

A Net of Friends: Investigating Friendship by Integrating Attachment Theory and Social Network Analysis

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Abstract

The current article focuses on attachment style—an individual difference widely studied in the field of close relationships—and its application to the study of social networks. Specifically, we investigated whether attachment style predicts perception and management of social networks. In Study 1, we examined the associations of attachment style with perceptions of network tie strength and multiplexity. In Studies 2a and 2b, we investigated the association between attachment style and network management skills (initiating, maintaining, and dissolving ties) and whether network management skills mediated the associations of attachment style with network tie strength and multiplexity. In Study 3, experimentally enhancing attachment security made people more likely to initiate and less likely to dissolve social ties (for the latter, especially among those high on avoidance or anxiety). As for maintenance, security priming also increased maintenance; however, mainly among people high on attachment anxiety or low on attachment avoidance.

Keywords

social networks, attachment, tie strength, multiplexity, friendship, priming

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Social networks play a central role in people's life and confer a multitude of benefits. For example, being a part of a social network is correlated with greater self-esteem and positive affect (e.g., Valkenburg, Peter, & Schouten, 2006), better mental and physical health (e.g., Berkman, Glass, Brissette, & Seeman, 2000), and greater life expectancy (Iyer, Jetten, Tsivrikos, Postmes, & Haslam, 2009). These benefits are largely a function of the *characteristics* of people's social networks, such as the extent to which network members are perceived as close (termed *tie strength*) or the extent to which network members are called upon to fulfill various social and emotional functions (termed *multiplexity*).

People, however, differ in the way they perceive and hence utilize their networks (Muscanell & Guadagno, 2012). For example, individual differences in trust may lead people to be more or less likely to rely on their network members for support in times of stress. To better understand the role of individual differences, one needs to combine traditional sociological research on networks with psychological research on individual differences (Kadushin, 2011). The studies undertaken and described as part of this paper do this by integrating attachment theory (Bowlby, 1969/1982), a leading theoretical framework used to study individual differences in close relationships (see reviews Cassidy & Shaver, 2016; Gillath, Karantzas, & Fraley, 2016) with constructs and

methods from social networks research. Specifically, we investigated here the extent to which individual differences in attachment style (i.e., people's sense of security in close relationships) predict how people characterize and manage their social networks.

Individual Differences in Attachment Style

Individual differences in attachment style reflect the extent to which people feel comfortable depending on others (attachment avoidance) and the extent to which they worry about being abandoned (attachment anxiety; Brennan, Clark, & Shaver, 1998). Those who score high on one or both of these dimensions have an insecure attachment style, whereas those who score low on both dimensions have a secure attachment style (Brennan et al., 1998; we use the terms attachment style

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and attachment dimensions interchangeably—style for short and dimensions when we need to differentiate anxiety vs. avoidance.)

To date, attachment style has been largely studied in terms of its associations with dyadic processes (e.g., infant–caregiver or adult pair bonds). We propose that attachment style is also likely to shape the characteristics of people’s social networks, including how close network members are perceived to be and what social roles network members fulfill (e.g., support seeking, spending time together). We further predict that attachment style shapes individuals’ network management skills and tendencies—the extent to which individuals initiate, maintain, or dissolve social ties. The management of social ties, in turn, may affect the characteristics of people’s networks. For example, a network where old ties are constantly replaced with new ones might be less closely knit.

Individual Differences in Social Network Characteristics and Management

A social network is defined as a relational system characterized by a set of people and their social ties to one another (van Duijn & Vermunt, 2006). Social networks can be comprised of different people such as colleagues, friends, or attachment figures. In the current work, we focus on people’s friendship networks—a primary source of emotional support and comfort, instrumental help, knowledge, and entertainment in daily life (Buote et al., 2007; Potts, 1997).

Network Characteristics

Any given social network has specific characteristics such as size or how connected network members are to one another that make it unique when compared to another person’s network (e.g., Antonucci, Akiyama, & Takahashi, 2004). Two widely studied network characteristics, which are central for friendship networks and their associations with attachment style are tie strength and multiplexity (Lewin, 1935; see also Parks, 2006). *Tie strength* refers to the extent that network members feel close to one another (Granovetter, 1973). The higher the tie strength, the higher the perceived or felt closeness between network members. *Multiplexity* refers to the number of social functions network members fulfill, such as meeting emotional or instrumental needs (e.g., Campbell, Marsden, & Hurlbert, 1986). The number of functions fulfilled—one’s multiplexity score—represents trust in that an individual can confidently rely on another to fulfill multiple roles and functions (Husted, 1994; Ibarra, 1995; Powell, 1991). The faith and dependability that an individual has in another (concepts fundamental to trust, Rempel & Holmes, 1985) is likely to be reflected in allowing a network member to fulfill more functions. It is also likely to be reflected in that

people low on trust will be less likely to allow others to fulfill multiple functions. Furthermore, the more functions each member fulfills, the more positively the social network is perceived and the more benefits (e.g., emotional support, instrumental help, improved health) the network is thought to provide (e.g., Kruglanski et al., 2002; Lewin, 1935).

We focus on tie strength and multiplexity because not only are they central to social networks research but also they align nicely with the issues of *closeness* and *trust*. These two concepts are central to attachment theory and attachment style (Brennan et al., 1998). People high on attachment anxiety tend to focus on closeness-related issues, often perceiving their relationships as lacking closeness. Conversely, people high on attachment avoidance tend to be more concerned with issues related to trust and dependence, tending to distrust others in fulfilling their attachment needs (Brennan et al., 1998). Level of trust in others in fulfilling one’s needs can be nicely captured using multiplexity—higher trust manifesting in more functions fulfilled by each member.

Tie strength and multiplexity can be examined via complete network analysis (i.e., every member of a given network reports on the associations with every other network member) or egocentric network analysis (i.e., an individual [termed the *ego* in the social networks literature] reports on his or her associations with each network member and the associations among network members). Here we took the latter approach focusing on egocentric friendship networks. Using data reported by each participant, we calculated network characteristics and analyzed how attachment style is linked to network characteristics and network management tendencies.

Network Management

Network management is a relatively less studied construct, especially with regard to individual differences such as attachment style. Of the work that has been conducted, Kadushin (2011) and others (e.g., Milardo, 1988) have suggested that the management of people’s social ties is driven largely by tendencies regarding the *initiation* of new relationships, the *maintenance* of existing ties, and the *dissolution* of ties that are no longer deemed close or no longer fulfill important social functions (see also Carstensen, 1993). Drawing on this literature, we hypothesize that people’s tendencies of initiating, maintaining, and dissolving social ties—their social network management skills—are likely to be associated with both social network characteristics and attachment style.

People with different attachment styles have different tendencies when it comes to affiliation (Mikulincer & Selinger, 2001)—or the management of their social ties. Individuals who are anxiously attached and strive for closeness are likely to be high on initiation and maintenance, whereas individuals who are avoidantly attached and tend to avoid intimacy are likely to be low on these skills or tendencies but high on dissolution.

The Present Study: Linking Attachment Style to Social Networks

Little empirical work has followed up Henderson's (1977) suggestion to integrate an attachment perspective as part of social networks research (e.g., Wallace & Vaux, 1993). In the few studies done to date, researchers have applied attachment theory to study various aspects of social networks such as people's perceptions of their closeness to network members (e.g., Antonucci et al., 2004; Doherty & Feeney, 2004; Rowe & Carnelley, 2005). Most of these studies, however, have focused on a very specific type of social network—networks comprised of the people who fulfill one's attachment needs for love, comfort, and security—termed *attachment networks* (e.g., Doherty & Feeney, 2004; Karantzas & Cole, 2011; Rowe & Carnelley, 2005) rather than on one's broader network. For example, Rowe and Carnelley (2005) showed that secure individuals mapped network members as closer to themselves (on a bull's eye diagram with the self in the center) as compared with insecure individuals. These findings suggest that insecurity is likely to be negatively associated with closeness-based indices such as tie strength.

Our studies are designed to go beyond existing findings that often focus on individual differences in attachment as they relate to a particular dyad or a discrete set of attachment figures (for a review, see Gillath et al., 2016). The present work examines whether what we know about adult attachment can be extended to other network members. To date, it is unknown whether the cognitions and behaviors that characterize attachment anxiety and avoidance in dyadic relationships extend to perceptions and interactions with network members and how perceptions color the appraisals of the closeness between alters. Much of the background and rationale we provide regarding tie closeness reflects "assumed" knowledge about how attachment style may affect social networks. Across the current set of studies, we test these assumptions.

Another limitation of existing research is that it does not integrate traditional social network techniques and indices (Kadushin, 2011) used in sociological research. Consequently, the capacity to comprehensively map the structure and functioning of social networks using multiple indices (i.e., tie strength and multiplexity), as well as to understand the management of these networks, is limited.

To address these gaps, we conducted four studies on the associations between attachment style, social network characteristics, and network management. In Study 1, we investigated the direct associations between attachment style, tie strength, and multiplexity. In Study 2a, we examined the associations between attachment style and network management skills, and the mediating role of management skills in the association between attachment style and tie strength. In Study 2b, we similarly examined the mediating role of network management skills, this time in the association between attachment style and multiplexity. Finally, in Study 3, we

used experimental methods to investigate causality and directionality in the associations between attachment style, network management, and tie strength and multiplexity.

Study 1

In Study 1, we focused on the associations between friendship networks characteristics (tie strength and multiplexity) and attachment style. As tie strength represents closeness in networks, we propose (Hypothesis 1.1) that attachment anxiety will be the primary dimension of interest and that highly anxious individuals will perceive their social network as low in tie strength.

In contrast, when examining multiplexity, we expect that attachment avoidance will be the primary dimension of interest. The number of functions others fulfill for the self is thought to represent the degree of trust—the more functions fulfilled, the higher the trust (Lewin, 1935). Given that individuals high on avoidance are less likely to trust others, we expect these individuals to ascribe *fewer* social roles to network members, that is, they will report lower multiplexity (Hypothesis 1.2).

Method

Participants. One hundred thirty-two undergraduate students (85 women, aged 18 to 27 years old, $Mdn = 18$) from a large Midwestern university in the United States participated in the study. The vast majority of the participants (87%) were Caucasian. Participants received course credit in exchange for participation.

Materials and procedure. Participants were recruited from the participant pool of the psychology department and run in small groups of four to thirteen people. They were told that the study was about personality and relationships. After completing measures assessing their online friendship networks (i.e., Facebook friends), participants completed measures of attachment style and personality traits as a part of a larger battery (see Online Appendix 1).

Name generators and interpreters. *Name generators* are the standard method to enumerate networks and outline the structure and characteristics of egocentric networks (Marin & Hampton, 2007). Name generators are administered through surveys or interviews. Participants are given one or more questions and are asked to list network alters (all network members bar the participant themselves). These alters can be the people with whom they discuss important matters (Burt, 1984) or the people with whom they chat or visit (Campbell & Lee, 1991). Once a list of names is generated, participants are presented with a series of *name interpreters*: questions that gather information on the demographic characteristics of each alter, the relationship between the participant and each alter, and the relationships between the alters (see Online

Appendix 1). The data collected through name generators and interpreters provide profiles of respondents' personal network members that can be aggregated into measures of network composition such as tie strength and multiplexity.

Based on previous research showing that five name generators assessing emotional support, instrumental support, and social companionship explain 80% to 85% of variance in network size (Schenk, 1995) and recent research showing that offline and online networks share similar characteristics (Dunbar, Arnaboldi, Conti, & Passarella, 2015), we asked participants in the current study to list their Facebook friends who fulfilled one or more of the following social functions: sharing social activities, discussing personal matters, providing instrumental support, providing emotional support, and sharing success and happy events. We asked participants to provide a separate list of names for each of the five social functions. Participants were allowed to list a network member on more than one list if they thought the network member fulfilled more than one function. The total number of friends participants generated in response to all five name generators ranged from 2 to 30 ($Mdn = 10$). To reduce fatigue that might occur due to providing information about each friend, and in line with past research (see Gerich & Lehner, 2006), we asked participants to select the 10 people who were the most important to them rather than provide information on all their alters. Participants were allowed to select any 10 people who fit the criteria.

Tie strength. Participants rated how close they felt to each network member, followed by their perceptions of how close each network member felt towards them. Finally, they rated their perception of the closeness between all pairs of network members. These items were rated on a 7-point scale ranging from 1 (*not very close*) to 7 (*very close*).

Multiplexity. We calculated a multiplexity score by counting the number of functions fulfilled by each alter in a participant's social network (Gerich & Lehner, 2006). For example, the alters received a score of "5" if they were listed on all five name generators, a score of "4" if they were listed on four name generators, and so on. The resulting possible multiplexity scores for each alter ranged from 1 to 5, with higher scores indicating a greater number of functions fulfilled by the alter.

Attachment style. Participants completed a shortened 16-item version of the Experiences in Close Relationships Inventory (ECR; Brennan et al., 1998; see also Lo et al., 2009). Eight items assessed attachment-related anxiety (e.g., "I worry about being rejected or abandoned," $\alpha = .83$) and eight items assessed attachment-related avoidance (e.g., "I prefer not to show others how I feel deep down," $\alpha = .87$). The dimensions were positively correlated ($r = .34, p < .001$). Participants rated the items on a 7-point scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*).

Data Analytic Strategy

To conduct our analyses, we first calculated the indices for tie strength and multiplexity.

Tie strength. We calculated perceived tie strength with the following formula:

$$t = \frac{\sum_{i=1}^n (Wi + Xi + Yi)}{n},$$

where Y_i represents the ego's perceptions of closeness to each alter (rated from 1 to 7), X_i represents the ego's perceptions of each alter's closeness to the ego (also rated from 1 to 7), W_i reflects the ego's perceptions of closeness between alters, and n is number of alters (e.g., Krackhardt, 1987; Wasserman & Faust, 1994).

Multiplexity. We calculated multiplexity with the following formula:

$$m = \frac{\sum_{i=1}^n (Xi)}{n},$$

where X_i represents the number of functions fulfilled by each alter, and n is the number of alters.

Results and Discussion

We conducted a series of hierarchical multiple regression analyses to estimate the associations between attachment style and network characteristics. Tables 1 to 4 present the descriptive statistics and intercorrelations for the variables included in these analyses. Because network size is typically controlled for in social network analysis (Prell, 2012), we included mean-centered network size in the first step of the analysis along with attachment anxiety and avoidance. We entered the two-way interaction between attachment anxiety and avoidance in the second step.¹ We estimated power to detect a moderate effect size ($r = .30$) using G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) and found our study to have high power (.94).²

Tie strength. The overall model was significant, $F(4, 127) = 16.15, p < .001$. All three predictor variables (attachment anxiety, attachment avoidance, and network size) were negatively associated with tie strength (see Table 5), that is, individuals high on attachment anxiety, attachment avoidance, or reporting a large network size perceived their network to be lower in tie strength. The addition of the interaction between anxiety and avoidance did not improve the model.

Table 1. Descriptive Statistics for Study 1 ($N = 132$).

	1	2	3	4	5
1. Network size	—				
2. Anxiety	.02	—			
3. Avoidance	.08	.34**	—		
4. Tie strength	.10	-.21*	-.37**	—	
5. Multiplexity	.11	.01	-.21*	.13	—
<i>M</i>	11.03	3.39	2.96	4.10	3.31
<i>SD</i>	5.08	1.16	1.16	0.63	1.12

Note. Anxiety = attachment anxiety; Avoidance = attachment avoidance.

* $p < .05$. ** $p < .01$.

Multiplexity. We conducted a second hierarchical multiple regression analysis to predict multiplexity. The overall model was again significant, $F(4, 127) = 5.64, p < .001$. Attachment avoidance and network size were significantly negatively associated with multiplexity (see Table 5). The effect of attachment anxiety was not significant. The two-way interaction between attachment anxiety and avoidance did not improve the model.

Study 1 provided initial support for the associations between attachment insecurity and perceived network characteristics. Specifically, attachment anxiety was negatively associated with tie strength (Hypothesis 1.1). Although our results are consistent with research on attachment at the dyadic level, where attachment anxiety was found to be negatively associated with closeness to attachment figures, they go beyond existing findings providing the first evidence linking attachment style to network characteristics.

Specifically, the findings suggest that as anxious people constantly try to get closer to people in their social network, their actions may actually push others away, as network members may feel smothered (e.g., Simpson & Rholes, 2012). Thus, anxious people's perception may reflect the reality. Alternatively, the high desire for love and excessive reassurance seeking may bias anxious individuals' perceptions of network members, making the members appear not as close as anxious people would like them to be (Brennan et al., 1998; Simpson & Rholes, 2012).

Avoidant attachment was negatively associated with multiplexity (Hypothesis 1.2). This finding is in line with avoidant people's tendency to distance themselves from, and not to depend on, others (Collins & Feeney, 2004; Rowe & Carnelley, 2005). A lower multiplexity indicates that on average participants high on avoidance perceive people in their network to fulfill fewer roles or functions (or perceive fewer people to fulfill multiple roles). By allowing each friend to fulfill only one or a smaller number of functions than nonavoidant individuals, avoidant individuals reduce their dependence on each specific friend. This potentially reduces their concerns regarding trust and reliance.

This finding is consistent with the reluctance of people high on avoidance to trust and depend on others due to their enduring concerns regarding rejection or relationship dissolution. The result also fits with the social networks literature showing positive associations between multiplexity, trust (Husted, 1994; Ibarra, 1995; Powell, 1991), and interdependence (Degenne & Forsé, 1999). Here, we extend on these literatures by demonstrating that avoidantly attached people's reluctance to trust and depend on others generalizes to social networks, thereby manifesting as a tendency to assign fewer functions per network member or to perceive each network member as fulfilling fewer social roles and functions.

Attachment avoidance was also negatively correlated with tie strength. Although we did not expect this a priori, this finding does fit with existing literature. Attachment avoidance is characterized by a discomfort with closeness (Brennan et al., 1998; Gillath et al., 2016). Individuals high on attachment avoidance may, therefore, perceive their network ties to lack closeness as a function of their own concerns and worries about becoming too close to others—we elaborate on this in the general discussion.

Study 2a

People differ in their tendencies to form new ties, maintain current ties, or relinquish existing ones (e.g., Schug, Yuki, Horikawa, & Takemura, 2009). In Study 2, we examined whether attachment anxiety and avoidance are associated with the way people manage their friendship network, and specifically, their tendencies to initiate, maintain, and dissolve network ties.

These tendencies and abilities, which together we refer to as *network management skills*, affect the way people affiliate with others and hence the way their networks are structured. For example, initiation of many new ties may prevent people from developing close relationships with network members (e.g., Xu, Ryan, Prybutok, & Wen, 2012) and may decrease network tie strength. The combination of high initiation and high dissolution can create a high turnover (a revolving door) in one's social network, which could also result in low tie strength as individuals have limited opportunity and time to forge close relationships. As with network characteristics, we argue that attachment style would predict people's network management skills. Individuals high on attachment anxiety strive for closeness and are hence likely to be high on initiation and maintenance, whereas those high on avoidant attachment tend to avoid intimacy, and hence likely to be low on these skills/tendencies and high on tie dissolution.

Our second goal in Study 2 was to examine whether network management skills mediate the associations between attachment style and network characteristics. Specifically, we examined whether network management skills mediated the associations between attachment anxiety and tie strength (Study 2a) and the associations between attachment avoidance and multiplexity (Study 2b).

Table 2. Descriptive Statistics for Study 2a (N = 101).

	1	2	3	4	5	6	7
1. Network size	—						
2. Anxiety	-.03	—					
3. Avoidance	-.02	.20*	—				
4. Maintain	.29**	-.06	-.43**	—			
5. Initiate	.26**	.28**	-.57**	.57**	—		
6. Dissolve	-.20*	.25*	.58**	-.54**	-.49**	—	
7. Tie strength	.00	-.23*	-.28**	.21*	.22*	-.31**	—
M	10.14	3.43	2.76	4.81	5.31	3.08	5.38
SD	3.94	1.13	1.07	1.07	1.28	1.30	0.67

Note. Anxiety = attachment anxiety; Avoidance = attachment avoidance.

*p < .05. **p < .01.

Table 3. Descriptive Statistics for Study 2b (N = 114).

	1	2	3	4	5	6	7	8
1. Network size	—							
2. Anxiety	-.15	—						
3. Avoidance	-.13	.17	—					
4. Maintain	.00	.20*	-.26**	—				
5. Initiate	.03	.24*	-.23*	.18*	—			
6. Dissolve	-.07	-.10	.47**	-.42**	-.20*	—		
7. Multiplexity	-.40**	.08	-.38**	.32**	.16	-.30**	—	
8. Tie strength	.06	-.20*	-.24**	.19*	.20*	-.28**	.11	—
M	11.63	3.65	2.80	4.83	4.92	3.06	2.15	5.59
SD	6.52	1.12	1.02	1.11	1.23	1.09	1.02	0.80

Note. Anxiety = attachment anxiety; Avoidance = attachment avoidance.

*p < .05. **p < .01.

Table 4. Descriptive Statistics for Study 3 (N = 80).

	1	2	3	4	5	6	7	8	9
1. Network size	—								
2. Anxiety	.03	—							
3. Avoidance	-.07	.51**	—						
4. Prime	-.09	.06	.10	—					
5. Initiate	.03	-.12	-.26*	.28*	—				
6. Maintain	.12	-.10	-.13	-.12	.35**	—			
7. Dissolve	-.08	.46**	.31**	-.18	-.06	-.30*	—		
8. Tie strength	-.17	-.11	-.04	-.02	.13	-.06	-.28*	—	
9. Multiplexity	-.21	.06	-.33**	-.04	.03	.05	-.38**	.47**	—
M	5.35	3.22	3.56	—	5.08	4.05	3.69	5.74	2.05
SD	1.41	0.92	0.95	—	1.11	1.21	1.10	0.69	0.90

Note. Anxiety = attachment anxiety; Avoidance = attachment avoidance.

*p < .05. **p < .01.

Based on the literature and Study 1, we hypothesized in Study 2a that attachment anxiety will be positively associated with tie initiation and maintenance (Hypothesis 2a.1), attachment avoidance will be negatively associated with tie initiation and maintenance and positively associated with tie dissolution (Hypothesis 2a.2), and the association between

attachment anxiety and tie strength will be mediated by network management skills (Hypothesis 2a.3). The associations we found between avoidance and tie strength in Study 1 were not in line with our hypotheses. Hence, before making further predictions about these associations, we wanted to examine whether these associations would replicate.

Table 5. Hierarchical Regression Analyses Predicting Network Characteristics in Study 1.

Variables	Tie strength							Multiplexity						
	95% CI							95% CI						
	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	β	LB	UB	R ²	ΔR^2
Step 1														
Att. Anx.	-.08	.04	-.17*	-.10	-.30	.33***		.00	.06	.00	-.12	.06	.14***	
Att. Av.	-.22	.04	-.47***	-.38	-.89			-.20	.06	-.28*	-.20	-.49		
Network size	-.05	.02	-.18*	-.15	-.34			-.10	.03	-.25*	-.20	-.46		
Step 2														
Att. Anx.	-.07	.04	-.15*	-.11	-.26	.34***	.01	-.01	.06	-.01	-.13	.04	.14***	.00
Att. Av.	-.22	.04	-.47***	-.39	-.89			-.20	.06	-.28*	-.40	-.49		
Network size	-.05	.02	-.19*	-.13	-.36			-.10	.03	-.25*	-.31	-.46		
Att. Anx. \times Att. Av.	.03	.03	.07	-.01	.17			-.01	.05	-.02	-.12	.01		

Note. CI = confidence interval; LB = lower bound; UB = upper bound; Att. Anx. = attachment anxiety; Att. Av. = attachment avoidance.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Method

Participants. One hundred one undergraduate students (56 women, aged 18 to 26 years old, $Mdn = 22$) from a large Midwestern university in the United States participated in the study in exchange for course credit. Approximately, 84% of participants were Caucasian.

Measures and procedure. Participants were asked to complete a battery of questionnaires. They were told that the study was about personality and relationships. Participants completed measures of attachment style, networks management skills, and network characteristics as a part of a larger battery in the laboratory.

The collection of data for Study 2a utilized the same measures used in Study 1, with the exception that the name generator was limited to listing 15 network members (this time face-to-face friendships rather than Facebook friends) and there were no questions assessing multiplexity. Perceived tie strength was assessed and calculated using the methods outlined in Study 1, while attachment style was measured using a 12-item short form of the ECR developed by Wei, Russell, Mallinckrodt, and Vogel (2007). Cronbach's alphas were .72 and .75 for anxiety and avoidance, respectively, the two dimensions were positively correlated ($r = .20, p < .05$).

To assess network management skills, we used a short version of the Network Management Inventory (NMI; Gillath, Johnson, Selcuk, & Teel, 2011). Both the original and our shortened version of the NMI consist of three subscales, each measuring a different network management skill: initiating ties (e.g., "I like meeting new people"), maintaining ties (e.g., "I keep my contact with my old social network members"), and dissolving ties (e.g., "It is easy for me to let go of old friends"). The shortened NMI consists of five items per subscale, and each item is rated on a 7-point scale ranging from 1 (*not at all*) to 7 (*very much*). The measure demonstrated good

fit to the sample data, $\chi^2(86) = 126.84, p < .05$; comparative fit index (CFI) = .946; Tucker-Lewis index (TLI) = .935; root mean square error of approximation (RMSEA) = .069; standardized root mean square residual (SRMR) = .064, and all subscales demonstrated adequate internal consistency for the current study ($\alpha s = .73-.85$). It is important to note that the NMI is not a behavioral measure but rather a self-report measure of tendencies and intentions.

Results and Discussion

We conducted a series of preliminary analyses to determine whether the direct associations between the attachment dimensions and network characteristics found in Study 1 were replicated in the current study. The findings indeed replicated Study 1; attachment anxiety was significantly negatively associated with tie strength ($\beta = -.21, p < .01$); however, attachment avoidance was also negatively associated with tie strength ($\beta = -.25, p < .01$).

We then conducted three hierarchical multiple regressions to determine the contribution of attachment style to the management of social networks (Hypotheses 2a.1 and 2a.2; see Tables 1 to 4 for descriptive statistics and intercorrelations for the variables included in these analyses). We included network size and attachment anxiety and avoidance in the first step and the interaction between attachment anxiety and avoidance in the second step. We estimated power using the same method used in Study 1. Our power to detect an association of $r = .30$ was .87.

The hierarchical regression predicting initiation of social ties was significant, $F(4, 96) = 21.50, p < .001$. Network size and attachment anxiety were positively associated, whereas attachment avoidance was negatively associated with initiation (Table 6). For the regression predicting maintenance of ties, the model was significant, $F(4, 96) = 10.17, p < .001$. Network size was positively associated, whereas attachment

Table 6. Hierarchical Regression Analyses Predicting Network Management Strategies in Study 2a.

Variables	Initiating ties										Maintaining ties										Dissolving ties									
	95% CI					95% CI					95% CI					95% CI					95% CI									
	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	β	LB	UB	R ²	ΔR^2		
Step 1																														
Att. Anx.	.26	.09	.22**	.18	.26	.47***		.03	.09	.03	-.01	.07	.28**	.02	.22	.10	.19*	.15	.23	.47**		.22	.10	.19*	.15	.23	.47**			
Att. Av.	-.77	.09	-.63***	-.67	-.58		-.33	.09	-.34***	-.38	-.30				.57	.09	.49**	.45	.53											
Network size	.09	.02	.28***	.24	.32		.07	.03	.24**	.20	.29				-.05	.03	-.15	-.19	-.11											
Step 2																														
Att. Anx.	-.02	.25	-.02	-.06	.03	.47***	.00	-.33	.25	-.34	-.38	-.30	.30**		.23	.27	.20	-.02	.24	.47**	.00									
Att. Av.	-1.08	.28	-.88***	-.92	-.84		-.57	.30	-.75***	-.79	-.71				.58	.30	.50	-.03	.54											
Network size	.10	.02	.29***	.25	.33		.07	.02	.25**	.21	.30				-.05	.03	-.15	-.19	.01											
Att. Anx. x Att. Av.	.10	.09	.39	-.03	.43		.13	.09	.62	-.04	.66				.00	.09	-.01	-.05	.03											

Note. CI = confidence interval; LB = lower bound; UB = upper bound; Att. Anx. = attachment anxiety; Att. Av. = attachment avoidance.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 7. Specific Indirect Effects for the Association Between Attachment, Network Management, Tie Strength, and Multiplexity (Studies 2a, 2b, and 3).

Indirect effect	Estimate	SE	95% CI (LB)	95% CI (UB)
Study 2a				
Att. Anx. → Initiate ties → Tie strength	-.0129	.0222	-.0626	.0270
Att. Anx. → Maintain ties → Tie strength	-.0009	.0179	-.0466	.0332
Att. Anx. → Dissolve ties → Tie strength	-.1758**	.0649	-.3222	-.0616
Att. Av. → Initiate ties → Tie strength	-.1732*	.0856	-.3838	-.0267
Att. Av. → Maintain ties → Tie strength	.0101	.0562	-.0466	.0332
Att. Av. → Dissolve ties → Tie strength	-.2121**	.0831	-.3961	-.0703
Study 2b				
Att. Anx. → Initiate ties → Multiplexity	.0015	.0261	-.0459	.0643
Att. Anx. → Maintain ties → Multiplexity	.0383	.0373	-.0277	.1203
Att. Anx. → Dissolve ties → Multiplexity	-.0037	.0182	-.0407	.0340
Att. Av. → Initiate ties → Multiplexity	.0010	.0185	-.0396	.0388
Att. Av. → Maintain ties → Multiplexity	-.0601**	.0300	-.1227	-.0067
Att. Av. → Dissolve ties → Multiplexity	-.1224***	.0488	-.2297	-.0390
Study 3				
Att. Anx. → Initiate ties → Tie strength	-.0558*	.0045	-.2200	-.0018
Att. Anx. → Maintain → Tie strength	.0001	.0068	-.0148	.0163
Att. Anx. → Dissolve ties → Tie strength	-.0886**	.0390	-.1913	-.0240
Att. Anx. → Initiate ties → Multiplexity	-.0167	.0176	-.590	.0091
Att. Anx. → Maintain → Multiplexity	.0007	.0103	-.0626	.0168
Att. Anx. → Dissolve ties → Multiplexity	-.0957**	.0360	-.1837	-.0394
Att. Av. → Initiate ties → Tie strength	.0013	.0140	-.0269	.0338
Att. Av. → Maintain ties → Tie strength	-.0007	.0097	-.0221	.0199
Att. Av. → Dissolve ties → Tie strength	-.0986**	.0410	-.1913	-.0322
Att. Av. → Initiate ties → Multiplexity	.0010	.0124	-.0289	.0283
Att. Av. → Maintain ties → Multiplexity	-.0266*	.0110	-.0951	-.0003
Att. Av. → Dissolve ties → Multiplexity	-.0893*	.0410	-.1811	-.0221
Prime × Att. Anx. → Initiate ties → Tie strength	-.0182	.0163	-.0518	.0104
Prime × Att. Anx. → Maintain ties → Tie strength	-.0020	.0191	-.0425	.0364
Prime × Att. Anx. → Dissolve ties → Tie strength	-.0943**	.0046	-.2017	-.0205
Prime × Att. Anx. → Initiate ties → Multiplexity	-.0140	.0169	-.0567	.0113
Prime × Att. Anx. → Maintain ties → Multiplexity	-.0176	.0205	-.0626	.0168
Prime × Att. Anx. → Dissolve ties → Multiplexity	-.1434**	.0700	-.3276	-.0385
Prime × Att. Av. → Initiate ties → Tie strength	.0051	.0158	-.0285	.0385
Prime × Att. Av. → Maintain ties → Tie strength	.0004	.0098	-.0190	.0236
Prime × Att. Av. → Dissolve ties → Tie strength	-.1279**	.0561	-.2752	-.0408
Prime × Att. Av. → Initiate ties → Multiplexity	.0039	.0151	-.0260	.0391
Prime × Att. Av. → Maintain ties → Multiplexity	.0039	.0132	-.0174	.0383
Prime × Att. Av. → Dissolve ties → Multiplexity	-.1585**	.0710	-.3393	-.0526

Note. CI = confidence interval; LB = lower bound; UB = upper bound; Att. Anx. = attachment anxiety; Att. Av. = attachment avoidance; Prime = priming condition (0 = neutral, 1 = security prime).

* $p < .05$. ** $p < .01$. *** $p < .001$.

avoidance was negatively associated with maintenance. For the regression predicting dissolution of network ties, the model was also significant, $F(4, 96) = 17.58, p < .001$. Both attachment anxiety and avoidance were positively associated with dissolution. The inclusion of the two-way interaction in Step 2 had no significant effect in any of the above mentioned analyses.

Indirect associations. To determine the extent to which network management skills mediated the association between

attachment anxiety and tie strength (Hypothesis 2a.3), we conducted a multiple mediation analysis. Following Hayes and Preacher's (2014) recommendations when testing multiple mediation we calculated specific indirect effects. This was done by bootstrapping the sample to 1000 replications and estimating the bias-corrected 95% confidence intervals for the indirect associations. The dissolution of ties was found to mediate the associations between attachment anxiety and tie strength (Table 7). Specifically, attachment anxiety was positively associated with reporting more dissolution

of ties, and in turn, the tendency to report more dissolution of ties was negatively associated with tie strength.

Although we predicted that anxiously attached people's concerns about abandonment and rejection might make them more inclined to maintain relationships, their incessant desire and the need for closeness can make relationship maintenance difficult. Friends may feel smothered and pull away or even end the relationship due to the overbearing nature of anxiously attached individuals. Furthermore, anxiously attached people are known to be ambivalent in their approach to significant others, often perceiving others as less close and intimate than they actually are (Mikulincer, Shaver, Bar-On, & Ein-Dor, 2010). It is possible that the effects of these opposite forces (striving for closeness on one hand and pushing people away on the other) may have canceled each other out resulting in an insignificant association between anxiety and tie maintenance.

As for the unexpected results regarding anxiety predicting higher dissolution, we examined the correlations between attachment anxiety and the items constituting the dissolution subscale of the NMI. Our correlational analyses revealed that attachment anxiety was not associated with dissolution items relating to active attempts to dissolve network ties (e.g., "I dissolve my social network"). Rather, attachment anxiety was mainly associated with items regarding perceptions that network ties were dissolving (i.e., a more passive view of dissolution; "I lose people from my social network," $r_s = .33-.48$). This suggests that the positive association reflects anxiously attached people's view on the inevitability of dissolution rather than how easy it is for them or how likely they are to dissolve ties.³

Study 2b

In Study 2b, we focused on the associations between attachment avoidance and multiplexity found in Study 1 and again examined the mediating role of network management skills. In this study, we also examined whether we would replicate the associations between attachment anxiety and avoidance and social network management skills (initiation, maintenance, and dissolution of network ties) found in Study 2a.

To further link our current work on friendship networks with existing work on attachment networks, as part of Study 2b, we conceptualized multiplexity as the extent to which network members fulfilled attachment-related functions, namely, secure base, safe haven, and proximity maintenance. Secure base is the provision of encouragement to a person to explore his or her surroundings. Safe haven is the provision of comfort and emotional support during times of distress. Proximity maintenance reflects the desire to stay close or protest separation from close others.

We hypothesized that attachment anxiety will be positively associated with tie initiation and also tested whether the positive association between attachment anxiety and tie dissolution found in Study 2a would replicate (Hypothesis

2b.1). The hypothesis is different from the hypotheses we made in Study 2a. As noted above, although anxiously attached people may want to maintain ties (merge with close others), they are also known to experience frustration and ambivalence when relationship partners are not perceived as reciprocating a high degree of closeness and pro-relationship behaviors (e.g., Feeney, 2008). This perception by individuals high on attachment anxiety may result in a tendency to dissolve ties. Thus, it is plausible for attachment anxiety to be positively associated with tie dissolution. We suggest that this association may speak more to the expectations of anxiously attached people that ties will have limited longevity rather than to active attempts by them to push partners away.

In relation to attachment avoidance, we predicted that it will be negatively associated with initiation and maintenance and positively associated with dissolution (Hypothesis 2b.2), and the associations between attachment avoidance and multiplexity will be mediated by network management skills (Hypothesis 2b.3).

Method

Participants. One hundred fourteen undergraduate students (69 women, aged 18 to 26 years old, $Mdn = 19$) from a large Midwestern university in the United States participated in the study in exchange for course credit. The majority of the sample (89%) was Caucasian.

Measures and procedure. Participants completed the measures over the Internet as part of a study examining social networks in young adulthood. They first completed measures delineating their social networks. Then, they completed measures of attachment style and network management skills.

Name generator. Participants were asked to provide the names of up to 30 people who they felt "played an important role in their lives, either positive or negative" and then noted the type of relationship that characterized their connection to their network members (family, friends, etc.; again, the name generator did not focus on Facebook friends but rather on face-to-face relationships). The data for this study were part of a larger project that focused on family and friendship ties, but since our focus in this article is on friendship networks, we only report network data pertaining to friends. On average, participants listed 11.63 friends in their network (range: 2-27). These people constituted the alters in the participants' friendship networks.

Multiplexity. To assess multiplexity, we used a modified version of the WHOTO measure (Fraleigh & Davis, 1997). The scale assesses three main functions/features of attachment relationships: proximity maintenance (which includes proximity seeking and separation protest [e.g., "I like to spend time with this person"]), safe haven (two items, e.g.,

“I turn to this person when I am feeling down), and secure base (two items, e.g., “This person will always be there for me”). Participants rated each item on a 7-point scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*), for each alter. If the alter received a score higher than 4 on a particular attachment function, we assumed that the alter fulfilled that function. We summed up the number of functions each alter met to derive a multiplexity score for each alter. Thus, the possible multiplexity scores ranged between 0 (the alter met no attachment functions) and 3 (the alter fulfills all three functions of an attachment figure).

Attachment style. As in Study 2a, participants completed the 12-item short form of the ECR (Wei et al., 2007). Cronbach's alphas were .78 and .75 for anxiety and avoidance, respectively, the two dimensions were not correlated ($r = .14, ns$).

Network management. Participants completed the shortened version of the NMI (Gillath et al., 2011; 15 items) used in Study 2a in which three sets of five items are used to assess the initiation, maintenance, and dissolution of ties, respectively ($as \geq .86$).

Results and Discussion

We again conducted a series of preliminary analyses to test for the direct associations between the attachment dimensions and network characteristics. The findings were consistent with Study 1 and 2a (attachment anxiety was associated with tie strength, $\beta = -.18, p < .05$, whereas attachment avoidance was associated with both tie strength, $\beta = -.22, p < .01$, and multiplexity, $\beta = -.34, p < .01$).

We then ran three hierarchical regressions predicting network management skills from attachment style (see Tables 1 to 4 for descriptive statistics and intercorrelations for the variables included in these analyses). In the first step of each regression, we entered network size as well as attachment anxiety and avoidance, and in the second step, we entered the interaction between attachment anxiety and avoidance. We estimated power using the same method used in Studies 1 and 2a. Our power to detect an association of $r = .30$ was .91.

The regression analysis predicting the initiation of social ties was found to be significant, $F(4, 108) = 3.25, p < .05$. Attachment anxiety, like in Study 2a, was positively associated, whereas attachment avoidance was negatively associated with initiation (Table 8). For the regression predicting maintenance, the model was significant, $F(4, 108) = 4.68, p < .01$. The only predictor was attachment avoidance, which was negatively associated with maintenance. The regression predicting dissolution of network ties was significant, $F(4, 108) = 8.08, p < .001$, only avoidant attachment was positively associated with dissolution. The inclusion of the two-way interaction in Step 2 had no effect in any of the analyses.

Indirect associations. We next conducted mediation analyses and estimated specific indirect associations in the same manner as in Study 2a. The maintenance and dissolution of social ties mediated the association between avoidant attachment and multiplexity (Table 7). Specifically, attachment avoidance was negatively associated with the maintenance of ties and positively associated with the dissolution of ties. In turn, the maintenance of ties was positively associated with multiplexity, and dissolution was negatively associated with multiplexity.⁴

The findings of Study 2b were similar to that of Study 2a and provided further support for our predictions regarding attachment style and network management skills. We found that attachment anxiety was positively associated with initiation of ties (Hypothesis 2b.1). However, we did not replicate the finding from Study 2a, in which anxiety positively predicted dissolution of ties. This discrepancy in the results between studies 2a and 2b may have been due to differences in the study characteristics (e.g., participants reporting online vs. offline, number of friends asked to be reported, reporting only on friends vs. reporting on friends and family).

With regard to avoidance, as predicted and consistent with Study 2a results, it was negatively associated with initiation and maintenance of network ties and positively associated with the dissolution of ties (Hypothesis 2b.2). Also, as expected, the association between avoidant attachment and multiplexity was mediated through the maintenance and dissolution of ties (Hypothesis 2b.3). These findings suggest that perceptions of multiplexity are a function of the way avoidant individuals manage their social relationships. By decreasing maintenance and increasing dissolution, avoidant people are likely to minimize their investment in network members while also terminating ties. These management behaviors may make avoidant individuals less likely to trust others to fulfill multiple social needs.

Study 3

Although Studies 1 to 2b provide important insights and fairly consistent support for our suggested associations, they do not address the issue of causality. Thus, it remains unclear whether attachment style influences network management and network characteristics or whether the management and perception of networks affect attachment style. From a developmental standpoint, it seems more plausible that attachment style, which develops earlier in life, will influence perceptions and management of friendship networks. To test this assumption, we manipulated levels of attachment security (Gillath, Hart, Nofle, & Stockdale, 2009) and examined the effects of this manipulation on network management and characteristics.

Priming techniques have been widely used to contextually enhance individual's sense of attachment security (Gillath, Selcuk, & Shaver, 2008; Mikulincer & Shaver, 2007). Previous studies show that enhancing people's sense

Table 8. Hierarchical Regression Analyses Predicting Network Management Strategies in Study 2b.

Variables	Initiating ties										Maintaining ties										Dissolving ties									
	95% CI					95% CI					95% CI					95% CI														
	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	β	LB	UB	R ²	ΔR^2									
Step 1																														
Att. Anx.	.23	.10	.21**	.17	.25	.10*		.18	.12	.18	.14	.22	.11*		-.03	.08	-.03	-.07	.01	.23***										
Att. Av.	-.26	.11	-.22**	-.26	-.18		-.34	.10	-.32**	-.36	-.28				.52	.09	.48***	.44	.52											
Network size	-.02	.02	-.08	-.12	.04		-.01	.02	-.04	-.08	.00				.00	.01	.01	-.03	.05											
Step 2																														
Att. Anx.	.25	.10	.22**	.18	.26	.11*	.01	.21	.15	.21	.17	.25	.14*	.00	-.04	.09	-.04	-.08	.00	.23***	.00									
Att. Av.	-.27	.11	-.23**	-.27	-.19		-.32	.10	-.29**	-.33	-.25				.51	.09	.48***	.44	.52											
Network size	-.02	.02	-.08	-.12	.04		-.01	.02	-.04	-.08	.00				.00	.01	.01	-.03	.05											
Att. Anx. x Att. Av.	-.07	.09	-.07	-.11	.03		.17	.09	.18	-.02	.22				-.03	.08	-.04	-.08	.00											

Note. CI = confidence interval; LB = lower bound; UB = upper bound; Att. Anx. = attachment anxiety; Att. Av. = attachment avoidance.
* $p < .05$. ** $p < .01$. *** $p < .001$.

of attachment security results in various beneficial effects, such as increases in people's prosocial and helping behavior, reductions in intergroup prejudice, and a decrease in negative affect (e.g., Gillath et al., 2005; Mikulincer & Shaver, 2001). Recently, some scholars have found that security priming interacts with people's trait level of attachment anxiety and avoidance to affect behavior. For example, Collins and Gillath (2012) have found that security priming reduces the tendency of insecure people to use less compassionate break-up strategies. In Study 3, we examined whether enhancing attachment security via priming would influence individuals' network management skills and perceptions of social networks. We predicted that feeling more secure following priming will increase the tendency to initiate and maintain ties (Hypothesis 3.1) and reduce the tendency to dissolve ties (Hypothesis 3.2). We also explored potential moderation by attachment style.

Method

Participants. Eighty adults (48 women, aged 18 to 56 years old, $Mdn = 21$) participated in the study. The sample consisted of members of a large Midwestern town in the United States, and the majority of participants were Caucasian (81%). Participants completed the measures on a voluntary basis.

Materials and procedure. Members of the community were randomly approached by research assistants across different locations of a Midwestern town. These locations included the local library, various apartment complexes, as well as areas of the local university (including the Campus Union, campus eating areas, sorority, or fraternity houses).

The questionnaire battery included a measure of attachment style (the full ECR; Brennan et al., 1998; $\alpha_s \geq .91$, $r = .18$, $p = .07$, between the anxiety and avoidance subscales). This was followed by a distracter task consisting of a series of simple arithmetic questions before the administration of the experimental manipulation. The arithmetic task was included to wash out any effects of completing an attachment measure before being exposed to the priming manipulation. After completing the arithmetic task, participants were randomly assigned into one of two priming conditions, a security priming condition ($n = 40$) or a neutral priming condition ($n = 40$).

In the security priming condition, we asked participants to write a detailed recollection of an event involving a close personal relationship in which the relationship partner provided love, comfort, and support. In the neutral priming condition, participants were requested to recall a time when they engaged in a mundane task with an acquaintance such as buying goods in a store or studying in the library with a peer. Participants in each priming condition were given a full page and approximately 5 min to complete this task. Previous research has shown that this supraliminal priming task can be

successfully used to activate mental representations associated with a secure attachment style (Gillath et al., 2009; Gillath & Shaver, 2007).

After completing the priming task, participants completed the NMI ($\alpha_s \geq .83$ across the three management subscales) used in Studies 2a and 2b as a measure of network management skills. To assess tie strength, participants completed a modified version of the name generator used in Studies 2a and 2b, with the exception that the name generator was limited to listing the 10 most significant people in one's social network. Network multiplexity was assessed using the modified WHOTO used in Study 2b.

Results and Discussion

In line with Studies 1, 2a, and 2b, preliminary analyses to test for the direct associations between the attachment dimensions and network characteristics were conducted. The findings were consistent with all three previous studies (attachment anxiety was associated with tie strength after controlling for attachment avoidance and network size, $\beta = -.20$, $p < .05$, while attachment avoidance was associated with tie strength, $\beta = -.24$, $p < .01$, and multiplexity, $\beta = -.36$, $p < .01$).

Three hierarchical regressions were then run, one for each network management skill (see Tables 1 to 4 for descriptive statistics and intercorrelations for the variables included in these analyses). Across all hierarchical regressions, the first step included network size, attachment anxiety, and avoidance and priming condition (coded dichotomously, security priming = 1, neutral priming = 0). In the second step, the two-way interaction between attachment anxiety and avoidance was entered (consistent with Studies 1 to 2b). However, we also included the two-way interactions between the priming conditions and the attachment dimensions in Step 2 to explore whether the attachment dimensions moderated the effects of the prime. For completeness in exploring the possible moderating role of attachment style, in Step 3, the three-way interaction between the priming condition, attachment anxiety, and attachment avoidance was entered. The two- and three-way interactions were included as exploratory analyses as there are some previous studies that have found the effects of security priming are moderated by the level of attachment anxiety and avoidance (e.g., Gillath et al., 2006). In particular, some studies find that individuals who are either high on attachment anxiety and/or avoidance appear to experience greater effects when primed with attachment security (e.g., Collins & Gillath, 2012; Green & Campbell, 2000). We estimated power using the same method used across all previous studies. Our power for our primary hypotheses (i.e., the main effect of the security prime) was estimated at .50.

The regression predicting the initiation of social ties was significant, $F(7, 65) = 2.74$, $p < .05$. As shown in Table 9, attachment anxiety, like in Studies 2a and 2b, was positively

Table 9. Hierarchical Regression Analyses Predicting Network Management Strategies in Study 3.

Variables	Initiating ties										Maintaining ties										Dissolving ties												
	95% CI					95% CI					95% CI					95% CI					95% CI												
	B	SE	β	LB	UB	R ²	ΔR^2	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	R ²	ΔR^2		
Step 1																																	
Att. Anx.	.44	.14	.41**	.37	.45	.20*	.03	.09	.09	.08	.09	.09	.08	-.04	.12	.08	.30	.06	.36**	.32	.40	.37*	.32	.40	.37*	.32	.40	.37*	.32	.40	.37*		
Att. Av.	-.03	.13	-.03	-.07	.01		-.31	.09	-.28**	-.32	-.24						.35	.07	.40**	.36	.44												
Network size	.03	.08	.04	.00	.08		.07	.05	.11	-.06	.15						-.09	.03	-.18*	-.22	-.14												
Prime	.51	.23	.25*	.21	.29		.14	.10	.11	.07	.15						-.17	.07	-.17*	-.21	-.13												
Step 2																																	
Att. Anx.	-.33	.23	-.30*	-.34	-.26	.23*	.03	.01	.10	.01	-.03	.05	.15*	.07*	.22	.07	.22	.07	.25*	.21	.29	.45*	.08*										
Att. Av.	-.19	.08	-.19	-.23	.02		-.26	.10	-.24*	-.28	.10				.41	.07	.46**	.42	.50														
Network size	.03	.05	.04	.00	.08		.05	.05	.08	-.04	.12				-.10	.03	-.21**	-.25	-.17														
Prime	.49	.23	.24	-.04	.28		.15	.10	.12	.08	.16				-.18	.07	-.19*	-.23	-.15														
Att. Anx. x Att. Av.	.16	.08	.16	-.01	.20		.11	.09	.09	-.05	.13				-.09	.06	-.10	-.14	-.06														
Att. Anx. x Prime	-.25	.17	-.19	-.23	.02		.26	.11	.21*	.17	.29				-.23	.07	-.24**	-.28	-.20														
Att. Av. x Prime	-.41	.35	-.27	-.31	.06		-.31	.11	-.28*	-.32	-.24				-.23	.08	-.23**	-.27	-.19														
Step 3																																	
Att. Anx.	-.33	.23	-.30*	-.34	-.26	.24*	.01	.01	.10	.01	-.03	.05	.15*	.00	.22	.07	.25**	.21	.29	.45*	.00												
Att. Av.	-.19	.17	-.19	-.23	.08		-.26	.10	-.24*	-.28	-.20				.41	.07	.46**	.42	.50														
Network size	.03	.08	.05	.01	.09		.05	.05	.08	-.04	.12				-.10	.03	-.20*	-.24	-.16														
Prime	.55	.25	.27*	.23	.31		.15	.12	.12	.08	.16				-.11	.08	-.11*	-.15	-.07														
Att. Anx. x Att. Av.	.16	.08	.15	.11	.19		.11	.09	.10	.06	.14				-.09	.06	-.10	-.14	-.07														
Att. Anx. x Prime	-.26	.29	-.19	-.23	-.15		.26	.11	.22*	.18	.30				-.23	.07	-.24**	-.28	-.20														
Att. Av. x Prime	-.49	.29	-.33*	-.37	-.29		-.31	.10	-.26*	-.30	-.22				-.23	.08	-.23**	-.27	-.19														
Att. Anx. x Att. Av. x Prime	-.14	.17	-.11	-.15	.07		.00	.07	.00	-.04	.04				.08	.05	.14	-.10	.18														

Note. CI = confidence interval; LB = lower bound; UB = upper bound; Att. Anx. = attachment anxiety; Att. Av. = attachment avoidance; Prime = priming condition (0 = neutral, 1 = security prime). * $p < .05$. ** $p < .01$. *** $p < .001$.

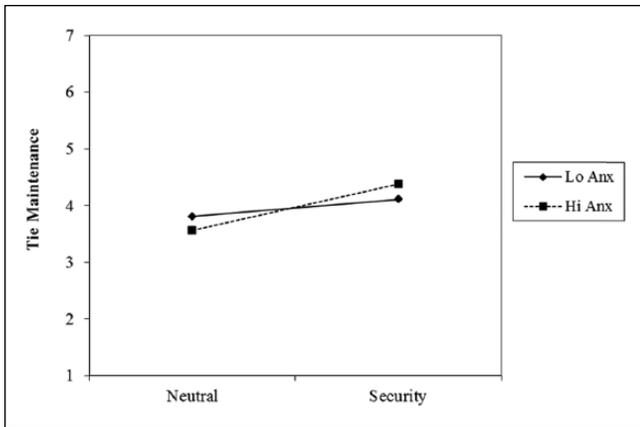


Figure 1. Tie maintenance as a function of priming condition and attachment anxiety.

Note. The above panel portrays the two-way interaction between prime condition and attachment style on network management skills. It illustrates the interactions of each attachment dimension with the prime to network tie maintenance. Lo Anx: low anxiety; Hi Anx: high anxiety.

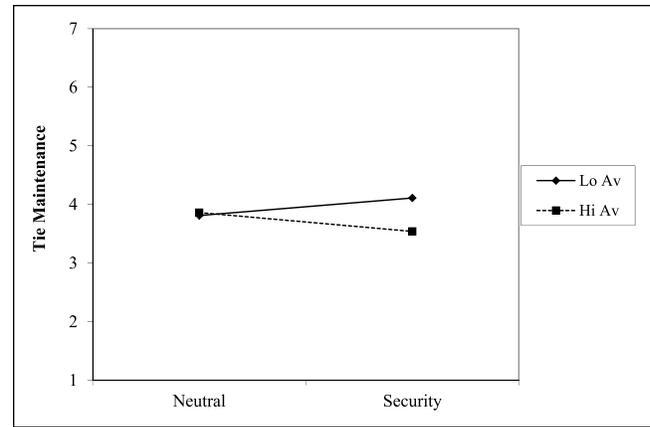


Figure 2. Tie maintenance as a function of priming condition and attachment avoidance.

Note. The above panel portrays the two-way interaction between prime condition and attachment style on network management skills. It illustrates the interactions of each attachment dimension with the prime to network tie maintenance. Lo Av: low avoidance; Hi Av: high avoidance.

associated with initiation. However, unlike Studies 2a and 2b, attachment avoidance was not significantly associated with initiation. Priming condition was found to affect initiation, such that participants exposed to the security prime reported a significantly greater tendency to initiate ties than participants exposed to the neutral prime (Hypothesis 3.1). The inclusion of the two- and three-way interactions did not significantly improve the model.

The regression analysis predicting maintenance of social ties was also significant, $F(7, 65) = 2.41, p < .05$. Attachment avoidance was as in our previous studies, negatively associated with the maintenance of network ties (Table 9). In contrast, attachment anxiety was not significant nor was there a significant main effect for priming condition (Hypothesis 3.1). The inclusion of the two-way interaction in Step 2, exploring the moderating role of attachment anxiety and avoidance, significantly improved the model, $\Delta R^2 = .07, p < .05$. The prime \times attachment anxiety interaction and the prime \times attachment avoidance interaction significantly predicted the maintenance of ties. The inclusion of the three-way interaction in Step 3 had no effect. A simple slopes analysis of the significant two-way interactions revealed that individuals high on attachment anxiety (1 *SD* above the mean), who were exposed to the security prime, reported a greater tendency to maintain ties than those exposed to the neutral prime, $t(78) = 3.74, p < .001$ (see Figure 1). No significant priming effects were found for individuals low on attachment anxiety (1 *SD* below the mean). In relation to attachment avoidance, there were no significant priming effects for individuals high on attachment avoidance (1 *SD* above the mean). However, individuals low on attachment avoidance (1 *SD* below the mean) who were exposed to the security prime reported a greater tendency to maintain ties, $t(78) = 3.54, p < .05$ (see Figure 2).

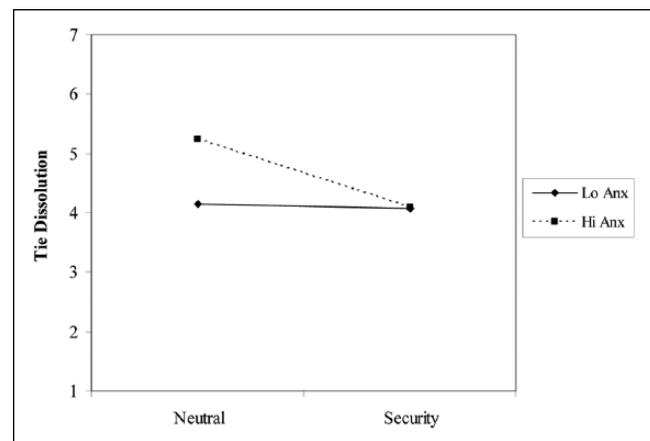


Figure 3. Tie dissolution as a function of priming condition and attachment anxiety.

Note. The above panel portrays the two-way interaction between prime condition and attachment style on network management skills. It illustrates the interactions of each attachment dimension with the prime to predict and network tie dissolution. Lo Anx: low anxiety; Hi Anx: high anxiety.

The regression analysis predicting the dissolution of social ties was found to be significant, $F(7, 65) = 6.78, p < .001$. As shown in Table 9, attachment avoidance and attachment anxiety were positively associated with the dissolution of ties. Moreover, exposure to the security prime (vs. the neutral condition) led to lower tendencies to dissolve social ties (Hypothesis 3.2). The inclusion of the two-way interaction in Step 2 significantly improved the model, $\Delta R^2 = .08, p < .05$. The prime \times attachment anxiety interaction and the prime \times attachment avoidance interaction were found to significantly predict the dissolution of ties. The inclusion of the three-way interaction in Step 3 had no effect. A simple slopes

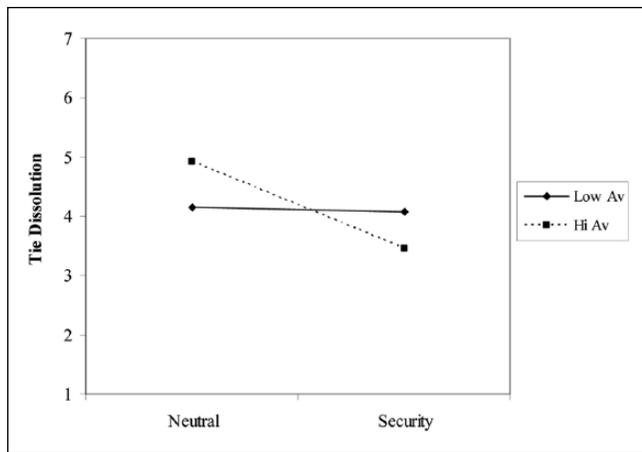


Figure 4. Tie dissolution as a function of priming condition and attachment avoidance.

Note. The above panel portrays the two-way interaction between prime condition and attachment style on network management skills. It illustrates the interactions of each attachment dimension with the prime to predict and network tie dissolution. Lo Av: low avoidance; Hi Av: high avoidance.

analysis of the significant two-way interactions revealed that participants high on attachment anxiety (1 *SD* above the mean) who were exposed to the security prime reported a *lower* tendency to dissolve ties than those exposed to a neutral prime, $t(78) = 5.20, p < .001$ (see Figure 3). This same trend was found for participants high on attachment avoidance, $t(78) = 6.62, p < .001$; 1 *SD* above the mean) who were exposed to the security prime (see Figure 4). No differences were found between the priming conditions among individuals low on attachment anxiety or avoidance.

Indirect effects. We next tested the extent to which network management skills were associated with tie strength and multiplexity. Furthermore, we tested the extent to which these network management skills mediated the direct associations between attachment and network characteristics established in Studies 1 to 2b as well as the new found interactions between priming condition \times anxiety and priming condition \times avoidance. Mediation analyses were conducted using the PROCESS model syntax developed by Hayes and Preacher (2014). This syntax allows for the estimation of the 95% bias-corrected confidence intervals of the specific indirect effects. As shown in Table 7, tests of specific indirect effects revealed that the dissolution of social ties mediated the association between attachment anxiety and tie strength and multiplexity, while initiation mediated the association between attachment anxiety and tie strength. In relation to avoidant attachment, dissolution again mediated the association between this attachment dimension and tie strength, while maintenance mediated the association between attachment avoidance and multiplexity.⁴ In relation to the interaction terms, the dissolution of ties mediated the associations between the prime \times anxiety interaction as well as the prime

\times avoidance interaction with tie strength and multiplexity, that is, individuals high on attachment anxiety or avoidance (1 *SD* above the mean) who were exposed to the security prime reported being less inclined to dissolve ties, and in turn, reported greater tie strength and multiplexity.

Overall, Study 3 replicated all but one of the associations between attachment style and network management skills and all but two indirect associations between attachment style and network characteristics through network management found in Studies 2a and 2b. Furthermore, numerous effects were found in relation to the priming of attachment security. Interestingly, most of these findings pertained to the interaction between attachment style and priming condition. For the maintenance of network ties, anxiously attached individuals demonstrated greater tie maintenance and lesser dissolution of ties when exposed to the security prime condition than to the neutral prime condition. Insecurely attached individuals (those high on attachment anxiety and those high on attachment avoidance) reported less dissolution of ties when exposed to the security prime than when exposed to the neutral prime. Finally, individuals low on attachment avoidance who were exposed to the security prime demonstrated greater tie maintenance than those exposed to the neutral prime. These findings generally support (with the exception of the association between attachment avoidance and tie maintenance) previous research demonstrating that prorelationship and prosocial processes can be enhanced when insecurely attached individuals are exposed to security priming (e.g., Collins & Gillath, 2012). Perhaps in the case of people high on avoidance, the security prime was not strong enough to overcome their natural tendency for lower maintenance.

General Discussion

Kadushin (2011) in his comprehensive review of the social networks literature highlights the need to incorporate psychological and sociological research to better understand social networks. In line with this proposition, researchers in recent years have started to integrate psychological individual differences with traditional social networks methodology, yielding intriguing findings (e.g., Kalish & Robins, 2006; Orchard, Fullwood, Galbraith, & Morris, 2014). Extending this line of research, the current work integrates a well-studied individual difference—attachment style—with sociological methods, all within the framework of Bowlby's (1969/1982) attachment theory. Specifically, we investigated the associations between attachment style (operationalized as levels of attachment anxiety and avoidance) and two aspects of friendship networks: *network characteristics*—tie strength and multiplexity and *network management skills*—namely, the initiation, maintenance, and dissolution of social ties. To achieve this, we ran three correlational studies and one experiment using different measures and samples. The overall picture that emerges from the studies is mostly

consistent across several methods and different measures and samples and in line with our predictions.

We predicted that tie strength—closeness between network members—would be primarily associated with attachment anxiety. However, in Study 1, tie strength was predicted by both anxiety and avoidance. Moreover, attachment avoidance was found to be a stronger predictor of tie strength in Studies 1, 2a, and 2b. One possible explanation of the associations between avoidance and tie strength is that individuals high on attachment avoidance may perceive their network ties to lack closeness as a function of their own concerns and worries about becoming too close to others. In Studies 1 and 2b, multiplexity was predicted only by avoidance—a finding in line with our predictions.

In the Studies 2a, 2b, and 3, we showed that the management of social networks (initiating, maintaining, and dissolving ties) plays a mediating role in the associations between attachment insecurity and social network characteristics. Specifically, attachment anxiety was positively associated with the dissolution of network ties (Studies 2a and 3) and with the initiation of network ties (Study 3), which were then associated with perceptions of network tie strength. Attachment avoidance was negatively associated with the maintenance of ties and positively associated with the dissolution of ties, which were then associated with multiplexity (Studies 2b and 3). No significant direct associations were found between attachment anxiety and multiplexity across any of the studies (though attachment anxiety was involved in one indirect association to multiplexity—via dissolution of ties, in Study 3).

Study 3, with a focus on causality, revealed both main effects for security priming (primary analyses) and interaction effects (exploratory analyses) between security priming and attachment style. Exposure to the security prime was found to increase initiation. For the maintenance of network ties, individuals high on attachment anxiety or low on attachment avoidance demonstrated a greater tendency to maintain ties when exposed to the security prime compared to the neutral prime. For the dissolution of ties, security priming resulted in a reduced tendency to dissolve ties, especially among insecurely attached individuals (i.e., those high on attachment anxiety or attachment avoidance). These findings suggest that exposing people to a security-enhancing prime buffers the effects of their chronic attachment insecurity. The results support the potential causal links between attachment and network management skills and speak to the directionality of our findings.

Our research demonstrates that attachment predicts and influences not only perceptions of close personal relationships, which are traditionally limited to the study of dyadic ties, but also people's tendencies regarding their broader friendship network. Attachment style serves as an orienting framework from which people construct and manage their social networks. Importantly, the direct and indirect associations found between attachment style and network

management skills provide an explanatory mechanism to unpack the associations between attachment and network characteristics. Just as people's attitudes and behaviors in dyadic relationships have repeatedly been shown to help explain direct associations between attachment and relationship outcomes (e.g., Feeney, 2008), we showed that people's attitudes and behaviors regarding the way they negotiate social ties (i.e., their management skills) help explain the associations between attachment style and network characteristics.

Unlike dyadic relationships that focus solely on a single significant other, the existence of multiple others brings into focus people's abilities to manage multiple relationships simultaneously. Thus, network management is important theoretically and conceptually in terms of the manner in which attachment may be connected to one's tendencies to affiliate with network members, in this case, the network of friends. This link between attachment and affiliation was theoretically discussed by Bowlby (1969/1982) but rarely examined empirically (see Mikulincer & Selinger, 2001). The current set of studies goes some way to addressing this gap in the literature and highlighting the importance of network management skills as a means of explaining the links between attachment style and affiliation with others, and between the attachment and affiliation behavioral systems.

Furthermore, it appears that security priming may have the capacity to change perceptions of network management skills, and especially for insecure people. In Study 3, we found that security priming caused people to initiate more and dissolve less social ties. We further found that it caused anxiously attached people (as well as people low on avoidance) to report they could better maintain ties, and it caused insecurely attached individuals (high on attachment anxiety or avoidance) to report a decreased tendency to dissolve existing ties. These findings suggest that security priming fosters social network management (more initiation and maintenance and less dissolution), and in turn, potentially fosters the longevity (and quality) of network ties. It is not surprising then that these associations had indirect effects on tie strength and multiplexity. The beneficial effects of security priming in the current study are in line with numerous studies that have found security priming to lead to positive benefits such as prosocial behavior and the management of relationship breakup for insecurely attached individuals (e.g., Collins & Gillath, 2012; Gillath et al., 2005).

Limitations

There are a few limitations to the current set of studies. First, most of our studies are correlational, and thus, caution should be taken in making causal interpretations. Study 3 using security priming provides initial support for our suggested links. However, further support would be best derived via longitudinal research on attachment and social networks.

Second, all studies used data collected from ego-centered networks. Thus, reports of social networks are derived from the perceptions of one individual. As such it is unclear if other members of one's social network would appraise the network in the same manner and whether these perceptions have a hold on reality (i.e., it is unclear whether anxiously attached people actually have fewer close ties or they just feel that way). Future researchers should collect data from complete networks. This would ensure multiple informants contribute to the understanding of a given social network. Third, our samples consisted of mainly young adults (means ranged from 18 to 22 years of age), which may affect the way friends and networks more broadly are perceived. For example, it may be the case that younger people have more online or virtual friends and therefore see their network as less close. Future studies should further examine adults' and young adults' perceptions of their online social networks and also examine age differences in networks. Fourth, while Studies 1 to 2b had an adequate sample size and achieved a power well above .80 to detect a medium effect size, Study 3 was underpowered. Thus, the findings of Study 3 should be interpreted with some caution and replication studies should be undertaken in the future. Finally, our findings, although highly similar, were not fully replicated throughout the studies, potentially because of differences between the measures and the samples. That said, despite using different measures and samples, we found considerable consistency across studies, which increases our confidence in the findings. Finally, our NMI was not a behavioral measure but rather a self-report measure—so it could only indicate a tendency or willingness to engage in behaviors rather than actually assessing the behaviors themselves.

Conclusion

Four studies provided insights into the interplay between the attachment theory and social networks research. This integration has revealed that people's attachment style, a well-studied individual difference largely thought to influence dyadic relationship functioning, has meaningful associations with and effects on the way individuals perceive and manage their friendship social networks. Furthermore, our research has demonstrated that network management skills mediate the associations between attachment style and perceptions of social network characteristics. Finally, security priming was found to change insecurely attached individuals' network management, and in turn, impact the way they perceive their social networks. Our findings advance understanding of how people's representations of the self and others shape the management and perceptions of social ties and networks, and shed light on the links between attachment and affiliation.

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Supplemental Material

Supplementary material is available online with this article.

Notes

1. This is a common approach when analyzing the impacts attachment anxiety and avoidance have on various outcomes. Often scholars want to know what happens, for example, when someone is low on both of these dimensions (e.g., secure) or high on one and low on the other (dismissing avoidant) as opposed to high on both (fearful avoidant).
2. We conducted preliminary analyses to determine the effects of personality variables not central to our study, which have been suggested to be associated with attachment. These preliminary analyses found that neuroticism (thought to correlate with attachment anxiety) was not associated with any of the dependent variables in the model (all $p > .05$), and the inclusion of neuroticism did not alter the associations between the independent variables and the dependent variables.
3. Although not the focus of Study 2b, we conducted analyses testing whether network management skills mediated the associations between the attachment dimensions and tie strength. Indirect effects analysis revealed that the initiation (estimate = $-.08821$; 95% confidence interval (CI) = $-.1615-.0247$) and dissolution (estimate = $-.1923$; 95% CI = $-.2464-.1136$) of ties mediated the association between attachment anxiety and tie strength. Likewise, the dissolution of ties mediated the association between attachment avoidance and tie strength (estimate = $-.2139$; 95% CI = $-.4116-.0632$). These indirect associations were consistent with the indirect effects reported in Studies 2a and 3 regarding tie strength.
4. While not hypothesized, we again found indirect associations between attachment avoidance and tie strength. Specifically, attachment avoidance was found to be indirectly associated with tie strength through the dissolution of ties. Likewise, the dissolution of ties mediated the association between the prime \times attachment avoidance interaction and tie strength.

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