



# Sex Differences in Intimacy Levels in Best Friendships and Romantic Partnerships

Eiluned Pearce<sup>1</sup> · Anna Machin<sup>1</sup> · Robin I. M. Dunbar<sup>1</sup> 

Received: 23 June 2020 / Revised: 6 October 2020 / Accepted: 8 October 2020

Published online: 18 October 2020

© The Author(s) 2020

## Abstract

**Objectives** Close romantic and friendship relationships are crucial for successful survival and reproduction. Both provide emotional support that can have significant effects on an individual's health and wellbeing, and through this their longer term survival and fitness. Nonetheless, the factors that create and maintain intimacy in close relationships remain unclear. Nor is it entirely clear what differentiates romantic relationships from friendships in these terms. In this paper, we explore which factors most strongly predict intimacy in these two kinds of relationship, and how these differ between the two sexes. **Results** Aside from best friendships being highly gendered in both sexes, the dynamics of these two types of relationships differ between the sexes. The intimacy of female relationships was influenced by similarity (homophily) in many more factors (notably dependability, kindness, mutual support, sense of humour) than was the case for men. Some factors had opposite effects in the two sexes: gift-giving had a negative effect on women's friendships and a positive effect on men's, whereas shared histories had the opposite effect. **Conclusion** These results confirm and extend previous findings that the dynamics of male and female relationships are very different in ways that may reflect differences in their functions.

**Keywords** Social relationships · Emotional closeness · Face-to-face contact · Homophily

## Introduction

There seems to be a universal human need to belong, which requires regular and frequent positive contact (Baumeister and Leary 1995; Jo et al. 2014; Sutcliffe et al. 2012). This

---

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s40750-020-00155-z>) contains supplementary material, which is available to authorized users.

---

✉ Robin I. M. Dunbar  
robin.dunbar@psy.ox.ac.uk

<sup>1</sup> Department of Experimental Psychology, University of Oxford, Radcliffe Observatory Quarter, Oxford OX2 6GG, UK

makes evolutionary sense because being part of a cohesive social network facilitates the sharing of information, cooperation in resource access and defence, and shared childcare (Burkart et al. 2009; DeScioli and Kurzban 2009; Lewis et al. 2011; Pearce 2014; Pearce and Moutsiou 2014; Whallon 2006). The number and quality of relationships also have dramatic effects on health and wellbeing (Diener et al. 2000; Domínguez and Arford 2010; Dunbar 2017; Haslam et al. 2014; Hawkey et al. 2008; Holt-Lunstad 2018; Holt-Lunstad et al. 2015; Holt-Lunstad et al. 2010; House 2001; Kiecolt-Glaser and Newton 2001; Koball et al. 2010; Pinquart and Duberstein 2010; Reblin and Uchino 2008; Tilvis et al. 2012), with significant downstream impacts on fitness.

Despite this universal need for stable and caring relationships, both individual and sex differences have been observed, for example in the levels of intimacy in friendships (lower in men: Aukett et al. 1988; Lewis et al. 2011; Machin and Dunbar 2013; Vigil 2007, 2008) and in the size and dynamics of their support cliques (smaller and more casual in men: Bhattacharya et al. 2016; Dávid-Barrett et al. 2015; Dunbar 2016a; Dunbar and Spoor 1995; Powell et al. 2012; Stiller and Dunbar 2007). Moreover, because close social ties require substantial time investment and because time budgets are finite, an individual's social relationships are not all equally intimate: social networks comprise a series of nested layers that decline in emotional closeness and frequency of contact from the innermost support layers closest to ego, outwards towards acquaintances and strangers (MacCarron et al. 2016; Miritello et al. 2013; Roberts et al. 2009; Sutcliffe et al. 2012).

There is widespread evidence for homophily in friendships: individuals tend to form relationships mainly with those who are similar to them (Byrne 1997; Dunbar 2018b; McPherson et al. 2001; Montoya and Horton 2013). Since similarity can be a reliable marker for in-groups, homophily may be a heuristic that both helps facilitate interpersonal coordination for cooperative tasks and minimises the risk of falling prey to free-riding from non-group members (Curry and Dunbar 2013). There is, however, evidence that some traits may be more important than others in creating homophily: sharing a sense of humour, hobbies and interests, moral beliefs, and being from the same area are the best predictors of emotional closeness and altruism in friendship networks, whereas other characteristics such as supporting the same sports team or sharing a workplace are not (Curry and Dunbar 2013). In addition, participants who thought they were interacting with strangers online reported that they liked their interaction partners more, and felt closer to them, if they had the same taste in music, religion or ethical views, whereas other traits such as common educational background and demographics did not seem to influence participants' ratings to the same extent (Launay and Dunbar 2015). In other words, different attributes are not weighted equally with regard to homophily in friendship networks overall, or in relationships with strangers.

Two of the closest non-kin relationships that humans have are those with a romantic partner and a 'best' friend. Despite the apparent tendency for men to interact in groups and women in dyads (Baumeister and Sommer 1997; Benenson & Heath, 2006; Dávid-Barrett et al. 2015; Gabriel and Gardner 1999; Rustin and Foels 2014), both best friendships and romantic partnerships are maintained by men as well as women (Machin and Dunbar 2013). Here, we ask whether similarity in some traits but not others is more predictive of relationship intimacy levels in these two particularly meaningful relationships, and whether relationship stability is more dependent on some traits than others.

## Methods

### Participants and Procedure

Participants were recruited via a questionnaire hosted on two online psychological research forums: Online Psychology Research UK (<http://www.onlinepsychresearch.co.uk/>) and Psychological Research on the Net (<http://psych.hanover.edu/Research/exponnet.html>). Participants indicated their consent to their inclusion in the study before being allowed to proceed to the questionnaire. Participants provided demographic information (age, sex and sexuality) for themselves and for their romantic partner and best friend, as well as the duration of their friendship/partnership. Participants who did not have a romantic partner were asked to simply answer those questions relating to their best friend. When identifying their best friend, participants were asked to refer to “*the non-related person who you would turn to first, after your romantic partner [if present], during a time of extreme difficulty or emotional distress*”.

In the analyses that follow, we focus on heterosexual participants, since there were too few participants identifying as homosexual or bisexual in our sample for meaningful results. We also excluded participants who reported their age to be under 18 years. This left 260 participants (201 female; age  $M = 31.09$  years,  $SD = 13.5$  years, range = 18–80 years). The mean length of a romantic partnership was 9.60 years ( $SD = 10.52$ , range = 1–46 years) and of a best friendship was 12.70 years ( $SD = 9.97$ , range = 1–50 years). Of the 254 participants who gave information on their location, 138 (54.1%) resided in Europe, 110 (42.3%) in North America and the remaining 6 (2.4%) in South America, Australia, Asia and Africa.

### Measures

To measure intimacy we used the intimacy sub-scale of Sternberg’s Triangular Love Scale (Sternberg 1988), comprising 17 items, such as ‘I am actively supportive of X’s wellbeing’ and ‘I have a warm relationship with X’, rated on a 5-point scale from ‘never’ to ‘always’.

We used Vigil’s Peer Relations questionnaire (Vigil 2007) to measure how participants scored themselves, their best friend and their romantic partner, partitioned into 13 attributes. The ratings were on a scale ranging from 1 (indicating low attainment on the trait) to 5 (indicating high attainment).

To measure the importance of different mechanisms of relationship maintenance, we asked participants to rate how important (a) meetings in person, (b) gift exchange, (c) shared history, (d) amount of mutual support offered, (e) intimacy and (f) duration of relationship were to maintaining the relationship in question. These items were rated on a 5-point scale ranging from not at all important (score of 1) to vital (score of 5). This scale was devised for this study.

### Analysis

To explore the role of the different traits in relationship maintenance, we first ran a principal components analysis of the responses to the Peer Relations questionnaire to

determine whether it was possible to cluster any together. We then examined the distribution of these factors for romantic partners and best friends for the two sexes.

Our primary focus is on how similar respondents perceived themselves to be to their romantic partner or best-friend. To index this, we calculated absolute differences between the participant score and the score they gave (i) their romantic partner or (ii) their best friend on the 13 traits in the Peer Relations questionnaire. From these, we calculated an Homophily Index as the normalised absolute difference between ratings of self and partner or friend, relative to the expected value for a random distribution of possible scores (mean absolute difference = 1.6), such that 1 = complete homophily and 0 = completely random.

Finally, to explore contribution of the individual traits from the two questionnaires to the intimacy of the relationship (indexed by Sternberg's intimacy subscale), we used backwards-stepwise linear regression models, separately for males and females, in order to assess which factors best predict intimacy in the two relationship types. All initial backwards-stepwise models included ego's age and the length of the relevant relationship. For the best-friendship models, a dummy variable coding whether best friendships were cross-sex or same-sex was also included.

Given the small sample size for opposite-sex friendships (29 for females and 11 for males, versus 164 and 38 same-sex best friendships, respectively), we do not differentiate the sex of the friend in any of the statistical analyses. Previous analyses suggest that the sex of the target makes less difference than the sex of the actor (Roberts and Dunbar 2015).

## Results

### Descriptives

Of the 201 female participants, 173 had romantic partners (86%) and 196 (98%) had best friends. Of the 59 male participants, 51 had romantic partners (86%) and 50 had best friends (85%). There were 202 same-sex best friendships (164 for females) and 40 cross-sex (29 for females) best-friendships (the sex of the best friend was not reported for 8 female participants and 10 male participants). Five females (2%) and 9 males (15%) had romantic partnerships but no best friend; 28 females (14%) and 8 males (14%) had a best friend but no romantic partner; and 168 females (84%) and 42 males (71%) had both. Males were more likely to declare having a best friend if they had no romantic partner (100%) than if they had a romantic partner (82.4%), whereas females were equally likely to have a best friend whether or not they had a romantic partner (97.1% versus 100%).

Descriptive statistics for the relationship ratings for best friends and romantic partners are given separately for males and females in Table 1, along with the significance of the difference between the sexes.

### Homophily

Fig. 1 plots mean and variance for the homophily indices for the 13 Peer Relations trait variables, where a value of 1 indicates complete homophily (no difference in rating

**Table 1** Descriptive statistics for males and females in relation to best friends (BF) and romantic partnerships (RP)

Relationship ratings variables		Females			Males			Difference* p
		N	Mean	SD	N	Mean	SD	
Sternberg Intimacy	RP	162	73.9	8.98	41	67.6	11.84	0.002
	BF	142	77.8	9.52	45	74.2	14.95	0.143
Shared history	RP	139	4.5	0.92	43	4.4	1.02	0.006
	BF	158	2.1	1.13	41	1.9	1.16	0.003
Gift-giving	RP	161	2.1	1.21	49	2.8	1.33	0.001
	BF	181	1.7	0.99	47	1.4	0.85	0.090
In-person contact	RP	138	4.7	0.61	41	4.6	0.79	0.255
	BF	158	3.8	1.47	38	3.6	1.12	0.367
Vigil (2007): Physical attractiveness	RP	160	3.7	0.89	51	4.1	0.82	0.002
	BF	184	3.7	0.85	48	3.3	1.12	0.061
Creativity	RP	160	3.3	1.12	51	3.6	1.05	0.068
	BF	185	3.4	1.08	47	3.4	0.99	0.897
Intelligence	RP	160	4.1	0.88	51	4.1	0.80	0.815
	BF	185	3.9	0.89	49	4.0	0.84	0.637
Education	RP	160	4.0	1.04	49	4.3	0.79	0.087
	BF	184	4.0	0.93	49	4.0	0.97	0.979
Financial prospects	RP	160	3.9	1.00	51	3.4	1.17	0.004
	BF	184	3.8	0.95	49	3.4	1.04	0.022
Sense of humour	RP	160	4.2	0.80	51	4.0	0.95	0.119
	BF	185	4.1	0.79	48	4.2	0.87	0.600
Outgoingness	RP	160	3.7	1.04	51	3.6	0.96	0.270
	BF	185	4.0	0.95	49	3.9	0.98	0.602
Athleticism	RP	158	3.5	1.18	51	2.9	0.96	0.001
	BF	183	3.1	1.20	49	3.1	1.38	0.980
Dependability	RP	160	4.2	0.97	51	4.5	0.67	0.024
	BF	185	4.1	1.04	49	3.9	1.24	0.147
Cooperativeness	RP	160	3.7	0.97	51	4.0	0.84	0.038
	BF	185	3.9	0.89	49	3.7	0.82	0.140
Social connections	RP	159	3.7	1.10	51	3.6	1.04	0.673
	BF	185	3.9	0.93	49	3.8	1.14	0.526
Kindness	RP	160	4.1	0.95	51	4.0	0.80	0.084
	BF	185	4.3	0.89	48	4.0	0.81	0.048
Optimism	RP	160	3.6	1.04	36	3.6	0.93	0.951
	BF	85	3.7	0.93	34	3.5	0.87	0.104

\*Difference between sexes (t-tests with unequal variances)

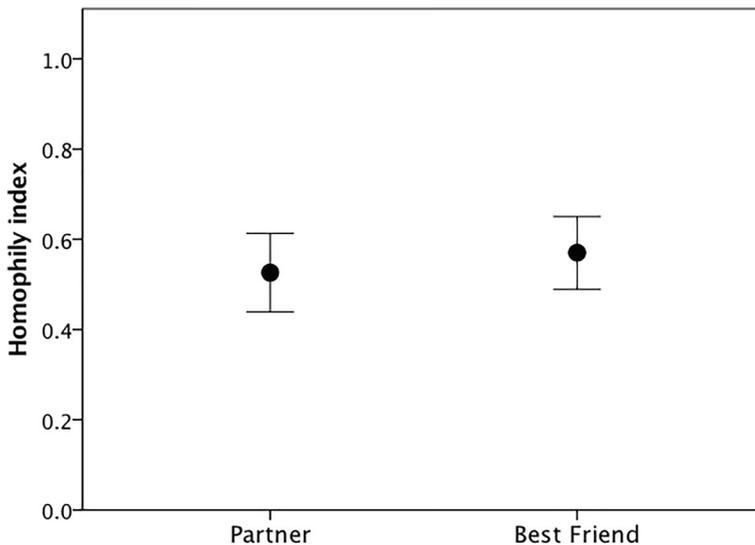
score) and 0 indicates random assortment. While not exhibiting complete homophily, both kinds of relationship are significantly more homophilous than would be expected if the correlations between the two sets of ratings were completely random. More

importantly, perhaps, it will be obvious that best friendships and romantic partnerships do not differ in this respect: both are chosen on the basis of significant similarity in traits (at least, as perceived by the respondent).

## Relationship Quality

Fig. 2 plots mean Sternberg intimacy ratings for romantic partners and best friends. There is a significant difference between the two sexes ( $F_{1,388} = 12.95, p = 0.0004$ ), with females rating intimacy higher for both kinds of relationship. This is especially true for romantic relationships ( $F_{1,201} = 14.14, p = 0.0002$ ), but due to the high variance in the male sample only marginally so for best friendships ( $F_{1,185} = 3.46, p = 0.065$ ). Notice that both sexes seemed to view relationships with the best friend as more intimate (at least as measured on the Sternberg scale) than their relationships with their romantic partners.

Significant sex differences were also found for differences in physical attractiveness ratings for romantic partners (males > females) and best friends (females > males), for the importance of shared history (females > males in both relationships), gift-giving in romantic relationships (males > females), in the importance of physical attractiveness in the partner (males > females for romantic relationships, but females > males for best friendships), for the partner's financial prospects (females > males in both relationship types), athleticism in romantic partners and kindness in best friendships (in both cases, females > males) and in respect of dependability and cooperativeness in romantic partners (males > females) (Table 1). None of the other trait variables differed significantly between the sexes.



**Fig. 1** Mean ( $\pm 95\%$  CI) homophily index for the 13 individual traits in Vigil's Peer Relations scale for romantic partnerships and best friendships. The index is the normalised ratio of observed to expected similarity in the two sexes' ratings on a given trait, and ranges from 0 (random pairing by trait rating) to 1 (complete homophily)

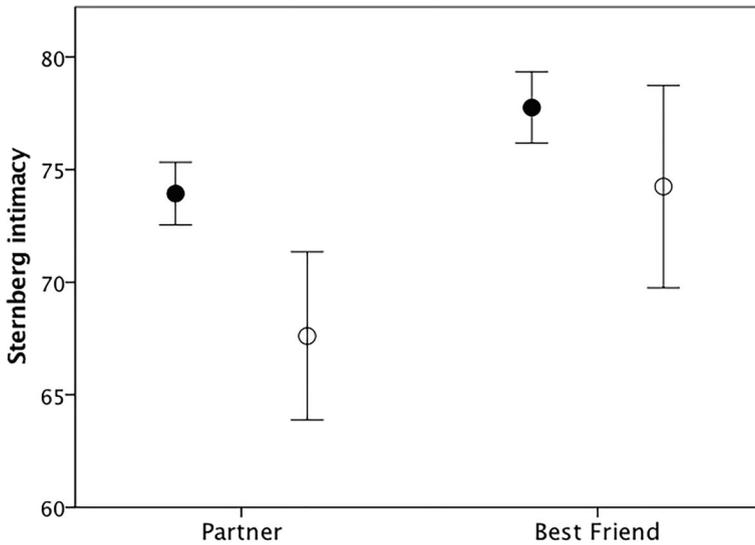


Fig. 2 Mean ( $\pm 95\%$ CI) Sternberg intimacy subscale ratings for romantic partners and best friends by sex

Table 2 gives the results of the principal component analyses for the 13 Peer Relations traits for romantic and best friend relationships, irrespective of sex. With the eigenvalue set at 1, these yielded a four-factor solution in both cases, which we label Outgoing, Social Skills, Intelligence and Creativity. The four factors explain 61% of the variance in each case. The allocation of variables to factors was remarkably similar, with almost identical weightings. Only Financial Success and (sense of) Humour were assigned to different factors in the two cases. Given this consistency, and in order to simplify further analyses, we opted to assign Financial Success to the Intelligence factor and Humility to the Outgoing factor on grounds of overall profile.

Fig. 3 plots the distribution of summed unweighted scores for the four factors, split by sex of respondent and type of relationship. Analysis of variance (with relationship as a fixed factor and respondent sex as a random factor) yields significant effects only for the interaction effect for the Social Skills and Creativity factors (Table 3). There were no significant main effects due to relationship type or sex of respondent. The interaction effects were mainly due to males rating their partners higher than their best friends, whereas female respondents rated them as more or less equal.

### Homophily and the Intimacy of Relationships

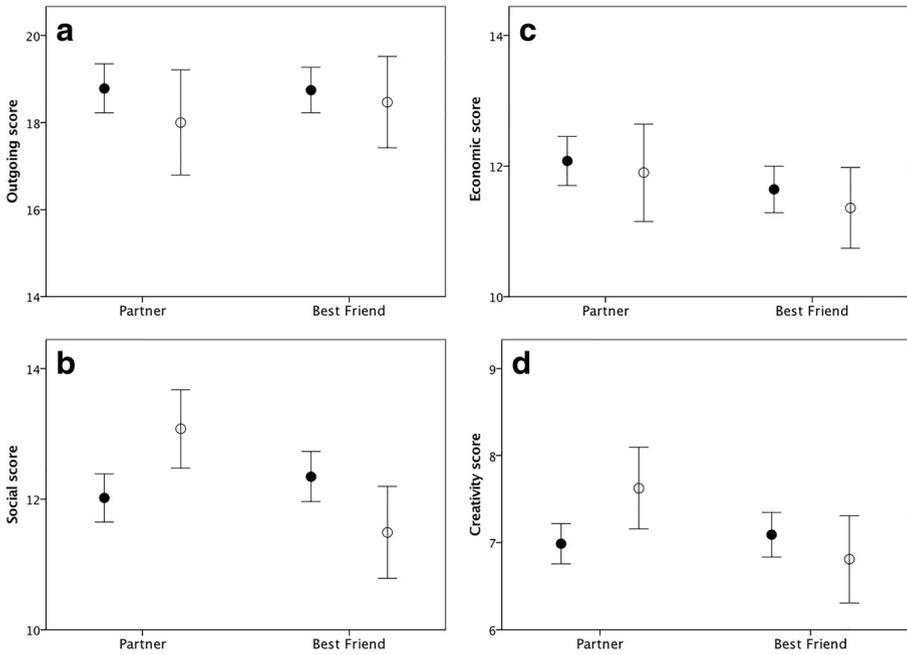
In order to examine the relationship between similarity in traits (homophily) and the quality of relationships (indexed by their rated intimacy), we ran separate backwards stepwise multiple regressions with relationship intimacy as the dependent variable and similarity on the variables for the Vigil Peer Relations questionnaire and our own relationship maintenance questionnaire. In each case, all the variables from the questionnaire were included as independent variables.

For women, intimacy with their romantic partner was best predicted ( $R^2 = 0.295$ ) by similarity in financial potential ( $t_{115} = 2.317$ ,  $p = 0.022$ ), outgoingness ( $t_{115} = 2.255$ ,  $p = 0.026$ ), dependability ( $t_{115} = 2.905$ ,  $p = 0.004$ ) and kindness ( $t_{115} = 3.208$ ,  $p = 0.002$ ).

**Table 2** Factor analysis of ratings for the 13 Vigil (2007) traits predicting relationship intimacy in romantic partners and best friends

Factors:	Romantic			Partner			Best			Friend				
	Outgoing	Social	Intelligence	Intelligence	Creativity	Outgoing	Social	Intelligence	Intelligence	Creativity	Outgoing	Social	Intelligence	Creativity
Connections	<b>0.711</b>	0.059	0.187	0.187	0.083	<b>0.782</b>	0.036	0.096	0.096	0.024				
Optimism	<b>0.548</b>	0.409	-0.016	-0.016	0.112	<b>0.543</b>	0.339	0.138	0.138	0.120				
Outgoingness	<b>0.754</b>	0.1333	-0.071	-0.071	0.170	<b>0.834</b>	0.090	-0.001	-0.001	0.043				
Athleticism	<b>0.595</b>	0.037	-0.015	-0.015	0.132	<b>0.463</b>	0.114	0.117	0.117	0.627				
Humour	<b>0.347</b>	0.148	0.208	0.208	0.533	<b>0.521</b>	0.255	0.305	0.305	0.080				
Dependability	0.119	<b>0.800</b>	0.061	0.061	-0.056	-0.020	<b>0.670</b>	0.379	0.379	0.210				
Cooperative	0.164	<b>0.811</b>	0.087	0.087	0.082	0.177	<b>0.832</b>	0.013	0.013	-0.067				
Kindness	0.037	<b>0.832</b>	0.104	0.104	0.113	0.229	<b>0.790</b>	0.103	0.103	0.008				
Financial	0.568	0.087	<b>0.487</b>	<b>0.487</b>	-0.065	0.324	-0.096	<b>0.698</b>	<b>0.698</b>	0.050				
Intelligence	0.092	0.136	<b>0.806</b>	<b>0.806</b>	0.189	0.006	0.253	<b>0.846</b>	<b>0.846</b>	0.008				
Education	-0.028	0.054	<b>0.870</b>	<b>0.870</b>	0.077	0.068	0.167	<b>0.763</b>	<b>0.763</b>	0.072				
Attractiveness	0.376	-0.012	-0.042	-0.042	<b>-0.674</b>	0.219	0.208	0.318	0.318	<b>0.556</b>				
Creativity	-0.068	0.169	0.163	0.163	<b>0.807</b>	0.344	0.261	0.233	0.233	<b>-0.601</b>				
Variance explained (%)	28.9	12.2	11.6	11.6	8.3	31.7	10.3	11.8	11.8	7.7				

**Bold** indicates principal loading; to maintain consistency across relationship categories, Financial (prospects) and (Sense of) Humour were assigned to the factor for which they had the best overall profile



**Fig. 3** Mean ( $\pm 95\%$  CI) unweighted summed ratings on (a) Outgoing factor ( $N=5$  traits), (b) Social Skills factor ( $N=3$  traits), (c) Economic factor ( $N=3$  traits) and (d) Creativity factor ( $N=2$  traits) for Vigil’s Peer Relations scale for romantic partners versus best friends. Filled symbols: female respondents; unfilled symbols: male respondents. The traits are those identified by the principal components analyses in Table 2

These results remained unchanged when controlling for age and relationship duration. Maintenance of romantic relationships was best predicted ( $R^2=0.143$ ) by respondent’s age ( $t_{114}=-2.352, p=0.020$ ), the duration of the relationship ( $t_{114}=2.040, p=0.044$ ) and the degree to which gifts ( $t_{114}=-1.984, p=0.050$ ) and mutual support ( $t_{114}=3.173, p=0.002$ ) were considered important. Interestingly, the effect for gift-giving was negative: the more importance placed on gift-giving, the *less* intimate the relationship was. This might reflect the fact that well established relationships do not require monetary reinforcement, even though this is important for weak or unstable relationships. Conversely, the more emphasis placed on mutual support as a means of maintaining the relationship, the more intimate that relationship was. Notice also that intimacy declined with respondent’s age (but not as a function of the duration of the relationship).

**Table 3** Analysis of variance for the four trait factors influencing intimacy of relationship

Factors:	Outgoing		Social Skills		Economic		Creativity	
Variable	F*	p	F*	p	F*	p	F*	p
Relationship	4.42	0.283	0.01	0.933	20.01	0.140	0.15	0.765
Sex	0.73	0.551	0.44	0.629	89.88	0.067	0.60	0.581
Interaction	0.36	0.548	11.47	0.001	0.03	0.853	5.96	0.015

\*df= 1,39

For men, the best-fit model for the intimacy of romantic relationships included only similarity in cooperativeness, although this effect was not statistically significant ( $t_{31} = 1.726$ ,  $p = 0.095$ ,  $R^2 = 0.09$ ). Intimacy in romantic partnerships was best predicted ( $R^2 = 0.458$ ) by the degree to which in-person (or face-to-face) contact was seen as important for relationship maintenance ( $t_{31} = 4.361$ ,  $p < 0.0001$ ). The degree of importance placed on engaging in shared history was also included in the best-fit model, but did not show a significant partial relationship with intimacy scores ( $p = 0.085$ ). These results remained unchanged when controlling for age and relationship duration.

For women, intimacy in best friendships was best predicted ( $R^2 = 0.242$ ) by the degree of similarity in education ( $t_{148} = 1.974$ ,  $p = 0.050$ ), sense of humour ( $t_{148} = 2.052$ ,  $p = 0.042$ ), dependability ( $t_{148} = 3.501$ ,  $p = 0.001$ ) and happiness ( $t_{148} = 1.996$ ,  $p = 0.048$ ). Although similarity in social connections was also included in the best-fit model, the significance of the partial relationship with intimacy was marginal ( $p = 0.068$ ). The intimacy of women's best friendships was also best predicted ( $R^2 = 0.242$ ) by shared history ( $t_{150} = -2.446$ ,  $p = 0.016$ ) and mutual support ( $t_{150} = 4.037$ ,  $p < 0.0001$ ). This remained true even when same-sex friendships were examined on their own. These results imply that the less important shared history was considered as a means of maintaining a friendship, and the more important mutual support was considered, the more intimate that friendship was. Although the best-fit model included additional variables, the partial relationships with intimacy were at best only marginally significant (shared goals:  $p = 0.06$ ; affection:  $p = 0.086$ ), irrespective of whether the friendship was cross- or same-sex ( $p = 0.052$ ).

For men, intimacy in best friendships was best predicted ( $R^2 = 0.544$ ) by the duration of the friendship ( $t_{33} = 2.587$ ,  $p = 0.015$ ) and the degree of similarity in financial potential ( $t_{33} = 2.690$ ,  $p = 0.012$ ), outgoingness ( $t_{33} = 2.349$ ,  $p = 0.026$ ), dependability ( $t_{33} = 2.778$ ,  $p = 0.010$ ) and social connections ( $t_{33} = -2.037$ ,  $p = 0.051$ ).

The maintenance of males' best friendships was best predicted ( $R^2 = 0.420$ ) by the length of the friendship ( $t_{34} = -2.061$ ,  $p = 0.048$ ), shared history ( $t_{34} = 2.585$ ,  $p = 0.015$ ) and mutual support ( $t_{34} = 2.447$ ,  $p = 0.021$ ). These variables remained significantly associated with intimacy when only same-sex friendships were considered. Additional variables in the best-fit model did not show significant partial relationships with intimacy scores: age of participant ( $p = 0.086$ ), and whether the friendship was cross- or same-sex ( $p = 0.081$ ).

## Discussion

Taken together, these results confirm previous findings that homophily is an important criterion for close relationships (Curry and Dunbar 2013; Launay and Dunbar 2015). In particular, similarity in dependability was consistently found to be strongly predictive of higher levels of intimacy. For women, this was the case in both best friendships and romantic partnerships, but for men dependability was included in the best-fit model only for intimacy in best friendships. For romantic partnerships, none of the variables measured showed significant partial relationships in men. Aside from these similarities, however, the results suggest that intimacy in males' friendships is underpinned by very different dynamics than intimacy in females' friendships.

Mirroring previous findings with respect to romantic partners (Buss 1989; Pawlowski and Dunbar 1999, 2001), we found that women seemed to be much more demanding in their selection of romantic partners than men were. The intimacy of

women's relationships were homophilous for at least four traits (financial prospects, outgoingness, dependability and kindness), whereas no traits predicted intimacy for males. Similarly, longterm maintenance of women's romantic relationships were predicted by relationship duration, gift-giving and supportiveness, but for males there was only one significant predictor (the frequency of face-to-face contact). In contrast, best friend relationships exhibited a very different pattern: their intimacy is predicted by similarity on four traits for both women and men, but the traits are very different (education, humour, dependability and happiness for women versus relationship duration, financial prospects, outgoingness and dependability in men).

Longevity in both women's and men's friendships was best predicted by provision of mutual support, but differed in the influence of shared histories (negative in the case of women, positive in the case of men). The traits characterizing women's friendships seem to have more to do with the closeness of the relationship itself, whereas those characterizing men's friendships seem to have more to do with engaging in social activities. Interestingly, none of the best-fit models included physical attractiveness or athleticism, indicating that personality and resource factors (such as education and financial potential) may be more important for intimacy levels in these close non-kin relationships than traits that might be assumed to correlate more directly with genetic fitness. This likely reflects the fact that relationships are indirect, rather than direct, means of enhancing fitness. In other words, this is a two-step process: we form close relationships not simply to access a direct fitness reward but in order to create coalitions or alliances that in turn allow us to maximise fitness. One possibility, for example, might be to mitigate the fertility costs of group-living (Mesnick 1997; Wilson and Mesnick 1997; Dunbar 2018a, 2019; Dunbar and MacCarron 2019).

The fact that outgoingness was a predictor for the intimacy of men's friendships might be linked to the fact that males tend to prefer social interaction in groups whereas females have a strong preference for one-to-one interactions (Baumeister and Sommer 1997; Benenson & Heath, 2006; Dávid-Barrett et al. 2015; Gabriel and Gardner 1999; Rustin and Foels 2014). In addition to these homophily effects, we also found that mutual support and shared history are important for intimacy, and are therefore key factors underpinning the successful maintenance of close personal relationships. Mutual support had a much stronger influence on intimacy in female participants for both romantic partners and best friends, but only in respect of best friends for men (Fig. 2). In relation to their romantic partners, the degree to which men considered in-person contact an important mechanism for relationship maintenance was the strongest predictor of intimacy, at least when the sample was considered as a whole, irrespective of the sex of the best friend.

Interestingly, the extent to which shared history were considered an important mechanism of relationship maintenance in best friendships had opposite effects on intimacy in men and women. Whereas this relationship was positive in men, in women it was negative (the greater the emphasis on shared history, the lower the level of intimacy). This might, again, reflect the difference between men's preference for group-based activities (for which shared history is usually an important component) and women's preference for more intimate dyadic ones (for which shared history might be less important than, for example, conversation and levels of mutual disclosure).

In women, both the importance placed on gift-giving and mutual support as ways of sustaining romantic partnerships were included in the best-fit model, but these variables had opposite effects on intimacy. The greater the importance placed on gift-giving, the lower the intimacy; in contrast, the greater the importance given to mutual support as a

mechanism of relationship maintenance, the greater the reported intimacy. Whereas gift-giving is observed cross-culturally as a means of creating and maintaining social network ties (e.g. Wiessner 1983), it may be that this strategy is only appropriate in the more distal layers of the social network where tokens of affiliation are required; in the inner layers, intimacy and emotional closeness may be more important (see Sutcliffe et al. 2012). It is possible that gift-giving is associated with forms of strict reciprocity in relationships that block the development of deeper emotional ties.

The importance of intimacy in same-sex female friendships may explain why similar humour profiles were found to be important for female but not male best friendships: laughter is thought to be important in the creation of social bonds (Dunbar 2017; Dunbar et al. 2012; Manninen et al. 2017). In contrast, similarity in social characteristics (outgoingness and social connections) were deemed more important for intimacy in male best friendships, perhaps reflecting the fact that men tend to prefer interacting in groups rather than one-to-one (Dávid-Barrett et al. 2015). Why this might be so evolutionarily remains to be answered, but one obvious suggestion relates to men's near-universal role in communal defence in small scale societies and the demand this imposes for being able to cooperate in groups.

These behavioural differences suggest that best friend relationships are viewed very differently by the two sexes, corroborating and extending previous studies which suggest that the two sexes have very different expectations as regards friendships (Hall 2011, 2012; Machin and Dunbar 2013) and very different social styles (Roberts and Dunbar 2015). This strongly suggests that friendships serve rather different functional roles in the two sexes arising from different evolutionary selection pressures. While romantic relationships are, inevitably, equally common in the two sexes (in both cases, 86% of respondents reported having a romantic partner), a smaller proportion of males reported having a best friend (85%, compared to 98% of females). Moreover, whereas only 2% of females had a romantic partner but no best friend, 15% of males were in this situation suggesting that males, but not females, are more likely to have one or the other but not both. Although a significant proportion of males reported having a best friend, the quality of these relationships seemed to be a great deal less intimate than was the case for females (Fig. 2). This reflects earlier findings suggesting that the male social world is built around half a dozen relatively casual relationships, whereas the female social world is built around one or two much more intimate, and hence more fragile, dyadic relationships (Benenson and Christakos 2003; Roberts and Dunbar 2015; Dávid-Barrett et al. 2015).

In both sexes, only a minority of best friends were opposite-sex (15% for females; 22% in males). The gender homophily is itself striking, and probably reflects the fact that social networks are highly assortative for sex (Block and Grund 2014; Mehta and Strough 2009; Roberts et al. 2008; Rose 1985; Dunbar 2021). Even conversations readily segregate by sex once they contain more than four individuals (Dunbar 2016b; Dahmardeh and Dunbar 2017). Although having male best friends may be advantageous to females in terms of protection against the unwanted attentions of other males (Mesnick's bodyguard hypothesis: Mesnick 1997; Wilson and Mesnick 1997; Dunbar 2010; see also Snyder et al. 2011; Ryder et al. 2016), it may be that male partners are likely to become jealous if their romantic partners show too much interest in male best friends, fearing either mate theft or cuckoldry. This might make cross-sex best friends less functional for paired females. Alternatively, intimate friendships between women may be more beneficial or easier to maintain (if only because of similar conversational

styles: Coates 1996; Grainger and Dunbar 2009), while common interests make cooperation more straightforward (de Waal and Luttrell 1986).

These data are, of course, self-report data and represent the views of only one party in a relationship, and so are inevitably subject to the usual distortions this can involve. Nonetheless, in that respect, they do represent the aspirations and expectations of the person concerned, and it is these as much as anything that we are here interested in. While relationships are necessarily two-way processes, it is nonetheless failure of one individual's expectations to be met in a relationship that is the usual cause of relationship breakdown (Dunbar and Machin 2014). Relationships break down because one party is dissatisfied with the deal they are getting, not because both parties "agree to disagree". In this sense, these results provide us with direct insights into how individuals view their relationships, irrespective of whether they are right in their views.

**Acknowledgments** Data collection was supported by the British Academy 'From Lucy to Language' Centenary Project. We thank the two referees for their very helpful comments, which greatly helped to improve the paper.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare no conflicts of interest.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Aukett, R., Ritchie, J., & Mill, K. (1988). Gender Differences in Friendship Patterns. *Sex Roles, 19*(1/2), 57–66.
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*, 497–529.
- Baumeister, R. F., & Sommer, K. L. (1997). What do men want? Gender differences and two spheres of belongingness: Comment on cross and Madson (1997). *Psychological Bulletin, 122*(1), 38–44. <https://doi.org/10.1037/0033-2909.122.1.38>.
- Benenson, J. F., & Christakos, A. (2003). The greater fragility of females' versus males' closest same-sex friendships. *Child Development, 74*, 1123–1129.
- Benenson, J. F. & Heath, A. (2006). Boys withdraw more in one-on-one interactions, whereas girls withdraw more in groups. *Developmental Psychology, 42*, 272–282.
- Bhattacharya, K., Gosh, A., Monsivais, D., Dunbar, R. I. M., & Kaski, K. (2016). Sex differences in social focus across the life cycle in humans. *Royal Society Open Science, 3*, 160097.
- Block, P., & Grund, T. (2014). Multidimensional homophily in friendship networks. *Network Science, 2*, 189–212.
- Burkart, J. M., Hrdy, S. B., & van Schaik, C. P. (2009). Cooperative breeding and human cognitive evolution. *Evolutionary Anthropology, 18*, 175–186.
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences, 12*, 1–14.
- Byrne, D. (1997). An overview (and underview) of research and theory within the attraction paradigm. *Journal of Social and Personal Relationships, 14*(3), 417–431.

- Coates, J. (1996). *Women Talk*. Oxford: Blackwell.
- Curry, O., & Dunbar, R. I. M. (2013). Do birds of a feather flock together? The relationship between similarity and altruism in social networks. *Human Nature*, *24*(3), 336–347.
- Dahmardeh, M., & Dunbar, R. I. M. (2017). What shall we talk about in Farsi? Content of everyday conversations in Iran. *Human Nature*, *28*, 423–433.
- Dávid-Barrett, T., Rotkirch, A., Carneý, J., Behncke Izquierdo, I., Krems, J. A., Townley, D., et al. (2015). Women favour dyadic relationships, but men prefer clubs: Cross-cultural evidence from social networking. *PLoS One*, *10*(3), e0118329. <https://doi.org/10.1371/journal.pone.0118329>.
- de Waal, F. B. M., & Luttrell, L. M. (1986). The similarity principle underlying social bonding among female rhesus monkeys. *Folia Primatologica*, *46*(4), 215–234. <https://doi.org/10.1159/000156255>.
- DeScioli, P., & Kurzban, R. (2009). The alliance hypothesis for human friendship. *PLoS One*, *4*, e5802.
- Diener, E., Gohm, C. L., Suh, E., & Oishi, S. (2000). Similarity of the relations between marital status and subjective well-being across cultures. *Journal of Cross-Cultural Psychology*, *31*(4), 419–436. <https://doi.org/10.1177/0022022100031004001>.
- Dominguez, S., & Arford, T. (2010). It is all about who you know: Social capital and health in low-income communities. *Health Sociology Review*, *19*(1), 114–129. <https://doi.org/10.5172/hesr.2010.19.1.114>.
- Dunbar, R. I. M. (2010). Deacon's dilemma: The problem of pairbonding in human evolution. In R. I. M. Dunbar, C. Gamble, & J. A. J. Gowlett (Eds.), *Social brain, distributed mind* (pp. 159–179). Oxford: Oxford University Press.
- Dunbar, R. I. M. (2014). *Human Evolution*. London: Pelican & New York: Oxford University Press.
- Dunbar, R. I. M. (2016a). Do online social media cut through the constraints that limit the size of offline social networks? *Royal Society Open Science*, *3*(150292), 150292. <https://doi.org/10.1098/rsos.150292>.
- Dunbar, R. I. M. (2016b). Sexual segregation in human conversations. *Behaviour*, *153*, 1–14.
- Dunbar, R. I. M. (2017). Breaking bread: The functions of social eating. *Adaptive Human Behavior and Physiology*, *3*(3), 198–211. <https://doi.org/10.1007/s40750-017-0061-4>.
- Dunbar, R. I. M. (2018a). Social structure as a strategy to mitigate the costs of group-living: A comparison of gelada and guereza monkeys. *Animal Behaviour*, *136*, 53–64.
- Dunbar, R. I. M. (2018b). The anatomy of friendship. *Trends in Cognitive Sciences*, *22*, 32–51.
- Dunbar, R. I. M. (2019). Fertility as a constraint on group size in African great apes. *Biological Journal of the Linnean Society*, *129*, 1–13.
- Dunbar, R. I. M. (2021). *Friends*. London: Little Brown.
- Dunbar, R. I. M., & MacCarron, P. (2019). Group size as a trade-off between fertility and predation risk: Implications for social evolution. *Journal of Zoology*, *308*, 9–15.
- Dunbar, R. I. M., & Machin, A. (2014). Sex differences in relationship conflict and reconciliation. *Journal of Evolutionary Psychology*, *12*, 109–133.
- Dunbar, R. I. M., & Spoor, M. (1995). Social networks, support cliques, and kinship. *Human Nature*, *6*(3), 273–290. <https://doi.org/10.1007/bf02734142>.
- Dunbar, R. I. M., Baron, R., Frangou, A., Pearce, E., van Leeuwen, E. J. C., Stow, J., et al. (2012). Social laughter is correlated with an elevated pain threshold. *Proceedings of the Royal Society B: Biological Sciences*, *279*(1731), 1161–1167.
- Dunbar, R. I. M., Amaboldi, V., Conti, M., & Passarella, A. (2015). The structure of online social networks mirrors those in the offline world. *Social Networks*, *43*, 39–47.
- Gabriel, S., & Gardner, W. L. (1999). Are there “his” and “hers” types of interdependence? The implications of gender differences in collective versus relational interdependence for affect, behaviour and cognition. *Journal of Personality and Social Psychology*, *77*(3), 642–655.
- Grainger, S., & Dunbar, R. I. M. (2009). The structure of dyadic conversations and sex differences in social style. *Journal of Evolutionary Psychology*, *7*, 83–93.
- Hall, J. A. (2011). Sex differences in friendship expectations: A meta-analysis. *Journal of Social and Personal Relationships*, *28*, 723–747.
- Hall, J. A. (2012). Friendship standards: The dimensions of ideal expectations. *Journal of Social and Personal Relationships*, *29*, 884–907.
- Haslam, C., Cruwys, T., & Haslam, S. A. (2014). “The we’s have it”: Evidence for the distinctive benefits of group engagement in enhancing cognitive health in aging. *Social Science & Medicine*, *120*, 57–66. <https://doi.org/10.1016/j.socscimed.2014.08.037>.
- Hawley, L. C., Hughes, M. E., Waite, L. J., Masi, C. M., Thisted, R. A., & Cacioppo, J. T. (2008). From social structural factors to perceptions of relationship quality and loneliness: The Chicago health, Aging, and Social Relations Study. *Journal of Personality and Social Psychology*, *95*(6), S375–S384. <https://doi.org/10.1088/0031-9155/55/20/011.DigiWarp>.

- Holt-Lunstad, J. (2018). Why social relationships are important for physical Health: A Systems Approach to Understanding and Modifying Risk and Protection. *Annual Review of Psychology*. <https://doi.org/10.1146/annurev-psych-122216-011902>
- Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, 7(7), e1000316. <https://doi.org/10.1371/journal.pmed.1000316>.
- Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, 10(2), 227–237.
- House, J. S. (2001). Social isolation kills, but how and why? *Psychosomatic Medicine*, 63(2), 273–274.
- Jo, H.-H., Saramaki, J., Dunbar, R. I. M., & Kaski, K. (2014). Spatial patterns of close relationships across the lifespan. *Scientific Reports*, 4. <https://doi.org/10.1038/srep06988>.
- Kiecolt-Glaser, J. K. & Newton, T. L. (2001). Marriage and health: His and hers. *Psychological Bulletin*. US: American Psychological Association. <https://doi.org/10.1037/0033-2909.127.4.472>
- Koball, H. L., Moiduddin, E., Henderson, J., Goesling, B., & Besculides, M. (2010). What do we know about the link between marriage and health? *Journal of Family Issues*. Sage Publications., 31, 1019–1040. <https://doi.org/10.1177/0192513X10365834>.
- Launay, J., & Dunbar, R. I. M. (2015). Playing with strangers: Which shared traits attract us most to new people? *PLoS One*, 10(6), e0129688. <https://doi.org/10.1371/journal.pone.0129688>.
- Lewis, D. M., Conroy-Beam, D., Al-Shawaf, L., Raja, A., DeKay, T., & Buss, D. M. (2011). Friends with benefits: The evolved psychology of same-and opposite-sex friendship. *Evolutionary Psychology*, 9(4), 543–563.
- MacCarron, P., Kaski, K., & Dunbar, R. I. M. (2016). Calling Dunbar's numbers. *Social Networks*, 47, 151–155.
- Machin, A., & Dunbar, R. I. M. (2013). Sex and gender as factors in romantic partnerships and best friendships. *Journal of Relationships Research*, 4, e8. <https://doi.org/10.1017/jrr.2013.8>.
- Manninen, S., Tuominen, L., Dunbar, R. I. M., Karjalainen, T., Hirvonen, J., Arponen, E., et al. (2017). Social laughter triggers endogenous opioid release in humans. *The Journal of Neuroscience*, 37(25), 6125–6131. <https://doi.org/10.1523/JNEUROSCI.0688-16.2017>.
- Mepheron, M., Smith-lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27, 415–444.
- Mehta, C. M., & Strough, J. (2009). Sex segregation in friendships and normative contexts across the life span. *Developmental Review*, 29, 201–220.
- Mesnick, S. L. (1997). Sexual alliances: Evidence and evolutionary implications. In P. A. Gowaty (Ed.), *Feminism and evolutionary biology* (pp. 207–260). London: Chapman & Hall.
- Miritello, G., Moro, E., Lara, R., LMartinez-Lopez, R., Belchamber, J., Roberts, S. G. B., & Dunbar, R. I. M. (2013). Time as a limited resource: Communication strategy in Mobile phone networks. *Social Networks*, 35(1), 89–95.
- Montoya, R. M., & Horton, R. S. (2013). A meta-analytic investigation of the processes underlying the similarity-attraction effect. *Journal of Social and Personal Relationships*, 30(1), 64–94.
- Pawlowski, B., & Dunbar, R. I. M. (1999). Impact of market value on human mate choice decisions. *Proceedings of the Royal Society, London*, 266B, 281–285.
- Pawlowski, B., & Dunbar, R. I. M. (2001). Human mate choice strategies. In J. van Hooff, R. Noë, & P. Hammerstein (Eds.), *Economic models of animal and human behaviour* (pp. 187–202). Cambridge: Cambridge University Press.
- Pearce, E. (2014). Modelling mechanisms of social network maintenance in hunter–gatherers. *Journal of Archaeological Science*, 50, 403–413. <https://doi.org/10.1016/j.jas.2014.08.004>.
- Pearce, E., & Moutsiou, T. (2014). Using obsidian transfer distances to explore social network maintenance in late Pleistocene hunter–gatherers. *Journal of Anthropological Archaeology*, 36, 12–20. <https://doi.org/10.1016/j.jaa.2014.07.002>.
- Pinquart, M., & Duberstein, P. R. (2010). Associations of social networks with cancer mortality: A meta-analysis. *Critical Reviews in Oncology/Hematology*, 75(2), 122–137.
- Powell, J., Lewis, P. A., Roberts, N., Garcia-Finana, M., & Dunbar, R. I. M. (2012). Orbital prefrontal cortex volume predicts social network size: An imaging study of individual differences in humans. *Proceedings of the Royal Society B: Biological Sciences*, 279(1736), 2157–2162.
- Reblin, M., & Uchino, B. N. (2008). Social and emotional support and its implication for health. *Current Opinion in Psychiatry*, 21, 201–205.
- Roberts, S. B. G., & Dunbar, R. I. M. (2015). Managing relationship decay: Network, gender, and contextual effects. *Human Nature*, 26, 426–450.
- Roberts, S. G. B., Wilson, R., Fedurek, P., & Dunbar, R. I. M. (2008). Individual differences and personal social network size and structure. *Personality & Individual Differences*, 44, 954–964.
- Roberts, S. G. B., Dunbar, R. I. M., Pollet, T. V., & Kuppens, T. (2009). Exploring variation in active network size: Constraints and ego characteristics. *Social Networks*, 31(2), 138–146. <https://doi.org/10.1016/j.socnet.2008.12.002>.

- Rose, S. M. (1985). Same- and cross-sex friendships and the psychology of homosociality. *Sex Roles*, 12, 63–74.
- Rustin, B., & Foels, R. (2014). Gender differences in the need to belong: Different cognitive representations of the same social groups. *Current Research in Social Psychology*, 22(5), 1–9.
- Ryder, H., Maltby, J., Rai, L., Jones, P., & Flowe, H. D. (2016). Women's fear of crime and preference for formidable mates: How specific are the underlying psychological mechanisms? *Evolution and Human Behavior*, 37, 293–302.
- Snyder, J. K., Fessler, D. M., Tiokhin, L., Frederick, D. A., Lee, S. W., & Navarrete, C. D. (2011). Trade-offs in a dangerous world: Women's fear of crime predicts preferences for aggressive and formidable mates. *Evolution and Human Behavior*, 32, 127–137.
- Sternberg, R. J. (1988). *The triangle of love: Intimacy, Passion, Commitment*. New York: Basic Books.
- Stiller, J., & Dunbar, R. I. M. (2007). Perspective-taking and memory capacity predict social network size. *Social Networks*, 29(1), 93–104. <https://doi.org/10.1016/j.socnet.2006.04.001>.
- Sutcliffe, A., Dunbar, R.I.M., Binder, J. & Arrow, H. (2012). Relationships and the social brain: integrating psychological and evolutionary perspectives. *British Journal of Psychology*, 103, 149–168.
- Tilvis, R. S., Routasalo, P., Karppinen, H., Strandberg, T. E., Kautiainen, H., & Pitkala, K. H. (2012). Social isolation, social activity and loneliness as survival indicators in old age; a nationwide survey with a 7-year follow-up. *European Geriatric Medicine*, 3(1), 18–22. <https://doi.org/10.1016/j.eurger.2011.08.004>.
- Vigil, J. M. (2007). Asymmetries in the friendship preferences and social styles of men and women. *Human Nature*, 18, 143–161. <https://doi.org/10.1007/s12110-007-9003-3>.
- Vigil, J. M. (2008). Sex differences in affect behaviors, desired social responses, and accuracy at understanding the social desires of other people. *Evolutionary Psychology*, 6, 147470490800600316.
- Whallon, R. (2006). Social networks and information: Non-"utilitarian" mobility among hunter-gatherers. *Journal of Anthropological Archaeology*, 25, 259–270.
- Wiessner, P. (1983). Style and social information in Kalahari san projectile points. *American Antiquity*, 48(2), 253–276.
- Wilson, M., & Mesnick, S. L. (1997). An empirical test of the bodyguard hypothesis. In P. A. Gowaty (Ed.), *Feminism and evolutionary biology* (pp. 505–511). London: Chapman & Hall.
- Wilson, M., & Mesnick, S. L. (1997). An empirical test of the bodyguard hypothesis. In P. A. Gowaty (Ed.), *Feminism and evolutionary biology* (pp. 505–512). London: Chapman & Hall.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.