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Human kin recognition is self- rather than family-referential

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Inclusive fitness theory predicts that organisms will tend to help close kin more than less related individuals. In a variety of birds and mammals, relatives are recognized by comparing their phenotype to an internal representation or template, which might be learned through either repeated exposure to family members or self-inspection. Mirrors are ubiquitous now, but were absent during our evolutionary history; hence it is hard to predict, and empirically unknown, whether human kin recognition is family- or self-referential. Here we put this issue to the strongest possible test by comparing nepotistic behaviour towards self- versus co-twin-resemblant individuals. Seventy monozygotic and dizygotic twins were shown same-sex faces, covertly manipulated to resemble either themselves or their co-twin, and indicated which individual they would prefer in two prosocial contexts. Self-resemblant faces were significantly preferred to twin-resemblant faces, showing that visual information about the self supersedes that about close family members in the kin-recognition template. Because, under conditions of paternal uncertainty, a reliable family-referent template could be based only on one's mother and maternal relatives, a unique advantage of self-referent phenotype matching is the possibility of (consciously or unconsciously) identifying one's father and paternal relatives as kin.

Keywords: kin recognition; nepotistic behaviour; facial resemblance; phenotype matching; inclusive fitness

1. INTRODUCTION

We feel more altruistic towards individuals who look similar to us, even when resemblance is so slight that we are not consciously aware of it (DeBruine 2002, 2004). Our preference for self-resemblant individuals makes evolutionary sense because they are likely to be kin; and a gene that causes its bearer to help close relatives will be positively selected, as long as the benefits to them (weighted by the probability that they also carry that gene, i.e. the coefficient of relatedness) are larger than the costs to the bearer (Hamilton 1964). An evolved preference would however date back to the Pleistocene, when, with still waters as the only available mirrors, direct information about self-appearance was bound to be scarce and degraded. To form a template of their own faces (serving the purpose of recognizing kin), our ancestors would have been forced to rely on the faces of kin—and these kin must be identified in some *other* way.

A viable mechanism has indeed been uncovered: whoever was associated with our mother as a baby or has been raised with us is automatically labelled as 'sibling', regardless of our conscious beliefs (Lieberman *et al.* 2007). If humans, in their childhood, learn what they look like by inspecting close kin, a sibling (especially one close in age and of the same sex) would provide a very good template. Yet, all indirect cues of relatedness are probabilistic and have, as such, a certain amount of error attached to them; siblinghood by association is no exception. Those ancestors of ours who managed to incorporate in the kin template information about their *own* appearance would hence be selectively rewarded. Some phenotypically distinctive traits, including hair colour (whose diversity arose in the Upper Palaeolithic; e.g. Frost 2006), can be self-inspected. Rudimentary information about one's facial features might have been obtained via reflections in still pools and lakes, remarks made by other people, possibly even portraits (a cave painting believed to be the earliest known portrait, recently discovered in Angoulême, France, dates back to 25 000 BC; see Jones 2006).

It is thus hard to predict, and empirically unknown, whether human kin recognition is family- or self-referential. Here we address this issue in the strongest possible way, i.e. with the closest possible sibling pairs. Monozygotic and dizygotic twins were shown same-sex faces that, unbeknownst to them, had been digitally manipulated to resemble either themselves or their co-twin, and had to choose which individual they would prefer in two prosocial contexts.

2. MATERIAL AND METHODS

(a) *Participants*

The participants were 70 twins (32 males and 38 females), forming 35 same-sex twin pairs: 17 monozygotic pairs (MZ; mean age 28 years, range 16–42) and 18 dizygotic pairs (DZ; mean age 32 years, range 16–45). All co-twins had cohabited continuously from birth to adulthood. They were found via acquaintances, and tested in their own homes, in Northern and Central Italy.

(b) *Stimuli*

Digital photographs of the participants' faces (neutral expression) were taken about two months prior to the experiment, on the pretext of a study on the effects of facial traits on memory for faces. Backgrounds were removed digitally, together with any skin markings or facial hair. Stimuli were created by morphing the photographs of participants with the image of a same-sex model, hence producing faces of the same sex as the participant. Morphs consisted of 35 per cent of the participant face and 65 per cent of the model face. Because monozygotic twins are identical genetically, but not developmentally, MZ morph pairs were very similar but never impossible to tell apart (figure 1). Each image was printed, in greyscale, on a 8×10 cm card.

(c) *Procedure*

The members of each twin pair were tested one after the other. Each participant was shown two images, allegedly extracted at random from a set of cards, as a part of a larger experiment on faces. The two images were the self-morph (subject merged with model) and the twin-morph (co-twin merged with model). The participant was asked: 'which of these two people would you help in case of danger?', and 'if you wished to encourage your brother [female participants]/sister [male participants] to marry one of these two people, which one would you choose?' The two questions were selected to reflect altruism, under the form of desire to help, and long-term likeability, under the form of desire

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Figure 1. Sample pair of stimulus faces, obtained by morphing the members of a female monozygotic twin pair with the female model.

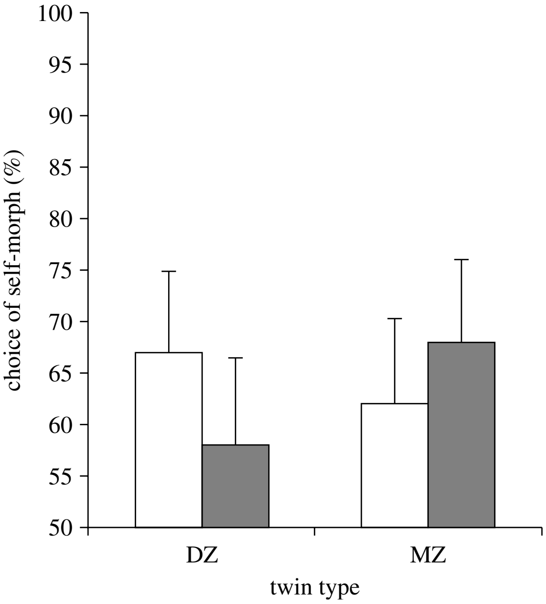

Figure 2. Self-morph choices in response to the question about which individual participants would prefer to acquire as a sibling-in-law (white bars) or would help in an emergency (grey bars). Percentages of choices are plotted separately for dizygotic and monozygotic twins. Values higher than 50% (chance level) represent a preference for self-morph over twin-morph. Error bars indicate one standard error of the mean.

to acquire the person as a sibling-in-law. Although a family-resemblant person might seem an unsuitable spouse for one's sibling because of inbreeding costs, people tend to choose family-resemblant partners for long-term alliances such as marriage (e.g. Hinsz 1989; Bereczkei *et al.* 2004), suggesting that fitness benefits overcome the costs. Also, same-sex faces have been shown to elicit judgements of prosocial regard, rather than of sexual or romantic appeal to the judge (DeBruine 2004). Question order was counterbalanced between subjects. Afterwards, participants completed a brief questionnaire and were asked to estimate the quality of their inter-twin relationship on a 1–10 scale. At debriefing, no participants reported recognizing their own or their co-twin's traits in the morphs.

3. RESULTS

Self-morph choices to the help and sibling-in-law questions correlated very little with one another ($r=0.11$, $p>0.38$, $n=70$), suggesting that some people were using separate criteria in the two cases. Yet, in both contexts, participants chose the face containing their own traits significantly more often than the face containing their co-twin's (figure 2). The self-morph was preferred, respectively, 63 and 64 per cent of the time. Both percentages are significantly higher than the chance level of 50 per cent (one-sample $t_{69}=2.2$, $p=0.030$, and $t_{69}=2.5$, $p=0.016$, two-tailed). Self-preference (as the average self-morph choice in the two contexts) was larger than chance ($t_{69}=3.2$, $p=0.002$, two-tailed) and differed across neither zygosis (DZ versus MZ twins) nor sex, both independent-sample t's<1. Self-preference did not significantly vary with age, $r=-0.16$, $p>0.19$ (age distribution in our sample was roughly uniform, with both mean and median 30 years), and was unrelated to birth order, dominance in the pair, or estimated relationship quality, all r's<0.05, all p's>0.71.

4. DISCUSSION

The fact that humans did not encounter their own face until recently might suggest, as remarked by DeBruine (2002), that only kin reference—as opposed to self-reference—occurs, and that either (i) resemblance to self evokes kin-recognition mechanisms only to the extent that a person resembles family members, or (ii) the introduction of mirrors has caused individuals to experience their own face as if it were a sibling's. Both variants of this account are plausible and parsimonious, but our data support neither one. Because same-sex twins growing up together are exposed to the face of their co-twin more than their own, a kin-recognition template including self-reflections would still be moulded on the co-twin's more than on one's own face. If instead we assume that template formation is family based but ongoing rather than confined to a critical period, the co-twin's relative contribution to the template would diminish as individuals, growing older and embarking on independent lives, become progressively less exposed to their sibling's face. This leads to the prediction that the preference for own face versus co-twin face should increase with age, but our data carry no indication that this might be the case; if anything, we found a non-significant *negative* correlation between self-preference and age.

The data we have reported here strongly suggest that visual information about the self supersedes that about family members in the construction of the kin-recognition template. Owing to paternal uncertainty, a reliable kin-referent template could be based only on the appearance of the mother and maternal relatives. Thus, a formidable advantage of self-referent phenotype matching is the possibility of (consciously or unconsciously) identifying as kin paternal relatives, including one's biological father, and distinguishing between full siblings (same mother, same father) and half-siblings (same mother, different father). Kin-recognition mechanisms based on self-inspection have been demonstrated in a variety of birds and mammals (see Hauber & Sherman (2001) for a review), and experiments on brown-headed cowbirds indicate that the template can be updated to keep up with an individual's phenotype changes throughout the lifespan (Hauber *et al.* 2000).

Our work shows that a stranger who resembles us elicits prosocial regard more than a stranger who resembles a close family member—even one as close as our *identical* twin, who is, incidentally, as genetically related to us as we are. Of course, preferring oneself to one's identical twin uncovers a mechanism that evolved in a world of non-twins. Human phenotype matching is thus self-referential, rather than kin-referential as our mirrorless evolutionary circumstances might have suggested.

The research was conducted in accordance with the Ethics Code of the University of Padova.

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