Original Article

# Extraverts Have Larger Social Network Layers

## But Do Not Feel Emotionally Closer to Individuals at Any Layer

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**Abstract.** Previous studies showed that extraversion influences social network size. However, it is unclear how extraversion affects the size of different layers of the network, and how extraversion relates to the emotional intensity of social relationships. We examined the relationships between extraversion, network size, and emotional closeness for 117 individuals. The results demonstrated that extraverts had larger networks at every layer (support clique, sympathy group, outer layer). The results were robust and were not attributable to potential confounds such as sex, though they were modest in size (raw correlations between extraversion and size of network layer, $.20 < r < .23$). However, extraverts were not emotionally closer to individuals in their network, even after controlling for network size. These results highlight the importance of considering not just social network size in relation to personality, but also the quality of relationships with network members.

**Keywords:** individual differences, extraversion, social brain hypothesis, social networks, emotional closeness

## Introduction

Personal network analysis starts with a focal individual and examines that individual's set of ties to other people (Wellman, 2007). There is a large variation in the size and composition of individual's personal networks (Bernard et al., 1990), some of which is related to characteristics of the focal individual such as sex, socioeconomic status, relationship status, and age (e.g., Lang & Cartensen, 2002; McPherson, Smith-Lovin, & Brashears, 2006; Milardo, Johnson, & Huston, 1983). Another important individual characteristic that may be expected to influence network size and composition is personality. Psychological personality theory assumes that people's behavior can be explained to some extent in terms of underlying personality traits, which are seen as enduring dispositions that are relatively stable over time (Costa & McCrae, 1992).

Extraversion is one of the Big Five personality traits (Costa & McCrae, 1992), and extraverts tend to be more outgoing, gregarious, energetic, cheerful, and sociable than introverts (Kalish & Robbins, 2006). Extraverts also have better social skills than introverts (Lieberman & Rosenthal, 2001), and they enjoy and participate more in social activities (Argyle & Lu, 1990). One of the core components of extraversion is argued to be "a tendency to behave in ways that attract or hold social attention and also to enjoy these behaviors" (Ashton, Lee, & Paunonen, 2002, p. 246). Because of the nature of trait, it may be expected that differences in extraversion explain some of the variation in social network size.

Several studies of university students demonstrated a positive correlation between extraversion and network size both cross-sectionally (e.g., Bolger & Eckenrode, 1991; Swickert, Rosentreter, Hittner & Mushrush, 2002) and longitudinally (Asendorpf & Wilpers, 1998). Other studies involving complete social networks, rather than personal networks, examined the link between extraversion and specific network characteristics such as structural holes (Burt, Jannotta, & Mahoney, 1998; Kalish & Robbins, 2006) or centrality (Klein, Lim, Saltz, & Mayer, 2004). However, extraversion tends to decline with age (McCrae et al., 1999), and after controlling for age there appears to be no effect of extraversion on the size of an individual's social network (Roberts, Wilson, Fedurek, & Dunbar, 2008).

Further, it is currently unclear whether extraverts simply have larger networks or actually have networks of higher




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quality. Asendorpf and Wilpers (1998) found that extraverts had higher levels of support from members of their network. In a 4-week longitudinal study using a student sample, Berry, Willingham, and Thayer (2000) found that extraversion predicted emotional closeness to friends. Similarly, a study by Long and Martin (2000) showed that extraversion was negatively related to loneliness in a sample of elderly. Swickert et al. (2002), however, found that extraverts did not report higher levels of satisfaction with their network, and Ashton, Jackson, Helmes, and Paunonen (1998) showed that extraversion was not strongly related to interpersonal affect or succorance, both of which involve the emotional intensity of relationships. Thus, based on the current literature, it is unclear whether extraversion is reliably associated with either having larger networks or having networks of higher quality.

The current study extends previous research on extraversion and social networks in three key ways. First, we include a broader age range than the typical student sample. Given that extraversion tends to decline with age (McCrae et al., 1999), it is important to include a wide range of ages when assessing the effects of extraversion on network size and to control for the possible effects of age on personality and network size (Roberts et al., 2008).

Second, social networks are not an undifferentiated set of individuals, but consist of a series of subgroups arranged in a hierarchically inclusive sequence. The successive grouping layers increase in size but decrease in the intensity of their typical relationship (Dunbar, 1998, 2008). The innermost layer is the "support group," which can be defined as individuals from whom one would seek support in times of crisis; it has a mean size of around five (Dunbar & Spoors, 1995). The next layer out is the "sympathy group," which can be defined as those whose sudden death would be greatly upsetting; it has a mean size of around 15, including the members of the support group (Buys & Larson, 1979; Stiller & Dunbar, 2007). All studies of extraversion and network size thus far have focused on these inner layers of the network. However, the broader social network also contains individuals who are less emotionally close and are contacted less often (Bernard et al., 1990; Hill & Dunbar, 2003; Roberts, Dunbar, Pollet, & Kuppens, 2009). These "weak ties" in the outer layer of the network are important sources of information and advice (Granovetter, 1983). It is currently unclear at what layer of the network extraversion has the greatest effect – in the support group, the sympathy group, and/or the outer layer of the network.

Third, in addition to network size, the quality of relationships in the network is a crucial issue. Here, we examine whether the peculiar socializing style of extraverts allows them to feel emotionally closer to individuals in their network. Thus, if extraverts have superior social skills over introverts (Lieberman & Rosenthal, 2001), participate in more social activities (Argyle & Lu, 1990), and attract and enjoy social attention (Ashton et al., 2002), this may translate into emotionally closer relationships with network members – as well as (or instead of) an increase in overall network size. For example, there is a close link between the frequency of communication between two individuals and the emotional intensity of their relationship (Hill & Dunbar, 2003; Mok, Wellman, & Basu, 2007; Roberts & Dunbar, 2010). Thus, if extraverts have a tendency to contact people in their network more frequently, they may be emotionally closer to these people. Some studies indeed showed that extraversion is negatively correlated with reported loneliness and positively with emotional closeness (e.g., Neyer & Asendorpf, 2001; Stokes, 1985). However, a study by Levin and Stokes (1986) indicated a substantial reduction in the effect of extraversion on loneliness after controlling for social network size, suggesting that extraversion is relatively less important for the quality of relationships than the quantity of relationships.

In examining the relationship between the emotional closeness of the network and extraversion, we controlled for the effects of network size, as a recent study showed that individuals with larger social networks tend to be less emotionally close to the people in their network, compared to individuals with smaller networks (Roberts et al., 2009). Thus, if extraverts have larger social networks, there are two possibilities with regard to the emotional closeness of their ties with network members. First, they may have larger social networks *and* still be emotionally closer to network members (in which case controlling for network size would have no effect); or they may be emotionally closer to network members, given their larger network size, in which case controlling for network size would have an effect.

Given the link between extraversion and social skills, we predict that extraversion is positively correlated with the size of the social network *at all three layers of the network* – the support group, the sympathy group, and the outer layer. This effect of extraversion should be limited to friends at the outer layer, as the size of an individuals family is not under their control, whereas the number of friends they have is. Further, we predict that extraverts will report emotionally closer relationships at each of these three layers, after controlling for network size.

# Methods

## Participants

117 Dutch participants were recruited. The sample consisted of 73 women and 44 men, with a mean age of 28 years (*SD* = 12 years; range 18 to 63 years). The large majority of the respondents did not have a university degree (86%). The majority of the respondents (59%) did not have a committed partner (married or living together or in a committed but living-apart-together relationship) at the time of the survey.

 

## Procedure

Because of the length of the questionnaire (which typically takes between 1 and 2 h to complete), participants were recruited via the personal student networks. Eight students (4 male/4 female) enrolled in a compulsory practical course at a large European university completed a questionnaire and were instructed to hand out 19 further surveys to friends, colleagues and family. The students received course credits in return for completing this task. 117 completed questionnaires were returned within a month (73% return rate). This procedure and content of this study was approved by Psychology Ethics Committee at the University where the study was conducted.

## Questionnaire

Participants first provided some basic sociodemographic data, including age, sex, educational attainment, and partnership status (in a committed relationship or not). Participants then listed all their living relatives (kin, step, and adopted) as well as their friends and acquaintances. Participants were asked how emotionally close they felt to each network member on a 1 to 10 scale (1 = *not close at all*; 10 = *very close*) and when they had last had face-to-face contact with each network member[1]. The participants were also asked to look through their mobile telephone, e-mail lists, and address books and to include everyone they personally know and would like to continue to have a personal relationship with during the next year. This method of generating a social network has been successfully used before (Roberts et al., 2009). Subsequently, they completed an Introversion-Extraversion Measure (from De Raad & Barelds, 2008) consisting of 20 items scored on a 5-point Likert scale (*strongly disagree* to *strongly agree*). This questionnaire is currently being validated (Barelds, personal communication). Sample questions were "I am talkative" and "I like to share a lot with others." Extraversion had a very good reliability (Cronbach's $\alpha = 0.91$), and none of these questions referred to the number of friends participants had.

We defined the support group as those individuals with whom the participant had had contact within the last week *and* who scored an 8 or higher on the emotional support measure. A cutoff score of 8 or higher on emotional closeness was necessary to ensure that no casual contacts that the participant happened to have seen that week had been included in the support group. The sympathy group was defined as the individuals with whom the participant had had contact within the last month. Contact within the last week and month have been shown to correspond to the support group and sympathy group respectively (Dunbar & Spoors, 1995; Hill & Dunbar, 2003; Roberts et al., 2008).

Conceptually, the layers of the social network are hierarchically inclusive (Zhou, Sornette, Hill, & Dunbar, 2005). However, in this study, each layer was analyzed separately so as to include only the "extra" individuals in that layer in each set of analyses (Roberts et al., 2008). Thus, for the sympathy group analysis, the members of the support group were not included, as otherwise these network members would be included two sets of analyses – one for the support group and again as part of the sympathy group. Similarly, the outer layer of the network was calculated by subtracting the support group and sympathy group size from the total social network size. For each of the layers (support group, sympathy group, outer layer), we calculated the average emotional closeness to individuals in that layer.

## Statistics

After presenting descriptive statistics and bivariate correlations, we introduce the results of ordinary least squares regressions for the three network layers (outer layer, sympathy group, support group). In the questionnaire, we explicitly instructed respondents to list all of their living relatives. Thus the total number of relatives of an individual would not be expected to be associated with personality, whereas the number of friends in the outer layer may be expected to be associated with extraversion. We therefore present separate results for friends and family for the outer layer. The inner layers, however, are based on emotional closeness and/or contact frequency, so that the total size of the inner layers (including both friends and family) may be expected to be associated with extraversion. As control variables, we used partnership status (0 = *no committed partner*; 1 = *currently with committed partner*), university degree (0 = *no*; 1 = *yes*), age and sex (0 = *male*; 1 = *female*). These variables were previously identified as important predictors for social network size and mean emotional closeness (McPherson et al., 2006; Roberts et al., 2009).

We used a stepwise procedure. In the first step we included the key variable of interest – extraversion. If a significant effect of extraversion was found, we subsequently tested whether the model could be further improved by including control variables using backward stepwise. The forward stepwise procedure leads to identical results as those presented with the exception that predictors with $p > .05$ would now be excluded. This combination approach is good practice for stepwise model selection (e.g., Tabachnick & Fidell, 2001). The backward stepwise procedure allowed us to examine whether the effect of extraversion remained after controlling for as many potential confounds

[1] Given that participants may have difficulty providing an accurate estimate of their general frequency of communication with each network member, time to last contact was used to provide a convenient proxy for this frequency. This method of estimating contact frequency has been successfully used in previous studies (Roberts et al., 2008; Roberts & Dunbar, 2010).

as possible. This method is actually more conservative than hierarchical linear regression, as it continues to add predictors whereas hierarchical regression does not. We followed the same procedure to examine whether extraversion predicted average emotional closeness at every layer.

Subsequently, we used the nonlinear regression module (CNLR) in SPSS 15.0 to bootstrap the standardized regression estimates from the backward stepwise models (Mooney & Duval, 1993). As starting values we used the βs from the regression analyses and generated standardized estimates for all the variables of interest. The goal of these analyses was to test the robustness of the regression parameter estimates. If the 95% confidence interval of the estimate does not include zero, then in all likelihood the population parameter estimate is not significantly different from the reported parameter estimate when drawing *N* samples. The number of samples is fixed by SPSS 15.0 (10 for univariate analyses: 30 for two variables and 60 for three variables. We report the trimmed confidence interval, i.e., excluding outliers, for bootstrapped parameter estimates.

Because stepwise methods have been criticized on various points (for a review see, e.g., Thompson, 1989), we also built models following an information-theory approach (by use of the Akaike information criterion; see Johnson & Omland, 2004). We first fitted a model containing only extraversion, and if a significant effect of extraversion was found, we then proceeded sequentially by adding control variables until the AIC could no longer be lowered (we also examined the Bayesian information criterion BIC; Kuha, 2004) by use of the GENLIN procedure in SPSS 15.0. If the effect of extraversion was not significant, we sequentially added control variables – greatest reduction in AIC first – until AIC could no longer be lowered. For these models we report only the final model and the effect of extraversion in that model.

Sensitivity power analysis by use of G-power showed that, in a (univariate) regression analysis, our sample allows detecting even modest effects ($r = .25$; Power = 0.80; $\alpha = .05$; two-tailed) (Faul, Erdfelder, Lang, & Buchner, 2007).

# Results

## Descriptive Statistics and Bivariate Correlations

The average overall network size was 53 (*SD* = 25), albeit with a substantial range (from 9 to 147). Three outliers, whose overall network size was two standard deviations above the mean, were excluded from further analyses. The support group consisted of 7 individuals on average (*SD* = 4; range 0 to 25). The sympathy group consisted of 11 individuals on average (*SD* = 8; range 0 to 42). Both the support group size and the sympathy group size fall within the range of previous reported figures of 0 to 14 and 6 to 20, respectively (Dunbar & Spoors, 1995; Hill & Dunbar, 2003).

Table 1 shows the bivariate correlations for the sample and all variables.

## Extraversion and Network Size: Do Extraverts Have Larger Networks?

At the outer layer, extraversion predicted number of friends but not number of relatives (Table 2). Extraverts also had significantly larger support groups and sympathy groups, and this remained the case after controlling for potential confounds. Individuals who had a partner reported a smaller outer friend's layer than those who did not have a partner. Women had larger outer layers and sympathy groups than men. Older respondents tended to have smaller support groups then younger respondents.

The models in Table 2 could not be further improved by including other variables (all $p > .15$).

The bootstrapping procedure showed that the estimates of extraversion were robust for the support group size, sympathy group size, and outer layer (friends only). Thus, it is likely that, if one were to draw 10, 30, or 60 similar samples, one would find a positive effect of extraversion on network size at any layer. For the control variables, having a partner was robustly associated with a decreased number of friends in the outer layer, and age was robustly associated with a smaller support group. The bootstrapping analysis revealed that the effects of gender were not robust either for the outer layer (friends only) or for the sympathy group.

Using an information-theory approach to build models revealed the same models as those of Table 2. In all cases the effect of extraversion documented in Table 2 was supported (*Support group*: $\beta = .216$; $p = .018$; *Sympathy group*: $\beta = .184$; $p = .043$; *Outer friend layer*: $\beta = .195$; $p = .025$). In all cases the second-best fitting model also contained a significant effect for extraversion (all $p < .05$).

## Extraversion and Emotional Closeness: Do Extraverts Report Closer Relationships?

Extraversion did not predict average emotional closeness in any of the three network layers (Table 3). Controlling for size of each layer – or other predictors of average emotional closeness – did not alter these findings. Subsequently, we tested whether the control variables predicted emotional closeness at different layers. These models could not be improved by including other variables ($p > .14$).

Average emotional closeness of the outer layer was a function of outer layer size for friends and family (Table 3). Thus, respondents with a larger outer layer tended to be less close on average to those individuals in their outer layer. This was not the case for the inner layers (*Sympathy*

 

*Table 1.* Bivariate correlations between all variables in the sample

| Variable | Female | Partnered | University | Extraversion | Support group size | Sympathy group size | Outer layer size (friends) | Outer layer size (family) | Support group mean EC | Sympathy group mean EC | Outer layer (friends) mean EC | Outer layer (family) mean EC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age | .049 | *.324*** | .001 | .014 | –.143 | –.016 | –.001 | .040 | *.224** | –.054 | *.279*** | .036 |
| Female | – | .012 | .095 | *.197** | .042 | *.202** | *.190** | .172 | .094 | .177 | .038 | –.046 |
| Partnered | | – | –.094 | .008 | –.018 | .098 | –*.214** | –.081 | *.288*** | –.077 | .027 | –.096 |
| University | | | – | .114 | –.107 | .098 | .111 | –.014 | –.007 | –.147 | –.176 | –.095 |
| Extraversion | | | | – | *.218** | *.221** | *.203** | –.072 | .156 | .080 | –.014 | –.033 |
| Support group size | | | | | – | .008 | .013 | .012 | .003 | *.263*** | .062 | *.189** |
| Sympathy group size | | | | | | – | *.503*** | .084 | .095 | .114 | –*.291*** | –.161 |
| Outer layer size (Friends) | | | | | | | – | *.330*** | –.105 | .044 | –*.319*** | –.054 |
| Outer layer size (family) | | | | | | | | – | –.047 | .063 | –.080 | –*.205** |
| Support group mean EC | | | | | | | | | – | –.029 | –.079 | –.041 |
| Sympathy group mean EC | | | | | | | | | | – | *.333*** | *.283*** |
| Outer layer (friends) mean EC | | | | | | | | | | | – | *.355*** |
| Outer layer (family) mean EC | | | | | | | | | | | | – |

*Notes.* EC = emotional closeness. Significant correlations are in italic. *$p < .05$, **$p < .01$.

*Table 2.* Parameter estimates and concomitant test characteristics from ordinary least squares regression models for social network sizes at three layers of the network

| Network layer | Model | Variable | β | *t* | *p* | β (bootstrap) | Lower | Upper | *n*(bootstrap) |
|---|---|---|---|---|---|---|---|---|---|
| Outer layer size *(family only)* | Model 1 ($R^2 < 0.001$) | Extraversion | –0.05 | 1.79 | .58 | | | | |
| Outer layer size | Model 1 ($R^2 = 0.04$) | Extraversion | *0.220* | 2.46 | .02 | *0.218* | 0.063 | 0.404 | 10 |
| *(friends only)* | Model 2 ($R^2 = 0.13$) | Extraversion | *0.197* | 2.21 | .029 | *0.194* | 0.055 | 0.351 | 60 |
| | | Partnered | *–0.275* | –3.15 | .002 | *–0.270* | –0.04 | –0.426 | 60 |
| | | Gender | *0.159* | 1.78 | .077 | *0.156* | –0.011 | 0.331 | 60 |
| Sympathy group size | Model 1 ($R^2 = 0.04$) | Extraversion | *0.221* | 2.4 | .018 | *0.217* | 0.058 | 0.426 | 10 |
| | Model 2 ($R^2 = 0.06$) | Extraversion | *0.187* | 2.01 | .048 | *0.203* | 0.002 | 0.419 | 30 |
| | | Gender | *0.170* | 1.82 | .072 | *0.114* | –0.166 | 0.321 | 30 |
| Support group size | Model 1 ($R^2 = 0.04$) | Extraversion | *0.218* | 2.36 | .02 | *0.220* | 0.06 | 0.313 | 10 |
| | Model 2 ($R^2 = 0.07$) | Extraversion | *0.213* | 2.04 | .021 | *0.215* | 0.046 | 0.387 | 30 |
| | | Age | *–0.185* | –2.34 | .044 | *–0.190* | –0.363 | –0.056 | 30 |

*Notes.* Betas were subsequently bootstrapped for either 10, 30, or 60 samples (β(bootstrap)). Lower and upper represent the 95% CI for the bootstrapped estimates.

*Table 3*. Parameter estimates and concomitant test characteristics from ordinary least squares regression models for average emotional closeness at every layer

| Network layer | Model | Variable | β | *t* | *p* | β(bootstrap) | Lower | Upper | *n*(bootstrap) |
|---|---|---|---|---|---|---|---|---|---|
| Outer layer | Model 1 | Extraversion | –0.055 | –0.58 | .564 | | | | |
| *(family only)* | Model 2 ($R^2$ = 0.03) | Size | *–0.205* | –2.20 | .029 | *–0.188* | –0.300 | –0.119 | 10 |
| Outer layer | Model 1 | Extraversion | –0.033 | –0.35 | .564 | | | | |
| *(friends only)* | Model 2 ($R^2$ = 0.12) | Size | *–0.184* | –1.98 | .050 | *–0.204* | –0.408 | 0.004 | 60 |
| | | Age | *0.294* | 3.21 | .002 | *0.296* | 0.134 | 0.518 | 60 |
| | | University | *–0.180* | –1.96 | .058 | *–0.165* | –0.309 | –0.031 | 60 |
| Sympathy Group | Model 1 | Extraversion | 0.08 | 0.85 | .397 | | | | |
| | Model 2 ($R^2$ = 0.03) | Gender | *0.198* | 2.06 | .042 | *0.180* | 0.048 | 0.309 | 10 |
| Support group | Model 1 | Extraversion | 0.026 | 0.22 | .828 | | | | |
| | Model 2 ($R^2$ = 0.10) | Partnered | *0.324* | 3.64 | <0.001 | *0.311* | 0.177 | 0.402 | 10 |

*Notes.* Betas were subsequently bootstrapped for 10 or 60 samples (β(bootstrap)). Lower and upper represent the 95% CI for the bootstrapped estimates.

*group*: β = 0.108; $p$ = .24; *Support group*: β = –0.025; $p$ = .79).

Age and having a university degree predicted emotional closeness at the outer layers of friends: Older individuals reported feeling closer than younger individuals, and those with a university degree reported less closeness than those without. Gender influenced the average emotional closeness to members of the sympathy group: Women felt closer to network members than did men. Individuals with a partner had higher emotional closeness to those in their support group.

The bootstrapping procedure revealed that the effect of size on closeness to individuals in the outer layer was robust for family members. The results were not robust for friends in the outer layer, although the majority of estimates for the effect of network size on emotional closeness were negative. For the control variables, the results for age, university attendance, partnership status, and sex were robust.

Using an information-theory approach to build models showed that the same models as those reported in Table 3, with the exception of the model for emotional closeness with friends. The procedure would add a nonsignificant effect of partnered to the model (β = –.158; *SE* = .093; $p$ = .09), the effects of the other variables remain the same strength as reported in Table 3. The difference in AIC between this four predictor model and the three predictor model reported in Table 3 is less than one, making the two models indistinguishable in terms of statistical support (see Kuha, 2004). Use of the BIC would lead to selection of the three-predictor model over the four-predictor model. Using an information-theory approach, there was no evidence for an effect of extraversion on emotional closeness in any model at any layer (all $p$ > .14).

## Discussion

This study has two key findings. First, as hypothesized, extraverts had larger social networks at all three layers of the network – the support group, the sympathy group, and the outer layer of the network. Thus, the tendency for extraverts to have larger networks was not limited to a small number of close relationships, but also applied to the larger number of weak ties at the outer layer of the network. The effects of extraversion on social network size were small, however. Given the relatively small sample and the wide confidence intervals for the effect of extraversion, further research remains necessary to replicate this association between extraversion and the size of network layers. Second, contrary to our hypothesis, extraverts were not emotionally closer to the individuals in their network at any of the three layers. This was the case even after controlling for network size. These results demonstrate that, in examining the impact of extraversion on social networks, it is important to assess not only network size, but also the nature and quality of the relationships within the network.

Extraverts have superior social skills (Lieberman & Rosenthal, 2001) and a preference for social activities (Argyle & Lu, 1990) and social attention (Ashton et al., 2002). Overall, the evidence from this and other studies demonstrates that extraversion is also positively correlated with network size both for students (Bolger & Eckenrode, 1991; Swickert et al., 2002) and in the broader population (this study). Age was not correlated with extraversion in this study, which may account for the different results of this study and that of Roberts et al. (2008), who found that once age was controlled for, there was no correlation between extraversion and network size. Previous studies showed that extraversion also correlates positively with soliciting advice or help from others (e.g., Asendorpf & Wilpers, 1988; Swickert et al., 2002; Wanberg, Kanfer, & Banas, 2000). However, the results of this study suggest that extraversion is not necessarily associated with an increase in the emotional intensity of relationships with network members. Thus using a network more effectively may be different from having more emotionally intense relationships with others.

An alternative explanation for our findings is that extraversion distorted the social perception of individuals, as suggested by Casciaro and colleagues (Casciaro, 1998; Casciaro, Carley, & Krackhardt, 1999). However, a detailed diary study demonstrated that extraversion is linked to a higher overall interaction rate and high amounts of available support, replicating the results of a self-report questionnaire (Asendorpf & Wilpers, 1998). Similarly, when asked about specific instances of social activities, extraverts reported engaging in the activities more often as well as enjoying them more (Argyle & Lu, 1990). Further studies based on more objective measures of interaction, such as mobile phone records or e-mail exchanges (e.g., Lazer et al., 2009), would help to clarify the link between extraversion and objective interaction patterns.

It could also be argued that the proposed relationship between extraversion and network characteristics runs in the opposite direction, namely, that larger networks or higher quality relationships lead to extraversion rather than vice versa. However two different longitudinal studies demonstrated that individual differences in personality traits predict aspects of social relationships. In contrast, relationship qualities did not predict personality traits, and changes in relationship qualities were unrelated to changes in personality traits (Asendorpf & Wilpers, 1998; Neyer & Asendorpf, 2001). Given these findings, and the general stability of personality traits over time (Costa & McCrae, 1992), it seems likely that extraversion is the cause rather than the effect of network characteristics.

This study used snowball sampling to recruit respondents. This method has been successfully used in previous studies to gather data on social networks (Pollet, Kuppens & Dunbar, 2006; Pollet, Roberts & Dunbar, 2010; Roberts et al., 2009). One advantage is that it produces data from a broader range of ages and backgrounds than a typical student sample. While ideally a large sample taken from the population as a whole could be used, there is little reason to assume that the patterns shown in this study would be substantially different for the population as a whole. It is possible, however, that there is some, if not a substantial, overlap in the network data we analyzed. For future studies it would be desirable to have a larger number of focal individuals who preferably are not acquainted with one another. Further, emotional closeness was measured via a single-item measure rather than using a series of questions or a scale. However, a single-item measure of closeness has been used in a large number of previous studies (e.g., Hill & Dunbar, 2003; Jeon & Buss, 2007; Korchmaros & Kenny, 2001; Roberts et al., 2009) and meaningfully relates to behavior toward others (e.g., Pollet & Nettle, 2009). A potential limitation is that one of the network layers, the support group, is partially operationalized via emotional closeness. While such a method has been employed before (e.g., Pollet et al., 2010), in a future study it would be desirable to operationalize this inner layer in a different way (e.g., Kahn & Antonucci, 1980). Finally, in further studies it would be useful to distinguish between contact with people at work and voluntary contact, as the latter may be more useful in identifying the underlying social network (Eagle, Pentland, & Lazer, 2009).

There is considerable turnover of individuals within social networks over time (Feld, Suitor, & Hoegh, 2007), and there are at least two possible mechanisms by which extraverts come to have larger networks. First, extraverts' social relationships may be less prone to decay, so they lose individuals from their network less quickly; second, extraverts may be better at replacing network members as their relationships – and their life situation – change. Some longitudinal research suggests the latter mechanism may be the more important one. For example, extraverts are better at building up a new network after they have moved to another country (Furukawa, Sarason, & Sarason, 1998). Further research, preferably longitudinal, is necessary to establish more precisely how extraversion relates to both the quantity and the quality of social relationships in the network and to how these relationships change over time.

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