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DO DOMINANT-LOOKING MALES HAVE BROWN EYES? A FURTHER INVESTIGATION OF THE ROLE OF IRIS COLOUR FOR DOMINANCE PERCEPTION

ABSTRACT: The eyes represent a conspicuous facial element of unique appearance; they play an important role in signalling and communication within many animal species including humans. In this paper, we investigate the possible influence of eye colour on the perception of dominance. This research is based on our previous study (Kleisner et al., 2010: Pers. Individ. Dif. 49: 59–64*) showing that eye colour had a significant effect on perceived dominance. Facial photographs of university students were rated for perceived dominance. To control for a possible idiosyncratic effect of selected facial photographs, the two distinct samples were compiled. The first sample of photos consisted of 80 faces and the second of 120 faces; both were of students from the Faculty of Science, Charles University in Prague. The rating of photographs was performed by volunteers from three different regions: Prague, Ústí nad Labem (both Czech Republic), and Tartu (Estonia). Controlling for sample and location, we showed that there is no statistically significant relationship between eye colour and perceived dominance: Prague (*P *= 0.822), Ústí nad Labem (*P *= 0.778), and Tartu (*P *= 0.565). These negative results thus contradict the previous study, wherein males with brown eyes were perceived as more dominant than males with blue eyes. In this study we consider the possible local-specific differences and confounding random factors which might be responsible for the previous positive results on an association between eye colour and the perception of dominance.*

KEY WORDS: Eye colour – Perceived dominance – Facial appearance – Cross-cultural comparison

INTRODUCTION

A considerable number of studies have described facial appearance as a cue for attributing different psychological characteristics to the face bearer (Langlois *et al.* 2000, Zebrowitz 1997). To some extent, the personality judgments from facial appearance are based on psychological processes established during human evolution (e.g., Shevlin *et al.* 2003). However neutral in expression, mere facial appearance could give an

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impression of such characteristics as attractiveness, babyfaceness, racial, or sex prototypicality, dominance, sociability, or trustworthiness (Montepare, Dobish 2003, Todorov 2008, Zebrowitz 2011, Zebrowitz, Montepare 1992).

In the human face, the viewer's attention appears to be captured by the eyes (Langton *et al.* 2000). The eyes, then, are not solely light sensitive physiological organs that receive a wide range of information from the outside world. The unique appearance of human eyes may also serve as a source of information about the outer behaviour as well as the inner attitude of the bearer. Compared to the closest human relatives, human eyes have a horizontally prolonged shape (Kobayashi, Kohshima 1997, 2001), an exposed white sclera (Kaplan, Rogers 2002), and a conspicuously coloured iris characterized by a variety of hues spanning from light blue to dark brown (e.g., Sturm, Frudakis 2004). The white sclera enables others to follow gaze direction (Tomasello *et al.* 2007). However, the very appearance of eyes including their colour is a quite often a neglected component in facial perception research.

There is some evidence of a relationship between iris colour and various physiological or psychological factors. The close metabolic relation of melanins to catecholamines indicates the possibility of hypertension in dark-eyed persons (Friedman *et al.* 1990), whose iris pigment epithelium contains a relatively greater amount of melanin when compared with those of blue-eyed persons (Prota *et al*. 1998). Some authors suggest a relation of eye colour to specific aspects of psychological functioning. Basset and Dabbs (2001) reported an increased amount of alcohol consumption by individuals with blue eyes, which could result from their alleged behavioural inhibition and proneness to anxiety. Blue-eyed children were reported both as more behaviourally inhibited (Rosenberg, Kagan 1987, 1989), high-reactive (Kagan, Snidman 2004), and socially wary (Coplan *et al.* 1998).

Human eye colour is also one of the traits investigated as a responsible factor in assortative mating. Little *et al*. (2003) suggested that the single best predictor of both male and female partner eye colour is the opposite-sex parents' eye colour. In the study of Laeng *et al*. (2007), male blue-eyed participants rated blue-eyed women as more attractive than brown-eyed women. Contrary to these findings, our own study did not show any relation between perceived attractiveness and eye colour in either males or females (Kleisner *et al.* 2010).

Based on the study of Coplan *et al.* (1998), we also asked whether eye colour may influence the perception of other personality traits, such as dominance (Kleisner *et al.* 2010). Coplan *et al.* (1998) found a correlation between eye colour and social wariness within preschoolers: blue-eyed males were rated as more socially wary than males with brown eyes, more temperamentally inhibited and displaying more reticent behaviour. Along with Coplan's finding we asked whether there is association between eye colour and perceived dominance or submissiveness in adult individuals (Kleisner *et al.* 2010). We found that eye colour had a significant effect on perceived dominance in males: brown-eyed men were rated as more dominant than blue-eyed men (Kleisner *et al.* 2010). To control this non-obvious correlation, the actual iris colour of brown-eyed subjects was changed to blue and vice versa. With this manipulation, males with eye colour changed to blue were rated as more dominant than males with brown coloured irises. Therefore, the perception was not an effect of eye colour, but a likely effect of particular morphological facial features, which cause the differences in perceived dominance/submissiveness between brown-eyed and blue-eyed subjects. A geometric morphometric approach was used to detect those morphological features associated with eye colour (Kleisner *et al.* 2010). The presence of brown eyes was correlated with broader chin, prolonged mouth, larger nose, closer position of eyes, and thick eyebrows, i.e., characteristics largely linked with higher perceived dominance (Berry 1990, Cunningham *et al.* 1990, Mazur *et al.* 1994, Mueller, Mazur 1997, Thornhill, Gangestad 1994).

This study follows the previous work on a possible association between eye colour and perceived dominance (Kleisner *et al.* 2010). Here, we used the same methodological approach, but the tests were provided in two different regions of the Czech Republic and in Estonia. Our main objective was to re-test our previous findings, and also to test whether the correlation between eye colour and perceived dominance validates across different populations.

MATERIAL AND METHODS

Photographs

Photographs of students from the Faculty of Science at Charles University in Prague were taken with a digital camera, Nikon D90, using a 50 mm lens, studio flash, and a reflection screen. The photographed subjects were seated in front of a white background, 1.5 m distant from the camera, and instructed to adopt a neutral facial expression. All of the participants were informed in advance to avoid any facial decorations. The photographs were all standardized regarding the eye

TABLE 1. Age structure of the raters.

		All raters			Males				Females			
Locality	SET	*N*	Mean	SD	*N*	Mean	SD	Range	*N*	Mean	SD	Range
Ústí nad Labem	80	92	22.6	4.1	40	23.4	4.0	18–34	52	22.1	4.1	19–40
Tartu	80	30	23.8	4.3	13	24.1	4.0	20–32	17	23.6	4.5	19–38
Prague	120	84	20.8	1.9	24	22.0	2.6	19–29	60	20.3	1.2	19–24

position and the clothing of the photographed subjects was digitally cropped so that a standard, minimal length of neck was visible. The hair of the photographed subjects was left uncovered. From our collection of digital photos we selected 100 females and 100 males, both with unambiguous hues of blue and brown irises. Individuals with intermediate and green eye colour were excluded from the sample. To control for a possible idiosyncratic effect of selected facial photographs, we compiled two distinct sets, which consist of 80 (40 males: mean age = 20.8 years, range: 19–26 years; 40 females: mean age = 21.2 years, range: 19–26 years) and 120 photographs (60 males: mean age = 21.2 years, range: 19–34 years; 60 females: mean age = 20.6 years, range: 18–24 years), respectively. The age of participants did not significantly vary between the individual sets (Mann-Whitney *U* test; males: $P = 0.828$; females: $P = 0.145$). In each set, there were an equal number of blue-eyed and brown-eyed subjects of both sexes.

Ratings of photographs

The set of 80 photographs (SET 80) was judged mainly by the university students in Ústí nad Labem, Czech Republic and in Tartu, Estonia. We also repeated previous research in Prague (Kleisner *et al.* 2010), where we had originally used the same SET 80. Now, another sample of local students rated a larger sample of 120 photographs (SET 120). *Table 1* gives a detailed overview of the structure of all raters participating in the research.

Each person rated the complete set of photos for dominance on a 10 point scale where the lowest number stands for very submissive and the highest for very dominant. We used ImageRater 1.1 software, adapted for the presentation of photos for judgment. Raters saw images on a standard LCD 14" displays with 1280×1024 pixel resolution and clicked the selected value. There was no time limit to rate a particular photo. The order of the displayed pictures was randomised for each rating session. In the case that a rater might know a photographed subject, the software enabled us to skip the rating of that particular picture. After the rating of all the photographs, we asked each participant for his or her own eye-colour.

Statistics

The ratings of all photographs evaluated by each single rater were converted to *z*-scores to eliminate possible influence of individual differences in the raters use of the scale. Perceived dominance was calculated for each photo as its mean *z*-score. Dominance ratings of male and female raters in all locations were highly correlated (*Table 2*) so the ratings of both sexes were merged for all subsequent statistical analysis. The relation between perceived dominance and eye colour was tested by univariate General Linear Models (GLM), using SPSS 17 software. We built a linear model wherein a mean *z*-score of perceived dominance was a dependent variable, and the eye colour of the rated subjects was set as a fixed factor. Following the approach originally used in Kleisner *et al.* (2010), the analysis was performed separately for male and female sets of photographs. Effect size was expressed by partial η^2.

TABLE 2. Correlation between the number of male and female raters.

Locality	SET	Males	Females	*r*
Ústí nad Labem	80	40	52	0.875**
Tartu	80	13	17	0.666**
Prague	120	24	60	0.858**

** $P \leq 0.01$.

RESULTS

The relatively balanced ratio of blue-eyed and brown-eyed raters in Czech samples was controlled: 39

TABLE 3. A possible association between perceived dominance and eye colour investigated in Prague, Ústí nad Labem (Czech Republic), and Tartu (Estonia).

	Males			Females		
	F	*P*	η^2	*F*	*P*	η^2
Ústí nad Labem (SET 80)	0.081	0.778	0.002	0.320	0.575	0.008
Tartu (SET 80)	0.337	0.565	0.009	2.687	0.109	0.066
Prague (SET 120)	0.051	0.822	0.001	0.068	0.795	0.001
Prague (SET 80)[a]	5.035	0.031	0.117	0.005	0.942	0.000

[a] Kleisner *et al.* (2010).

blue-eyed, 42 brown-eyed, and 11 green-eyed in Ústí nad Labem, and 38 blue-eyed, 32 brown-eyed, and 14 green-eyed in Prague, respectively. However, in Tartu we collected data from 13 blue-eyed, 5 brown-eyed, and 10 green-eyed participants. A frequency distribution of eye colours between our three samples was thus significantly different (Pearson's chi-squared test: $\chi^2 = 11.356$, $P = 0.022$, contingency coefficient $C = 0.229$).

The participants in Ústí nad Labem, in north Bohemia, judged a perceived dominance of 40 male faces (SET 80). Eye colour had no significant effect on dominance attribution ($F_{1, 38} = 0.081$, $P = 0.778$, $\eta^2 = 0.002$). When we used the same SET 80 in Tartu (Estonia), we again found no significant effect of eye colour relating to dominance attribution ($F_{1, 38} = 0.337$, $P = 0.565$, $\eta^2 = 0.009$).

Trying to replicate our previous significant results from Charles University in Prague, we repeated the same test using the larger set of photos (SET 120). We did not find any statistically significant effect of eye colour on perceived dominance in males ($F_{1, 58} = 0.051$, $P = 0.822$, $\eta^2 = 0.001$).

We also did not observe any significant effect for perceived dominance in females (Ústí: $F_{1, 38} = 0.320$, $P = 0.575$, $\eta^2 = 0.008$; Tartu: $F_{1, 38} = 2.687$, $P = 0.109$, $\eta^2 = 0.066$; Prague: $F_{1, 58 =} 0.068$, $P = 0.795$, $\eta^2 = 0.001$). See *Table 3* for summary of results, including those published in Kleisner *et al.* (2010).

DISCUSSION

In the present study we found no statistical support for the hypothesis that eye colour affects perceived dominance in males. Our recent findings thus do not support the previous suggestion that brown-eyed men are perceived as more dominant than men with blue eyes (Kleisner *et al.* 2010). Previous research also revealed that brown-eyed and blue-eyed male faces show significant morphological differences in their particular facial features (Kleisner *et al.* 2010). We obtained a similar result after the comparison of the facial photographs from SET 120. On average, a brown-eyed male face shows a relatively massive chin and lips, bigger nose, broader bizygomatic width, and thick eyebrows whereas blue-eyed males had rounder faces, smaller noses and lips, and a seemingly greater span between the eyes (*Figure 1*, for a discussion of the methodology of geometrics morphometrics and the results of shape regressions, see Kleisner *et al.* 2010, 2013). Facial features – such as squared jaws, thick eyebrows, or broader bizygomatic width – are linked with higher perceived dominance and masculinity (Mueller, Mazur 1997, Thornhill, Gangestad 1994). On the contrary, a round face with large eyes, smallish nose, and thinner eyebrows (i.e., babyfaceness) is perceived as more submissive (Berry 1990, Berry, McArthur 1986).

Why didn't repeated tests show significant differences in perceived dominance between blue-eyed and brown-eyed males, despite the differences in the shape of their faces? First, we consider why the sensitivity of association between the perception of dominance and eye colour is not generally valid. The other option is that such a relationship is specific to raters in Prague where the previous research was done. To control the effect of the local community of raters, we invited raters from another Czech city (Ústí nad Labem) and from different country (Estonia) to judge the same photographs (SET 80). The individuals from different geographical regions are exposed to different environmental and cultural influences that presumably affect their perception. Moreover, different European populations reveal significant differences in frequencies of the expression of phenotypic traits such eye and hair colour. For example, the Baltic region, which includes Estonia, has

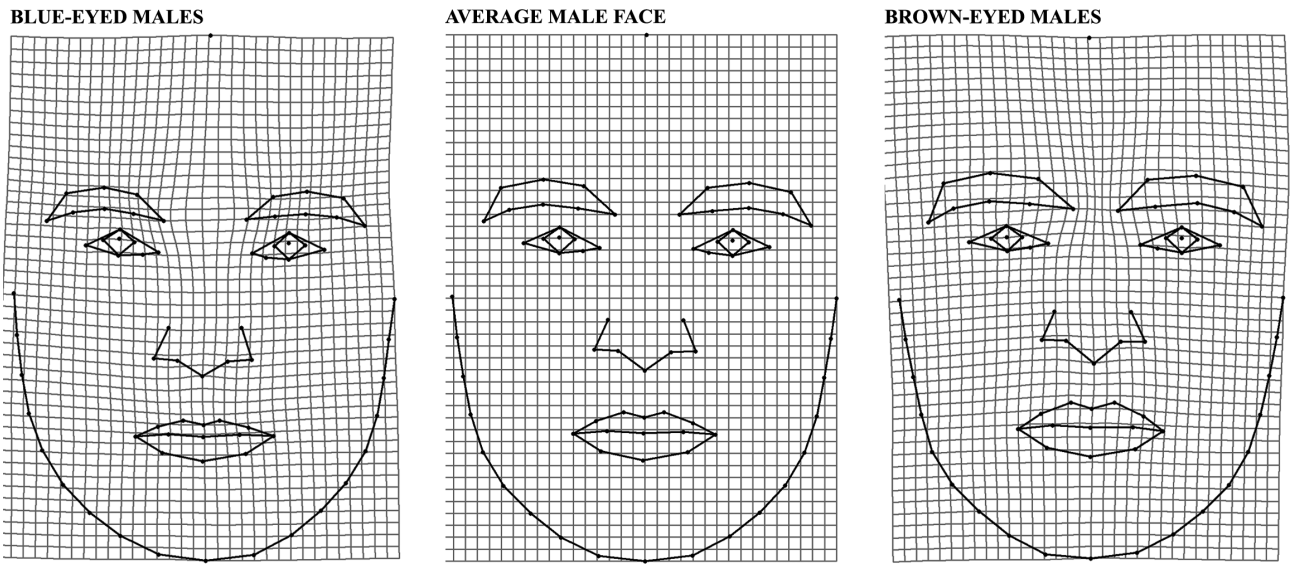

FIGURE 1. Shape changes associated with eye colour in males (SET 120). Photos of 30 brown-eyed and 30 blue-eyed men were analysed by geometric morphometrics (for a discussion of the methodology of geometrics morphometrics, see Kleisner *et al.* 2010, 2013). The effect of eye colour on shape differences was significant ($P = 0.012$; permutation $N = 10{,}000$). Visualisation of shape regression on eye colour in males by thin-plate spline deformation grids illustrates differences between blue-eyed (left) and brown-eyed (right) males compared to average male face (middle). The generated facial images were magnified 3×.

a higher percentage of blue-eyed than brown-eyed inhabitants (Beals, Hoijer 1965, Frost 2006). In contrast to the positive results from a sample in Prague as reported Kleisner *et al.* (2010), neither Estonian ratings nor data from Ústí nad Labem have shown any association between eye colour and perceived dominance. As we did not report any effect in Prague using the new SET 120, it is unlikely that there were any differences between the local raters. Most likely, the positive results of the original Prague set were due to unknown effects that led authors to unjustifiably reject the null hypothesis of no relationship between eye colour and perceived dominance (Type I Error). To test this assumption we performed another rating study in Prague using a larger set of photos (SET 120) that were non-identical with those of SET 80. In contrast to the previous study (Kleisner *et al.* 2010), we found no association between eye colour and perceived dominance. These results do not provide any support for the hypothesis of a higher sensitivity of Prague raters to association between eye colour and perceived dominance.

It may also have been that the target samples were not large enough to detect the effect we searched for. This means that we could possibly reject the null hypothesis of no association between perceived dominance and eye colour, even though the null hypothesis was false (Type II error). Nevertheless, we do not think that this was the case in our study. The number of 80 and 120 targets should be sufficient for testing our hypothesis as comparable sample sizes occurs in the majority of face perception studies (DeBruine 2002, Campbell *et al.* 1996, Rhodes *et al.* 2003). Moreover, the test was repeated both with a higher number of stimuli and different photos using three independent populations of raters. In addition to the above, post-hoc calculation of the observed power of a test from GLM analysis is considered a pure re-stating of the statistical significance of the test rather than rigorous solution to a problem of minimum sample size (Thomas, Krebs 1997). The *P*-value and observed effect size itself should provide sufficient evidence of the power of a statistical test (Thomas 1997).

CONCLUSION

To sum up, based on the new negative results of three independent tests, we suggest that the significant correlation of the perceived dominance with eye colour reported by Kleisner *et al.* (2010) might be due to chance. More specifically, we suggest that a combination of a random idiosyncrasy of a particular sample of facial photos used in the original research, together with further

confounding factors led to an erroneous rejection of the hypothesis of no association between perceived dominance and eye colour (Type I error). The take-home message of this study is that the re-test of already published "facts" of association between perception of psychological factors and physical appearance might be more than relevant. However, there is a pitfall. Independently repeated experiments are not a common practice in contemporary biological and anthropological science due to increasing requirements for higher number of published results. Simply put, the reliability of scientific discovery is not always congruent with pressure for a steep production of novel scientific facts – especially nowadays.

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