., 2011). Finally, there has also been conjecture of a possible link between synaesthesia and autism (Baron-Cohen et al., 2007; Simner, Mayo, & Spiller, 2009); for instance, on the basis that both may be linked to a concrete and visually-based cognitive style. Although we cannot say what the prevalence of autism spectrum disorder is within synaesthesia, we can say on the basis of this research that synaesthesia is generally not linked to an autistic-like reduction in empathy scores (e.g., see Baron-Cohen & Wheelwright, 2004).

In summary, synaesthesia is not only linked to unusual perceptual experiences it is also linked to a particular personality profile that is likely to affect how these individuals interact with the world and each other.

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