

- VORACIK, M. and FISHER, M.  
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ratios? Evidence from the  
228.
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- YU, D. W. and SHEPARD, G. H.  
322.

primates trichromatic vision based on blood flow (CHIANGIZI et al. 2006). It generally bare faced (CH) flushing is associated with

In animals the additic et al. 1997) and in huma physically competitive sp over opponents (HILL an associations of red with d the same way that artfici (BURLEY et al. 1982; CU shown that wearing blue white (ROWE et al. 2005, special and that some asp sports advantage for red at

Research on colour anthropology. For exam countries viewed light co OSGOOD 1973). The same "active" and "strong". M generally showing that bri while dark colors elicited for specific colours, the et al. 1997).

Previous research (HEMPHILL 1996) and has "red", "blue") instead of examine human percept aggression, dominance, an shapes with and without h tied closely to anger our t directly. We presented n rectangles), one of which shape was "more aggressi in a physical competitio aspect of our study as pr included presentations of colour information to col colour perception (which greyscale stimuli).

## Procedure

Participants were administered a short followed by the colour tests. Order of rating which shape you think looks most likely to clicking below", "Please indicate which shape by clicking below", "Please indicate DOMINANT by clicking below". Coloured order and side of presentation randomised. of the pair they found most of a particular chosen shape moved on to the next shape presented four times, once as a pair of differently coloured rectangles, as well as

## RESULTS

For analysis we computed a continuous variable and square judgements separately (scores for each participant can be 0, 0.5 tailed.  $D$  denotes Cohen's  $D$ ,  $\eta_p^2$  denotes pr

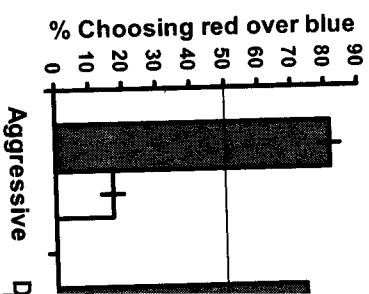


Figure 2. Percentage of participants choosing red over blue for all traits when stimuli were shown in greyscale (blue is chosen over red in colour and in greyscale (+/- 1 SE of mean)).

Using one-sample  $t$ -tests against chance for the coloured stimuli, red was seen as more aggressive ( $t_{104} = 9.4$ ,  $p < .001$ ).

differentially influence colour perceptions based on question (Figure 3). We conducted repeated measures ANOVA's with 'question' as a within-participant factor and 'sex' as a between-participant factor. For the colour stimuli this revealed a significant effect of question ( $F_{1,103} = 5.6, p = .004, \eta_p^2 = .052$ ) and a significant interaction between sex and question ( $F_{1,103} = 3.4, p = .036, \eta_p^2 = .032$ ). This reflects that red was generally most associated with aggressiveness and that women judged red as more dominant than men, while men judged red as more likely to win a physical fight than women. For the greyscale images there was no significant effect of question ( $F_{1,103} = 1.7, p = .19, \eta_p^2 = .016$ ) and no interaction between question and sex ( $F_{1,103} = 0.1, p = .96, \eta_p^2 < .001$ ). See Figure 3 for sex differences in judgements.

Splitting by sex, for the colour images, red was significantly associated with dominance by women ( $t_{74} = 6.7, p < .001, D = 1.6$ ) but not men ( $t_{59} = 1.7, p = .103, D = 0.6$ ) and red was significantly associated with winning over blue by men ( $t_{59} = 2.7, p = .012, D = 1.0$ ) but not women ( $t_{74} = 1.1, p = .28, D = 0.3$ ).

## DISCUSSION

Our findings show that red dominates blue, but that this pattern reverses when hue information is removed demonstrating dissociation between hue (colour) and contrast (lightness/darkness) in social perception. As the greyscale images remove hue they act as a control and the data then suggest we can attribute the dominance of red to hue information in the stimuli. Red hue then elicits perceptions consistent with it signalling dominance in a way seen in other non-human animals (MILLINSKI and BAKKER 1990; PRYKE and GRIFFITH 2006; SETCHELL and WICKINGS 2005; WAITT et al. 2003). Our data are also consistent with previous cross cultural work on associations between emotion and colour demonstrating that light colours are seen as good and dark colours as bad (ADAMS and OSGOOD 1973; HEMPHILL 1996) and that red colour is seen as strong and angry (ADAMS and OSGOOD 1973; HUPKA et al. 1997). We also show that females are more sensitive to the dominance signalling properties of red colour whereas males are more sensitive to the physical competitiveness between combatants. While aggression has implications for both males and females, dominance may be most salient to women judging colour if they are using it to estimate male quality (WAITT et al. 2003). Males on the other hand may be most sensitive to red as dominant in judgements of potential physical conflicts with other males. Of course assessing both traits is important to both sexes, as evidenced that the directions are the same for both men and women – it is only the relative associations that differ between the sexes.

It is of course possible that colour associations are learnt within an individual's life-time. For example, English as a language contains links between the colour red and volatility via a link to red coloured fire, for example, fiery tempered, and feeling 'blue' is to feel sad, an emotion unlikely to be associated with dominance.

This does not necessarily mean within language though, we know words are there in the first instance social perception and language are after all ones that evoke each other that people turn red and likely to win fights. If this is then an association between red and development of the associative automatic the process is.

Previous studies have shown white can only be a different similar reasons (ROWE et al. 2005) common sexually selected signal win over white as it also acts evolutionary signalling explained supported by our results. The more dominant than lighter shades white, as white will be seen contrast). In this way blue hue contrast. In human skin, dark testosterone (MANNING et al. 2004) (FROST 1994) and so dark colour to dark colours (ADAMS and biological link, testosterone in human males (MAZUR and BROWN 1991) play a role in the different perceptions the influence of such effects may have its basis in signalling.

Our results then suggest signalling dominance more so a signal of dominance. Sex-specific are unlikely to represent different. Moving to basic perceptual principles fundamental in human visual colour perception may have implications for sporting competitors.

**Acknowledgements.** At University Research Fellowship Little was a lecturer at the University of

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