THE QUARTERLY JOURNAL OF EXPERIMENTAL PSYCHOLOGY, 2016
Vol. 69, No. 8, 1498–1507, http://dx.doi.org/10.1080/17470218.2015.1086392

Routledge
Taylor & Francis Group

The varying value of a friendly face: Experimentally induced stress is associated with higher preferences for friendship with people possessing feminine versus masculine face traits

Anthony C. Little and **Kerry Harcus**

School of Natural Sciences, University of Stirling, Stirling, UK

(Received 14 March 2015; accepted 14 July 2015; first published online 12 November 2015)

Social support can provide a buffer to the negative consequences of stress. Previous research suggests that stress can promote affiliative and cooperative behaviours in those who are stressed. Here we examined how stress might influence who we choose to affiliate with. We measured preferences for friendships with friendly appearing feminized faces versus less friendly appearing masculinized faces after individuals undertook a stressful laboratory task. Stressed individuals had increased preferences for friendships with people with feminine faces. These data demonstrate that individuals prefer more friendly appearing feminine faced people as friends when stressed than when not stressed. This preference is likely adaptive in directing individuals towards others who are most likely to provide social support when it is needed and so reflect strategic friendship preferences.

Keywords: Stress; Friendship; Masculinity; Femininity; Social support.

Friendships are important social relationships that are costly to maintain (Roberts & Dunbar, 2011). The importance of friendships can be seen in research demonstrating that individuals report pain akin to physical pain when a close friendship is lost (Eisenberger, 2012). It has been suggested that friendship bonds share similarities with the bonding processes observed in the choice of mating partners (Dunbar, 2009). Indeed, friendship formation is affected by factors that influence the formation of romantic relationships: factors such as proximity, intimacy, and reciprocity (Amichai-Hamburger, Kingsbury, & Schneider, 2013). Other aspects are also shared between partnership and friendship formation. For example, assortative pairing, in which individuals pair up with similar others, is observed in both romantic partnerships and in same-sex friendships (Feingold, 1988; Rushton, 2009). Given that long-term romantic relationships involve cooperation and mutual support, it is easy to believe that some traits that are valued in romantic partners are also likely to be valued in friends, such as behavioural traits like trustworthiness. Of course, there are also likely to be traits that are differentially valued in romantic partners and friendships, such as traits that are relevant to sexual reproduction/desire, which are more relevant for romantic partnerships. Consistent with distinct processing, neuroimaging studies show that viewing the objects of romantic

Correspondence should be addressed to Anthony C. Little, School of Natural Sciences, University of Stirling, Stirling, FK9 4LA, UK. E-mail: anthony.little@stir.ac.uk

love activates brain regions that are distinct to viewing friends (Bartels & Zeki, 2000). Reactions to romantic partners and friends are quantifiably different in terms of patterns of activation in areas of the brain associated with affective reactions, and the distinct response to romantic partners led the authors to suggest that there is a functionally specialized system in the brain for processing romantic love (Bartels & Zeki, 2000).

Friendships and strong social networks have been associated with positive benefits including higher subjective well-being (van der Horst & Coffe, 2012) and better health (see Martire & Franks, 2014, for a brief review). A striking finding from a meta-analysis on studies relating social support and mortality risks suggests that those with stronger social relationships had a 50% increased chance of survival compared to those with weaker social relationships (Holt-Lunstad, Smith, & Layton, 2010). Friendship has been linked to stress with the suggestion that a strong social support network may act as a buffer against the negative aspects of stress (Cohen & Wills, 1985). For example, individuals who have a low number of ties to friends exhibit higher levels of cortisol, a hormone associated with stress, than individuals who have a greater number of friends (Kornienko, Clemans, Out, & Granger, 2013). More direct evidence for friendships influencing stress responses comes from experimental work. For example, in both humans and nonhuman animals social contact and affiliation are associated with lower levels of cortisol being produced in response to exposure to aversive stimuli (DeVries, Glasper, & Detillion, 2003).

Possibly because support from friends can ameliorate the negative aspects of stress, studies have shown that stress may impact on affiliative behaviours. Indeed, some authors have argued that the buffering effect on stressful events may be a selection pressure driving the formation of social bonds (Seyfarth & Cheney, 2012). Stress affects a number of physiological and psychological mechanisms with the body. Primarily, the stress response suppresses the parasympathetic system, which triggers the secretion of adrenaline and noradrenaline and in turn results in the physical effects associated with stress, such as increased heart-rate and blood pressure (Ulrich-Lai & Herman, 2009). The hypothalamus is also activated, causing glucocorticoids, such as cortisol, to be secreted. These hormones in turn may be responsible for changes in behaviour related to affiliation (Seyfarth & Cheney, 2012). Oxytocin has also been suggested to play a role in promoting affiliation in response to stress (Taylor, 2006). In line with the potential effect of stress on affiliative behaviour, women tend to show a greater tendency to associate with other people when under stress (Taylor et al., 2000), and individuals who are experimentally exposed to a social stressor engage in more prosocial behaviour (e.g., sharing) than those not exposed to such stress (von Dawans, Fischbacher, Kirschbaum, Fehr, & Heinrichs, 2012).

While friendships form in many ways, as in romantic partner selection, one of the first cues available to potential friends is visual appearance. In terms of mate preferences, much research has focused on facial attractiveness (see e.g., Little, Jones, & DeBruine, 2011, for review), and the face may also be used to guide friendship choices. Faces do appear to contain some valid cues to personality traits (e.g., Little & Perrett, 2007), including traits such as approachability (Berry & Brownlow, 1989), aggression (Carre & McCormick, 2008), honesty (Bond, Berry, & Omar, 1994), and cooperation (Little, Jones, DeBruine, & Dunbar, 2013). Masculinity and femininity in faces have been associated with a variety of personality attributions that may be relevant to friendship choices. Masculinized faces are seen as possessing higher dominance, masculinity, and age but lower warmth, emotionality, honesty, cooperativeness, and quality as a parent than feminine faces (Perrett et al., 1998). Feminized faces are also seen as more likely to provide high-quality social support than masculinized faces (Watkins, DeBruine, Little, & Jones, 2012). Consequently, after priming with cues to low levels of available social support, individuals show stronger preferences for feminized faces of both sexes than when primed with cues to high levels of social support (Watkins et al., 2012).

The current experiment examined same-sex and opposite-sex friendship preferences for

masculinized and feminized male and female faces comparing preferences under stressful versus control conditions using a between-participant design. Given that feminized faces are associated with "nice" personality attributions (Perrett et al., 1998), we predicted that if stress causes individuals to seek out individuals who are likely to be friendly towards them then those in the stressed group would select more feminine faced individuals as potential friends than those in the control group would. We additionally examined attraction to masculinized and feminized faces to test whether the effects of stress were specific to friendship selection or generalized to impact on attractiveness judgements.

EXPERIMENTAL STUDY

Method

Participants

A total of 68 participants (20 men, 48 women) were recruited from the university's online recruitment system using a combination of convenience and snowball sampling. The mean age of the sample was 20.14 years ($SD = 2.96$). Participants were selected for reporting to be less than 40 years of age. The original sample was 70 participants but two participants were excluded for reporting being older than 40 years of age. This restriction was placed prior to data analysis on the basis that the faces used were of students around 20 years old (18–25-year-olds) and that older participants may not see the stimuli as realistic friendship choices. After applying this cut-off, participant ages ranged from 18 to 33 years old with 91% between 18 and 25 years old. Participants were awarded course credit for participation and were entered into a prize draw to win a £25 Amazon voucher. The sample size was based on previous tests of between-subject testing indicating that a sample of around 50 participants is sufficient to see group differences in preferences (Little, DeBruine, & Jones, 2013). The stopping rule for data collection was the availability of participants during one semester of testing.

Stimuli for preference tests

To measure preferences for masculinized versus feminized faces, we used 20 pairs of composite face images (10 male pairs and 10 female pairs). Each pair comprised one masculinized and one feminized version of the same face (see Figure 1 for example images). Original images were 50 young adult Caucasian male and 50 female photographs taken under standard lighting conditions and with a neutral expression. The composite images were made by creating an average image made up of five randomly assigned individual facial photographs. This technique has been used to create composite images in previous studies (see Benson & Perrett, 1993; Little & Hancock, 2002; Tiddeman, Burt, & Perrett, 2001). Faces were transformed for sexual dimorphism using the linear difference between a composite of all 50 adult males and a composite of all 50 young adult females (using the technique as reported in Perrett et al., 1998). Transforms represented $\pm 50\%$ of the difference between these two composites. This meant that each face was transformed along the sexual dimorphism axis by the same amount, either increasing masculinity or increasing femininity, and that faces retained their identities and perceived sex (female faces remained female in appearance, and male faces remained male in appearance). Composite images were made perfectly symmetric so that transforms did not manipulate symmetry. Images were masked on the outline of the face so that clothes and hair were not visible in the images. Example images can be seen in Figure 1.

Stress induction

For the stressed group, the stress induction involved participants undertaking two components adapted from the Maastricht Acute Stress Test (MAST; Smeets et al., 2012): (a) Participants were filmed while completing a cold pressor task (plunging a hand in to icy water for up to 3 min); (b) participants completed a series of visual cognitive block design tasks within a 3-min time limit. The MAST has been shown to stimulate glucocorticoid secretion associated with

Figure 1.. *Transformed composite images representing feminized (left) and masculinized (right) face shapes. To view this figure in colour, please visit the online version of this Journal.*

stress in a safe laboratory setting (Smeets et al., 2012).

Water used in the cold pressor task was kept at room temperature between testing and was contained in a plastic bucket. The water was made cold with the addition of 12 large ice cubes at any one time, which were placed into the bucket 5 min before the participant was asked to undertake the task. Participants were able to withdraw their hand from the icy water at any point but were

asked to hold their hand in the bucket for as long as they could stand.

The block design task, undertaken after the cold pressor task, was a visual cognitive puzzle normally used as a measure for IQ testing taken from the Wechsler Adult Intelligence Scale–Fourth Edition (WAIS–IV; Wechsler, 2008). Participants were shown a series of pictures comprising red and white blocks and then had to arrange nine red and white blocks to form the pattern within a timed 3 min.

In the control (unstressed) group, participants were not filmed and did not participate in the cold pressor task. Participants completed but were not timed for the block design task. In order to help equate time in each group condition, the control group were asked to attempt to complete three picture patterns for the block design.

Procedure

Participants filled out a consent form and were randomly assigned to a group condition (stressed/control, 34 subjects in each condition: 21 women and 13 men in the stressed condition, 27 women and 7 men in the control condition); there was no significant difference in age between groups, $t(66) = 0.49$, $p = .626$, $d = 0.12$. Participants then filled out a series of questions using an online form including basic demographic information: age, gender, and sexual orientation.

Following the questionnaire, participants engaged in either the stressful or the nonstressful tasks described above. After the relevant tasks were completed, participants then returned to the computer to complete the face selection tasks.

In the selection/preference tests, the 20 (10 male, 10 female) pairs of masculinized and feminized faces were shown as pairs with both order and side of presentation randomized. Participants were asked to: "Click on the face you would most like to be friends with." There was no time limit, and clicking on one of the faces moved participants on to the next face trial. After completing friendship selection, participants were presented with the face pairs again and were asked to: "Click on the face you think is most attractive."

Results

For the selection of masculinized and feminized faces for friendship and attractiveness, the number of masculinized images chosen by each participant was converted to the proportion chosen separately for male and female faces images for each participant. This meant that each set of ratings generated four proportion scores for each participant representing preference for masculinized images: preference for male friends, preference for female friends, attractiveness of males, and attractiveness of females.

All analyses are reported two-tailed.

Selection for friendship

A 2 (sex of face: male, female) × 2 (group: stressed, control) × 2 (sex of participant: male, female) mixed-model analysis of variance (ANOVA) with selection of masculinized image as the dependent variable was carried out to investigate the effect of stress condition on masculine friendship preference.

The main effect of group was significant, $F(1, 64) = 5.29$, $p = .025$, $\eta_p^2 = .076$. There was also a significant main effect of sex of face, $F(1, 64) = 4.13$, $p = .046$, $\eta_p^2 = .061$, but no significant interaction between sex of face and group, $F(1, 64) = 0.52$, $p = .472$, $\eta_p^2 = .008$. The main effect of sex of participant was not significant, $F(1, 64) = 0.78$, $p = .381$, $\eta_p^2 = .012$, and there was no significant interaction between sex of participant and group, $F(1, 64) = 2.34$, $p = .131$, $\eta_p^2 = .035$. There was no significant interaction between sex of participant and sex of face, $F(1, 64) = 2.55$, $p = .116$, $\eta_p^2 = .038$. Finally, there was no significant three-way interaction between sex of face, sex of participant, and group, $F(1, 64) = 0.08$, $p = .775$, $\eta_p^2 = .001$. From Figure 2, it can be seen that the main effect of group reflected that stressed participants were less likely to prefer masculinized male and female faces for friendship than those in the control group who were unstressed. The main effect of sex of face appears to reflect that feminized female faces were selected more often than feminized male faces (see *t*-tests below).

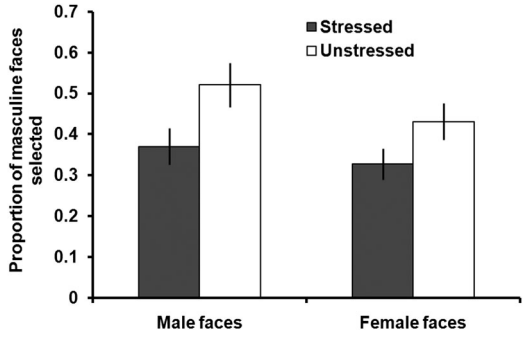

Figure 2.. *Mean proportion of masculinized faces chosen for friendship ±1* SEM *(.5 = chance). Means are shown separately for male versus female faces and stressed versus control group.*

One-sample *t*-tests were conducted to determine whether people preferred more masculinized or feminized faces for friendship (chance = .5) ignoring condition. For male faces, feminized faces were preferred ($M = .44$, $SD = .26$, 95% CI [.38, .50], where CI = confidence interval). This preference was not significantly different from chance, although the test was close to the threshold for significance, $t(67) = -1.92$, $p = .059$, $d = 0.47$. For female faces, feminized faces were preferred ($M = .35$, $SD = .21$, 95% CI[.30, .40]). This preference was significantly different from chance, $t(67) = -5.80$, $p < .001$, $d = 1.42$.

A Pearson product–moment correlation revealed a significant positive relationship between selection of male and female masculinized faces for friendship ($r = .499$, $p < .001$).

Selection for attractiveness

A 2 (sex of face: male, female) × 2 (group: stressed, control) × 2 (sex of participant: male, female) mixed-model ANOVA with selection of masculinized image as the dependent variable was carried out to investigate the effect of stress condition on masculine attractiveness preference.

The main effect of group was not significant, $F(1, 64) = 0.01$, $p = .995$, $\eta_p^2 < .001$. There was a significant main effect of sex of face, $F(1, 64) = 15.31$, $p < .001$, $\eta_p^2 = .193$, but no significant interaction between sex of face and group, $F(1, 64) = 0.02$, $p = .894$, $\eta_p^2 < .001$. The main effect of sex of participant was not significant, $F(1, 64) = 0.21$, $p = .653$, $\eta_p^2 = .003$, and there was no significant interaction between sex of participant and group, $F(1, 64) = 0.02$, $p = .879$, $\eta_p^2 < .001$. There was a significant interaction between sex of participant and sex of face, $F(1, 64) = 10.04$, $p = .002$, $\eta_p^2 = .136$. Finally, there was no significant three-way interaction between sex of face, sex of participant, and group, $F(1, 64) = 1.04$, $p = .312$, $\eta_p^2 = .016$. From Figure 3, it can be seen that group had no impact on preferences for attractiveness and that the main effect of sex of face reflected that feminized female faces were selected more often than feminized male faces.

To parse the interaction between sex of participant and sex of face, independent-samples *t*-tests were used to examine differences between male and female participants. These revealed that men chose significantly more feminized male faces as attractive ($M = .44$, $SD = .22$, 95% CI[.33, .54]) than women did ($M = .59$, $SD = .29$, 95% CI[.51, .67]), $t(66) = -2.13$, $p = .037$, $d = 0.52$. No significant difference was found for selection of masculinized/feminized female faces, $t(66) = 1.50$, $p = .140$, $d = 0.37$.

One sample *t*-tests were conducted to determine whether people preferred more masculinized or feminized faces for attractiveness (chance = .5) ignoring condition. For male faces, masculinized faces were preferred ($M = .54$, $SD = .28$, 95% CI [.48, .61]). This preference was not significantly

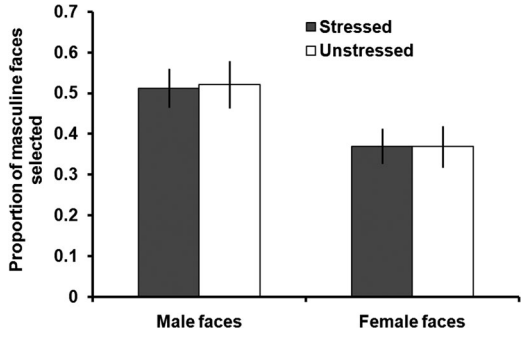

Figure 3.. *Mean proportion of masculinized faces chosen for attractiveness ±1* SEM *(.5 = chance). Means are shown separately for male versus female faces and stressed versus control group.*

different from chance, $t(67) = 1.28$, $p = .206$, $d = 0.31$. For female faces, feminized faces were preferred ($M = .35$, $SD = .24$, 95% CI[.30, .42]). This preference was significantly different from chance, $t(67) = -5.03$, $p < .001$, $d = 1.23$.

A Pearson product–moment correlation revealed a significant positive relationship between selection of male and female masculinized faces for attractiveness ($r = .366$, $p = .002$). Additional correlations demonstrated that preferences for masculinized males for friendship and attractiveness were significantly positively related ($r = .489$, $p < .001$) and that preferences for masculinized females for friendship and attractiveness were significantly positively related ($r = .488$, $p < .001$).

Discussion

The results of our experiment demonstrated that, compared, stressed individuals had stronger preferences for friendships with people with feminized faces. While stress was induced in the laboratory, individuals undertook a stressful task that has been shown to stimulate glucocorticoid secretion (Smeets et al., 2012), indicating that our results should be applicable outside of the laboratory to other sources of stress. Our between-participant design minimized potential demand characteristics in asking participants to judge images twice. This design, however, is less powerful than a within-participant design documenting change in preferences according to condition, and future studies may usefully employ this more powerful design. This finding is novel in demonstrating that stress not only changes behaviour towards others, such as changing affiliative and cooperative behaviours (von Dawans et al., 2012), but also can affect who we may choose to associate with as friends.

Our data highlight the potential role of visual appearance in friendship selection. While there is much prior research on mate preferences, how visual appearance may influence friendship formation has received little attention. Indeed, as in mate preferences, one of the first cues available to potential friends is visual appearance, and faces appear to contain some valid cues to personality traits (e.g., Bond et al., 1994; Carre & McCormick, 2008; Little, Jones et al., 2013; Little & Perrett, 2007).

Social support may act as a buffer against the negative aspects of stress (Cohen & Wills, 1985; DeVries et al., 2003; Kornienko et al., 2013). Consequently, during times of stress it is potentially adaptive to seek out social support. Because feminized faces are associated with "nice" personality attributions such as higher emotionality, honesty, cooperativeness, and quality as a parent than masculinized faces (Perrett et al., 1998), it may be further adaptive to preferentially want to associate with feminine faced individuals when stressed. Indeed, feminized faces are also seen as more likely to provide high-quality social support than masculinized faces (Watkins et al., 2012). In this way, stress may not only promote affiliation but promote affiliation with individuals most likely to offer social support. This logic can be reversed, and under times of stress the less pleasant personality traits associated with masculine appearance may be more aversive, and indeed it may be equivalently adaptive to avoid seeking friendship from masculine faced individuals when stressed.

We examined same-sex and opposite-sex friendship preferences but found no effect of sex of face on selection for friendship and no interactions with group. This pattern of data suggests that friendship selection based on facial appearance is similar when selecting both same-sex and opposite-sex friends. Further, we found no effects of sex of participant for selection for friendship and no interactions with group. We note, however, that our sample of men in this experiment was small, which limits our power to detect effects of sex. Averaging preferences across male and female faces, the mean friendship preferences of men and women were similar (men's preference = .41, women's preference = .39) and not significantly different from each other, $t(66) = 0.26$, $p = .794$, $d = 0.06$. The low effect size of the difference is suggestive that friendship selection based on facial appearance is similar for both men and women but the absence of sex effects here must be treated cautiously because of the small sample size. Future work can usefully address the effect of sex

and stress on friendship preferences with larger sample sizes.

When examining selection of attractive faces we found no difference between the stressed and control group. This suggests that the effects of stress were specific to friendship selection and did not generalize to impact on general attractiveness judgements. While friendship bonds share similarities with the bonding processes observed in the choice of mating partners (Dunbar, 2009), stress may not have impacted on attractiveness ratings in the current study because participants focused more on physical traits associated with attraction than personality attribution. Potentially, when rating for friendship, perceived personality traits are weighted more highly than when rating for attractiveness. Despite the different results for the effect of stress, preferences for masculinized faces as friends were positively and significantly correlated with preferences for attractiveness, supporting the notion that, at the individual level, people do prefer traits in friends that they see as generally attractive (Dunbar, 2009).

Stress may impact on friendship preferences via hormonal release. As noted earlier, stress triggers the secretion of adrenaline and noradrenaline and glucocorticoids, such as cortisol (Ulrich-Lai & Herman, 2009). Glucocorticoids have been found to have various effects on social perception, such as administration of cortisol attenuating memory for fearful facial expressions (Putman, Hermans, & van Honk, 2007), and these hormones may contribute to the effects seen here. Oxytocin has also been linked to affiliation in response to stress (Taylor, 2006), and changing levels of oxytocin may also impact on visual preferences for friend's faces. We note that at the time they were judging the faces participants may not have been at the peak of the physiological reactions seen to laboratory stressors. For example, plasma cortisol peaks 10–20 min after cessation of the stressor (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999). However, physiological reactions to stress, such as cortisol increasing, begin when individuals are stressed, are present immediately after the stressor ends, and continue for some time afterwards (Kirschbaum et al., 1999). This pattern of reaction means that our stressed participants would have been influenced by the physiological stress response during face judgements. We also note that previous authors have found that cycle phase impacts on women's physiological reaction to stress (Kirschbaum et al., 1999). While we do not have data available on this variable, previous studies suggest that while reactions may be larger for women in the fertile follicular phase, women experience an increase in cortisol in response to stressors at all stages of the cycle (Kirschbaum et al., 1999). We would then expect our results to apply across all stages of the cycle although cycle stage may have moderated the strength of the effects. The direct link between hormonal response, cycle phase, and preferences for feminine faced friends are fruitful avenues for future research.

In conclusion, the current experiment demonstrated that an experimental stressor led to higher preferences for feminine faced individuals as friends than in a nonstressed control group. This preference may prove adaptive in directing individuals towards others who are most likely to provide social support when it is needed. In this way, our experiment demonstrates potentially strategic friendship preferences. Our data also highlight the important role that facial appearance may play in affiliative behaviour and the initial selection of friends.

ORCID

Anthony C. Little http://orcid.org/0000-0001-9100-1903

REFERENCES

Amichai-Hamburger, Y., Kingsbury, M., & Schneider, B. H. (2013). Friendship: An old concept with a new meaning? *Computers in Human Behavior*, *29*(1), 33–39. doi:10.1016/j.chb.2012.05.025

Bartels, A., & Zeki, S. (2000). The neural basis of romantic love. *Neuroreport*, *11*(17), 3829–3834. doi:10.1097/00001756-200011270-00046

Benson, P. J., & Perrett, D. I. (1993). Extracting prototypical facial images from exemplars. *Perception*, *22*, 257–262. doi:10.1068/p220257

Berry, D. S., & Brownlow, S. (1989). Were the physiognomists right? Personality correlates of facial babyishness. *Personality and Social Psychology Bulletin*, *15*, 266–279. doi:10.1177/0146167289152013

Bond, C. F., Berry, D. S., & Omar, A. (1994). The kernal of truth in judgements of deceptiveness. *Basic and Applied Social Psychology*, *15*, 523–534. doi:10.1207/s15324834basp1504_8

Carre, J. M., & McCormick, C. M. (2008). In your face: facial metrics predict aggressive behaviour in the laboratory and in varsity and professional hockey players. *Proceedings of the Royal Society B-Biological Sciences*, *275*(1651), 2651–2656.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98* (2), 310–357. doi:10.1037/0033-2909.98.2.310

DeVries, A. C., Glasper, E. R., & Detillion, C. E. (2003). Social modulation of stress responses. *Physiology & Behavior*, *79*(3), 399–407. doi:10.1016/S0031-9384(03)00152-5

Dunbar, R. I. M. (2009). The social brain hypothesis and its implications for social evolution. *Annals of Human Biology*, *36*(5), 562–572. doi:10.1080/03014460902960289

Eisenberger, N. I. (2012). The pain of social disconnection: Examining the shared neural underpinnings of physical and social pain. *Nature Reviews Neuroscience*, *13*(6), 421–434. doi:10.1038/nrn3231

Feingold, A. (1988). Matching for attractiveness in romantic partners and same-sex friends: a meta-analysis and theoretical critique. *Psychological Bulletin*, *104*(2), 226–235. doi:10.1037/0033-2909.104.2.226

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, *7*(7). doi:e100031610.1371/journal.pmed.1000316

Kirschbaum, C., Kudielka, B. M., Gaab, J., Schommer, N. C., & Hellhammer, D. H. (1999). Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis. *Psychosomatic Medicine*, *61*(2), 154–162. doi:10.1097/00006842-199903000-00006

Kornienko, O., Clemans, K. H., Out, D., & Granger, D. A. (2013). Friendship network position and salivary cortisol levels. *Social Neuroscience*, *8*(4), 385–396. doi:10.1080/17470919.2013.795500

Little, A. C., DeBruine, L. M., & Jones, B. C. (2013). Environment contingent preferences: Exposure to visual cues of direct male-male competition and wealth increase women's preferences for masculinity in male faces. *Evolution and Human Behavior*, *34*(3), 193–200. doi:10.1016/j.evolhumbehav.2012.11.008

Little, A. C., & Hancock, P. J. B. (2002). The role of masculinity and distinctiveness in judgments of human male facial attractiveness. *British Journal of Psychology*, *93*, 451–464. doi:10.1348/000712602761381349

Little, A. C., Jones, B. C., & DeBruine, L. M. (2011). Facial attractiveness: Evolutionary based research. *Philosophical Transactions of the Royal Society B-Biological Sciences*, *366*(1571), 1638–1659. doi:10.1098/rstb.2010.0404

Little, A. C., Jones, B. C., DeBruine, L. M., & Dunbar, R. I. M. (2013). Accuracy in discrimination of self-reported cooperators using static facial information. *Personality and Individual Differences*, *54*(4), 507–512. doi:10.1016/j.paid.2012.10.018

Little, A. C., & Perrett, D. I. (2007). Using composite images to assess accuracy in personality attribution to faces. *British Journal of Psychology*, *98*, 111–126. doi:10.1348/000712606X109648

Martire, L. M., & Franks, M. M. (2014). The role of social networks in adult health: Introduction to the special issue. *Health Psychology*, *33*(6), 501–504. doi:10.1037/hea0000103

Perrett, D. I., Lee, K. J., Penton-Voak, I. S., Rowland, D. R., Yoshikawa, S., Burt, D. M., . . . Akamatsu, S. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature*, *394*, 884–887. doi:10.1038/29772

Putman, P., Hermans, E. J., & van Honk, J. (2007). Exogenous cortisol shifts a motivated bias from fear to anger in spatial working memory for facial expressions. *Psychoneuroendocrinology*, *32*(1), 14–21. doi:10.1016/j.psyneuen.2006.09.010

Roberts, S. G. B., & 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*(3), 186–197. doi:10.1016/j.evolhumbehav.2010.08.005

Rushton, J. P. (2009). Inclusive fitness in human relationships. *Biological Journal of the Linnean Society*, *96*(1), 8–12. doi:10.1111/j.1095-8312.2008.01110.x

Seyfarth, R. M., & Cheney, D. L. (2012). The evolutionary origins of friendship. In S. T. Fiske, D. L.

Schacter, & S. E. Taylor (Eds.), *Annual review of psychology*, *63*, 153–177. doi:10.1146/annurev-psych-120710-100337

Smeets, T., Cornelisse, S., Quaedflieg, C. W. E. M., Meyer, T., Jelicic, M., & Merckelbach, H. (2012). Introducing the Maastricht acute stress test (MAST): A quick and non-invasive approach to elicit robust autonomic and glucocorticoid stress responses. *Psychoneuroendocrinology*, *37*(12), 1998–2008. doi:10.1016/j.psyneuen.2012.04.012

Taylor, S. E. (2006). Tend and befriend: Biobehavioral bases of affiliation under stress. *Current Directions in Psychological Science*, *15*(6), 273–277. doi:10.1111/j.1467-8721.2006.00451.x

Taylor, S. E., Klein, L. C., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., & Updegraff, J. A. (2000). Biobehavioral responses to stress in females: Tend-and-befriend, not fight-or-flight. *Psychological Review*, *107*(3), 411–429. doi:10.1037/0033-295X.107.3.411

Tiddeman, B. P., Burt, D. M., & Perrett, D. I. (2001). Prototyping and transforming facial texture for perception research. *IEEE Computer Graphics and Applications*, *21*, 42–50. doi:10.1109/38.946630

Ulrich-Lai, Y. M., & Herman, J. P. (2009). Neural regulation of endocrine and autonomic stress responses. *Nature Reviews Neuroscience*, *10*(6), 397–409. doi:10.1038/nrn2647

van der Horst, M., & Coffe, H. (2012). How friendship network characteristics influence subjective well-Being. *Social Indicators Research*, *107*(3), 509–529. doi:10.1007/s11205-011-9861-2

von Dawans, B., Fischbacher, U., Kirschbaum, C., Fehr, E., & Heinrichs, M. (2012). The social dimension of stress reactivity: Acute stress increases prosocial behavior in humans. *Psychological Science*, *23*(6), 651–660. doi:10.1177/0956797611431576

Watkins, C. D., DeBruine, L. M., Little, A. C., & Jones, B. C. (2012). Social support influences preferences for feminine facial cues in potential social partners. *Experimental Psychology*, *59*(6), 340–347. doi:10.1027/1618-3169/a000162

Wechsler, D. (2008). *Wechsler adult intelligence scale*, fourth edition. San Antonio, TX: Pearson.