Czarna, A. Z., Leifeld, P., Śmieja, M., Dufner, M., and Salovey, P. (2016) Do narcissism and emotional intelligence win us friends? Modeling dynamics of peer popularity using inferential network analysis. Personality and Social Psychology Bulletin, 42(11), pp. 1588-1599.

There may be differences between this version and the published version. You are advised to consult the publisher's version if you wish to cite from it.

http://eprints.gla.ac.uk/121533/

Deposited on: 09 August 2016

Enlighten – Research publications by members of the University of Glasgow
http://eprints.gla.ac.uk

This is a postprint version of the accepted article: Czarna, Anna Z., Philip Leifeld, Magdalena Śmieja, Michael Dufner and Peter Salovey (2016): Do Narcissism and Emotional Intelligence Win Us Friends? Modeling Dynamics of Peer Popularity Using Inferential Network Analysis. *Personality and Social Psychology Bulletin* 42(11): 1588–1599. The final publication is available via Sage at http://dx.doi.org/10.1177/0146167216666265.

Do Narcissism and Emotional Intelligence Win Us Friends? Modeling Dynamics of Peer Popularity Using Inferential Network Analysis

Anna Z. Czarna Philip Leifeld, Magdalena Śmieja, Michael Dufner, and Peter Salovey

Abstract
This research investigated effects of narcissism and emotional intelligence (EI) on popularity in social networks. In a longitudinal field study we examined the dynamics of popularity in 15 peer groups in two waves (*N*=273).We measured narcissism, ability EI, explicit and implicit self-esteem. In addition, we measured popularity at zero acquaintance and three months later. We analyzed the data using inferential network analysis (temporal exponential random graph modeling, TERGM) accounting for self-organizing network forces. People high in narcissism were popular, but increased less in popularity over time than people lower in narcissism. In contrast, emotionally intelligent people increased more in popularity over time than less emotionally intelligent people. The effects held when we controlled for explicit and implicit self-esteem. These results suggest that narcissism is rather disadvantageous and that EI is rather advantageous for long-term popularity.

KEYWORDS: Emotional Intelligence, Narcissism, Popularity, Peers, Change over Time

Acknowledgements
We thank David Kenny and Carolyn C. Morf for inspiring comments of an earlier version of this manuscript. The present research was supported by a grant from the National Science Centre (DEC-2013/09/D/HS6/02982) in Poland and by funding from the Jagiellonian University within the SET project, co-financed by the European Union, to the first author, as well as by a grant from the Polish Ministry of Science and Higher Education (N N106 051139) to the third author. Corresponding author: Anna Z. Czarna, telephone number: +48533609033, email address: anna.czarna@vp.pl

Who is popular among one's peers, and who is unpopular? This question is of major theoretical and practical importance, given that social inclusion is a basic human need and a major predictor of an array of adjustment outcomes (Leary & Baumeister, 1995). Nevertheless, the dispositional antecedents of popularity are not fully understood yet. The investigation of the links between personality and popularity in naturally occurring groups is complicated by the fact that group phenomena, such as popularity, are not only influenced by exogenous factors (e.g., personality traits and skills of group members) but also by endogenous, or self-organizing factors, such as, for example, group members' tendencies to form mutual friendships or to dislike members who are disliked by a friend.

The goal of the current research was to solve this problem by using a sophisticated statistical procedure that is able to account for such self-organizing forces. We employed an inferential network-analytic method called temporal exponential random graph model (TERGM) to investigate the effects of narcissism and emotional intelligence (EI) on popularity. We tested whether the well documented finding from earlier research that narcissists have an initial, but no long-term advantage in popularity also emerges when self-organizing network forces are taken into account. Furthermore, we investigated the main effect of EI and its interactive effects with narcissism in predicting popularity.

Narcissism and Popularity

Grandiose narcissism is a personality trait characterized by excessively positive undeserved self-regard and a constant desire for external self-affirmation. Persons high in narcissism use other people instrumentally to construct and maintain their desired self-concepts. Several theories, such as the chocolate cake model of narcissism (Campbell, 2005) and the contextual reinforcement model of narcissism (Campbell & Campbell, 2009) predict that when interactions with narcissists are considered, excellent first impressions are followed by disappointment. In their effort to maintain a positive sense of self, people with high levels of narcissism often denigrate others, and as a result experience significant dislike from those around them at longer acquaintance. Their low communal focus and high antagonism (Czarna, Czerniak, & Szmajke, 2014; Czarna, Jonason, Dufner, & Kossowska, 2016; Lamkin, Clifton, Campbell, & Miller, 2014) might be discouraging to freshly won friends. Indeed narcissism predicts initial popularity (Back, Schmukle, & Egloff, 2010; Carlson, Vazire, & Oltmanns, 2011; Dufner et al., 2012; Dufner, Rauthmann, Czarna, & Denissen, 2013; Friedman, Oltmanns, Gleason, & Turkheimer, 2006, Wurst et al., in press), but studies showing longer-term costs of narcissism rather than short-term benefits have been rare, and both longitudinal studies (Leckelt, Küfner, Nestler, & Back, 2015; Paulhus, 1998) and investigations of wider interpersonal contexts are exceptions (Clifton, 2011; Czarna, Dufner, & Clifton, 2014; Küfner, Nestler, & Back, 2013). A limitation of most studies on the topic is that they used laboratory settings and artificially created groups of participants. Hence, generalizability is questionable, because ecological validity is low. A second limitation of past studies is that none of them has taken into account the self-organizing forces of social networks that determine popularity. A third limitation of many past studies is that they did not control for self-esteem, which is a major correlate of narcissism (Campbell, Sedikides, Gregg, Kumashiro, & Rudich, 2004). We addressed these limitations by studying changes in popularity within naturalistic groups using social network analysis and controlling for self-esteem. Furthermore, for the first time we investigated the role of socio-emotional skills in predicting popularity, especially when they were paired with high narcissism.

EI and Popularity

We have argued that narcissism is a motivational trait. Yet, motivation is often insufficient to attain desired outcomes. In most cases, it is necessary to possess the respective abilities as well. This point has been under-emphasized in past research. An ability that seems particularly important in the current context is EI.

People need to process emotional information to understand and manage the social world. Emotions serve communicative functions, conveying information about others' intentions and thoughts. For this reason, EI, defined as the ability to perceive, use, understand, and manage emotions (Mayer & Salovey, 1997), should be a positive predictor of adaptive social outcomes. Accumulating data support that notion. Emotionally intelligent people display higher social competence (Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006), greater empathy (Ciarrochi, Chan, & Caputi, 2000; Mayer, Caruso & Salovey, 1999) and develop more positive and harmonious personal relationships (Rivers, Brackett, Salovey, & Mayer, 2007), even when independently assessed by peers (Lopes, Brackett, Nezlek, Schütz, Sellin, & Salovey, 2004; Lopes, Salovey, Côté, & Beers, 2005). Particularly in men better emotion regulation results in fewer conflicts and less antagonism in social relationships (Brackett, Mayer, Warner, 2004; Lopes, Salovey, & Straus, 2003). Accordingly, EI should lead to positive interpersonal outcomes in group settings, such as, for example, an increased number of friends. It is likely that the advantage inherent in EI is not immediately observable at early stages of relationships, because opportunities to apply emotional skills, such as accurately recognizing other people's emotional states, giving effective support or managing one's own affect, might emerge only as the relationship develops. Therefore, it is possible that EI has beneficial effects over time rather than right at the beginning of a relationship. Few studies have examined the effects of EI on popularity in peer groups, mostly in children, and found conflicting results (Alves & Cruz, 2010; Windingstad, McCallum, Mee Bell, & Dunn, 2011). To our best knowledge there has been no research investigating such effects longitudinally.

Narcissism and EI

What are the links between narcissism and EI? Socio-emotional skills, such as EI, have often been associated with desirable and socially adaptive traits and behaviors (e.g., Niven, Holman, & Totterdell, 2012). However, they do not necessarily have to be instrumental toward prosocial goals. Instead, EI might also be directed against other people and it might lead to manipulation (Salovey & Mayer, 1990). Although research on the “darker side” of EI is slowly accumulating (e.g., Austin, Farrelly, Black, & Moore, 2007; Austin, Saklofske, Smith, & Tohver, 2014; Cote, DeCelles, McCarthy, Van Kleef, & Hideg, 2011; Copestake, Gray, & Snowden, 2013; Ermer, Kahn, Salovey, & Kiehl; 2012; Grieve & Mahar, 2010; Moeller & Kwantes, 2015), investigations of the association between EI and narcissism are still scarce. Given that low empathy, which is positively related to low EI (Ciarrochi et al., 2000), is one of defining qualities of narcissism (Campbell & Miller, 2011, Czarna, Wróbel, Dufner, & Zeigler-Hill, 2015; Ritter et al., 2011; Watson, Grisham, Trotter, & Biderman, 1984), a negative association between narcissism and EI might be expected.

On the other hand, narcissists are often able to manipulate and exploit other people, which suggests that their emotional competencies might be rather high than low (Nagler, Reiter, Furter, & Rauthmann, 2014). The results of prior research are mixed. In some cases narcissism was unrelated or negatively related to emotion recognition skills (e.g., Ames & Kammrath, 2004; Marissen, Deen, & Franken, 2012; Jauk, Freudenthaler, & Neubauer, 2016). Yet, in a study by Konrath, Corneille, Bushman, and Luminet (2014), exploitativeness, the facet of narcissism most closely related to manipulation, was positively linked to emotion recognition skills. Other recent research showed that persons scoring high on grandiose narcissism appear to perform well on tasks assessing theory of mind, EI, and empathy (Delič, Novak, Kovačič, & Avsec, 2011; Vonk, Zeigler-Hill, Ewing, Mercer, & Noser, 2015; Vonk, Zeigler-Hill, Mayhew, & Mercer, 2013).

It thus remains an open question whether or not narcissism is associated with high EI. Another unresolved issue is whether a combination of high EI and high narcissism might afford popularity. Does high EI compensate for the negative effects of narcissism on long-term popularity among peers? Which combination of narcissism and EI levels brings highest and which the lowest benefits in terms of popularity? These questions call for further integrated research and we attempted to answer them.

Self-organization of Social Networks

Personality and abilities are strong forces shaping our relationships. Yet, they do not work in a void. Instead, relationships emerge from a complex interplay of dispositions and self-organizing forces of social networks. In network-analytical terms, relationships (and, similarly, liking nominations) constitute *ties* (or *edges*) between *nodes* (*actors)* in social networks. When studying the role of node attributes (e.g., narcissism or EI of group members) in shaping network structures, it is necessary to consider self-organizing forces such as the tendency to reciprocate another's liking or the observation that two persons who are both befriended with a third person become befriended with each other (transitivity). Otherwise conclusions might be biased (Back & Vazire, 2015; Cranmer, Leifeld, McClurg, & Rolfe, 2016; Lusher, Koskinen & Robins, 2013; Nestler, Grimm, & Schönbrodt, 2015).

Accordingly, it is necessary to include self-organizing forces in the model when estimating the effects of exogenous factors, such as personality traits or abilities, for popularity. Fortunately, there is a strategy developed for investigating social structures through the use of network theory—exponential random graph modeling (ERGM). This method of inferential social network analysis has so far been underutilized in the study of the processes underlying the social consequences of personality (Nestler et al., 2015). The technique can be employed for the study of friendship or acquaintance formation, alliances between firms, social media networks, kinship, disease transmission, sexual relationships, co-sponsorship of bills by legislators, advice-seeking relations among employees, interest group networks as well as analysis of group and community development or international relations (Lusher et al., 2013). All of these examples exhibit complex dependencies between observations, and social network analysis is able to test the effects of exogenous factors while accounting for endogenous network dependencies that may affect these. Accordingly, we used this network-analytic method to test the hypothesized effects of narcissism and EI on popularity in peer groups.

The Current Research

The goal of this research was to investigate the association between narcissism and EI, and their longitudinal effects on popularity in the realistic, ecologically valid setting of existing peer groups. The study consisted of two waves, the first wave taking place at zero acquaintance and the second one three months later. First, we asked members of 15 freshly formed student groups to complete dispositional measures and to nominate one or several person(s) they liked most in their groups. Three months later we met the same groups and repeated the nomination procedure.

We hypothesized that narcissism would positively predict the number of received liking nominations at the first measurement and then a decrease in this number over time. We expected that these effects hold when self-esteem was controlled. We also expected that EI would predict popularity and we explored whether this effect would vary depending on the time of measurement or not. We explored the association between narcissism. We also explored whether any constellation of narcissism and EI would be particularly beneficial for popularity and whether this effect would show temporal variability.

We endeavored a particularly stringent test of these hypotheses by running a series of analyses using statistical network-analytic methods (temporal exponential random graph modeling, TERGM). The benefits of this approach can be outlined in a simplified way as follows. The analyses test the hypothesized effects of personal dispositions on peer popularity while taking into account non-independence and different levels of the data (two measurements nested in persons nested in groups) and also accounting for self-organizing network phenomena. They allow checking whether the hypothesized relationships remain significant when endogenous processes naturally occurring in friendship networks, such as reciprocity or transitivity of friendly relationships, are taken into account.

Method

Participants and procedure

Fifteen mixed-sex groups of students from southern Polish public universities participated in the study (mean number of people per group M_g = 19.0, *SD* = 5.57, *Min* = 9.00, *Max* = 29). In the Polish higher education system, freshmen are generally assigned to formal study groups that take all of their classes together. The first assessment took place in the first week of the semester and students within each group had not been acquainted with one another before the start of the study (zero-acquaintance). The second measurement took place three months later. In total, 273 students participated in the study, of whom 98 were male, mean age was 20.10 (*SD* = 3.22, *Min* = 18, *Max* = 55.00). Of those, all 273 participants provided data at the first measurement and 170 of them (62%) at the second measurement. The persons who dropped out from the study were not systematically different from those who participated in both measurements on any of the variables (all ps>.35).

Assessments took place in groups. Participants were seated in a circle and filled out demographic, self-report, and round-robin measures. To safeguard anonymity, they were randomly assigned adhesive cards with numbers which they affixed to themselves. These numbers, rather than names, were used to refer to group members in questionnaires.

At each assessment session, participants were asked to nominate persons they liked most in their group. No limit on the number of nominees was imposed—participants were only requested preferably not to nominate all group members. Additionally, at the first session data were collected about sex and age of participants, scores on EI and self-reported personality traits: grandiose narcissism, explicit and implicit self-esteem.

Measures

Narcissism. Narcissism was measured with a validated Polish version of Narcissistic Personality Inventory (NPI; Raskin & Hall, 1979). The Polish adaptation of the NPI (Bazińska & Drat-Ruszczak, 2000) consists of 34 items and has a five-point Likert-type response format (1 = *does not apply to me*, 5 = *applies to me*) (α = .91).

Emotional intelligence (EI). EI was measured with the Test of Emotional Intelligence (TIE, Śmieja, Orzechowski, & Beauvale, 2007; Śmieja, Orzechowski, & Stolarski, 2014), a 24-item ability test based on the four-factor model of EI (Mayer & Salovey, 1997; Salovey & Mayer, 1990). Participants were provided with descriptions of social situations and asked to indicate on a 1–5 Likert scale the emotions involved in a given situation, or to suggest the most appropriate action. Scoring is based on the judgments of experts (professional psychotherapists, coaches, and HR specialists). In line with the theoretical model of ability EI, the results of the TIE share about 10% of common variance with a general intelligence test, and are independent of major personality dimensions validating also the structure of EI as a set of four abilities (α = .88).

Self-esteem. Explicit self-esteem (ESE) was assessed with a validated Polish version of Rosenberg's Self Esteem-Scale (RSES; Rosenberg, 1965; Polish version by Łaguna, Lachowicz-Tabaczek, & Dzwonkowska, 2007; 1 = *strongly agree* to 4 = *strongly disagree)* (α = .80).

Implicit self-esteem (ISE) was assessed by measuring the size of a participant's signature. At the end of the study, participants were told that the study would be continued and in order to assure that they would recognize their own work in case they forgot their number a few months later they were asked to sign their questionnaires with their casual hand-written signature. The size of the smallest square covering the whole handwritten signature served as a measure of their implicit self-esteem (Rudman, Dohn, & Fairchild, 2007; Stapel & Blanton, 2004; Zweigenhaft, 1977; Zweigenhaft & Marlowe, 1973). All signatures were scanned and their size measured in millimeters using Gimp 2 software. Measurements were taken with precision to .01 mm.

Data structure and analytic plan

We regarded the 15 peer groups as networks. Because each network was measured at two different time points, this yielded a total of 30 networks. For our analyses, group members were considered nodes (actors) in these networks, and a single nomination was considered a directed tie, i.e., an edge, between two nodes in a network. All available nomination data were utilized and no missing values (nominations made to and by group members who were absent at the moment of the measurement) were imputed. We applied network analysis to the data as application of conventional regression models like a generalized linear model or a mixed-effects model would likely introduce bias due to violation of the i.i.d. (independent and identically distributed) assumption (Cranmer et al., 2016). Therefore, we employed a TERGM, which is able to fix this problem (Hanneke, Fu, & Xing 2010). The TERGM is a temporal or multi-group extension of the exponential random graph model (ERGM), which is a parametric model for inference on single networks (Wasserman & Pattison 1996; Robins, Pattison, Kalish, & Lusher, 2007; Lusher, et al., 2013; Snijders, Pattison, Robins, & Handcock, 2006). The ERGM treats a network as a single multivariate observation in which the relations in the network depend on covariates (i.e. here: traits and abilities of group members) as well as on each other (i.e., self-organizing or endogenous processes). Mathematical details on the applied models are provided in the appendix.

In applying the TERGM to the 30 networks, we assumed that there were no dependencies between the networks. There was one exception: as there were two time points, we hypothesized that time played a role for friendship formation. That is, individuals with high narcissism scores were expected to have lower incoming edge probabilities than individuals with low narcissism scores the further time progressed. We captured this temporal dependency between network realizations—one of our main hypotheses—by introducing an interaction term between time (1 or 2) and the narcissism score of the potential receiver. To do so, we first included the exogenous factor ‘time period’ that determined whether networks 16-30 (the second time point) exerted higher edge probabilities than networks 1-15 (the first wave). We also included the factors ‘Narcissism: receiver’ and ‘Narcissism: sender’, which indicated effects of narcissism on received and provided liking nominations, respectively. Finally, an interaction term was included that captured whether narcissists tended to gain or lose friendship ties over time. We followed the same logic when adding exogeneous terms for EI effects (‘EI: receiver’, ‘EI: sender’; and an interaction term between ‘EI: receiver’ and ‘time course’). Finally, we included the two- way interaction effect of receiver’s narcissism with EI and the three-way interaction of receiver’s narcissism with EI and time.

Next to these exogenous factors, the model included parameters of endogenous (self-organizing) network statistics which might be relevant in friendship networks: *Reciprocity* (i.e., the tendency for an edge to be reciprocated), *GWESP* (i.e., the Geometrically Weighted Edgewise Shared Partner distribution, captures higher-order transitivity in the network, that is, the tendency of direct friends to have multiple shared third-party friends; Hunter, 2007), *GWODegree* (Geometrically Weighted Out-Degree distribution, captures the differential activity distribution of nodes across the network*), two-paths* (i.e., the number of open and directed triads, that is, paths from node *i* to node *j* and onwards to node *k* without a direct connection between *i* and *k*), and *cyclic triplets* (i.e., the tendency of friendships to close two-paths by going back to the initial node).

Finally, our model included the effects of age and sex of actors in the networks on both their popularity and activity and the homophily (similarity) effects of age (Age: abs diff) and sex (Sex: node match), tendencies of group members of the same age or sex to like each other more or less than expected by chance. Similarly, the model included homophily effects for narcissism and EI.

The TERGM was estimated by Markov Chain Monte Carlo Maximum Likelihood Estimation (MCMC-MLE), as implemented in the *xergm* suite of packages (Leifeld, Cranmer, & Desmarais, 2016) for the statistical programming environment R (R Core Team 2015). Regression tables were created using the *texreg* package (Leifeld, 2013). Coefficients can be interpreted as log odds of a tie conditional on the rest of the respective network.

Results

Descriptive statistics and correlations are presented in Table 1. EI and narcissism were not significantly related (r = .06, p =.17). Table 2 presents the estimated model parameters from the TERGM along with standard errors in parentheses. Significant results are bolded. Among the control variables, most endogenous model terms were significant and in the expected direction.

Table 1. *Intercorrelations and descriptive statistics of key variables in the study*

	Narcissism	EI	ESE	ISE
Narcissism	-			
EI	.06	-		
ESE	.44**	.14**	-	
ISE	.12*	.03	.07	-
M	99.56	28.14	29.28	424.37
SD	22.29	5.08	5.38	465.09

Note. * p <.05, ** p<.01; EI = emotional intelligence; ESE = explicit self-esteem; ISE = implicit self-esteem.

Table 2. *Estimates of the Temporal Exponential Random Graph Model (TERGM).*

	TERGM
Main effects	
Age: receiver	-0.0089 (0.0177)
Sex: receiver	**-0.2127** (0.0250)***
Narcissism: receiver	**0.0269** (0.0055)***
Narcissism: receiver x Time period	**-0.0075** (0.0020)***
EI: receiver	0.0151 (0.0188)
EI: receiver x Time period	**0.0256** (0.0073)***
Narcissism: receiver x EI: receiver	**-0.0005** (0.0002)***
Exogenous control variables	
Time period	**0.2088** (0.0107)***
Group size	0.0087 (0.0058)
ISE: receiver	**0.0995** (0.0277)***
Age: sender	-0.0274 (0.0160)
Age: abs diff	-0.0107 (0.0162)
Narcissism: sender	0.0010 (0.0011)
Narcissism: abs diff	0.0004 (0.0012)
EI: sender	-0.0036 (0.0048)
EI: abs diff	-0.0051 (0.0056)
Sex: sender	0.0523 (0.0390)
Sex: node match	**0.2247** (0.0482)***
Endogenous network dependencies	
Edges (intercept)	**-2.5092** (0.0302)***
Reciprocity	**1.5956** (0.0143)***
GWESP	**0.6689** (0.0544)***
GWODegree	**-2.2824** (0.0074)***
Two-paths	**-0.2677** (0.0166)***
Cyclic triplets	**0.6404** (0.0551)***

Note. * zero outside the 95% confidence interval.
EI = emotional intelligence; ISE = implicit self-esteem; abs diff = absolute difference; GWESP = Geometrically Weighted Edgewise Shared Partner distribution; GWODegree = Geometrically Weighted Out-degree distribution (details provided in the text).

The significant *Reciprocity* term indicates that liking nominations are more mutual than expected purely by chance. The significant *GWESP* effect shows that liking was transitive in our networks: friends of a friend were also nominated as friends. The *GWODegree* term indicates that some people have generally lower thresholds of calling others “friends” while others have higher thresholds. The significant and negative effect of *two-paths* and the positive significant effect of *cyclic triplets* suggest that people connect to their indirect peers, they close friendship triads by befriending the initial node, i.e., friendship tends to form cliques involving more than two individuals.

Moreover, the significant exogenous effects indicate that between the first and the second wave the probability of a person nominating another person increased (significant positive Time period effect), and if two individuals had the same sex, they were more likely to be tied (significant positive Sex: node match effect). The abs diff terms denote absolute differences in a variable between the value of the potential sender of a friendship tie and the potential receiver. For example, a positive effect of the term Narcissism: abs diff would indicate that the more individuals differ from each other in terms of narcissism, the more likely it is that they nominate each other as friends. Yet, none of these abs diff terms was significant.

Relevant to our main research question, narcissism was significantly linked to received liking nominations (significant positive Narcissism: receiver effect, Figure 1). Such an effect indicates that people high in narcissism had more incoming friendship ties than people low in narcissism. Moreover, the interaction effect between time and the narcissism score of the potential receiver was significant and negative. This means that group members with high narcissism levels found significantly fewer friends over time than group members with low narcissism levels. Importantly, this effect was significant when the overall advantage that highly narcissistic individuals have was taken into account. The effect size indicates that the odds of a friendship tie are reduced by 17% if the narcissism score is increased by one standard deviation (SD_{NPI} = 22.29) and time progresses to the second wave (((exp(-.0076)-1)*22.29)=-.17), controlling for the narcissism scores of the potential senders, for time, and for the absolute difference in narcissism between sender and receiver.

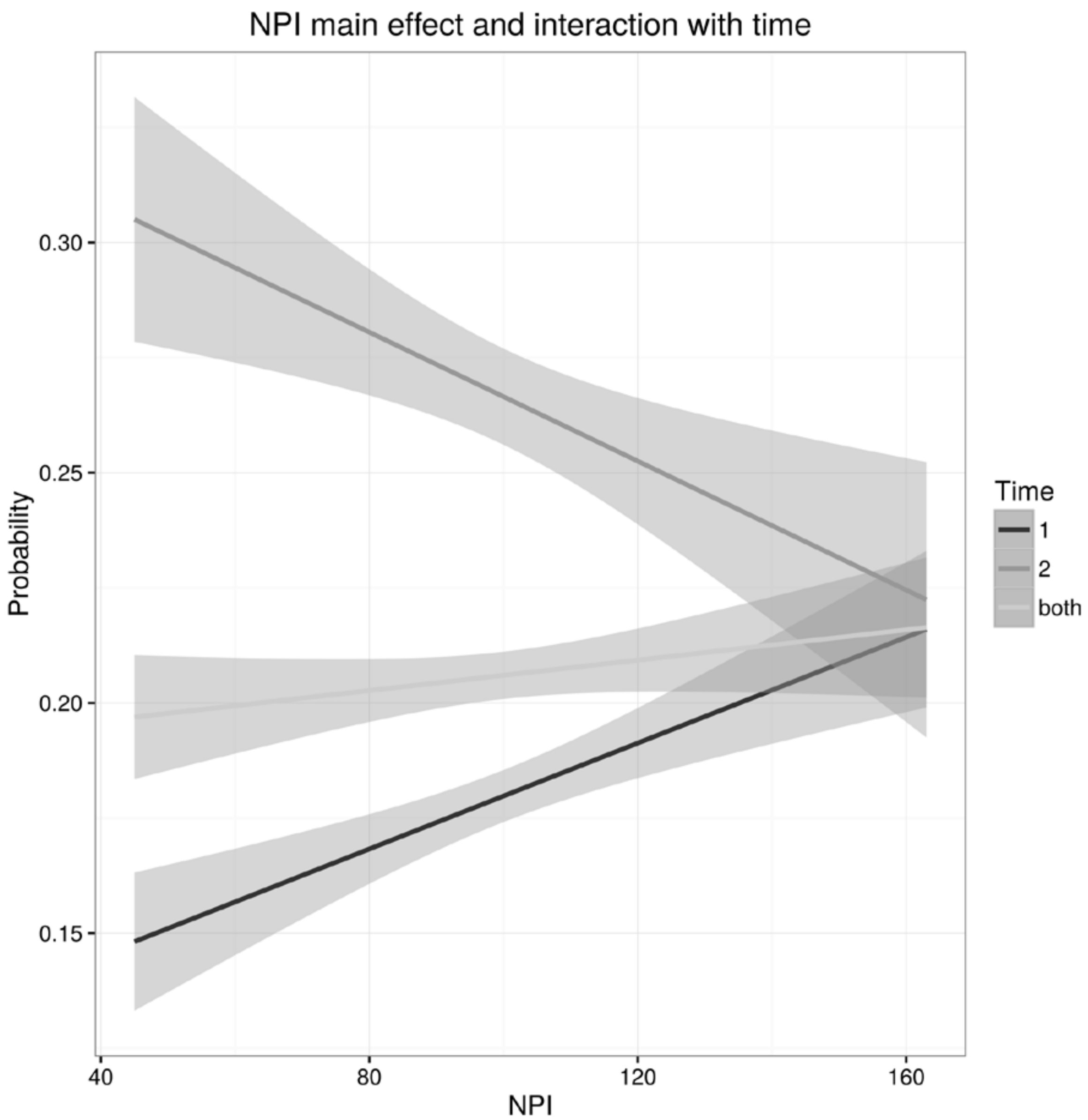

Figure 1. Main effect of 'narcissism: receiver', irrespective of time, on popularity is presented in light gray; the effect for the first time point in black and for the second time point in dark gray. Y-axis represents probability of receiving a friendship tie. The gray areas around lines represent 95% confidence intervals. NPI = Narcissistic Personality Inventory.

Figure 1 shows that generally, regardless of time, higher narcissism was paired with higher incoming edge probabilities. However, higher narcissism was paired with more popularity at the first measurement and with less popularity at the second measurement. The friendships of highly narcissistic individuals did not change to a great extent over time, but the friendships of individuals low in narcissism became more likely. In other words, high narcissists did not lose friends, but they found new friends at a lower rate than low narcissists.

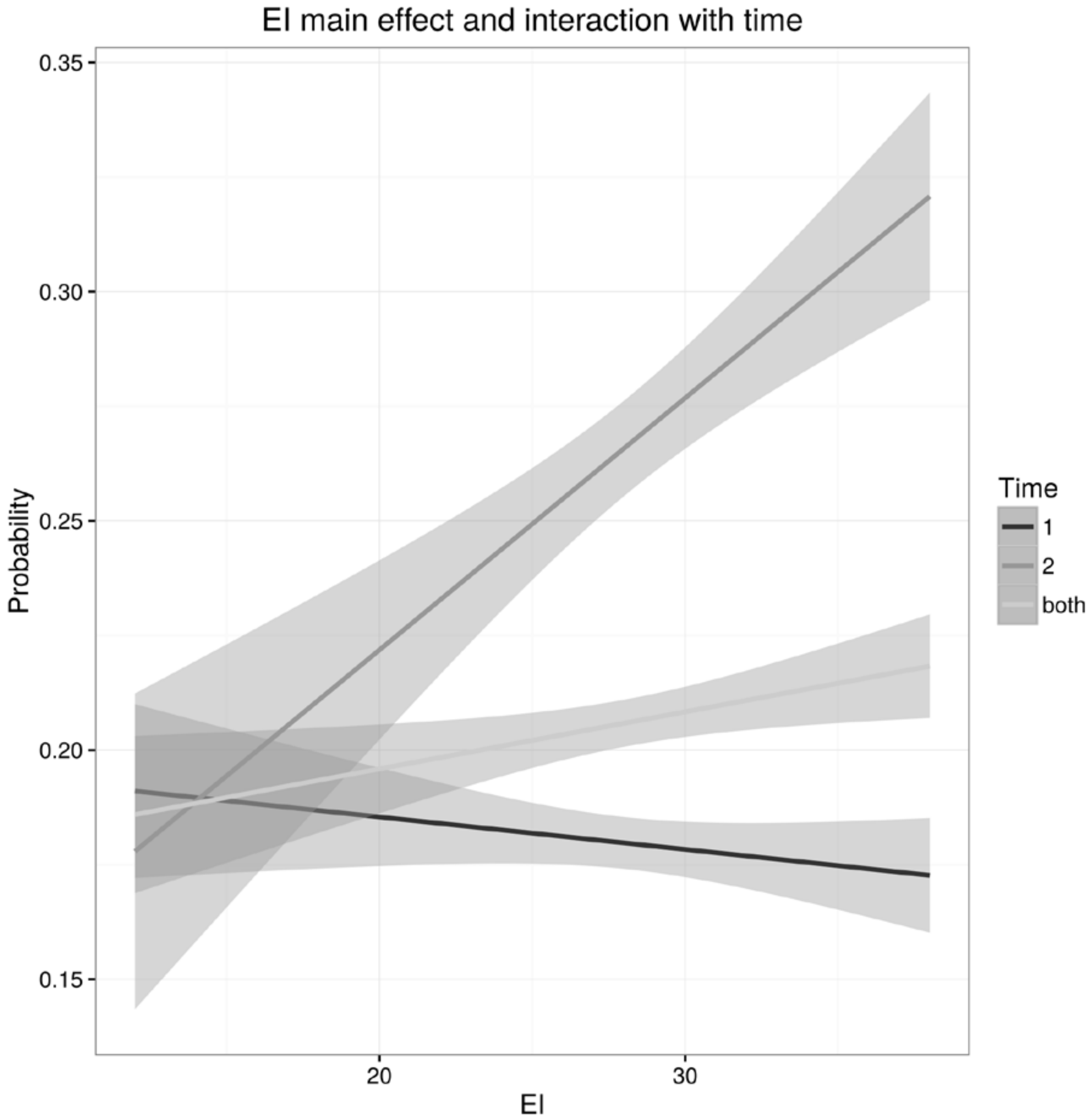

Figure 2. Main effect of ‘EI: receiver’, irrespective of time is presented in light gray; the effect for the first time point in black and for the second time point in dark gray. Y-axis represents probability of receiving a friendship tie. The gray areas around lines represent 95% confidence intervals. EI = emotional intelligence.

The main receiver effect of EI was marginally significant and the interaction effect between receiver term of EI with time was significant and positive indicating that highly emotionally intelligent group members tended to receive more liking nominations than those low on EI, and this difference significantly increased with time. The effect size indicates that the odds of a friendship tie are increased by around 13% if the EI score is increased by one standard deviation (SD_{EI} = 5.08) and time progresses to the second wave (((exp(0.0243)-

1)*5.08)=.13), controlling for the EI scores of the potential senders, for time, and for the absolute difference in EI between sender and receiver. Figure 2 shows that the persons high in EI have an increasing chance of receiving friendship ties with time.

A three-way interaction term between time, narcissism score, and EI was not significant and thus was subsequently dropped from the model. However, a two-way interaction term between narcissism score and EI was significant and negative. We plotted this interactive effect using a micro-level interpretation technique for ERGMs based on block Gibbs sampling to compare several subgroups of data points conditional on the model and the rest of the network (for details, see Desmarais & Cranmer 2012). Figure 3 shows probabilities of receiving a liking nomination (friendship tie) for combinations of high/low narcissism/EI values, using the extreme 10% on each variable. By comparing median probabilities (with bootstrapped bias-corrected 95% confidence intervals based on 10,000 draws), one can see that group members who were low on narcissism and high on EI had the highest probability of being nominated as a friend, followed by individuals who were highly narcissistic and low on emotional intelligence. Emotionally unintelligent group members who were also low on narcissism had the lowest probability of receiving a liking nomination. This group had significantly lower probability of being nominated as a friend than any other group (all $ps<.003$), across time. No other significant differences were noted. These effects were not significantly different between the two measurement points, as indicated by insignificant three-way interaction of narcissism, EI and time.

Neither explicit nor implicit self-esteem accounted for any of these effects: the receiver effect of explicit self-esteem was not significant and was subsequently dropped from the model, while the analogous effect of implicit self-esteem (ISE: receiver) was significant and positive and was therefore retained in the model (Table 2). Having higher implicit self-esteem predicted receiving more liking nominations.

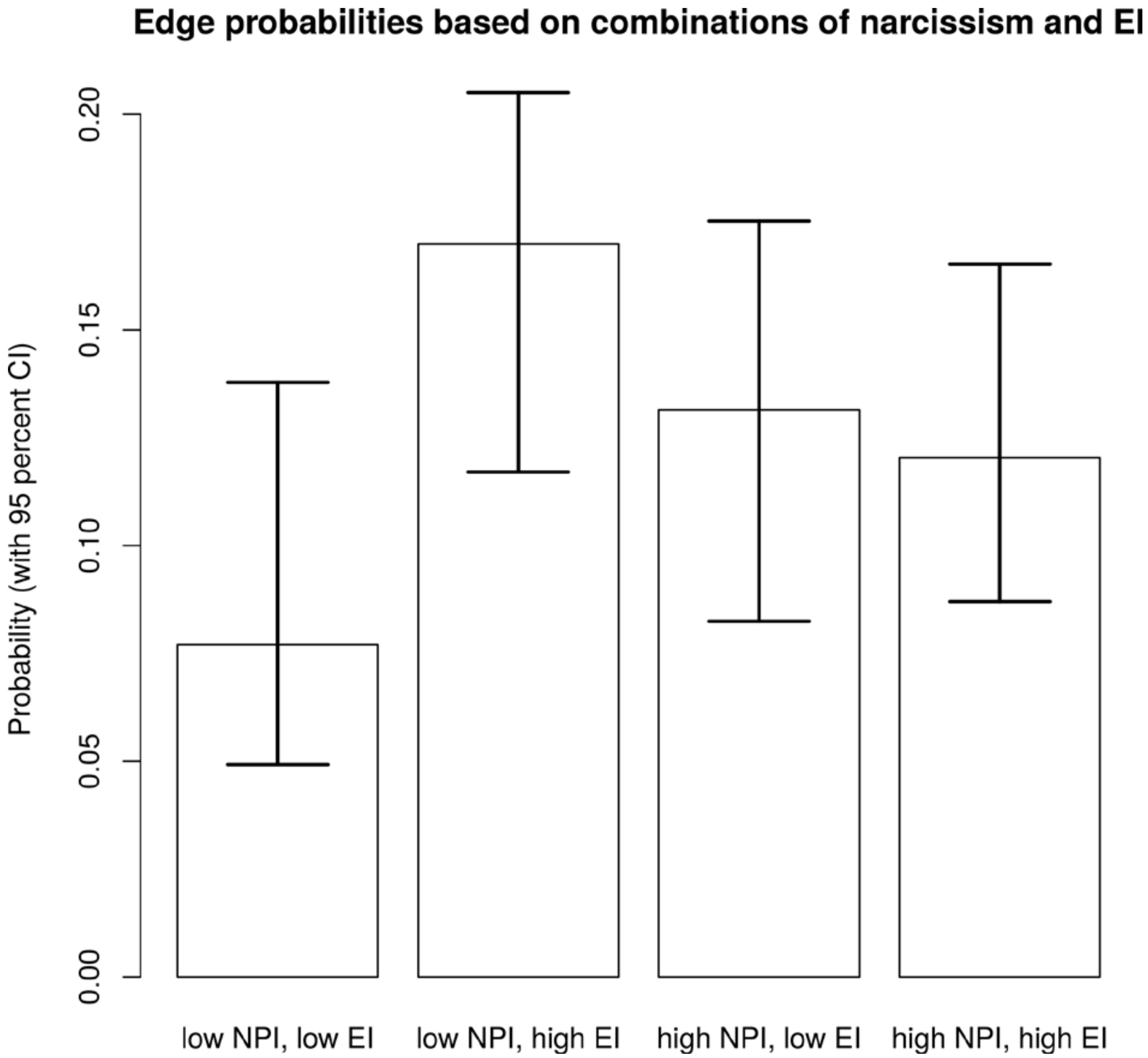

Figure 3. Median probabilities of receiving a friendship nomination for group members with combinations of the lowest and highest 10% of scores on EI and narcissism at the first and second time steps. The leftmost bar is significantly different from each of the other ones.

Goodness of fit assessment

Finally, we conducted a test that indicates whether the results of the TERGM analysis are trustworthy. One hundred new networks were simulated in lieu of each observed network based on the model parameters and covariates and compared with the observed networks. The distributions of several typical network characteristics match the observed distributions of the same statistics well enough that omitted variable bias due to unmodeled endogenous network dependence can be ruled out (Figure 4: the gray boxplots of the first five panels represent the simulations, and the solid and dashed black lines represent the median and mean of the observed networks). More details on the assessment of goodness of fit can be found in the appendix and in Hunter, Goodreau, & Handcock 2008). These results indicate that model specification is satisfactory.

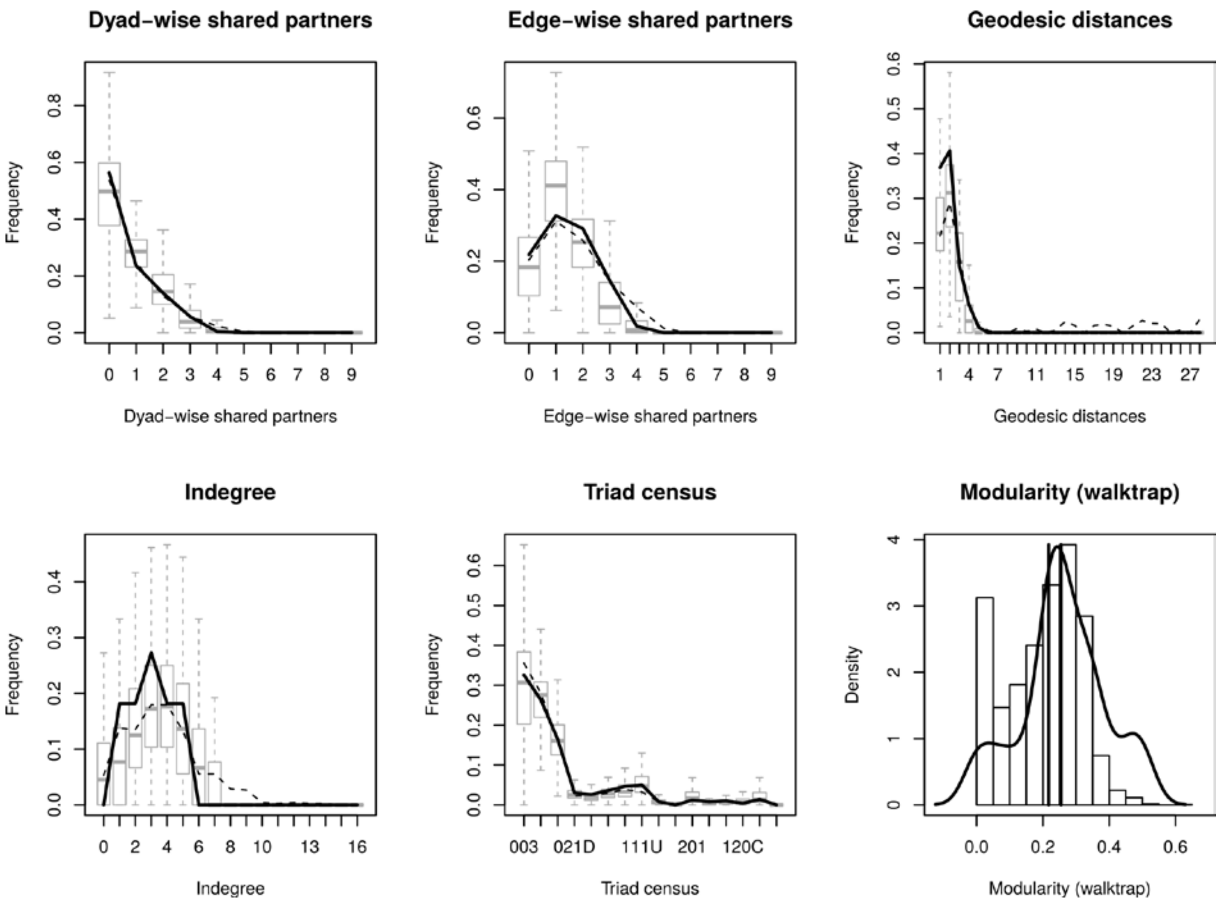

Figure 4. The goodness of fit assessment for the TERGM.

Discussion

Even though a better understanding of the emergence of popularity is crucially important, research investigating longitudinal effects of dispositions on interpersonal outcomes is rare. The current investigation is among the first to consider aspects of motivation and ability as well as their interplay within a single study. We tracked the effects of EI and narcissism in a number of natural occurring peer groups that were tested at zero acquaintance and three months later. The study is also among the first to test these effects while taking into account self-organizing network factors such as the tendency of friendships to be reciprocal, to be transitive and many others. We applied a sophisticated statistical procedure labeled temporal exponential random graph modeling to achieve this goal.

The results confirmed that indeed both high narcissism and high EI brought about popularity. However, while people high in narcissism were initially popular, they gained fewer friends over time than people lower in narcissism; in contrast, people high in EI gained more friends over time than people low in EI. Narcissistic group members had an advantage in popularity in their peer groups at zero acquaintance, but lost this advantage with time. More precisely, whereas group members on average developed new friendships over time, this happened to a smaller degree in the case of high narcissists. The results of our study corroborate predictions derived from the chocolate cake model of narcissism (Campbell, 2005) as well as contextual reinforcement models of narcissism (Campbell & Campbell, 2009), and earlier research (Back et al., 2010; Czarna et al., 2014; Dufner, et al.,, 2013; Paulhus, 1998). Narcissists fare well in the “emerging zone” of relationships with other people, but fare less well in the “enduring zone” (Campbell & Campbell, 2009). Our analyses demonstrated that neither explicit, nor implicit self-esteem accounted for these effects. They seem to be genuinely driven by narcissism.

The positive effect of EI on popularity was also in line with our hypotheses. There was a positive effect of EI over time suggesting that revealing emotional skills needs time, as chances for regulating affect or understanding peers’ feelings appear only in specific social interactions. Hence, emotionally intelligent people find more friends with time than their emotionally unintelligent counterparts. The likely driving forces for these effects are high communal qualities of emotionally intelligent persons, which get noticed and appreciated by their social surrounding over time.

Narcissism was unrelated to EI. This null finding is in line with some earlier research (Ames & Kammrath, 2004). However, it does not contradict other findings concerning particular components of narcissism and specific emotional competencies (Konrath et al., 2014). Narcissism is a multifactorial construct with more and less adaptive aspects (Back et al., 2013)—those can have different associations with emotional skills. Future research would do well to address the issue more thoroughly.

Interestingly, an interaction between narcissism and EI emerged. Low narcissism paired with low EI was a particularly unfortunate combination bringing about lower popularity than any other combination of these two dispositions. We also found that the combination of high narcissism and low EI was no less advantageous than having low narcissism and high EI, when average popularity across the entire time period was considered. However, keeping in mind that high initial popularity of strongly narcissistic individuals exhibits a declining trajectory over time, it seems that the combination most beneficial for long-term peer popularity is low narcissism paired with high EI. It seems that a quieter and less needy ego coupled with abilities to perceive, understand, use and manage emotions ensures better relationships in the long run.

Finally, we found that these effects were independent of self-organizing network factors. In line with Heider’s (1958) social balance theory, friendships within the peer groups of the present study were highly reciprocal and transitive. We also found that friendships between group members of the same sex were more likely than friendships between group members of opposite sexes. No other homophily effect emerged as significant, and so similarity in personality or skills did not appear to be equally important for forming friendships. Implicit self-esteem did not affect the observed effects of narcissism or EI, but turned out to be a relatively strong predictor of popularity in itself. The main effect of implicit self-esteem is interesting as it might suggest that the size of signature is indeed a valid measure of implicit self-esteem (Rudman et al., 2007; Stapel & Blanton, 2004; Zweigenhaft, 1977; Zweigenhaft & Marlowe, 1973), and also that implicit self-esteem might have status-signaling function, which would be in line with a self-broadcasting function of (Swann, Chang-Schneider, & McClarty, 2007; Zeigler-Hill, Besser, Myers, Southard, & Malkin, 2013).

Our research is not free from limitations. It did not elucidate mediators of the observed interpersonal effects, such as concrete behavioral processes. It seems possible that charming, and aggressive behaviors account for the links between narcissism and (un)popularity (Küfner et al., 2013; Leckelt et al., 2015) and that empathic and prosocial behaviors account for the link between EI and popularity.

The approach we took has its strengths: the large sample, the longitudinal design, its long time span and natural setting. The long time span and natural setting enabled participants to express themselves more genuinely and develop deeper acquaintance than is usually possible in a laboratory. As a consequence, it allowed for highly ecologically valid test of interpersonal effects of studied individual differences on functioning in peer groups. Furthermore, the cutting-edge statistical approach we employed allowed to put the robustness of hypothesized effects to a comprehensive and stringent test by properly accounting for network phenomena. The results provide evidence for the theorized decline in popularity of persons high on socially disruptive features over time as well as for tangible personal benefits of having high emotional skills.

References

Alves, D. P., & Cruz, O. (2010). Preditores emocionais e sociais da aceitação pelos pares em crianças de idade escolar. [Emotional and social predictors of peer acceptance in school-age children.] *Psicologia: Revista Da Associação Portuguesa Psicologia*, *24*(2), 113-129.

Ames, D. R., & Kammrath, L. K. (2004). Mind-reading and metacognition: Narcissism, not actual competence, predicts self-estimated ability. *Journal of Nonverbal Behavior*, *28*(3), 187-209. doi: 10.1023/B:JONB.0000039649.20015.0e

Austin, E. J., Farrelly, D., Black, C., & Moore, H. (2007). Emotional intelligence, Machiavellianism and emotional manipulation: Does EI have a dark side? *Personality and Individual Differences*, *43,* 179–189. doi:10.1016/j.paid.2006.11.019

Austin, E. J., Saklofske, D. H., Smith, M., & Tohver, G. (2014). Associations of the managing the emotions of others (MEOS) scale with personality, the Dark Triad and trait EI. *Personality and Individual Differences*, *65,* 8–13. doi:10.1016/j.paid.2014.01.060

Back, M. D., Küfner, A. C., Dufner, M., Gerlach, T. M., Rauthmann, J. F., & Denissen, J. J. (2013). Narcissistic admiration and rivalry: Disentangling the bright and dark sides of narcissism. *Journal of Personality and Social Psychology*, *105*, 1013-1037.

Back, M. D., Schmukle, S. C., & Egloff, B. (2010). Why are narcissists so charming at first sight? Decoding the narcissism–popularity link at zero acquaintance. *Journal of Personality and Social Psychology, 98,* 132-145. doi:10.1037/a0016338

Back, M. D., & Vazire, S. (2015). The social consequences of personality: Six suggestions for future research. *European Journal of Personality*, *29*(2), 296-307.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497.

Bazińska, R., & Drat-Ruszczak, K.(2000). Struktura narcyzmu w polskiej adaptacji kwestionariusza NPI Raskina i Halla. [The structure of narcissism measured with Polish adaptation of Raskin and Hall NPI]. *Czasopismo Psychologiczne*, *6,* 171-187.

Borgatti, S. P., Everett, M. G., & Johnson, J. C. (2013). *Analyzing social networks*. SAGE Publications Limited.

Brackett, M. A., Mayer, J. D., & Warner, R. M. (2004). Emotional intelligence and its relation to everyday behaviour. *Personality and IndividualDifferences,36*(6), 1387-1402. doi:10.1016/S0191-8869(03)00236-8

Brackett, M. A., Rivers, S. E., Shiffman, S., Lerner, N., & Salovey, P. (2006). Relating emotional abilities to social functioning: a comparison of self-report and performance measures of emotional intelligence. *Journal of Personality and Social Psychology*, *91*(4), 780. doi:10.1037/0022-3514.91.4.780

Campbell, W. K. (2005). *When you love a man who loves himself: How to deal with a oneway relationship*. Chicago: Sourcebooks Casablanca.

Campbell, W. K., & Campbell, S. M. (2009). On the self-regulatory dynamics created by the peculiar benefits and costs of narcissism: A contextual reinforcement model and examination of leadership. *Self and Identity*, *8*(2-3), 214-232. doi: 10.1080/15298860802505129

Campbell, W. K., Brunell, A. B., & Finkel, E. J. (2006). Narcissism, interpersonal self-regulation, and romantic relationships: An Agency Model approach. In: E. J. Finkel, K. D. Vohs (Eds.), *Self and relationships: Connecting intrapersonal and interpersonal processes* (p. 57–83). New York: Guilford Press.

Campbell, W. K., & Miller, J. D. (2011). *The handbook of narcissism and narcissistic personality disorder*. Hoboken, NJ: Wiley.

Campbell, K. W., Sedikides, C., Rudich, E. A., Gregg, A. P., Kumashiro, M., & Rusbult, C. (2004). Are normal narcissists psychologically healthy?: self-esteem matters. *Journal of Personality and Social Psychology*, *87*(3), 400-416.

Carlson, E. N., Vazire, S., & Oltmanns, T. F. (2011). You probably think this paper's about you: narcissists' perceptions of their personality and reputation. *Journal of Personality and Social Psychology*, *101*(1), 185. doi: 10.1037/a0023781

Ciarrochi, J. V., Chan, A. Y., & Caputi, P. (2000). A critical evaluation of the emotional intelligence construct. *Personality and Individual Differences*, *28*(3), 539-561. doi:10.1016/S0191-8869(99)00119-1

Clifton, A. (2011). Narcissism and social networks. In W. K. Campbell & J.D. Miller (Eds.) *The handbook of narcissism and narcissistic personality disorder: Theoretical approaches, empirical findings, and treatments* (p.360-370). Hoboken, NJ: Wiley.

Copestake, S., Gray, N. S.; Snowden, R. J. (2013). Emotional intelligence and psychopathy: A comparison of trait and ability measures. *Emotion, 13(4)*, 691-702. doi: 10.1037/a0031746

Côté, S., DeCelles, K. A., McCarthy, J. M., Van Kleef, G. A., & Hideg, I. (2011). The Jekyll and Hyde of emotional intelligence: Emotion regulation knowledge facilitates prosocial and interpersonally deviant behavior. *Psychological Science*, 22, 1073-1080. doi: 10.1177/0956797611416251

Cranmer, S. J., & Desmarais, B. A. (2011). Inferential network analysis with exponential random graph models. *Political Analysis*, *19*(1), 66-86.

Cranmer, S. J., Leifeld, P., McClurg, S. D., & Rolfe, M. (2016). Navigating the Range of Statistical Tools for Inferential Network Analysis. *American Journal of Political Science.* Forthcoming.

Czarna, A.Z., Czerniak, A., & Szmajke, A. (2014). Does Communal Context Bring the Worst in Narcissists? *Polish Psychological Bulletin*, *45*, 464-468.

Czarna, A.Z., Dufner, M., & Clifton, A.D. (2014). The Effects of Vulnerable and Grandiose Narcissism on Liking-based and Disliking-based Centrality in Social Networks. *Journal of Research in Personality, 50*, 42–45. doi:10.1016/j.jrp.2014.02.004.

Czarna, A.Z., Jonason, P.K., Dufner, M., & Kossowska, M. (2016). The Dirty Dozen Scale: Validation of a Polish Version and Extension of the Nomological Net. *Frontiers in Psychology, 6 (0045).* doi: 10.3389/fpsyg.2016.00445.

Czarna, A. Z., Wróbel, M., Dufner, M., & Zeigler-Hill, V. (2015). Narcissism and Emotional Contagion Do Narcissists "Catch" the Emotions of Others? *Social Psychological and Personality Science*, *6*(3), 318-324.

Delič, L., Novak, P., Kovačič, J., & Avsec, A. (2011). Self-reported emotional and social intelligence and empathy as distinctive predictors of narcissism. *Psychological Topics*, *20*(3), 477-488.

Desmarais, B. A., & Cranmer, S. J. (2012). Micro-level interpretation of exponential random graph models with application to estuary networks. *Policy Studies Journal, 40*(3), 402-434.

Dufner, M., Denissen, J. J., Zalk, M., Matthes, B., Meeus, W. H., van Aken, M. A., & Sedikides, C. (2012). Positive Intelligence Illusions: On the Relation Between Intellectual Self-Enhancement and Psychological Adjustment. *Journal of Personality, 80*(3), 537-572.

Dufner, M., Rauthmann, J. F., Czarna, A. Z., & Denissen, J. J. A. (2013). Are Narcissists Sexy? Zeroing in on the Link Between Narcissism and Short-Term Mate Appeal. *Personality and Social Psychology Bulletin, 39,* 870-882. doi: 10.1177/0146167213483580

Ermer, E., Kahn, R. E., Salovey, P., & Kiehl, K. A. (2012). Emotional intelligence in incarcerated men with psychopathic traits. *Journal of Personality and Social Psychology, 103*, 194–204. doi: 10.1037/a0027328

Friedman, J. N., Oltmanns, T. F., Gleason, M. E., & Turkheimer, E. (2006). Mixed impressions: Reactions of strangers to people with pathological personality traits. *Journal of Research in Personality*, *40*(4), 395-410.

Grieve, R., & Mahar, D. (2010). The emotional manipulation-psychopathy nexus: Relationships with emotional intelligence, alexithymia and ethical position. *Personality and Individual Differences*, *48,* 945–950. doi:10.1016/j.paid.2010.02.028

Heider, Fritz (1958). *The Psychology of Interpersonal Relations*. John Wiley & Sons.

Hanneke, S., Fu, W., & Xing, E. P. (2010). Discrete temporal models of social networks. *Electronic Journal of Statistics*, *4*, 585-605.

Hunter, D. R. (2007). Curved exponential family models for social networks. *Social Networks*, *29*(2), 216-230.

Hunter, D. R., Goodreau, S. M., & Handcock, M. S. (2008). Goodness of fit of social network models. *Journal of the American Statistical Association*, *103*(481), 248-258.

Jauk, E., Freudenthaler, H. H., & Neubauer, A. C. (2016). The Dark Triad and Trait Versus Ability Emotional Intelligence. *Journal of Individual Differences*, *37*, 112-118. doi: 10.1027/1614-0001/a000195

Küfner, A. C., Nestler, S., & Back, M. D. (2013). The Two Pathways to Being an (Un-) Popular Narcissist. *Journal of Personality*, *81*(2), 184-195. doi: 10.1111/j.1467-6494.2012.00795.x

Konrath, S., Corneille, O., Bushman, B. J., & Luminet, O. (2014). The relationship between narcissistic exploitativeness, dispositional empathy, and emotion recognition abilities. *Journal of Nonverbal Behavior*, *38*(1), 129-143. doi: 10.1007/s10919-013-0164-y

Łaguna, M., Lachowicz-Tabaczek, K., & Dzwonkowska, I. (2007). Skala samooceny SES Morrisa Rosenberga–polska adaptacja metody [Morris Rosenberg's SES scale of self-esteem – Polish adaptation of the method]. *Psychologia Społeczna*, *2*(02), 164-176.

Lamkin, J., Clifton, A., Campbell, W. K., & Miller, J. D. (2014). An examination of the perceptions of social network characteristics associated with grandiose and vulnerable narcissism. *Personality Disorders*, *5*, 137-145.Leckelt, M., Küfner, A. C., Nestler, S., & Back, M. D. (2015). Behavioral processes underlying the decline of narcissists' popularity over time. *Journal of Personality and Social Psychology*, *109*(5), 856-871.

Lee, V. E., Loeb, S., & Lubeck, S. (1998) Contextual effects of prekindergarten classrooms for disadvantaged children on cognitive development: The case of chapter 1. *Child Development, 69* (2), 479-494. doi: 10.1111/j.1467-8624.1998.tb06203.x

Leifeld, P. (2013). texreg: Conversion of Statistical Model Output in R to LaTeX and HTML Tables. *Journal of Statistical Software*, *55*(8), 1-24.

Leifeld, P., & Cranmer, S. J. (2016). A Theoretical and Empirical Comparison of the Temporal Exponential Random Graph Model and the Stochastic Actor-Oriented Model. Working paper. https://arxiv.org/abs/1506.06696 (last access: May 8, 2016).

Leifeld, P., Cranmer, S. J., & Desmarais, B. A. (2016). xergm: Extensions of Exponential Random Graph Models. *R package version 1.7.3*.

Lopes, P. N., Brackett, M. A., Nezlek, J. B., Schutz, A., Sellin, I., & Salovey, P. (2004). Emotional intelligence and social interaction. *Personality and Social Psychology Bulletin, 30*, 1018–1034. doi: 10.1177/0146167204264762

Lopes, P. N., Salovey, P., Côté, S., & Beers, M. (2005). Emotion regulation abilities and the quality of social interaction. *Emotion, 5*, 113-118. Doi: 10.1037/1528-3542.5.1.113

Lopes, P. N., Salovey, P., & Straus, R. (2003). Emotional intelligence, personality, and the perceived quality of social relationships. *Personality and Individual Differences,* 641–659. doi: 10.1016/S0191-8869(02)00242-8

Lusher, D. Koskinen, J, & Robins, G. (2013), *Exponential random graph models for social networks*. New York: Cambridge University Press.

Marissen, M. A., Deen, M. L., & Franken, I. H. (2012). Disturbed emotion recognition in patients with narcissistic personality disorder. *Psychiatry Research, 198*(2), 269-273.

Mayer, J.D., & Salovey, P. (1997). What is emotional intelligence? In: Salovey P., Sluyter, D.J., (Eds.), *Emotional development and emotional intelligence: Educational implications*. New York: Basic Books, Inc. 3–34.

Mayer, J. D., Caruso, D. & Salovey, P. (1999). Emotional intelligence meets traditional standards for an intelligence. *Intelligence, 27*, 267–298.

Miller, J. D., & Maples, J. (2011). Trait personality models of narcissistic personality disorder, grandiose narcissism, and vulnerable narcissism. In: W. K. Campbell & J.D. Miller (Eds.) *The handbook of narcissism and narcissistic personality disorder: Theoretical approaches, empirical findings, and treatments* (p.71-88). Hoboken, NJ: Wiley.

Moeller, C., & Kwantes, C. T. (2015). Too Much of a Good Thing? Emotional Intelligence and Interpersonal Conflict Behaviors. *The Journal of Social Psychology, 155*, 314-324.

Nagler, U. K., Reiter, K. J., Furtner, M. R., & Rauthmann, J. F. (2014). Is there a “dark intelligence”? Emotional intelligence is used by dark personalities to emotionally manipulate others. *Personality and Individual Differences, 65*, 47-52.

Newman, M. E. (2006). Modularity and community structure in networks. *Proceedings of the National Academy of Sciences, 103*(23), 8577-8582.

Nestler, S., Grimm, K. J., & Schönbrodt, F. D. (2015). The Social Consequences and Mechanisms of Personality: How to Analyse Longitudinal Data from Individual, Dyadic, Round-Robin and Network Designs. *European Journal of Personality*, *29*(2), 272-295.

Niven, K., Holman, D., & Totterdell, P. (2012). How to win friendship and trust by influencing people's feelings: An investigation of interpersonal affect regulation and the quality of relationships. *Human Relations*, *65*(6), 777-805.

Paulhus, D. L. (1998). Interpersonal and intrapsychic adaptiveness of trait self-enhancement: A mixed blessing? *Journal of Personality and Social Psychology, 74*, 1197−1208. doi: 10.1037/0022-3514.74.5.1197

Pons, P., & Latapy, M. (2006). Computing communities in large networks using random walks. *Journal of Graph Algorithms and Applications*, *10*(2), 191-218.

R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: https://www.R-project.org/.

Raskin, R. N., & Hall, C. S. (1979). A narcissistic personality inventory. *Psychological Reports*, *45*(2), 590-590.

Ritter, K., Dziobek, I., Preißler, S., Rüter, A., Vater, A., Fydrich, T., ... & Roepke, S. (2011). Lack of empathy in patients with narcissistic personality disorder. *Psychiatry research*, *187*, 241-247. doi: 10.1016/j.psychres.2010.09.013

Rivers, S. E., Brackett, M. A., Salovey, P., & Mayer, J. D. (2007). Measuring emotional intelligence as a set of mental abilities. *The science of emotional intelligence: Knowns and unknowns*, 230-257.

Robins, G., Pattison, P., Kalish, Y., & Lusher, D. (2007). An introduction to exponential random graph (p*) models for social networks. *Social Networks*, 29(2), 173-191

Rosenberg, M. (1965). *Society and the adolescent self-image*. NJ: Princeton University Press.

Rudman, L. A., Dohn, M. C., & Fairchild, K. (2007). Implicit self-esteem compensation: automatic threat defense. *Journal of Personality and Social Psychology*, *93*(5), 798.

Salovey, P., & Mayer, J.D. (1990). Emotional intelligence. *Imagination Cognition Personality, 9,* 185– 211. doi: 10.2190/DUGG-P24E-52WK-6CDG

Śmieja, M., Orzechowski, J., & Stolarski, M. (2014). TIE: An Ability Test of Emotional Intelligence. PLoS ONE 9(7): e103484. doi: 10.1371/journal.pone.0103484

Śmieja, M., Orzechowski, J., & Beauvale, A. (2007). TIE - Test Inteligencji Emocjonalnej [TIE – Test of Emotional Intelligence]. *Studia Psychologiczne, 54,* 80-99.

Snijders, T. A., Pattison, P. E., Robins, G. L., & Handcock, M. S. (2006). New specifications for exponential random graph models. *Sociological Methodology*, *36,* 99-153.

Snijders, T. A., Van de Bunt, G. G., & Steglich, C. E. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks, 32,* 44-60.

Stapel, D. A., & Blanton, H. (2004). From seeing to being: subliminal social comparisons affect implicit and explicit self-evaluations. *Journal of Personality and Social Psychology*, *87*(4), 468.

Swann Jr, W. B., Chang-Schneider, C., & Larsen McClarty, K. (2007). Do people's self-views matter? Self-concept and self-esteem in everyday life. *American Psychologist*, *62*(2), 84-94.

Vonk, J., Zeigler-Hill, V., Ewing, D., Mercer, S., & Noser, A. E. (2015). Mindreading in the dark: Dark personality features and theory of mind. *Personality and Individual Differences*, *87*, 50-54.

Vonk, J., Zeigler-Hill, V., Mayhew, P., & Mercer, S. (2013). Mirror, mirror on the wall, which form of narcissist knows self and others best of all? *Personality and Individual Differences, 54*(3), 396-401.

Wasserman, S., & Pattison, P. (1996). Logit models and logistic regressions for social networks: I. An introduction to Markov graphs and p. *Psychometrika*,*61*(3), 401-425.

Watson, P. J., Grisham, S. O., Trotter, M. V., & Biderman, M. D. (1984). Narcissism and empathy: validity evidence for the narcissistic personality inventory. *Journal of Personality Assessment, 48,* 301-305. doi: 10.1207/s15327752jpa4803_12

Windingstad, S., McCallum, R. S., Bell, S. M., & Dunn, P. (2011). Measures of emotional intelligence and social acceptability in children: A concurrent validity study. *Canadian Journal of School Psychology*, *26*(2), 107-126.

Wurst, S., Gerlach, T.M., Dufner M., Rauthman, J.F., Küfner A.C.P, Denissen J.J.A, & Back, M.D. (2016).The two Faces of the Narcissistic Lover: Differential Impacts of Narcissistic Admiration and Rivalry on Relationship Outcomes.*Journal of Personality and Social Psychology, revise and resubmit*.

Zeigler-Hill, V., Besser, A., Myers, E. M., Southard, A. C. and Malkin, M. L. (2013), The Status-Signaling Property of Self-Esteem: The Role of Self-Reported Self-Esteem and Perceived Self-Esteem in Personality Judgments. *Journal of Personality, 81*, 209–220. doi: 10.1111/j.1467-6494.2012.00790.x

Zweigenhaft, R. L. (1977). The empirical study of signature size. *Social Behavior and Personality, 5,* 177-185.

Zweigenhaft, R. L., Marlowe, D. (1973). Signature size: Studies in expressive movement. *Journal of Consulting and Clinical Psychology*, *40,* 469-473.

<u>Appendix</u>

Details on the applied ERGMs:

The probability density function of the ERGM is given by

$$P(N, \boldsymbol{\theta}) = \frac{\exp\{\boldsymbol{\theta}^{\mathrm{T}}\mathbf{h}(N)\}}{\sum_{N^* \in \mathcal{N}} \exp\{\boldsymbol{\theta}^{\mathrm{T}}\mathbf{h}(N^*)\}}$$

where N is a binary $m \times m$ network matrix with positive values representing friendship ties between the row node and the column node, the $\boldsymbol{\theta}$ vector denotes the parameters of the model terms, the **h** vector contains the model terms, and the denominator represents the same sum of weighted statistics as the numerator, over all the network configurations one could have observed (Cranmer & Desmarais 2011; Cranmer, Leifeld, McClurg, & Rolfe, 2016). In the analysis, the user's task is to specify the exogenous and endogenous effects, or h statistics, that contribute to the topology of the network.

The h statistics permit inclusion of both exogenous covariates—as in a dyadic regression model—and endogenous network statistics defined over the network matrix N. These network statistics represent tendencies of the network to exert local dependencies, such as reciprocity, transitivity, cyclical triads, open triads, and arbitrary other structures. Including the right set of network statistics in a model is part of the model-building process, just like inclusion of the exogenous model terms that represent the hypotheses of interest. For each model term, including exogenous and endogenous terms, a parameter is estimated.

The TERGM can employ the same sufficient statistics as an ERGM and may additionally contain dependencies over time or between groups. The probability density function of the TERGM is given by

$$P(N^{K+1}, \dots, N^T | N^1, \dots, N^K, \boldsymbol{\theta}) = \prod_{t=K+1}^{T} \frac{\exp\{\boldsymbol{\theta}'\mathbf{h}(N^t, N^{t-1}, \dots, N^{t-K})\}}{\sum_{N^{T^*} \in \mathcal{N}^T} \exp\{\boldsymbol{\theta}'\mathbf{h}(N^{t-K^*}, \dots, N^{t-1^*})\}}$$

where *K* is the number of time steps in the past on which any current network depends, and *T* denotes the number of time steps at which the network is observed. The TERGM multiplies the individual network probabilities to obtain the probability of the list of consecutive networks, and each individual network probability can (but need not) depend on the previous network observations (Hanneke, Fu and Xing 2010). Dependency statistics must be specified such that both the dyads within a network and the networks over time are independent conditional on the model terms that capture the dependence.

The TERGM was chosen over a competing method called the stochastic actor-oriented model (SAOM) (Snijders, Steglich, & van de Bunt 2010) because the SAOM primarily serves to model the Markovian dependence between two (or more) time points of a single network while we were interested in explaining ties and network structure by pooling across 15 completely independent networks. Pooling across these independent networks in the TERGM also enabled us to ameliorate some of the issues with panel attrition whereas the SAOM is troubled by strong composition change. The TERGM modeling strategy allowed us to estimate a single model of network structure across two time steps of fifteen independent networks and model changes over time using interaction effects with time, which is a somewhat unusual setup. Therefore the recommendation of Leifeld and Cranmer (2016) to estimate and compare both models using out-of-sample prediction is not a feasible strategy in this specific context.

Goodness of fit assessment

TERGMs are only valid if the endogenous network statistics indeed capture the endogenous dependencies (Leifeld, Cranmer, & Desmarais, 2016; Cranmer et al. 2016). Therefore we simulated 100 new networks in lieu of each observed network based on the model parameters and covariates and compared the observed network with the simulations. For comparison, we employed several typical network characteristics: the distributions of dyad-wise shared partners, edge-wise shared partners, geodesic (= shortest path) distances, indegree centrality, various triadic configurations, and modularity (with the Walktrap algorithm; Pons & Latapy 2006). If the distributions of these statistics approximately match the observed distributions of the same statistics, one can be confident that the endogenous part of the data-generating process has been captured well. Details on this goodness of fit procedure can be found in Hunter, Goodreau, & Handcock (2008).

Figure 4 displays the goodness of fit comparison for the model presented above. The gray boxplots of the first five panels represent the simulations, and the solid and dashed black lines represent the median and mean of the observed networks. With very few exceptions and some random variation, the model captures the endogenous properties of the network very well. The sixth panel displays the distribution of modularity for the simulated networks (histogram and left vertical bar) and the observed networks (density curve and right vertical bar). Modularity measures the tendency of the network to have multiple dense clusters (Newman 2006). The modularity of the observed networks is represented reasonably well by the model.