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Original Article

Cross-cultural effects of color, but not morphological masculinity, on perceived attractiveness of men's faces

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Abstract

Much attractiveness research has focused on face shape. The role of masculinity (which for adults is thought to be a relatively stable shape cue to developmental testosterone levels) in male facial attractiveness has been examined, with mixed results. Recent work on the perception of skin color (a more variable cue to current health status) indicates that increased skin redness, yellowness, and lightness enhance apparent health. It has been suggested that stable cues such as masculinity may be less important to attractiveness judgments than short-term, more variable health cues. We examined associations between male facial attractiveness, masculinity, and skin color in African and Caucasian populations. Masculinity was not found to be associated with attractiveness in either ethnic group. However, skin color was found to be an important predictor of attractiveness judgments, particularly for own-ethnicity faces. Our results suggest that more plastic health cues, such as skin color, are more important than developmental cues such as masculinity. Further, unfamiliarity with natural skin color variation in other ethnic groups may limit observers' ability to utilize these color cues.

Keywords: Color; Masculinity; Attractiveness; Health; Face; Perception

1. Introduction

A number of researchers have examined the aspects of facial appearance that affect perceived attractiveness, focusing primarily on facial shape cues such as symmetry (Perrett et al., 1999) and averageness (Rhodes, Sumich, & Byatt, 1999). Sexual dimorphism in shape has also received much research interest, with studies finding that the femininity of women's faces is closely associated with their rated attractiveness (Perrett et al., 1998; Rhodes, 2006). However, findings regarding the attractiveness of masculine features in male faces have been more mixed.

It has been suggested that facial masculinity should enhance attractiveness in men due to an immunohandicapping effect of testosterone ensuring that only high-quality males can achieve a strongly masculine appearance during development (Hamilton & Zuk, 1982; Lozano, 1994; see Rhodes, 2006). There is some evidence that facial masculinity is associated with levels of circulating testosterone in men (Pound, Penton-Voak, & Surridge, 2009). However, some studies have found that women prefer more *feminine* male faces (Perrett et al., 1998) or found no preference for masculinity (Rhodes, Chan, Zebrowitz, & Simmons, 2003). Further studies have found that women's preferences for masculinity fluctuate, for example, (a) over the course of the menstrual cycle, with reduced preference for femininity in the follicular (fertile) phase and femininity preferred in the luteal phase (Johnston, Hagel, Franklin, Fink, & Grammer, 2001; Jones et al., 2005; Penton-Voak & Perrett, 2000; Penton-Voak & Perrett, 2001; Penton-Voak et al., 1999; Scarbrough & Johnston, 2005); (b) depending

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on the type of relationship sought, with masculinity preferred for short-term relationships and femininity preferred for long-term relationships (Little, Cohen, Jones, & Belsky, 2007); (c) dependent on the attractiveness of the *woman*, with more attractive women preferring more masculine men (Penton-Voak et al., 2003). All of these papers posit a trade-off between gaining the "good genes" benefits of mating with masculine men and the negative personality traits (such as aggression and violence) that are associated with masculine men.

However, although it is possible that, for adult males in many species, aspects of anatomical masculinity may be reliable cues to health status during development, their importance may be limited in the presence of more salient cues to current health. This is particularly likely to be the case in situations where fluctuations in pathogen pressure and health status are rapid relative to host life span (Adamo & Spiteri, 2005, 2009; Scott, Pound, Stephen, & Penton-Voak, 2010) and female mate choice for multiple cues is constrained (Kokko, Brooks, Jennions, & Morley, 2003). Mathematical models developed recently indicate that, for most animals, females can derive fitness benefits from paying attention to the current condition of potential mates, but may derive little or no additional benefit from attending to cues to past immune function (Adamo & Spiteri, 2005, 2009). Consequently, relatively stable traits that are likely not influenced substantially by short-term fluctuations in adult health (e.g., degree of anatomical masculinization; Bulygina, Mitteroecker, & Aiello, 2006) should be of less importance to females than other more condition-dependent cues to current health. Moreover, this tendency should be more pronounced in animals with long life spans and slow reproduction, such as humans (Scott et al., 2010).

Further, recent theoretical work has suggested that the primary selective force driving the evolution of more robust features in male faces may have been intrasexual competition rather than female choice (Puts, 2010). Puts (2010) points out that the high degree of sexual dimorphism in muscle mass (similar to the dimorphism seen in gorillas; Zihlman & MacFarland, 2000) and the ability to control access to females predict that male–male contest competition would have been more important in the evolution of masculine traits than female choice. This prediction is supported by the finding that male sex-typicality on a number of traits, including beard growth (Neave & Shields, 2008), masculine voice (Puts, 2006), masculine face (DeBruine et al., 2006), and brawny build (Frederick & Haselton, 2007), increases ratings of dominance more than it does attractiveness (Puts, 2010). However, women are able to control mating to an extent, for example, by extra-pair copulations, and consequently are predicted to favor males with healthy appearance (Puts, 2010). This adds further to the expectation that men's masculinity will contribute little to attractiveness, with women preferring cues to current health, such as color.

Recent work has shown that the distribution and homogeneity of skin color across the face contributes to perceptions of health, age, and attractiveness of human faces (Fink, Grammer, & Thornhill, 2001, Fink, Grammer, & Matts, 2006; Matts, Fink, Grammer, & Burquest, 2007; Stephen & McKeegan, 2010), with more homogenous skin color and chromophore distribution associated with higher-rated attractiveness (Fink et al., 2001; Matts et al., 2007). Overall skin color has also been shown to affect the apparent health—and likely attractiveness (Jones, Little, Burt, & Perrett, 2004)—of human faces, with redder, yellower, and lighter skin appearing healthier (Stephen, Law Smith, Stirrat, & Perrett, 2009). The enhanced healthy appearance obtained from increased skin redness has been attributed to increased skin blood perfusion and oxygenation, which are associated with current cardiac and respiratory health (Stephen, Coetzee, Law Smith, & Perrett, 2009), and the enhanced healthy appearance associated with increased skin yellowness has been attributed to increased levels of carotenoids, which are associated with increased resistance to reactive oxygen species (Dowling & Simmons, 2009; Stephen, Coetzee, & Perrett, 2001). It is thought that color provides an indicator of current health since the levels of pigmentation in the skin react rapidly to changes in health status. Skin carotenoid levels change within days in response to changes in dietary intake (Stahl et al., 1998) and parasitic infestation (Koutsos, Calvert, & Klasing, 2003); melanin levels increase in the skin within an hour of exposure (Robins, 1991); blood oxygenation and perfusion change rapidly in response to a number of stimuli, such as exercise and illness (Paxton, Redd, Steketee, Otieno, & Nahlen, 1996).

Scott et al. (2010) have recently shown that masculinity—a possible cue to health status during development—may not be an important predictor of attractiveness when more salient cues to current condition, such as color, are available and that many previous findings may have been dependent largely on the experimental methods employed (e.g., using stimuli in which masculinity has been varied while other cues have been held constant). However, Scott et al. (2010) used relatively wealthy participants from highly developed environments with good access to healthcare for both the stimuli and the choosers. Masculinity preferences have been shown to vary cross-culturally, with masculinity preferred more in countries with lower standards of health than in countries with high standards of health (DeBruine, Jones, Crawford, Welling, & Little, 2010; Penton-Voak et al., 2004; Scott, Swami, Josephson, & Penton-Voak, 2008), though this effect may in fact reflect different levels of income inequality, with more masculine features preferred in more unequal countries (Brooks et al., 2010). Potentially, masculinity may be associated with the ability to obtain and defend resources when male–male competition is high (Puts, 2010; as is the case in cultures with high resource inequality), though health standards predict masculinity preference better than do measures of violence within the United States when income inequality is controlled (DeBruine et al., 2011).

Here, we replicate and extend the work of Scott et al. (2010) using two color-calibrated image sets taken from a

Caucasian, UK-based population (hereon "Caucasian") and a black South African population (hereon "African"). South Africa has both lower standards of health than the UK (life expectancy is 80.05 years in the UK compared to 49.33 years in South Africa; Central Intelligence Agency, 2009) and a greater level of wealth inequality (the UK has a Gini coefficient of 34 compared to South Africa's 65; Central Intelligence Agency, 2009). If masculinity is an important cue of either health or access to resources, we would expect that masculinity would have a greater impact on attractiveness ratings in the African sample than in the Caucasian sample. If cues of condition are more important, we would expect that the current health indicator (skin color) would better predict attractiveness than a possible long-term health indicator (masculinity) in both Caucasian and African samples.

It has been shown that individuals are better at recognizing faces of their own ethnic group (O'Toole, Deffenbacher, Valentin, & Abdi, 1994; Valentine, 1991), possibly because of greater familiarity with own-ethnicity faces (Rhodes et al., 2005). Further, participants rate own-ethnicity faces as more attractive than other-ethnicity faces (Rhodes et al., 2005). Skin color is a trait that varies widely between ethnic groups and is markedly different between Caucasians and Africans. It may be expected that the ability to discriminate between relatively subtle skin color differences will be better when observing own-ethnicity faces than other-ethnicity faces. We predict, therefore, that skin color will predict attractiveness better in own- than in other-ethnicity faces.

2. Methods

All research was approved by the ethics committees at the University of St Andrews and/or the University of Pretoria, as appropriate.

2.1. Photography and color measurements

We photographed 34 male Caucasian participants (ages 18–27) at the University of St. Andrews, Scotland, and 41 male black African participants (ages 18–25) at the University of Pretoria, South Africa. Participants posed with neutral expressions in a booth painted Munsell N5 gray and illuminated with three Verivide F20 T12/D65 daylight simulation bulbs in high-frequency fixtures (Verivide, UK) to reduce the effects of flicker. The booth was located in a room with no other lighting. We placed a Munsell N5 painted board over the shoulders and included a Gretag-Macbeth Mini ColorChecker color chart in the frame. We color-corrected images using a least-squares transform from an 11-expression polynomial expansion (Hong, Luo, & Rhodes, 2001) of camera RGB values for 24 ColorChecker patches to the manufacturer-specified CIELab values of the same patches. This achieved a mean color error (ΔE) of 2.44 between the 24 manufacturer-stated color values and the color values obtained from the corrected images. (ΔE is the Euclidean distance between two color points in CIELab space and is the standard method used for quoting color differences in CIELab color space.)

The CIELab color space is defined by $L*$ (lightness), $a*$ (redness), and $b*$ (yellowness) color dimensions. It is modeled on the human visual system and designed to be perceptually uniform, a change of one unit appearing to be of approximately the same magnitude regardless of its dimension (Martinkauppi, 2002).

We used Matlab to calculate mean CIELab values across skin pixels for each face image (defining initial CIELab face color). One Caucasian face was excluded from analysis due to having skin $b*$ values more than 3 standard deviations from the mean.

2.2. Masculinity measurement

Morphometric analysis was carried out to measure the extent to which each face was typical of its sex, in a manner analogous to that used for bodies by Brown, Price, Kang, Pound, Zhao, and Yu (2008) and recently for faces (Scott et al. 2010). First, using criteria established by Stephan et al. (2005), the x–y coordinates of the 129 facial landmarks used in Scott et al. (2010) were delineated for each face using Psychomorph (Tiddeman, Burt, & Perrett, 2001). Geometric morphometric techniques were then used to calculate a masculinity index for each face. Using Morphologika (O'Higgins and Jones, 1998), the Cartesian landmark coordinates were subjected to Procrustes registration—a best-fit procedure that removes scale, rotational, and translational differences between shapes (Goodall, 1991; Gower, 1975; Rohlf and Slice, 1990). Then, to identify dimensions of variation in facial landmark configuration, Morphologika was used to conduct Principal Components Analysis of the Procrustes-registered landmark data. A Kaiser–Guttman criterion was used to select Principal Components (PCs) for inclusion in subsequent analysis; i.e., those with eigenvalues greater than the average eigenvalue were retained. This led to the retention of the first 19 PCs which together accounted for 88.5% of the variance in facial landmark configuration.

Masculinity indices were calculated within each sample to avoid confounding effects of sample differences in face shape. For each sample, stepwise discriminant analysis (SPSS 13) was used to establish which of the 19 PCs were best able to discriminate between the male and female faces. For African faces, the resulting discriminant function incorporated five of the PCs (Wilks' λ=0.326; df=5; χ^2=81.3.1, p<.00001) and yielded correct sex classifications for 97.6% of males and 100.0% of females. For Caucasian faces, the resulting discriminant function incorporated 12 of the PCs (Wilks' λ=0.051; df=12; χ^2=199.5, p<.00001) and yielded correct sex classifications for 100% of males and females. In light of the classification accuracy, discriminant function scores were therefore used as an index of morphological masculinity, oriented such that high scores indicated a more masculine facial structure.

2.3. Experimentation

Female participants were asked to rate the attractiveness of the African (15 African raters aged 18–26, 20 Caucasian raters aged 18–23) and Caucasian (15 African raters aged 18–23, 12 Caucasian raters aged 19–26) faces on a 7-point Likert-type scale from 1 (*very unattractive*) to 7 (*very attractive*). Faces were presented on a CRT monitor calibrated using a DataColor Spyder3Pro in blocks according to ethnicity of face, and the order of presentation within blocks was randomized. Caucasian raters were tested at the University of St. Andrews, UK. African raters were tested at the University of Pretoria, South Africa.

2.4. Statistical methods

Interrater reliability was high (Cronbach's $\alpha>0.9$) for raters in all four conditions (African and Caucasian raters, African and Caucasian faces). Mean attractiveness ratings were calculated for each face, and for raters of each ethnicity, so that each face had an attractiveness rating attributed by African raters and an attractiveness rating attributed by Caucasian raters.

We used linear regressions (backwards method) to identify the contribution of masculinity, $L*$ (lightness), $a*$ (redness), and $b*$ (yellowness) to attractiveness of faces. Each of these analyses was performed separately on attractiveness ratings by African and Caucasian raters. To check for possible curvilinear relationships between each variable and rated attractiveness, squared terms for each dependent variable were included in the analysis. To avoid multicollinearity caused by including both squared and linear terms in the model, masculinity and color variables were centered by subtracting the mean. All variance inflation factors (VIFs; an indicator of multicollinearity) in all regression analyses were <2, and there were no significant correlations between the masculinity index and the CIELab $L*$, $a*$, and $b*$ variables (all $p>.05$).

Since several factors have been suggested to influence individual differences in women's preferences for male masculinity—such as phase of menstrual cycle (Johnston et al., 2001; Jones et al., 2005; Penton-Voak & Perrett, 2000; Penton-Voak & Perrett, 2001; Penton-Voak et al., 1999; Scarbrough & Johnston, 2005), relationship status (Little et al., 2007), and own attractiveness (Penton-Voak et al., 2003)—it may be hypothesized that different women's positive and negative preferences for masculinity may cancel each other out. If menstrual cycle effects (or other factors) leading to variation in women's preferences for masculinity are "cancelling each other out," some women should show positive relationships between their attractiveness ratings of men's faces and the morphological masculinity of those faces, while others will show negative relationships. When summed, these relationships could, potentially, negate the identification of positive and negative relationships between masculinity and attractiveness in subsamples of women, masking the menstrual cycle (or other) effects. To test if this is a possibility in the current sample, Spearman's rank correlation analyses between morphological masculinity and attractiveness rating were carried out for each rater individually following Scott et al. (2010). If the "cancelling out" effect is hiding preferences for masculinity in the current sample, it is predicted that positive relationships between rated attractiveness and morphological masculinity of men's faces will be found for some women, while negative relationships will be found for other women.

3. Results

Table 1 summarizes the results of the linear regression analyses. Linear regressions revealed no role for morphological masculinity in predicting rated attractiveness, as neither the masculinity nor the masculinity squared term remained in the model for faces of either ethnicity, rated by raters of either ethnicity. For Caucasian faces rated by Caucasian raters, greater attractiveness was predicted by increased yellowness ($b*$; β=0.658; p=.032) and decreased lightness ($L*$; β=−0.385; p=.032) of the face. The yellowness ($b*$) squared term remained in the model, but only as a nonsignificant trend (β=−0.356; p=.070). For African faces rated by African raters, greater attractiveness was predicted by increased yellowness ($b*$; β=0.669; p=.001) and decreased lightness ($L*$; β=−0.475; p=.011). The lightness squared term was also significant, suggesting that very light and very dark faces are not attractive (β=0.669; p=.001). Color was not found to predict rated attractiveness in

Table 1
β Values of variables in the linear regression models, dependent variable=attractiveness rating

		African raters	Caucasian raters
African faces	Model	$F_{3,40}$=8.835; p<.001***	$F_{1,40}$=2.974; p=.093
	Masculinity		
	Masculinity^2		
	$L*$	β=−0.475; p=.011*	β=−0.266; p=.093
	$L*^2$	β=0.669; p=.001**	
	$a*$		
	$a*^2$		
	$b*$	β=0.669; p=.001**	
	$b*^2$		
Caucasian faces	Model	NS	$F_{3,34}$=3.732; p=.021*
	Masculinity		
	Masculinity^2		
	$L*$		β=−0.385; p=.032*
	$L*^2$		
	$a*$		
	$a*^2$		
	$b*$		β=0.658; p=.032*
	$b*^2$		β=−0.356; p=.070

NS=not significant.
*p<.05; **p<.01; ***p<.001.

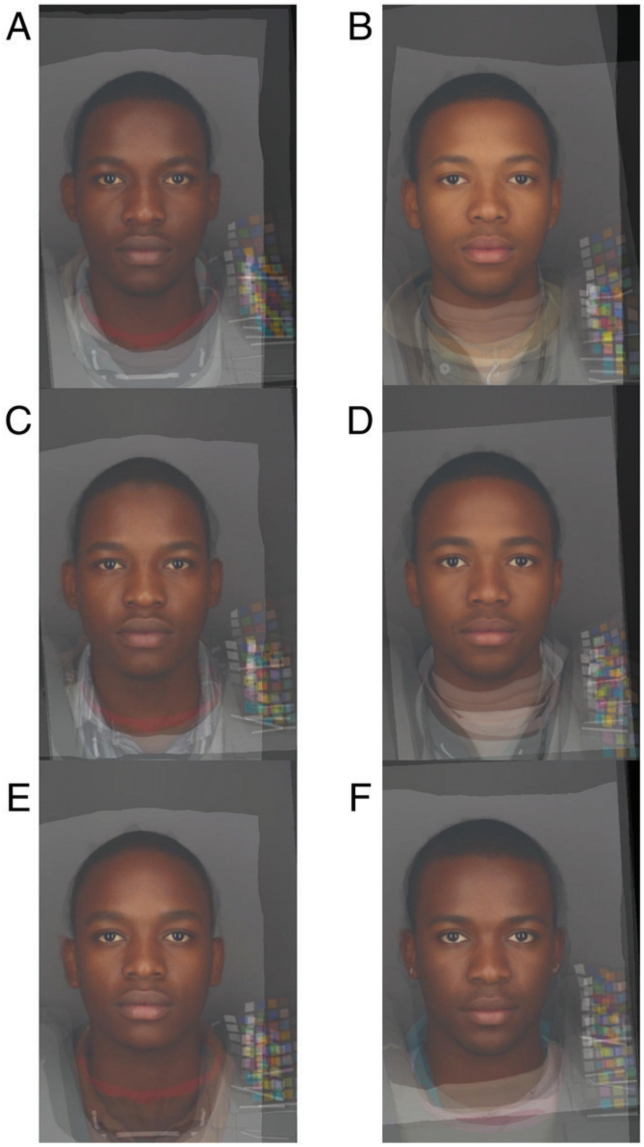

Fig. 1. African face composite images made from the five (A) least attractive faces, rated by African raters; (B) most attractive faces, rated by African raters; (C) least attractive faces, rated by Caucasian raters; (D) most attractive faces, rated by Caucasian raters; (E) least masculine faces; and (F) most masculine faces. The more attractive composites are noticeably yellower (higher $b*$) than the less attractive composites, especially as rated by African raters. Composites are used to illustrate typical faces of each category. Faces used in the ratings tasks and for measurements were photographs of real individuals.

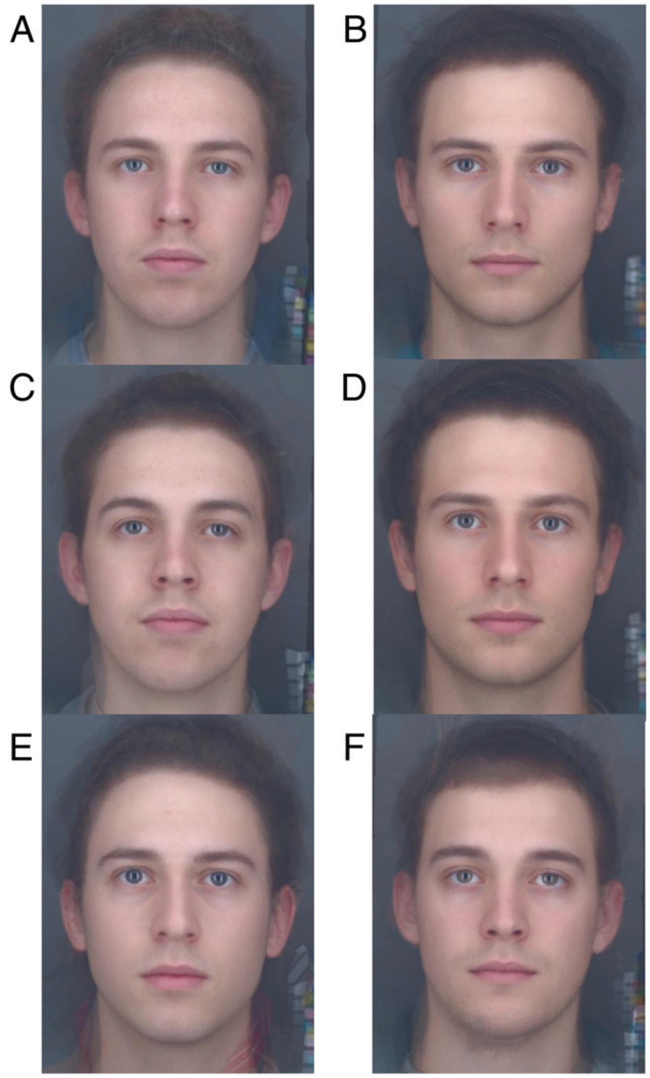

Fig. 2. Caucasian face composite images made from the five (A) least attractive faces, rated by African raters; (B) most attractive faces, rated by African raters; (C) least attractive faces, rated by Caucasian raters; (D) most attractive faces, rated by Caucasian raters; (E) least masculine faces; and (F) most masculine faces. The more attractive composites are noticeably yellower (higher $b*$) than the less attractive composites. Composites are used to illustrate typical faces of each category. Faces used in the ratings tasks and for measurements were photographs of real individuals.

Caucasian faces rated by African raters. For African faces rated by Caucasian raters, color did not significantly predict attractiveness, though the lightness ($L*$) term remained in the model (β=−0.266; p=.093).

In the individual participant analyses, only four of the 62 participants (6.5%) showed a significant negative correlation between rated attractiveness and facial masculinity, preferring less masculine faces. The other 58 participants (>93.5%), however, showed no such preference, suggesting that individual differences in preferences for masculinity (e.g., as a result of menstrual cycle effects "cancelling each other out") cannot account for the lack of relationship between facial masculinity and rated attractiveness.

4. Discussion

Skin color was found to be an important predictor of facial attractiveness when participants judged faces from their own ethnic group, whereas morphological masculinity was not found to significantly predict attractiveness in own- or other-ethnicity faces. This provides a cross-cultural validation, using color-calibrated images, of the findings of Scott et al. (2010) that cues related to current or recent health (i.e., "state" cues) are more important predictors of facial attractiveness than structural cues to past health during development (i.e., "trait" cues; Figs. 1 and 2). In addition, a "cancelling out" effect of individual differences in preferences for masculinity, caused by a menstrual cycle effect (or relationship status or other factors), was not found, with more than 93.5% of participants showing no preference for high or low masculinity. It is worth noting that, since probability of conception is above 5% on 8 days of the cycle (Wilcox, Dunson, & Baird, 2000), we would expect around 28% of participants to show a preference for more masculine faces. Even assuming a high 50% rate of oral contraception among participants, nine participants would be predicted to show a masculinity preference. In our analysis, none of the participants showed this preference. Further, mathematical modeling predicts that, even in groups containing mixed-quality females or those judging for long-term relationships, preferences for quality would still be detectable (Hill & Reeve, 2004). We detect preferences for color cues, but not for masculinity.

Masculinity has been found to affect attractiveness ratings in studies where *only* masculinity differed between faces—i.e., studies where masculinity is manipulated while other variables are held constant, even though the direction of preferences for masculinity is somewhat inconsistent (e.g., Penton-Voak & Perrett, 2000; Perrett et al., 1998; Scott et al., 2010). However, there is only limited evidence that naturally occurring variation in facial masculinity between individuals is an important determinant of attractiveness in the presence of other cues (e.g., Cunningham, Barbee & Pike, 1990; Komori et al., 2009; Penton-Voak et al., 2001). It appears, therefore, that masculine facial appearance may not have evolved under selection pressure from female choice. Instead, selection pressures associated with male–male contest competition seem likely to have played a more important role (Puts, 2010).

Our analysis of the association between skin color and attractiveness revealed an "other-race" effect, with variation in color cues strongly predicting attractiveness in own-ethnicity faces, while this relationship was absent for raters viewing other-ethnicity faces. This may be attributable to a lack of familiarity with other-ethnicity faces and therefore a lack of familiarity with the meaning of cues in other-ethnicity faces (Shepherd & Deregowski, 1981). Moreover, the effect may be particularly strong in the present study as a consequence of the considerable difference in skin color between African and Caucasian groups, which will mean that familiarity with these cues would be particularly limited (Valentine, 1991). No effect of ethnicity was found on preference for masculinity since masculinity did not affect attractiveness perceptions in either ethnic group.

Skin redness was not found to predict attractiveness in the linear regression models. This may be due to problems of multicollinearity among the predictor variables, (skin $L*$, $a*$, and $b*$ values are all correlated, though tolerance and VIF values were well within acceptable levels). Multicollinearity makes it difficult to evaluate the importance of individual predictors and may be masking the effects of $a*$ that have been seen when $a*$ alone is manipulated (Stephen, Law Smith, et al., 2009; Stephen, Coetzee, et al., 2009). It is expected that the color axes will correlate with each other in human skin since human skin color is determined by pigments—primarily melanin, carotenoids, oxygenated and deoxygenated hemoglobin—each of which impacts on the $L*$, $a*$, and $b*$ values of the skin. A change in the concentration of any of these pigments thus results in changes in all three color axes (Stephen, Coetzee, & Perrett, 2011; Stephen, Coetzee, et al., 2009). It may also be the case that redness ($a*$) only affects attractiveness of faces in the absence of other, more salient cues.

In conclusion, we have provided further evidence that morphological masculinity is at best a weak predictor of attractiveness ratings of male faces when variation in more salient cues to current health status, such as skin color, is present. This suggests that cues to current health status ("state" cues) may be more important determinants of attractiveness judgments than cues to past health status ("trait" cues), as predicted by recent models of mate choice (Adamo & Spiteri, 2005, 2009). In addition, we have demonstrated an "other-race" effect for skin color as a predictor of attractiveness ratings, which may be attributable to an unfamiliarity with the very different skin colors of African and Caucasian individuals. Further research on skin color cues and "other-race" effects on attractiveness would be desirable to establish whether the greater importance of color over masculinity is consistent across groups of women.

Note added in proof

While the regression analysis reported in this paper shows a negative relationship between skin L* and attractiveness for African faces rated by African women, further analysis suggests that this is due to collinearity between the color variables. In this note added in proof, we present an alternative analysis consisting of the following for both Caucasian and African faces rated by Caucasian and African raters. 1) Zero order correlations between attractiveness ratings and color and masculinity variables; 2) principal components analysis to reduce the number of color variables and remove the issue of collinearity between color variables; and 3) new regression models using the principal components, their squared terms, masculinity, and its squared term to predict rated attractiveness.

African faces

Significant correlations were found between L* and a* ($r=0.880$), L* and b* ($r=0.952$) and a* and b* ($r=0.956$; all $p<0.001$). Zero-order correlations show positive relationships between attractiveness rated by African women and L* (r=0.443; p=0.005), a* (r=0.398; p=0.010) and b* (r=0.490; p=0.001). No relationship was found between attractiveness rated by Caucasian participants and L* (r=-0.123; p=0.443), a* (r=-0.049; p=0.761) or b* (r=-0.056; p=0.730). Principal components analysis was therefore used to reduce the L*, a*, and b* variables to a single factor (using the Kaiser-Guttman criterion), onto which all three color variables heavily loaded (all loadings >0.96). This color component showed a significant relationship with attractiveness, rated by African women (r=0.451; p=0.003) but not Caucasian women (r=-0.078; p=0.630). No relationship was found between masculinity and attractiveness rated by African (r=0.193; p=0.227) or Caucasian women (r=0.278; p=0.078).

For the attractiveness ratings made by African women, multiple regression analysis (backward method; DV=attractiveness rating; IV=masculinity, masculinity squared, color component, color component squared) produced a significant model ($F_{2,40}$=7.139; p=0.002). Color component was a significant predictor (β=0.491; p=0.001), and masculinity remained in the model, but was not a significant predictor (β=0.266; p=0.065). For attractiveness ratings made by Caucasian women, no significant model was produced.

Caucasian faces

For Caucasian faces, attractiveness rated by Caucasian women was significantly correlated with b* (r=0.458; p=0.006), but not with L* (r=-0.118; p=0.506) or a* (r=0.311; p=0.074). Attractiveness rated by African women was significantly correlated with b* (r=0.366; p=0.036), but not L* (r=-0.046; p=0.799) or a* (r=-0.070; p=0.699).

Principal components analysis produced 2 components (using the Kaiser-Guttman criterion). Component 1 showed positive loadings for L* (0.890) and, to a lesser extent, b* (0.472), but negative loading for a* (-0.646). Component 2 showed positive loadings for a* (0.662) and b* (0.815). For attractiveness ratings made by Caucasian women, multiple regression analysis (backward method; DV=attractiveness rating; IV=masculinity, masculinity squared, PC1, PC1 squared, PC2, PC2 squared) produced a model ($F_{1,33}$= 7.820; p=0.002) in which only the linear term of component 2 was a significant predictor (β=0.620; p<0.001) and masculinity remained as a non-significant term (β=-0.277; p=0.088). For attractiveness ratings made by African women, no significant model was produced.

Summary

In line with the main part of the paper, these new analyses confirm that color is a stronger predictor of attractiveness than structural cues to masculinity in African and Caucasian men's faces rated by own-ethnicity women. In line with the findings in the main part of this paper, neither masculinity nor color significantly predicted attractiveness of men's faces rated by other-ethnicity women in the regression analyses.

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