Original Article

Apparent health encourages reciprocity

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Abstract

Reciprocity evolves only when social partners reliably repay, with interest, the investments of others. However, not all individuals are equally able—or motivated—to recompense others satisfactorily. As such, reciprocity relies greatly on the capacities and motives of partners. Apparent health may provide a cue to the value of potential exchange partners in this regard: healthier individuals will tend to live longer and accrue more, higher quality resources, thus increasing the incentives for mutual cooperation. In a monetary exchange task, we show that the apparent health of partners' faces affects human reciprocity. Specifically, participants were more willing to return a profitable amount to, but not more willing to invest in, apparently healthy than unhealthy partners. This effect appears to be a function of the attractiveness of apparent health, suggesting a preference for repayment of attractive partners. Furthermore, the effect of apparent health on reciprocal exchange is qualified by the sex of the partners, implicating a history of sexual selection in the evolution of human social exchange.
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1. Introduction

Reciprocity, a universal feature of human social organization (Brown, 1991), is a mutually beneficial arrangement in which individuals repay the investments of others. At the functional level, its evolution requires reliable compensation, with interest, for prior investments (Alexander, 1987; Nowak & Sigmund, 2005; Trivers, 1971; see also Roberts, 2005). Nevertheless, investments can be misdirected toward unsuitable exchange partners who subsequently fail to translate the investment into a profitable return. Thus, patterns of exchange are expected to reflect a psychology of discriminative allocation: individuals should prefer to invest in partners who are likely to make a return (Leimar, 1997; Tooby & Cosmides, 1996).

Social partners may fail to reciprocate an exchange for a number of reasons. Short time horizons will curtail the forecasted length of an exchange relationship, thus reducing the potential benefits of cooperation (Axelrod & Hamilton, 1981; Trivers, 1971), so long-lived partners will find greater incentives to partake of reciprocal exchange. Moreover, individuals with lengthier expected life spans will tend to be in better condition, and will thus accrue more resources of quality. In short, cues of health—which will be associated with longevity and condition—may make useful predictors of the value of a potential partner, because an unhealthy individual has a higher probability, moment to moment, of incapacity and death and so is less justified as a candidate for current investment against future returns.

The problem of prudent investment raises the specter of trust. Reciprocal exchanges are often complicated by incomplete information about a partner's intentions and an incentive structure that fails to compel the partner to make a return (Yamagishi & Yamagishi, 1994). We suggest that, in these circumstances, exchanges require a degree of trust, or faith, in the beneficence of one's partner. How trust is garnered, however, remains something of a puzzle.

We investigated effects of apparent health on reciprocal exchange in a series of one-shot, anonymous "Trust" games (TG; Berg, Dickhaut, & McCabe, 1995; DeBruine, 2002; McCabe, Rigdon, & Smith, 2003). In the incarnation used here, the first player (P1) chooses between two options: either to (i) terminate the game, in which case P1 and the second player (P2) are each allocated £3 (the *not*
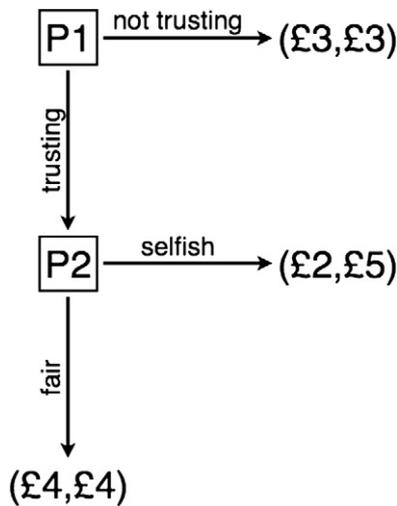
Fig. 1. Tree schematic of the TG. P1 makes the initial decision to terminate the game (the *not trusting* option), in which case both players receive £3, or to entrust P2 with a larger amount to allocate (the *trusting* option). In the event that P1 chooses to trust P2, P2 may return the money such that both players receive £4 (the *fair* option) or that P2 receives £5 and P1 receives only £2 (the *selfish* option).

trusting option), or (ii) allow P2 to make the allocation decision (the *trusting* option) from one of two larger pools of money (Fig. 1). Hence, P1 makes a *de facto* investment in P2 by choosing the trusting option. In the event that P1 entrusts P2 with the allocation decision, P2's choices are either that P1 and P2 both receive £4 (the *fair* option) or that P1 receives £2 and P2 receives £5 (the *selfish* option). Thus, P1 benefits by investing in P2 only if P2 reciprocates P1's trust by paying a personal cost in order to make a fair return. Prior work shows that decisions in the TG indeed reflect a psychology of trust and reciprocity (McCabe et al., 2003; Pillutla, Malhotra, & Murnighan, 2003), even in designs where the size of the "pot" varies between P2's options, as is the case in the current study (where the pot is £8 for the pair should P2 choose the fair option, but £7 for the pair should P2 choose the selfish option).

Exchange decisions, including P1 trust, are often associated with the attractiveness of social partners (Andreoni & Petrie, 2008; Solnick & Schweitzer, 1999; Takahashi, Yamagishi, Tanida, Kiyonari, & Kanazawa, 2006; Wilson & Eckel, 2006), a finding in line with studies of character attributions (Eagly, Ashmore, Makhijani, & Longo, 1991; Langlois et al., 2000) and labor markets (Biddle & Hamermesh, 1998; Hamermesh & Biddle, 1994). Wilson and Eckel (2006), for instance, find a "beauty premium" in the TG: more attractive P2s are entrusted with more money than their less attractive counterparts. Similar results have been reported in a group cooperation task (a Public Goods game; Andreoni & Petrie, 2008) and a bargaining task (an Ultimatum game; Solnick & Schweitzer, 1999), whereby more attractive players earned more money than other players. Much of this work, however,

has relied on natural variation in attractiveness rather than experimental manipulation, potentially conflating the general property of "attractiveness" with a particular *component* thereof. Thus, a test of the effects of one or more components of attractiveness on exchange behavior is essential to understanding whether it is attractiveness or something confounded with it that is a cause of variation in patterns of reciprocal exchange.

In the TG, participants viewed images of ostensible partners' faces that had been digitally altered to vary in apparent health, an important component of physical attractiveness (Jones et al., 2001; Jones, Little, Boothroyd, & DeBruine, et al., 2005; Jones, Little, Boothroyd & Feinberg, et al., 2005; Jones, Perrett et al., 2005; Rhodes et al., 2007). Apparent health could be predicted to affect reciprocal exchange decisions via its effects on attractiveness (Andreoni & Petrie, 2008; Solnick & Schweitzer, 1999; Takahashi et al., 2006; Wilson & Eckel, 2006), even when attractiveness is not actually associated with a partner's value (Mobius & Rosenblat, 2006). What remains unclear, however, is whether it will have its effects on the initial investment decision or on its reciprocation. As attractive individuals may take advantage of their appearance as recipients of an investment, they may not be especially trustworthy partners. Rather, individuals may instead reward the investments of attractive partners with enhanced reciprocation. Smith, DeBruine et al. (2009), for instance, find that attractive P1s are more trusting than less attractive P1s of ostensible P2s in the TG, but only when they are informed that the P2s can see an image of the P1's face. Thus, it seems as if attractive P1s selectively exploit their appearance when engaging in reciprocal exchange. A finding that P2s reciprocate the trust of apparently healthy P1s more fairly than that of apparently unhealthy P1s would complement Smith, DeBruine et al.'s (2009) result.

2. Methods

2.1. Stimuli

Stimulus images of ostensible exchange partners were manufactured with a digital transformation procedure, using custom image manipulation software (Tiddeman, Burt, & Perrett, 2001). Twelve male and twelve female *face identities* were transformed to create a total of 24 healthy and 24 unhealthy stimulus faces, divided into three different *face sets* of eight unique face identities (two of each *face type*: healthy male, unhealthy male, healthy female, unhealthy female). The original face images were transformed by applying to them +75% (healthy) or −75% (unhealthy) of the vector differences in shape, color and texture between same-sex composites of faces previously rated as healthy and as unhealthy (Fig. 2). These male (and female) healthy and unhealthy composite faces were made up of 15 images that comprised the top and bottom 25% samples of 60 male (female) faces previously rated for

Fig. 2. Example of the apparent health manipulation. Stimulus faces were manufactured by adding to (left, apparently healthy) or subtracting from (right, apparently unhealthy) a face image 75% of the vector differences in shape, color, and texture between same-sex composites of faces rated as healthy and as unhealthy.

apparent health. This method has been used extensively to manipulate apparent health (Jones, Little, Boothroyd, & DeBruine, et al., 2005; Jones, Little, Boothroyd, & Feinberg, et al., 2005; Jones, Perrett et al., 2005).

To confirm that our stimuli differed in perceived health, 188 raters (139 women) were shown the 24 pairs of healthy and unhealthy face images (each pair consisting of a high and a low apparent health version of the same identity) and were asked to indicate which individual in each pair appeared healthier. Raters chose the high apparent health version as the healthier significantly more often than the chance value of 50% when judging male (M=96.45%, t_{187}=58.46, p<.001) and female faces (M=95.0%, t_{187}=69.23, p<.001), confirming that the apparent health manipulation had the intended effect.

2.2. Procedure

Forty-six participants (30 women) played eight one-shot, anonymous rounds of the TG as P1 (Session 1) and then an additional eight rounds as P2, approximately 2 weeks later (Session 2). Participants were tested at personal computer stations, separated by partitions, with ostensible exchange partners located at other universities. The face images of ostensible partners were presented on-screen while participants made their decisions. Participants were exposed twice to each face type for a total of eight trials per session, and they never saw the same face identity twice. The presentation of face sets and health transformations was counterbalanced as a function of participant sex and health transformation, so that every face in each set was seen as healthy and as unhealthy an equal number of times by an equal number of male and female participants. Participants were not given feedback about the decisions of their partners and were told that they would be paid for one of their decisions, chosen at random. Once the data

collection phase was complete, all participants were debriefed and paid £4 to keep earnings equivalent. Two male participants did not return for Session 2 and so were not included in the Session 2 analyses.

On both occasions following the TG, participants completed a forced-choice preference task, embedded in a larger number of tasks, to determine individual differences in the strength of attraction to apparent health. Participants viewed eight pairs of healthy and unhealthy faces (four male and four female from a fourth, previously unseen, face set) of the same identity presented concurrently, counterbalanced for side of screen. They were asked to indicate which face they found more attractive (and by how much) by clicking on one of four options above each face, ranging from "Slightly more attractive" to "Much more attractive" (following, e.g., Jones, DeBruine, Little, Conway, & Feinberg, 2006). Responses to the eight trials were summed, a higher score indicating stronger attraction to healthy faces. Participants performed this task along with numerous other such tasks later in each session and were told that there was no relation between the different sets of tasks, so it is unlikely that this task had any impact on the participants' subsequent decisions.

Seven participants elected not to complete the preference test in either testing session, and an additional five participants elected not to complete this task in the second session. We used a mean substitution procedure to correct for missing data (Tabachnik & Fidell, 2001). When values were missing from session two only, the overall preference score was replaced with the participant's averaged value from the first session; when values were missing from both sessions, the overall preference score was replaced with the mean preference score across all other participants. This method only biases results towards the central tendency and, thus, should contribute to the underestimation of any effect of apparent health on attractiveness attributions. We find such an effect nonetheless (see Section 3.1). Moreover, excluding these 12 cases from the analyses that control for strength of attraction to apparent health does not alter the general pattern of results.

3. Results

3.1. Attraction to health

In both sessions, participants found healthy faces significantly more attractive than unhealthy ones (all ts>8.99, ps<.001, Cohen's ds>1.33). Male and female participants did not differ in their attractiveness preferences for health in male or in female faces (all ts<1.29, ps>.205, ds<0.44). Health preferences were significantly correlated within sessions (Session 1: r=.53, p<.001; Session 2: r=.77, p<.001) and between sessions (female faces: r=.46, p=.001; male faces: r=.44, p=.002). We thus collapsed across face sex and session to create an overall attraction to health score per participant.

3.2. Trusting and return decisions

On average, P1s trusted P2s 38% of the time (male M=35%, female M=40%) and P2s chose to make fair returns 63% of the time (male M=47%, female M=70%). The latter result is a significant departure from 50%, below which a P1's trust would be unprofitable (t_{43}=2.84, p=.007). Moreover, participants were significantly more willing to make fair returns as P2s than they were to make trusting decisions as P1s (t_{43}=3.99, p<.001), but these two types of decisions were not significantly correlated (r=−.10, p=.516).

Two mixed factorial analyses of variance (ANOVAs) were performed to examine the effects of participant sex, face sex, and health transformation (apparently healthy vs. unhealthy) on P1 and P2 decisions, respectively. Two mixed factorial analyses of covariance (ANCOVAs) were subsequently performed to control for individual differences in the strength of attraction to apparent health, to examine whether any effect of apparent health on P1 and P2 decisions is independent of its effects on attractiveness. There were no significant effects of any variable on P1 decisions in the ANOVA (all Fs<1.26, ps>.267; Fig. 3A). Controlling for strength of attraction to health did not alter the results of the analysis (all Fs<3.35, ps>.073).

There were, however, significant main effects of health transformation ($F_{1,42}$=15.14, p<.001) and participant sex ($F_{1,42}$=6.24, p=.016) on P2 decisions, whereby participants fairly reciprocated the trust of healthy P1s more than unhealthy P1s and female participants fairly reciprocated the trust of P1s more often than male participants (Fig. 3B). Additionally, there was a two-way interaction between face sex and health transformation ($F_{1,42}$=10.13, p=.003), whereby participants fairly reciprocated the trust of healthy more than unhealthy female P1s (t_{43}=4.45, p<.001) but not of healthy *versus* unhealthy male P1s (t_{43}=1.09, p=.280).

The three-way interaction between participant sex, face sex, and health transformation is of theoretical interest, though it was not significant ($F_{1,42}$=2.03, p=.162). Thus, while we examine the simple effects among these three variables, the analysis should be interpreted with caution. Among male P2s, the number of fair returns to healthy female P1s was significantly greater than the number of fair returns to the remaining P1 face types (all ts>2.27, ps<.041). Among female P2s, the number of fair returns to healthy female P1s was significantly greater than to (i) unhealthy male P1s (t_{29}=2.35, p=.026) and (ii) unhealthy female P1s (t_{29}=2.97, p=.006), but not (iii) healthy male P1s (t_{29}=1.65, p=.109). Controlling for strength of attraction to health, only the main effect of participant sex remained significant ($F_{1,41}$=9.38, p=.004). The effect of the health transformation on returns was an order of magnitude smaller when controlling for strength of attraction to health (partial η^2=.025) than when this was not controlled for (partial η^2=.265).

We conducted a final mixed factorial ANOVA to directly compare the pattern of results for trust and reciprocation; a significant interaction between decision type (trusting vs. return) and health transformation shows that the effect of apparent health differs between the P1 and P2 roles. This analysis revealed significant effects of health transformation ($F_{1,42}$=11.55, p=.001) and decision type ($F_{1,42}$=10.52, p=.002), significant two-way interactions between health transformation and decision type ($F_{1,42}$=4.16, p=.048) and between face sex and health transformation ($F_{1,42}$=5.25, p=.027), and a marginally significant three-way interaction among face sex, health transformation, and decision type ($F_{1,42}$=3.77, p=.059). These results confirm that the pattern of results observed for reciprocation of trust in our earlier analyses are significantly different from those observed for trusting decisions. A mixed factorial ANCOVA with strength of attraction to health entered as a covariate revealed no significant main effects or interactions (all Fs<2.96, ps>.093).
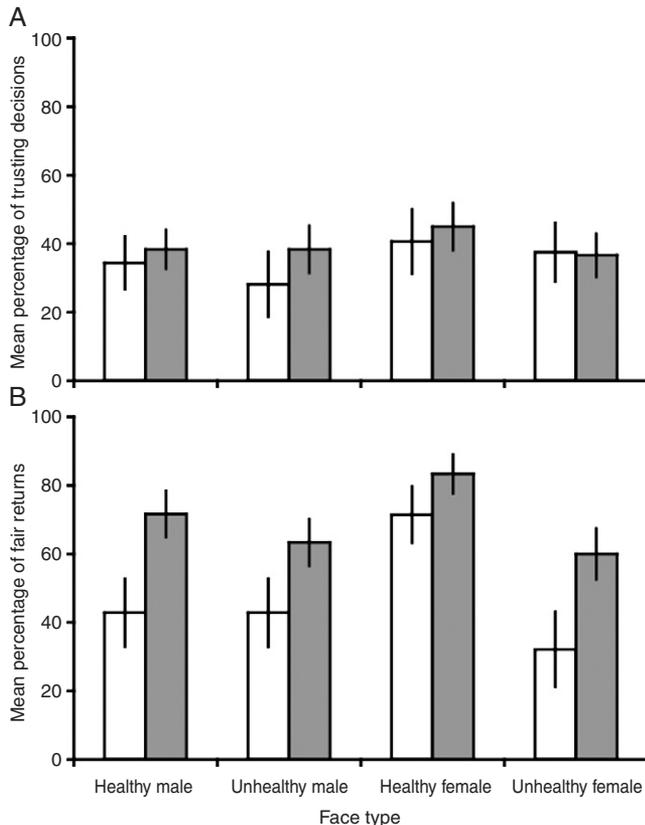

Fig. 3. Mean percentage (±S.E.M.) of trusting decisions by P1s (A) and fair returns by P2s (B) as a function of participant sex (open bars: males; filled bars: females), face sex, and health transformation.

4. Discussion

In the current study, apparent health promoted the reciprocation of an investment. Controlling for individual differences in strength of attraction to health abolished this

effect, suggesting that the influence of apparent health on exchange decisions is driven largely by its impact on attractiveness. Specifically, it seems that an increase in attractiveness (via the manipulation of apparent health) leads to an increase in the willingness to reciprocate fairly, at an immediate cost to the reciprocator, but does not affect initial investment decisions. Interestingly, Smith, DeBruine et al. (2009) found that attractive P1s are also more willing than unattractive P1s to trust P2s, but only when they know that the P2s will be able to see their faces. Together, these findings suggest a considerable degree of synergy between the expectations of P1s and the actions of P2s.

Our results and those of Smith, DeBruine et al. (2009) run counter to other published findings (e.g., Takahashi et al., 2006; Wilson & Eckel, 2006). As discussed in Section 1, Wilson and Eckel (2006) found a result opposite to ours: attractive P2s were trusted more than unattractive ones, but attractive P1s did not benefit from trusting (see also Andreoni & Petrie, 2008; Solnick & Schweitzer, 1999). This and other research, however, has relied on natural variation in attractiveness, whereas our study is the first to experimentally manipulate a component of attractiveness in the context of reciprocal exchange. It is thus probable that past findings are based on the confounding of attractiveness with some other dimension of facial appearance: a trust-worthy face may be attractive but, as we have shown, an attractive face is not ineluctably trustworthy. Relative to studies using natural variation in faces, the digital transformation methods used herein better divorce the effects of components of physical attractiveness from one another, providing the strongest test to date of the effects of attractiveness on reciprocal exchange.

The lack of an effect of the health transformation on investment decisions may reflect trade-offs inherent in choosing attractive over unattractive partners. The relative desirability of attractive individuals grants them opportunities to abuse the trust of others, so, in the absence of additional information (e.g., a cue of kinship; DeBruine, 2002; Krupp, DeBruine, & Barclay, 2008), the attractiveness of a partner may be moot. Indeed, prior research tends to find only small effects of attractiveness on attributions of "integrity" and "concern for others" (Eagly et al., 1991). With regard to returns, however, exchange partners may consider an investment to be an honest signal of cooperative intent (Barclay & Willer, 2007). If so, it could be in the interests of individuals to repay this investment when exchange partners are attractive, because of the advantages an attractive, cooperative partner brings. Thus, attractiveness suffices not to leverage an investment but instead to encourage a profitable return.

We note in passing that male P2s appeared to discriminate against all partner types except attractive female P1s (though this result should be interpreted with caution, as the three-way interaction between participant sex, face sex, and health transformation was not statistically significant). This suggests that reciprocal exchange decisions, even in one-shot and anonymous contexts, are not immune to what appear to be courtship motivations. Plausibly, men perceive investments by women as a signal of sexual interest, and are inclined to reciprocate such a signal (when originating from an attractive woman) with a profitable return. Sexual selection may thus have played a part in the evolution of human reciprocity.

Although we found that manipulating the apparent health of faces modulated participants' responses, we did not consider possible effects of the baseline attractiveness of the faces we manipulated. This has been shown to qualify the effects of apparent health on face preferences (Smith, Jones, DeBruine, & Little, 2009) and should be investigated in future studies, as it may yield further relevant results. Moreover, in common with many previous studies of behavioral responses to perceived health in faces (e.g., Conway et al., 2008; Jones, Little, Boothroyd, & DeBruine, et al., 2005; Jones, Little, Boothroyd, & Feinberg, et al., 2005), our current research did not address the nature of the specific facial cues that contribute to perceived health. Previous research has shown that both surface characteristics, such as red color information, and shape characteristics, such as symmetry, averageness, and low adiposity, contribute to perceptions of health when viewing faces (Coetzee, Perrett, & Stephen, 2009; Jones et al., 2001; Rhodes et al., 2001; Stephen, Law Smith, Stirrat, & Perrett, 2009). Likewise, both shape and surface cues to perceived health are correlated with indices of actual health (Coetzee et al., 2009; Rhodes et al., 2001; Roberts et al., 2005). We suggest that research addressing the contribution of each of these facial cues of health to behavior in economic interactions is likely to be a fruitful avenue for study in the future.

Acknowledgments

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