

## Evolutionary Psychology

www.epjournal.net – 2014. 12(4): 673-686

---

### Original Article

## Gratitude for Help among Adult Friends and Siblings

Anna Rotkirch, Population Research Institute, Väestöliitto – Finnish Family Federation, Finland. Email: [Anna.Rotkirch@vaestoliitto.fi](mailto:Anna.Rotkirch@vaestoliitto.fi) (Corresponding author).

Minna Lyons, School of Psychology, University of Liverpool, UK.

Tamas David-Barrett, Department of Experimental Psychology, University of Oxford, UK.

Markus Jokela, Institute of Behavioural Sciences, University of Helsinki, Finland.

**Abstract:** Although gratitude is a key prosocial emotion reinforcing reciprocal altruism, it has been largely ignored in the empirical literature. We examined feelings of gratitude and the importance of reciprocity in same-sex peer relations. Participants were 772 individuals (189 men; mean age = 28.80) who completed an online survey using a vignette design. We investigated (i) differences in reported gratitude and the importance of reciprocity among same-sex siblings and same-sex friends, and (ii) how relationship closeness moderates these associations. Based on the theory of kin altruism, we expect that people would feel more grateful towards friends than towards their siblings, and that lack of gratitude or failure to pay back a loan would bother more with friends than with siblings, irrespective of emotional closeness. Results showed that levels of gratitude and expectations of reciprocity were higher towards friends compared to siblings. This was the case also after controlling for emotional closeness. Being close generally made participants feel more grateful and expect lower displays of gratitude in the other. Closeness was also strongly associated with emotional gratitude among siblings compared to friends. We conclude that feelings and displays of gratitude have a special role in friendships. Although a close sibling may elicit as much gratitude as a friend does, even a very close friend is not exempt from the logic of reciprocity in the same way that a sibling is.

**Keywords:** gratitude, helping behavior, friendship, siblings, relationship closeness

---

### Introduction

Long-term affectual bonds are common phenomena across a number of social species, rooted deep in evolutionary history. They typically appear among close kin, as

predicted and explained by inclusive fitness theory (Hamilton 1964), according to which the costs of altruistic helping can be outweighed by increased reproductive success. However, close social bonds including considerable altruistic helping are also found between non-related individuals across a wide range of social species (Massen, Streck, and de Vos 2010; Seyfarth and Cheney, 2012), raising the question of which ultimate and proximate mechanisms can promote such cooperation and exchange.

Reciprocal altruism is the standard ultimate explanation for how friendships can arise between non-kin (Laursen and Hartup, 2002; Trivers, 1971). In abstract models, reciprocal altruism follows a tit-for-tat strategy where you help those who help you. Prosocial emotions (e.g., guilt, gratitude, and sympathy) may function as proximate mechanisms driving behavioral reciprocity between close, non-related associates (Trivers, 1971). Pro-social emotions may also help individuals to monitor and track exchanges both in specific situations (Clark and Ayers, 1993; Tooby and Cosmides, 1996) and over time, serving as emotional shortcuts for whom to trust and to help (Clark and Ayers, 1993; Seyfarth and Cheney, 2012; Xue and Silk, 2012).

Although the body of research comparing friends to kin has grown in recent years (e.g., Ackerman, Kenrick, and Schaller, 2007; Apicella, Marlowe, Fowler, and Christakis, 2012; O’Gorman, Wilson, and Miller, 2005; Roberts and Dunbar, 2011; Volland, 2011), there are few studies of relations between peers (for a recent review, see McHale, Updegraff, and Whiteman, 2012). Here, we study the proximate mechanisms of peer bonds in human adults by comparing how gratitude and reciprocity are manifested between siblings and friends.

Gratitude is a moral affect that motivates and reinforces future prosocial behavior (McCullough, Kilpatrick, Emmons, and Larson, 2001; McCullough, Kimeldorf, and Cohen, 2008). It can be elicited by acts that have a value to the recipient and incur a cost to the benefactor (Algoe, Haidt, and Gable, 2008), suggesting that gratitude may fuel reciprocal altruism. Empirical research has found that inducing feelings of gratitude increases altruism (DeSteno, Bartlett, Baumann, Williams, and Dickens, 2010; Tsang, 2006) and that gratitude plays an important role when new friendships are being formed (Algoe et al., 2008). However, it is not known what function gratitude plays between friends after the initial bond has been formed.

In humans, the importance of how and when to reciprocate a favor varies with social distance. It typically matters less when dealing with kin than when dealing with friends (e.g., Osinsky, 2009; Rachlin and Jones, 2008), and most when dealing with acquaintances (Gurven et al., 2001; Stewart-Williams, 2007; Xue, 2013). Close friendships are not exclusively based on reciprocal altruism and often lack exact bookkeeping of help given and received (Clark, Mills and Powell, 1986; Roberts, 2005; Tooby and Cosmides, 1996; for a summary, see Hruschka, 2010). Kin interactions are also characterized by more instrumental and high-cost support, whereas friends typically provide each other with more emotional and less costly support (Park and Ackerman, 2011), in the absence of which friendships deteriorate more rapidly than do kin relations (Roberts and Dunbar, 2011).

There is, thus, an overlap between kin and friend relations regarding prosocial emotions such as gratitude. Close friends may be likened to or even treated “like a brother/sister” (Voorpostel and van der Lippe, 2007), suggesting that very close friendships

may activate cognitive mechanisms that originally evolved among primate kin (Kummer, 1971; Taylor et al., 2000, 2002). Compared to other kinds of kin, siblings may also be treated more “like friends,” since they are typically of the same age cohort as friends. Further, it is possible that sibling competition for parental investment (Lawson and Mace, 2009; Trivers, 1974) increases the need for reciprocity and exchange monitoring among siblings compared to other kin.

There is some evidence that people feel more grateful towards help given by non-relatives than relatives (Bar-Tal, Bar-Zohar, Greenberg, and Hermon, 1977). However, gratitude among close social relations has been largely ignored in the empirical literature. If gratitude serves to promote and monitor reciprocal altruism, we would expect that people feel more grateful towards friends than towards their siblings. Further, we would expect that a lack of gratitude from the beneficiary would bother the benefactor more with friends than with siblings.

Emotional closeness serves to maintain both kin and reciprocal altruism (Korchmaros and Kenny, 2001; Kruger, 2003). Psychological mechanisms that initially evolved to promote kin altruism, but were later extended to unrelated individuals, may be based on propinquity, similarity, and frequency of interaction (Korchmaros and Kenny, 2006). We are more likely to help people to whom we feel emotionally close. However, there is also evidence for a so-called kinship premium: Even when controlling for emotional closeness, kin may receive more altruistic help than friends (Curry, Roberts, and Dunbar, 2012; Rachlin and Jones, 2008).

Here, we compare relations to same-sex friends and siblings only. This is because friends are usually of the same sex and age, and also because we wanted to compare possible sex differences in social styles. Several friendship studies have found no or minor sex differences (Brewer, Abell, and Lyons, 2013; Roberts and Dunbar, 2011; Stewart-Williams, 2007), whereas some meta-analytical reviews detected consistent sex differences in children’s close friendship (Rose and Rudolph, 2006). Many of these sex differences appear to increase during adolescence, but data on adult friendships are scarce (Hall, 2010). It has also been claimed that women are more prone to extend a “kinship module” (Lieberman, Tooby, and Cosmides, 2007) to their friends than men are (Ackerman et al., 2007; Park and Ackerman, 2011).

Following the theories of kin altruism and of reciprocal altruism origins of friendship, we expect *the importance of gratitude and reciprocity, as well as emotional closeness, to be more pronounced among friends than among siblings* (Hypothesis 1). Second, we expect *relationship closeness to moderate the importance of gratitude and reciprocity*, so that the associations will vary depending on felt closeness but remain more important in friendships, irrespective of relationship closeness (Hypothesis 2). We also explore possible sex differences in these associations.

## **Materials and Methods**

Participants were 907 individuals (202 males,  $M_{age} = 28.80$ ,  $SD = 11.30$ ) taking part in an online survey on “relationships between friends and siblings.” The survey was advertised to students at three universities in the UK and one university in Finland through

the researchers' social media networks, student email lists, and through research participation websites. The survey was in English and open for individuals who self-identified as having a same-sex sibling. Participants were from 31 countries, but the great majority were from three countries: the UK (36%), Finland (36%), and the US (21%). Participants with adopted siblings and half siblings were removed from the analysis, leaving us with a final sample of 583 women and 189 men.

We asked participants to think about a certain same-sex sibling or same-sex friend. If they had several such siblings or friends, they were instructed to think about the one they felt closest to. We created three short vignettes describing two scenarios, designed to elicit feelings of gratitude for emotional or financial help (here referred to as "emotional gratitude" and "financial gratitude"): one scenario eliciting annoyance due to lack of gratitude for emotional support ("emotional reciprocity"), and one scenario for the importance of paying back a debt ("financial reciprocity") (see Appendix). The vignettes were rated on a 9-point Likert scale (1 = "not grateful / bothered / important at all," 9 = "very grateful / bothered / important"). For the regression analysis the raw scores were converted into standardized *t* score coefficients, which are based on z-scores but with a standard deviation of 10 units and centered on 50. These scores were used because they permit comparisons of regressions results.

Prior to the study, we conducted a pilot survey testing the emotions that the scenarios evoke on 32 participants, who gave a free response to the question "How would you feel in this situation?" The majority indicated feelings of gratitude in the scenarios where they were the recipients of help, and anger and disappointment in the scenarios where they did not receive gratitude when they had provided help.

Relationship closeness was assessed by asking the participants how close they feel towards the target, how much they like the target, and how similar they feel to the target, all rated on a 9-point Likert scale (1 = "not at all," 9 = "very much"). These were averaged to create an index for felt closeness ( $\alpha = .62$  for friends,  $\alpha = .83$  for siblings). Additional covariates included participant age and the degree of relatedness to sibling (half, full, or adopted sibling); all but full siblings were removed from the data.

On entering the survey, participants were first directed to a participant information page with brief details and relevant ethics information. After that, participants filled in demographic information, rated the questions relating to perceived closeness and similarity, and were given the following instructions:

Please think about a good SAME SEX friend (if you have several friends, think about the one you feel closest to). If you are a woman, think about a good female friend. If you are a man, think about a good male friend.

After rating the vignettes relating to friends, participants were given the same instructions, and they were asked to rate the same vignettes thinking about a same-sex sibling. The order of the friend and sibling conditions was counter-balanced for different participants. In a series of Mixed ANOVAs (independent variable = order of the condition, dependent variable = rating of friends/sibling vignettes), we found that the order of the condition did not affect the ratings. After the rating task, participants were thanked for their time and provided with contact details of the researchers.

Associations of sex, relationship type (friend or kin), and relationship closeness

with the outcomes (gratitude and reciprocity) were assessed using random-intercept multilevel regression in which ratings for kin and friend were treated as repeated nested measurements within individuals. The analyses were carried out with descriptive statistics and the *xtreg* procedure of STATA 12.

## Results

*Hypothesis 1.* We first studied whether the rated importance of gratitude and reciprocity was more pronounced amongst friends than siblings. This was the case for all four vignettes, and also for reported emotional closeness (see Table 1). The differences between friends and siblings were all significant (Bonferroni adjusted *t*-tests, all *ps* < .001) except for emotional reciprocity in male participants (*p* = .09). Women gave significantly higher ratings than men for all relationship types and scenarios. Sex differences by relationship type were significant (*p* < .01), except for the importance of financial reciprocity between siblings (*p* = .23).

**Table 1.** Levels of gratitude and reciprocity by gender and relationship type

	Sibling mean ( <i>SD</i> )	Friend mean ( <i>SD</i> )	<i>d</i> (sibling/friend)
<b>Emotional gratitude</b>			
Women	8.18 (1.55)	8.60 (0.93)	-0.33
Men	7.78 (1.53)	8.08 (1.34)	-0.21
<i>d</i> (women/men)	0.21	0.41	
<b>Financial gratitude</b>			
Women	8.38 (1.26)	8.63 (0.95)	-0.22
Men	8.00 (1.49)	8.35 (1.07)	-0.27
<i>d</i> (women/men)	0.24	0.24	
<b>Emotional reciprocity</b>			
Women	4.67 (2.46)	5.27 (2.46)	-0.24
Men	4.06 (2.36)	4.48 (2.40)	-0.18 <sup>a</sup>
<i>d</i> (women/men)	0.20	0.27	
<b>Financial reciprocity</b>			
Women	5.07 (2.56)	6.24 (2.39)	-0.47
Men	4.83 (2.54)	5.70 (2.42)	-0.36
<i>d</i> (women/men)	0.08 <sup>a</sup>	0.19	
<b>Closeness index</b>			
Women	6.50 (1.81)	7.30 (1.04)	-0.54
Men	6.08 (1.90)	7.02 (1.05)	-0.62
<i>d</i> (women/men)	0.19	0.22	

*Note.* *d* (women/men) expresses the effect magnitude of sex difference in Cohen's *d* (i.e., units of standard deviations), *d* (sibling/friend) expresses the corresponding difference between siblings and friends. All group differences were statistically significant, except those marked by <sup>a</sup>. *n* = 583 women, 189 men.

**Table 2.** Associations of gender and relationship type on gratitude and reciprocity

	Emotional gratitude	Financial gratitude	Emotional reciprocity	Financial reciprocity
<b>Model 1</b>				
Sex†	-0.31* (-0.47, -0.15)	-0.31* (-0.47, -0.14)	-0.19* (-0.35, -0.02)	-0.05 (-0.22, 0.12)
Relation‡	0.28* (0.19, 0.36)	0.21* (0.14, 0.29)	0.28* (0.21, 0.35)	0.5* (0.43, 0.57)
Sex–Relation	0.01 (-0.17, 0.19)	0.08 (-0.08, 0.24)	-0.08 (-0.23, 0.07)	-0.17* (-0.31, -0.02)
<b>Model 2</b>				
Sex†	-0.24* (-0.4, -0.08)	-0.25* (-0.42, -0.08)	-0.26* (-0.43, -0.09)	-0.15 (-0.32, 0.02)
Relation‡	0.17* (0.08, 0.25)	0.17* (0.09, 0.25)	0.31* (0.23, 0.38)	0.57* (0.5, 0.64)
Sex–Relation	-0.03 (-0.21, 0.15)	0.05 (-0.12, 0.22)	-0.02 (-0.18, 0.14)	-0.1 (-0.25, 0.05)
Closeness	0.38* (0.32, 0.44)	0.15* (0.09, 0.21)	-0.1* (-0.15, -0.04)	-0.18* (-0.24, -0.13)
Relation–Closeness	-0.19* (-0.3, -0.07)	-0.06 (-0.18, 0.05)	0.06 (-0.05, 0.16)	0.03 (-0.07, 0.13)
Sex–Closeness	-0.06 (-0.18, 0.06)	0.04 (-0.08, 0.16)	-0.12* (-0.23, -0.01)	-0.12* (-0.23, -0.01)
Sex–Relation– Closeness	0.01 (-0.22, 0.24)	-0.18 (-0.4, 0.05)	0.26* (0.05, 0.48)	0.18 (-0.03, 0.39)

Note. Values are coefficients (and 95% confidence intervals) of multilevel regression models. † 0 = Women, 1 = Men, ‡ 0 = Sibling, 1 = Friend, \*  $p < .05$ . All models are adjusted for participant's age.

The effect size for these differences ranged from small to moderate (Cohen's  $d$ s: .18 to .47 in the four scenarios) and was largest of all measures in relationship closeness, especially in men. Hypothesis 1 was also tested with multilevel regression models (see Table 2, Model 1), which include interaction effects between sex and relationship type.

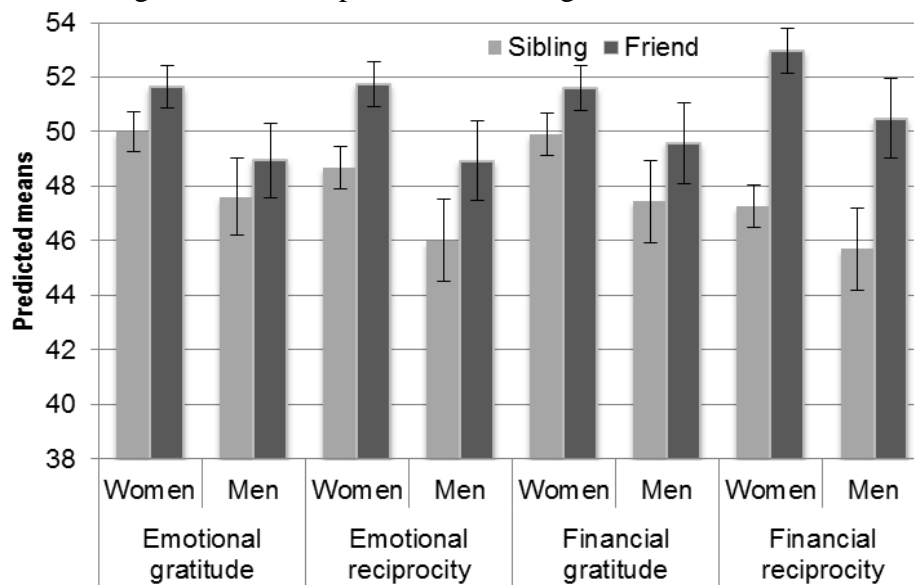
The negative values on the first line in Model 1 indicate that for each of the four vignettes, men gave significantly lower ratings compared to women, who constitute the reference group. The positive values on the second line in Model 1 indicate that friends are consistently and significantly given higher ratings in all four vignettes compared to siblings, which constitute the reference group. The last line in this model illustrates the interaction between sex and relationship type. A significant interaction effect was not observed for the three scenarios concerning gratitude, but was observed for the scenario

concerning financial reciprocity, indicating that it was more important for women that their friend returned a loan compared to their sister, than it was for men that their friend returned a loan compared to their brother.

*Hypothesis 2.* Next, we examined whether relationship closeness moderated the above associations (see Table 2, Model 2). The moderating effect of closeness was statistically significant in all four scenarios, being positive for emotional and financial gratitude and negative for emotional and financial reciprocity. Being close to a friend or sibling tends to increase gratefulness and dampen expectations of reciprocity towards these persons. Sex differences persisted in all scenarios even after controlling for closeness, as indicated by the negative values in the first line in Model 2. These differences were statistically significant except in the case of financial reciprocity.

Friends also received higher scores compared to siblings when taking emotional closeness into account. This is illustrated in Figure 1, which displays the regression-based predicted probabilities for each scenario and relationship type when holding closeness constant.

**Figure 1.** Predicted means for scenarios of gratitude and reciprocity by sex and relationship type after controlling for relationship closeness and age



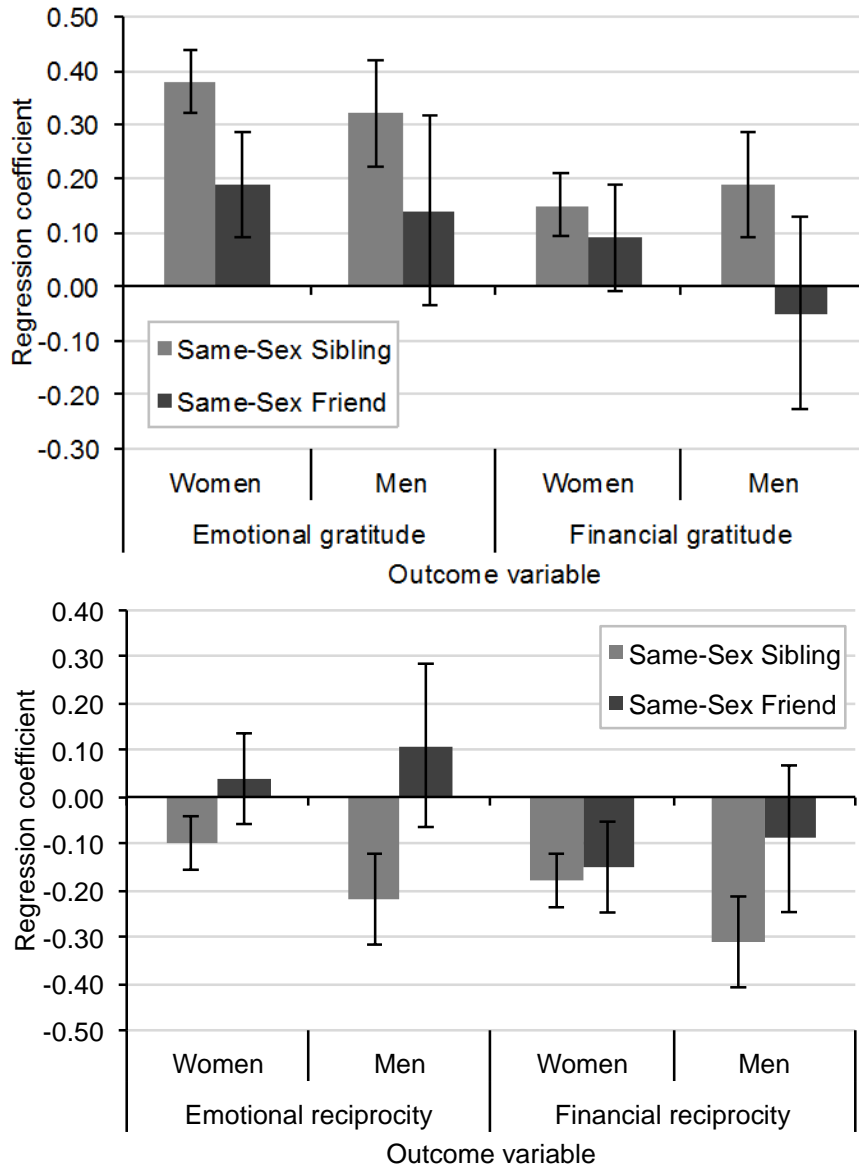
Note. Bars indicate raw scores converted into standardized *t* score regression coefficients (*SD* = 10 and centered on 50); error bars are 95% confidence intervals.

There was no longer any interaction between sex and relationship type after controlling for relationship closeness (see Table 2, Model 2). The significant interaction between sex and financial reciprocity in Model 1 lost statistical significance in Model 2.

The three last lines of Model 2 (see Table 2) display interaction effects. We see that the effect of closeness significantly interacted with relationship type in emotional gratitude, being stronger among siblings. Closeness also significantly interacted with sex concerning the importance of emotional and financial reciprocity, its impact being lower among men compared to women. For emotional reciprocity, the interaction between closeness and both

sex and relationship type was significant. The strengths of these associations with closeness are illustrated in Figure 2.

**Figure 2.** Strength of associations of relationship closeness with gratitude (top panel) and reciprocity (bottom panel) by sex and relationship type



Note. Bars indicate standardized regression coefficients ( $SD = 1$ ); error bars are 95% confidence intervals.

Closeness was positively associated with feelings of emotional and financial gratitude (see Figure 2, top panel), with the exception of financial gratitude among male friends. Conversely, feeling close to the target was generally negatively associated with the importance of emotional and financial reciprocity (see Figure 2, bottom panel). The interesting exception is that closeness is associated with stronger rather than weaker



importance of showing emotional reciprocity among friends, although the association is statistically significant only among male friends as compared to brothers (see Table 2, Model 2).

## **Discussion**

This is the first study investigating the role of gratitude in kin versus non-kin relations. As predicted in the first hypothesis, participants rated their expected feelings of emotional and financial gratitude higher, and assigned higher importance to emotional and financial reciprocity, when dealing with same-sex friends as opposed to same-sex siblings. Our results support the view of gratitude as a prosocial emotion that serves to trigger and maintain reciprocal interactions in friendships (Algoe et al., 2008; Trivers, 1971). Although the effect sizes for gratitude by relationship type were not large, this is in line with previous studies that have found relatively small but persistent differences between friends and kin in help scenarios (Stewart-Williams, 2007; Voorpostel and van der Lippe, 2007).

Perceived closeness to the target affected expected feelings of gratitude and the importance of reciprocity. People appear to be more grateful to those they are close to, and to be both closer and more grateful to their friends compared to their siblings. The differences between kin and siblings persisted when controlling for closeness, in line with our second hypothesis. Even after taking into account the boosting effect of closeness on gratitude, people are more grateful towards their friends than their siblings. This is in line with other studies suggesting a “kin premium” that is not dependent on relationship quality (Curry et al., 2012; Rachlin and Jones, 2008). We appear to take kin support as self-evident, which is why felt and expected gratitude is weaker between siblings compared to friends.

Women rated the importance of gratitude and reciprocity higher than men did, but there were no sex differences in the differential treatment of siblings versus friends. Only in the question measuring the importance of paying back a financial debt did women treat friends less like siblings compared to men, suggesting that women may be more attuned to highly monitoring friends than men are (Geary, Byrd-Craven, Hoard, Vigil, and Numtee, 2003; Geary and Flinn, 2002). However, this effect disappeared after controlling for relationship closeness. This result is in line with previous studies finding no interaction with target or recipient sex in gratitude related to helping and harm-doing (Bar-Tal et al., 1977), altruistic punishment (O’Gorman et al., 2005, or altruistic helping (Curry et al., 2012; Stewart-Williams, 2008; Xue, 2013). Combined, these studies question the claims for a general tendency among women to treat close friends more like kin than men do. Of course, an extended “kinship module” characteristic of female friendships may still function in specific situations such as high-cost help, or with regards to specific emotions such as sexual aversion (Ackerman et al., 2007; Park and Ackerman, 2011).

Relationship closeness tended to make participants both more grateful and more likely to forgive failed reciprocity. However, closeness had partly different effects on sibling and friend relations. Expected feelings of gratitude and the importance of showing gratitude were more strongly associated with closeness among siblings than among friends. This is somewhat surprising, giving the lower importance of closeness predicted by evolutionary theory among kin compared to friends. Another study also found a similar

result: The effect of contact frequency on the provision and reception of emotional support was stronger among siblings compared to friends (Voorpostel and van der Lippe, 2007).

This pattern may stem from a selection effect. In contemporary, developed, low-fertility societies, people have a larger pool of potential close friends than of potential close same-sex siblings. Sibling competition and rivalry also affect ties between siblings more than they do between friends. Several open commentaries to our survey stressed the intensity of sibling competition: “My answers don’t give a fair representation of how much I hate my sister” (20 year-old UK woman); “I would never confide in her for anything and do not respect her as an adult on any level” (38-year old US woman); “My friends are better than my sister, generally speaking. Almost everybody is better than my sister, even my brother-in-law, and I can’t stand him. I cannot imagine her helping me under any circumstances” (47-year old Spanish woman). A few men refused to fill in the survey because they found it impossible to imagine any situation in which their brother would help them in any way. In line with this interpretation, Stewart-Williams (2007) found altruistic help among siblings to match that among friends. He suggested that this may stem from kin altruism being stronger in cross-generational relations such as the parent-child bond, where help flows to the younger, than in intragenerational relations between kin who are of similar need and reproductive value (see also Niezink, 2008). Between siblings in particular, altruism and companionship coexist with conflict and competition (McHale et al., 2012).

A major benefit of our study is that it compared friends with peer kin, in this case siblings. Other evolutionary studies have collapsed close friends and kin (Bar-Tal et al., 1977) or not differentiated between different types of kin (Ackerman et al., 2007; Niezink, 2008). Among the limitations of our study is the absence of scenarios including other peers such as cousins, as well as acquaintances and strangers, which would both have further illuminated the relative similarities and differences between kin and friends. We also tested for imagined emotional responses rather than actual reactions. Men were underrepresented as respondents, although this is typical for these kinds of surveys. Further, we did not gather data on the age of friends, so we could not compare age differences between siblings and friends. Neither did we include opposite-sex friends or siblings.

We conclude that gratitude follows the logic of reciprocal altruism in close friendships, and to a higher degree among friends than with siblings. Although a very close sibling may elicit as much emotional gratitude as a close friend does, even a very close friend is not exempt from the logic of reciprocity in the same way that a sibling is. There is no evidence that women treat friends more like siblings compared to men in expressions of gratitude. The complex interactions between emotional closeness and sociality highlight the need for further studies on how both altruism and competition shape peer relations.

**Acknowledgements:** We are grateful to Venla Berg for her assistance in the data collection. This research was supported by the Academy of Finland (project nr 266898).

**Received 17 Nov 2013; Revision submitted 09 May 2014; Accepted 11 May 2014**

## References

- Ackerman, J. M., Kenrick, D. T., and Schaller, M. (2007). Is friendship akin to kinship? *Evolution and Human Behavior*, 28, 365-374.
- Algoe, S. B., Haidt, J., and Gable, S. L. (2008). Beyond reciprocity: Gratitude and relationships in everyday life. *Emotion*, 8, 425-429.
- Apicella, C. L., Marlowe, F. W., Fowler, J. H., and Christakis, N. A. (2012). Social networks and cooperation in hunter-gatherers. *Nature*, 481, 497-501.
- Bar-Tal, D., Bar-Zohar, Y., Greenberg, M. S., and Hermon, M. (1977). Reciprocity behavior in the relationship between donor and recipient and between harm-doer and victim. *Sociometry*, 40, 293-298.
- Brewer, G., Abell, L., and Lyons, M. (2013). It's not just a man-thing: Testing sex as a moderator between peer attachment and machiavellianism, competition and self-disclosure. *Individual Differences Research*, 11, 114-120.
- Clark, M. L., and Ayers, M. (1993). Friendship expectations and friendship evaluations: Reciprocity and gender effects. *Youth and Society*, 24, 299-313.
- Clark, M. S., Mills, J., and Powell, M. C. (1986). Keeping track of needs in communal and exchange relationships. *Journal of Personality and Social Psychology*, 51, 333-338.
- Curry, O., Roberts, S. G., and Dunbar, R. I. (2012). Altruism in social networks: Evidence for a "kinship premium". *British Journal of Psychology*, 104, 283-295.
- DeSteno, D., Bartlett, M. Y., Baumann, J., Williams, L. A., and Dickens, L. (2010). Gratitude as moral sentiment: Emotion-guided cooperation in economic exchange. *Emotion*, 10, 289-293.
- Geary, D. C., Byrd-Craven, J., Hoard, M. K., Vigil, J., and Numtee, C. (2003.) Evolution and development of boys' social behavior. *Developmental Review*, 23, 444-470.
- Geary, D. C., and Flinn, M. V. (2002). Sex differences in behavioral and hormonal response to social threat: Commentary on Taylor et al. (2000). *Psychological Review*, 109, 745-750.
- Gurven, M., Allen-Arave, W., Hill, K., and Hurtado, A. M. (2001). Reservation food sharing among the Ache of Paraguay. *Human Nature*, 12, 273-297.
- Hall, J. A. (2010). Sex differences in friendship expectations: A meta-analysis. *Journal of Social and Personal Relationships*, 28, 723-747.
- Hamilton, W. D. (1964). The genetical evolution of social behaviour (I and II). *Journal of Theoretical Biology*, 7, 1-52.
- Hruschka, D. J. (2010). *Friendship: Development, ecology, and evolution of a relationship*. Berkeley, CA: University of California Press.
- Korchmaros, J. D., and Kenny, D. A. (2001). Emotional closeness as a mediator of the effect of genetic relatedness on altruism. *Psychological Science*, 12, 262-265.
- Korchmaros, J. D., and Kenny, D. A. (2006). An evolutionary and close-relationship model of helping. *Journal of Social and Personal Relationships*, 23, 21-43.
- Kruger, D. J. (2003). Evolution and altruism: Combining psychological mediators with naturally selected tendencies. *Evolution and Human Behavior*, 24, 118-125.
- Kummer, H. (1971) *Primate societies*. Chicago, IL: Aldine.
- Laursen, B., and Hartup, W. W. (2002). The origins of reciprocity and social exchange in

- friendships. *New Directions for Child and Adolescent Development*, 95, 27-40.
- Lawson, D. W., and Mace, R. (2009). Trade-offs in modern parenting: A longitudinal study of sibling competition for parental care. *Evolution and Human Behavior*, 30, 170-183.
- Lieberman, D., Tooby, J., and Cosmides, L. (2007). The architecture of human kin detection. *Nature*, 445, 727-731.
- Massen, J. M., Streck, E., and de Vos, H. (2010). Close associations in animals and humans: Functions and mechanisms of friendship. *Behaviour*, 147, 1379-1412.
- McCullough, M. E., Kilpatrick, S. D., Emmons, R. A., and Larson, D. B. (2001). Is gratitude a moral affect? *Psychological Bulletin*, 127, 249-266.
- McCullough, M. E., Kimeldorf, M. B., and Cohen, A. D. (2008). An adaptation for altruism: The social causes, social effects, and social evolution of gratitude. *Current Directions in Psychological Science*, 17, 281-285.
- McHale, S. M., Updegraff, K. A., and Whiteman, S. D. (2012). Sibling relationships and influences in childhood and adolescence. *Journal of Marriage and Family*, 74, 913-930.
- Niezink, L. W. (2008). *Considering others in need: On altruism, empathy, and perspective taking* (Doctoral dissertation). University of Groningen, Groningen, The Netherlands.
- O’Gorman, R., Wilson, D. S., and Miller, R. (2005). Altruistic punishment and helping differ in sensitivity to relatedness, friendship, and future interactions. *Evolution and Human Behavior*, 26, 375-387.
- Osinski, J. (2009). Kin altruism, reciprocal altruism and social discounting. *Personality and Individual Differences*, 47, 374-378.
- Park, J. H., and Ackerman, J. M. (2011). Passion and compassion: Psychology of kin relations within and beyond the family. In C. Salmon and T. Shackelford (Eds.), *Oxford handbook of evolutionary family psychology* (pp. 329-344). New York: Oxford University Press.
- Rachlin, H., and Jones, B. A. (2008). Altruism among relatives and non-relatives. *Behavioural Processes*, 79, 120-123.
- Roberts, S. G. B., and Dunbar, R. I. M. (2011). The costs of family and friends: An 18-month longitudinal study of relationship maintenance and decay. *Evolution and Human Behavior*, 32, 186-197.
- Roberts, G. (2005). Cooperation through interdependence. *Animal Behaviour*, 70, 901-908.
- Rose, A. J., and Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin*, 132, 98-131.
- Seyfarth, R. M., and Cheney, D. L. (2012). The evolutionary origins of friendship. *Annual Review of Psychology*, 63, 153-177.
- Stewart-Williams, S. (2007). Altruism among kin vs. nonkin: Effects of cost of help and reciprocal exchange. *Evolution and Human Behavior*, 28, 193-198.
- Stewart-Williams, S. (2008). Human beings as evolved nepotists: Exceptions to the rule and effects of cost of help. *Human Nature*, 19, 414-425.
- Taylor, S. E., Klein, L. C., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., and

- Updegraff, J. A. (2000). Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psychological Review, 107*, 411-429.
- Taylor, S. E., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., Updegraff, J. A., and Klein, L. C. (2002). Sex differences in biobehavioral responses to threat: Reply to Geary and Flinn (2002). *Psychological Review, 109*, 751-753.
- Trivers, R. L. (1971). The evolution of reciprocal altruism. *The Quarterly Review of Biology, 46*, 35-57.
- Trivers, R. L. (1974). Parent-offspring conflict. *American Zoologist, 14*, 249-264.
- Tooby, J., and Cosmides, L. (1996) Friendship and the banker's paradox: Other pathways to the evolution of adaptations for altruism. In W. G. Runciman, J. M. Smith, and R. I. M. Dunbar (Eds.) *Evolution of social behavior patterns in primates and man*. (pp. 119-143). Oxford and New York: Oxford University Press.
- Tsang, J. (2006). Gratitude and prosocial behavior: An experimental test of gratitude. *Cognition and Emotion, 20*, 138-148.
- Vollan, B. (2011). The difference between friendship and kinship: (Field-) experimental evidence on trust and punishment. *Journal of Socio-Economics, 40*, 14-25.
- Voorpostel, M., and van der Lippe, T. (2007). Support between siblings and between friends : Two worlds apart ? *Journal of Marriage and Family, 69*, 1271-1282.
- Xue, M. (2013). Altruism and reciprocity among friends and kin in a Tibetan village. *Evolution and Human Behavior, 34*, 323-229.
- Xue, M., and Silk, J. B. (2012). The role of tracking and tolerance in relationship among friends. *Evolution and Human Behavior, 33*, 17-25.

**Appendix.** Study Vignettes

Not grateful at all

Very grateful

1      2      3      4      5      6      7      8      9

*Scenario 1* (Measuring gratitude for emotional support)

Your friend/sibling has supported you a lot after your recent break-up with a partner. S/he has stood unconditionally on your side, and s/he has been available for you at any time of the day. How grateful do feel for this help?

*Scenario 2* (Measuring gratitude for financial support)

Your friend/sibling has recently given you a large sum of money, as s/he had some to spare, and you really needed it. How grateful would you feel for this help?

*Scenario 3* (Measuring importance of lack of gratitude for emotional support)

Your friend/sibling recently broke up with her/his partner, and you have given her/him a lot of emotional support. However, s/he seems to take you for granted and hasn't really thanked you. How much would this bother you?

*Scenario 4* (Measuring importance of financial reciprocity)

You have recently lent your friend/sibling 100 pounds. S/he was supposed to pay back to you soon, but hasn't mentioned doing so. How important is it that s/he eventually pays this money back?