ONLINE SAFETY NETS:
HOW PERCEIVED ISOLATION MOTIVATES
NETWORK CLOSURE

By

Joseph B. Bayer

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Communication)
in the University of Michigan
2016

Doctoral Committee:

Professor Scott W. Campbell, Chair
Associate Professor Sonya Dal Cin
Associate Professor Ethan Kross
Professor Rich Ling, Nanyang Technological University

DEDICATION

For my mother and her parents.

ACKNOWLEDGEMENTS

Finally I get to write the section about my own social network. I first want to thank my official committee members, Dr. Scott Campbell, Dr. Sonya Dal Cin, Dr. Rich Ling, and Dr. Ethan Kross. But I also want to thank my backstage committee members, Dr. Emily Falk and Dr. Nicole Ellison. I am exceptionally grateful for our time together. The team-based advising strategy may not be the most conventional route in academia, but it has given me an amazing toolkit for confronting new challenges. Below, I go further in describing a few of the distinctive things that I have come to value about each of you over the past five years.

To my chair and confidant, Scott, thank you for giving me this chance. I have no idea what you saw in my college thesis, as I'm too embarrassed to actually go back and read it. From our first conversation prior to my application to the text I just sent you while writing this, you have never been too busy to hush my fears or grab a few beers. You have helped me to understand the significance of the mundane, pushed me to aim for big theories, and shown me how to enjoy the publication process that so many scholars dread. Most importantly, you have provided a substantial amount of evidence that academia and banjos are not mutually exclusive.

To my long-lost advisor, Emily, thank you for not forgetting about me. After five years of testing, I am now fairly confident you have work clones. You are free to confirm or debunk this theory after I've received tenure. I have learned (or at least attempted to learn) from your emotion regulation, leadership, composure, and drive as a young professor. I truly respect how humble and accessible you have remained over the last five years. You have provided more professional and life guidance than I can remember… even when I have procrastinated some of our data analysis for longer periods that I will acknowledge in written form.

To Sonya, thank you reminding me where I come from and what matters. I like to think of myself as a social psychologist that doesn't like social psychology. You understand this, along with my overall perspective on academia, better than anyone else. I also appreciate how flexibly you can kick ass across different methodological and and statistical domains. Combined, you have shown me how to walk softly epistemologically and carry a big stick methodologically. And you have always kept me grounded at key crossroads. Please look out for Hakeem and Neil while I'm gone; they think about the world like me but study more important things.

To my long-distance advisor, Rich, thank you for not disowning me. More seriously, I have greatly appreciated you as my super long-distance advisor and friend. Through our time together in Ann Arbor, Singapore, and random conferences, I have come to know your family and singular way of pondering everyday life. You have successfully turned me into a macro-psychologist and wannabe micro-sociologist. This is no easy feat given how committed to psychology I was at the time of my entrance to graduate school. And last, you have given me a more global perspective and represent the origin of my budding international aims.

To Nicole, thank you for introducing me to the world of I-Schools, CSST, CMC, and CSCW, among other acronyms. I'm still not sure if you consider me one of your "students", but I have come to comprehend qualitative and design work because of you. I admire your candor, scholarly toughness, and web of academic friends and collaborators that you sincerely care for on a personal level. I don't always know what you will think of the work I send you – but I know you will give it to me straight up. In doing so, you have made me sharper and forced me to question whether each research question is truly novel, rather than popular and recent.

To Ethan, thank you for welcoming me into Michigan social psychology from my first steps in Ann Arbor. Although I clearly failed to get a first-author project through the ringer during our time together, I nonetheless learned a lot from our relationship. I have greatly enjoyed

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

The feeling of being alone – and drive to vanquish that feeling – represents a common interest among theorists in communication, psychology, and sociology. Despite extensive literatures on isolation, exclusion, rejection, and loneliness, less is known about how these feelings reverberate through personal networks. Concurrently, the ascent of mobile and social technologies has generated a range of communicative possibilities that complicate our understanding of how people respond to moments of social isolation. Indeed, evolving network theories suggest that these media affordances have the potential to steer communication toward certain people and away from others. In this dissertation, I attempt to interlace this dual theoretical backdrop, integrating classic theories on the experience of social isolation with recent theories on the social implications of online affordances.

I argue that perceived isolation is likely to drive people toward network closure, or what Kadushin (2012) refers to as "network safety". I also argue that this thrust is more likely to occur in online networks that are defined by availability and awareness, such as Facebook. In order to substantiate these claims, this dissertation encompasses studies measuring online network outcomes in combination with three different versions of perceived isolation: induced exclusion (Study 1), exclusion reactivity (Study 2), and rejection sensitivity (Study 3). Altogether, the combined results indicate that feelings of isolation can shift social attention and preference toward trusted ties and core circles. Over time, these patterns suggest that people who experience more frequent and intense feelings of isolation may choose to fortify close relationships and closed communities, rather than embrace weak ties and open networks.

To conclude, I contextualize the findings within other models of perceived isolation, and propose an extra component for the observed network dynamics. Expanding on this phenomenon, I theorize how certain cognitive states may operate as *network switches*, changing personal network motivations in a dynamic manner. With the emergence of increased availability and awareness, individuals have increased capacity to choose, and thus shift, their personal network patterns during daily life. Consequently, I call for new research on the cognitive mechanisms that underlie social network motivations, perceptions, and choices.

Chapter I

Introduction

The ascent of mobile and social platforms has multiplied our range of communication options. At any given moment, our complete set of relationships is simply a text, post, or like away across a number of social mediums. This enhanced connectivity provides more efficient ways to seek and maintain chosen friends during daily life, bypassing the need for physical presence and default tendency to focus on nearby others. Over time, these relational choices may have longer-term consequences for the aggregate shape of communication networks, and thus influence the diversity of everyday engagement. Yet our understanding of why people choose to communicate with *this* friend, instead of *that* friend, remains largely unexplained.

The purpose of this dissertation is to specify one factor that operates as an online network "switch", redirecting the focus of communication targets. The proposed factor is the *fear of social isolation* (FSI). The FSI has a strong legacy within communication due to its association with the spiral of silence theory (Noelle-Neumann, 1974). Noelle-Neumann (1977) asserted, "as social beings, most people are afraid of becoming isolated from their environment" (p. 144). This intense fear, which can be viewed as a state or a trait, has been used to explain the underlying motivation behind why people shift their personal opinions, along with the implications for public opinion in the media (see Hayes, Matthes, & Eveland, 2013, for a review).

Noelle-Neumann (1977) argued that individuals regularly sample or scan the opinions of others around them to avoid behaving in a way that could result in ostracism. As more people start to believe that a given opinion is unpopular, the number of people willing to express that

1

opinion quickly shrinks. Soon enough, the unpopular opinion has "spiraled" into nothingness, or perhaps anonymous online forums. The practical consequence of this is that minority opinions are disproportionally silenced. Despite its prevalence in communication research, the fear of social isolation has not been examined in conjunction with personal communication patterns or network characteristics, such as the diversity of interaction partners.

The fear of isolation thus embodies the precursor or social psychological mechanism beneath Noelle-Neumann's prominent theory. Empirical research shows that people who have higher fear of social isolation attend more to what the general public thinks (Hayes et al., 2011), and are less willing to express less popular opinions (Ho & McLeod, 2008). Further, recent survey data suggests that some social platforms (e.g., Facebook) may exaggerate this effect (Hampton et al., 2014). While interest in FSI tends to concentrate on how media discourse shapes public opinion, the fear itself represents a more fundamental motivation. Hence, FSI may come to influence a range of communication outcomes, including with whom an individual chooses to contact in moments of personal uncertainty.

In addition to communication studies, other disciplines – in particular, social psychology and sociology – also have established literatures tied to the perception of being isolated from others. Drawing on classic writings by Freud (psychoanalysis), Bowlby (attachment), and other motivational theories, psychologists Baumeister and Leary (1995) state, "…the belongingness hypothesis is that human beings have a pervasive drive to form and maintain at least a minimum quantity of lasting, positive, and significant interpersonal relationships" (p. 497). In turn, their conceptual integration of "need to belong" theories has now spawned a wide range of experimental studies on the direct effects of being excluded from others.

Whereas research on FSI has centered on fluctuations in public opinion, psychological research has generally pursued the mental and physical costs of exclusion and rejection, as well as strategies for recovery. Such research confirms that exclusion is a common challenge and one potent example where social experiences can impact personal well-being (DeWall & Richman, 2011; Gerber & Wheeler, 2009). The occurrence of exclusion has been shown to induce worse mood and self-esteem (Blackhart et al., 2009). Stronger reactions to negative social encounters may confer some benefits, such as prompting increased efforts toward regaining social acceptance. Nevertheless, heightened stress on the associated biological systems may have detrimental effects if repeated frequently (Eisenberger, 2013).

Sociological research also has a strong tradition of examining social isolation. In his influential work from the century before last, Durkheim (1851) attributes suicide not to life events or psychoses, but rather to a discrepancy between social standards and personal mentalities due to the changes of industrialization. Durkheim's notion of *anomie* characterizes the contrast that can emerge from such societal changes, along with the associated outcome of purposelessness. More recently, research suggests that network factors, such as being around similar others, can buffer perceptions of anomie (Brashears, 2010). Other research shows that more isolated people have higher risks for diminished well-being, poor physical health, and even suicide (Bearman & Moody, 2004; Hawkley & Cacioppo, 2010).

Some research attempts to operationalize "actual" social isolation, such as labeling people who report not "discussing important matters" with anyone else as isolated (McPherson, Smith-Lovin, & Brashears, 2006)[1]. By contrast, the current research follows the perceptual fear of isolation defined by Noelle-Neumann (1974), adopting a focus on *perceived isolation*. The

---

[1] Although this work showed that social isolation had increased over the last few decades, follow-up work has refuted this finding (Brashears, 2011; Hampton, Sessions, & Her, 2011).

wide interest in perceptions of "isolation", "exclusion", "rejection", and "loneliness" across disciplines mirrors the underlying assumption in Noelle-Neumann's theory: the fear of isolation is nearly universal. Of course, this also produces an obstacle in integrating the various literatures and terminologies. Although there are surely ways to distinguish among the nuances of perceived aloneness, instead I[2] attempt to bridge disciplinary divides in pursuit of a separate objective. Specifically, I develop a broader framework for explaining how the perception of being alone, even momentarily, may shift how people engage with their online networks.

I thus approach "perceived isolation" as a generalizable state variable and disposition (or, more precisely, socio-cognitive orientation[3]) tied to feelings of being alone. From a state standpoint, momentary feelings of isolation may modify communication patterns during everyday life. Psychological research provides strong evidence for the robustness of perceived isolation effects across individuals (Leary, 2010). At the same time, Hayes et al. (2011) assume, "…it is most certainly true that some people possess a stronger tendency to fear isolation than others, regardless of where they happen to have been born and raised" (p. 442)[4]. From a trait perspective, then, individual differences in the fear of social isolation, or perceived isolation, may result in people developing distinguishable stable networks. As a consequence of repeated feelings of social isolation, and certain communication choices in the aftermath, some people may catalyze enduring changes to their personal online networks.

---

[2] To clarify upfront, I use the pronoun "I" in the introduction and general discussion to reflect the sole author nature of the broader theoretical framework. However, I use "We" within the individual to acknowledge the collaborative work of my empirical research.

[3] In line with Levy, Ayduk, and Downey's (2001) definition of rejection sensitivity, I view "trait" feelings of social isolation as a tendency to process social situations in certain ways based on past experience – as opposed to a global personality factor that is constant across contexts. As such, people with "trait" isolation are more likely to experience feelings of isolation more frequently and intensely, but these feelings still depend on situational conditions.

[4] Likewise, plenty of research in psychology measures perceptions of exclusion as a trait or disposition (e.g., Vanhalst et al., 2015; Downey et al., 1996).

Egocentric Social Networks

Throughout this dissertation, I concentrate on *egocentric* or personal communication networks (see also Campbell & Russo, 2003). As compared to the more macro perspectives of *sociocentric* networks (e.g., communities, societies), egocentric networks are better suited for questions related to psychological processes and motivations, such as the fear of social isolation. Adopting a network viewpoint allows examination of *structural* aspects of the social environment for a given individual, or "ego", (Burt, Kilduff, & Tasselli, 2013; Lakon, Godette, & Hipp, 2008). Surrounding the ego is an egocentric network, which includes all people, or "alters", who are linked with the target person (Boase, 2008).

Core networks represent the most essential source of social resources, providing people to discuss important matters and help in times of need. These confidants, typically the top 5 to 15 friends of the ego, come with higher relationship expectations, especially around mobile communication and accessibility – but also provide security and trust (Ling, Bjelland, Sundsøy, & Campbell, 2014; Sutcliffe, Dunbar, Binder, & Arrow, 2012). There is also some evidence that communication technologies, including Facebook, help individuals maintain a larger core network size (Hampton et al., 2011). In this research, "core networks" are used to describe Facebook networks with the top 15 friends (in terms of number of interactions).

Outside of core discussion networks, broader theories of network organization come into play. The number 150 has come to encapsulate the Dunbar school of network research. The number refers to the typical scope of the outer layer of people who we know and know us (Dunbar, 2014a; Sutcliffe et al., 2012). The number also reflects the primary claim of the theory: humans can only maintain a certain number of relationships successfully. Beneath the outer of layer of maintained relationships, sub-layers of 50, 15, and 5 relationships are referred to as the

"affinity", "sympathy", and "support" groups, respectively. Research shows that the frequency of contact and emotional closeness with these relationships decreases beyond each threshold (5, 15, 50, 150) on average (Roberts, Wilson, Fedurek, & Dunbar, 2008).

As whole, the Dunbar and colleagues line of research stipulates that there is a stable, uneven distribution of communication time and psychological investment across the innermost and outermost layers. Sutcliffe et al. (2012) suggest that the different layers offer unique "tradeoffs". For instance, whereas the inner layers may provide emotional support in times of need, the outer layers provide access to resources. Similarly, there appears to be a tradeoff in closeness, such that having more strong ties reduces the average emotional closeness for strong and significant ties (Binder, Roberts, & Sutcliffe, 2012). The issue, as expanded on below, is that there are limits on the amount of energy one can consume in (non-kin) relationship maintenance (Kobayashi & Boase, 2014; Roberts & Dunbar, 2011).

In parallel with the core versus outer network distinction, researchers of all stripes regularly distinguish between strong and weak ties. Individuals may also display preferences for stronger or weaker ties. Vanhalst and Leary (2014) refer to this as sociotropic differentiation – how much a given individual distinguishes between strong and weak ties. Generally, past egocentric network theories focus on the importance of weak ties (e.g., Granovetter, 1973; Burt, 1992) for novel information and opportunities, and significance of strong ties for deep trust and emotional support (Wellman & Wortley, 1990). As discussed in Chapter 4, communication researchers such as Wright have begun to consider individual differences in preferences for strong-versus-weak ties in online and offline contexts (Wright & Miller, 2010).

Over the last decade, there have been renewed calls for greater integration between social network theory and social psychological processes (e.g., Felmlee & Faris, 2013; Robins &

Kashima, 2008). Given the constraints and tradeoffs of maintaining more or less relationships (Saramaki et al., 2014; Miritello et al., 2013), individuals must make choices on social network preferences. In essence, people need to decide where, or perhaps whom, to distribute their limited amount of communication. I argue that different social orientations, such as perceived isolation tendencies, may underlie how people allocate their limited social investments – and these choices may shape their enduring networks. Nonetheless, research has not yet broached how FSI may affect network size or other features of offline or online networks.

Online vs. Offline Networks

A personal network is not one concrete object. Rather, individuals have overlapping and diverging face-to-face networks, calling networks, texting networks, email networks, and Facebook networks, to name just the most common interactions among college students in 2014 (Bayer, Ellison, Schoenebeck, & Falk, 2015). As stipulated in media multiplexy theory (Haythornthwaite & Wellman, 1998), stronger ties will tend to involve more communication channels, and therefore will be featured in more network types. At the same time, empirical work thus far provides a mixed story on the total degree of overlap across networks.

On one side, Saramaki et al. (2014) identified "social signatures" of how a given individual allocated his or her calling. In other words, individuals have distinctive communication patterns that remain consistent markers even when specific relationships are removed or added. In addition, Burt (2012) found evidence using an online social world that one's network position is actually somewhat consistent across contexts (i.e., players who used different characters). Similarly, Dunbar and colleagues have now demonstrated repeatedly that the essential layering structure appears to occur in both "offline" and "online" (Arnoboldi et al., 2012), though this work primarily focuses on average network size alone.

Conversely, Small (2013) found that "weak ties" made up 45% of individuals' core discussion networks, or contacts whom the ego views as personally important. Accordingly, more recent research has argued that the previously imagined "core" discussion networks are not actually that stable after all (Small et al., 2015). Separately, Foucault Welles and Contractor (2014) find that transitivity, but not homophily or proximity observed in past offline work, predict the development of online relationships on *Second Life*. Hence, as discussed in Study 3, the ways in personality relates to network features are likely to vary by the type of network. For these reasons, there are probably a variety of network differences yet to be discovered.

The studies above utilize a wide range of network types. Unfortunately, individual studies typically privilege one type of network at a given time due to challenge of network data collection. In turn, online networks are then frequently treated as rough proxies for the idealized *offline* (or in-person) networks. The "social signatures" perspective implies that these different networks will share the same characteristics for a given individual (e.g., bigger vs. smaller, denser vs. sparser). At the same, the wide variance in ego-network characteristics suggests that a focus on averages like "Dunbar's Number" may be masking network dynamics. As I develop in the section below, I explicitly focus on online networks due to their potential to amplify the relationship between perceived isolation and personal network structure.

Network Brokerage vs. Closure

The research above supplies a foundation for considering the basic configuration of personal networks. That is, people tend to have a very limited number of strong ties and incrementally more ties with descending layers of emotional closeness. In addition to network size, however, network analysis provides advanced ways to characterize different types of friend configurations, including measures such as density, transitivity, and clustering. As such, another

significant dimension of network structure is the contrast between brokerage and closure, which

relates to all three measures. Kadushin's (2002; 2012) motivational framework asserts that

individuals are "driven" to pursue both closure and brokerage for different ends[5].

Brokerage refers to network spread. That is, network "brokers" span multiple social

circles or groups, filling the "structural holes" that tend to exist between the natural clustering of

people (Burt, 1992). Most of the extant research, concentrated in the organizational literature,

examines the entrepreneurial benefits of brokerage. Brokers gain advantage by being exposed to

more forms of information, ideas, and ways of thinking (Burt et al., 2012). Post-industrial

societies, and online societies especially, require some degree of brokerage for people to

maximize their resources (Kadushin, 2012). As Kadushin (2012) concludes, "Structural holes are

not for satisfying present needs but for creating change and movement" (p. 66).

By contrast, more closed parts of a network may be more appropriate for "satisfying

present needs", such as emotional regulation following negative social experiences. Network

closure is associated with a higher concentration of close ties and interconnectedness. These

people are more likely to know each other (and be similar), thus minimizing the range of novel

ideas and perspectives. At the same time, as opposed to brokerage, there are a greater number of

emotional implications associated with closure. Closure refers to interconnectedness among

network members[6]. Greater network closure is associated with increased trust in others (Burt et

al., 2013), as well as stronger norms and reputational concerns (Lakon et al., 2008). In fact,

Durkheim (1851) cites density as a buffer to suicide. Schroeder and Ling (2014) describe

---

[5] Note that in addition to closure and brokerage, Kadushin (2012) discusses also briefly mentions
status as an extra potential motivation (when social hierarchies are visible).

[6] It is important to note that theoretical perspectives on closure, like brokerage, suggest both
social advantages (e.g., social support) and disadvantages (e.g., stronger penalties for norm
violations) that are not dealt with here (Albrecht & Adelman, 1984; Burt, 2000; Lakon et al.,
2008; Monge & Contractor, 2003; Walker, 2015).

Durkheim's macro vision of everyday life as "…an organic society strengthened by denser and more complex ties that yield a more cohesive society" (p. 791).

Altogether, networks with high closure provide a greater degree of trust, security, and support – and, concurrently, provide less diversity and opportunity (Burt, 2000; Kadushin, 2012). Whereas brokerage is associated with the strength-of-weak-ties hypothesis (Granovetter, 1973), closure is linked to the emotional benefits of strong ties[7]. Indeed, Sutcliffe et al. (2012) proposed that, "Stronger ties should also show more connectivity and centrality within the Ego network, especially within the support clique [5-person layer] where inter-relationships between all the members may be particularly dense" (p. 162). In turn, one study found that within the inner layers, density is strongly related to emotional closeness and altruism (Curry & Dunbar, 2011). Sutcliffe et al. (2012) also propose trust as a mechanism for why people can only maintain so many relationships at a given time. These strong ties come to be viewed on an emotional level, rather than calculative level, making them less susceptible to decay.

Within individuals, Kalish and Robins (2006) found support for the idea that the two motivations regularly co-occur within networks; however, their occurrence is still negatively correlated. Hence, while a network composed of both brokerage and closure is likely to be advantageous, most individuals' networks tend to exhibit a greater degree of closure *or* brokerage. Kadushin (2012) summarizes, "…Burt finds closure (density) and brokerage to be complementary, each having certain advantages. Closure makes one's life easier, but perhaps complacent, while brokerage seeks out the advantages, however temporary, of moving beyond one's closed circle and leads to the development of new ideas (Burt 2005)" (p.67). Given this description, it makes sense that Kadushin (2012) rebranded closure as "safety".

---

[7] More broadly, closure vs. brokerage contrast maps onto bonding social capital (close ties, density) and bridging social capital (weak ties, diversity), respectively (Hampton, 2016).

Individual Differences and Network Characteristics

Over the last two decades, some sociologists and psychologists have sought to uncover the key individual differences that are related to social network characteristics. At the most basic level, demographic and socioeconomic variables are related to differences in network size (Mcpherson, Smith-Lovin, & Cook, 2001). For example, people in higher socioeconomic classes tend to have more diverse geographic networks, providing a wider exposure to ideas (Kadushin & Jones, 1992). From a broader standpoint, Kadushin (2012) suggests that cultural differences might lead to an inclination toward certain network types, while Hampton and Ling (2013) show that core network size is actually negatively related to societal prosperity.

Casciaro et al. (2015) recognize three established mechanisms from the social network literature explaining why people form relationships with certain people versus available alternatives. Specifically, people seek out similar others (i.e., homophily), nearby others (i.e., proximity), and rewarding others (i.e., likeability). Likewise, Contractor, Whitbred, Fonti, and Steglich (2012) specify eleven different predictors of communication network structure, including those above and some organization-specific factors. Of particular relevance, their theoretical review also stresses that reciprocity and transitivity underlie evolving network structure. Essentially, these network forces state that people tend to reciprocate when approached by others and connect separate friendships to each other.

In addition to these basic network tendencies, certain personalities are predisposed to these mechanisms. For instance, friendly individuals have a lower tolerance for intransitivity – unbalanced triads in which A is friends with B, B is friends with C, but C is not friends with A (Hallinan & Kubitschek, 1988). Other research highlights how general personality traits can influence the broader structure of personal networks. As discussed later on, researchers have now

evaluated a range of personality facets, including self-monitoring (e.g., Oh & Kilduff, 2008), optimism (e.g., Andersson, 2012), and the Big Five Inventory (e.g., Kalish & Robins, 2006). Separately, some work has shown that cognitive factors (e.g., working memory, perspective-taking) are positively correlated with network size (Stiller & Dunbar, 2007).

In sum, there is strong evidence that individual differences in social context, demographics, and disposition underpin egocentric network features, with a primary emphasis on network size. As discussed later on, research shows that characteristics of an ego network may represent somewhat stable individual differences, or a "network-relevant personality" (Burt, 2012). There is also some evidence that specific personality (e.g., extraversion) and social cognition (e.g., mentalizing) are associated with certain network characteristics. For its part, the fear of social isolation (FSI) can be viewed as a socio-cognitive orientation. In spite of the surge of recent research on personality factors, it remains unclear whether differences in key social motivations, such as FSI, underlie offline and online network attributes.

Communication Theory and Networks

One notable absence in the research above is that of communication scholars. Indeed, the communication literature has been quiet on the question of how personality contributes to online and offline network structure. This missing perspective is surprising given that network theory has vibrant history within communication (e.g., Campbell & Russo, 2003; see Hampton, 2016; Monge & Contractor, 2003; Parks, 2011; Wellman, 2001)[8]. Nonetheless, I argue that communication scholars represent a vital set of intermediaries in the quest to understand how certain orientations influence both online and offline network characteristics.

---

[8] Interestingly, Hampton (2016) also posits of classic sociologists, "…one could easily have described many of these early contributors to community theory as scholars of communication, technology, or information" (p. 104).

As Scannell (2007) recounts, communication was always "…both the problem and solution to social psychology's basic question: the link between individuals (the psychological) and groups (the social)" (p. 10). Egocentric networks, in particular, offer a midlevel context to mine the intersections of psychological and social processes. Communication researchers, therefore, are especially well positioned to study how psychological factors explain the structure of online and offline networks. In particular, I assert that approaching the personality-network connections from a communication perspective is valuable for two major reasons.

First, communication is not subject to the same methodological boundaries of more longstanding disciplines, thus enabling direct examination of the overlooked meso space between psychology and sociology. Robins and Kashima (2008) clarify, "Much of the difference between the two approaches, especially in the practice of research, centres around their perspectives on social context, in turn leading to different data analytical methods" (p. 2). As such, the superior control of "social context" afforded by laboratory experiments is well suited to the core processes of social cognition, such as how people respond to exclusion. In Chapter 2, for instance, I examine how people respond to exclusion through a hypothetical sharing task.

Nonetheless, Robins and Kashima point out that, "For research in this tradition, social networks surrounding participants, which exist prior to their entry to the laboratory and continue to engage them after departure, is assumed to be a source of uncorrelated random errors" (p. 2). Alternatively, sociological research on networks privilege social context as the primary object of study, often minimizing the presence of individual factors. Yet, network analysis can produce fine-grained metrics of the context around individuals in everyday life. In Chapters 3 and 4, I compute network measures from Facebook accounts. In doing so, I directly compare personality factors with logged communication network structure from daily life.

13

Second, communication offers a vantage for dealing with the multidimensional dynamics of real world human networks. For years now, communication theorists have moved away from the online-offline binary and toward mutual physical-virtual links (Burchell, 2015; Campbell & Kwak, 2011). For instance, an alternative to the online-offline contrast is the treatment of a given network type as one slice of a multidimensional social environment, in line with Boase's (2008) notion of the overarching *Personal Communication System*. Nonetheless, communication scholars are also attuned to "media effects", even if daily experiences overlap. As such, one unanswered question is whether dispositional factors have differential effects across network types. As discussed in Chapter 3, I suggest the differences between effects for various network types can be treated (with caution) as "media effects"[9].

Perceived Isolation as *Network Switch*

As discussed above, a body of research has evaluated on how psychological differences underpin network structure. In particular, self-monitoring and extraversion[10] are personality facets that are consistently associated with less network closure, or more brokerage (see Landis, 2016, for a review). Similarly, in the current case, I argue that the fear of social isolation has the potential to influence network closure. However, whereas self-monitoring and extraversion represent broad ways of engaging with others, the fear of social isolation is a dynamic motivation that rises and falls. Thus, fears of isolation, rejection, or loneliness may shift the present motivation, at least momentarily, toward particular communication partners over others.

---

[9] It is worth pointing out that different types of communication networks may confound channel and relationship type. In other words, different networks (e.g., Facebook, Twitter, Email) may be dominated with weak ties or work ties, in addition to having different affordances. In doing so, the nature of the communication will also vary greatly, since different relationships are associated distinctive interactions (Duck et al., 1991; Wellman & Wortley, 1990).

[10] See Chapter 4 for a more complete theoretical engagement with these traits.

Of course, this is not first proposition that certain factors can drive people to focus on their certain relationships, as opposed to engage with less established relationships. In particular, the emerging framework is comparable to socioemotional selectivity theory (SST; Carstensen et al., 1999), which argues that personal networks become dominated by secure, supportive, and enjoyable relationships with older age. According to SST, this shift in social priorities appears to occur in part due to the perceived threat of death. The perception of evaporating time adjusts personal priorities to highlight emotional meaning, rather than long-term planning.

Setting aside teen angst, the everyday experience of exclusion, rejection, or isolation is by no means equivalent to the prospect of death. At the same time, perceptions of incoming isolation and mortality both represent fundamental, if not existential, threats. As Hawkley and Cacioppo (2010) argue, perceived social isolation "is tantamount to feeling unsafe" (p. 219). Moreover, Levy et al. (2001) discuss how rejection sensitive individuals imagine uncertain social situations as potential threats. Sociological theory also suggests that isolated individuals suffer from a lack of support and trust in the larger social world (e.g., Durkheim, 1851). In sum, feelings of present or future isolation are likely to be cognitively processed as threats.

Psychological research suggests that excluded people reach out to others when acceptance seems likely – but avoid social risks when more rejection may occur (Kawamoto et al., 2015). Other research suggests that people with high self-esteem sometimes respond to rejection by reaffirming their core relationships (Levy, Ayduk, & Downey, 2001) and that people with higher trait loneliness benefit more from interactions with intimate relationships (van Roekel et al., 2016). Drawing on past research on how people respond to perceived threats, Levy et al. (2001) advance the idea that people with higher rejection sensitivity may respond to college

transition by "limiting their social circle". Supporting their prediction, those individuals with rejection fears ended the academic year with fewer and less racially diverse friends.

Complementing the above work, communication research suggests that individuals with higher fear of social isolation will prefer social contexts with clear expectations (Hayes et al., 2011). Likewise, the foundations of uncertainty reduction theory (C. Berger & Calabrese, 1975) suggest that people tend to prefer trusted others with more "certain" engagement, particularly in times of increased uncertainty (Albrecht & Bach, 1997). By contrast, some research also finds that people will seek out divergent sources of support, ranging from weak tie barbers to strong tie spouses, when they feel threatened (Albrecht & Adelman, 1984; see also Fink et al., 2015). Fink et al. (2015) recently relayed, "…comparatively little is known about the structural characteristics of social networks that influence the selection of support providers" (p. 26). Hence, there are reasons to expect that perceived threat will shift network motivations toward trusted others, though various threats may be linked to separate sources of support.

All in all, the three disciplines contribute to a broader story of network safety: the fear of social isolation should prompt a preference for protected social spaces. Expanding on this cross-disciplinary platform, I assert that perceived isolation may shift personal network motivations, elevating the drive for network safety at the expense of opportunity. Under this model, the fear of social isolation operates as a *network switch*. When the potential isolation is made salient, individuals will retract toward their personal safe spaces – that is, trusted ties and close-knit circles. By pulling inward, individuals receive the emotional benefits associated with closer ties and fortify these relationships for the future. In turn, regular fears of isolation have the potential to alter the overall closure of communication networks.

Affordances and Network Safety

Weaving together theories of perceived isolation and evolving theories of social affordances, I also suggest that the hypothesis asserted above will be amplified for online networks. As noted previously, minimal research in communication has examined the personality predictors of network structure. Nonetheless, a number of recent frameworks argue that certain social and mobile media *affordances* have the potential to affect personal network structure. Hence, there is reason to think that the degree of network closure may be changing, albeit slowly. In the present case, my aim is to highlight how these affordances might accelerate the activation of network safety following moments of perceived isolation.

Research over the last decade has theorized, and then tested, whether mobile media increases attention to strong ties (vs. weak ties). Recently, Campbell (2015) synthesized these lines of work and characterized the overall arc as a hypothesis of "network privatism". The central claim emerging from Ling ("bounded solidarity"), Habuchi ("tele-cocooning"), and Gergen ("monadic clusters") is that mobile affordances facilitate a socially inward focus. Hence, network privatism maps onto Kadushin's (2012) network safety, though the former is typically treated more as an outcome than motivation. Combined, these theories spurred a number of empirical studies into the effects of mobile usage on network outcomes.

Why would mobile communication prompt network closure? First, temporal limitations on possible communication mean that increased close tie communication might displace that of weak ties (Kobayashi & Boase, 2014). Second, the increased availability of core ties allows individuals to *choose* to communicate with their core ties, which they do consistently (Ling et al., 2014). In turn, individuals can also choose to ignore weaker ties, thereby leading to network closure over time. Third, core ties will tend to be more cognitively activated in general, and thus likely to be more *salient* than other communication options. The findings from Kobayashi and

Boase's (2014) study can be interpreted as support for the reasoning that some people are more "salient" than others. Likewise, Bayer, Campbell, and Ling (2015) postulated that more rehearsed communication partners become more salient, automatically, over time.

All three of the proposed mechanisms tied to the mobile literature – limited time, unlimited choice, and strong-tie salience – depend on the mobile affordances Schrock (2015) labels as availability[11] and (by default) portability. Together, these mobile affordances allow for "directness" and shared implicit expectations of ambient accessibility (Ito & Okabe, 2005; Ling, 2012). In his seminal work on *connected presence*, Licoppe (2004) speaks of the perceived "reassurance" that comes with enhanced directness. Indeed, Licoppe notes that, "The aims of reassurance and of maintaining a close link through small communicative gestures tend to merge" (p. 145). As such, strong ties come to be a source of reassurance. Thus, the mobile phone allows for trusted ties to serve a special role – security – that are surely there in times of need.

Recently, Hampton (2016) predicted that another (related) affordance, pervasive awareness[12], would also facilitate network closure. In contrast to the focus on texting in past theory on network privatism, Hampton stresses the emerging role of one-to-many social platforms, and Facebook especially. Indeed, Hampton (2016) argues that pervasive awareness need not come from direct interaction; rather, passive consumption of social information (e.g., newsfeed) can be quite effective. With the lower effort required to achieve surface awareness of close relationships at all times, as well as added public space to expedite cohesion within social circles and small communities, awareness offers another route to network closure.

---

[11] To clarify, I (nor Schrock) do not treat availability as synonymous with frequency, though the two are likely to be related.
[12] Arguably, Hampton's conceptualization of awareness includes most dimensions of availability and portability, muddying the various terminologies.

In total, a number of affordances have been theorized to guide individuals inward to network safety, rather than outward to network efficacy. Yet in spite of four theories – or five if you count Campbell's (2015) meta-framework – positing a shift toward closure, empirical evidence is rather mixed. For instance, Kobayashi and Boase (2014) find evidence that heavy texting is associated with lower general social trust in others (i.e., including weak ties). However, other work by the authors, as well as other researchers, finds little evidence that more mobile use undermines connections to weak ties, diverse ties, or new ties (see Campbell, 2015). The lack of support for network privatism may be a result of these technologies providing an "added layer" of connectivity to strengthen close ties without subtracting from weak ties (Campbell, 2015), especially with increasing numbers of smartphones.

An alternative explanation for the lack of current evidence for network privatism theory is that gross counts of communication mask underlying processes. Clearly, there is indisputable data showing that individuals largely use their mobile devices to connect with their strong ties (Ling et al., 2014; Miritello et al., 2013). The problem is that such data does not speak to *when* individuals target strong ties *instead* of their wider network. I suggest one time when this shift might occur is moments of perceived social isolation. The affordances reviewed above, including availability and awareness, grant people with high concerns of isolation new ways to focus on their strong ties and core circles. Consequently, the effects for perceived isolation might be stronger for communication networks that are defined by these social affordances.

Overview of Studies

In order to substantiate the theoretical framework above, this dissertation encompasses three studies linking exclusion sensitivity to online networks. The studies offer complementary perspectives with three discrete measures of perceived social isolation. Previous research in

overlapping areas has primarily evaluated interactions with strangers, romantic partners, or general others, rather than implications for personal online networks. Accounting for this overlooked dimension, the current studies measure real world networks in terms of tie strength (strong vs. weak) and egocentric structure (density, transitivity, clustering).

The first study (Chapter 2) tests the idea that individuals immediately turn to their close ties when potential social isolation is made salient. To do so, I conduct an experiment to determine whether people share more or less information online with different relationships after exclusion. The study adopts a classic manipulation from social psychology in which participants partake in a basic cooperation game – only to be excluded from the game after the first round. Based on the theoretical model above, excluded (vs. included) participants should share more news articles online with their closer ties, but not their weaker relationships.

The second study (Chapter 3) examines if individuals with high reactivity to perceived isolation exhibit increased online network closure in their enduring networks. Hence, I examine whether isolation sensitivity, as measured through implicit *in vivo* reactions via fMRI, predicts Facebook network closure. Once again, I utilized the same exclusion task from the previous study. In this case, however, all participants are excluded and scored based on how much discomfort felt (via neural responses) during the experience. Participants with higher sensitivity to exclusion, as indexed by the amount of activity in so-called "social pain" brain regions of interest (ROIs), should have increased online network closure.

The third study (Chapter 4) evaluates how trait isolation fears manifest at two levels of analysis: everyday interactions and enduring structure. First, perceived isolation tendencies were measured using an established questionnaire on rejection sensitivity (MSR). To test whether more rejection sensitive people engage differentially with strong (vs. weak) ties, I draw on data

from experience sampling method (i.e., *in vivo* real world interactions). As in Study 2, network closure was assessed using online network friendships via the Facebook API. If participants report stronger fears of social isolation, these concerns should lead to less rewarding weak tie interactions during daily life, as well as increased online network closure.

The series of studies thus incorporates different measures of perceived isolation and different measures of online networks. Specifically, I group three social experiences under the umbrella of perceived isolation: induced exclusion (Study 1), exclusion reactivity (Study 2), and rejection sensitivity (Study 3). In addition, the network measures focus primarily on Facebook. As discussed above, Facebook is a social platform defined by both availability and awareness affordances. Therefore, feelings of isolation are especially likely to manifest in core Facebook networks. As a set, the studies help to build a new framework for theorizing the relationship between perceived isolation and online network structure.

Chapter II

Social Exclusion Increases Online Sharing with Close Friends

Isolating the factors that determine when people share – and to whom – is essential to understanding not only classic social transmission (Lasswell, 1948), but also everyday emotion regulation (Rime, 2009). Moving beyond generalized social support and social capital (e.g., Albrecht & Adelman, 1984), research is just starting to unpack how newer technologies allow for newer versions of emotion regulation. In particular, the heightened connectedness in contemporary society allows people to share with almost *anyone* in their personal network at almost *anytime* (Bayer, Campbell, & Ling, 2016; J. Berger, 2014). In turn, mobile technologies offer a new and immediate path to emotion regulation via supportive others (Hoffner & Lee, 2015; Cheung et al., 2014). Responding to these societal changes, this experiment integrates emerging perspectives on social transmission and personal networks to clarify how people respond in the minutes after negative social events.

People share more information with others when in high arousal emotional states and tend to share more positive (vs. negative) content (J. Berger & Milkman, 2012; J. Berger, 2011). Most controlled tests of arousal on sharing, however, have focused on positive or neutral arousal, typically using personal activities to elicit arousal (e.g., reading news, physical exercise, etc.). Research has yet to consider how different sources of emotion, such as social vs. nonsocial experiences, may alter the sharing process. Accounting for the type of distress is important because different events motivate different types of regulatory strategies (Bonanno & Burton,

2013; Frijda, Ridderinkhof, & Rietveld, 2014). To begin to address this gap, we focus on one common source of arousal that is known to affect subsequent social behavior: exclusion.

The current study is thus differentiated from previous work on social transmission in a number of ways. First, we test how a common *negative arousal* state causally alters social sharing and discuss the implications for emotion regulation. Second, we concentrate on *social arousal*, or arousal caused by a social event. Previous research within the stress literature has shown that social-evaluative threat and other social threats produce particularly strong physiological responses, relative to other kinds of negative affect (Dickerson & Kemeny, 2004). In doing so, we expand theory on social transmission to consider the role of emotions induced through social situations. The interpersonal source of certain emotional states may lead to different outcomes than those arising from personal behaviors.

Social Exclusion to Social Transmission

Social exclusion represents a regular occurrence in human life, and reliably causes more negative mood (Blackhart, Nelson, Knowles, Baumeister, & Nelson, 2009). Some work also suggests that it causes drops in perceptions of self-esteem, belonging, and control (Gerber & Wheeler, 2009). The negative reactions to ostracism begin with an emotional "numbness" followed by distress that has been compared to physical pain (Kross, Berman, Mischel, Smith, & Wager, 2011; c.f., Woo et al., 2014). Nonetheless, the temporary effects of lower mood can compound into long-term distress if repeated in a consistent manner (Sebastian, Viding, Williams, & Blakemore, 2010). Indeed, low levels of belonging are associated with a range of negative indices of psychological and physical health (Baumeister & Leary, 1995).

Social exclusion need not occur in face-to-face interaction to be impactful; rather, the effects of are just as potent online (A. Smith, 2004). Given these psychological costs, it is vital

for individuals to regulate their emotional reactions to exclusion in order to minimize long-term damage. After the initial stage of numbness and social distress, unconscious processes shift victims' attention to stimuli with positive affect to restore psychological equilibrium (DeWall et al., 2011). Individuals can also emotionally regulate by reaching out to others, consciously or unconsciously. Indeed, research suggests that people will react anti-socially if inclusion seems unlikely – but otherwise pursue prosocial goals (DeWall & Richman, 2011; Kawamoto, Ura, & Nittono, 2015; Williams & Nida, 2011).

In past experimental work, individuals "reconnect" by choosing to interact with others over being alone, attending to social information more closely, seeking out new social connections, viewing new contacts in a more positive light, or contributing more money to a group task (Maner, DeWall, Baumeister, & Schaller, 2007; Romero-Canyas et al., 2010; Williams & Nida, 2011) Moreover, past work shows that while exclusion weakens self-control (Baumeister, Dewall, Ciarocco, & Twenge, 2005), excluded participants regain self-control when performance on a subsequent task offers potential for social acceptance (DeWall, Baumeister, & Vohs, 2008). Yet these experiments largely focus on manipulations that involve unknown strangers and overlook the role of emerging media. In this study, we designed an experiment in which participants could engage with their personal networks. .

Online Sharing as Emotion Regulation

Surprisingly, extant research is limited in explaining how people respond to social exclusion using their own networks. When new people are not available to engage with after rejection, research suggests that individuals turn to symbolic reminders of their own connections (see Leary, 2010). However, individuals are now free to communicate with their online network at any moment, and these relationships are generally expected to stay connected through mobile

devices (Ling, 2012). More than symbols, current technologies provide "ambient" availability to core ties (Ito & Okabe, 2005; Schrock, 2015), and the act of sharing may provide an emotional reward even if these messages are not reciprocated (Meshi et al., 2016; Tamir & Mitchell, 2012).

Consequently, online connections have the potential act as extra emotional resources throughout daily experiences (Hoffner & Lee, 2015). Accordingly, some work suggests that people may turn to online networks in order to overcome negative offline events. For example, Toma and Hancock (2013) found that people tend to respond to negative feedback by turning to their Facebook profiles in a self-affirming manner. As such, experiences of rejection have the potential to cause carryover effects for subsequent online activities, such as reading news websites in line with social transmission research (e.g., Berger, 2010). Bringing these ideas together, we expected that excluded individuals would share more online news articles with their own contacts in an allegedly unrelated task.

H1: Participants who are excluded (vs. included) will share more news articles with members of their online social network.

Strong and Weak Relationships

If excluded people seek out others when social acceptance appears probable, then one's personal relationships represent a safer choice than strangers. However, within a personal network, discrete ties serve different emotion regulation needs (Cheung, Gardner, & Anderson, 2014), so it is unclear who exactly excluded people would seek out. The foremost variable for differentiating relationships is perceived closeness, or tie strength (Marsden & Campbell, 1984). Strong ties represent clear targets for sharing given their deeper trust, perceived supportiveness, and emotional benefits (Forgas, Bower, & Krantz, 1984; Wellman & Wortley, 1990). On the other hand, recent work reveals that weak ties are common outlets for discussing important

25

matters, preferred contacts for some sensitive information, and surprisingly beneficial to personal well-being (Sandstrom & Dunn, 2014; Small, 2013).

Aside from tie strength, social dynamics differ greatly as a function of whether ties are family or friends (Burt, 2000; Wellman & Wortley, 1990; Brashears, 2013). For instance, Roberts and Dunbar (2011) find that more frequent contact is associated with greater emotional closeness for friends – but not for family. Likewise, close family contacts do not appear to require the same type of relationship maintenance that others do. Individuals travel further to visit genetically closer kin even when those relationships lack emotional closeness (Pollet, Roberts, & Dunbar, 2013). Considering the unclear theoretical links between social exclusion and relationship type (strong vs. weak ties, family vs. friends), we approached this set of sharing outcomes as a research question.

RQ1: Do participants who are excluded (vs. included) share more with (1a) close or weak family and (1b) close or weak friends?

Method

Participants

Ninety-four college students (62 female; age range 18-24) participated in exchange for psychology and communication course credit[13].

Materials and procedure

The study was conducted over two sessions (Appointment 1 and 2) in order to minimize potential demand and carryover effects. In Appointment 1, participants completed a task in which they filled out information about their personal social network. The social network task

---

[13] One hundred and twenty-eight students attended both of two appointments, but thirty-two participants experienced errors with our news sharing software, and two participants didn't complete the self-control scale.

26

mapped each personal social network such that the participant would enter up to 20 family

members, 20 recent calling partners, 20 recent texting partners, and 20 recent Facebook

interaction partners (via the Facebook API). For calling and texting partners, participants were

asked to take out their phones to identify their recent interaction partners. For Facebook

relationships, participants logged into Facebook and installed an app that automatically identified

the most recent interaction partners via logged data. Once the network was populated with the

four types of relationships, participants then rated the perceived "closeness" of each contact on a

seven-point scale ranging from (1) do not know to (7) very close.

After a minimum of 5 days, participants came back for Appointment 2. In line with

research discussed above (i.e., DeWall, Baumeister, & Vohs, 2008), we also accounted for the

potential role of trait self-control as a secondary interest. As such, participants filled out the

shortened version of the Brief Self-Control Scale (Maloney, Grawitch, & Barber, 2012; Tangney,

Baumeister, & Boone, 2004) in order to evaluate dispositional self-control, which included eight

items in total (e.g., *I am good at resisting temptation, I am lazy, People would say that I have

iron self-discipline, I refuse things that are bad for* me). After completing the surveys,

participants completed two tasks: *Cyberball* (social exclusion) and *BlueReader* (news sharing).

Cyberball is an established and reliable exclusion paradigm in which participants are told

they will do "a mental visualization task" (Williams, Cheung, & Choi, 2000). In the game, an

avatar, representing the participant, throws a ball with two other avatars. Participants were told

they were engaging in the task with two students from other nearby colleges. Participants were

randomly assigned to one of two conditions (exclusion vs. inclusion). In the inclusion condition,

the other avatars were pre-programmed to throw the ball to the participant at regular occasions.

However, in the exclusion condition, the other avatars were pre-programmed to begin the game

by throwing the ball to the participant but later only threw the ball to one another, excluding the participant from the game. The game reliably elicits distress and has been replicated both offline and online (see Williams & Nida, 2011, for a review).

Following the Cyberball task, participants completed a standard manipulation check measure for Cyberball, the need threat scale (NTS; van Beest & Williams, 2006). Responses were assessed on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Participants answered 20 questions (e.g., *I think that my participation in the game was useful, I had the idea that I had the same value as the other players,* and *I had the feeling that I belonged to the group during the game*). The Need Threat Scale is made up of four sub-scales relating to perceived belongingness, self-esteem, control, and meaningfulness related to the Cyberball activity. Higher scores on the NTS indicate greater need *satisfaction*, or less self-reported distress following the experimental manipulation.

Participants were then asked to complete a second, ostensibly unrelated task. The second task involved "pilot testing" *BlueReader*, a news site for reading and sharing news articles with other students at the researchers' university. The name of the site was chosen to invoke the primary official color of the university. Using the news-sharing website, participants were asked to read six pre-selected news articles. The software had a feature to share the news articles with friends (populated with each participant's contacts from their personal network).

After participants read each article, *BlueReader* presented four contacts semi-randomly from the participants' own network – two close ties and two weak ties – with whom participants could share the article. The site also included a search option where participants could search for and share with other members from their networks. Participants were asked to share articles as they normally would in "real life" in order provide feedback on the best and worst features of the

website. As such, participants were instructed to share as much as they wanted but were given no requirements for sharing. The counts of news stories shared, along with the types of relationships shared with, were recorded for statistical analysis.

Results

In order to check the effectiveness of the Cyberball manipulation, we computed indices of belongingness ($\alpha = .76$), self-esteem ($\alpha = .69$), meaningfulness ($\alpha = .69$), and control ($\alpha = .73$) from the Need Threat Scale.[14] Excluded participants felt less included [$M_{included} = 3.72$, $M_{excluded} = 2.79$; $F(1, 82) = 33.17$, $p < .001$], lower in self-esteem [$M_{included} = 2.91$, $M_{excluded} = 2.46$; $F(1, 82) = 8.79$, $p = .004$], less meaningful [$M_{included} = 3.52$, $M_{excluded} = 2.79$; $F(1, 82) = 23.32$, $p < .001$], and less control [$M_{included} = 3.01$, $M_{excluded} = 2.22$; $F(1, 82) = 20.70$, $p < .001$]. Thus, Cyberball effectively manipulated social exclusion.

In order to test the research question concerning the types of sharing partners, we identified whether the targets of article sharing were socially distant (closeness rating of four, three, or two) or socially close to the participant (closeness rating of five, six, or seven) and whether the targets of article sharing were family members. Separate models were run for number of articles shared with close family, close friends, weak family, and weak friends as outcome variables. For each model, we submitted number of shares measure to a multiple regression, with self-control (continuous), Cyberball condition (included vs. excluded), and their interaction simultaneously entered as mean-centered predictors. We also controlled for individual differences in overall sharing behavior by entering each participant's total number of article shares in the BlueReader task as a factor in the model.

---

[14] Ten cases were missing Cyberball manipulation check data, bringing the total number of cases for this analysis down to 84.

We first evaluated (H1) the effect of exclusion on overall sharing independent of relationship type but found no significant effect ($p > 0.10$). We next tested (RQ1) whether exclusion produced more sharing to close friends, close family, distant friends, and distant family. The hypothesis was supported for close friends: $b = 1.37$, $se = 0.53$, $t(89) = 2.59$, $p = .011$, $r = .26$ for the effect of Cyberball condition. Therefore, exclusion prompted more sharing than inclusion for close friends. We additionally conducted the same multiple regressions on our other measures of sharing behavior: number of shares with close family targets, distant friend targets, and distant family targets. Exclusion, self-control, and their interaction had no significant effects on sharing behavior with neither distant non-family targets nor distant family targets: all ps > .10. However, Cyberball exclusion prompted less sharing with close family ties: $b = -1.17$, $se = .49$, $t(89) = -2.41$, $p = .018$, $r = .25$ for the main effect of Cyberball condition.

The Brief Self-Control Scale (BSCS) items were averaged to create a single score. There was no main effect of trait self-control on news sharing: $b = 0.40$, $se = 0.28$, $t(89) = 1.42$, $p = .160$. There was, however, a marginally significant interaction between self-control and condition on sharing behavior, $b = 1.12$, $se = 0.58$, $t(89) = 1.93$, $p = .057$, $r = .20$. We diagnosed this two-way interaction with a spotlight analysis (Aiken & West, 1991; Hayes, 2012) that assessed the effect of Cyberball exclusion condition at low (-1 SD) and high (+1 SD) trait self-control. At high self-control (+1 SD), exclusion prompted more sharing behavior than inclusion, $b = 2.46$, $se = 0.78$, $t(89) = 3.14$, $p = .002$, $r = .32$ for the simple slope. However, at low self-control (-1 SD), exclusion had no effect on sharing behavior, $b = 0.28$, $se = 0.77$, $t(89) = 0.37$, $p = .712$. Thus, people with high trait self-control – but not low trait self-control – share more news articles in response to exclusion. See Figure 1.

Discussion

Social exclusion increases online news sharing to close friends, but not weak friends or family. These results suggest that sharing more with close friends represents an emotional response tied to a negative social experience. When belongingness is threatened, close friendships may represent a salient cure for feeling excluded, despite increasing attention to the emotional benefits of weak relationships (e.g., Sandstrom & Dunn, 2014). The existing literature has shown that people tend to reach out when acceptance seems probable. Strong friendships are associated with greater trust, thus providing a safer set of targets in times of need. Therefore, the shift toward core friendships may reflect the fact that they are likely prospects for receiving emotional support and avoiding further rejection.

From a more fine-grained standpoint, this study also provides initial evidence for the reallocation of social network attention. Participants shared more with close friends and less with close family. Family ties do not require as much effort to maintain (Roberts et al., 2011), and seem to be less susceptible to relationship decay (Burt, 2000). Given their special status, it is possible that participants tended to disregard family ties after exclusion because they draw from a separate pool of social belongingness than non-kin relationships. Levy, Ayduk, & Downey (2001) suggest, "…the need to be accepted can be fulfilled or denied in many types of relationships, ships, including proximal (parents, peers, romantic) and distal relationships (group, community, society). People can simultaneously experience social acceptance or rejection in one or more kinds of relationships" (s. 3682-3684). If genetic ties are more secure and draw from a separate pool, they may be less primed when excluded by college peers.

More broadly, we bolster emerging theoretical work on "emotionships" that argues different relationships often offer unique benefits for emotional regulation (Cheung et al., 2014). Unexpectedly, we found that the effects of exclusion on sharing occurred more strongly for

31

people with higher self-control. Hence, people with lower self-control did not differ in their sharing across conditions (inclusion vs. exclusion). Trait self-control is predictive of better emotion regulation and social relationships (Hagger, 2014), so people with higher self-control are likely to be more versatile in their self-regulatory repertoire. As suggested by the example items listed above, the Tangney measure of trait self-control indexes whether participants view themselves as personifying a general self-efficacy. For these reasons, the observed effects most likely reflect the ability of high self-control participants to regulate their emotions through multiple strategies, including reaching out to close friends. Together with the main effects, the findings suggest a self-regulatory role of targeted sharing with core friendships.

Implications for Social Transmission

Similar to Berger (2010), we find that a manipulation known to affect emotional arousal can spur "unrelated" news sharing to others. In this case, however, the high arousal emotion is induced by a social activity. This distinction is significant given that the act of sharing is inherently social, and socially derived emotions are sometimes processed differently. The fact that exclusion only increased sharing with close relationships can be contrasted with the general arousal effects found in prior work (e.g., Berger, 2010). In other words, whereas previous studies found a categorical positive effect of arousal on sharing, we found a contextual effect. The lack of a universal effect in our study may be due to our focus on social arousal (and social exclusion, specifically), as compared to non-social arousal manipulations (e.g., running in place). Although exclusion represents a common experience and established literature, a wider variety of social challenges should be considered in future work on sharing as emotion regulation.

In contrast to research on "emotion sharing" (see Rime, 2009), we did not measure the extent to which people shared discrete emotional events. As a result, it is unclear whether

individuals would be more likely to reference the negative emotional experience. Instead, the current research suggests that negative emotional experiences in offline life could prompt separate social transmission through mediated channels. The implication here is that regardless of whether people talk about negative emotional events post hoc, the event may guide later mediated communication. Nonetheless, another question for future research is whether individuals acknowledge their negative experiences explicitly, or whether the effects of exclusion on sharing unfold invisibly in the background of daily life.

Implications for Social Networks

Concurrently, the results must be placed within the larger context of communication technology. Research has established that mobile technologies allow people to feel closer to their core ties, and people communicate mostly with core ties (Campbell, 2015). Recent work also highlights the importance of mobile devices for emotion regulation strategies (Hoffner, & Lee, 2015). The (somewhat) recent technological changes in social interaction make it easier – and perhaps more salient – for people to respond to negative social experiences by interacting with their core friends. Since people can choose whom to "reconnect" with at any moment via texting, close relationships may come to act as a social safety kit.

More broadly, the observed effects raise the possibility that mobile affordances may supplement traditional emotion regulation strategies. These implications warrant contrast with the *tele-cocooning hypothesis* (Kobayashi & Boase, 2014), which states that mobile technology strengthens strong ties at the expense of weak ties. In our case, the increased sharing for close friends and decreased sharing for close family indicate that exclusion shifts the outlets for sharing – as opposed to changing total sharing. It is also worth noting that individuals did not share *less* with their weak ties after exclusion (vs. inclusion). In other words, people were not

avoiding weak ties post exclusion; they were simply reaching more toward their close friends. This represents a more contextual "tele-cocooning" effect in which communication technologies allow for a shift in social targets under specific conditions (e.g., post-exclusion).

Conclusion

Whereas much of the literature on social exclusion has focused on how people respond to in-lab strangers, our research allowed participants to respond using an added social resource: a personal online network. By giving participants the chance to share as much as they want (or not at all) with real relationships, we provide a more naturalistic setting to investigate the effects of being excluded. Further research on the psychological processes underlying social transmission should adopt paradigms that incorporate the complete armory of social resources. When individuals experience negative social events, they are likely to have their smartphones in hand with access to an abundance of interaction partners and channels. Based on these social choices due to increased availability, more research on social network cognition is needed to determine how individuals overcome the unfortunate moments of social life.

Chapter III

Sensitivity to Exclusion Underpins Core Network Closure

Past research shows that psychological differences strongly contribute to the shape of personal networks. In particular, stable personality traits, such as extraversion, neuroticism, and self-monitoring, are consistently predictive of egocentric network structure in organizational and personal life (Kalish & Robins, 2006; Landis, 2016; Oh & Kilduff, 2008). Other research suggests that individual differences like emotional expressivity (H. Lin, Tov, & Qiu, 2014), optimism (Andersson, 2012), and genetic predispositions (Fowler, Dawes, & Christakis, 2009) can also contribute to the overall the structure of personal networks. Indeed, one recent study showed that characteristics of an ego network are indicative of a stable individual differences variable, or a "network-relevant personality" (Burt, 2012).

In other words, some people are likely to find themselves in certain types of networks regardless of the social context. Burt's (2012) study of a virtual world and multirole characters found that roughly one third of network structure was attributable to individual tendencies. Here, we consider how individual differences in sensitivity to social exclusion, as indexed by *in vivo* neurocognitive reactions during fMRI, may also underlie personal network characteristics. Individuals differ on the degree to which their personal networks are interconnected, or network closure. Nonetheless, much remains unknown about the psychological precursors to personal network closure. Therefore, we suggest that unpacking this relationship can provide insight into the links between brain function, individual differences, and social ecologies.

Neural Responses to Social Exclusion

As discussed in the previous chapter, experimental research has reliably shown that discrete social exclusion damages mood, self-esteem, and sense of belonging (see Blackhart et al., 2009, for a review). Additionally, neuroscience research has shown that there are consistent brain regions that respond to social disconnection (Eisenberger, 2013), including the anterior insula (AI), dorsal anterior cingulate cortex (dACC), and subgenual anterior cingulate cortex (subACC) in adolescents and some studies of adults (Masten, Eisenberger, & Borofsky, 2009). As such, this study focuses on adolescents' responses within a priori hypothesized neural regions associated with distress during exclusion, known as the "social pain network". See Figure 2.

Given that exclusion is highly costly in an evolutionary context (Eisenberger, 2013) as well as a contemporary context (e.g., fear of missing out, or "FoMO"; see Przybylski, Murayama, Dehaan, & Gladwell, 2013), social pain signals are thought to keep individuals connected to their groups. If individuals felt nothing when a negative social event occurred, there would be less motivation to prevent disconnection or take steps to reestablish group membership. And this concern is particularly significant during adolescence – when peer relationships, and social exclusion, become increasingly salient (Reich, Subrahmanyam, & Espinoza, 2012). Thus, social pain responses represent a physiological measure of exclusion sensitivity.

Social and Communication Networks

Social network theories are used to explain social outcomes across disciplines (e.g., Burt, 1992; Granovetter, 1973; Monge & Contractor, 2003), and are increasingly relevant to communication neuroscience research (O'Donnell & Falk, 2015). Kornienko et al. (2013) state, "Social network analysis provides powerful tools for measuring and quantifying an individual's social ecology by focusing on his or her position in a network" (p. 386). As such, ego-network analysis represents one way of measuring the socioemotional resources of a given individual.

36

Yet, surprisingly, such ecological perspectives have not been emphasized within research on psychological processes thus far (Kalish & Robins, 2006; Oishi & Graham, 2010).

In classic network studies, researchers often utilized name-generator methods in which participants are asked to self-report contacts (Hlebec & Kogovšek, 2013; Merluzzi & Burt, 2013). With the advent of computer-mediated interaction, a prominent subtype of social network is a communication or interaction network (Miritello, 2013; Wellman, 2001). In contrast to previous work combining social network analysis and biological measures, we report on semi-objective measures from Facebook's Application Programming Interface (API), rather than self-reported personal contacts. Collecting data via the Facebook API also allowed us to draw on logs of past communication to create more refined "active" or core networks.

We thus focus on two forms of social networks gathered through Facebook: full networks and active networks. The first encompasses all individuals with whom the ego is directly connected on the social platform, and strongly overlaps with offline networks. Indeed, full networks on Facebook can index a relatively accurate depiction of overall social networks for some groups (Kane, Alavi, Labianca, Borgatti, & Center, 2014; La Gala, Arnaboldi, Passarella, & Conti, 2012). Separately, communication networks may provide a discrete compass of the individual's active social environment (Miritello, 2013). By concentrating specifically on the active interpersonal relationships (or core Facebook network), the resulting measure may have different consequences and correlates from the static friendship network.

Facebook Network Size and Closure

Facebook, in particular, occupies a central position in adolescent interaction and the site represents a large resource for social support and social capital (Rozzell et al., 2014; Steinfield, Ellison, Lampe, & Vitak, 2012). The use of Facebook also allows for insight into potential

distinctions in more "online" and "offline" network correlates (Kane et al., 2014). Whereas the overall friendship network is highly overlapping with one's offline network (La Gala et al., 2012), interaction networks are likely to be more fluid. Indeed, recent research suggests that the members of one's core network shift regularly as people change life contexts (Small, Deeds Pamphile, & McMahan, 2015). Yet people still appear to have a "signature" network size and communication pattern that subsists despite turnover in specific partners (Saramäki et al., 2014).

In this case, we examine the shared and unique links between brain reactivity to social exclusion and core network metrics, including size and closure. One recent study found that neural reactivity during a reputational gains fMRI task (ROI: nucleus accumbens) predicted self-reported Facebook usage intensity (Meshi, Morawetz, & Heekeren, 2013). Hence, there is some reason to think that neural measures can help to explain Facebook network features, in line with the "brain-as-predictor" approach (Berkman & Falk, 2013). In a Facebook friendship network, network size is equal to the number of accepted "friends" of the participant. By contrast, interactive relationships between each ego and alter afford a more dynamic measure of social relationships. In these cases, the alters who do not meet a specific criterion (i.e., amount or type of communication) are removed (Miritello, 2012). Therefore, for interaction networks, size equals the remaining "pruned" or "active" network after dropping inactive members.

Moving beyond network size or "ego degree", a second prominent dimension of networks is closure, or the extent to which individuals within the network are interconnected. Two network metrics that signal network closure are density and transitivity. Density is the proportion of connected nodes out of total possible links, whereas transitivity is the proportion of closed triangles in cases when two links share a vertex. In our data, two friends are connected if they are friends with each other on Facebook independent of the ego. Thus, in a hypothetical

network of five friends, the ego would have a maximally dense network if all five friends know each other, but a minimally dense network if none of them are friends on Facebook.

Social Cognition and Social Networks

Although most research linking individual differences to network structure has focused on broad personality traits (e.g., Big Five factors), some studies have moved toward understanding how cognitive factors relate to network characteristics. Recent fMRI research has started to examine the neurocognitive mechanisms associated with one's social network position. For example, more popular people are more sensitive to others' social network popularity (via affective valuation system activity; vmPFC, ventral striatum, amygdala), and even better at detecting others' actual popularity (Zerubavel, Bearman, Weber, & Ochsner, 2015).

Nonetheless, most of the cognitive network research thus far considers (and bolsters) the "social brain" hypothesis, or the idea that larger brain processing has evolved to keep track of complicated social worlds (Dunbar, 2014b). For instance, one experimental study found that greater consideration of others' mental states (mentalizing) and memory capacity are associated with larger network size (Stiller & Dunbar, 2007). More recently, a series of neurocognitive studies have found similar links between neuroimaging measures and network attributes. Kanai et al. (2011) observed positive correlations between the grey matter volume of social cognitive regions and Facebook network size. Further, personal network size is related to (1) larger brain volumes and greater functional connectivity between the amygdala and cortical regions associated with social perception and affiliation (Bickart, Hollenbeck, Barrett, & Dickerson, 2012), and (2) the diversity of social roles in a social network is positively correlated with white matter integrity (Molesworth, Sheu, Cohen, Gianaros, & Verstynen, 2014). Yet minimal research

has evaluated how social cognitive tendencies – such as responses to social exclusion – may underpin social network structure.

Extant research suggests neural reactivity to social exclusion is related to individuals' social environments and social support. For example, people who interact with supportive others more often show less neural sensitivity to social exclusion (Eisenberger, Taylor, Gable, Hilmert, & Lieberman, 2007). Prior research has also observed a negative relationship between social pain responses and the amount of time spent with friends (Masten et al., 2012). By comparison, people with higher rejection sensitivity tend to make less friends during their freshman year of college (Levy et al., 2001). Separately, personality research has found that rejection sensitivity is positively correlated with neuroticism, and neuroticism is sometimes (but not always) associated with smaller personal network size (Butler, Doherty, & Potter, 2007; Ishiguro, 2016). Building on these studies, we hypothesized that increased neural reactivity within social pain regions would predict smaller network size.

H1: Social pain responses will be negatively associated with social network size.

Social Exclusion to Network Safety

Kadushin (2002; 2012) advances a framework of two competing motivations – safety vs. efficacy – that influence personal network structure. Accordingly, individuals are motivated to both (1) reinforce their most trusted circles and (2) seek out new leverage positions in an entrepreneurial fashion. However, one situation that might shift one's goal toward the inward "safety" motivation is a recent negative event. Following exclusion, individuals feel highly threatened and socially insecure (Baumeister & Leary, 1995). In response to such perceived social threat, Levy, Ayduk, & Downey (2001) argue that people with high rejection sensitivity may "withdraw" into close-knit groups. As such, we assert that exclusion may cause individuals

to retract into their safest social environment. In doing so, people who respond more intensely should exhibit increased enduring network closure.

As compared to network size, dense egocentric networks are inherently more close-knit (Hurlbert, Haines, & Beggs, 2000; Parks, 2011). The friends of the ego are more likely to know and interact with one another. Such close-knit groups may confer social support and an increased sense of community (N. Lin, 2001; Monge & Contractor, 2003). People who are positioned in denser networks are part of a more cohesive community with shared trust in each other, leading to stronger in-group norms (Burt et al., 2013). For these reasons, a more interconnected network theoretically represents a safe space with clear expectations and perhaps loyalty. At the same time, there is limited research on the motivational precursors to increased network closure.

Supporting this line of reasoning, one recent study found that after exclusion individuals were more likely to exaggerate the density of displayed social (but not geographical) networks (O'Connor & Gladstone, 2015). As such, there is now initial evidence for a cognitive link between responses to social exclusion and *perceived* density of networks. In the trait rejection sensitivity study referenced above, findings revealed that freshman students with high rejection sensitivity not only ended with fewer friends, but also less diverse friends (as indexed by demographics). Here, we consider whether differences in experienced "social pain" are related to *actual* density and transitivity in individuals' own stable communication networks over a yearlong period. If individuals tend to exhibit stronger reactions to exclusion, and exclusion causes individuals to engage with more trusted ties (in line with Study 1), then they may come to inhabit – or even pursue – denser communities.

H2: Social pain responses will be positively associated with social network closure.

Methods

41

Participants

Participants were recruited from a list of recently licensed teenage drivers provided by the Secretary of State in a Midwestern state in the U.S., as part of a larger study examining adolescent male driving behavior and susceptibility to peer influence (Falk et al., 2014; Simons-Morton et al., 2014). As such, the sample was homogenous with regard to age (all participants ranged were between 16 and 17), gender (male), and race (White). Participants were collected in two groups during 2012 (n = 35; M = 16.9 years, SD = 0.47 years) and 2013 (n = 70; M = 16.9, SD = .30) a year later[15]. As such, the sample was homogenous with regard to age, (16-17), gender (male), and race (White). In addition to completing an fMRI session, a subsample of 76 participants also provided logged Facebook network data[16].

Participants met standard fMRI and driving simulator inclusion criteria, such that all participants were right-handed, did not suffer from claustrophobia, were not currently taking any psychoactive medications, had normal (or corrected to normal) vision, did not have metal in their body that was contraindicated for fMRI, and did not typically experience motion sickness. Participants and their parents gave verbal and written assent/consent, respectively, before beginning the study in line with Institutional Review Board requirements.

Procedure

All data collection was completed ruing one study appointment. All participants completed Cyberball (Williams & Jarvis, 2006), a game in which they are socially excluded,

---

[15] The samples did not differ on demographics or key study variables (overall network size, p > 0.35; overall network density, p > 0.96) and are combined for the purpose of this investigation. Additional regression models were run to confirm the observed effects did not differ when controlling for sample wave.

[16] The remaining participants from the larger sample (n = 29) either chose not to contribute data from their Facebook profiles when asked to do so voluntarily or experienced technical problems that undermined logged data collection.

during an fMRI session. They also completed a post-scan self-report measure of distress (need threat scale [NTS]; van Beest & Williams, 2006) in response to the exclusion experience and later provided access to their logged Facebook network data.

   fMRI Session. Participants played Cyberball while we monitored neural activity throughout the brain using fMRI. Subjects who participated in the first data collection period met two age-matched confederates at the beginning of the study and were told that they would be participating in some tasks as a group later in the session. Subjects who participated in second data collection period of the study were shown a login screen in which the subject and two other participants "joined" the virtual game. During the Cyberball task, all participants were shown the visual representation of three people: their own hands and two other avatars with the names of the other players above them. In actuality, the participants all interacted with a preset computer program that mimicked the experience of playing catch with two others. The task was made up of two three-minute rounds. In the first round (inclusion), the participant was included equally in the passing from other players. In the second round (exclusion), the other players stopped throwing to the participant and only threw to one another; this manipulation has been shown to produce negative feelings associated with ostracism in many replications (Wolf et al., 2014).

   Self-Reported Distress Following Exclusion. The Need Threat Scale (NTS) was administered after the participants exited the fMRI scanner in order to evaluate self-perceptions of the social exclusion scenario. Responses were assessed on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Participants answered 20 questions (e.g., *I think that my participation in the game was useful, I had the idea that I had the same value as the other players,* and *I had the feeling that I belonged to the group during the game*). The Need Threat Scale is made up of four sub-scales relating to perceived belongingness, self-esteem, control, and

meaningfulness related to the Cyberball activity. Higher scores on the NTS indicate greater need *satisfaction*, or less self-reported distress following the manipulation. We averaged each sub-scale in line with previous work and tested the reliability across the four dimensions, confirming that the full scale had good reliability (Cronbach's $\alpha = 0.89$).

Facebook Data. After completing the fMRI session, each participant was asked whether he had a Facebook account. If so, he was asked whether he would be willing to contribute data from his personal wall feed to the study using an app that automatically logs historical data from the participant's profile. There were no penalties for individuals who preferred not to do so and all included participants provided informed assent, along with informed consent from their parents. In some cases, we encountered technical difficulties that precluded participants from volunteering their personal Facebook data. For individuals who volunteered Facebook data, the Facebook API was used to programmatically collect information about their network including the number of friends, the connections between their friends and a record of their recent interactions through wall posts, comments and likes. The names of all Facebook friends were removed during collection and before they were stored in a secure database. All Facebook identifiers (for people, messages, groups and connections) were encrypted using a one-way MD5 hash, which makes it impossible to go back from hashed ID to the original ID.

fMRI data acquisition. Imaging data were acquired using a 3 Tesla GE Signa MRI scanner. One functional run was recorded for each participant (251 volumes). Functional images were recorded using a reverse spiral sequence (TR = 2000ms, TE = 30ms, flip angle = 90°, 43 axial slices, FOV = 220mm, 3mm thick; voxel size = 3.44 x 3.44 x 3.0mm). A set of high resolution in plane structural images was recorded (43 slices; slice thickness = 3mm; voxel size = .86 x .86 .3.0mm) to facilitate co-registration and normalization. In addition, a set of high-

resolution structural T1-weighted anatomical SPGR images was acquired (124 slices; slice thickness = 1mm; voxel size = 1.02 x 1.02 x 1.2mm). Behavioral responses (i.e., Cyberball throws) were executed using a scanner compatible five-finger glove.

　　　　fMRI preprocessing and modeling. Functional data were pre-processed and analyzed using Statistical Parametric Mapping (SPM8, Wellcome Department of Cognitive Neurology, Institute of Neurology, London, UK). To allow for the stabilization of the BOLD signal, the first four volumes (eight seconds) of each run were discarded prior to analysis. Functional images were despiked using the 3dDespike program as implemented in the AFNI toolbox. Next, data were corrected for differences in the time of slice acquisition using since interpolation; the first slice served as the reference slice. Data were then spatially realigned to the first functional image. We then co-registered the functional and structural images using a two-stage procedure. First, in-plane T1 images were registered to the mean functional image. Next, high-resolution T1 images were registered to the in-plane image. Following co-registration, the high-resolution T1 images were segmented into white and gray matter allowing the skull to be removed. Structural and functional images were then normalized to the skull-stripped MNI template provided by FSL ("MNI152_T1_1mm_brain.nii"). In the final pre-processing step the functional images were smoothed using a Gaussian kernel (8 mm FWHM). Data were modeled for each subject using the general linear model as implemented in SPM8. Three trial phases were modeled: social inclusion, social exclusion, and a visual tracking phase, which is not the focus of the current investigation. These phases were modeled as blocks and convolved with the synthetic hemodynamic response as provided by SPM. The six rigid-body translation and rotation parameters derived from spatial realignment were also included as nuisance regressors. Data were high-pass filtered with a cutoff of 128 s.

Social Pain Regions of Interest. We focused on a priori hypothesized regions of the brain that have been previously associated with distress during exclusion: dACC, anterior insula, and subACC (Eisenberger, Lieberman, & Williams, 2003; Masten et al., 2009). See Figure 1. Anatomical ROIs were constructed in Wake Forest University Pickatlas toolbox within SPM (Maldjian, Laurienti, Kraft, & Burdette, 2003), taking definitions from the Automated Anatomical Labeling Atlas (AAL; (Tzourio-Mazoyer et al., 2002), Brodmann areas, and manual tracing, intersected with x, y, z bounds. MarsBar (Brett, Anton, Valabregue, & Poline, 2002) was used to convert these anatomical images to regions of interest (ROIs). The anterior insula ROI was defined as all voxels within the left and right insula masks provided by PickAtlas that were anterior to the y = 0 plane. The dACC ROI was defined as the union of Brodmann areas 24 and 32 (dilated to 2mm), as well as the anterior, middle, and posterior cingulate masks from the AAL atlas, minus Brodmann areas 8 and 9. Finally, the ROI is restricted to the voxels bounded by (x = -16 to 16, y = 0 to 33, and z = 6 to 52). The subACC ROI was manually traced to include regions of the cingulate and paracingulate cortices ventral to the body of the corpus callosum and posterior to the genu. The social pain network was constructed from the union of the anterior insula, dACC, and subACC (Falk et al., 2014). Finally, percent signal change scores were extracted from the contrast exclusion > inclusion for the network of ROIs as a whole.

Network Measures. The logged Facebook data, including data about participants' Facebook friends and friends-of-friends, was used to create the ego-network measures. First, the full network measures were computed from the complete friend list. Network ego degree is the total count of Facebook friends. Network density is equal to the proportion of actual friend connections out of all possible links among people included in the ego network. Transitivity is equal to the proportion of completed triangles out of all possible triads, or cases in which Friend

A knows Friend B and Friend B knows Friend C. Since the ego was automatically connected to all other nodes in the network (by virtue of them being friends), the default networks have the potential exaggerate structural measures of interconnectedness. For this reason, density and transitivity were calculated with ego node and its edges removed from the network. In Figure 3, two networks of similar size – but different density – are displayed, demonstrating how core and active networks can vary considerably despite including the same number of alters.

Second, we utilized the Facebook wall data to create more refined networks with participants' most frequent interaction partners over the prior year. However, Facebook wall activities are more symbolic than direct forms of interaction (e.g., likes, comments), and amount of activity varies greatly from person to person. Thus, building on the framework advanced by Dunbar and colleagues network layers (Sutcliffe et al., 2012), we created separate networks for the top five and top fifteen Facebook friends. In line with past research on communication networks, Facebook activity was highly skewed such that the top friends represented a large share of the overall interactions for each participant. The average number of interactions for each friend rank is displayed in Figure 4. This method helped to identify the most central friends independently from how much the participant used Facebook. In doing so, this allowed us to test how different structural features, including density and transitivity, operated at different network layers while holding size constant.

Finally, as a comparison set of "active" friendship networks, we also created one-month, two-month, three-month, and six-month networks based on Facebook interaction frequency. In this case, network measures were computed by removing people from the overall network who did not meet a communication criterion. Specifically, friends of the participant were not included in these "recent interaction" networks if they did not interact on any of the posts on participants'

47

Facebook walls at least once per month. In other words, whereas the other networks held size constant regardless of total Facebook post frequency, these networks held the interaction cutoff constant while allowing size to vary from person to person[17].

Data Analysis

Standard ordinary least squares (OLS) regression models were run in R to test our hypotheses (unless noted elsewhere). Primarily, we were interested in the relationship between implicit neural activity in the social pain network during exclusion (vs. inclusion) and personal network characteristics. However, we also considered the predictive capacity of self-reported need satisfaction (Need Threat Scale) following the exclusion manipulation.

To test the network size hypothesis, full friendship size was input as the DV. To test the network closure hypothesis, multiple models were specified with density and transitivity as DVs. Separate models were run for each network operationalization: full friendship network, significant tie network (top fifteen friends), and strong tie network (top five friends). Density and transitivity measures were transformed to maintain the regression assumption of normality. Following these transformations, all models passed standard linear assumption checks. Extra density models were also run for each of the supplementary active networks related to recent interactions (one-month, two-month, three-month, and six-month).

---

[17] Individuals who did not have at least ten qualifying friends during a given time span were dropped from the "recent interaction" models. This decision was made for three reasons. First, extremely small networks undercut the theoretical rationale for investigating network structure. For example, a network that includes only one friend cannot have a density since there are no other people for the individual to know. Previous research on organizational work networks suggests that a minimum of 5 friends, or alters, should be included when computing measures of network structure (Merluzzi & Burt, 2013). However, given that participants' personal communication networks were much larger and ranged more widely than this previous study on organizational networks, we tested models using both 5-person and 10-person cutoffs.

All regression models controlled for participant wave (1 or 2) to account for potential confounds in sample source. Each model also controlled for full network size and number of interactions with friends (i.e., "alters") in the ego network. Therefore, in full network models, Facebook activity represented the total amount of wall interactions with friends. Alternatively, in core network models, Facebook activity equaled the count of post interactions with core ties (Top 5 or Top 15 alters). Finally, significant and strong tie networks included an extra control for the proportion of total interactions accounted for by those core ties, respectively.

In addition, we examined a set of exploratory whole brain models to determine if additional neural processes associated with social exclusion were related to network size and density that extended beyond our hypothesized ROI analyses. These additional whole brain analyses independently regressed network size and density (one-month and full networks) onto the contrast (exclusion > inclusion) during the Cyberball task. Based on our a priori hypotheses that activity in social pain regions (dACC + AI + subACC) is related to social exclusion, whole brain regressions were corrected using a threshold of (p=.005, K=12), corrected for multiple comparisons based on a Monte Carlo simulation for the social pain regions (dACC + AI + subACC) mask in order to maintain an appropriate balance of type I and type II error risk (Lieberman & Cunningham, 2009). Regions outside of the hypothesized social pain network are reported with a threshold of p=.005, K=35, corrected for multiple comparisons based on a Monte Carlo simulation using a whole brain mask in AlphaSim (Ward, 2000).

Results

For our first hypothesis, the regression output showed that neither neural responses nor self-reported need satisfaction following exclusion were predictive of Facebook friendship network size (*p*'s > 0.38). Hence, H1 is not supported. For our second hypothesis, six models

were run in total (three density models, three transitivity models). In the case of density (Table 1), increased social pain activity during exclusion was associated with greater density in both the significant and strong friendship networks. Likewise, in the case of transitivity (Table 2), neural responses to exclusion were associated with increased transitivity, or triadic clustering, in both core networks. In addition, self-reported distress was positively correlated with full network transitivity. See Tables 1 and 2 for a complete description of path coefficients and model statistics. Finally, the "recent interaction" models also revealed a positive relationship between social pain responses and network closure, despite using different network computations and varying in size and timespan. Together, these results suggest that social pain responses are predictive of greater network closure, supporting H2.

Discussion

Our research supports the idea that individuals who experience more intense "social pain" communicate with a denser core network on Facebook. These results suggest that exclusion sensitivity is related to interacting online with a more close-knit circle during daily life. In addition, individuals who reported lower emotional satisfaction also exhibited greater full network closure. Combined, the results bolster the notion that individuals who are more sensitive to exclusion may gravitate to "safer" sets of relationships. By surrounding oneself with a dense set of trusted friends, one is less at risk for social isolation.

From a cognitive perspective, the social pain network, and dACC in particular, is implicated in conflict monitoring (MacDonald, Cohen, Stenger, & Carter, 2000), as well as other mental processes such as anxiety and distress that suggest an alarm-like function (Lieberman, 2007). The social pain network (dACC, AI, subACC) reliably responds to negative social encounters such as social rejection (e.g., Masten et al., 2012). This increased reactivity may serve

50

to preserve social ties, especially for those whose day-to-day social context would make exclusion particularly costly. For individuals who respond more strongly to negative cues from others, it is safer to maintain membership in a close-knit group of confidants.

The divergence between two forms of measuring reactions to exclusion (fMRI vs. self-reported NTS scale) demonstrates the usefulness of neural methods for studying interpersonal interaction, as fMRI can capture experiences that may not be evident from self-report alone (Falk, 2012). Indeed, whereas the implicit neural measures were reliably related to core network closure, the self-reported distress was only associated with full network closure. Although the two measures provide parallel implications – linking exclusion sensitivity to increased closure – more work is needed to clarify whether discrete mechanisms exist.

Our results also highlight discrete roles of online communication networks and friendship networks. For participants on Facebook, the network of core or strong ties – rather than simple friendships – was most strongly associated with responses to exclusion. Hence, the social network of active online communication (vs. total friends) is more strongly related to the intensity of exclusion. This calls to mind other research showing that the number of "actual friends" on Facebook, as opposed to total friends, can be predictive of social outcomes (Ellison, Steinfield, & Lampe, 2011). Overall, our study strengthens the relevance of social cognitive differences in predicting online network structure, with an emphasis on core ties.

Previous research focusing on offline support and raw time spent with friends demonstrates the power of social activity to buffer reactivity to exclusion (Eisenberger et al., 2007; Masten, Telzer, Fuligni, Lieberman, & Eisenberger, 2012). Counter to our first hypothesis, our findings showed that exclusion sensitivity was unrelated to network size. The absence of a total friendship network size effect may further highlight the limitations of total Facebook

51

networks. By contrast, our second hypothesis concerning network closure was supported across all models. Altogether, our findings strengthen calls for network measures to be incorporated into studies of psychological processes (Burt et al., 2013; Robins & Kashima, 2008), and for greater links between sociological and cognitive neuroscience perspectives (e.g., Cerulo, 2010).

In sum, more studies are needed that link sociological and individual perspectives, and implicit methods provide an opportunity for clarifying these links. Most research on these links, however, has focused on psychological characteristics with self-report methods (Landis, 2016; Robins & Kashima, 2008). Likewise, previous work on social network factors within cognitive neuroscience has typically taken a social influence, or environmental, theoretical perspective. Our study thereby demonstrates the usefulness of combining two distinct forms of data collection for communication research: logged social media activity for measures of social context and neurological measures of psychological experience. Bringing these two types of data together can inform our understanding of how more macro-level variables 'get under the skin' as well as informing our understanding of neuroscience, the human brain, and how brain function may be shaped by the social and communication environment.

The integration of network and neurocognitive methods is significant because it allows us to evaluate how different characteristics of social environments may moderate responses to social experiences that are difficult to observe through observation or self-report. Hence, these newer forms of data not only aid in the accurate description of social behavior, but also have the potential to unwind core processes of social cognition. For example, our data revealed that core interaction network closure – but not size or static network closure – is associated with one implicit form emotional processing. This finding would not have been possible with the use of self-report or neuroimaging data alone, as the broader social ecology (i.e., network closure)

effectively modulates the effects observed. Likewise, the increasing adoption of neuroimaging to answer research questions related to social cognition opens up new options for social network research. In this case, the real-time consequences for reactivity to social experience would not be clear by observing network attributes alone.

Of course, this data set also encompasses several limitations. We focused on adolescent, male Facebook users who volunteered information about their Facebook profiles. Although most participants chose to contribute their digital trace data, it is possible that this self-selection process biases our sample. It is also possible that different results would be observed using other forms of networks and/or samples. Future research should evaluate whether different types of networks (e.g., Face-to-Face, Twitter, Calling) relate to *in vivo* cognitive tendencies. Finally, the results should be interpreted with the usual caution regarding reverse inference in neuroimaging research (Poldrack, 2006), given that multiple functions underlie our brain regions of interest. Our a priori hypothesized regions of interest, however, attenuate this concern.

Conclusion

In this research, adolescents who reacted more intensely to exclusion (via fMRI) tended to have a denser core network on Facebook. These findings reveal how implicit exclusion sensitivity is related to the structure, rather than the sum, of interaction partners. As such, this study extends our understanding of the social cognitive underpinnings of network structure. Further, our findings underscore the promise of combining neuroimaging with networking to connect social cognitive processes and social network properties. Although the social network literature has linked structural features to a broad range of informational, organizational, and health outcomes, research is just starting to identify the links to personal cognition.

Chapter IV

Rejection Sensitivity Bolsters the Preference for Strong Ties

Classic theories in communication, psychology, and sociology suggest that the fear of being rejected, ignored, and isolated by others is nearly absolute (Baumeister and Leary, 1995; Durkheim, 1851; Noelle-Neumann, 1974). And in many ways, these core human concerns are not specious. To the contrary, experimental research on social exclusion has affirmed how the experience of being excluded, even temporarily and artificially, is remarkably potent (DeWall & Richman, 2011). Research also demonstrates that the periphery of social networks, the most secluded individuals, suffer substantially worse health consequences over time (Binder et al., 2012; Cacioppo, Fowler, & Christakis, 2009; K. P. Smith & Christakis, 2008).

Unquestionably, then, empirical research demonstrates that a fate of social isolation is detrimental for long-term well-being. At the same time, less is known about how mundane forms of social rejection manifest in individuals' everyday contacts and reverberate through their long-term social networks. The experience of rejection is not restricted to recluses; rather, most individuals regularly experience minor alarms for isolation. Some people, though, are more concerned than others about the potential for rejection to occur (Kelly, 2001). As such, this study follows calls for increased attention to the social outcomes of personality (Back & Vazire, 2015) to clarify how the fear of rejection ricochets through personal networks.

Strong Ties, Weak Ties, and Network Closure

Perhaps the most basic network dimension is tie strength, along with the core contrast between strong and weak ties (Easley & Kleinberg, 2010; Granovetter, 1973). Strong ties tend to

provide more emotional rewards – regardless of who initiates contact (Fu, Ho, & Chen, 2013), and plenty of studies confirm the tight link between interacting with close ties and experiencing positive affect (Ramsey & Gentzler, 2015). Studies also show that perceptions of emotional closeness are highly tied to the time since last contact, though this is less essential for family ties (Eagle, Pentland, & Lazer, 2009; Roberts & Dunbar, 2011). In fact, communication predicts closeness better than the frequency of collocation (Wiese et al., 2011).

Combined, these lines of research imply that communication increases emotional closeness, and communication with close ties provide more emotional rewards. On the other hand, ever since Granovetter's (1973) famous weak tie hypothesis, research has proliferated around the strategic value of interacting and maintaining weak ties. According to the established social capital theories, weaker ties represent a chance for actors to find new leverage positions (or "structural holes") and exclusive bits of information (Burt, 1992; N. Lin, 2001). Other work has now linked weak tie interaction to creativity (Baer, 2010). Thus, being connected to a wider range of weak ties– i.e., less network closure – yields new ideas.

Other research has highlighted potential benefits of weak ties beyond informational access (Albrecht & Adelman, 1984; Fu et al., 2013; c.f., Krämer, Rösner, Eimler, Winter, & Neubaum, 2014; Small, 2013). For instance, emerging research emphasizes the emotional benefits of interacting with weaker ties (Sandstrom & Dunn, 2014). Apparently, people often assume (incorrectly) they will get more satisfaction from interacting with close ties, yet the "returns" are sometimes greater on average when an ego contacts a weak tie (Fu, Ho, & Chen, 2013). Wright and Rains (2013) summarize other overlooked benefits: "Weak ties offer several advantages relative to strong ties such as family and friends, including being less judgmental and more objective, offering unique information, and a reduced potential for role conflict" (p. 310).

Communication researchers have recently started to investigate the role of weak ties in online and offline support acquisition. In particular, Wright and colleagues have shown that "strong-tie versus weak-tie support preference" influences the process of social support mobilization (Wright & Miller, 2010; Wright, Rains, & Banas, 2010). For example, this line of research has found evidence that people preferred to received social support about sensitive health information from weak ties. At the same time, Wright et al. (2010) also show that preference for weak ties decreases with age in line with the socioemotional selectivity theory (SST) of developmental psychology (Carstensen, Isaacowitz, & Charles, 1999).

Moving past the strong-versus-weak comparison, we also consider the role of broader network structure. Certainly, the two levels of analysis are linked. Stronger ties should be more central within a network (see Sutcliffe et al., 2012), whereas ego-network peripheries are likely to be dominated by weak ties. As discussed previously, closure is generally associated with safety, trust, support, security, and altruism in a given network structure (Curry & Dunbar, 2011). Core network layers are denser than more outlying network layers (Sutcliffe et al., 2012), reinforcing their emotional closeness. As such, individuals with higher network density are likely to privilege their strongest ties in daily communication.

Personality and Social Relationships

Research suggests that personality influences the quality of social relationships – and more so than vice versa (Asendorpf & Wipers, 1998). For instance, Asendorpf and Wilpers (1998) observed that extroverts both give and receive more social support than introverts. Still, the bulk of research on how dispositional factors influence social relationships thus far has concentrated on romantic relationships (Tov, Nai, & Lee, 2016). Furthermore, even the more

recent psychological research tends to be oriented toward general friendship satisfaction, rather than the role of relationship strength or friendship network structure.

At the ground level, personality predicts the quality of social interactions during daily life, as well as overall friendship satisfaction (Tov et al., 2016; Wilson, Harris, & Vazire, 2015). Extraversion tends to be associated with higher quality interactions, at least in terms of increased self-disclosure, conversation depth, and emotional expression (Wilson et al., 2015). In this work, agreeableness and (less) neuroticism were also tied to better interactions, albeit to a less consistent extent. Extending this work, Tov, Nai, and Lee (2016) find that the impact of extraversion on friendship satisfaction is mediated by perceived trust, whereas the agreeableness contributes to satisfaction through less confrontational interactions.

Another growing trend is research examining the links between personality and personal network structure (see Landis, 2016, for a review). However, with some exceptions, network research on personality typically concentrates on small networks within organizations, along with an interest in performance-based outcomes. As noted in Landis' (2016) review article, the consistency with which individuals reach similar network positions (see Burt, 2012) suggests the essential role of personality in network shape. Remarkably, some researchers have even turned to demonstrating how algorithms can predict personality based on network structure alone (Lepri, Staiano, Shmueli, Pianesi, & Pentland, 2016; Staiano, Pianesi, Lepri, & Pentland, 2012).

As discussed previously, researchers have now identified an array of individual differences with the potential to influence network structure. Nonetheless, one of the most consistent predictors of personal network structure is extraversion, a component of the Big Five framework (Costa & McCrae, 1992). Some studies also suggest the relevance of other Big Five factors – though these connections are less consistent than extraversion (Ishiguro, 2016).

Neuroticism tends to be associated with lower network size and ego centrality, whereas agreeableness, conscientiousness, and openness have mixed relationships that depend on samples and data collection methods (Quercia et al., 2012; c.f., Lepri, 2016; Landis, 2016).

Extraversion is defined by the proclivity to be "sociable". In contrast to introverts, extroverts tend to be more talkative and exhibit a more natural speech style (Mehl, Gosling, & Pennebaker, 2006; Dewaele & Furnham, 2000). They are more popular even in childhood, and this effect may be mediated by oral fluency (Ilmarinen et al., 2015). Extroverts are more likely to have friend (vs. family) dominant networks (Doeven-Eggens et al., 2008), larger total network size, and larger core network layers (e.g., Kalish & Robins, 2006; Pollett, Roberts, & Dunbar, 2008; Ishiguro, 2016; c.f., Landis, 2016). Extroverts tend to be more central in their networks and occupy strategic brokerage positions (Casciaro, 1998; Totterdell, Holman, & Huskin, 2008), as well as exhibit membership in a larger number of smaller communities (Friggeri et al., 2012).

Why do extroverts have more expansive personal networks than their more introverted counterparts? Totterdell, Holman, and Huskin (2008) show that trait extraversion is strongly related to the propensity to seek new acquaintances and broaden personal networks. Extroverts are also more likely to bring their close ties together (Kalish & Robins, 2006; Lepri et al., 2016). This concurs with classic research showing that friendlier individuals have a lower tolerance for "intransitivity" – unbalanced triads in which Rich is friends with Scott, Scott is friends with Sonya, but Sonya is not friends with Rich (Hallinan & Kubitschek, 1998). Given the prominent role of extraversion within past research on daily interactions and network structure, we specifically consider its role alongside a new potential factor: rejection sensitivity.

Toward Trait Rejection Sensitivity

Rejection sensitivity (RS) represents the dispositional tendency to anticipate and overreact to the possibility of social rejection (Downey & Feldman, 1996; Mehrabian, 1970). Laboratory studies overwhelmingly show that being excluded – from close ties to strangers – will damage individuals' mood and self-esteem (Blackhart et al., 2009; DeWall & Bushman, 2011; Gerber & Wheeler, 2009; Williams & Nida, 2011). Given these results, it is not surprising that trait rejection sensitivity is also associated with a number of negative indictors of social relationships and general well-being (Moieni et al., 2015; Wang, Hartl, Laursen, & Rubin, 2016). Furthermore, along with exclusion, fMRI research suggests that rejection activates overlapping areas with physical pain (Kross et al., 2011; c.f., Woo et al., 2014).

Not only do people with increased sensitivity to rejection experience worse outcomes for themselves and their social relationships, they also approach new interactions with greater trepidation and defensiveness (Kawamoto, Nittono, & Ura, 2015). For instance, individuals with higher RS misperceive ambiguous cues as signs of rejection (Downey & Feldman, 1996) and view their romantic partners as more contrary than third party observers (Norona, Salvatore, Welsh, & Darling, 2014). Conversely, people with low rejection sensitivity actually overlook rejection cues in line with a sort of interpersonal optimism (Romero-Canyas & Downey, 2012).

From a broader personality perspective, rejection sensitivity is positively associated with neuroticism and negatively associated with extraversion (Mehrabian, 1994). Additionally, the negative effects of rejection sensitivity on social well-being are amplified for people with low agreeableness (Wang et al., 2016). Likewise, Lazarus et al. (2016) find that people with borderline personality disorder have worse relationship satisfaction and support if they also fear rejection. Finally, rejection sensitivity is negatively related to interpersonal competence (Butler

et al., 2007). As a whole, Butler et al. (2007) suggest that rejection sensitivity can be viewed as a more contextual version of neuroticism that is focused on social interactions.

Past research on personality and daily interactions suggested that more neurotic and shy people have worse interactions and develop fewer friendships (Asendorpf & Wilpers, 1998; Wilson et al., 2015). Nonetheless, the literature on social rejection has focused predominantly on their implications for strangers, romantic partners, or general interactions (e.g., Mehrabian, 1970; see Vanhalst & Leary, 2014; DeWall & Bushman, 2011; Kawamoto et al., 2015). Hence, much less is known about how the dynamics of social rejection intersect with specific network variables, including tie strength and network structure.

DeWall and Bushman (2011) note that there are actually two components to the classic "need to belong" that underlies rejection sensitivity: "First, people want some kind of positive regular social contact. Second, people want the stable framework of some ongoing relationship in which the individuals share a mutual concern for each other. Having either of these without the other provides only partial satisfaction of the need to belong" (p. 257). Here, we consider both sides by testing how rejection sensitivity affects **(1)** *regular* experiences with strong vs. weak ties during daily life and **(2)** *stable* network structure among established friendships.

Rejection Sensitivity and Interaction Preferences (H1)

First, we examine the relationship between rejection sensitivity and in vivo interactions during daily life while accounting for tie strength. Social network research tends to focus on strong ties due to the difficulty of measuring weak ties, which are less likely to named or even remembered in retrospective surveys. This is not to suggest that weak tie interactions are not prevalent or important; rather, such interactions have the potential to leave lasting impressions despite their brevity and ephemerality. Partly in response to this concern, more recent work has

begun to consider the role of daily interactions with weak ties. Following research on social network contact diaries (Fu et al., 2013), we also ask: "what do contacts with weak ties mean to individuals in everyday life?" (p. 280). To answer this question, we utilize experience sampling method (ESM) to examine interactions with network ties in the midst of daily life.

Although the majority of network research focuses on either name generators or more recently logged contacts, experience sampling taps into perceptions of a range of interactions at the ground level. The advantage of conducting "field" studies of this sort is the proximity to actual interactions of various types, along with increased generalizability to real world phenomena (Wrzus & Mehl, 2015). Interaction quality was measured with two social dimensions: enjoyment and supportiveness. These dimensions have been delineated in past psychological research related to daily interactions, friendship maintenance, and mediated interactions (Bayer et al., 2015; Oswald, Clark, & Kelly, 2004; Vittengl & Holt, 1998).

Examining daily interactions *across* levels of tie strength is especially valuable for the current case of rejection sensitivity. Leary notes that more research "…is needed to identify the conditions under which people who are rejected perceive others as more versus less friendly and approachable" (p. 884). Mehrabian's (1970) early operationalization of rejection sensitivity suggested that such individuals are more likely to rely on familiar others to minimize the chance of new rejection. Likewise, Butler et al. (2007) assert, "as rejection sensitivity increases, both confidence and ability in social interactions decreases, particularly on the occasion of meeting new people where the chances of rejection are highest." (p. 207).

Therefore, rejection sensitive individuals tend to anticipate negative outcomes of social interactions, but these expectations may differ based on the specific relationship at hand. Among the various domains of interpersonal competence, Butler et al. (2007) find support for the idea

that RS individuals are generally worst at relationship initiation. In sum, those with higher

rejection sensitivity take a more guarded approach to social interaction, particularly when it

comes to meeting newer people. Since "newer" ties are likely to be weaker ties on average, we

suggest that tie strength may represent an underlying moderator. In other words, the relationship

between rejection sensitivity and interaction quality may depend on tie strength. Individuals with

rejection sensitivity may view weak tie interactions as especially challenging or negative, and

then perceive those interactions as less satisfying post-hoc. Thus, we hypothesized:

H1a: Rejection sensitivity will predict less rewarding *weak tie interactions.*

In both face-to-face and mediated interaction, research suggests that people differ in their

preference for receiving social support from strong ties versus weak ties (see Wright & Rains,

2013, for a review). Nonetheless, Wright and Miller (2010) note that research building on the

strength-of-weak-ties theory often neglects the differential role of online contexts. We argue this

neglect is especially problematic when combined with the current focus on rejection sensitivity

given what is known about computer-mediated interactions and personality. Specifically,

research has consistently shown that more socially anxious individuals – such as those who are

more rejection sensitive – prefer online interactions over face-to-face (Prizant-Passal, Shechner,

& Aderka, 2016). Hence, as a secondary goal, we also hypothesized:

H1b: Rejection sensitivity will predict less rewarding *face-to-face interactions.*

Rejection Sensitivity and Network Structure (H2)

Second, we consider the implications of trait rejection sensitivity for enduring network

structure, as indexed by friendship and communication on Facebook. If people with higher RS

come to prefer strong ties to weak ties, they may also choose their friendships and interactions

around this social preference. Over time, such network choices should accumulate – thereby

shifting the shape of personal network structure. Individuals who concentrate on strong ties should develop denser networks (i.e., closure), whereas those who pursue weak ties should develop sparser networks. Supporting this logic, Levy, Ayduk, and Downey (2001) posited that people with high rejection sensitivity would pursue close-knit groups in threatening social contexts – and found that RS students entered into less diverse friendships.

As reviewed before, the hypothesis above parallels that of socioemotional selectivity theory (SST), which asserts that people focus on core ties when their personal health seems threatened. Although the fear of social rejection is evidently not the same as physical death, the experience is nonetheless powerful. In both cases, the state of feeling threatened leads individuals to target their social "safety net". The current study posits that one condition is the perceived *safety* of the potential interaction partners. Strong ties and dense circles are associated with greater trust, security, and safety – providing constant sources of approachable others. In turn, rejection sensitive (vs. insensitive) individuals may prefer trusted social outlets.

Oftentimes, social network researchers discriminate between core networks and peripheral or general networks (Binder et al., 2012). Our study follows Bhardwaj et al.'s (2015) approach to examining personality by directly comparing close friendship and general friendship networks. Similar to their study, we also argue that personality inclinations can have distinct effects on the structural features of different types of personal networks. Following Binder, Roberts, and Sutcliffe (2012), we refer to the innermost ties as the "strong tie" network (top 5 friends) and secondary ties as "significant tie" network (top 15 friends). These designations also map on to the support and sympathy cliques, respectively, of the Dunbar framework.

To test both types of networks, we draw on logged friendships and wall interactions from Facebook. In doing so, we were able to delineate general friendship networks from core online

63

interaction networks (Top 5 and Top 15 Facebook interaction partners). We concentrate on Facebook networks because they tend to present a similar layered structure as offline networks (Arnaboldi, Guazzini, & Passarella, 2013; Sutcliffe et al., 2012). As discussed in the previous chapter, human social networks are made up of an average of five "supportive" ties and ten "sympathetic" ties (Sutcliffe et al., 2012). Building on the previous research and theory described above, we put forth matching hypotheses for the two network types:

H2a: Rejection sensitivity will predict greater closure in *overall Facebook networks.*

H2b: Rejection sensitivity will predict greater closure in *core Facebook networks.*

Method

Participants

A sample of undergraduates at a large university in the Midwestern United States provided data as part of a larger study about social media use. A total of 1,656 undergraduates, randomly selected by the Registrar's Office, received an invitation email with a link to an online screening survey. Screened individuals (n = 364) were automatically and immediately informed of their eligibility; to be eligible (n = 220), participants were required to be 18 years or older, own a smartphone, have a United States phone number, and report posting content to Facebook daily (in order to restrict the sample to active users of social media). Of the 220 eligible participants, 154 participants chose to participate in the complete three-part study[18]. Among this final sample, 67% of participants identified as female, 74% identified as White, 23% identified as fraternity/sorority members, and 83% reported that one or both parents had a college degree or graduate education. The average age was 20.4 years.

---

[18] A few additional participants (n = 6) started the first portion of the online study but did not choose to continue onward (and thus are not included in the final sample of 154). Note that certain survey measures, including our measure of trait rejection sensitivity (MSR), were only displayed to a random sub-sample (n = 109) of participants as part of the survey design.

Procedure

Participation included three main parts: (1) an initial online baseline questionnaire which included demographic items and personality measures, (2) experience sampling composed of six daily smartphone surveys over fourteen days, (3) a final online endpoint questionnaire about social media and communication technology use. Additionally, personal network graphs and logged wall feeds were collected via the Facebook API following the initial study consent.

After completing the baseline questionnaire, participants were given instructions for the experience-sampling portion of the study. During the ESM component, participants received six surveys each day for two weeks, spaced semi-randomly (spread out over the course of each day). The sixth and final survey each day ("end-of-day" survey) was longer than the other five, asking questions about the full day in addition to the standard questions.

Participants were paid for completing surveys in three complementary ways to motivate participation. Specifically, participants were paid (1) $0.50 for each regular survey completed, (2) $1.00 for each end-of-day survey completed, and (3) $1.50 for all six of the surveys in a given day. The overall completion rate for the study was 89% (range: 33%-100%), with 128 of 154 participants completing 80% or more of the 84 total possible ESM surveys.

Survey links for ESM surveys were delivered via text message using the API services of a public cloud communications company. Participants were instructed to complete the surveys "right away", but not to answer a survey once a newer one arrived. The survey questions were designed such that all questions could be answered whenever the participant opened the survey link, even if the text message had been delivered at an earlier point. The surveys were typically completed in less than two minutes given their short length.

Measures

65

Personality. At the baseline appointment, participants completed the Sensitivity to Rejection Scale (MSR; Mehrabian, 1970, 1976). The MSR scale focuses more on the perceived (lack of) control related to common social scenarios, such as potential controversial arguments, critical discussions, and personal requests. Individuals who are high on rejection sensitivity are more concerned about the potential for negative social feedback. The complete MSR scale contains 24 items, including items such as "I sometimes prefer being with strangers than with familiar people" and "I try to feel a group out before I take a definite stand on a controversial issue" and "I seldom contradict people for fear of hurting them".

We also collected broader personality measures using the 10-item short version of the Big Five Inventory that has been shown to be valid and reliable (Rammstedt & John, 2007). Within the scale, each of the five factors – extraversion, openness, agreeableness, conscientiousness, and neuroticism – are measured using two items (one reverse-coded). The two items of each factor were averaged prior to analysis in line with standard practice.

Daily Interactions. Four ESM questions asked about participants' "most recent interaction." Interactions were defined broadly as "any form of communication between you and another person." The first question was "How did your most recent interaction occur?" and presented the following interaction options: Face-to-Face, Voice Call, Text or Instant Message, Email, Facebook (including messenger), Twitter, Instagram, Snapchat, and Other. However, the latter four interaction types were reported infrequently. For the purposes of the current study, we concentrated on the contrast between face-to-face and Facebook interactions.

The remaining questions dealt with interaction enjoyment, interaction supportiveness, and closeness of interaction partner (Eisenberger et al., 2007): "How pleasant or unpleasant was your most recent interaction?" with response options: (5) very pleasant to (1) very unpleasant (*M*

= 3.99, *SD* = 0.98); "Within that interaction, how supportive or unsupportive was that person to you?" with response options: (5) very supportive to (1) very unsupportive (*M* = 3.90, *SD* = 0.97); and "How close are you to that person?" with response options: (1) not at all close to (5) very close (*M* = 3.89, *SD* = 1.24) . Three additional questions asked about participants' current physical and emotional status: 1) location, 2) emotional valence (5-point scale; very negative to very positive; *M* = 3.53, *SD* = 1.02), and 3) emotional arousal (5-point scale; very low energy to very high energy; *M* = 3.08, *SD* = 1.08).

Social Networks. To compute participants' social network metrics, friendships and wall interactions were first recorded via the Facebook API. Full friendship network graphs were then built and analyzed using the NetworkX Python library. Rather than allow core network size to vary as some network research does, we instead create set core network sizes in agreement with the established theoretical cutoffs (5, 15). As with the previous chapter, this was done for a number of reasons. Interactions on Facebook posts do not represent direct interactions in the same way that 1-to-1 calls or messages do. Rather, we suggest that such indirect interactions are more in line with symbolic gestures and relationship grooming. As such, the pure rate of interactions is less meaningful. Moreover, our theoretical goal in this study was to differentiate structural differences – not debate size constraints.

To create the core Facebook friendship networks, we ranked friends in terms of the number of interactions mentioning them that occurred over the three months prior to the study. Similar to Study 2, Facebook activity was skewed such that the top friends represented an immense share of the total interactions for each participant. The average number of interactions for each friend rank is displayed in Figure 5. The top fifteen friends were then used to create the smaller core networks referenced from hereon. We focused on three egocentric (personal)

67

network measures as outcome variables: density, transitivity, and communities. The three measures are related to one another in the sense that they all gauge personal network closure, or versions of friendship spread. That is, the measures all tap into how interconnected (vs. disconnected) one's friends are to each other. Hence, having many distinctive communities will tend to produce lower overall network density and transitivity than having one giant community.

As stated in the previous chapter, density represents the proportion of connected nodes out of total possible edges, while transitivity represents the number of closed triangles out of probable triangles. Density and transitivity were computed using the standard commands in NetworkX. In this study, we also examined the number of communities, which can be generally understood as clusters of friends who know each other more than other ties in the network. To compute the number of discrete communities within participants' networks, we used the add-on Community library. This package draws on the Louvain method, an efficient and effective method for detecting communities within a given network. Further, the method has been used within Facebook specific network research (Brooks, Hogan, Ellison, Lampe, & Vitak, 2014).

We focused on these three network metrics given their relevance to basic psychological constructs. More specifically, as opposed to commonly used network measures in organizational contexts (e.g., ego betweenness, constraint) that identify people who are more central or situated on structural holes, our goal was to understand the overall shape of one's informal friendship network in line with Kalish and Robins (2006). Although global measures of egocentric network structure do not allow one to differentiate among the specific forms of structural holes (see Kalish & Robins, 2006), they provide robust metrics concerning the overall network closure apparent in participants' more informal social lives.

Experience Sampling Analysis

The experience sampling method (ESM) analysis accounted for the nested dimensions of the data set, which undermined the assumption of independent observations. As such, for each model, we specified day (1-14) inside of participant (1-154) with their intercept terms specified as random effects and our theoretical predictors as fixed effects. Models were run in R using the lmer function via REML estimation, which is openly available through the lme4 package.

Beyond the linear mixed effects models, we computed summary measures using data across the complete two-week period. First, averages were computed for the three ESM social interaction variables (closeness, enjoyment, support) for each participant. Due to high correlations, we combined the social enjoyment and social supportiveness variables to create a single *interaction satisfaction* measure. Hence, average closeness and satisfaction variables were computed for each participant across the 14-day period of experience sampling.

Second, in addition to these averages across the two-week period, we next computed measures of *flux*, or the variability in a single dimension of social behavior. Specifically, standard deviations for each of the summary averages above were extracted to capture intrapersonal variability in closeness and satisfaction. Past work has found that flux is correlated with greater neuroticism, lower extraversion, and lower agreeableness (Sadikaj, Moskowitz, & Zuroff, 2015). Of particular relevance, Sadikaj et al. (2015) recently floated the idea that, "High negative affect flux may indicate an enhanced sensitivity and reactivity to negative interpersonal situations, such as those in which the individual is at risk for exclusion and rejection, thereby leading to higher negative affect flux" (p. 471). For these reasons, we compute interactional flux as an exploratory or secondary predictor of our key social network outcomes.

Third, we computed a difference score to measure close-versus-weak tie "preference" based on the two-week period. To do so, we divided the data in terms of close tie interactions

("very close" or "close" partners) and weak tie interactions ("somewhat close", "not close", or "not close at all" partners). We then subtracted average weak tie satisfaction from average close tie satisfaction. Higher scores indicated greater preference for interactions with close ties.

For the hypotheses related to interaction rewards via experience sampling (H1), we controlled for gender, age, and day of participation. We also examined the predictive ability of Big Five factors in all models given their significance in past research. To examine the hypothesis (H1a) that rejection sensitivity would predict more rewarding interactions with strong ties, we input an interaction term of RS and partner closeness. To examine the hypothesis (H1b) that rejection sensitivity would predict more rewarding face-to-face interactions, we input an interaction term of RS and channel type. Two models were run for each hypothesis that differed only in terms of their DVs (social enjoyment vs. social supportiveness).

Social Network Analysis

Standard OLS multiple regression models were run in R to test the hypotheses related to social network closure. Aside from hypothesized network structure models, we also examined the relationship between daily interactions (via ESM data) and personal network structure. Specifically, we tested whether the closeness average, closeness flux, and closeness preference variables described above mapped onto ego-network structure. In doing so, we were able to glean insight into the overlap between daily interaction rhythms and network features.

For the hypotheses related to network structure (H2), we controlled for age, gender, full network size, and number of interactions with friends in the network. Once again, we also included the Big Five facets based on their relevance in past research. To test the hypothesis (H2a) that rejection sensitivity would be associated with full network closure, we entered RS as a direct predictor in models for the three network metrics using participants complete set of

Facebook friends. To test the parallel hypothesis about core Facebook network closure, the same predictors were entered into separate models specifying for the significant (top-15) and strong ties (top-5). In the latter case (H2b), we focused primarily on the density models because transitivity exhibited clear non-normality among the current sample. In addition, the number of distinct communities was extremely (negatively) correlated with density (r > 0.80), suggesting that the two variables were indexing the same structural features.

Results

The hypothesis (H1a) that rejection sensitivity would be associated with less satisfying weak tie interactions was supported. Specifically, higher rejection sensitivity predicted less supportive (Figure 6) and less pleasant (Figure 7) interactions with weak ties, as well as more pleasant and more supportive interactions with strong ties. As such, the effects displayed a radial pattern such that RS participants had greater divergence in interaction quality for closer and weaker relationships. The hypothesis (H1b) that rejection sensitivity would predict less satisfying face-to-face interactions was also supported. As illustrated in Figure 8, RS participants had less enjoyable face-to-face interactions as compared to Facebook.

We also observed significant effects for a number of our covariates in the experience sampling analyses. Specifically, more neurotic individuals tended to have less enjoyable interactions, whereas conscientiousness strongly predicted both more enjoyable and supportive interactions. In line with past research, extraversion was also positively correlated with supportiveness, but marginally significant with other covariates included. Finally, texting – but not calling – interactions were also found to be more enjoyable than face-to-face communication for participants who were high in rejection sensitivity.

71

As expected from the results of the H1 models, our strong tie (vs. weak tie) preference average exhibited a small, positive correlation with rejection sensitivity (r = 0.12), thereby detecting the effects of the lmer models. Moreover, rejection sensitivity was positively related to flux in interaction satisfaction (r = 0.14). We also checked whether interaction flux varied as a function of relationship strength (close tie vs. weak tie interactions), but no differences were observed. Hence, people who are more sensitive to rejection tend to have less rewarding interactions with weak ties – yet somewhat more flux in social interaction generally.

The summary ESM variables (closeness average, closeness flux, and closeness difference) were not significantly related to transitivity and communities at either the full or core network level of analysis. However, we found a reliable connection between the average closeness of interaction partners and density. More precisely, we find the people who interact with a higher proportion of close ties during everyday life tend to have denser networks, especially for participants' core Facebook networks. We also found some evidence that closeness flux – i.e., interacting with a wider range of relationship strengths during daily life – is associated with less density in significant tie networks (see Table 3).

The hypothesis (H2a) that rejection sensitivity would be positively linked to full network closure was not supported. Likewise, the hypothesis (H2b) that RS individuals would predict greater core Facebook network closure was not supported either. Alternatively, we found that extraversion was associated with less density and more communities at the full network level. Trait openness was also tied to less density in participants' overall friendship networks (see Table 4). Surprisingly, none of the measured personality factors – either Big Five or MSR – was predictive of core network structure, despite its connection to daily interactions.

Discussion

Previous work establishes that the fear of social rejection is profound, but its relevance to tie strength and stable network structure is less concrete. Responding to this void, this study examined how trait rejection sensitivity weighs on real world network processes. More broadly, this work attempts to triangulate theoretical perspectives on personality, *in vivo* network interactions, and enduring network structure. The combined approach demonstrates the promise, and challenges, associated with integrating two distinctive types of social network outcomes.

All in all, the findings reveal divergent stories. First, supporting our hypothesis (H1a), people with rejection sensitivity reported less enjoyable and supportive interactions with weak ties during daily life. These findings reveal that individual differences in rejection sensitivity influence social experiences along clear levels of tie strength. In addition, RS individuals evinced a small, but significant preference against face-to-face interactions (H1b). Second, undermining our other hypotheses (H2), those who are more rejection sensitive exhibited no more network closure in their overall nor core Facebook networks. However, clarifying past research, extraversion was strongly negatively related to multiple measures of network closure.

The Role of Rejection Sensitivity

This study provides evidence that individuals who are more sensitive to rejection tend to have less rewarding social interactions with weak ties. Concurrently, these individuals tend to have greater discrepancy in their daily social experiences between their close and weak ties. Network theories typically presume that strong ties are more emotionally rewarding than weak ties (e.g., Sutcliffe et al., 2012). Rejection sensitivity, however, appears to widen this established "affect gap" between strong ties and weak ties, thereby moderating one of the basic assumptions of tie strength. Conversely, we find no evidence that the fear of rejection leads individuals to have increased network closure in terms of density, transitivity, or fewer communities. The

73

absence of a main effect for rejection sensitivity highlights the blurry space between momentary social experience and longstanding social environment. Given these mixed findings, future work must identify the discrete mechanisms that influence network outcomes.

We also observe initial evidence linking rejection sensitivity to interpersonal flux, in support of recent research proposals. As Sadikaj et al. (2015) argued, "High intrapersonal variability in negative affect can be conceptualized as a measure of affect instability and may reflect an increased sensitivity and reactivity (i.e., emotion dysregulation) to social rejection and exclusion" (p. 481). In their study, findings showed that negative affect flux moderated interpersonal perceptions among romantic couples. By contrast, we find that rejection sensitivity is linked to greater flux in perceived interaction quality[19]. Although the effect observed was fairly small, we provide a starting point for network researchers to consider flux going forward.

The lack of network closure among rejection sensitive people contradicts the key finding from the previous chapter. One explanation for why RS was not linked to network closure – as compared to implicit exclusion sensitivity – is the contrast between approach and response. Whereas Mehrabian's (1970) measure of rejection sensitivity concentrates on the expectation of offending others, the fMRI exclusion manipulation measures the degree of "social pain" felt during an actual experience of rejection. As such, it is feasible that the two dimensions of social sensitivity manifest in different ways. Perhaps expected rejection leads individuals to enjoy weak tie interactions less, yet only experienced rejection influences network motivations. However, a competing explanation is that the divergent methods across the two studies (self-report vs. implicit) are tapping into markedly different psychological processes.

---

[19] Although not reported in this manuscript due to space constraints, we also find that rejection sensitivity is positively correlated with flux in mood across the two-week study.

The established literature on social rejection has considered the negative implications of perceived and actual rejection for children, romantic relationships, and strangers, among other populations (Leary, 2001). Here, we clarify an underlying moderator: tie strength. The visible connection between rejection sensitivity and tie strength is likely to be mediated by trust. As we theorized, perceived social threat should make people prefer more secure social contexts. Based on the null findings for network closure, however, future research is needed to understand whether RS people pursue or avoid weaker ties. In our data, rejection sensitivity was not related to interaction with *more* close ties, which may explain the lack of structure effects.

Aside from the implications for network ties, we also find evidence that RS individuals experience face-to-face and computer-mediated interactions differently. In particular, more rejection sensitive individuals tend appear to get less social rewards out of face-to-face interactions (vs. Facebook) interactions. This parallels research showing that socially anxious individuals tend to prefer mediated interactions (Prizant-Passal et al., 2016). Specifically, socially anxious individuals tend to prefer computer-mediated communication (CMC) to face-to-face interaction because there are fewer audio and visual cues apparent. Moreover, in the case of asynchronous channels such as texting and Facebook, anxious individuals are granted more time to respond. More research is needed to determine how rejection sensitivity underlies social media choice, as different communication technologies offer more and less "safe" environments.

Offline and Online Social Networks

Sutcliffe et al. (2012) hypothesized that, "Meeting intimate friends should produce a measurably more intense emotional response than meeting just good friends" (p. 162). Supporting this hypothesis (2012), we find strong evidence that interaction satisfaction is successively related to tie closeness. The closer participants felt to interaction partners, the more

75

enjoyable and supportive they reported the associated interactions at each level of tie closeness. Further, this progressive pattern was replicated in our rejection sensitivity models, suggesting that closeness effects on satisfaction operate in a reliably linear manner.

The lack of network structural effects for rejection sensitivity implies that people who prefer close tie interactions do not necessarily have more closed networks. More generally, we found no evidence that average satisfaction *in vivo* interactions with close or weak ties is predictive of different levels of network closure. This undermines the notion that interaction quality is related to more enduring personal network features – despite its relevance for understanding different network layers. From our original standpoint, it is rather surprising that neither general interaction quality – nor weak tie interaction quality – is related to network closure. The results thereby raise the question of how exactly personality influences longer-term network characteristics if not through everyday interaction quality.

At the same time, we observed a clear connection between core network density and the average tie strength of daily interaction partners over the course of the two-week experience-sampling period. Specifically, people who interact predominantly with their close ties more (vs. weaker ties) tend to have denser core networks. This finding affirms the basic relationship between core network density and tie closeness. Given that people commit most of their communication time to their core ties, more central friendships should make up a larger share of everyday interactions. Therefore, for people with denser core networks, their daily interaction patterns exhibit this pattern to a greater extent than those with sparser core networks.

By comparison, we find a weaker connection between average closeness and outer layers of participants' networks. As compared to the inner layer, Sutcliffe et al. (2012) argue that relationships in the outer circles "…should be more fluid and reflect individuals' different

interests beyond the cluster; more broadly, relationships will become increasingly diffuse and less well integrated as one moves out through the layers" (p. 162). As such, our pattern of results also supports the network layer framework, as least as it relates to density. People with less connected inner layers are more likely to distribute their interactions more evenly across their ties – but this density-closeness relationship should be attenuated in the outer layers.

Another consideration is the psychological meaning of network closure, and transitivity in particular, within full Facebook networks. One possible reason overall network transitivity was not linked to any of the personality facets is the contradictory implications of the measure in diverse Facebook networks (Brooks et al., 2014). Specifically, Brooks et al. (2014) argue that a given Facebook network may be more intransitive due to less closure within discrete social circles – or because there are overlapping communities. In the latter case, a lack of local closure (i.e., closed triads) may actually indicate higher global cohesion in the sense that various contexts are more connected to one another. Because of this, the standard transitivity measure confounds more and less closed networks in populations such as our college Facebook users.

The link between average partner closeness and Facebook network density also speaks to questions surrounding overlap in online-offline networks. For years now, communication research has called for breaking the conceptual wall between physical and virtual spaces. Moreover, research has shown that there is a strong overlap between Facebook and offline networks, both in terms of people and structure (Dunbar, 2016). In addition, research suggests that Facebook serves as a conduit for offline relationship development (Ellison et al., 2011). Thus, our findings can be viewed as indirect evidence for the idea that individuals have personal network "signatures" (Saramaki et al., 2014). In other words, the cross-channel network

relationships suggest that individuals tend to communicate in predictable network patterns, regardless of the specific platform or context.

Even more broadly, this study responds to calls for greater attention on how social network structure manifests in everyday life (Fu, Ho, & Chen, 2013), as well how intra-individual variability may relate to network characteristics (Landis, 2016). In turn, we observe multiple correlations between daily social experiences and stable network features. Aside from average closeness, we also observe some small evidence that individual *flux* in interaction tendencies hold some potential. Specifically, we found that individuals who interact with a wider range of network ties have less dense core networks. Altogether, we suggest that experience sampling offers an untapped avenue for examining micro-macro links in personal networks.

The Big Five and College Networks

Beyond rejection sensitivity, our findings are notable in both confirming and clarifying previous research on personality in combination with daily interactions and network structure. In contrast to rejection sensitivity, none of the other big five factors of personality displayed differential relationships with strong versus weak ties. This pattern affirms the unique link between rejection sensitivity and tie closeness. However, a number of personality facets were directly related to everyday social experiences, i.e., independent on tie strength.

On the first front, we replicate past research that individuals who score higher on extraversion and lower on neuroticism have more rewarding interactions with both close and weak ties during daily life using experience-sampling method[20]. In contrast to this previous work, our results revealed that more conscientious individuals have higher quality interactions regardless of tie strength. Although we had no theoretical rationale for expecting the strong

---

[20] This relationship was attenuated, resulting in marginal significance ($p < 0.10$), when conscientiousness was included in the complete linear mixed effects model.

relationships with conscientiousness, one possibility is that these individuals strive to have "successful" interactions just they approach other tasks.

On the second front, extraversion and openness were significantly related to less network closure within the overall friendship network. At the same time, our analyses revealed no significant relationships between personality and core network structure. This can be interpreted in two ways. Despite the strong link between extraversion and friendship network density, the extroverts in our sample did not actually have less dense core Facebook networks. Since our daily contact measures across channels mapped onto the network measures, the null finding shows that central personality facets may not actually underpin core network closure.

Significantly, we affirm the central role of extraversion at both levels of analysis: *in vivo* experience and network structure. Extroverts' overall friendship networks exhibit less density and more communities than introverts. In contrast to Kalish and Robins (2006), who found a positive relationship between extraversion and density, we find a clear negative relationship to both density and number of communities. One probable explanation for the difference in findings is that we used objectively logged Facebook networks that are much greater in size, whereas their 2006 study adopted a combination name- and setting-generator method to gather just 18 contacts. As such, these networks are more akin to our support networks (15 alters).

The fact that extraversion predicts network closure – and daily social enjoyment and support do not – suggest that it is not extroverts' fondness for live interaction that leads to wider networks. Although extraversion was positively related to interaction quality, these observations imply that more work is needed to understand how extroverts develop broader networks. In line with Assendopf and Wilpers (1998), it may be that extroverts simply meet more people, rather than engage in qualitatively better meetings. Therefore, the distinction between the quantity and

quality of social interactions represents an important step to take for the psychological underpinnings, such as extraversion, of personal network structure.

Our findings thus echo the limits of personality in line with work by Pollet et al. (2011) and Assendorpf and Wilpers (1998). In the former, the authors show that despite having larger network layers, extroverts are not closer to their relationships at any individual layer. In the latter, the researchers find that extroverts tend to interact with their peers more – but do not have closer relationships. In his/her review, Landis (2016) summarizes these two studies, "…extraverts may interact more often with others in the workplace and even build larger networks as a result of these interactions but do not necessarily become emotionally closer to their network contacts than their introverted peers" (p.116). By contrast, our results suggest that extroverts inhabit wider friendship networks than introverts – but this effect does not trickle down to their core networks of communication partners on Facebook. The current research suggests that extroverts may build more expansive networks – but temporal and cognitive limits may prevent people from accruing a diverse set of strong ties.

Conclusion

Rejection represents a perennial possibility during daily life for most people. Yet some people worry about this possibility to a much greater extent than others. We find that the mere expectation of rejection degrades the quality of social experiences with weaker ties in the midst of everyday life, as well as during face-to-face interactions. On the bright side, people with rejection sensitivity also appear to savor their interactions with strong ties to a greater extent than others. Together, these effects clarify how trait rejection sensitivity widens the "affect gap" between strong and weak ties. Conversely, we bolster the idea that it is extraversion – and not rejection sensitivity – that appears to influence friendship network closure over time. Core layer

networks, however, appear to be less susceptible to personality influences. Altogether, the

confirmed and debunked findings of the current study demonstrate the potential of triangulating

personality perspectives, *in vivo* experience sampling, and social network analysis.

Chapter V

Conclusion

Over the course of three studies, this dissertation offers evidence that feelings of social isolation are associated with the preference for trusted ties and core circles. In doing so, this research assists in articulating the ways in which perceived isolation shapes how people engage with their online networks. In Study 1, excluded individuals shared more online news articles with their close friendships, but not their weak ties. In Study 2, individuals who responded more intensely to exclusion via fMRI had greater network closure among their core friends. In Study 3, individuals with higher rejection sensitivity reported less satisfying interactions with weak ties, as well as less enjoyable face-to-face (vs. Facebook) interactions.

As reviewed in the opening chapter, previous theories and findings suggested that individuals with isolation fears might be inclined to prefer certain and intimate social contexts. Further, emerging theory related to social media affordances proposes that online networks such as Facebook may bolster this process. Following past perspectives, the present work represents an integrative effort to link perceived isolation to personal network dynamics. Combined, the observed effects indicate that people with high perceptions of isolation are likely to concentrate their mediated communication on close-knit companions and circles. As a consequence, feeling alone may act as a catalyst for Kadushin's (2002, 2012) framework of dual motivations – driving individuals to look inward for safety, rather than outward for opportunity.

Circuits and Switches

The *Rejection Sensitivity Model* (Levy et al., 2001) and the *Loneliness Model* (Cacioppo & Hawkley, 2009) represent useful comparisons to the current findings based on their attention to the long-term ramifications of perceived isolation. Levy, Ayduk, and Downey (2001) argue that angry or anxious expectations of rejection lead to perceptions of rejection, and these perceptions spur mental and behavioral responses that lead to increased rejection and further rejection sensitivity. Similarly, Cacioppo and Hawkley's (2009) model represents a circular process in which perceptions of loneliness shape future perception toward social threats, with the added specification of negative health effects. Therefore, both longitudinal models[21] emphasize a recursive process in which past experiences drive future expectations.

Unfortunately, the two models provide limited guidance on how these circular effects influence social network engagement. For instance, the Rejection Sensitivity Model proffers mixed hypotheses regarding whom rejection sensitive (RS) people will seek out in order to cope with recent rejection. On one hand, rejection sensitive individuals may attempt secure highly involved relationships in order to maximize commitment; on the other, RS individuals may keep their distance from others to avoid outright rejection. The Loneliness Model, for its part, includes a basic "social environment" sub-loop that initiates and moderates the isolation process – but does not engage with social network dimensions. In turn, I propose an addendum to the agreed upon circular process related to personal network structure.

Drawing on Kadushin's (2012) network motivation framework, I advance an extra dimension to the social process that specifies how isolation fears influence personal network engagement. The three studies in this dissertation demonstrate a link between raised fears of

---

[21] Although I refer to RS as a general disposition at times, Levy et al. (2001) argue that, "RS is not a global disposition. Rather, defensive expectations of rejection are triggered only in situations that afford the possibility of rejection by valued others." (Kindle 3672-3673).

isolation and network closure. The experimental results (Chapter 2) bolster the idea that that when potential isolation is made salient, individuals will reach for their strong ties. The correlational findings (Chapters 3 and 4) provide evidence that people with dispositional isolation fears have better quality interactions with strong ties and a more compact core network on Facebook. Together, the studies indicate that perceived isolation may prompt the motivation for network closure, or what Kadushin (2012) refers to as *safety*.

The summary above clarifies how individuals respond to discrete isolation, and suggests that regular experiences with isolation may alter enduring network shape. Such activation of the safety motivation may help people overcome negative experiences, as well as fortify their trusted core network. Simultaneously, these individuals become more susceptible to the social influence processes associated with network density. Hence, pursuing network safety may buffer against the possibility of future exclusion, yet also increase their reliance on a dense community. From an influence perspective, density is associated with social trust – but also strict norms and severe sanctions (Burt, 2000; Lakon et al., 2008). Since exclusion is a signal of disapproval, being a member of a denser social circle might amplify reactivity to potential threats of isolation.

The emerging story is that individuals will repeatedly seek out safety following isolating events, developing a circular network regulation strategy. Past experiences of rejection may influence which contacts come to mind when new rejection occurs. In other words, certain ties and circles within personal networks become cognitively activated. As covered in Chapter 3, O'Connor and Gladstone (2015) found that people *perceive* social networks as denser after being excluded. When this process is repeated over time, the safety portions of personal networks develop increasing salience. Hence, routinized relationships will tend to become salient social targets automatically (Bayer et al., 2016). Consequently, this form of network emotion regulation

may also become recursive, as moments of isolation quickly flip the *network switch* for safety. For people with reoccurring (i.e., "trait") feelings of isolation, these motivational shifts are likely to be more frequent and more intense – yet they still depend on situational cues[22].

I develop the notion of a network switch as a way of theorizing the more basic cognitive processes implied in the observed effects. Network switches can be viewed as socio-cognitive factors that shift personal network motivations. As compared to broader personality influences on personal network structure (e.g., extraversion), network switches are more dynamic processes that adjust motivations in response to situational changes (e.g., exclusion). People with dispositional isolation perceptions are thus more likely to activate the switch for safety. Other potential network switches beyond feelings of isolation include feelings of power and positive affect, which also affect how people perceive social networks (Shea, Menon, Smith, & Emich, 2015; Simpson, Markovsky, & Steketee, 2011). Hence, more research is needed to identify the factors that switch personal motivations toward network closure and brokerage.

Recently, there has been growing interest in psychology concerning the capacity of different types of personal relationships to serve emotion regulation and self-regulation needs and goals (Cheung et al., 2014; Fitzsimons & Finkel, 2011; Orehek & Forest, 2016). In contrast to the person-centered approaches, however, this dissertation stresses a wider scope on social network structure (vs. relationships). Certainly, the different perspectives are related, if not complementary. In particular, psychological research tends to emphasize value of close relationships – that is, strong ties from a network vantage point. Nonetheless, taking a social

---

[22] Once again, this concurs with Levy, Ayduk, and Downey's (2001) treatment of the trait question for rejection sensitivity. They state, "RS is not a global disposition. Rather, defensive expectations of rejection are triggered only in situations that afford the possibility of rejection by valued others" (s. 3672-3673).

network approach allows for analysis of how various relationships connect to one another, as well as the associated advantages of different network shapes.

Media Affordances and Network Closure

In addition assessing the implication of perceived isolation for motivation, this research also theorizes the roles of key online affordances in facilitating network closure. As reviewed previously, past theory has suggested availability could lead to exaggerated network closure (Gergen, 2003; Habuchi, 2005; Ling, 2008). More recently, Hampton (2016) suggests that pervasive awareness in platforms (e.g., Facebook) may also contribute to closure. Some types of communication networks, however, are likely to enhance these affordances much more than others. Prior to the smartphone wave, calling and texting provided the primary source of persistent availability. Whereas calling and messaging are strongly associated with availability among close ties, Facebook is more associated with awareness. Still, with the growth of smartphones, Facebook increasingly exhibits both availability *and* awareness.

Returning to the original framework, I expected that all communication networks would exhibit increased closure for people with elevated fears of social isolation. Beyond this primary relationship, I have also hypothesized that perceived isolation is most likely to predict the structure of communication networks with inflated availability and awareness. This suggestion is based in part on the assumption that these affordances are likely to facilitate network closure on their own. Moreover, I suggest that people with high isolation fears are especially likely to engage with these affordances in ways that may exaggerate closure.

Why would people with regular and/or reactive feelings of social isolation utilize these affordances more? First, people with more frequent and intense isolation concerns are more likely to *choose* strong ties when deciding whom to engage using availability affordances during

daily life. Similar to the theories on maximal social network size, the temporal constraints assumption included by some theories argues that there is a fixed amount of communication time (Kobayashi & Boase, 2014). Strong relationships are likely to be more secure and salient, thus making them safe choices for their limited socializing time. Furthermore, the increased availability of online networks means that individuals can call on specific ties in dire moments of need, such as perceived isolation. Supporting this, the results from Chapter 2 suggest that state isolation may prompt people to share with their strong ties as an emotion regulation strategy.

Second, people with isolation concerns are also more likely to *watch* the public posts of their strong ties, thus strengthening these friendships and meeting the other friends of core ties. Indeed, a basic piece of the original spiral of silence theory was the tendency to monitor social contexts. As a consequence, unconnected friends who interact in public spaces online (e.g., Facebook wall post) may be more inclined to develop direct relationships (Hampton, 2016). Moreover, individuals may also be more cognizant of occasions when they are excluded. This possibility warrants comparison the cultural phenomenon of "FoMO", or "Fear of Missing Out" (Przybylski et al., 2013). Feelings of isolation also warrant comparison to *symbolic exclusion*[23], or the tendency for some people to "reject" others through expressions of cultural preferences (Lizardo & Skiles, 2016). As with FoMO, pervasive awareness may increase the rate of symbolic exclusion. Altogether, passive tracking has the potential to augment network density.

Mechanisms and Network Cognition

The idea of a true network motivation hinges on there being a cognitive structure (e.g., schema) that encodes a form of network structure (e.g., brokerage). Or, an alternative

---

[23] Interestingly, Lizardo (2016) finds that, with growing diversity in America, young people and nonwhites are now less likely to symbolically exclude others by expressing dislike for cultural objects (e.g., rap music).

explanation is that people are motivated to pursue certain people (e.g., Friend A, Friend B), and broader structure simply evolves naturally over time. Kadushin (2012) argues that the need to "get ahead" among people who are highly motivated for network brokerage is likely to be an unconscious process. Either way, the cognitive mechanism that mediates the effect of isolation fears on network outcomes remains unclear. As implied above, the tendency for individuals to share with close friends after exclusion suggests that these people become cognitively salient – a theoretical proposition for follow-up research to validate.

Sutcliffe et al. (2012) predict, "…memory schemata for Alters in strong-tie relationships should be more detailed than those for medium-tie Alters in terms of intimate details, both about the other person and about their relationships with third parties" (p. 162). Thus, there is a special role for strong ties in personal memory, which should be amplified for people with FSI. At the same time, Sutcliffe et al (2012) subsequently note, "…these cognitive aspects of relationships have yet to be explored" (p. 162). Likewise, Brashears & Quintaine (2015) summarize the state of the network psychology literature: "A growing number of studies indicate that aspects of psychology and cognition influence network structure, but much remains to be learned about how network information is stored and retrieved from memory." (p. 113).

Looking forward, I suggest that "social network cognition" (Brashears, Hoagland, & Quintane, 2016) represents a promising avenue for research on communication networks. Not surprisingly, despite its recent surge in sociology, the recent perspective on network cognition represents an extension of Krackhardt's (1987) established "cognitive social structures". The older line of work attempted to clarify how social networks are represented mentally, as well as how cognitive factors lead individuals to develop networks with certain characteristics. For instance, people tend to imagine more clustering among relationships than exists in reality

(Kilduff, Crossland, Tsai, & Krackhardt, 2008). As a whole, research in this area has revealed a range of cognitive biases that underlie how people perceive social networks.

More locally, these theoretical perspectives are promising for emerging questions in communication studies and social psychology. For instance, Bayer, Campbell, and Ling (2016) include personal network expectations in their socio-cognitive model of social connectedness. However, how these cognitive expectations actually influence individual behavior on a moment-to-moment basis is unknown. As such, more research is needed that focuses on how people mentally represent their online and offline networks, as well as individual differences in those representations. Thus, social network cognition represents one opportunity to clarify the mechanisms underlying communication choice in the context of social media.

Limitations from Isolation Perspective

Different effects were observed for exclusion sensitivity (via fMRI in Study 2) and rejection sensitivity (via self-report in Study 3), suggesting a measurement limitation. Previous research has confirmed a link between these different measurement techniques (Burklund, Eisenberger, & Lieberman, 2007; Masten et al., 2009; Way, Taylor, & Eisenberger, 2009). Nonetheless, the small-to-moderate correlations observed in these studies (e.g., r = 0.34; Way et al., 2009), demonstrates that these are by no means identical metrics. As such, the explicit self-perception that one is regularly nervous about offending others is not tapping into the same process as the intensity of implicit discomfort felt after exclusion. Zayas et al. (2016) showed that thinking about a friend buffers the negative impact of rejection – but only after the event, not before. Hence, there is past evidence to suggest that the degree of anticipation is related, yet distinct, from how people respond to rejection.

89

Recent research on perceived isolation has tended to favor alternative scales. For instance, some studies of rejection sensitivity have begun to adopt the RSQ measure by Downey and Feldman (Downey & Feldman, 1996), as opposed to the classic Mehrabian (1970) one used in Study 3. Although these instruments are clearly related, future research should also investigate the predictive capacity of the RSQ. Other popular scales from the belongingness and loneliness lines of work include the UCLA Loneliness Scale (Russell et al., 1980) and the Need to Belong scale (Leary, Kelly, Cottrell, & Schreindorfer, 2007). Finally, Hayes, Matthes and Eveland (2013) validated a Fear of Social Isolation (FSI) scale in line with the spiral of silence framework from communication research. Regardless of the specific survey instrument and various origins, however, the core distinction identified in this dissertation was between the explicit anticipation of rejection (Study 3) and implicit responses to exclusion (Study 2).

Beyond the social media affordances discussed above, Study 3 tested the relative preference for face-to-face versus mediated interactions. The results showed that people with higher rejection sensitivity reported less enjoyable face-to-face interactions, as compared to Facebook (and to a lesser extent, texting). In doing so, the study provides a generalization of past work on social anxiety. Specifically, both rejection sensitivity and social anxiety appear to be associated with the preference for some forms of mediated interaction. Past research has shown that the two concepts are positively related to one another (Butler et al., 2007), though Study 3 did not include a measure of social anxiety. In turn, future research should clarify how the various forms of social trepidations relate to social media preferences.

Limitations from Network Perspective

The studies included in the dissertation must be situated in the wider literature on social network development across the lifespan. In my studies, all of the participants were male

adolescents (Study 2) or college students (Studies 1 and 3). In their meta-analysis on social

network change, Wrzus et al. (2012) review how personal friendship networks increase in size

through young adulthood, before dropping steeply thereafter[24]. They also find that other context-

based networks, such as work colleagues or neighbors, were only significant at certain age

ranges. Given the established patterns in overall network size across human life, the findings for

exclusion sensitivity and network closure should be replicated with other demographics.

Moreover, based on these longer-term implications, future work should also develop more

dynamic models of communication networks (see Welles & Contractor, 2015).

One substantial limitation in making claims about online network affordances is that I did

not collect separate measures of "offline" networks. In Chapter 3, the measure of implicit social

pain was related to active Facebook communication networks – but not overall friendship

networks. Given that wall feed interactions are general viewed as more "online" than simple

friendship connections, this strengthens the relevance of online interaction networks, as opposed

to offline networks. Still, the basic question of how distinct offline and online networks are from

one another remains disputed. For example, Hampton et al. (2011) find evidence that online

networks can augment traditional offline social settings, thereby increasing the odds of personal

network diversity. More generally, it is important to keep in mind that core ties help to shape

perceptions of communication technologies (Campbell & Russo, 2003). Hence, there is a certain

degree of theoretical strain that occurs in forcing online-offline distinctions.

Aside from the measurement choices around trait fears of isolation, it is also essential to

discuss the limitations of the correlational studies (Chapters 3, 4). The causal direction implied in

the previous chapters reflects the theoretical framework in past research on social networks.

---

[24] There is also evidence that exclusion responses change with age (Lockenhoff et al., 2012).

Nonetheless, in addition to individuals shaping their social environments, social environments also affect individuals. As Brashears and Quintane (2015) summarize:

> …if our pool of possible associates is likened to the menu in a restaurant, structural accounts are very good at predicting which menu is selected from, but are relatively poor at predicting which dish is ultimately chosen. Agentic explanations show how individuals choose from among their options, but are less effective in explaining which individuals become available for association in the first place. (p. 114)

Importantly, the potential of network closure to function as social influence was included in network process described above. However, one issue with the including density as a social influence factor is the unresolved state of research its psychological implications. For instance, Walker (2015) recently found that the relationship between density and well-being depends on the level of self-affirmation. A self-affirming dense network increases self-efficacy and self-esteem, whereas a disaffirming dense environment can actually undermine well-being. Although network closure is associated with trust and security on average, the effects of density also depend on more nuanced factors, including the type of network (friendship vs. communication), level of analysis (e.g., team vs. individual), and outcomes of interest (e.g., social support vs. idea generation), among other factors (Donati, Zappalà, & González-Romá, 2016; Walker, 2015).

Future research is thus needed to establish causality – the extent to which those with more sensitive systems choose to embed themselves in closed network, the extent to which interacting with a closed network sensitizes individuals, and the extent to which the two directions may mutually reinforce one another. In all likelihood, there is a reciprocal relationship between network closure and individual differences (Tasselli, Kilduff, & Menges, 2015), and previous work has found that both personality and social influence are predictive of organization network structure (Fang et al., 2015). In the current case, the fact that these studies support the personality-first theory – but not influence-first theory – provide evidence for the assumed

92

directionality. Specifically, influence models would suggest that the added social support provided by network closure should minimize the perceived isolation. Instead, this research, and Study 2 in particular, provides support for the opposite.

Conclusion

This dissertation can be encapsulated in a basic question: *Who comes to mind?* Who comes to mind when an individual wants someone to talk to? And who comes to mind after a threatening moment of social isolation? Across three different approaches, I strengthen the hypothesis that perceived isolation can drive people toward trusted ties and core circles – i.e., safety. Over time, these confidants are increasingly likely to become salient until culminating as the default answer to the question above. It is at *this* point that the trusted partner becomes part of the individual's online safety net, delivering personal and persistent security through the social media affordances of availability and awareness. Nevertheless, given the range of channel options now afforded at all times, these questions are just the first of many needed to explain daily communication choice. Next up: *Which media comes to mind?*
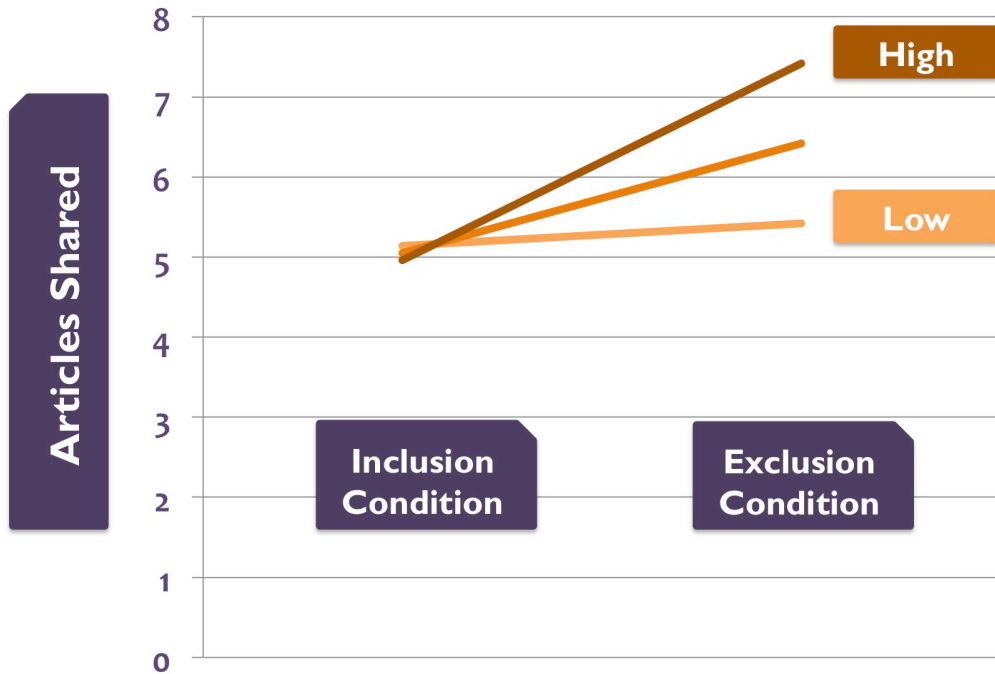
Figure 1. Interaction effect between trait self-control (BSCS) and condition [Chapter 2]. The lines represent three levels of self-control (high, medium, low). Excluded participants with higher levels of self-control shared more news articles with their close friends.
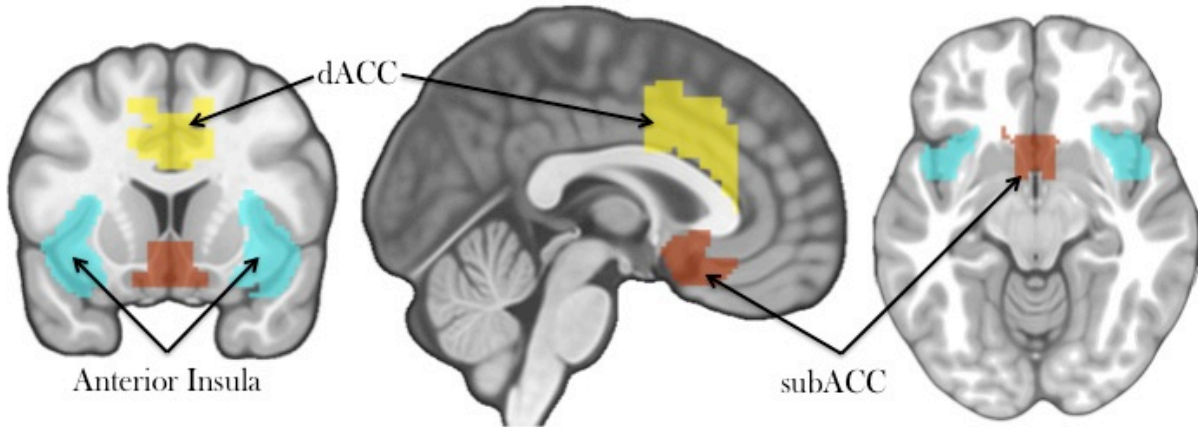
Figure 2. Social pain regions of interest (dACC, AI, and subACC). In the regression models in Study 2, separate acitivity in each of the three regions is averaged to create a single DV.
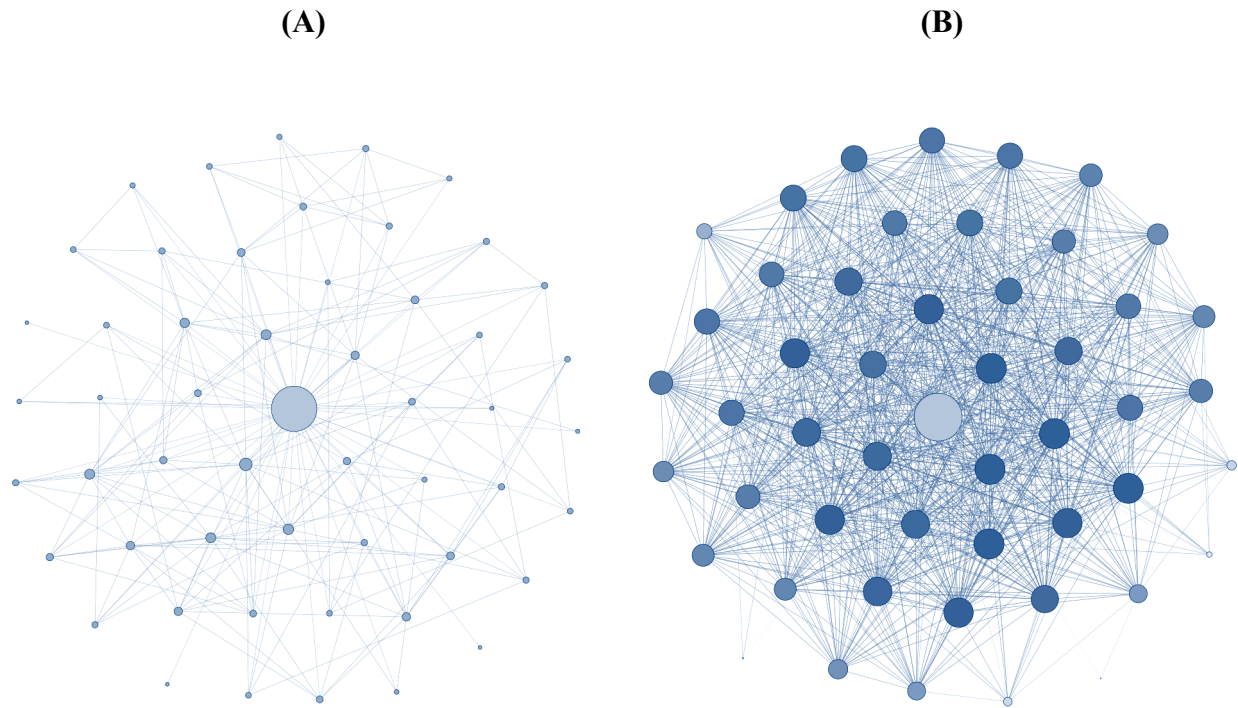
Figure 3. Two example active interaction networks including all friends who were including on the participnts' newsfeeds during the previous two-month period. Central node (light blue) is the EGO. Node sets of ALTERS indicates degree (i.e., number of connections to other friends). (A) size (number of friends) 52, density 0.11 . (B) size 49, density 0.73.
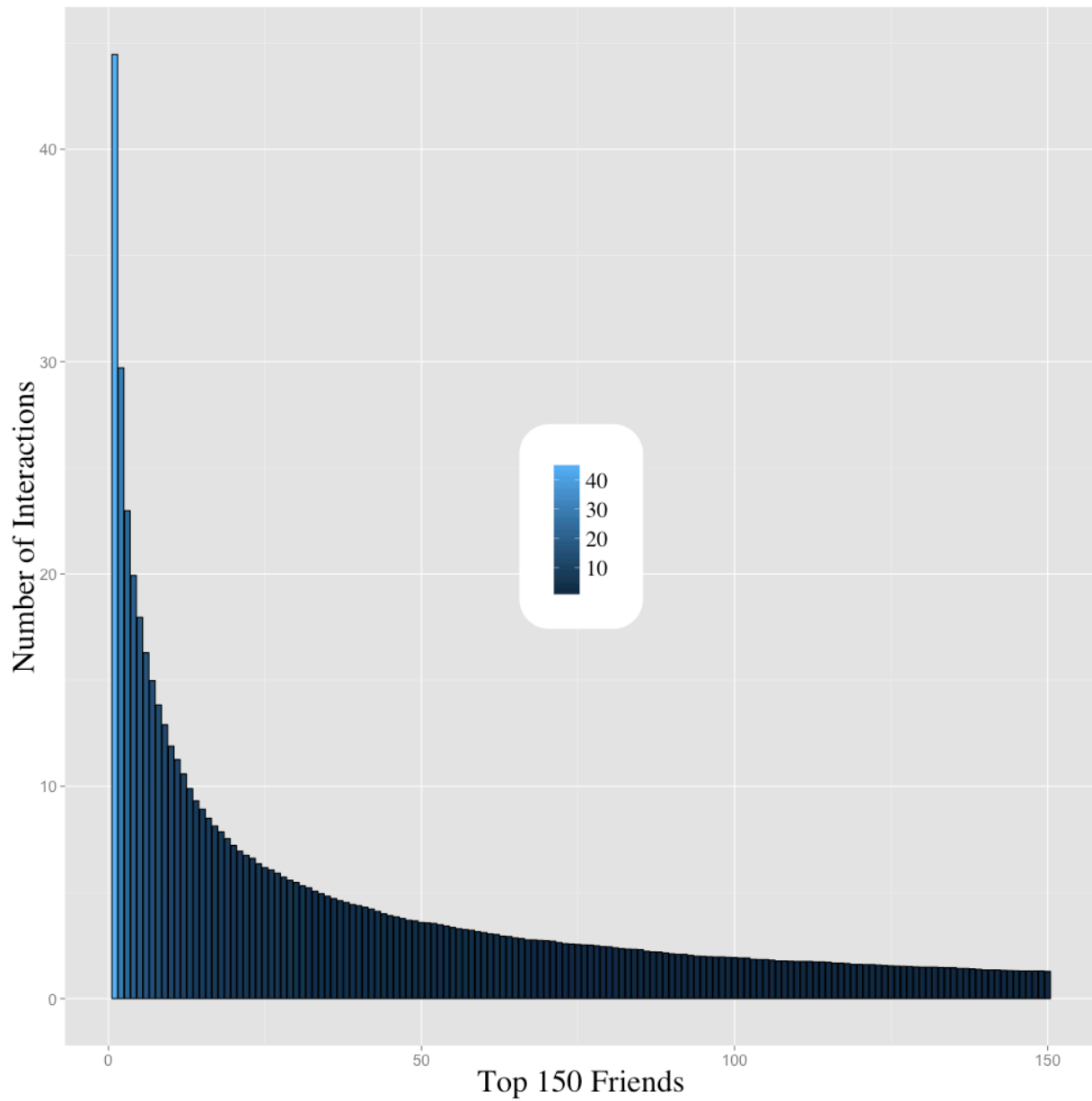
Figure 4. Distribution of interaction counts for participants' Top 150 Facebook Friends from Study 2. The values represent averages for each friend ranked 1 through 150 across the full sample over the previous year of Facebook activity.
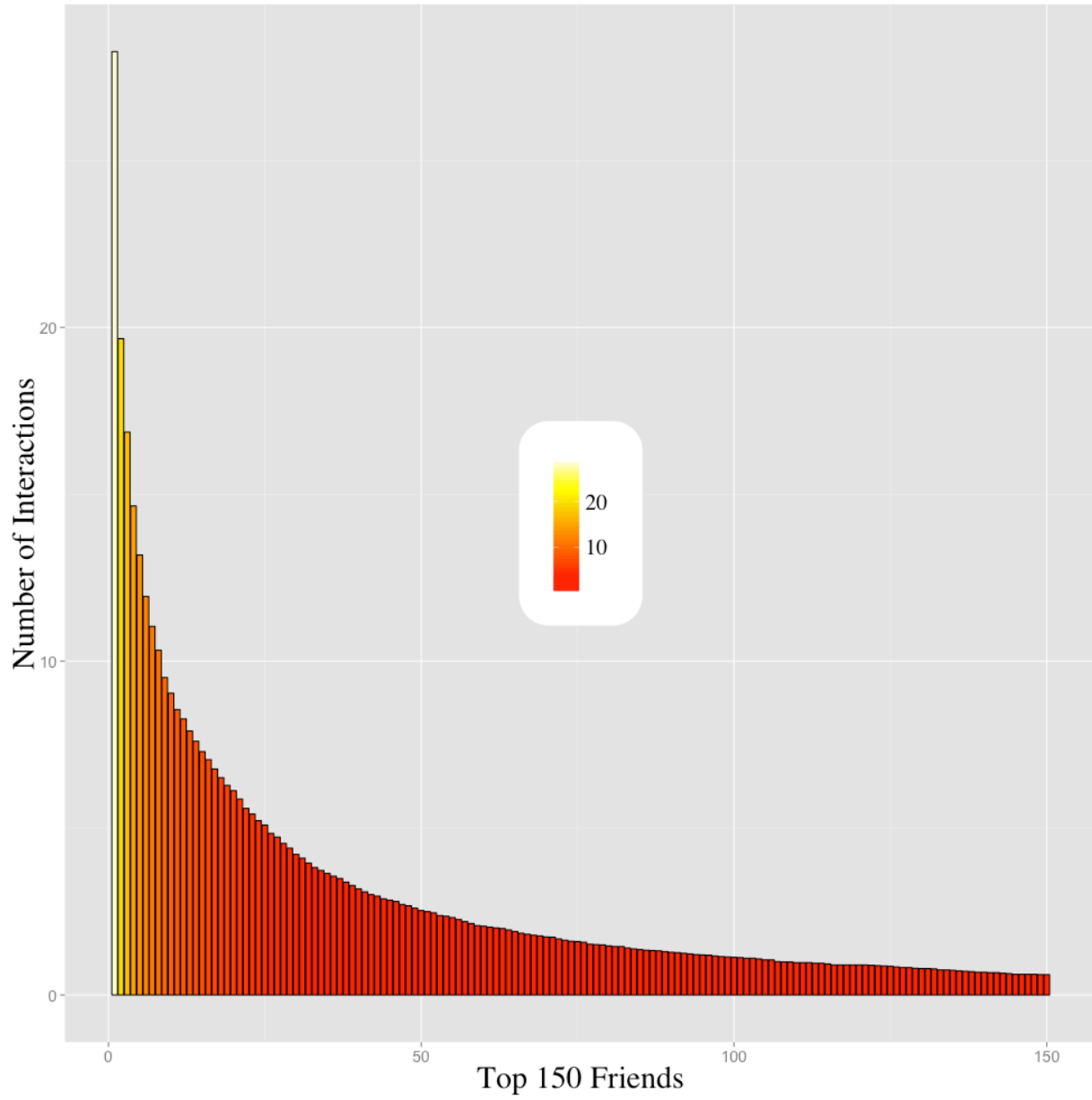
Figure 5. Distribution of interaction counts for participants' Top 150 Facebook Friends from Study 3. The values represent averages for each friend ranked 1 through 150 across the full sample over the previous three months of Facebook activity.
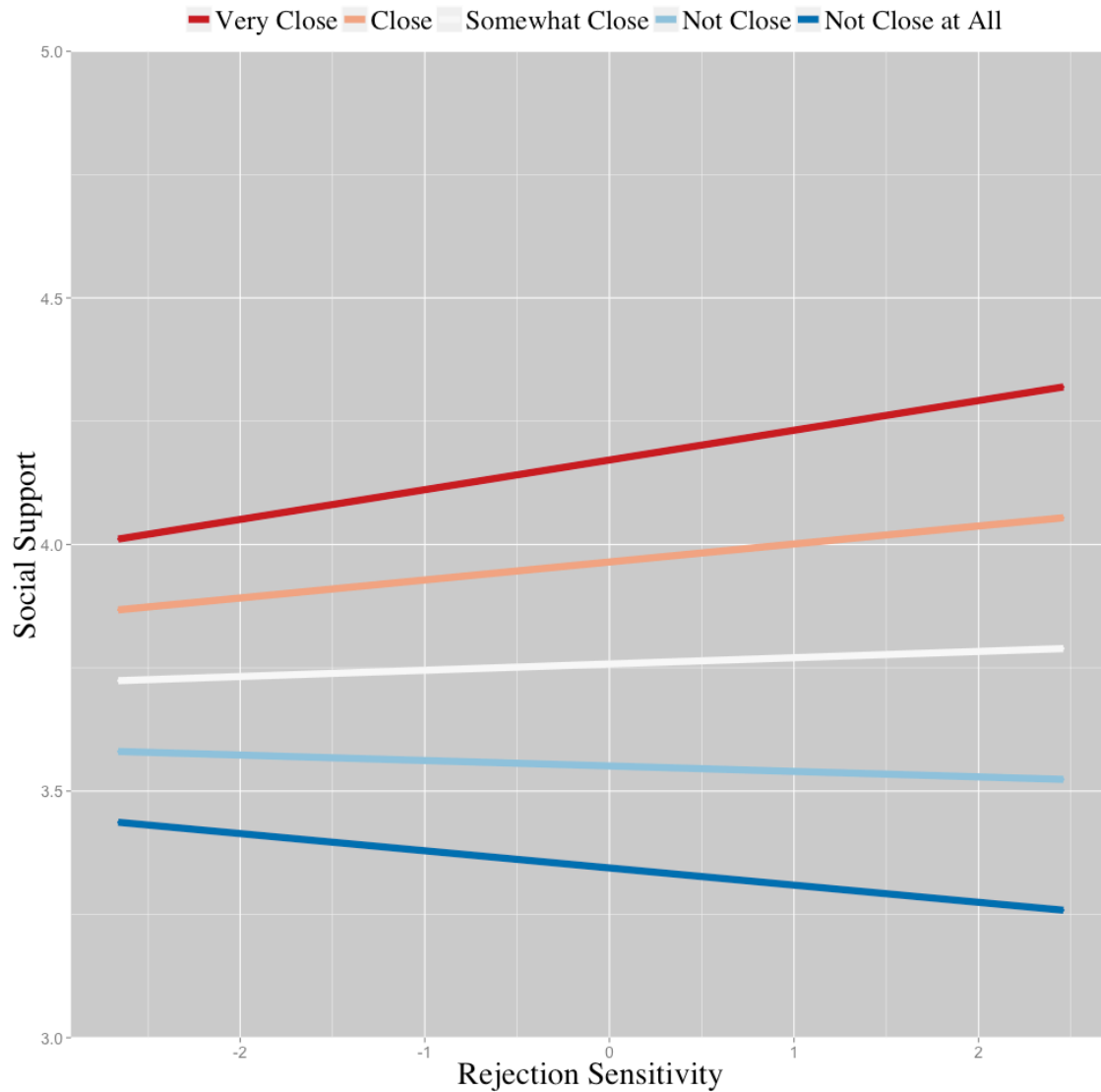
Figure 6. The supportiveness (DV) plot above displays the significant interaction effect between rejection sensitivity and tie strength, (b = 0.02, t(7566) = 2.77, p < 0.006). The model also included significant fixed effects for tie strength (b = 0.21, t(7558) = 23.96, p < 0.001) and conscientiousness (b = 0.19, t(97) = 4.26, p < 0.001), as well as insignificant main effects for rejection sensitivity (p > 0.26), neuroticism (p > 0.08), extraversion (p > 0.10), agreeableness (p > 0.30), and openness (p > 0.31). Additionally, the model included covariates for age (p > 0.30), gender (p > 0.13), and day of data collection (p > 0.26).
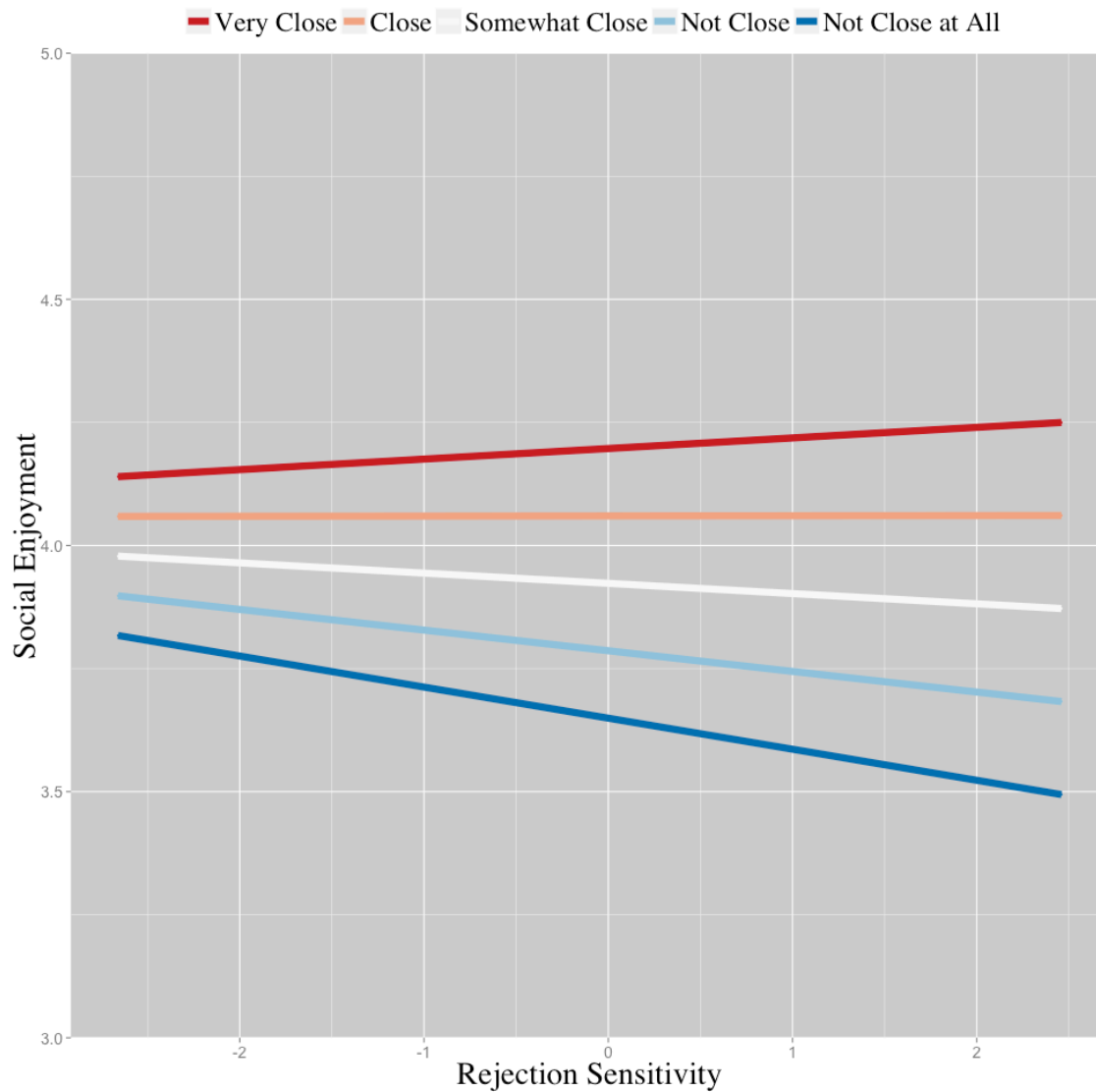
Figure 7. The enjoyment (DV) plot above displays the significant interaction effect between rejection sensitivity and tie strength, (b = 0.02, t(7578) = 2.40, p < 0.02). The model also included significant fixed effects for tie strength (b = 0.14, t(7570) = 15.47, p < 0.001), conscientiousness (b = 0.13, t(97) = 2.70, p < 0.01) and neuroticism (b = -0.10, t(97) = -2.29, p < 0.03), as well as insignificant main effects for rejection sensitivity (p > 0.13), extraversion (p > 0.62), agreeableness (p > 0.99), and openness (p > 0.76). Additionally, the model included covariates for age (p > 0.63), gender (p > 0.06), and day of data collection (p > 0.36).
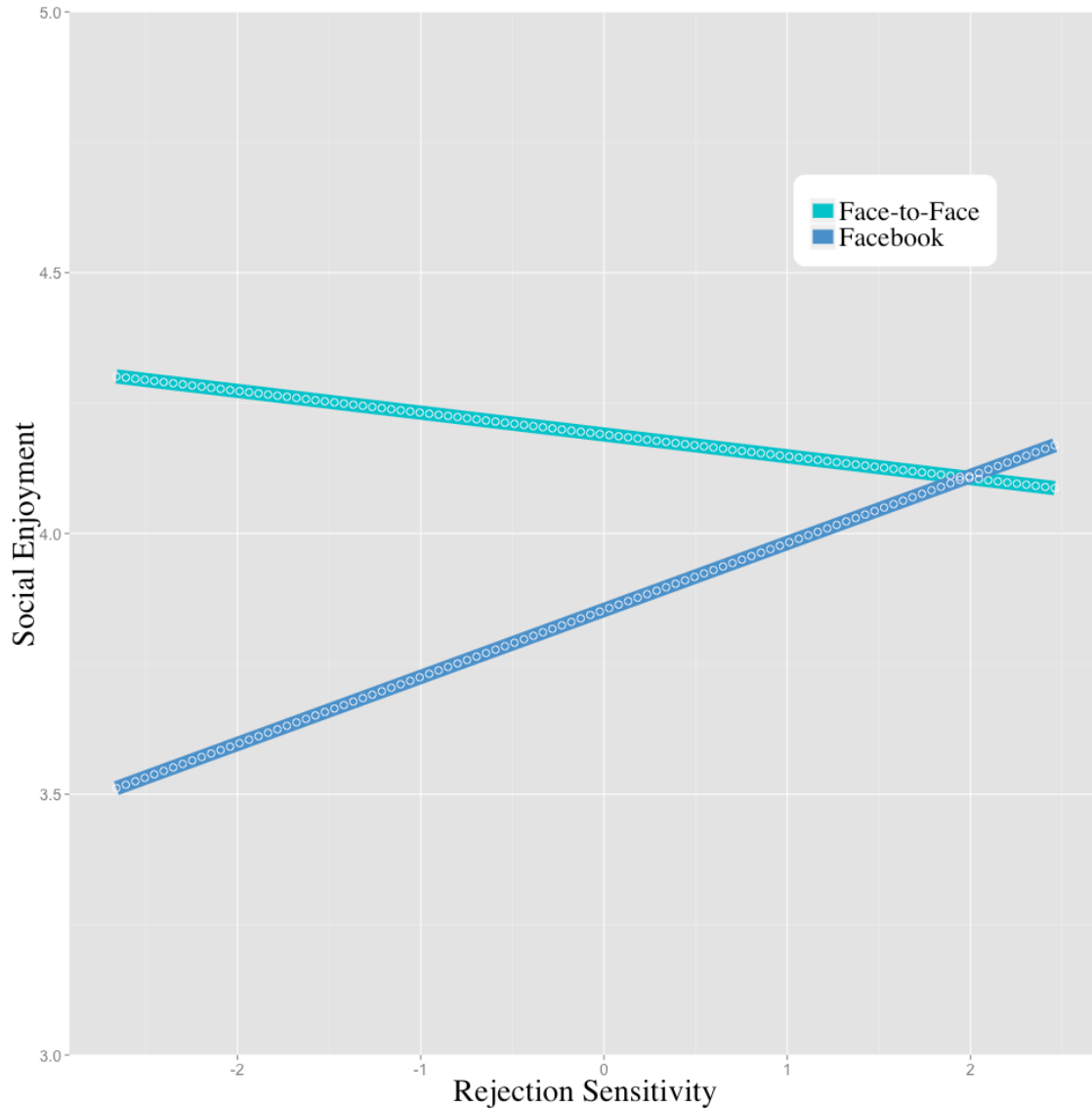
Figure 8. The enjoyment (DV) plot above displays the interaction effect between rejection sensitivity and interaction type (face-to-face vs. Facebook; $b = 0.17$, $t(7006) = 3.58$, $p < 0.001$). The model also included significant fixed effects for Facebook (vs. face-to-face; $b = -0.34$, $t(7082) = -7.15$, $p < 0.001$), texting (vs. face-to-face; $b = -0.37$, $t(7082) = -14.58$, $p < 0.001$), calling (vs. face-to-face; $b = -0.24$, $t(7040) = -5.08$, $p < 0.001$), tie strength ($b = 0.15$, $t(7095) = 15.81$, $p < 0.001$), and conscientiousness ($b = 0.13$, $t(97) = 2.63$, $p < 0.01$), as well as insignificant main effects for rejection sensitivity ($p > 0.34$), neuroticism ($p > 0.07$), extraversion ($p > 0.79$), agreeableness ($p > 0.73$), and openness ($p > 0.65$). Once again, the model included covariates for age ($p > 0.78$), gender ($p > 0.08$), and day of data collection ($p > 0.57$). Last, the models included extra interaction effects between rejection sensitivity and (a) texting (vs. face-to-face; $b = 0.07$, $t(7065) = 2.98$, $p < 0.003$) and (b) calling ($p > 0.38$).

Table 1

Exclusion Responses Predicting Network Density [Chapter 3]

	Full Network All Friends		**Significant Network** Top 15 Friends		**Strong Network** Top 5 Friends	
	β	*t* Value	β	*t* Value	β	*t* Value
Covariates						
Participant Wave	-0.05	-0.47	-0.12	-0.95	-0.19	-1.64
Full Network Size	**-0.28***	**-2.45**	-0.01	-0.04	-0.02	-0.11
Alter Interaction Count	**-0.31****	**-2.71**	0.07	0.60	0.14	1.21
Alter Interaction Share	--	--	0.09	0.64	**0.27***	**2.04**
Exclusion Predictors						
Self-Report Need Satisfaction	-0.16	-1.44	0.05	0.40	-0.09	-0.74
fMRI Social Pain Contrast	-0.01	-0.07	**0.24***	**2.08**	**0.22#**	**1.94**
R² (%)	24.5** (df = 70)		8.4 (df = 69)		17.1* (df = 69)	

Estimates are standardized regression coefficients.
 # p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Table 2

Exclusion Responses Predicting Network Transitivity [Chapter 3]

	Full Network All Friends		Significant Network Top 15 Friends		Strong Network[1] Top 5 Friends	
	β	*t* Value	β	*t* Value	b	*t* Value
Covariates						
Participant Wave	-0.07	-0.69	-0.18	-1.56	-0.71	-1.28
Full Network Size	**-0.46 *****	**-4.20**	-0.10	-0.73	-0.00	-0.47
Alter Interaction Count	-0.12	-1.13	0.15	1.34	0.00	0.54
Alter Interaction Share	--	--	0.03	0.25	**5.86*****	**22.21**
Exclusion Predictors						
Self-Report Need Satisfaction	**-0.26 ***	**-2.49**	0.00	-0.04	0.06	0.26
fMRI Social Pain Contrast	0.04	0.35	**0.31****	**2.72**	**1.62****	**2.57**
R² (%)	30.3*** (df = 70)		14.8# (df = 69)		AIC = 159.8 (df = 69)	

[1]Strong Network triadic closure was recoded due to non-normality and run as a logistic regression.
Estimates are standardized regression coefficients, except for the Strong Network logit model.
 # p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Table 3

Daily Contact Predictors of Facebook Network Density [Chapter 4]

	Full Network All Friends		Significant Network Top 15 Friends		Strong Network Top 5 Friends	
	β	t Value	β	t Value	β	t Value
Covariates						
Age	-0.33 ***	-4.48	0.16 #	1.88	0.18*	2.06
Gender	0.09	1.05	0.02	0.20	0.06	0.73
Facebook Activity	-0.21 **	-2.64	0.09	1.10	0.13	1.48
Full Network Size	-0.22 **	-2.76	0.17*	2.09	0.21*	2.38
Full Network Density	--	--	0.32 ***	3.62	0.23*	2.49
Daily Contact Predictors						
Closeness Average	0.14 #	1.75	0.18*	2.14	0.21*	2.43
Closeness Flux	-0.04	-0.54	-0.18*	-2.11	-0.06	-0.68
Closeness Difference	-0.07	-0.95	0.08	0.96	0.10	1.16
R^2 (%)	**38.4*** (df = 136)**		**19.9*** (df = 135)**		**15.2** (df = 132)**	

Estimates are standardized regression coefficients.

$# p < 0.10$; $* p < 0.05$; $** p < 0.01$; $*** p < 0.001$

Table 4

Personality Predictors of Full Network Closure [Chapter 4]

	Density		Transitivity		Communities	
	β	*t* Value	β	*t* Value	β	*t* Value
Covariates						
Age	**-0.41 *****	-4.65	-0.18	-1.77	0.11	1.15
Gender	0.03	0.32	0.03	0.97	-0.11	-1.02
Facebook Activity	**-0.20 ***	-2.10	-0.03	-0.31	-0.02	-0.20
Full Network Size	-0.06	-0.66	**-0.31****	**-2.92**	0.03	0.28
Personality Predictors						
Extraversion	**-0.32 ****	-2.82	-0.14	-1.06	**0.32***	**2.54**
Neuroticism	-0.08	-0.74	-0.13	-1.12	-0.03	-0.31
Conscientiousness	-0.00	-0.01	0.12	1.17	**0.24***	**2.50**
Openness	**-0.20 ***	-2.10	0.01	0.10	0.14	1.38
Agreeableness	0.07	0.78	0.11	1.01	-0.05	-0.44
Rejection Sensitivity	-0.04	-0.39	-0.03	-0.28	0.12	1.02
R² (%)	**38.4*** (df = 90)**		**21.9* (df = 89)**		**24.7** (df = 90)**	

Estimates are standardized regression coefficients.
 # p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.00

105

REFERENCES

Albrecht, T. L., & Adelman, M. B. (1984). Social support and life stress: New directions for communication research. *Human Communication Research*, *11*(1), 3–32.

Albrecht, T. L., & Bach, B. W. (1997). *Communication in complex organizations: A relational approach*. New York, NY: Harcourt Brace.

Andersson, M. (2012). Dispositional optimism and the emergence of social network diversity. *Sociological Quarterly*, *53*(1), 92–115. doi:10.1111/j.1533-8525.2011.01227.x

Arnaboldi, V., Guazzini, A., & Passarella, A. (2013). Egocentric online social networks: Analysis of key features and prediction of tie strength in Facebook. *Computer Communications*, *36*, 1130–1144. doi:10.1016/j.comcom.2013.03.003

Asendorpf, J., & Wipers, S. (1998). Personality effects on social relationships. *Journal of Personality and Social Psychology*, *74*, 1531–1544.

Back, M. D., & Vazire, S. (2015). The social consequences of personality: Six suggestions for future research. *European Journal of Personality*, *29*(2), 296–307. doi:10.1002/per.1998

Baer, M. (2010). The strength-of-weak-ties perspective on creativity: a comprehensive examination and extension. *The Journal of Applied Psychology*, *95*(3), 592–601. doi:10.1037/a0018761

Baumeister, R., Dewall, C. N., Ciarocco, N. J., & Twenge, J. M. (2005). Social exclusion impairs self-regulation, *88*(4), 589–604. doi:10.1037/0022-3514.88.4.589

Baumeister, R., & Leary, M. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497–529. doi:10.1037/0033-2909.117.3.497

Bayer, J. B., Campbell, S. W., & Ling, R. (2016). Connection cues: Activating the norms and

habits of social connectedness. *Communication Theory*, 1–22. doi:10.1111/comt.12090

Bayer, J. B., Ellison, N. B., Schoenebeck, S. Y., & Falk, E. B. (2015). Sharing the small

moments: Ephemeral social interaction on Snapchat. *Information, Communication &*

Society, Advance online publication.

Bearman, P., & Moody, J. (2004). Suicide and friendship among American adolescents.

American Journal of Public Health, *94*(1), 89–95. doi:10.2105/AJPH.94.1.89

Berger, C., & Calabrese, R. J. (1975). Some explorations in initial interaction and beyond:

Toward a developmental theory of interpersonal communication. *Human Communication*

Research, *1*(2), 99–112.

Berger, J. (2011). Arousal increases social transmission of information. *Psychological Science*,

22(7), 891–893.

Berger, J. (2014). Word of mouth and interpersonal communication: A review and directions for

future research. *Journal of Consumer Psychology*, *24*(4), 586–607.

doi:10.1016/j.jcps.2014.05.002

Berger, J., & Milkman, K. L. (2012). What makes online content viral? *Journal of Marketing*

Research, *49*, 192–205.

Berkman, E. T., & Falk, E. B. (2013). Beyond brain mapping using neural measures to predict

real-world outcomes. *Current Directions in Psychological Science*, *22*(1), 45–50.

Bickart, K. C., Hollenbeck, M. C., Barrett, L. F., & Dickerson, B. C. (2012). Intrinsic amygdala–

cortical functional connectivity predicts social network size in humans. *Journal of*

Neuroscience, *32*(42), 14729–14741. doi:10.1523/JNEUROSCI.1599-12.2012

Binder, J. F., Roberts, S. G. B., & Sutcliffe, A. G. (2012). Closeness, loneliness, support: Core

ties and significant ties in personal communities. *Social Networks*, *34*(2), 206–214. doi:10.1016/j.socnet.2011.12.001

Blackhart, G. C., Nelson, B. C., Knowles, M. L., Baumeister, R. F., & Nelson, B. C. (2009). Rejection elicits emotional reactions but neither causes immediate distress nor lowers self-esteem: A meta-analytic review of 192 studies on social exclusion. *Personality and Social Psychology Review*, *13*, 269–309. doi:10.1177/1088868309346065

Boase, J. (2008). Personal networks and the personal communication system. *Information, Communication & Society*, *11*(4), 490–508.

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science*, *8*, 591–612. doi:10.1177/1745691613504116

Brashears, M. E. (2011). Small networks and high isolation? A reexamination of American discussion networks. *Social Networks*, *33*(4), 331–341. doi:10.1016/j.socnet.2011.10.003

Brashears, M. E., Hoagland, E., & Quintane, E. (2016). Sex and network recall accuracy. *Social Networks*, *44*, 74–84. doi:10.1016/j.socnet.2015.06.002

Brashears, M. E., & Quintane, E. (2015). The microstructures of network recall: How social networks are encoded and represented in human memory. *Social Networks*, *41*, 113–126. doi:10.1016/j.socnet.2014.11.003

Brooks, B., Hogan, B., Ellison, N., Lampe, C., & Vitak, J. (2014). Assessing structural correlates to social capital in Facebook ego networks. *Social Networks*, *38*, 1–15. doi:10.1016/j.socnet.2014.01.002

Burchell, K. (2015). Tasking the everyday: Where mobile and online communication take time. *Mobile Media & Communication*, *3*, 36–52. doi:10.1177/2050157914546711

Burklund, L. J., Eisenberger, N. I., & Lieberman, M. D. (2007). The face of rejection: rejection sensitivity moderates dorsal anterior cingulate activity to disapproving facial expressions. *Social Neuroscience*, *2*, 238–53. doi:10.1080/17470910701391711

Burt, R. S. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Burt, R. S. (2000). The network structure of social capital. In R. Sutton & B. Staw (Eds.), *Research in Organizational Behavior* (Vol. 22, pp. 345–423). Greenwich, CT: JAI Press. doi:10.1016/S0191-3085(00)22009-1

Burt, R. S. (2012). Network-related personality and the agency question: Multirole evidence from a virtual world. *American Journal of Sociology*, *118*(3), 543–591. doi:10.1086/667856

Burt, R. S., Kilduff, M., & Tasselli, S. (2013). Social network analysis: foundations and frontiers on advantage. *Annual Review of Psychology*, *64*, 527–47. doi:10.1146/annurev-psych-113011-143828

Butler, J. C., Doherty, M. S., & Potter, R. M. (2007). Social antecedents and consequences of interpersonal rejection sensitivity. *Personality and Individual Differences*, *43*(6), 1376–1385. doi:10.1016/j.paid.2007.04.006

Cacioppo, J. T., Fowler, J. H., & Christakis, N. A. (2009). Alone in the crowd: The structure and spread of loneliness in a large social network. *Journal of Personality and Social Psychology*, *97*(6), 977–991. doi:10.1037/a0016076

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences*, *13*(10), 447–454. doi:10.1016/j.tics.2009.06.005

Campbell, S. W. (2015). Mobile communication and network privatism: A literature review of the implications for diverse, weak, and new ties. *Review of Communication Research*, *3*, 1–

21. doi:10.12840/issn.2255-4165.2015.03.01.006

Campbell, S. W., & Kwak, N. (2011). Mobile communication and civil society: Linking patterns and places of use to engagement with others in public. *Human Communication Research*, *37*, 207–222.

Campbell, S. W., & Russo, T. C. (2003). The social construction of mobile telephony: an application of the social influence model to perceptions and uses of mobile phones within personal communication networks. *Communication Monographs*, *70*(4), 317–334. doi:10.1080/0363775032000179124

Carstensen, L. L., Isaacowitz, D. M., & Charles, S. T. (1999). Taking time seriously: A theory of socioemotional selectivity. *The American Psychologist*, *54*(3), 165–181. doi:10.1037/0003-066X.54.3.165

Casciaro, T., Barsade, S. G., Edmondson, A. C., Gibson, C. B., Krackhardt, D., & Labianca, G. (2015). The integration of psychological and network perspectives in organizational scholarship. *Organization Science*, *26*(4), 1162–1176. doi:10.1287/orsc.2015.0988

Cerulo, K. A. (2010). Mining the intersections of cognitive sociology and neuroscience. *Poetics*, *38*(2), 115–132. doi:10.1016/j.poetic.2009.11.005

Cheung, E. O., Gardner, W. L., & Anderson, J. F. (2014). Emotionships: Examining people's emotion-regulation relationships and their consequences for well-being emotionships. *Social Psychological and Personality Science*, 1–8. doi:10.1177/1948550614564223

Contractor, N. S., Whitbred, R. C., Fonti, F., & Steglich, C. (2012). Understanding the ties that bind: A longitudinal investigation of the evolution of a communication network. *Western Journal of Communication*, *76*(4), 333–357. doi:10.1080/10570314.2012.674172

Curry, O., & Dunbar, R. I. M. (2011). Altruism in networks: the effect of connections. *Biology*

Letters, *7*(5), 651–3. doi:10.1098/rsbl.2010.1202

DeWall, C. N., Baumeister, R. F., & Vohs, K. D. (2008). Satiated with belongingness? Effects of acceptance, rejection, and task framing on self-regulatory performance. *Journal of Personality and Social Psychology*, *95*(6), 1367–1382. doi:10.1037/a0012632

DeWall, C. N., & Bushman, B. J. (2011). Social acceptance and rejection: The sweet and the bitter. *Current Directions in Psychological Science*, *20*(4), 256–260. doi:10.1177/0963721411417545

DeWall, C. N., & Richman, S. B. (2011). Social exclusion and the desire to reconnect. *Social and Personality Psychology Compass*, *5*(11), 919–932.

DeWall, C. N., Twenge, J. M., Koole, S. L., Baumeister, R. F., Marquez, A., & Reid, M. W. (2011). Automatic emotion regulation after social exclusion: Tuning to positivity. *Emotion*, *11*(3), 623–636.

Dickerson, S. S., & Kemeny, M. E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*, *130*(3), 355–391. doi:10.1037/0033-2909.130.3.355

Donati, S., Zappalà, S., & González-Romá, V. (2016). The influence of friendship and communication network density on individual innovative behaviours: a multilevel study. *European Journal of Work and Organizational Psychology*, *Advance on*, 1–14. doi:10.1080/1359432X.2016.1179285

Downey, G., & Feldman, S. I. (1996). Implications of rejection sensitivity for intimate relationships. *Journal of Personality and Social Psychology*, *70*(6), 1327–1343. doi:10.1037/0022-3514.70.6.1327

Dunbar, R. (2014a). The social brain psychological underpinnings and implications for the

structure of organizations. *Current Directions in Psychological Science*, *23*(2), 109–114.
doi:10.1177/0963721413517118

Dunbar, R. (2014b). What's so social about the social brain? In J. Decety & Y. Christen (Eds.),
New Frontiers in Social Neuroscience (pp. 1–10). Springer.

Durkheim, E. (1851). *Suicide:* New York [1997]: Free Press.

Eagle, N., Pentland, A., & Lazer, D. (2009). Inferring friendship network structure by using
mobile phone data. *PNAS*, *106*, 15274–15278.

Easley, D., & Kleinberg, J. (2010). *Networks, crowds, and markets: Reasoning about a highly
connected world*. Cambridge: Cambridge University Press.

Eisenberger, N. (2013). Social ties and health: A social neuroscience perspective. *Current
Opinion in Neurobiology*, *23*(3), 407–413. doi:10.1016/j.conb.2013.01.006

Eisenberger, N., Lieberman, M., & Williams, K. (2003). Does rejection hurt? An fMRI study of
social exclusion. *Science*, *302*, 290–292.

Eisenberger, N., Taylor, S. E., Gable, S. L., Hilmert, C. J., & Lieberman, M. D. (2007). Neural
pathways link social support to attenuated neuroendocrine stress responses. *NeuroImage*,
35(4), 1601–12. doi:10.1016/j.neuroimage.2007.01.038

Ellison, N. B., Steinfield, C., & Lampe, C. (2011). Connection strategies: Social capital
implications of Facebook-enabled communication practices. *New Media & Society*, *13*(6),
873–892. doi:10.1177/1461444810385389

Falk, E. B. (2012). Can neuroscience advance our understanding of core questions in
communication studies? An overview of communication neuroscience. In S. Jones (Ed.),
Communication at the Center (pp. 77–94). New York: Hampton Press.

Falk, E. B., Cascio, C. N., O'Donnell, M. B., Carp, J., Tinney Jr, F. J., Bingham, C. R., …

Simons-Morton, B. G. (2014). Neural responses to exclusion predict susceptibility to social

    influence. *Journal of Adolescent Health*, *54*, S22eS31.

Fang, R., Landis, B., Zhang, Z., Anderson, M. H., Shaw, J. D., & Kilduff, M. (2015). Integrating

    personality and social networks: A meta-analysis of personality, network position, and work

    outcomes in organizations. *Organization Science*, *26*, 150430111317009.

    doi:10.1287/orsc.2015.0972

Felmlee, D., & Faris, R. (2013). Interaction in social networks. In J. DeLamater & A. Ward

    (Eds.), *Handbook of Social Psychology* (pp. 439–464). Dordrecht: Springer.

    doi:10.1007/978-94-007-6772-0

Fitzsimons, G. M., & Finkel, E. J. (2011). Outsourcing self-regulation. *Psychological Science*,

    22(3), 369–375. doi:10.1177/0956797610397955

Forgas, J. P., Bower, G. H., & Krantz, S. E. (1984). The influence of mood on perceptions of

    social interactions. *Journal of Experimental Social Psychology*, *20*(6), 497–513.

Fowler, J. H., Dawes, C. T., & Christakis, N. a. (2009). Model of genetic variation in human

    social networks. *PNAS*, *106*(6), 1720–1724. doi:10.1073/pnas.0806746106

Frijda, N. H., Ridderinkhof, K. R., & Rietveld, E. (2014). Impulsive action: Emotional impulses

    and their control. *Frontiers in Psychology*, *5*, 1–9. doi:10.3389/fpsyg.2014.00518

Fu, Y. C., Ho, H. C., & Chen, H. M. (2013). Weak ties and contact initiation in everyday life:

    Exploring contextual variations from contact diaries. *Social Networks*, *35*(3), 279–287.

    doi:10.1016/j.socnet.2013.02.004

Gerber, J., & Wheeler, L. (2009). On being rejected: A meta-analysis of experimental research

    on rejection. *Perspectives on Psychological Science*, *4*(5), 468–488.

Gergen, K. J. (2003). Self and community in the new floating worlds. In K. Nyiri (Ed.), *Mobile*

Democracy: Essays on Society, Self, and Politics (pp. 103–114). Vienna: Passagen Verlag.

Granovetter, M. S. (1973). The strength of weak ties. *American Journal of Sociology*, *78*, 1360–1380.

Habuchi, I. (2005). Accelerating reflexivity. In *Personal, Portable, Pedestrian: Mobile phones in Japanese life* (pp. 165–182). Cambridge, MA: The MIT Press.

Hallinan, M., & Kubitschek, W. (1998). The effects of individual structural characteristics on ontransitivity in social networks. *Social Psychology Quarterly*, *51*, 81–92. doi:10.1017/CBO9781107415324.004

Hampton, K. (2016). Persistent and pervasive community: New communication technologies and the future of community. *American Behavioral Scientist*, *60*, 101–124. doi:10.1177/0002764215601714

Hampton, K., Lee, C.-J., & Her, E. J. (2011). How new media affords network diversity: Direct and mediated access to social capital through participation in local social settings. *New Media & Society*, *13*(7), 1031–1049. doi:10.1177/1461444810390342

Hampton, K., & Ling, R. (2013). Explaining communication displacement and large-scale social change in core networks. *Information, Communication & Society*, *16*(4), 561–589. doi:10.1080/1369118X.2013.777760

Hampton, K., Rainie, L., Lu, W., Dwyer, M., Shin, I., & Purcell, K. (2014). *Social Media and the "Spiral of Silence." Pew Research Internet Project*.

Hampton, K., Sessions, L. F., & Her, E. J. (2011). Core networks, social isolation, and new media. *Information, Communication & Society*, *14*(1), 130–155. doi:10.1080/1369118X.2010.513417

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical

review of consequences and mechanisms. *Annals of Behavioral Medicine*, *40*(2), 218–227. doi:10.1007/s12160-010-9210-8

Hayes, A. F., Matthes, J., & Eveland, W. P. (2013). Stimulating the quasi-statistical organ: Fear of social isolation motivates the quest for knowledge of the opinion climate. *Communication Research*, *40*(4), 439–462. doi:10.1177/0093650211428608

Haythornthwaite, C., & Wellman, B. (1998). Work, friendship, and media use for information exchange in a networked organization. *Journal of the American Society for Information Science*, *49*(12), 1101–1114.

Hlebec, V., & Kogovšek, T. (2013). Different approaches to measure ego-centered social support networks: A meta-analysis. *Quality and Quantity*, *47*(6), 3435–3455. doi:10.1007/s11135-012-9731-2

Ho, S. S., & McLeod, D. M. (2008). Social-psychological influences on opinion expression in face-to-face and computer-mediated communication. *Communication Research*, *35*(2), 190–207.

Hurlbert, J. S., Haines, V. a., & Beggs, J. J. (2000). Core networks and tie activation: What kinds of routine networks allocate resources in nonroutine situations? *American Sociological Review*, *65*(4), 598. doi:10.2307/2657385

Ishiguro, I. (2016). Extroversion and neuroticism affect the right side of the distribution of network size. *Social Networks*, *44*, 219–225. doi:10.1016/j.socnet.2015.10.004

Ito, M., & Okabe, D. (2005). Technosocial situations: Emergent structurings of mobile email use. *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*, *20*(6), 257–273.

Kadushin, C. (2012). *Understanding social networks: Theories, concepts, and findings*. New York: Oxford University Press.

Kadushin, C., & Jones, D. J. (1992). Social networks and urban neighborhoods in New York
City. *City & Society*, *6*(1), 58–75.

Kalish, Y., & Robins, G. (2006). Psychological predispositions and network structure: The
relationship between individual predispositions, structural holes and network closure. *Social
Networks*, *28*(1), 56–84. doi:10.1016/j.socnet.2005.04.004

Kanai, R., Bahrami, B., Roylance, R., & Rees, G. (2011). Online social network size is reflected
in human brain structure. *Proceedings of the Royal Society B: Biological Sciences*.
doi:10.1098/rspb.2011.1959

Kane, G., Alavi, M., Labianca, G., Borgatti, S., & Center, L. (2014). What's different about
social media networks? A framework and research agenda. *MIS Quarterly*, *Advance on*, 1–
30.

Kawamoto, T., Nittono, H., & Ura, M. (2015). Trait rejection sensitivity is associated with
vigilance and defensive response rather than detection of social rejection cues. *Frontiers in
Psychology*, *6*, 1–14. doi:10.3389/fpsyg.2015.01516

Kawamoto, T., Ura, M., & Nittono, H. (2015). Intrapersonal and interpersonal processes of
social exclusion. *Fronties in Neuroscience*, *9*, 1–11. doi:10.3389/fnins.2015.00062

Kelly, K. (2001). Individual differences in reactions to rejection. In M. Leary (Ed.),
Interpersonal rejection (pp. 291–315). New York: Oxford University Press.

Kilduff, M., Crossland, C., Tsai, W., & Krackhardt, D. (2008). Organizational network
perceptions versus reality: A small world after all? *Organizational Behavior and Human
Decision Processes*, *107*(1), 15–28. doi:10.1016/j.obhdp.2007.12.003

Kobayashi, T., & Boase, J. (2014). Tele-cocooning: Mobile texting and social scope. *Journal of
Computer-Mediated Communication*, *19*(3), 681–694. doi:10.1111/jcc4.12064

Kornienko, O., Clemans, K. H., Out, D., & Granger, D. a. (2013). Friendship network position and salivary cortisol levels. *Social Neuroscience*, *8*(4), 385–96. doi:10.1080/17470919.2013.795500

Krackhardt, D. (1987). Cognitive social structures. *Social Networks*, *9*(2), 109–134. doi:10.1016/0378-8733(87)90009-8

Krämer, N. C., Rösner, L., Eimler, S., Winter, S., & Neubaum, G. (2014). Let the weakest link go! Empirical explorations on the relative importance of weak and strong ties on social networking sites. *Societies*, *4*(4), 785–809. doi:10.3390/soc4040785

Kross, E., Berman, M. G., Mischel, W., Smith, E. E., & Wager, T. D. (2011). Social rejection shares somatosensory representations with physical pain. *PNAS*, *108*(15), 6270–6275. doi:10.1073/pnas.1102693108

La Gala, M., Arnaboldi, V., Passarella, A., & Conti, M. (2012). Ego-net digger: A new way to study ego networks in online social networks. In *ACM Proceedings of KDD* (pp. 9–16).

Lakon, C., Godette, D., & Hipp, J. (2008). Network-based approaches for measuring social capital. In I. Kawachi, S. V. Subramanian, & D. Kim (Eds.), *Social Capital and Health* (pp. 63–81). New York: Springer.

Landis, B. (2016). Personality and social networks in organizations: A review and future directions. *Journal of Organizational Behavior*, *37*, 107–121. doi:10.1002/job

Lasswell, H. D. (1948). The structure and function of communication in society. In L. Bryson (Ed.), *The Communication of Ideas* (pp. 37–51). New York: Harper.

Leary, M. (2010). Affiliation, acceptance, and belonging: The pursuit of interpersonal connection. In S. Fiske & D. T. Gilbert (Eds.), *Handbook of Social Psychology*. John Wiley & Sons.

Leary, M., Kelly, K. M., Cottrell, C. A., & Schreindorfer, L. S. (2007). Individual differences in the need to beong: Mapping the nomological network. *Unpublished Manuscript*.

Lepri, B., Staiano, J., Shmueli, E., Pianesi, F., & Pentland, A. (2016). The role of personality in shaping social networks and mediating behavioral change. *User Modeling and User-Adapted Interaction*, *Advance on*, 1–33. doi:10.1007/s11257-016-9173-y

Levy, S., Ayduk, O., & Downey, G. (2001). The role of rejection sensitivity in people's relationships with significant others and valued social groups. In M. Leary (Ed.), *Interpersonal rejection* (pp. 251–271). Oxford: Oxford University Press.

Lieberman, M. D. (2007). Social cognitive neuroscience: A review of core processes. *Annual Reviews of Psychology*, *58*, 259–289.

Lin, H., Tov, W., & Qiu, L. (2014). Emotional disclosure on social networking sites: The role of network structure and psychological needs. *Computers in Human Behavior*, *41*, 342–350. doi:10.1016/j.chb.2014.09.045

Lin, N. (2001). Building a network theory of social capital. In N. Lin, R. S. Cook, & R. S. Burt (Eds.), *Social Capital: Theory and Research* (pp. 3–29).

Ling, R. (2008). *New Tech, New Ties: How Mobile Communication is Reshaping Social Cohesion*. Cambridge, MA: MIT Press.

Ling, R. (2012). *Taken for Grantedness: The Embedding of Mobile Communication into Society*. Cambridge, MA: MIT Press.

Ling, R., Bjelland, J., Sundsøy, P. R., & Campbell, S. W. (2014). Small circles: mobile telephony and the cultivation of the private sphere. *The Information Society*, *30*(4), 282–291. doi:10.1080/01972243.2014.915279

Lizardo, O., & Skiles, S. (2016). The end of symbolic exclusion? The rise of "categorical

tolerance" in the musical tastes of Americans: 1993-2012. *Sociological Science*, *3*, 85–108. doi:10.15195/v3.a5

MacDonald, A. W., Cohen, J. D., Stenger, V. . A., & Carter, C. S. (2000). Dissociating the role of the dorsolateral prefrontal and anterior cingulate cortex in cognitive control. *Science*, *288*, 1835–1838. doi:10.1126/science.288.5472.1835

Maloney, P. W., Grawitch, M. J., & Barber, L. K. (2012). The multi-factor structure of the Brief Self-Control Scale: Discriminant validity of restraint and impulsivity. *Journal of Research in Personality*, *46*(1), 111–115. doi:10.1016/j.jrp.2011.10.001

Maner, J. K., DeWall, C. N., Baumeister, R. F., & Schaller, M. (2007). Does social exclusion motivate interpersonal reconnection? Resolving the "porcupine problem." *Journal of Personality and Social Psychology*, *92*, 42–55. doi:10.1037/0022-3514.92.1.42

Marsden, P., & Campbell, K. (1984). Measuring tie strength. *Social Forces*, *63*(2), 482–501.

Masten, C., Eisenberger, N., & Borofsky, L. (2009). Neural correlates of social exclusion during adolescence: understanding the distress of peer rejection. *Social Cognitive Affective Neuroscience*, *4*, 143–157.

Masten, C., Telzer, E., Fuligni, A., Lieberman, M., & Eisenberger, N. (2012). Time spent with friends in adolescence relates to less nerual sensitivity to later peer rejection. *Social Cognitive Affective Neuroscience*, *7*, 106–114.

McPherson, M., Smith-Lovin, L., & Brashears, M. E. (2006). Social isolation in America: Changes in core discussion networks over two decades. *American Sociological Review*, *73*(6), 353–375. doi:10.1177/000312240807300610

Mcpherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, *27*, 415–444.

Mehrabian, A. (1970). The development and validation of measures of affiliative tendency and

    sensitivity to rejection. *Educational and Psychological Measurement*, *30*, 417–428.

Mehrabian, A. (1976). Questionnaire measures of affiliative tendency and sensitivity to rejection.

    Psychological Reports, *38*(1974), 199–209.

Mehrabian, A. (1994). Evidence bearing on the affiliative tendency (MAFF) and sensitivity to

    rejection (MSR) scales. *Current Psychology*, *13*(2), 97–116. doi:10.1007/BF02686794

Merluzzi, J., & Burt, R. S. (2013). How many names are enough? Identifying network effects

    with the least set of listed contacts. *Social Networks*, *35*(3), 331–337.

    doi:10.1016/j.socnet.2013.03.004

Meshi, D., Mamerow, L., Kirilina, E., Morawetz, C., Margulies, D. S., & Heekeren, H. R.

    (2016). Sharing self-related information is associated with intrinsic functional connectivity

    of cortical midline brain regions. *Scientific Reports*, *6*. doi:10.1038/srep22491

Meshi, D., Morawetz, C., & Heekeren, H. R. (2013). Nucleus accumbens response to gains in

    reputation for the self relative to gains for others predicts social media use. *Frontiers in*

    Human Neuroscience, *7*, 439. doi:10.3389/fnhum.2013.00439

Miritello, G. (2013). *Temporal patterns of communication in social networks*. New York:

    Springer. doi:10.1007/978-3-319-00110-4

Miritello, G., Moro, E., Lara, R., Mart??nez-L??pez, R., Belchamber, J., Roberts, S. G. B., &

    Dunbar, R. I. M. (2013). Time as a limited resource: Communication strategy in mobile

    phone networks. *Social Networks*, *35*(1), 89–95. doi:10.1016/j.socnet.2013.01.003

Moieni, M., Irwin, M. R., Jevtic, I., Breen, E. C., Cho, H. J., Arevalo, J. M. G., … Eisenberger,

    N. I. (2015). Trait sensitivity to social disconnection enhances pro-inflammatory responses

    to a randomized controlled trial of endotoxin. *Psychoneuroendocrinology*, *62*, 336–342.

doi:10.1016/j.psyneuen.2015.08.020

Molesworth, T., Sheu, L., Cohen, S., Gianaros, P., & Verstynen, T. (2014). Social network

diversity predicts white matter microstructural integrity in humans. *Psychosomatic*

Medicine, *76*(3), A–9. doi:10.1093/scan/nsv001

Monge, P. R., & Contractor, N. S. (2003). *Theories of communication networks*. Oxford

University Press.

Noelle-Neumann, E. (1977). Turbulences in the climate of opinion: Methodological applications

of the spiral of silence theory. *Public Opinion Quarterly*, *41*(2), 143–158.

Noelle-Neumann, E. (1974). The spiral of silence: A theory of public opinion. *Journal of*

Communication, *24*(2), 43–51.

Norona, J. C., Salvatore, J. F., Welsh, D. P., & Darling, N. (2014). Rejection sensitivity and

adolescents' perceptions of romantic interactions. *Journal of Adolescence*, *37*(8), 1257–

1267. doi:10.1016/j.adolescence.2014.09.003

O'Connor, K., & Gladstone, E. (2015). How social exclusion distorts social network perceptions.

Social Networks, *40*, 123–128. doi:10.1016/j.socnet.2014.09.002

O'Donnell, M. B., & Falk, E. B. (2015). Big Data under the microscope and bains in social

context: Integrating methods from computational social science and neuroscience. *The*

ANNALS of the American Academy of Political and Social Science, *Advance on*.

doi:10.1177/0002716215569446

Oh, H., & Kilduff, M. (2008). The ripple effect of personality on social structure: Self-

monitoring origins of network brokerage. *The Journal of Applied Psychology*, *93*(5), 1155–

1164. doi:10.1037/0021-9010.93.5.1155

Oishi, S., & Graham, J. (2010). Social ecology: Lost and found in psychological science.

Perspectives on Psychological Science, *5*, 356–377. doi:10.1177/1745691610374588

Orehek, E., & Forest, A. L. (2016). When people serve as means to goals: Implications of a motivational account of close relationships. *Current Directions in Psychological Science*, *25*(2), 79–84. doi:10.1177/0963721415623536

Oswald, D. L., Clark, E. M., & Kelly, C. M. (2004). Friendship maintenance: An analysis of individual and dyad behaviors. *Journal of Social and Clinical Psychology*, *23*(3), 413–441. doi:10.1521/jscp.23.3.413.35460

Parks, M. R. (2011). Social networks and the life of relationships. In M. L. Knapp & J. A. Daly (Eds.), *The SAGE Handbook of Interpersonal Communication* (4th ed., pp. 355–388). Los Angeles: Sage.

Poldrack, R. A. (2006). Can cognitive processes be inferred from neuroimaging data? *Trends in Cognitive Sciences*, *10*(2), 59–63.

Pollet, T. V., Roberts, S. G. B., & Dunbar, R. I. M. (2011). Extraverts have larger social network layers. *Journal of Individual Differences*, *32*(3), 161–169. doi:10.1027/1614-0001/a000048

Prizant-Passal, S., Shechner, T., & Aderka, I. M. (2016). Social anxiety and internet use – A meta-analysis: What do we know? What are we missing? *Computers in Human Behavior*, *62*, 221–229. doi:10.1016/j.chb.2016.04.003

Przybylski, A. K., Murayama, K., Dehaan, C. R., & Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computers in Human Behavior*, *29*(4), 1841–1848. doi:10.1016/j.chb.2013.02.014

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality*, *41*(1), 203–212. doi:10.1016/j.jrp.2006.02.001

Ramsey, M. A., & Gentzler, A. L. (2015). An upward spiral: Bidirectional associations between positive affect and positive aspects of close relationships across the life span. *Developmental Review*, *36*, 58–104. doi:10.1016/j.dr.2015.01.003

Reich, S. M., Subrahmanyam, K., & Espinoza, G. (2012). Friending, IMing, and hanging out face-to-face: Overlap in adolescents' online and offline social networks. *Dev Psychol*, *48*(2), 356–368. doi:10.1037/a0026980

Rime, B. (2009). Emotion Elicits the Social Sharing of Emotion: Theory and Empirical Review. *Emotion Review*, *1*(1), 60–85.

Roberts, S., & Dunbar, R. (2011). Communication in social networks: Effects of kinship, network size, and emotional closeness. *Personal Relationships*, *18*, 439–452. doi:10.1111/j.1475-6811.2010.01310.x

Roberts, S., Wilson, R., Fedurek, P., & Dunbar, R. I. M. (2008). Individual differences and personal social network size and structure. *Personality and Individual Differences*, *44*(4), 954–964. doi:10.1016/j.paid.2007.10.033

Robins, G., & Kashima, Y. (2008). Social psychology and social networks: Individuals and social systems. *Asian Journal of Social Psychology*, *11*(1), 1–12. doi:10.1111/j.1467-839X.2007.00240.x

Romero-Canyas, R., & Downey, G. (2012). What I see when I think it's about me: People low in rejection-sensitivity downplay cues of rejection in self-relevant interpersonal situations. *Emotion*, *13*(1), 104–117. doi:10.1037/a0029786

Romero-Canyas, R., Downey, G., Reddy, K. S., Rodriguez, S., Cavanaugh, T. J., & Pelayo, R. (2010). Paying to belong: When does rejection trigger ingratiation? *Journal of Personality and Social Psychology*, *99*(5), 802–823. doi:10.1037/a0020013

Rozzell, B., Piercy, C. W., Carr, C. T., King, S., Lane, B. L., Tornes, M., … Wright, K. B.

(2014). Notification pending: Online social support from close and nonclose relational ties

via Facebook. *Computers in Human Behavior*, *38*, 272–280. doi:10.1016/j.chb.2014.06.006

Sandstrom, G. M., & Dunn, E. W. (2014). Social interactions and well-being: The surprising

power of weak ties. *Personality & Social Psychology Bulletin*, *40*(7), 910–922.

doi:10.1177/0146167214529799

Saramäki, J., Leicht, E. A., López, E., Roberts, S. G. B., Reed-Tsochas, F., & Dunbar, R. I. M.

(2014). Persistence of social signatures in human communication. *PNAS*, *111*(3), 942–7.

doi:10.1073/pnas.1308540110

Scannell, P. (2007). *Media and Communication*. London: Sage.

Schrock, A. R. (2015). Communicative affordances of mobile media: Portability, availability,

locatability, and multimediality. *International Journal of Communication*, *Advance on*.

Schroeder, R., & Ling, R. (2014). Durkheim and Weber on the social implications of new

information and communication technologies. *New Media & Society*, *16*(5), 789–805–.

doi:10.1177/1461444813495157

Sebastian, C., Viding, E., Williams, K. D., & Blakemore, S. (2010). Social brain development

and the affective consequences of ostracism in adolescence. *Brain and Cognition*, *72*(1),

134–145. doi:10.1016/j.bandc.2009.06.008

Shea, C. T., Menon, T., Smith, E. B., & Emich, K. (2015). The affective antecedents of cognitive

social network activation. *Social Networks*, *43*, 91–99. doi:10.1016/j.socnet.2015.01.003

Simons-Morton, B. G., Bingham, C. R., Falk, E. B., Kaigang, L., Pradhan, A. K., Ouimet, M. C.,

… Shope, J. T. (2014). Experimental effects of injunctive norms on simulated risky driving

among teenage males. *Health Psychology*, *33*, 616–627.

Simpson, B., Markovsky, B., & Steketee, M. (2011). Power and the perception of social networks. *Social Networks*, *33*(2), 166–171. doi:10.1016/j.socnet.2010.10.007

Small, M. L. (2013). Weak ties and the core discussion network: Why people regularly discuss important matters with unimportant alters. *Social Networks*, *35*(3), 470–483. doi:10.1016/j.socnet.2013.05.004

Small, M. L., Deeds Pamphile, V., & McMahan, P. (2015). How stable is the core discussion network? *Social Networks*, *40*, 90–102. doi:10.1016/j.socnet.2014.09.001

Smith, A. (2004). R u there? Ostracism by cell phone text messages. *Group Dynamics: Theory, Research, and Practice*, *8*(4), 291–301. doi:10.1037/1089-2699.8.4.291

Smith, K. P., & Christakis, N. a. (2008). Social networks and health. *Annual Review of Sociology*, *34*(1), 405–429. doi:10.1146/annurev.soc.34.040507.134601

Staiano, J., Pianesi, F., Lepri, B., & Pentland, A. (2012). Friends don't lie - inferring personality traits from social network structure. In *UbiComp* (pp. 321–330). Pittsburgh, USA: ACM. doi:10.1145/2370216.2370266

Steinfield, C., Ellison, N., Lampe, C., & Vitak, J. (2012). Online social network sites and the concept of social capital. In D. Lee, F. L., Leung, L., Qiu, J. S., and Chu (Ed.), *Frontiers in New Media Research* (pp. 115–131). New York: Routledge.

Stiller, J., & Dunbar, R. (2007). Perspective-taking and memory capacity predict social network size. *Social Networks*, *29*(1), 93–104. doi:citeulike-article-id:4155538

Sutcliffe, A., Dunbar, R., Binder, J., & Arrow, H. (2012). Relationships and the social brain: Integrating psychological and evolutionary perspectives. *British Journal of Psycholgy*, *103*, 149–168.

Tamir, D. I., & Mitchell, J. P. (2012). Disclosing information about the self is intrinsically

rewarding. *Pnas*, *109*(21), 8038–8043. doi:10.1073/pnas.1202129109

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good

adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*,

72(2), 271–324.

Tasselli, S., Kilduff, M., & Menges, J. I. (2015). The microfoundations of organizational social

networks: A review and an agenda for future research. *Journal of Management*, *41*(5),

1361–1387. doi:10.1177/0149206315573996

Toma, C. L., & Hancock, J. T. (2013). Self-affirmation underlies Facebook use. *Personality and

Social Psychology Bulletin*, *39*(3), 321–31. doi:10.1177/0146167212474694

Totterdell, P., Holman, D., & Hukin, A. (2008). Social networkers: Measuring and examining

individual differences in propensity to connect with others. *Social Networks*, *30*(4), 283–

296. doi:10.1016/j.socnet.2008.04.003

Tov, W., Nai, Z. L., & Lee, H. W. (2016). Extraversion and agreeableness: Divergent routes to

daily satisfaction with social relationships. *Journal of Personality*, *84*(1), 121–134.

doi:10.1111/jopy.12146

van Beest, I., & Williams, K. D. (2006). When inclusion costs and ostracism pays, ostracism still

hurts. *Journal of Personality and Social Psychology*, *91*(5), 918–928.

Vanhalst, J., & Leary, M. (2014). Sociotropic differentiation: Differential anticipatory reactions

to rejection by close versus distal others predict well-being. *Personality and Individual

Differences*, *68*, 176–182. doi:10.1016/j.paid.2014.04.004

Vittengl, J. R., & Holt, C. S. (1998). A time-series diary study of mood and social interaction.

Motivation and Emotion, *22*(3), 255–275.

Walker, M. H. (2015). The contingent value of embeddedness: Self-affirming social

environments, network density, and well-being. *Society and Mental Health*, *Advance on*. doi:10.1177/2156869315574601

Wang, J. M., Hartl, A. C., Laursen, B., & Rubin, K. H. (2016). The high costs of low agreeableness: Low agreeableness exacerbates interpersonal consequences of rejection sensitivity in U.S. and Chinese adolescents. *Journal of Research in Personality*, *Advance on*. doi:10.1016/j.jrp.2016.02.005

Way, B. M., Taylor, S. E., & Eisenberger, N. I. (2009). Variation in the u-opioid receptor gene (OPRM1) is associated with dispostional and neural sensitivity to social rejection. *PNAS*, *106*(35), 15079–15084.

Welles, B. F., & Contractor, N. (2015). Individual motivations and network effects: A multilevel analysis of the structure of online social relationships. *The ANNALS of the American Academy of Political and Social Science*, *659*(1), 180–190. doi:10.1177/0002716214565755

Wellman, B. (2001). Computer networks as social networks. *Science*, *293*(5537), 2031–2034. doi:10.1126/science.1065547

Wellman, B., & Wortley, S. (1990). Different strokes from different folks: Community ties and social support. *American Journal of Sociology*, *96*, 558–588.

Wiese, J., Kelley, P. G., Cranor, L. F., Dabbish, L., Hong, J. I., & Zimmerman, J. (2011). Are you close with me? Are you nearby? Investigating social groups, closeness, and willingness to share. In *UbiComp*. Beijing, China: ACM.

Williams, K. D., Cheung, C. K., & Choi, W. (2000). Cyberostracism: Effects of being ignored over the Internet. *Journal of Personality and Social Psychology*, *79*(5), 748–762.

Williams, K. D., & Jarvis, B. (2006). Cyberball: A program for use in research on interpersonal ostracism and acceptance. *Behavior Research Methods*, *38*(1), 174–180.

doi:10.3758/BF03192765

Williams, K. D., & Nida, S. A. (2011). Ostracism: Consequences and coping. *Current Directions in Psychological Science*, *20*(2), 71–75. doi:10.1177/0963721411402480

Wilson, R. E., Harris, K., & Vazire, S. (2015). Personality and friendship satisfaction in daily life: Do everyday social interactions account for individual differences in friendship satisfaction? *European Journal of Personality*, *29*(2), 173–186. doi:10.1002/per.1996

Wolf, W., Levordashka, A., Ruff, J. R., Kraaijeveld, S., Lueckmann, J.-M., & Williams, K. D. (2014). Ostracism online: A social media ostracism paradigm. *Behavior Research Methods*, *Advance on*. doi:10.3758/s13428-014-0475-x

Woo, C.-W., Koban, L., Kross, E., Lindquist, M. a., Banich, M. T., Ruzic, L., … Wager, T. D. (2014). Separate neural representations for physical pain and social rejection. *Nature Communications*, *5*, 5380. doi:10.1038/ncomms6380

Wright, K., & Miller, C. H. (2010). A measure of weak-tie/strong-tie support network preference. *Communication Monographs*, *77*(4), 500–517. doi:10.1080/03637751.2010.502538

Wright, K., & Rains, S. (2013). Weak-tie support network preference, health-related stigma, and health outcomes in computer-mediated support groups. *Journal of Applied Communication Research*, *41*(3), 309–324. doi:10.1080/00909882.2013.792435

Wright, K., Rains, S., & Banas, J. (2010). Weak-tie support network preference and perceived life stress among participants in health-related, computer-mediated support groups. *Journal of Computer-Mediated Communication*, *15*(4), 606–624. doi:10.1111/j.1083-6101.2009.01505.x

Wrzus, C., & Mehl, M. R. (2015). Lab and/or field? Measuring personality processes and their

social consequences. *European Journal of Personality*, *29*(2), 250–271.

doi:10.1002/per.1986

Zerubavel, N., Bearman, P. S., Weber, J., & Ochsner, K. N. (2015). Neural mechanisms tracking

popularity in real-world social networks. *PNAS, 112*, 15072–15077.

doi:10.1073/pnas.1511477112