The role of altruistic costs in human mate choice

Manpal Singh Bhogal (m.s.b2@wlv.ac.uk)* [1], Daniel Farrelly [2], Niall Galbraith [1], Ken Manktelow [1] & Hannah Bradley [2]

*ORCID: 0000-0002-7913-0726 (corresponding author)

[1] Department of Psychology, City Campus, University of Wolverhampton, Wolverhampton, WV1 1LY, UK

[2] School of Psychology, University of Worcester, St John's Campus, Henwick Grove, Worcester, WR2 6AJ, UK

*Corresponding author (m.s.b2@wlv.ac.uk)

Acknowledgments: We thank David Boyda, Robert Dempsey, & Danielle McFeeters for their valuable comments on an earlier draft of this manuscript.

Note: This is the accepted version of the manuscript to appear in Personality and Individual Differences. Date accepted: 20th February 2020.

Abstract

There is a large body of research exploring the role of altruism in mate choice, showing altruism is a mating signal. However, it is still unclear whether these traits signal good genetic quality, due to their costly nature, or good partner/parenting qualities. We report the findings of three experiments that aimed to address this, by comparing the desirability of individuals who displayed either moderate or high levels of altruistic behaviour, and non-altruistic behaviour in dictator games and hypothetical social scenarios. These experiments adopted a variety of experimental designs to test our hypotheses. We consistently found that individuals displaying moderate levels of altruism were rated as more desirable than those displaying higher levels (and both more so than non-altruistic individuals). Our findings offer strong evidence for the underlying characteristics displayed by altruistic behaviour, rather than their absolute costs, being more important in mate choice. To our knowledge, this is the first paper to report a suite of experiments providing strong support that the cost of an altruistic act is more important than the act itself in a mate choice context. These findings go beyond and extend previous literature on altruism and mating by unpacking the role of prosociality in mate choice.

Keywords: prosocial behaviour; altruism; mate choice; costly signals

"It pays to be nice, but not really nice."

(Klein et al. 2015, p. 356)

Altruism is defined as behaviour which is beneficial to another, at cost to oneself (Trivers, 1971). To explain why humans behave altruistically, researchers have proposed that one of the adaptive benefits of altruism is that it can increase reproductive success, due to it being a desired trait in mate choice (e.g. Miller, 2000, 2007). Subsequently, empirical research has found support for the role of altruistic behaviours in mate choice. For example, individuals who behave altruistically are viewed as more desirable romantic partners (Barclay, 2010; Ehlebracht et al. 2018; Farrelly, 2011, 2013; Farrelly et al., 2016; Farrelly & King, 2019; Moore et al., 2013; Phillips et al., 2008) and altruistic displays are used in mate choice scenarios to attract potential romantic partners (Bhogal et al., 2019; Bhogal et al., 2016a, Farrelly et al., 2007; Iredale et al., 2008; Raihani & Smith, 2015; Schwarz & Baßfeld, 2019; Tognetti et al., 2012; Tognetti et al., 2016; van Vugt & Iredale, 2013). Furthermore, such positive effects of being altruistic are found in real-life settings, where altruists have greater mating success than non-altruists (Arnocky et al., 2017; Stavrova & Ehlebracht, 2015).

Although the above evidence suggests that altruistic behaviour is important in human mating, it remains unclear as to what qualities are being signalled via these altruistic displays. In other words, what information about an individual is being signalled by their altruistic behaviour that is of benefit to the receiver? One premise is that altruistic displays signal that the actor has good genetic quality (Miller, 2000) suggesting that only those that are genetically 'fit' enough to afford the costs of these displays tend to hold these traits, making them more desirable, as future offspring would then inherit these qualities (Andersson, 1994). Therefore, altruistic behaviour can merely act as exaggerated and/or ornamental costly signals of an individual's genetic quality (Gintis et al., 2001; Zahavi, 1975), akin to the peacock's tail

(Zahavi, 1975), where the size of the trait is directly proportional to its underlying quality. This premise is supported by Miller (2000; 2007), who suggests that altruistic behaviours do indeed act as indicators of genetic fitness, due to their heritability, their cost, and the conspicuous nature of their display.

In this premise, what are often being signalled in altruistic displays are an individual's levels of resources or similar indicators of status such as hunting ability (e.g. Smith & Bleige Bird, 2000). In a recent genome-wide association study (GWAS), it has been shown that this can have a genetic origin, which suggests that cognitive ability is a causal phenotype which accounts for the link between genetic inheritance and resource levels (Hill et al., 2019). Therefore, this offers support for the premise that resource levels or status, or potential thereof, can be directly correlated with an individual's genetic quality (via phenotypes such as cognitive ability) and can thus be signalled to others via altruistic acts.

An alternative premise to altruistic behaviour being a signal of good genetic quality is that instead, it may better act as a signal to potential mates that the actor can be a good quality partner and/or parent to future offspring. This would mean that altruists will be desired as mates primarily for the immediate phenotypic benefits they provide in relationships and offspring care (Kokko, 1998) rather than for the genetic benefits offspring would then inherit. Such signals will be particularly important in species such as humans where offspring require high levels of investment from parents in order to survive and reach maturity. In terms of altruistic behaviour, this may signal levels of resources, or it may signal important personality traits such as kindness (e.g. Buss, 1989; Thomas et al., in press), generosity (e.g. Bhogal et al., 2016a, Farrelly, 2011) or trustworthiness (Ehlebracht et al., 2018) that can be beneficial qualities in a partner or future parent.

Therefore, there are two proposed qualities that altruistic behaviour can predominantly signal in mate choice; good genetic quality and good parent/partner quality. This now begs the question; how can these be distinguished? One way is to examine the effect of relationship type on the desirability of potential altruistic mates. Signals of good partner/parenting qualities are more desired for longer term relationships (where care and provisioning of offspring is particularly important) as this is where the phenotypic benefits will be most beneficial (Bhogal et al. 2019). Conversely, signals of genetic quality are more desired for short-term relationships where the genetic benefits from a partner will be more important (and good partner/parent qualities less so, see Bhogal & Hughes, 2019). Altruism is more desired for long-term compared to short-term relationships, because altruism advertises cooperative intent towards a partner and future offspring (Bhogal, 2019). This is particularly important as long-term relationships are regarded as cooperative ventures, whereas short-term relationships are not (DeMaris, 2010). In support, a plethora of research has shown that due to altruism signalling good parent/partner qualities, altruistic partners are desired more for long-term, compared to short-term relationships (Barclay, 2010; Bhogal et al., 2019; Ehlebracht et al., 2018; Farrelly, 2011; 2013 Farrelly et al., 2016; Farrelly & King, 2019; Kelly & Dunbar, 2001; Norman & Fleming, 2019; Stavrova & Ehlebracht, 2015).

Another area where a distinction between these two competing hypotheses can be made is in relation to sex differences. Due to the asymmetry in parental investment (Trivers, 1972), whereby females invest more in offspring care, females are the ‘choosier’ sex (Darwin, 1871). Therefore, females seek high quality males as partners, and in species where males provide little or no parental investment, women specifically seek signals of genetic quality that are passed on to shared offspring. Furthermore, in such circumstances, males will be more likely to display such signals of genetic quality, such as the peacock’s tail. However, in species where males do invest considerably in offspring (such as in humans), both men and women actively

select partners, and will place more value on signals of good partner/parenting. When it comes to altruism, there is strong evidence that both men and women find such behaviours desirable (Farrelly, 2013; Farrelly & King, 2019) and signal them to potential mates (Bhogal et al., 2019; Farrelly et al., 2007). Furthermore, it is important to note that despite this effect of mutual rather than female mate choice in species with more equal investment in offspring, it is still females who invest more into offspring than males, meaning they will still find such traits more important compared to men. This is also found with altruism, where although both sexes find altruism desirable, it is more desired by women compared to men (Bhogal et al. 2019; Farrelly, 2013; Farrelly & King, 2019). This coupled with the finding that men and women both find altruism more desirable in long-term partners (Farrelly, 2013), once again strongly suggests that altruistic behaviours mainly signal good partner/parenting qualities.

Recent research has examined the desirability of altruistic behaviours concurrently with physical attractiveness, as the latter can be a reliable signal of genetic quality (Farrelly et al., 2016; Ehlebracht et al., 2018). Farrelly et al. (2016) found that women found altruism to be more desirable than physical attractiveness in men, particularly for long-term relationships, which as mentioned above indicates it is an important signal of good partner/parent qualities. Subsequently, Ehlebracht et al. (2018) found that there was an additional, synergistic effect of behaving altruistically on a physically attractive individual's desirability for long term relationships. The authors hypothesised that this is because they signal different qualities; the individual's altruistic behaviour signals that they can be a good partner/parent and their physical attractiveness signals that they also have good genetic quality. These studies therefore show that once again altruistic behaviours can clearly act as signals of good partner/parenting qualities in mate choice.

The aim of the research presented here is to further attempt to distinguish between whether altruistic behaviours signal good genes or good partner/parent qualities by examining

if altruistic displays in mate choice are indeed costly signals. Zahavi (1975) stated that for a trait to be a costly signal, it must be a handicap, and that the size of the trait will be directly related to its underlying quality. This will be more applicable to signals of genetic quality which means that if altruistic behaviours are predominantly signalling genetic quality, then as already stated, the size of the cost will be directly and positively related to one's underlying genetic quality. However, if altruistic acts are primarily desired due to the immediate characteristics that they can bring to a relationship or shared parenthood (such as desirable personality traits), then it is argued here that the relationship between the size of the cost and the underlying quality will be less precise and/or less important. In other words, highly costly or exaggerated altruistic acts will not be more desired (and may even be potentially less desired due to their wasteful nature), whereas acts that simply reflect an individual has a more general, prosocial nature, will be desirable. Or, to put it into simpler terms, in human pair-bonding where high levels of bi-parental care are important, it will be important for a potential partner to be as altruistic or kind as *necessary*, rather than as *possible*.

In order to identify potential mates who possess the traits we desire, it is important to have the mechanisms in place to be able to screen a potential partner's behaviour through observation. By observing isolated acts, we can make inferences about another person's character. As mentioned previously, a key focus of this paper was to investigate the differing costs associated with altruistic behaviour and explore whether the size of such a costly signal influences how desirable such a trait is. Therefore, we compared how desirable different potential mates were who behaved altruistically, but with differing levels of costs associated with these acts. Using scenarios and economic games where individuals could allocate their resources to themselves and/or another, we differentiated between 'high altruistic' allocations (high costs), and 'moderately altruistic' allocations (moderate cost). We argue here that the latter would signal a more nuanced form of prosocial behaviour (e.g. fairness), and more

importantly that such individuals who choose this allocation have the *necessary* good partner/parenting qualities that are desired, rather than those who choose to incur higher costs from being as altruistic as *possible* in such scenarios.

To test this question, participants across a series of experiments were presented with details about how different potential partners behaved in a video-based dictator game (Experiment 1), a hypothetical dictator game (Experiments 3) and/or social scenarios (Experiment 2). The dictator game is an economic game, typically used to measure altruism in the laboratory (Camerer, 2003). It has been used extensively in behavioural science research, typically involving two people. One person is given the role of the 'dictator' whereby they are given a sum of resources to distribute (or not) with a recipient. The recipient's role is passive, as they are unable to negotiate offers made by the dictator. The dictator game is a simplistic, useful tool in research exploring altruism (in both online and offline contexts, see Bhogal et al. 2019), and has been used in research exploring altruism and mate choice (e.g. see Bhogal et al., 2016b, 2017).

Our research question was: does the desirability of altruistic behaviour depend on the costs associated with an altruistic act? To unpack altruistic behaviour, there were three potential behaviours explored in dictator games, or social scenarios: the individual was either non-altruistic (kept all the resource for themselves), moderately altruistic (donated half of the resources to the other person) or highly altruistic (donated all or most of the resources to the other person). Based on previous research detailed above that suggests altruistic behaviours act as signals of an individual's partner/parenting qualities, rather than costly signals of genetic quality (where the size of cost is directly related to desirability), it was hypothesised that individuals who incur moderate costs by donating half their resources, will be viewed as more desirable as potential partners than those that display more costly acts of altruism (donating all

their resources), and that both will be viewed more desirable than those who act non-altruistic (donating nothing). Therefore, we hypothesised the following:

Hypothesis 1: Both men and women would find potential mates who behave moderately altruistic as more desirable than those that behave highly altruistically (Experiments 1, 2), but this difference would be greater for women than men.

Hypothesis 2: The preference for moderately altruistic over highly altruistic potential partners would be greater for long-term than short-term relationships (Experiments 2 & 3).

Hypothesis 3: Consistent with Farrelly et al. (2016), women would report greater desirability for moderately altruistic than high attractive individuals, particularly for long-term relationships. Furthermore, this preference for moderate altruism over high attractiveness would be greater than similar preferences for highly altruistic individuals (Experiment 3).

Hypothesis 4: Consistent with Ehlebracht et al. (2018), there would be a synergistic effect of being both moderately altruistic and attractive on desirability for long-term relationships. Furthermore, this effect would be greater for moderately altruistic than highly altruistic behaviour (Experiment 3).

2. Experiment 1

2.1. Method

2.1.2. Participants and Design

Two hundred and sixty-two heterosexual people took part from two UK universities (124 men, 138 women, *M*age = 19.77 years old, *SD* = 1.44), recruited via opportunity sampling. Confederates were two (one man, one woman) members of staff at a UK university. For experiment 1, efforts were made to recruit first-year undergraduate students, or non-

psychology students to avoid potential confounds such as familiarity towards the staff in the video. In addition, those who were in a relationship were asked to answer the questions as though they were single.

We adopted a 2 (participants' sex: man, woman) x 3 (allocation: highly altruistic, moderately altruistic, non-altruistic) between groups design. Perceived attractiveness was the dependent variable, measured on a 1 (*very unattractive*) to 5 (*very attractive*) Likert Scale. To conceal the aims of the experiment, participants were also required to answer non-relevant 'dummy' items related to the target (how much do you think each person earns, how interesting and intelligent the person looks etc.).

To guide our anticipated sample size, an a-priori power analysis was conducted using G*Power (Faul et al., 2009). To achieve 80% power (effect size of .25 with six groups, and an alpha level of .05 – all for ANOVA: fixed effects), G*Power recommended 158 participants, which we surpassed.

2.1.3. Materials and Procedure

A man and woman were recorded playing six variations of the dictator game, with each person distributing either moderately altruistically (donating £50 of their initial £100), non-altruistically (donating £0 of their initial £100), or highly altruistically (donating £80 of their initial £100). Participants viewed only one video of opposite sex dictators and same-sex recipients, after which they answered questions outlined in the design section. For example, men viewed a video where the dictator was a woman, and women viewed a video where the dictator was a man.

2.2. Results

A 2 x 3 between groups ANOVA was conducted to measure the effect of the allocation made by the target, and the participants' sex on the participants' attraction to the target. Descriptive statistics are presented in Table 1.

Table 1. Descriptive statistics for perceived attractiveness as a function of sex and allocation (Experiment 1).

Allocation	**Participants' sex**	**Attraction to target**	**N**
High	Men	2.26 (0.50)	42
altruism	Women	2.60 (0.58)	47
Moderate	Men	2.26 (0.50)	42
altruism	Women	3.51 (0.72)	47
Non-	Men	1.15 (0.36)	40
altruistic	Women	1.16 (0.37)	44

Hypothesis 1: Both men and women would find potential mates who behave moderately altruistic as more desirable than those that behave highly altruistically, but this difference would be greater for women than men.

There was a significant main effect of the allocation, F (2, 256) = 251.08, p <.001, η_p^2 = .66, and post-hoc tests revealed that participants rated moderately altruistic targets as more attractive than highly altruistic targets (t = 5.82, p <.001), highly altruistic targets as more attractive than non-altruistic targets (t = 2.67, p <.001) and moderately altruistic targets as more attractive than non-altruistic targets (t = 2.54, p <.001).

There was a significant interaction between the participants' sex and allocations, F (2, 256) = 32.76, p <.001, η_p^2 = .20. In terms of between-sex effects, women's attractiveness

ratings of highly altruistic targets were significantly higher than those of men ($F = 9.00$, $p < .01$, $\eta_p^2 = .03$), and the same was true for moderately altruistic targets ($F = 125.97$, $p < .001$, $\eta_p^2 = .33$). However, there was no sex difference when viewing non-altruistic targets ($F = .01$, $p = .94$, $\eta_p^2 = .00$). We also conducted further post-hoc tests to explore within-sex differences between each condition (allocation). Women rated moderately altruistic male targets as more attractive than highly altruistic male targets and non-altruistic male targets. Women rated highly altruistic targets as more attractive than non-altruistic targets (all *p*s <.001). For men, there was no significant difference in attractiveness ratings for highly altruistic female targets and moderately altruistic female targets. Non-altruistic female targets were rated as less attractive than highly altruistic female targets, and moderately altruistic female targets (both *p*s <.001).

All findings from experiment 1 support Hypothesis 1, as participants (particularly women) rated moderately altruistic targets as more attractive than highly altruistic targets. As a result, in experiment 2, we aimed to replicate this finding by exploring the role of relationship type in the desirability of high and moderately altruistic targets. As mentioned in the introduction, research shows altruistic targets are more desirable for long-term compared to short-term relationships. Here, we extended experiment 1 by exploring the role of allocations (in social dilemmas involving financial and time costs) *and* relationship type on desirability ratings.

3. Experiment 2

3.1. Method

3.1.2. Participants and Design

One hundred and eleven heterosexual people took part from a UK university (49 men, 62 women, *M*age = 18.82 years old, *SD* = 1.36). We adopted a 2 (between groups variable:

participants' sex: man, woman) x 3 (within-subjects variable: allocation - highly altruistic, moderately altruistic, non-altruistic) x 2 (within-subjects variable: relationship type - short-term, long-term) mixed design. Perceived attractiveness was the dependent variable, measured in the same manner as Experiment 1.

To guide our anticipated sample size, an a-priori power analysis was conducted using G*Power (Faul, Erdfelder, Buchner & Lang, 2009). To achieve 80% power (effect size of .25, and an alpha level of .05 – all for ANOVA, repeated measures, between factors), G*Power recommended 78 participants, which we surpassed.

3.1.3. Materials and Procedure

Participants took part via Bristol Online Survey (www.onlinesurveys.ac.uk) and via paper/pen. Prior to taking part, participants were provided with definitions of what a short-term and long-term relationship were (Consistent with Farrelly, 2011, we defined a short-term relationship as an affair, one-night stand, and a long-term relationship as a committed, romantic relationship). Participants read four scenarios in which there were three targets behaving highly altruistic (Person A), moderately altruistic (Person B) or non-altruistic (Person C). Scenarios were non-gender specific. Participants were asked how attractive they considered each person to be for a short-term and long-term relationship, again measured on a 1 (*very unattractive*) to 5 (*very attractive*) Likert Scale.

3.2. Results

Hypothesis 1: Both men and women would find potential mates who behave moderately altruistic as more desirable than those that behave highly altruistically, but this difference would be greater for women than men.

There was a main effect of allocation, F (2, 108) = 1826.43, p <.001, η_p^2 = .94, and post-hoc tests revealed that (consistent with Experiment 1), participants rated moderately altruistic targets as more attractive than highly altruistic (t = 17.73, p <.001) and non-altruistic targets (t = 36.88, p <.001). Highly altruistic targets were rated as more attractive than non-altruistic targets (t = 34.42, p <.001).

There was a significant interaction between allocation and the participants' sex, F (2, 108) = 137.43, p <.001, η_p^2 = .56, and post hoc tests show that men rated highly altruistic targets as more attractive than non-altruistic targets (p <.001, d = 3.10), moderately altruistic targets as more attractive than highly altruistic (p <.001, d = 1.09), and non-altruistic targets (p <.001, d = 3.55). Women rated highly altruistic targets as more attractive than non-altruistic targets (p <.001, d = 3.45), and moderately altruistic targets as more attractive than highly altruistic (p <.001, d = 5.27) and non-altruistic targets (p <.001, d = 7.93).

Hypothesis 2: The preference for moderately altruistic over highly altruistic potential partners would be greater for long-term than short-term relationships.

There was a significant interaction between relationship type and allocation, F (1.83, 199.83) = 134.57, p <.001, η_p^2 = .55. There was a three-way interaction between relationship type, allocation, and the participants' sex, F (1.83, 199.83) = 41.95, p <.001, η_p^2 = .28. To further understand the three-way interaction, we conducted two 3 (allocation) x 2 (relationship type) repeated measured ANOVAs, by sex.

For women, there was a significant interaction between allocation and relationship type, F (2, 122) = 127.50, p <.001, η_p^2 = .68. Further exploration of these effects showed that women preferred long-term relationships with highly altruistic (t = 20.05, p <.001) and moderately altruistic (t = 2.01, p =.049) targets, but preferred short-term relationships (over long-term) with non-altruistic targets (t = 5.82, p <.001).

For men, there was also a significant interaction between allocation and relationship type, F (2, 96) = 39.41, p <.001, η_p^2 = .45. Further exploration of these effects showed that men preferred short-term relationships (over long-term) with non-altruistic targets (t = 8.0, p <.001). No further significant differences were found for men. Descriptive statistics are presented in Table 2.

Table 2. Descriptive statistics for perceived attractiveness as a function of sex, relationship type, and allocation (Experiment 2).

Allocation/Relationship Type	**Participants' sex**	**Attraction to target**
Short-Term		
High altruism	Men	3.06 (0.24)
	Women	1.97 (0.25)
Moderate altruism	Men	3.67 (0.55)
	Women	4.40 (0.49)
Non-altruistic	Men	1.90 (0.37)
	Women	1.40 (0.49)
Long-Term		
High altruism	Men	3.04 (0.35)
	Women	3.14 (0.40)
Moderate altruism	Men	3.65 (0.69)
	Women	4.55 (0.50)
Non-altruistic	Men	1.33 (0.52)
	Women	1.02 (0.13)

We found significant effects of the level of allocations made on each level of relationship type. These main effects were also present between sexes. Men rated highly altruistic targets as more attractive for a short-term relationship than women did, women rated highly altruistic targets as more attractive for a long-term relationship than men did, and women rated moderately altruistic targets as more attractive for short-term relationships than men did (all *ps* <.001). There was no sex difference in participants' attractiveness ratings when rating moderately altruistic targets for long-term relationships. In relation to non-altruistic targets, men rated them as more attractive for short-term relationships and long-term relationships (*p*s <.001) compared to women.

Further within-sex comparisons revealed that men and women rated moderately altruistic targets as more attractive than highly altruistic targets for short-term and long-term relationships (although this was more prominent amongst women, all *p*s<.001). Women rated highly altruistic targets as more attractive than non-altruistic targets for short-term and long-term relationships (both *p*s <.001).

The findings from experiment 2 replicate the findings from experiment 1 by showing moderate altruism was more desirable than high-level altruism. In addition, these findings are consistent with previous literature showing people find altruistic behaviour to be desirable for long-term rather than short-term relationships, although men and women did not differ in their preference for moderate altruistic targets when seeking a short-term or long-term relationship. The aim of experiment 3 was to examine the role of physical attractiveness in preferences for moderate and high altruistic behaviour, whilst also considering relationship type.

4. Experiment 3

4.1. Method

4.1.2. Participants and Design

One hundred and twenty-six heterosexual women took part from a UK university (*M*age = 24.60 years old, *SD* = 8.90). As this study was designed to replicate the findings of Farrelly et al. (2016) with the additional analysis of altruism (through allocations), focus here was solely on female participants. We adopted a 2 (attractiveness: high, low) x 3 (allocation: highly altruistic, moderately altruistic, non-altruistic) x 2 (relationship type: short-term, long-term) within subject's design. Perceived attractiveness was the dependent variable, measured in the same manner as experiments 1 and 2. Participants were asked how attractive they found the individual to be for a short-term and long-term relationship.

To guide our anticipated sample size, an a-priori power analysis was conducted using G*Power (Faul et al., 2009). To achieve 80% power (effect size of .25, and an alpha level of .05 – all for ANOVA: repeated measures), G*Power recommended 118 participants, which we surpassed.

4.1.3. Materials and Procedure

Participants took part online via ESurvey Creator (www.esurveycreator.ac.uk). Images were retrieved from the Chicago Face Database, which have been pre-set into high and low attractiveness (Ma et al., 2015). Each image was paired with a hypothetical scenario involving a dictator game, whereby the person in the image behaved highly altruistically (gave all the stake - £10), moderately altruistic (offered half the stake - £5), and non-altruistic (gave none of the stake).

4.2. Results

Hypothesis 1: Both men and women would find potential mates who behave moderately altruistic as more desirable than those that behave highly altruistically, but this difference would be greater for women than men.

Table 3. Descriptive statistics for perceived attractiveness as a function of relationship type, allocation, and targets attractiveness (Experiment 3).

Allocation	**Relationship type**	**Attractiveness**	**Attraction to target**
Non-altruistic	Long	Low	1.45 (0.47)
		High	2.30 (0.70)
	Short	Low	1.51 (0.57)
		High	2.76 (0.75)
Moderate altruism	Long	Low	2.09 (0.71)
		High	2.90 (0.70)
	Short	Low	1.97 (0.64)
		High	3.00 (0.65)
High altruism	Long	Low	1.94 (0.87)
		High	2.76 (0.95)
	Short	Low	1.93 (0.81)
		High	2.61 (0.83)

There was a significant main effect of allocation, F (2, 250) = 41.07, p <.001, η_p^2 = 0.25, as women were more attracted to men who were moderately altruistic compared to men who were highly altruistic, t (125) = 5.23, p <.001, d = .47, and non-altruistic, t (125) = 9.09, p <.001, d = .81, and women were significantly more attracted to highly altruistic men than non-altruistic men, t (125) = 4.44, p < .001, d = .40.

Hypothesis 2: The preference for moderately altruistic over highly altruistic potential partners would be greater for long-term than short-term relationships.

There was a significant interaction between allocation and relationship type, F (2, 250) = 33.10, p <.001, η_p^2 = 0.21, and subsequent pairwise comparisons revealed that only the desirability of non-altruists varied by relationship type, with non-altruistic men being rated as more desirable for short-term than for long-term relationships, t (125) = 7.37, p <.001, d = .67 (see Table 3 for descriptive statistics).

Hypothesis 3: Consistent with Farrelly et al. (2016), women would report greater desirability for moderately altruistic than high attractive individuals, particularly for long-term relationships. Furthermore, this preference for moderately altruistic over high attractiveness would be greater than similar preferences for highly altruistic individuals.

It was found that the desirability of high attractive, non-altruistic men was significantly higher than for low attractive, moderately altruistic men, t (125) = 6.25, p <.001, d = .56, and low attractive, highly altruistic men, t (125) = 6.31, p <.001, d = .56. When analysing desirability in relation to long-term relationships, it was found that high attractive, non-altruistic men were again rated significantly higher than low attractive, highly altruistic men, t (125) = 3.38, p <.001, d = .30, and significantly higher than low attractive, moderately altruistic men, t (125) = 2.34, p =.021, d = .21.

Hypothesis 4: Consistent with Ehlebracht et al. (2018), there would be a synergistic effect of being both moderately altruistic and attractive on desirability for long-term relationships. Furthermore, this effect would be greater for moderately altruistic than highly altruistic behaviour.

Finally, there was a three-way interaction amongst allocation, relationship type and attractiveness, F (2, 250) = 39.27, p <.001, η_p^2 = 0.24, whereby high attractive, moderately altruistic men were rated as most attractive compared to high attractive, highly altruistic men, and high attractive, non-altruistic men. Furthermore, this synergistic effect was stronger when women were seeking long-term compared to short-term relationships, thus supporting H4.

5. Discussion

Overall, we find strong support that those who behave moderately altruistic are rated as more attractive than those that behave highly altruistically, which was evident across all three experiments (Hypothesis 1). Furthermore, as predicted, this effect was found to be greater in women, reflecting previous research which finds altruism to be more important for female than male mate choice (see Bhogal et al., 2019 for a review). There is also partial support for moderate altruism being more desirable in long-term relationships than high altruism (Hypothesis 2), which was the case for women only (Experiment 2), but no evidence was found for this hypothesis in Experiment 3. Mixed support was found for hypotheses where physical attractiveness was concerned, with greater preferences being found for highly attractive non-altruistic men than less attractive, moderately or highly altruistic men (Hypothesis 3) which is counter to the findings of Farrelly et al. (2016). However, there was an interactive synergistic effect of greater desirability of being both moderately altruistic and attractive, which was greater than that of being both highly attractive and highly altruistic (Hypothesis 4).

The findings of these experiments offer support for moderate levels of altruism being more desirable than high levels of altruism in mate choice contexts. As a result, it offers further support for the view that altruism is important in mate choice for the good partner/parenting qualities they signal (Kokko, 1998). This is because, as consistently shown here, moderate levels of altruistic behaviour, which can signal necessary levels of underlying psychological traits such as kindness or fairness, were more important than more costly altruistic displays which could be directly related to the levels of underlying genetic quality. Further support for this can be found in the fact that moderate levels of altruism were more desirable than higher levels of altruism for both men and women, which is consistent with previous research that shows altruistic behaviour is a good partner/parenting indicator (Farrelly, 2011; 2013, Farrelly et al., 2016).

Moderate levels of altruistic behaviour were found to be more desirable for women, as sexual selection has possibly shaped women to be sensitive to a man's ability to commit to a relationship and future offspring (Sefcek et al. 2007). This means that women are more sensitive to cues that signal commitment and investment, which are signalled by allocating resources moderately, as this signals other important qualities in mate choice, such as kindness and fairness. Moreover, women have been found to value traits such as fairness more in romantic relationships compared to men, and relationships where unfairness is present are more likely to dissolve than those which are fair (DeMaris, 2007; DeMaris, 2010). This could therefore explain our findings, and further strengthens the need to explore the role of altruistic costs in mate choice, with future research exploring a wide range of costs across marital contexts, such as costs in housework, child rearing, and relational maintenance. Of further interest, albeit beyond the scope of the current research, is the finding that non-altruistic men were desirable for short-term relationships. This is a similar finding to Farrelly et al., (2016) who found 'low altruists' were desirable for short-term mating, and further highlights that this

finding may be commensurate with the literature that shows anti-social traits such as the Dark Triad (e.g. Jonason et al., 2009) as well as pro-social traits have roles to play in the rich tapestry of human mating.

Most research exploring the desirability of altruism in mate choice has largely focused on single altruistic acts, ignoring the costs, and level of altruism being displayed. The novelty of this paper is that our findings are the first to suggest that it is the size of an altruistic cost which is desirable in romantic relationships, not necessarily the altruistic act itself. Furthermore, this opens the door to future research to explore what moderate levels of altruism exactly signal in mate choice. This paper therefore offers a novel analysis of the role of altruism in mate choice, thus building on, and significantly extending previous findings. These consistent novel findings therefore point to future directions of research in this area which further explore the nature of what is precisely desirable about being altruistic, or prosocial in general. For example, we know that altruism is a prosocial trait, however there are further prosocial traits such as fairness and heroism. As a result, further investigation should focus on the size of prosocial acts relating to these traits, rather than simply focusing on the existence and non-existence of these traits in potential mates. Indeed, recent findings that have looked at unpacking specific prosocial behaviours, such as heroism (Margana et al., 2019) and trustworthiness (Ehlebracht et al., 2018) in mate choice contexts. As such, further research can increase our overall understanding of the role of altruism in mate choice from an adaptive point of view.

We operationalized moderate altruism as a 50/50 split of resources. We employed this cut off point, as the 50/50 split has been argued to be a fairness norm (Young, 2015). As a result, an explanation for the finding that people find such levels of altruism to be more attractive in a potential partner could be that people find norm-abiding people to be more attractive than those who behave highly altruistically, which could be argued to be anti-

normative. A further explanation derives from the do-gooder derogation hypothesis (Minson & Monin, 2012), in that people react negatively towards those who act morally superior compared to others.

An important point to note, is that mate choice is complex, occurring in a variety of contexts and processes. Mate choice is a sequential process whereby people screen potential partners over time before cementing a relationship (Sefcek et al. 2007). As a result, perhaps future research should explore the role of altruistic costs in mate choice across a wider range of contexts. One such context relevant here relates to the recipient of an altruistic act. By varying who the recipients are, future research could explore whether the size of altruistic acts given to different individuals, such as family members (e.g. Oda & Hiraishi, 2015) or either friends or potential partners, affects how others perceive them. This may contribute to our understanding of altruism as a potential signal in mate choice and/or its role in terms of willingness to provide (Oda & Hiraishi, 2015). Additionally, it would be of interest to understand more about the decisions people make in such studies, namely why high altruism was not as desirable as moderate altruism, as found in the experiments reported here. Again, this is beyond the parameters of the current research, but asking people to explain their choices (perhaps qualitatively) may further help us understand the current findings. Overall, although the ultimate role of altruism in relationships is a complex one, the current findings do offer a significant, substantial, and novel contribution to this burgeoning area of research.

Further investigation of costs associated with altruism and mate choice can concentrate on real-world or applied consequences. Previous findings have shown that altruistic individuals have greater mating success (Arnocky et al., 2017) and are more likely to be in longer term relationships (Stavrova & Ehlebracht, 2015). If, as we suggest, it is relatively moderate levels of altruistic behaviour that are more important in mate choice than higher levels, then similar findings should be found in real human relationships. Furthermore, examining how the relative

costs of different altruistic behaviours are differentially used when interacting directly with a potential partner rather than a third party (as was the case here in experiment 1) can also be of value.

In conclusion, the findings presented here offer a novel, important, significant, and impactful direction for our understanding of why being altruistic is important in human mating. Our research goes beyond past research highlighting the positive effects of altruism in mate choice, by showing that it is the size of an altruistic cost rather than an altruistic act itself which is important in making altruism a desirable trait in mate choice. The results in this paper are the first to empirically show that moderate levels of altruistic behaviour are more important than higher levels of altruistic behaviour in mate choice contexts.

References

Andersson, M. (1994). *Sexual selection*. Princeton, NJ: Princeton University Press.

Arnocky, S., Piché, T., Albert, G., Ouellette, D., & Barclay, P. (2017). Altruism predicts mating success in humans. *British Journal of Psychology*, *108*(2), 416–435. https://doi.org/10.1111/bjop.12208

Barclay, P. (2010). Altruism as a courtship display: Some effects of third-party generosity on audience perceptions. *British Journal of Psychology*, *101*(1), 123–135. https://doi.org/10.1348/000712609X435733

Bhogal M.S. (2019) Altruism Advertises Cooperativeness. In: Shackelford T., Weekes-Shackelford V. (eds) *Encyclopedia of Evolutionary Psychological Science*. Springer

Bhogal, M.S., Bartlett, J. E., & Farrelly, D. (2019). The influence of mate choice motivation

on non-financial altruism. *Current Psychology*, *38*(4), 959-964. https://doi.org/10.1007/s12144-018-0070-x

Bhogal, M. S.**,** Farrelly, D., & Galbraith, N. (2019). The Role of Prosocial Behaviors in Mate Choice: A Critical Review of the Literature. *Current Psychology, 38*(4), 1062-1075

Bhogal, M.S., Galbraith, N., & Manktelow, K. (2019). A Research Note on the Influence of Relationship Length and Sex on Preferences for Altruistic and Cooperative Mates. *Psychological Reports*, *122*(2), 550-557. https://doi.org/10.1177/0033294118764640

Bhogal, M. S., Galbraith, N., & Manktelow, K. (2016a). Physical attractiveness and altruism in two modified Dictator games. *Basic and Applied Social Psychology*, *38*, 212–222.

Bhogal, M. S., Galbraith, N., & Manktelow, K. (2016b). Sexual selection and the evolution of altruism: males are more altruistic and cooperative towards attractive females. *Letters on Evolutionary Behavioral Science*, *7*(1), 10–13. https://doi.org/10.5178/lebs.2016.42

Bhogal, M. S., Galbraith, N., & Manktelow, K. (2017). Physical Attractiveness, Altruism and Cooperation in an Ultimatum Game. *Current Psychology, 36*, 549–555. https://doi.org/10.1007/s12144-016-9443-1

Bhogal M.S., & Hughes S. (2019) Short-Term Mating. In: Shackelford T., Weekes-Shackelford V. (eds) Encyclopedia of Evolutionary Psychological Science. Springer.

Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, *12*, 1–49.

DeMaris, A. (2010). The 20-year trajectory of marital quality in enduring marriages: Does equity matter? *Journal of Social and Personal Relations, 27*(4), 449-471.

DeMaris, A. (2007). The role of relationship inequity in marital disruption. *Journal of Social and Personal Relationships, 24*, 177-195.

Ehlebracht, D., Stavrova, O., Fetchenhauer, D., & Farrelly, D. (2018). The synergistic effect of prosociality and physical attractiveness on mate desirability. *British Journal of Psychology, 109*(3), 517–537. https://doi.org/10.1111/bjop.12285

Farrelly, D. (2011). Cooperation as a signal of genetic or phenotypic quality in female mate choice? Evidence from preferences across the menstrual cycle. *British Journal of Psychology*, *102*(3), 406–430. https://doi.org/10.1348/000712610X532896

Farrelly, D. (2013). Altruism as an Indicator of Good Parenting Quality in Long-Term Relationships: Further Investigations Using the Mate Preferences Towards Altruistic Traits Scale. *Journal of Social Psychology*, *153*(4), 395–398. https://doi.org/10.1080/00224545.2013.768595

Farrelly, D., Clemson, P., & Guthrie, M. (2016). Are Women's Mate Preferences for Altruism Also Influenced by Physical Attractiveness? *Evolutionary Psychology, 14*(1), 1-6. https://doi.org/10.1177/1474704915623698

Farrelly, D., & King, L. (2019). Mutual mate choice drives the desirability of altruism in relationships. *Current Psychology*, *38*(4), 977–981. https://doi.org/10.1007/s12144-019-00194-0

Farrelly, D., Lazarus, J., & Roberts, G. (2007). Altruists Attract. *Evolutionary Psychology, 5*(2), 313-329. doi: 10.1177/147470490700500205.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using

G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Gintis, H., Smith, E. A., & Bowles, S. (2001). Costly signaling and cooperation. *Journal of Theoretical Biology*, *213*, 103–119.

Iredale, W., Vugt, M. Van, & Dunbar, R. (2008). Showing Off in Humans : Male Generosity as a Mating Signal. *Evolutionary Psychology, 6*, 386–392.

Jonason, P. K., Li, N. P., Webster, G. D., & Schmitt, D. P. (2009). The dark triad: Facilitating a short-term mating strategy in men. *European Journal of Personality, 23*, 5-18.

Kelly, S., & Dunbar, R. I. M. (2001). Who dares, wins: Heroism versus altruism in women's mate value on mate choice. *Human Nature, 12*, 89-105.

Kokko, H. (1998). Should advertising parental care be honest? *Proceedings of the Royal Society B: Biological Sciences*, *265*, 1871–1878.

Klein, N., Grossmann, I., Uskul, A. K., Kraus, A. A., & Epley, N. (2015). It pays to be nice, but not really nice: Asymmetric reputations from prosociality across 7 cultures. *Judgment and Decision Making, 10*, 355-364.

Ma, D. S., Correll, J., Wittebrink, B. (2015). The Chicago face database: A free stimulus of faces and norming data. *Behavior Research Methods, 47*, 1122-1135.

Miller, G. F. (2000). *The Mating Mind: How Sexual Selection Shaped the Evolution of Human Nature*. William Hienemann.

Miller, G. F. (2007). Sexual selection for moral virtues. *The Quarterly Review of Biology, 82*, 97–125.

Oda, R. & Hiraishi, K. (2015). Willingness to provide is more important than ability to provide: women's choice of a long-term male partner. *Letters on Evolutionary Behavioral Science, 6*, 21-24.

Margana, L., Bhogal, M. S., Bartlett, J. E., & Farrelly, D. (2019). The Roles of Heroism, Altruism, and Physical Attractiveness in Female Mate Choice. *Personality and Individual Differences, 137*, 126-130.

Minson, J. A., & Monin, B. (2012). Do-Gooder Derogation. *Social Psychological and Personality Science, 3*(2), 200–207. https://doi.org/10.1177/1948550611415695

Moore, D., Wigby, S., English, S., Wong, S., Székely, T., & Harrison, F. (2013). Selflessness is sexy: reported helping behaviour increases desirability of men and women as long-term sexual partners. *BMC Evolutionary Biology, 13*, 182. https://doi.org/10.1186/1471-2148-13-182

Norman, I., & Fleming, P. (2019). Perceived attractiveness of two types of altruist. *Current Psychology, 38*(4), 982-990.

Phillips, T., Barnard, C., Ferguson, E., & Reader, T. (2008). Do humans prefer altruistic mates? Testing a link between sexual selection and altruism towards non-relatives. *British Journal of Psychology, 99*, 555–572.

Raihani, N. J., & Smith, S. (2015). Competitive helping in online giving. *Current Biology, 25*, 1183–1186. https://doi.org/10.1016/j.cub.2015.02.042

Schwarz, S., & Baßfeld, L. (2019). Do men help only beautiful women in social networks? *Current Psychology, 38*(4), 965-976.

Sefcek, J. A., Brumbach, B. H., Vasquez, G., & Miller, G. F. (2007). The Evolutionary Psychology of Human Mate Choice. How Ecology, Genes, Fertility, and Fashion

Influence Mating Strategies. *Journal of Psychology and Human Sexuality*, *18*(2-3), 125-182.

Stavrova, O., & Ehlebracht, D. (2015). A Longitudinal Analysis of Romantic Relationship Formation : The Effect of Prosocial Behavior. *Social Psychological and Personality Science*, *6*, 521–527. https://doi.org/10.1177/1948550614568867

Thomas, A. G, Jonason, P. K, Blackburn, J. D, et al. (in press). Mate preference priorities in the East and West: A cross-cultural test of the mate preference priority model. *Journal of Personality*. 2019; 00: 1– 15. https://doi.org/10.1111/jopy.12514

Tognetti, A., Berticat, C., Raymond, M., & Faurie, C. (2012). Sexual selection of human cooperative behaviour: an experimental study in rural Senegal. *PloS One*, *7*, e44403. https://doi.org/10.1371/journal.pone.0044403

Tognetti, A., Dubois, D., Faurie, C., & Willinger, M. (2016). Men increase contributions to a public good when under sexual competition. *Scientific Reports*, *6*(July). https://doi.org/10.1038/srep29819

Trivers, R. L. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology*, *46*, 35-57.

Trivers, R. L. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man, 1871-1971* (pp. 136–179). Chicago, IL: Aldine.

Van Vugt, M., & Iredale, W. (2013). Men behaving nicely: Public goods as peacock tails. *British Journal of Psychology*, *104*(1), 3–13. https://doi.org/10.1111/j.2044-8295.2011.02093.x

Young, H. P. (2015). The Evolution of Social Norms. *Annual Review of Economics*, *7*, 359-387.

Zahavi, A. (1975). Mate Selection - A Selection for a Handicap. *Journal of Theoretical Biology*, *53*, 205–214. https://doi.org/10.1016/0022-5193(75)90111-3