

Eye color predicts disagreeableness in North Europeans: Support in favor of Frost (2006)

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## Abstract

The current study investigates whether eye color provides a marker of Agreeableness in North Europeans. Extrapolating from Frost's (2006) research uncovering an unusually diverse range of hair and eye colour in northern Europe, we tested the hypothesis that light eyed individuals of North European descent would be less agreeable (a personality marker for competitiveness) when compared to their dark eyed counterparts, whereas there would be no such effect for people of European descent in general. The hypothesis was tested in Australia to provide consistent environmental conditions for both groups of people. Results support the hypothesis. Implications and conclusions are discussed.

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(2006)

Since the influential book on eye color by Morgan Worthy (1974), a small number of researchers have been interested in whether eye color provides an indication of personality and associated behavior. Eye color is determined by the number and size of melanin particles in the layers of the iris. More melanin therefore makes the eyes appear darker (Sturm & Frudakis, 2004). The lightest shade is blue through gray, green, hazel and brown to black, the darkest shade. Eye color has been shown to be related to alcohol use (Basett & Dabbs, 2001), response styles (Worthy, 1974), non-verbal communication and sociability (Gary & Glover, 1976) and although at first thought the proposal of a relationship between amount of melanin in the iris and behavior seems unexpected, there are some good theoretical reasons for thinking that such a relationship may exist.

One explanation that has been offered to link these two concepts together is from an environmental and evolutionary perspective. Eye color diversity appears to be consistent with sexual selection as this form of selection is known to particularly favor color traits and color polymorphisms. Frost (2006) argues that sexual selection was stronger in ancestral Northern and Eastern Europeans because the steppe-tundra environment of the last ice age skewed the operational sex ratio towards a male shortage. There were two causes for this shortage of males: firstly, men had to hunt over large distances in search for herds thereby often incurring injuries and dying younger; secondly, women had fewer opportunities to

gather food and thus required more male provisioning, resulting in less polygyny. As a consequence, women were forced to compete for mates because there were fewer males in existence and even less polygynous ones. Frost (2006) suggests that this male shortage led to an increased diversification of eye coloring. Such a rare-color advantage may have produced new hair and eye colors among Europeans during this period of intense sexual selection. Although there is some evidence indicating that the 'average' or 'familiar' other is attractive (e.g. Jones & Hill, 1993; Thornhill & Gangestad, 1993; Grammer & Thornhill, 1994) there is compelling evidence to suggest that rare-colour advantage exists and is a powerful determinant for humans (e.g. Riedl, 1990; Schweder, 1994; Thelen, 1983).

Whilst it has been suggested that the stability of personality has a genetic basis the nature of this influence is still unclear (Penke, Denissen & Miller, 2007). To date, most research has focused on the idea that eye color is related to personality according to the original theory by Worthy (1974) in which dark eyed people tend to be sensitive, quick and reactive and light eyed people tend to hesitate, be inhibited and be self-paced. However, Worthy's research was mostly preoccupied with simple motor performance as opposed to personality. Although our logic is supported by Worthy's (1974) findings, the current study does not follow Worthy's (1974) position that personality differences are caused by differences in physiology. Similarly, whilst our research is not aimed at replicating literature on the existence of a shared eye color/personality gene (PAX6) (Larsson, 1998) it is supported by these genetic findings.

The rationale of this paper is based on the logical reasoning that if competitiveness can be displayed in a physical form (Frost, 2006) then it may also be displayed

psychologically. Unlike Worthy (1974), it is argued that the predicted relationship between eye color and personality resulted from the higher need to be competitive in the North European climate. A competitive person is characterised by a tendency to be antagonistic, egocentric, and sceptical of others' intentions rather than cooperative and, as such, could be expected to score low on a measure of Agreeableness. Since eye color is weakly sex-linked (Frost, 2006) we do not anticipate this phenomena to still be present in only females, we argue that light-eyed people, whatever their sex, would be more competitive psychologically than dark eyed people if they are of north European descent.

We think that the intrasexual competition amongst females during the last ice-age was focused on two aspects, firstly attracting a mate and secondly, maintaining some kind of commitment from their mate and defending against challenges from other women. Intrasexual competition includes tactics such as derogating competitors, sexual poaching, exerting dominance and guarding acquired mates (Buss, 1988). Psychological competitiveness between females, together with the rare-color advantage of light eyed females, is likely to increase the chance of being noticed by a male. Moreover, competitive personality traits (such as wanting to beat others and being sceptical of others' intentions) secure the long-term commitment necessary for self and off-spring survival. Whilst some may argue that it is unlikely that a male would choose a disagreeable female we argue that mating is not the sole choice of males and that the disagreeable traits of competitive women are directed primarily at other female competition rather than towards males per se.

Our suggestion that female – female competitiveness has an adaptive significance is in line with other research stipulating that ‘the dynamics of human mating involve

female-female competition and male choice, in addition to male-male competition and female-choice' (Geary, 1998, p. 121). Furthermore, it could be argued that some males would consider competitive females as having great reproductive value, that is, males would be attracted to their competitiveness as a trait that they would want transferred to their offspring (e.g. Buss, 1988).

In summary, Frost (2006) argues that differential mating with light-eyed females from Northern Europe led to hair and eye color differences across men and women. We extend this by arguing that light-eyed females of north European descent are likely to also have been competitive and that this will lead to traits of psychological competitiveness being related to eye color across men and women. No such relationship would be expected from a broad mix of Europeans.

Specifically, we hypothesise:

*Light eyed ethnically white North Europeans are more competitive (i.e. less agreeable) than their dark eyed counterparts.*

Whilst there is some research linking eye color to personality (e.g. Gary & Glover, 1976; Bassett & Dabbs, 2001) there is also evidence that such a relationship does not exist (e.g. Rim, 1983). This study attempts to address this inconsistency. Unlike previous studies, the current research is aimed at testing this relationship for just North Europeans as opposed to within a single ethnic group.

## Method

### *Participants*

A total of 336 participants (266 females and 70 males) from the campus of a large

Australian University participated in exchange for partial course credit (average age = 21.63;  $SD = 7.43$ ). Participants of White UK origin were classified as North European in origin (63.1%) and all other white Europeans were classified as being of Non-UK White European descent. Our designation of participants from the UK as being classified as North European and subject to the effects of the Ice Age is in-line with Frost's (2006) theoretical account and Frost, by private communication (November, 2006), agrees with our classification. We chose UK participants as being representative of North Europeans because we thought that its relative isolation as an island would be more likely to have led to less migration than other parts of Europe which might be more commonly defined as being part of North Europe such as the Scandinavian countries.

The composition of Non-UK White Europeans can be estimated from two sources. Firstly, Australian immigration statistics show that Non-UK European immigrants are predominantly of Italian, Greek, Dutch and Polish origin (ABS, 2005). Secondly, the ethnic distribution of Australia has been estimated by Price (1999) as 69.88% Anglo-Celtic, 6.88% other North and West European, 6.96% Southern European and 4.36% East European, thereby suggesting that the Non-UK White European sample is a balanced mixture of North, South, East and West Europeans.

The participants were assessed in two groups to enable cross-validation of results. The first group ( $n = 278$ ; 178 = UK White origin; 100 = Non UK White origin) completed the NEO-IPIP questionnaire. The second group ( $n = 58$ ; 33 = UK White origin and 25 Non-White origin) completed the Big Five Inventory (BFI).

### *Measures*

(1) *Eye color*. Respondents reported their eye color as being Blue, Green, Hazel, Brown or Black. As noted by Worthy (1974), this reflects a natural continuum of melanin found in the iris where blue reflects a small amount and black reflects a large amount. Thus a scale of eye color was developed where Blue eyes were awarded 1, Green 2, Hazel 3, Brown 4 and Black 5. High scores therefore represent dark pigmented eyes.

(2) *NEO-IPIP Personality Questionnaire*. The International Personality Item Pool (IPIP, 2001) captures personality superfactors similar to Costa and McCrae's NEO Personality Inventory (NEO-FFI; 1992), and measures Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness to experience. The 50 items were measured on a five point scale ranging from 'Strongly Disagree' (1) to 'Strongly Agree' (5) with 'Undecided' (3) as the midpoint.

(3) *Big Five Inventory*. The Big Five Inventory (BFI; 1991) was administered which measures the dimensions of Openness, Conscientiousness, Agreeableness, Neuroticism and Extraversion. The 44 items were measured on a five point scale ranging from 'Disagree Strongly' (1) to 'Agree Strongly' (5) with 'Neither agree nor Disagree' (3) as the midpoint. Alpha reliabilities for these scales are high (John, Donahue & Kentle, 1991).

### *Procedure*

Participants completed the battery of electronically administered questionnaires under the direct supervision of a research assistant. Each participant was given instructions on how to complete the electronically formatted survey.



## Results

Table 1 shows the means, standard deviations, alpha reliabilities and correlations of all the scales used in this study. All the alpha reliabilities are satisfactory. Table 1 also shows the correlations between eye color and personality split between those of Non-UK White European and North European descent.

Northern European's eye color was found to correlate significantly and reasonably strongly with both measures of Agreeableness across both samples. Specifically, the relationship indicates that light eyed Europeans are less agreeable than their dark eyed counterparts. Eye color was not found to significantly correlate with any personality dimensions for the more general Non-UK White European sample.

*Table 1.* Mean, standard deviation, alpha and correlations for eye colour split according to origin

\* indicates significance at .05. Note: 278 participants completed NEO-IPIP whereas 58 participants completed the BFI.

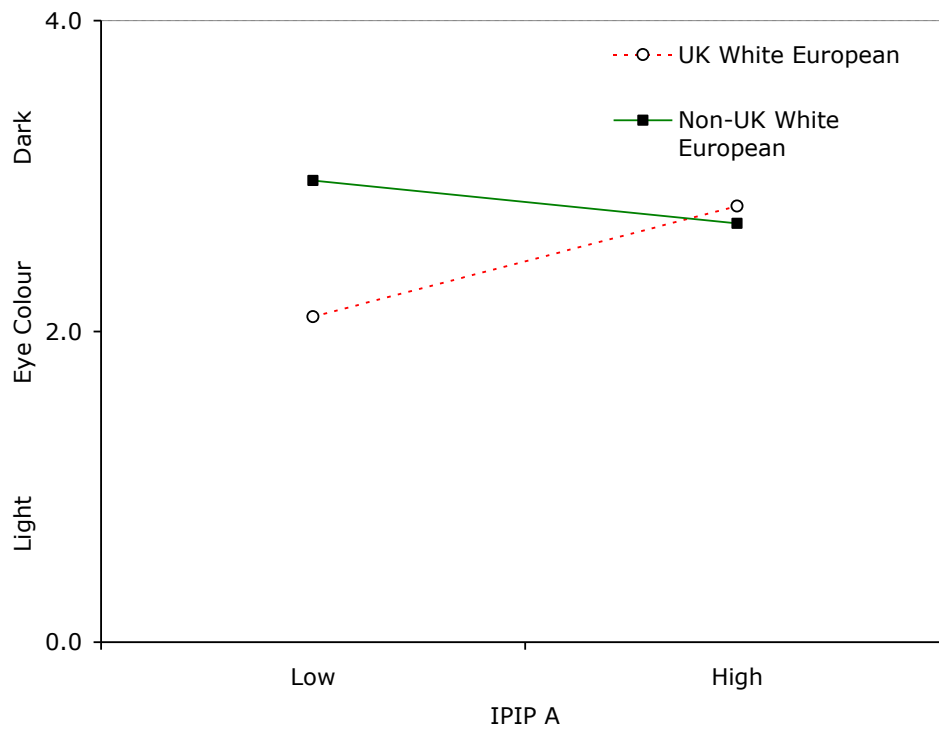
For sample 1, a moderated multiple regression was conducted with eye color and ethnicity as predictors and Agreeableness as the dependent variable. In Step 1, mean centred eye color and ethnicity were entered. In Step 2, the interaction was entered. The

Dimension	M	SD	Alpha	Non-UK White	Northern European
				European descent	descent
				Eye Colour	Eye Colour
Agreeableness					
NEO	38.80	4.49	.738	-.128	.206*
BFI	30.55	2.84	.768	.070	.463*
Extraversion					
NEO	33.43	6.88	.881	-.083	.064
BFI	27.65	2.85	.897	.115	.176
Neuroticism					
NEO	31.00	6.98	.860	-.030	.051
BFI	25.38	2.84	.853	-.206	.173
Conscientiousness					
NEO	31.89	5.46	.741	-.115	.110
BFI	31.98	3.34	.775	.089	.271
Openness to experience					
NEO	35.67	5.62	.795	-.066	.116
BFI	35.48	4.56	.725	.080	.018
Psychoticism					
EPQ	7.26	3.97	.718	.086	-.091

ethnicity x eye color interaction significantly predicted Agreeableness ( $B = -.161, t(232) =$

-2.462,  $p = .015$ ). The plot of the significant interaction is shown in Figure 1. The simple slope shows that eye color significantly predicts Agreeableness for North Europeans ( $B = .7364$ ,  $t(229) = 2.76$ ,  $p = .006$ ) but not for Non-UK White Europeans ( $B = -0.196$ ,  $t(229) = -0.727$ ,  $p = .468$ ).

Figure 1. Interaction between Ethnicity and Eye Colour in the prediction of Agreeableness



## Discussion

These results showed that North European eye color was significantly related to two measures of Agreeableness across two different samples such that the darker the eyes

the more agreeable the individual. In contrast, no significant correlations were found for the White Non-UK European sample. Combined these results support the hypothesis that lighter eyed North Europeans are more competitive than their darker eyed counterparts. Moreover, eye color was not predictive of any personality dimension for Europeans in general; only for a particular subset (North Europeans).

These results suggest that there is a distinct difference between those of North European descent and other Europeans such that the darker a Northern European's eye color the more likely they are to be altruistic, sympathetic to others and eager to help. Conversely, lighter eyed people are more likely to be observed as competitive, egocentric and sceptical of others intentions. However, light eyed and dark eyed Europeans as a general group did not significantly differ on any of the personality variables regardless of the personality questionnaire used.

This study extends Frost's work by suggesting that the physical utility resulting from rare-colour advantage can also be realised psychologically. Specifically, these results are in accordance with our earlier reasoning that psychological competitiveness and the rare color advantage of light eyed females worked to first attract a mate and then the competitive personality traits secured the long-term commitment necessary for self and off-spring survival. Whilst others may argue that such a link between eye color and competitiveness has no adaptive significance we argue that this is not the case for two reasons. Firstly, blue eyes are still much rarer than brown and thus selection based on rare color advantage, even in the present time, may still exist in North Europe. Secondly, this genetic competitive advantage is likely to persist since only mutations with negative or

survival limiting effects are selected out of the population (Peneke et al., 2007).

Additionally, these results are in line with our reasoning that through mating with light-eyed females the traits of psychological competitiveness have been inherited by both males and females such that results generalise across the sexes. It might be considered surprising that competitive females seem to have an advantage in mate selection since at first thought it seems unlikely that such females would be considered desirable by males. However we are not surprised by this relationship. Competitive females have advantages in terms of both competing with other females and in securing male interest and co-operation and although very few researchers have looked at this area, there is some evidence to indicate that male choice influences female-female competition (Smuts, 1987). These results are in line with other research findings that women, compared to males are likely to engage in more subtle aggressive behaviors such as social manipulation rather than obvious aggressive behaviors like fighting (Powch & Houston, 1996; Bjorkqvist, Oesterman & Kaukiainen, 1992). Females tend to inhibit their anger (Eron, 1992) and therefore, it is unlikely that a male would suspect much less be discouraged from mating with a female simply because of her competitive temperament. Furthermore, evidence provided by Rudman (1998) indicates that self-confident and assertive women are perceived as more competent (by both males and females) and were more likely to be hired by males who were outcome dependent. Similarly, Buss' (1988) results support the evolutionary hypothesis that reproductive capability in females is a powerful trait that can be used to attract male partners. Therefore, linking back to the focus of this paper, it might even be argued that a male would be attracted to a competitive female since such competitiveness

would be considered as an adaptive advantage transferred to offspring.

Whilst our results provide evidence that expands on the work of Frost (2006), some limitations need to be noted. An alternative but not necessarily mutually exclusive explanation for these results is that differences in eye color and agreeableness may be affected by possible sex differences. For instance, the hair and eye color variability in Europe may be mildly sexually dimorphic and could potentially be related to prenatal oestrogen (Frost, 2006). Unpublished work reviewed by Frost found that non-brown-eyed individuals have longer second fingers in relation to their fourth fingers (Manning, 2006) and a high level of prenatal exposure to oestrogen/testosterone is indicated through this kind of relationship between the digits. Additionally, some women may be less agreeable because of higher levels of prenatal oestrogen. Fink et al (2004) found a negative correlation between digit ratio and agreeableness in women but not men; however, Luxen and Buunk (2005) found a positive correlation for both sexes and Lippa (2006) failed to find a significant correlation. This question remains largely unsettled but in general does not conflict with the findings of our research.

It would be interesting to see if the relationship between eye color and Agreeableness would be also found in just dark eyed females of north European descent. However, due to the small number of males in our sample it was not possible to test this hypothesis and moreover we have argued the relationship between eye color and Agreeableness is likely to be found in North Europeans across both sexes. However, future research could aim at trying to resolve this issue.

The fact that participants were tested in the same neutral environment can be

considered a strength of this experiment. Sharing the same levels of light, atmospheric temperature and humidity rule out the possibility of environmental factors interacting with eye color to affect personality and its associated behaviors. Another strength of this study is the employment two different personality tests across two samples as this increases the criterion validity of the personality construct.

We classified our white UK participants as being North European which fits in well with Frost's (2006) classification and we think that our UK sample might have been kept reasonably pure due to the UK's island status. Nevertheless, our results should be interpreted in the context that the UK has been subject to migration since the Ice Age (such as by the Romans, the Saxons and the Normans) which will have served to reduce the likelihood of finding support for our hypothesis.

In summary, this study reports that dark eyed North Europeans are more agreeable and therefore, less competitive, than their light eyed counter parts. Furthermore, this study has extended previous research by testing the relationship of personality and eye color within North Europeans only. The current study provides first evidence that eye color, for North Europeans, is related to Agreeableness and presents results that extend Frost's (2006) theory. We think our study goes some way to understanding why research on personality and eye color which is usually conducted within or across race has tended to produce equivocal results.

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