Individual differences in personality and face identification

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Abstract

Unfamiliar face identification is characterized by substantial variation between individual observers, but the cause of this variation is largely unknown. This study investigated whether individual differences in face identification are linked to an observer's personality, by combining performance on an established face-matching test with two in-depth personality assessments (the 16PF5 and the NEO-PI-R). The face test revealed a broad distribution in identification ability, but associations between face perception and personality were found only in female observers. In this group, correct face identifications related to low anxiety, low tension, and high emotional stability. These results suggest that associations between personality and face perception are limited, and are confined to anxiety and facets of neuroticism.

Keywords: face identification, individual differences, personality, anxiety

Introduction

The identification of unfamiliar faces is a difficult process that is marked by substantial individual differences. In a simple face-matching task, for example, in which observers decide if pairs of unknown faces depict one person or two different people, individual performance ranges from close-to-chance to perfect (Burton, White, & McNeill, 2010). Studies of recognition memory reveal a similarly broad distribution of ability, with individual *d'* scores ranging from 0.5 to 6.8 for old/new decisions to previously seen faces (Woodhead & Baddeley, 1981). The range of individual abilities in unfamiliar face identification is therefore substantial (see also Bindemann, Avetisyan, & Rakow, 2012; Bindemann, Brown, Koyas, & Russ, 2012; Russell, Duchaine, & Nakayama, 2009), but rather little is still known about their underlying cause.

Previous studies on unfamiliar face identification have focused on the properties of face photographs (e.g., lighting, viewpoint; for a review, see Johnston & Edmonds, 2009). However, as stimuli are typically held constant across participants, these external factors are unlikely to account for individual differences in face identification. Understanding these individual differences might therefore require an alternative approach that focuses on internal factors, within observers. Some of these factors have already been identified, but a complete picture remains elusive. A person's face processing ability appears to be related, for example, to contact-based factors, such as exposure to same- and other-race faces (e.g., Sporer, 2001). Competence in face perception may also reflect a more general advantage in visual processing ability, as people who are good at face recognition appear to be good at object and scene perception (Woodhead & Baddeley, 1981), while face-matching performance correlates with short-term memory, perceptual speed, and object-matching ability in adults (Megreya & Burton, 2006). These studies suggest, therefore, that good face processing ability is linked to similar proficiency in other visual tasks.

Intriguingly, however, several studies suggest that face perception ability is also driven by factors that are "non-visual" in nature. High anxiety, for example, seems to reduce individual face recognition performance (Mueller, Bailis, & Goldstein, 1979; Nowicki, Winograd, & Millard, 1979), and subjects are also more accurate under moderate than high arousal (Brigham, Maass, Martinez, & Whittenberger, 1983). There is also evidence that observers exhibiting high levels of extroversion and emotional stability are more accurate at face recognition than introvert and neurotic individuals (Li et al., 2010). These findings are somewhat inconclusive as others have failed to find a similar role for extroversion (Thompson & Mueller, 1984), but neuroticism does appear to produce a consistent negative impact on face recognition (Bothwell, Brigham, & Pigott, 1987). Taken together, these studies therefore already demonstrate a connection between some personality traits and face identification ability.

In this paper, we sought to extend these findings in two important respects. Firstly, previous studies have focused only on a selection of personality traits so our aim was to provide a more comprehensive assessment. In addition, the previous research in this field has examined the role of personality in face processing with recognition *memory* paradigms. Face perception and memory appear to be separable components (see, e.g., Herzmann, Kunina, Sommer, & Wilhelm, 2009; Wilhelm et al., 2010; Megreya & Burton, 2008) that can be manipulated to produce different task outcomes (see, e.g., Bindemann, Sandford, Gillatt, Avetisyan, & Megreya, 2012). This raises the question of whether an association between personality and face perception ability persists when such memory demands are eliminated.

To investigate this issue, we used a face matching task, in which observers had to identify a face target from a concurrent identity-lineup (see, e.g., Megreya & Burton, 2006, 2008). This test provides a sensitive measure of individual ability and also a "pure" measure of unfamiliar face identification, by minimising any memory demands (Megreya & Burton, 2008).

Performance on this test was then correlated with Cattell and Cattell's (1995) Sixteen Personality Factor Questionnaire (16PF5) in Expeirment 1, and with the NEO big-five personality inventory (NEO-PI-R) in Experiment 2 (Costa & McCrae, 1992). These are two widely used personality assessments that include the factors that have been linked previously to face recognition but also offer extended taxonomies, beyond the traits that have already been highlighted.

Experiment 1

Method

Participants

One hundred and sixteen students from Menoufia University participated for course credit (M_{age} = 20.5, SD_{age} = 0.7; 50% female). None reported to suffer from psychological disorders.

Materials

The face task

One hundred 1-in-10 face-matching arrays were used in this experiment, which were taken from an Egyptian database (for full details, see Megreya & Burton, 2008). Each stimulus array consisted of a video still of a face target and an identity lineup comprising digital photographs of ten faces, which was shown simultaneously with the target. For each target face (N = 50), two accompanying lineups were created, in which the target identity was either present or absent. All face images measured approximately 5 x 7 cm and were shown in a similar full-face view with a neutral expression. An example display is provided in Figure 1.

---------- FIGURE 1 HERE PLEASE ----------

Sixteen Personality Factors 5th Edition (16PF5)

The 16PF5 is a self-rating questionnaire of 170 items measuring five global personality factors (extraversion, anxiety, tough-mindedness, independence, and self-control), which consist of 16 further sub-traits (see Cattell & Cattell, 1995). The validity of this hierarchical structure has been confirmed in several cultures and the global factors of the 16PF5 correlate strongly with other personality scales, such as the five-factor model in the NEO-PI-R (e.g., Rossier, de Stadelhofen, & Berthoud, 2004). This indicates that this is an appropriate questionnaire for the present study.

The 16PF5 was translated from English into Arabic for this experiment. We therefore re-tested a sample of our participants (15 females, 15 males) after an interval of 2 weeks to examine the reliability of the Egyptian 16PF5. Pearson's *r* ranged from 0.64 to 0.88 (all *p*s < 0.001) between the test and retest for all 16 factors. Furthermore, a series of Alpha Cronbach tests using the whole sample (N = 116) showed high rates of internal reliability across all of the sixteen factors, ranging from 0.71 to 0.84 with an average of 0.83.

Procedure

The order of the face task and the personality assessment was counterbalanced. Each participant completed 50 face matching trials (25 target-present, 25 target-absent), which were presented intermixed, but in a fixed random order, in a booklet at a rate of one array (1 video still and 10 photos) per page. Participants were randomly assigned to one of two sets of stimuli in order to counterbalance target present/target-absent face matching arrays. For each array, participants were asked whether the target was present, and if so, to indicate which of the faces they believed it to be. The task was self-paced and accuracy was emphasized. The 16PF5 was administrated according to the standard instructions of the test (see Cattell & Cattell, 1995).

Results and Discussion

Performance on target-present and target-absent trials of the face task reflects dissociable processing abilities (Megreya & Burton, 2007), so these conditions were analyzed separately. We calculated the percentage of correct identifications for target-present lineups, and correct rejections for target-absent displays, which refers to the accurate response that the target is not in the lineup. The correct identification rate was 76.6% (*SD* = 14.8%), whereas the correct rejection rate was 70.6% (*SD* = 21.0%). No sex differences were found for these measures, $t(114) = 1.28$ and 1.12, both ps > 0.05. A series of one-sample Kolmogorov-Smirnov tests of these two face matching measures using the female and male data (separately) showed that performance was distributed normally around the means (Zs ranged from 0.78 to 0.99, all ps > 0.05).

The personality measures were also distributed normally. The Kolmogorov-Smirnov Z scores for the global five factors using the female and male data ranged from 0.80 to 0.99, all ps > 0.05. However, in contrast to the face test we observed sex differences in personality traits, in line with previous research (e.g., Booth & Irwing, 2010). Females expressed higher levels of anxiety, $t(114) = 2.08$, $p < 0.05$, tough-mindedness, $t(114) = 4.83$, $p < 0.001$, and self-control, $t(114) = 3.40$, $p < 0.01$, whereas the females and males were matched evenly in extraversion, $t < 1$, and independence, $t = 1.52$. For this reason, the subsequent analyses were conducted separately for male and female observers.

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A series of correlations was performed between the five global personality factors and face matching performance (see Table 1). To adjust for multiple comparisons, correlations were considered significant only if *p* values were below 0.01 to increase the power of this analysis. This analysis revealed a negative correlation between correct identifications and anxiety in female participants, but not in male observers (see Figure 2). No other correlations were found.

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We followed up the negative correlation between correct identifications and anxiety in female participants by splitting the latter into its personality sub-factors (emotional stability, vigilance, apprehension, and tension). This analysis shows that correct identifications correlated positively with emotional stability, $r(56) = .32$, $p < 0.01$, and negatively with tension, $r(56) = -.49$, $p < 0.001$, but not with vigilance, $r = –.16$, or apprehension, $r = –.20$.

Anxiety, emotional stability and tension relate to the personality factor of neuroticism (DeNeve & Cooper, 1998; Goldberg, 1992). They may therefore reflect a common trait here, whereby stable and relaxed individuals are more accurate on the target-present trials of the face test than reactive and tense participants. This observation converges with previous reports of correlations between face recognition memory and anxiety (Mueller et al., 1979; Nowicki et al., 1979) or neuroticism (Bothwell et al., 1987; Li et al., 2010). In contrast to previous studies, these associations were found here with a face task that minimizes any memory demands. However, it is also notable that these correlations were only observed in female observers. We return to a discussion of these sex differences in the General Discussion, but first we therefore sought to replicate our findings with a larger sample of female observers in another experiment. For this purpose, we combined the face test of Experiment 1 with the NEO-PI-R. The five-factor model

of this personality assessment correlates with the global structure of the 16PF5 (e.g., Rossier et al., 2004), and is therefore appropriate to assess the reliability of our findings.

Experiment 2

Method

Participants

Eighty-two new female students participated for course credit (M_{age} = 18.9, SD_{age} = 0.5). None reported to suffer from psychological disorders.

Materials and Procedure

This experiment consisted of the face-matching task from Experiment 1 and the NEO-PI-R (Costa & McCrae, 1992). The NEO-PI-R measures the five-factor model of personality (extroversion, agreeableness, conscientiousness, neuroticism, and openness to experience), and 6 subordinate traits (facets) within each factor. Note, however, that the Egyptian version of this test does not include two facets of openness to experience (actions and values) because their operational definitions are not consistent with Egyptian culture.

As in Experiment 1, thirty participants completed the Egyptian version of this test twice to assess its reliability, in a fortnightly interval. This revealed strong positive correlations between the two tests for all personality facets, with *r* ranging from 0.65 to 0.87. Furthermore, there were good Alpha Cronbach rates across all facets, ranging from 0.76 to 0.87. The face task and personality assessment were then administrated in the main experiment in a counterbalanced order.

Results and Discussion

On the face test, observers registered 76.6% correct face identifications (*SD* = 17.1%) and 69.5% correct rejections (*SD* = 22.5%). As in Experiment 1, these face measures (*Z*s ≥ 1.06, *p*s > 0.05) and all of the global and individual personality factors (all *Z*s ≥ 0.44, all *p*s > 0.05) were distributed normally. Table 2 shows Pearson's correlations between the face test and the big-five personality factors. This data shows that no correlations between the face test and the global personality factors were found.

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However, because Experiment 1 reported correlations between correct identifications and three factors of neuroticism (anxiety, emotional stability, and tension), we also correlated performance on the face test with the six personality facets underlying neuroticism in the NEO-PI-R (anxiety, angry hostility, depression, self consciousness, impulsiveness, and vulnerability; see Table 3). As in Experiment 1, these correlations were only considered significant if *p* values were below 0.01. This analysis revealed that only anxiety correlated with correct identifications, $r(80) = -.30$, $p < 0.01$, whereby more anxious observers were less likely to identify the targets from the lineups.

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General Discussion

In two experiments, we examined whether personality is linked to the ability to identify unfamiliar faces. For this purpose, we combined a matching task with two well-known personality inventories (the 16PF5 in Experiment 1 and the NEO-PI-R in Experiment 2).

Experiment 1 revealed strong sex differences in personality traits, which is consistent with much previous research (e.g., Booth & Irwing, 2010). However, face matching only appeared to be related to the global personality trait of anxiety, so that more anxious observers were less likely to correctly identify the face targets from the lineups. These results were only found with female participants and not with male observers, but the scatter plots in Figure 2 indicate that this negative correlation does not simply arise from some highly anxious outliers in the female sample. Rather, this data points to a robust association between anxiety and face matching here. The effect of anxiety is underpinned by correlations between correct identifications with emotional stability and tension. This suggest that stable and relaxed individuals are more accurate on the target-present trials of the face test than reactive and tense participants. Finally, Experiment 2 replicated the correlation between correct face identifications and anxiety in female participants, while all other personality factors, once again, did not correlate with face matching. Taken together, these experiments therefore provide good evidence that anxiety is related to face matching accuracy.

These findings converge with previous research which has found negative correlations between face recognition memory and anxiety (e.g., Deffenbacher, Bornstein, Penrod, & McGorty, 2004; Valentine & Mesout, 2009). Moreover, anxiety, emotional stability and tension are all aspects of neuroticism, which also correlates with face recognition memory (Bothwell et al., 1987; Brigham et al., 1983; Li et al., 2010; Mueller et al., 1979; Saito et al., 2005; Nowicki et al., 1979). In addition, previous studies have also shown a similar gender bias to the present findings. Nowicki et al. (1979) found, for example, that anxiety correlated with face recognition, but only in female observers. Similarly, Valentine and Mesout (2009) observed that eyewitness identification was modulated by anxiety on target-present lineups, and this effect was particularly pronounced in female observers, in whom identification accuracy was twice as low as in male

eyewitnesses (25.9% vs. 65.5%). Moreover, in a meta-analytic review of eyewitness identification, high levels of anxiety also exerted a detrimental effect on identification accuracy but only in female participants (Deffenbacher et al., 2004). Females typically report higher levels of anxiety than men (see, e.g., McLean, Asnaani, Litz, & Hofmann, 2011) and this was also the case here, which indicates that these gender differences might reflect the occurrence of higher anxiety levels in the former group.

In contrast to previous studies, the current experiments show that the relationship with anxiety persists with a "pure" test of face identification that minimizes memory demands. This is a potentially important finding for understanding face perception. A renewed focus on individual differences in face identification is currently emerging, which points to a broad distribution in ability across observers (see, e.g., Bindemann et al., 2012; Burton et al., 2010; Russell et al., 2009). In these studies, external factors, such as stimulus properties and viewing conditions, are usually held constant across participants. A focus on internal or "non-visual" factors, such as personality, might therefore be necessary to understand interindividual variation. In the current study, we sought to provide an important step in this direction by combining a sensitive test of face identification ability with broad personality assessments that cover many traits. Both experiments suggest that anxiety is one of the internal factors that contributes to individual differences in face processing. In addition, the comprehensive personality assessments that were used here also allow us to eliminate many other personality traits that did not correlate with unfamiliar face identification.

A benefit of this, we hope, is to allow future research to concentrate on fewer variables, based on these results, to pursue more specific research questions. One open question is, for example, whether the interactions between face processing and personality that were observed here are face-specific or generalize to non-face objects. Anxiety, for example, can affect a range

of visual tasks and particularly those placing strong demands on cognitive resources (see, e.g., Derakshan & Eysenck, 2009; Eysenck, Derakshan, Santos, & Calvo, 2007; Sadeh & Bredemeier, 2011). Moreover, anxiety correlates negatively with visual tasks such as the Matching Familiar Figures Test, which is based on non-face stimuli but is conceptually similar to the face test employed here (Dusek, Mergler, & Deyaegerkermis, 1976). Neuroticism also appears to impair cognitive performance on a variety of tasks (e.g., see Matthews, 2004; Robinson & Tamir, 2005), which could suggest that the correlations between anxiety/neuroticism and face matching that were observed here are general effects. However, it is also conceivable that these effects are specific to face processing. Anxiety has, for example, been characterized by an avoidance of threatening emotional faces (see, e.g., Fox, 2008). If this reduces general exposure to faces, then this could perhaps also affect a person's proficiency to differentiate facial identities in a matching task.

The present study cannot address whether the relation between anxiety and face matching is face-specific or relates to more general cognitive impairments associated with this personality trait. In fact, the issue of face-specificity remains in itself divisive despite the already large literature on whether faces are processed in the same way as other stimuli (see, e.g., Bentin et al., 2007; Gauthier & Bukach, 2007), and we therefore did not attempt to address this question. However, considering the direct importance of faces for human social interaction (see, e.g., Hari & Kujala, 2009) and the many links between personality and social behavior (see, e.g., Rhodewalt, 2008), investigations into face perception and personality are clearly worthy in its own right (see, e.g., Cheung, Rutherford, Mayes, & McPartland, 2010). Moreover, individual differences in face perception are of great current interest and further studies, focusing on personality or alternative "internal" factors, may be needed to explain variation between observers in this ability.

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TABLE 1. Correlations between Face Matching and the Global Factors of the 16PF5 in Experiment 1 (*p* values in parentheses)

	Correct Identifications		Correct Rejections	
	Females	Males	Females	Males
Extraversion	–.13 (.32)	–.08 (.56)	.03 (.81)	.06 (.67)
Anxiety	–.44 (<.01)	–.05 (.73)	–.02 (.91)	–.01 (.92)
Tough-Mindedness	–.15 (.26)	.03 (.84)	–.01 (.99)	.10 (.46)
Independence	–.23 (.09)	.05 (.70)	.27 (.04)	.13 (.34)
Self-Control	.11 (.42)	.05 (.70)	.23 (.08)	.03 (.80)

TABLE 2. Correlations between Face Matching and the NEO-PI-R (*p* values in parentheses)

	Correct Identifications	Correct Rejections
Neuroticism	–.14 (.20)	.08 (.47)
Extroversion	.12 (.29)	.03 (.78)
Openness to Experience	.20 (.07)	.02 (.88)
Agreeableness	.06 (.61)	.11 (.30)
Conscientiousness	.12 (.27)	.03 (.79)

Table 3. Correlations between Face Matching and the Sub-traits of Neuroticism in the NEO-PI-R (*p* values in parentheses)

	Correct Identifications	Correct Rejections
Anxiety	–.30 (<.01)	.08 (.47)
Angry Hostility	–.07 (.53)	.04 (.69)
Depression	.05 (.64)	.18 (.11)
Self Consciousness	–.17 (.12)	–.01 (.96)
Impulsiveness	.09 (.44)	–.01 (.92)
Vulnerability	–.15 (.17)	.04 (.73)

FIGURE 1. An example stimulus from the face identification task. The target person shown at the top may or may not be one of the ten below. Observers had to decide whether the target is present in the lineup, and if so, indicate which face he is.

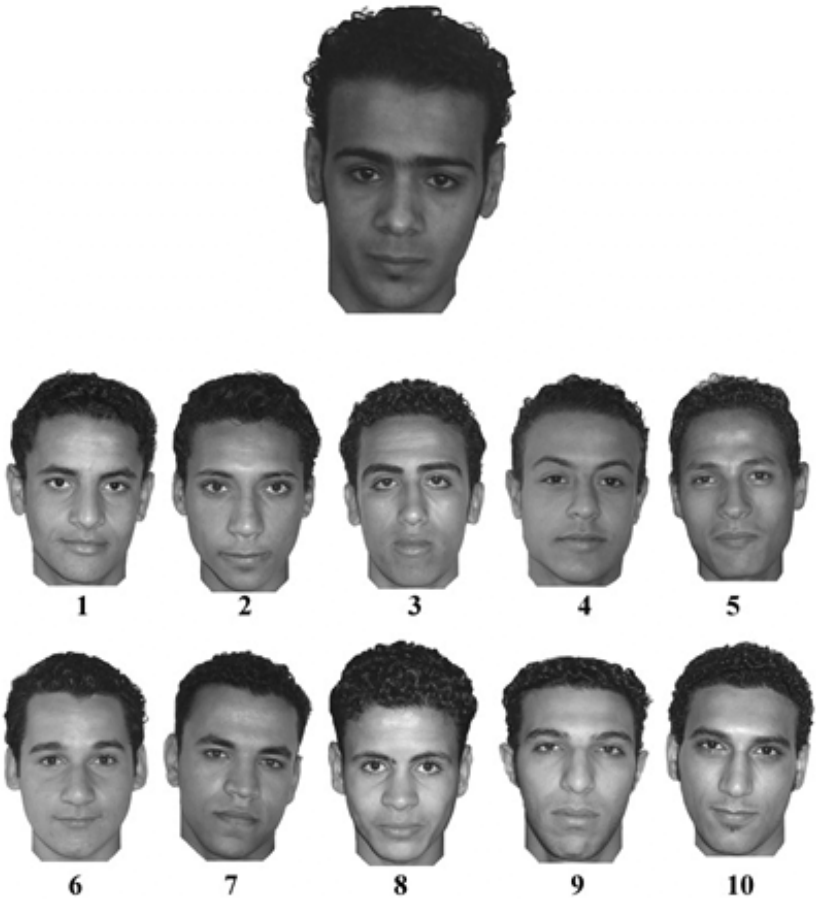

Figure 2a. The relationship between anxiety and correct identifications (in % responses) in female participants in Experiment 1.

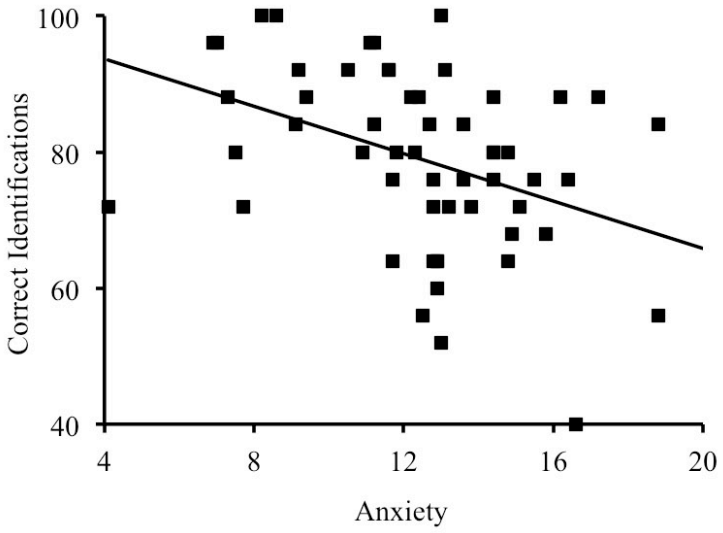

Figure 2b. The relationship between anxiety and correct identifications (in % responses) in male participants in Experiment 1.