Fluctuating Asymmetry of Responders Affects Offers in the Ultimatum Game Oppositely According to Attractiveness or Need as Perceived by Proposers

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Abstract

The Ultimatum Game (UG) measures cooperative tendencies in humans. A proposer offers to split a given sum of money between self and a responder, who may accept or reject the offer. If accepted, each receives the proposed split; if rejected, nobody receives anything. We studied the effect of the putative responder's degree of facial symmetry (fluctuating asymmetry, FA) on the offer he/she received in opposite-sexed UGs. Symmetry is an important measure of biological quality so subjects were expected to receive higher offers when symmetrical than asymmetrical. In a sample of Jamaicans, individuals played two UGs with opposite-sexed responders, a symmetrical photo of a Lebanese and an asymmetrical one. Individuals do indeed give more to symmetrical responders ($p = 0.032$). When subjects are asked their motivation, a striking dichotomy emerges: those who cite 'attractiveness' as a motive, give strongly to symmetrical responders while those citing 'need' invariably give more to asymmetrical ones ($p < 0.0001$). Females also show a nearly significant tendency to cite need as a motive more often than do males.

Introduction

The Ultimatum Game (UG) is a valuable experimental tool from behavioral economics that provides an objective measure of cooperative and punitive behavior. Indeed, it amounts to an implicit measure of our sense of fairness, as people have to suffer a cost to prevent an unfair arrangement. In a UG, a proposer is allocated an amount of money to split with a responder. He or she proposes a split. If the responder accepts the offer, the two share the money accordingly. If not, neither receives any money (Guth et al. 1982; Camerer 2003). The game can be played as a one-shot anonymous interaction where two participants know nothing about each other and do not expect to interact again in the future. In such games responders are expected to accept any offer above zero, but extensive cross-cultural research shows that offers lower than 20–30% are typically rejected (Guth et al. 1982; Gintis 2000). This has led to a lively debate over how best to interpret these findings (Fehr & Fischbacher 2004; Trivers 2004, 2006; Hammerstein & Leimar 2006).

The game can also be played so that some information is provided to one or both parties. For example, offers are increased when the sex of the responder is a male (Solnick 2001), or when he or she is attractive (Solnick & Schweitzer 1999; Joergensen & Hancock 2001; Solnick 2001; Hancock & DeBruine 2003). We were curious whether the degree of facial symmetry (FA) of the respondent would affect size of offers made in an opposite-sex UG. We were also curious whether the FA of the proposer (bodily) would interact with the FA of the

responder (facial). We had already shown that, in anonymous UGs in Jamaica, young men who are more symmetrical in their body (low FA) offer less while there is no such effect in females (Zaatari & Trivers 2007). As symmetrical individuals (especially males) are more attractive to the opposite sex in a wide range of species, including humans (Gangestad et al. 1994; Møller & Swaddle 1997; Thornhill & Gangestad 1999; Hughes et al. 2002), this finding is consistent with a range of other games, in which attractive males defect more often (as opposed to cooperate) while attractiveness has no effect on female behavior (Takahashi et al. 2006).

Fluctuating asymmetry (FA) is a measure of biological quality because it measures an important underlying variable, the degree of developmental stability, which is an organism's ability to reach an adaptive end point despite ontogenetic perturbations Møller 2006; Møller & Swaddle 1997; Polak 2003). The more symmetrical an organism is (low FA), the better is the rest of its phenotype. Symmetry is shown to have strong positive associations with immune strength and resistance to parasites (Møller 2006), ability to escape predators, speed, strength, mental acuity and ability to cope with a wide range of stressors (Polak 2003; Møller 2006; Thoma et al. 2006).

Given that people typically offer more to those rated attractive (Solnick & Schweitzer 1999; Joergensen & Hancock 2001; Hancock & DeBruine 2003), and given that low FA individuals (of both sexes) are consistently rated as more attractive than high FA individuals (Gangestad et al. 1994; Thornhill & Gangestad 1999; Hughes et al. 2002), we expected that the more symmetrical the opposite-sexed responder, the more attractive he or she would be and the more money he or she would be offered. In general, we expect people to prefer to interact with relatively high quality people whether for reproductive benefit or for better access to resources given high quality people's increased ability to obtain resources, so the prediction holds independently of FAs correlation with attractiveness.

Methods

Facial Symmetry

Photos of 166 young adults from Sidon, Lebanon were taken in Jan. 2006 and measured for degree of facial FA using computer software, Psychomorph (version 8.4.7.0, copyright University of Saint Andrews 1999–2004) (Penton-Voak et al. 2001; Tiddeman et al. 2001). The photos were face front and of neutral expression. Twenty photos were selected to act as responders in an ultimatum game; 10 males and 10 females, which included five of the most symmetrical for each sex and five of the least symmetrical for each sex.

UGs

In March 2007 and 2008 Jamaican young adults enrolled in the Jamaican Symmetry Project played two UGs as proposers, each time with a different photo of an opposite-sexed responder, one relatively asymmetrical and one symmetrical (Fig. 1), randomly assigned for each category from the 20 selected photos. In each UG, Jamaican subjects made two offers (out of 1 000 Jamaican dollars, ~15 US dollars) to a symmetrical (low FA) photo and an asymmetrical (high FA) photo in random order, both of opposite sex to the proposer. Proposers were told that individuals in the photos are from a different country, and they had already decided on the amount they would accept. Offers below 30% were rejected, and every fourth offer of 30% was also rejected to undermine outcome communication between subjects. When offers were accepted, proposers kept their portion of the money. Afterwards, proposers also rated the two photos on a scale of 1–5 for attractiveness (1 very unattractive, 5 very attractive). If they made different offers to the two photos, they were then asked why they offered one photo more than they offered the other. Attractiveness ratings and reasons why they gave more to one photo were collected as the study progressed, and so such data is not available for subjects participating early on in the study. Responder faces were chosen from a distant population to avoid the illusion of any future interaction and minimize any pre-existing biases regarding local faces. Faces were also purposefully chosen with phenotypic traits distinct to Jamaican traits to prevent predisposed bias to favor some local traits that would correlate with symmetry. If symmetry is an important measure of phenotypic quality, individuals are expected to favor it regardless of population-specific physical features that could correlate with it.

Subjects

Study participants consisted of 106 males and 82 females (mean age $\pm$ SD = 18.07 $\pm$ 1.75) enrolled since 1996 in the Jamaican Symmetry Project. Subjects were measured for degree of bodily symmetry

Top: asymmetrical female (left), symmetrical female (right)
Bottom: asymmetrical male (left), symmetrical male (right)

Fig. 1: Representative examples of the four categories of photos acting as responders.

(wrists, ankles, elbows, third digit, fourth digit etc) with vernier calipers to 0.01 mm accuracy in 1996 and 2002 in Southfield, Jamaica (Trivers et al. 1999; Zaatari & Trivers 2007). FA values from 1996 to 2002 were averaged to get one number for each subject after correcting for missing data as described in Zaatari & Trivers (2007). When analyzing the effect of subjects' own FA on UG offers, we separated our sample into two non-overlapping categories of less than 0.12 for symmetrical (n = 47) and greater than 0.15 for asymmetrical (n = 54).

Results

One hundred and eighty eight Jamaican subjects made separate offers to two photos of a symmetrical and an asymmetrical opposite-sexed responder whose minimum accepted offer was said already to have been determined. The total available was $1000JA (~$15US). The modal offer size was $500 (range 0–1000, median offer $400). After averaging the two offers per individual, the mean offer size was 375.8 (N = 188, SD = 166.9, SE = 12.2, hereafter $\bar{x} \pm$ SE). Mean offer size was approximately normally distributed with no significant skewness or kurtosis. The order in which the photos were presented – symmetrical photo presented first or asymmetrical photo first – had no significant effect on the difference in offer size between symmetrical and asymmetrical photos (unpaired $t_{185} = 1.39$, $p = 0.17$; one missing data point), although there was a trend toward giving more to the first photo.

Photo Symmetry and Offer Size

As predicted, there was a significant tendency (paired $t_{187} = 2.16$, $p = 0.032$) for subjects to give more to symmetrical than asymmetrical photos although effect size was small (mean difference = 20.0 Jamaican Dollars, Cohen's $d = 0.11$). This difference was nearly significant for female subjects ($t_{81} = 1.83$, $p = 0.072$) but not for males ($t_{105} = 1.33$, $p = 0.19$). Overall, 47.9% of subjects gave more to symmetrical photos, 28.7% gave more to asymmetrical photos, and 23.4% gave the same amount to both. There was no sex difference in this distribution of offers among photos ($\chi^2_2 = 0.65$, $p = 0.72$).

Comparing only those who offered variably to photos, the distribution of offers differs significantly from 50:50 ($\chi^2_1 = 9.00$, $p = 0.003$). Females made a larger offer to the symmetrical photo significantly more frequently than to the asymmetrical one ($\chi^2_1 = 6.25$, $p = 0.012$); this difference was not quite significant among males ($\chi^2_1 = 3.20$, $p = 0.074$).

Table 1: Comparison of amount offered to photos judged to be more attractive vs. photos judged to be less attractive

	Subjects who offered more to the more attractive photo % (N)	Subjects who offered more to the less attractive photo % (N)	Mean offer to the more attractive photo ± SE	Mean offer to the less attractive photo ± SE	Subjects who offered equally to both photos %(N)	p=two-tailed
Total	59% (74)	23% (29)	379.92 ± 15.13	342.42 ± 15.99	18% (23)	0.002
Males	57% (40)	21% (15)	400.29 ± 19.31	353.50 ± 21.28	21% (15)	0.0076
Females	61% (34)	25% (14)	354.46 ± 23.74	328.57 ± 24.30	14% (8)	0.12

Total: paired $t_{125} = 3.16$, $p = 0.002$, mean difference = 37.50.
Males: paired $t_{69} = 2.75$, $p = 0.0076$; mean difference = 46.79.
Females: paired $t_{55} = 1.60$; $p = 0.12$; mean difference = 25.89.

Photo Attractiveness and Offer Size

As predicted, subjects offered more to photos they rated as more attractive (paired $t_{125} = 3.16$; $p = 0.002$; mean difference = 37.5 Jamaican Dollars, Cohen's $d = 0.21$; Table 1). This difference was also highly significant in males ($t_{69} = 2.75$; $p = 0.0076$), but not in females ($t_{55} = 1.60$; $p = 0.12$). There was no difference between males and females in the distribution of offers to photos judged to be more or less attractive ($\chi^2_2 = 0.60$, $p = 0.74$).

Photo Symmetry and Attractiveness Rating

Symmetrical photos were typically judged to be more attractive than asymmetrical ones (on a scale of 1–5, with 5 being very attractive). The mean attractiveness rating for symmetrical photos was 4.0 ± 0.1 while it was 3.2 ± 0.1 for asymmetrical photos (paired t-test, $t_{181} = 7.98$, $p < 0.0001$; Cohen's $d = 0.76$). This was also highly significant when split by sex of raters (for males, $t_{103} = 5.42$, $p < 0.0001$; symmetrical photos ratings = 4.1 ± 0.1, asymmetrical photos ratings = 3.3 ± 0.1; for females, $t_{77} = 6.03$, $p < 0.0001$; symmetrical photos ratings = 4.0 ± 0.1, asymmetrical photos ratings = 3.1 ± 0.1).

Results also suggested that if the symmetrical photo was rated more attractive, subjects gave more to symmetrical photos (mean difference in offer size = 39.9 ± 12.2, $n = 111$). If rated less attractive, subjects responses were highly variable with a tendency to give more to asymmetrical photos (-25.0 ± 41.0, $n = 16$), and if rated the same, subjects tend to give close to the same amount (6.0 ± 12.4, $n = 55$). Using an ordered-heterogeneity testing procedure with three categories (symmetrical is more attractive, same, less attractive), this comparison is statistically significant (ANOVA $F_{2,179} = 2.81$, $r_sP_c = 1(1-0.063) = 0.937$, $P < 0.025$; Rice & Gaines 1994).

Why Give More?

When asked why they gave one photo more than the other, subjects' responses revealed a striking dichotomy: 35 gave more to a photo because they thought it was more attractive or cute and of these, 29 picked the symmetrical photo. Eleven gave more to the photo they said needed it more, and all chose the asymmetrical photo. Separate comparisons of 29 vs. 6 and 11 vs. 0 when a 50:50 split is the null hypothesis show highly significant effects (Table 2). Indeed the difference between giving to symmetrical photos on basis of attractiveness and asymmetrical on the basis of need is also highly significant (Table 2). Females show a nearly significant tendency to cite need as a motive more often than do males (2×2 Contingency chi-square with Continuity Correction, $\chi^2_1 = 3.24$, $p = 0.072$). This would be consistent with various lines of evidence that females are more likely to show compassion for the pain of others than are males (Singer et al. 2004).

It might be expected that subjects' FA would have an effect on the size of their offers to partners whose own FA varies. For example, asymmetrical males might avoid high investment in a superior quality female as such females would tend to seek out better quality males but we find no difference between

Table 2: Comparison between reasons for giving more to a photo (need vs. attractiveness) split by photo symmetry

Reason for giving more to a photo		
	Need	Attractiveness
Symmetrical	0	29
Asymmetrical	11	6
p-value (chi square) two-tailed	0.001	<0.0001

2×2 contingency chi-square with continuity correction for 0 and 11 vs. 29 and 6: $\chi^2 = 21.23$, $p < 0.0001$ (df = 1).

how symmetrical (composite bodily FA < 0.12) and asymmetrical (composite bodily FA > 0.15) proposers play the game. Symmetrical proposers are no more (or less) likely than asymmetrical subjects to give more to the symmetrical photo ($\chi^2_2 = 1.41$, $p = 0.49$).

However, subjects' degree of bodily FA had an effect on the reported reason for offering one photo more than another. For symmetrical individuals who said they gave more to a photo because they said it was more attractive or cute, 13 of 13 gave more to the symmetrical photo. For asymmetrical individuals who said they gave more to a photo because it was more attractive/cute, only 3 of 7 gave more to the symmetrical photo (Fisher's Exact Test $p = 0.0072$).

Discussion

Behavior in the UG, in our view, reflects tendencies selected in a world of frequent interactions. Subjects take these tendencies with them to the games, and so a higher offer may be the first act in a series of favorable exchanges, or in this case even an act of courtship. Because subjects were playing with the opposite sex, generous offers to symmetrical photos could be viewed as an implicit attempt at initiating a relationship, perhaps a mating opportunity. Males could have acted generously to females who appeared to be of good quality as a gift of resources or as a display of resources available. As for women, in rural Jamaica young men often do not provide much parental investment, and there is evidence that women may be relatively selective about male genetic quality (Penton-Voak et al. 2004). In our study female choice was mostly responsible for the effect of photo symmetry on offer size. By offering more, females could express interest and initiate a series of interactions leading to a mating opportunity with a good quality male. Or generous offers could also be a female's way of showing interest in a male's genetic quality rather than his resources. An alternative explanation for why males offer symmetrical females more is that males may assume that symmetrical females will be more discriminating and hence demand higher offers.

To our knowledge this is the first time that relative need or neediness has been associated with FA in situations of choice. That is, subjects in our game who offered more to individuals because they were perceived to be in greater need, invariably gave more to the asymmetrical individual. This, of course, makes sense on the assumption that asymmetrical individuals are indeed on average, in worse shape.

By the same token we have shown that FA of a potential recipient can evoke opposite effects on offer size depending on whether individuals claim to bias offers upwards in response to apparent attractiveness of the recipient or its neediness. The overall effect of degree of facial symmetry is still positive, but it is easy to imagine situations in which the two effects could cancel out when lumped together, so that there could exist strong effects of FA that would easily be overlooked. To us, this suggests the value of asking simple questions such as 'why did you choose x?' to reveal the underlying dynamics more clearly.

Our work is also the first to show an interaction between a proposer's and responder's FA. Symmetrical proposers gave more to symmetrical responders based on attractiveness rather than need while asymmetrical responders were less likely to do so.

Finally, we note that our work joins a growing list of effects of individual variables in one-shot anonymous (or semi-anonymous) UGs. Offers are affected by sex, FA and BMI of actor (Solnick & Schweitzer 1999; Solnick 2001; Zaatari & Trivers 2007) and attractiveness and facial FA of apparent recipient (see above), while tendency to reject low offers is positively affected by testosterone of male responders (Burnham 2007) and negatively related to serotonin levels in both sexes (Crockett et al. 2008).

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