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Assessment of health in human faces is context-dependent

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ABSTRACT

When making decisions between options, humans are expected to choose the option that returns the highest benefit. In practice, however, adding inferior alternatives to the choice set can alter these decisions. Here we investigated whether decisions over the facial features that people find healthy looking can also be affected by the context in which they see those faces. To do this we examined the effect of choice set on the perception of health of images of faces of light-skinned Caucasian females. We manipulated apparent facial health by changing yellowness of the skin: the healthy faces were moderately yellow and the less healthy faces were either much more yellow or much less yellow. In each experiment, two healthy faces were presented along with a third, less healthy face. When the third face was much more yellow, participants chose the more yellow of the two healthy faces more often as the most healthy. However, when the third face was the least yellow, participants chose the less yellow of the two healthy faces more often. A further experiment confirmed that this result is not due to a generalised preference for an intermediate option. These results extend our understanding of context-dependent decision-making in humans, and suggest that comparative evaluation may be a common feature across many different kinds of choices that humans have to make.

1. Introduction

If humans make rational choices based on the absolute utility of the options available then we would predict that decision-makers should choose the option that confers the largest benefit, the 'best' option (Edwards, 1961; Rieskamp et al., 2006; Schoemaker, 1982; Simon, 1959). Humans do not, however, always choose the best option. Instead, choices can be altered by the context of the decision, either by the presence or absence of other options or by the framing of the choice. These changes in preference suggest that humans use comparative decision-making mechanisms rather than making choices based on absolute utility. Most of the evidence for comparative decision-making mechanisms comes from investigations into the effects of context on preferences for products or services (Bateman et al., 2008; Doyle et al., 1999; Huber et al., 1982) although there is also considerable evidence that animals also make context-dependent decisions (Bateson et al., 2003; Dougherty and Shuker, 2015; Latty and Beekman, 2011; Morgan et al., 2012, 2014; Scarpi 2011). The decision-making mechanisms that underlie the everyday choices that people make about products and services may, however, be different from those underpinning important social decisions, such as those used in the choice of social partners or other social groups.

There are several reasons why social group decisions might differ from less biologically pertinent decisions, such as those for products. Face perception itself is considered to be special as information about faces is processed by different parts of the brain from other visual stimuli (humans: Haxby et al., 2000; Kanwisher et al., 1997; Yovel and Kanwisher, 2004; paper wasps: Sheehan and Tibbetts, 2011). Facial attributes influence assessments of health and attractiveness and are probably indicators of physical and genetic health (Gangestad and Simpson, 2000). Choosing a healthy and attractive partner may have multiple benefits including superior resource acquisition, provision and defence (Andersson, 1994; Hoelzer, 1989). Healthy individuals are expected to experience better direct reproductive fitness by producing healthy offspring due to better genetics and resources, and also to attain higher indirect fitness by producing offspring who will themselves be judged attractive as potential mates (Gangestad et al., 1994; Thornhill and Gangestad, 1993). The perception and assessment of some facial

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attributes, especially those that indicate health and attractiveness, might therefore be sufficiently consequential so as to require choices that depend on absolute evaluations.

The alternative hypothesis is that decision-making is a process that is generalized across all types of choices. It is possible, then, that during mate choice the judgement of the attractiveness of other individuals is again context-dependent and there is at least some evidence that decisions over attractiveness or health of possible mates might be relative rather than absolute (Dougherty and Shuker 2015; Kenrick et al., 1989; Wanke et al., 2001; Wedell et al., 1987, 2005). For example, males presented with images of attractive female faces rated subsequent images of average female faces as less attractive than did males presented with images of average female faces (Kenrick and Gutierres, 1980). If decisions as to which face is the most attractive or healthy depend strongly on the set of faces over which the decision is to be made, and particularly if just the presence of faces that would not be judged as attractive or healthy has a significant impact on those that are deemed attractive or healthy, then much of the work to date investigating attractiveness or health judgments might be much less robust than is currently thought.

Here we present the results of an experiment in which we attempted to determine whether the assessment of health in images of human faces is governed by an absolute or a relative decision-making mechanism. Specifically, we asked whether the assessment of two faces generally deemed healthy would be influenced by the addition of a third, unhealthy, option to the choice set.

In order to determine whether context influences the choices humans make about health, we presented participants with sets of faces that varied in a single manipulated feature, yellowness, and asked them to judge which of the faces appeared to be the healthiest. Yellowness in a human face appears to reflect both the dietary intake of anti-oxidant carotenoids and their loss via oxidative stress (Whitehead et al., 2012b). In many other vertebrate specices yellow/red pigments derived from dietary caroteniods are used as sexual selected cues to condition (Whitehead et al., 2012a). Among light-skinned people, faces with a moderate amount of yellow are considered to be healthier than either faces with very little yellow or faces with a large amount of yellow (we stress that is a repeatable finding across experiments: Stephen et al., 2009, 2011; Whitehead et al., 2012a. A yellower skin tone may be preferred because it is an indicator of fitness or, alternatively, it may have culturally-derived origins. For example, as the fruit and vegetable consumption in developed countries is higher amongst people in more privileged social groups (Grimm et al., 2012; Middaugh et al., 2012), it is possible that a preference for yellower faces are at least partly due to a link between facial colour and social status. In addition to increasing the perceived health of faces, increasing the level of yellowness also increases the attractiveness of faces, across a number of cultures (Stephen et al., 2012). In both African and Caucasian faces, faces that were more yellow were considered more attractive (Stephen et al., 2012), although the yellower African faces were also lighter than were the faces that were less yellow. When participants could manipulate the lightness and colour of the skin of photographs of African faces independently, those participants increased both the lightness of the skin but also the amount of yellow (Stephen et al., 2011). As the origin of the preferences themselves should not influence decision-making mechanisms (Busemeyer et al., 2006; Luce, 1959), we did not investigate the origin of preferences for yellowness in the current study.

To determine whether assessment of health would be influenced by the decision-context we designed two experiments. In the first experiment, we presented participants with pairs or trios of light-skinned faces that varied in the degree of yellowness and asked them to choose the face that they thought looked the healthiest. We presented participants with binary choices between two moderately yellow faces and trinary choices with these faces and a face with either a much reduced or increased yellowness. In this experiment the moderate faces that were present in each choice set exhibited different levels of yellow, both of which previous studies indicated would be rated as healthy. A trio consisted of this pair plus one face with very little yellow or a great deal of yellow (Fig. 1), assessed in past studies as less healthy (Stephen et al., 2009). We predicted that if the perception of the health of a face depends on the range of options within the choice set, the addition of either of the inferior options should alter the perceived health of the moderately yellow faces. Specifically we predicted that the perceived relative health of the two moderate shades would be greatest when it was the intermediate shade within the choice set.

In our second experiment we addressed whether or not there is a bias towards intermediate options regardless of the nature of those options. We hypothesized that context-dependent preferences are not a product of simply adding a third option and therefore should not be expected in all circumstances. The second experiment featured one shade that is within the range usually considered to be healthy looking as well as three shades that were less yellow than shades in this healthy range. As these shades are less yellow than those presented in Experiment 1, we predicted that upon adding either of the least yellow options to the choice that participants will not change their preference, instead choosing the yellowest option almost exclusively.

2. Methods

2.1. Ethics statement

Ethical approval was obtained from the University of St Andrews Teaching and Research Ethics Committee and prior to the experiment we obtained informed written consent from all participants.

2.2. Participants

Students at the University of St Andrews volunteered to participate in this experiment investigating of the effect of skin colour on the perception of health. They first completed a questionnaire identifying their sex, country of residence, ethnic origin (participants were given a blank box to self-identify however they wished) and sexual preference (on a 7 point Kinsey scale). In Experiment 1 was completed by thirty one undergraduate and post-graduate students from the University of St Andrews. Twenty-four of the participants identified as Caucasian and seven did not give their ethnicity. Seventeen participants identified themselves as male, twelve as female and two did not give their sex. In Experiment 2 the participants were nineteen undergraduate and post-graduate students from the University of St Andrews, none of whom had participated in Experiment 1. Eleven of the participants identified themselves as Caucasian, two as Latin American and six did not give their ethnicity. Six participants identified themselves as male, twelve as female and one participant did not give their sex. The experiment took place between 9 am and 5 pm and participants were alone when they completed the experiment, which took roughly an hour to complete. Participants were made aware that they could withdraw from the experiment at any time without explanation.

2.3. Image creation

The faces used in the experiment were of 30 light-skinned Caucasian females without makeup and with neutral expressions. The photographs were taken under controlled conditions and colour calibrated (for more information see (Stephen et al., 2009). Matlab was used to calculate mean colour values across skin pixels for each