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Co-rumination In Social Networks

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Abstract

Although co-rumination is associated with positive relationship perceptions, individuals that engage in this behaviour often report fewer friends and peer difficulties. Those with a tendency to co-ruminate also report elevated levels of internalizing symptoms. Thus, the tendency to co-ruminate may put individuals at risk of depressive and anxious symptoms as well as social problems as they make the challenging transition to university and build new social networks. I analyzed social network data from 458 first year undergraduate students during their first university semester. Co-rumination within a particular relationship was associated with greater tie strength and socio-emotional multiplexity. Co-rumination was positively associated with depressive and anxious symptoms. Contrary to predictions, individuals with a tendency to co-ruminate did not differ from their peers in terms of network size and density. Results suggest that the negative impacts of co-rumination on social well-being may develop over time, rather than being apparent in the early stages of network building.

Keywords

Co-rumination, social networks, relationship quality, gender differences

Summary for Lay Audience

Excessive venting about personal problems and negative feelings, known as “co-rumination”, is linked to mental health difficulties such as increased depressive and anxious symptoms. While this behaviour may create a uniquely strong bond between two people, it may also put individuals at risk for other social difficulties such as peer rejection and having fewer friends overall. Given its association with social and mental health challenges, it is important to understand how co-rumination may impact an individual’s ability to form friendships and support networks during life transitions. Entering university may be a particularly stressful life transition during which individuals are balancing a new academic course load while entering a new social climate. Thus, I explored how an individual’s tendency to co-ruminate influenced their social relationships and mental health symptoms during the first semester of their undergraduate studies. I surveyed 458 first year undergraduate students about their tendency to co-ruminate, their mental health (i.e., depressive and anxious symptoms) symptoms and their social relationships (i.e., friendships, acquaintances, and romantic/sexual partners). Individuals with a tendency to co-ruminate showed higher levels of depressive and anxious symptoms compared to their peers. Moreover, relationships, where co-rumination occurred, were shown to be particularly close, high quality and satisfactory while also fulfilling a variety of social and emotional support roles (e.g., engaging in social activities together, helping with studying, etc.). Individuals with a tendency to co-ruminate did not differ from their peers regarding the number of social connections or relationships in their network. These findings suggest that the social difficulties associated with co-rumination may occur slowly over time. Additionally, the frequency of network building activities during the beginning of one’s undergraduate studies may be a protective factor in the association between co-rumination and social difficulties.

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Chapter 1

1 Introduction

1.1 Co-rumination: An Overview

Co-rumination is a form of self-disclosure that occurs within conversations and involves frequent, repetitive, and speculative discussions of personal problems and negative feelings (Rose, 2002). Co-rumination is conceptualized as a social form of rumination which refers to an individual's passive focus on their distress including thoughts about the causes and consequences of those feelings (Nolen-Hoeksema, 1991). During co-rumination individuals engage in behaviors that focus on their distress such as speculating about personal problems or rehashing negative events with an active social partner. Typically, co-rumination occurs and is examined in the context of close dyadic relationships, as this construct was originally proposed as a relationship process between same-sex friends (Rose, 2002). Since the concept of co-rumination was first introduced, the study of co-rumination has expanded to a diverse array of relationships. Evidence now shows that across many types of relationships, co-rumination is associated with both adaptive and maladaptive socio-emotional outcomes (e.g., Calmes & Roberts, 2008; Haggard et al., 2010; Rose & Waller, 2013).

Co-rumination can be assessed in terms of an individual's tendency to co-ruminate with a same-sex close friend or within a typical relationship of interest (Rose, 2007; Calmes & Roberts 2008). Some evidence suggests that co-rumination increases as children enter adolescence and continues to increase until about middle adolescence (Felton et al., 2019; Rose, 2002; 2007). Across all age groups, females tend to report more co-rumination than males within same-sex friendships (e.g., Balsamo et al., 2015; Rose et al., 2007; Tompkins et al., 2011), however, these sex differences do not appear to carry over to other types of relationships, e.g., parent-child, sibling, roommate, or romantic relationships (Ames-Sikora et al., 2017; Barstead et al., 2013; Calmes & Roberts, 2008). Thus, both males and females appear to co-ruminate in close relationships, however, females are more likely to make it a focus in same-sex friendships. In accord, women

tend to select same-sex friends as their co-ruminative partner whereas men tend to co-ruminate more with cross-sex friends (Barstead et al., 2013). Interestingly both the gender of the individual and the nature of the relationship which they co-ruminate in can have an impact on the outcomes associated with this behavior.

1.2 Co-rumination and Internalizing Symptoms

Given that the ruminative aspect of co-rumination has been likened to depressive rumination and it may therefore be associated with depressive and other internalizing symptoms (Rose, 2002). In line with this idea, longitudinal evidence suggests that co-rumination at earlier time points predicts future rumination (Felton et al., 2019). Evidence suggests that rumination exacerbates an individual's distress and contributes to difficulties with problem solving, mood and increases in anxious and depressive symptoms (Nolen-Hoeksema et al., 2008). Given the link between rumination and co-rumination, engaging in co-rumination about a problem within a friendship may exacerbate an individual's distress over the problem, leading to increases in both depressive and anxious symptoms. In accord, evidence suggests that higher levels of co-rumination are positively associated with depressive and anxious symptoms within same-sex friendships (Rose, 2002; Carlucci et al., 2018). Subsequent research has replicated this finding in same-sex friendships and extended it to roommates, siblings, parent-child, and romantic relationships (Ames-Sikora et al., 2017; Calmes & Roberts, 2008; Guassi et al., 2015). These results suggest that like rumination, co-rumination may indeed serve a similar stimulating function for individual-level depressive and anxiety-related cognitions and may help to account for gender differences in these symptoms.

An early study within the co-rumination literature found that depressive and anxious symptoms associated with co-rumination appeared only in female participants (Rose et al., 2007). Further research has indicated that co-rumination may mediate the association between gender and internalizing symptoms such that females tend to report more internalizing symptoms than males, possibly due to their higher co-rumination tendencies (Calmes & Roberts 2008; Tompkins et al., 2011). Thus, females with a tendency to co-ruminate may be particularly at risk for the development of internalizing symptoms.

At the level of the dyad, co-rumination has also been found to mediate the contagion of anxiety and depression between dyad members (Schwartz-Mette & Rose, 2012). That is, individual-level depressive and anxious symptoms may predict co-rumination within a dyad, creating a cycle between co-rumination and further internalizing symptoms for both dyad members (Rose et al., 2007). Nonetheless, despite robust evidence that co-rumination predicts symptoms of anxiety and depression, people continue to co-ruminate. One reason why they may continue to do so is the perceived positive effects it has on individual relationships.

1.3 Co-rumination in Relationships

Mutual positive perceptions of relationship quality have been associated with co-rumination and thereby play a role in reinforcing the behavior, despite its negative effects (Rose, 2002). For example, individuals who have a higher tendency to co-ruminate in same-sex friendships report greater feelings of closeness and positive friendship quality compared to those with a lower tendency to co-ruminate in these relationships (Rose 2002; 2007). Moreover, these positive perceptions of friendship quality appear to be mutual within the dyad (Rose 2002).

Within same-sex friendships, co-rumination is associated with a secure attachment style and greater levels of communication within the relationship (Starr & Davila, 2009), although this benefit may be stronger for men's same-sex friendships than for women's (Rose et al., 2002; 2007). Interestingly, co-rumination also mediates the associations between gender and positive friendship quality, indicating that co-rumination is partially responsible for females' tendency to report higher perceptions of friendship quality compared to men (Calmes & Roberts, 2008; Felton et al., 2019). Thus, while the effect of co-rumination on positive friendship quality may be stronger in males, it nonetheless plays a critical role in the positive friendship quality reported by females.

Outside the context of same-sex friendships, co-rumination has also been found to be associated with positive relationship quality and satisfaction within roommate and romantic relationships (Calmes & Roberts, 2008). Moreover, individuals who report moderate-to-high co-rumination within a specific relationship (e.g., significant other,

same-sex friend) indicate feeling supported by their co-ruminative partners (Ames-Sikora et al., 2017). However, individuals with a tendency to co-ruminate may lack opportunities for support outside of this relationship due to an association between co-rumination and peer dysfunction (Tompkins et al., 2011). Over time, co-rumination predicts fewer friends, as well as reduced self-perceived social competence (Starr & Davila, 2009; Tompkins et al., 2011). In addition, individuals who tend to co-ruminate are observed to be less socially accepted, and females with a higher tendency to co-ruminate report greater peer stress (Rose et al., 2017; Tompkins et al., 2011).

Peer communication may also play a role in the internalizing symptoms associated with co-rumination. Specifically, one study found that the association between co-rumination and depressive symptoms was only significant when communication with peers was low (Dam et al., 2014). Thus, it appears that co-rumination may lead to a trade-off between close, positive relationships and interpersonal problems outside of these relationships, which may contribute to internalizing symptoms. That is, individuals who tend to co-ruminate, have fewer friends (Tompkins et al., 2011), and females with this disposition report greater peer difficulty (Rose et al., 2017). One explanation may be that individuals who co-ruminate may prioritize a few close co-ruminative relationships over the maintenance of other friendships and friendship initiation.

Interestingly, co-rumination tends to occur at similar levels within both members of a friendship dyad (Schwartz-Mette & Rose, 2012). That is, individuals who self-identify as "co-ruminators" may tend to befriend other co-ruminators. Furthermore, within co-ruminative conversations, both an individual's and their partner's personal problems and negative feelings seem to be equally discussed (Calmes & Roberts, 2008). Thus, it appears that co-ruminative tendencies may be a mutually occurring friendship selection factor. Given that the association between co-rumination and friendship quality is bidirectional (Felton et al., 2019), it is likely that the equitable discussion of personal problems leads both partners to perceive the relationship as highly satisfying and particularly close, thereby reinforcing the act of co-rumination within the relationship, to the exclusion of external relationships. One outcome of this process may be that co-ruminators have smaller and more sparsely populated social networks.

1.4 Social Networks

Social networks include all the relationships within an individual's life or within a particular environment (Tabassum et al., 2018). Having a larger social network is associated with higher levels of subjective well-being (Zhang et al., 2019). Conversely, having fewer social relationships and/or being socially isolated is associated with depressive and anxious symptoms (Domènech-Abella et al., 2019; Wildes et al., 2002). Thus, there is a potential interaction between co-rumination, smaller network size, and internalizing symptoms.

Networks that are bound to specific environments or contexts such as a classroom cohort, or organization are referred to as sociocentric networks (Chung et al., 2005; Tabassum et al., 2018). To examine a bounded network, researchers analyze all individuals within a specific environmental or contextual boundary, as well as the connections between them (Hawe et al., 2004). Within organizations, sociocentric network analyses can highlight, for example, areas where network characteristics may lead to increased productivity (Reagans & Zuckerman, 2001).

Alternatively, egocentric networks are those involving a single individual and their relationships with friends, relatives, colleagues, etc. (Chung et al., 2005; Tabassum et al., 2018). Within an egocentric network, an individual is the "ego," and the people with whom they have relationships are the "alters" (Chung et al., 2005). An egocentric network can be graphically characterized as a central node representing the ego, surrounded by alter nodes. The connections or relationships between individuals, graphically represented by lines, are known as "ties" (Tabassum et al., 2018). Social network analysis allows researchers to gather information about the broad characteristics of social networks, and the quality and quantity of ties within them.

Researchers compare differences in social network sizes by examining the number of alters within those networks. They compare network density based on the proportion of ties in a network relative to the total possible ties within that network (Tabassum et al., 2018). For example, a network where all alters are connected to each other is considered highly dense. Ties within a social network can be assessed in several ways and provide a

nuanced understanding of the relationships between an ego and their alters. Tie strength is most often defined as a combination of time, emotional intensity, intimacy, and reciprocity within a relationship (Granovetter, 1973). Several measurements of tie strength have been used over the years such as closeness, frequency/amount of time spent together, and relationship "multiplexity" (Marsden & Campbell, 1984). Multiplexity can refer to the number of socio-emotional roles an alter, such as a parent, friend, or colleague, fulfills (e.g., Gillath et al., 2017; Verbrugge, 1979).

Mappings of alters and ties within egocentric networks are typically used to examine associations between an individual's traits, such as characteristics, behaviors, and attitudes, and the social effects of those traits. For example, large, dense networks and strong social ties are associated with positive outcomes such as greater life satisfaction and subjective well-being (Zhang et al., 2019; Zou et al., 2015). However, in an environment where sparse networks are the norm, having or striving for a high-density network may have negative outcomes such as a limited access to resources or feelings of isolation (Kane et al., 2011). Taken together, this research indicates that network density may be associated with positive or negative outcomes, depending on the broader social context. Additionally, the presence of strong ties indicates close relationships, which may provide individuals with greater opportunities to receive social support. Because characteristics such as network size, density, and tie strength are associated with both positive and negative outcomes, it is important to understand how individuals form social networks, whether the presence of a co-ruminative interpersonal style predicts network management behaviors, and whether differences in network size or density are associated with more positive or more negative outcomes for individuals.

Most people actively manage and maintain their social networks. Network management behaviors include the initiation, maintenance, and dissolution of network ties (Gillath et al., 2017), measured in terms of people's tendencies to engage in these behaviors. An individual's tendency to initiate, maintain and dissolve ties may be influenced by individual factors such as gender (Bleske-Rechek & Buss, 2001), attachment (Gillath et al., 2011), or personality (Shipilov et al., 2014). Network management behaviors affect network characteristics such as network size, tie strength, and multiplexity (Gillath et al.,

2017). Individuals who initiate many relationships may have larger networks with lower density while those who cultivate closer friendship groups may have smaller, denser networks. Thus, network management skills may play an important role in understanding how co-ruminators build their networks and how those networks relate to social outcomes. Understanding the effects of co-rumination on social networks and network management may be particularly pertinent during the transition to college or university, when people typically leave their old social environment and enter a new one.

1.5 Transition to University

Many students entering their first year of university are either older adolescents or young adults and are thus entering the early or emerging stages of adulthood. During emerging adulthood (late adolescence to mid-twenties), individuals experience a variety of challenges relating to the determination of one's identity in new social, work/academic and community contexts (Arnett, 2007). The first year of university may be particularly stressful for many young adults because they must manage the demands of a rigorous academic program while transitioning to independent living. Indeed, both men and women report increases in internalizing symptoms and stress during the first year in university, along with decreases in perceived support (Conley et al., 2018). Co-rumination tendencies may critically affect the degree to which young adults successfully navigate this transition, as co-rumination has been shown to play a role in stress generation (Hankin et al., 2010), internalizing symptoms (e.g., Carlucci et al., 2018; Felton et al., 2019; Rose, 2002), and social relationships (Starr & Davila, 2009; Tompkins et al., 2011). This volatile life-stage may therefore, place individuals entering their first year of college or university at an increased risk for co-rumination and its negative consequences. Thus, it is important to examine how the presence of co-rumination affects this life-transition.

1.6 Current Study

The current study examines how co-ruminative tendencies relate to an individual's relationships within their social network via social network analysis. Previous research indicates that although individuals who co-ruminate have close relationships in which

they co-ruminate (Felton et al., 2019), they have fewer friends overall (Tompkins et al., 2011). While there is extensive research on the impact of co-rumination at the dyadic level, few researchers have sought to examine how co-rumination impacts an individual's overall network structure. This is the first study to examine associations between co-rumination and social factors through social network analysis. Additionally, I examined how co-rumination relates to network management behavior, including the tendency to initiate, maintain, and dissolve relationships. The results of this study provide insight into the potential mechanisms that may cause both the adaptive and maladaptive outcomes associated with co-rumination.

Here, I used egocentric social network analysis to determine how co-ruminative tendencies relate to various social network characteristics. Specifically, I examined both the size and density of an individual's network in relation to their tendency to co-ruminate. I also examined how co-ruminative tendencies associate with internalizing symptoms and network management behaviors. I proposed the following preregistered hypotheses:

I. Because co-rumination is associated with mutual and enhanced perceptions of relationship quality (Rose, 2002), I anticipated that greater levels of co-rumination within a particular relationship would be associated with greater tie strength (i.e., a composite of self-reported relationship closeness, relationship quality and satisfaction with that quality; Hypothesis IA) and socio-emotional multiplexity (Hypothesis IB).

II. In line with the evidence that co-rumination is associated with fewer friends (Tompkins et al., 2011), I expected that a greater tendency to co-ruminate in general (across relationships) would be associated with smaller network size and lower network density. The association between co-rumination and network size would at least be partially mediated by a unique pattern of network management behaviors (i.e., a greater self-reported tendency to prioritize the maintenance of close ties, a greater self-reported tendency to dissolve ties, and a lower self-reported tendency to initiate new ties).

III. Both co-rumination and smaller network size are positively associated with internalizing symptoms (Domènech-Abella et al., 2019; Schwartz-Mette & Rose,

2012; Wildes et al., 2002). I therefore predicted that a greater tendency to co-ruminate in general would be associated with greater levels of depressive symptoms. This association between co-rumination and depressive symptoms would be at least partially mediated by network size.

Chapter 2

2 Methods

2.1 Participants

Participants were undergraduate students participating in a large-enrolment (~3000 students) introductory psychology course at Western University in Ontario, Canada. They completed the study in exchange for partial course credit. Western University is a large institution with ~25,000 undergraduate students (Western University, 2019-2020). In the current sample, 88.9% of participants reported having moved away from home to attend university. Thus, most participants in the sample were experiencing the transition to independent living and university studies simultaneously. Data were collected during the first semester of students' first year of university (between 29 September 2021 and 22 November 2021), as I was interested in social network development as individuals enter this new life stage (i.e., emerging adulthood and the beginning of post-secondary education). To maximize the likelihood that study participants were making their initial transition to university, I only analyzed data from participants that were enrolled in year one of their undergraduate programs at the time of the study and aged 17 to 22 years. While many studies examining emerging adults have focussed on individuals aged 18 and above, I included 17 year-olds in the study, as many students (14% of the final sample) entering university in Canada begin the year aged 17 and turn 18 before the end of first semester. Importantly, analyses showed few meaningful differences between 17 year-olds and those 18 and older in the sample (see Appendix E; Table 3). I therefore included the 17 year-olds in my analyses.

Consistent with literature assessing personal factors on social network characteristics, this study aimed to have a sample of 500 participants, before exclusions. To determine sample size, I used a Monte Carlo power analysis toolkit for indirect effects (Schoemann et al., 2017). I used a single mediator model for the power analysis, which aligns with my hypothesis (HIII) assessing co-rumination, network size and depressive symptoms. I set the confidence level at 95% and the target power at 90%. Associations between co-rumination and depressive symptoms (Spendelow et al., 2017), co-rumination and

number of friends (Tompkins et al., 2011), as well as network size and depression (Santini et al., 2015), have small-to-moderate effect sizes. Thus, I set correlation values at 0.2 for all paths. I used the following standard deviations for the variables: $SD_{co\text{-}rumination}$=0.73 (White & Shih, 2012), $SD_{depression}$=8.16 (Rose et al., 2017) and $SD_{networksize}$=3.94 (Gillath et al., 2017). This analysis suggested that 378 participants would provide a statistical power of 0.90. To ensure that I achieved this sample with exclusions, I oversampled and stopped data collection once I obtained 549 participants.

I excluded 62 participants that were either outside of the desired age bracket (17 to 22 years old), were not in their first year of university or failed to participate in the network interview. Of the remaining 487 participants who completed the survey, I excluded 5 participants who failed 2 or more of the 4 attention check items built into the online survey, as well as those with invariant responses on the co-rumination questionnaire (defined as answering the same response for the entire survey; 1 participant) and those who had more than 20% missing responses on the survey (3 participants). Individuals who failed to complete the Network Interview and/or those that failed to provide information on key variables of interest were also excluded (2 participants), as well as those that had network sizes outside of the instructed maximum of 35 (8 participants). Finally, I excluded statistical outliers, i.e., those with scores on either the Co-rumination Questionnaire (CRQ; Rose, 2002), Network Management Inventory Short-Form (NMI-SF; Gillath et al., 2008) or the Hospital Anxiety-Depression Scale (HADS; Zigmond & Snaith, 1983) that were three or more standard deviations above or below the mean (14 participants; included in the raw data file on the study's OSF page). All materials, measures and confirmatory analysis scripts were uploaded to a preregistration document on the OSF page. De-identified raw data have also been uploaded onto the study's OSF page. To de-identify raw data, I used random and anonymous participant IDs for each individual and their alters.

After data quality and outlier exclusions listed above, the final sample consisted of 458 (335 women) first year students aged 17 to 20 years old (M = 17.94, SD = 0.49). Most individuals were heterosexual (n = 398) and cisgender (n = 451). Any participant who identified as either a man or woman regardless of being cisgender or transgender were

included in the subsamples of men and women used for gender analyses. Within the sample, about 83% of individuals identified as either white (n = 184) or Asian (n = 196) while the other 17% of the sample identified as one of the following ethnicities: Black, Latinx, Arab, Indigenous, mixed ethnic/racial background or preferred not to specify. Further information regarding the sample demographics can be found in Table 1.

2.2 Measures

2.2.1 Demographics

At the beginning of the study, participants answered several demographic questions assessing the following variables: age, gender identity, race/ethnicity/cultural identity, year of study, whether they moved away from home for university and sexual/gender orientation.

2.2.2 Co-rumination Questionnaire (CRQ)

The Co-rumination Questionnaire (Rose, 2002) includes 27 statements assessing the discussion of personal problems and negative feelings between an individual and a close same-sex friend. For this study, the term “same-sex friends” from the original questionnaire was replaced with “confidant(s)” to account for the fact that participants may co-ruminate with friends, acquaintances, or romantic/sexual partners (e.g., “We spend most of our time together talking about problems that my confidant(s) or I have.”). Participants rated statements on the questionnaire using a 5-point Likert scale ranging from “not true at all” (1) to “really true” (5). The CRQ had excellent internal consistency (α = .91).

2.2.3 Network Survey

After completing the demographic and co-rumination questionnaires, participants were directed to the Network Canvas Interviewer, which collects social network data. The Network Canvas Interviewer is part of the freely available Network Canvas Software Suite (Complex Data Collective. Network Canvas: Software to Simplify Complex

Table 1.

Demographic characteristics of final sample

	n	%
Gender Identity		
Woman	335	73.14
Man	117[a]	25.32
Non-binary	1	0.22
Genderqueer	1	0.22
Other gender identity	1	0.22
Prefer not to say	3	0.66
Sexual Orientation		
Heterosexual	398	86.90
Gay/Lesbian	8	1.75
Bisexual	41	8.95
Other orientation	4	0.87
Prefer not to say	7	1.53
Ethnicity		
White	184	40.17
Asian	196	42.79
Black	8	1.75
Latin American	4	0.87
Arab	19	4.15
Indigenous	0	0
Mixed ethnic/racial background	41	8.95
Another ethnicity not specified	6	1.31
Did you move away from home to attend university/college?[b]		
Yes	406	88.84
No	51	11.16

[a] This sample includes both cisgender (n = 116) and transgender (n = 1) men. All women identified as cisgender

[b] One *participant chose not to answer*

Network Data Collection. 7 2016. https://networkcanvas.com). Participants completed the network survey with the help of video-based instructions/examples at key interview stages. A trained interviewer was available to answer questions throughout the process. The interview included the following components.

2.2.3.1 Name Generator

Participants listed individuals in their social network with whom they interact with (either in-person or virtually) on a regular basis (ranging from multiple times a year to multiple times a day) in a social network name generator. Name generators are used in egocentric network analysis to obtain a list of alters relative to the ego (Perry et al., 2018). Research indicates that using multiple name generators reduces the chance of participants forgetting individuals in their life (Carrington et al., 2005). Thus, the name generator portion of the survey was broken into three parts in which participants were instructed to list up to 5-20 individuals in the following categories: (1) friends [maximum 20 individuals] (2) acquaintances [maximum 10 individuals] (3) romantic/sexual partners [maximum 5 individuals]. A definition was provided for each relationship of interest (i.e., friend: “an individual with whom one has a mutual bond of affection/liking” [Oxford English Dictionary, n.d.]; acquaintance: “an individual that one knows casually or is familiar with but who is not considered a friend” [Merriam-Webster, n.d.]; and romantic partner/sexual partner: “an individual with whom one is romantically intimate and/or engages in sexual activity with”). In total, the size of social networks that participants were instructed to report on ranged from 0 to 35 alters. The maximum number of alters was capped at 35 to reduce demands on participants, who were asked follow-up questions about each alter.

Participants identified individuals with unique names, nicknames, or initials and were instructed to avoid listing relatives. After naming an alter, participants were asked to identify the gender of their alter, whether or not they live with that individual and specify in which context they live together if applicable. For romantic/sexual partners, individuals were additionally asked how long they had been engaging in a relationship with a particular partner and to specify the nature of that relationship (e.g., hooking up, dating etc.)

2.2.3.2 Name Interpreters

Name interpreters refer to questions asked to an ego about their alters (Perry et al., 2018). A combination of questions from previous social network analysis studies, as well as supplementary items assessing my specific research questions were used as name interpreters. In this study, several survey stages were used to assess the nature of the participant's relationship with their alters. These stages assessed both broad network characteristics (network size, network density) and relationship-level characteristics (where they met each individual, frequency of interactions, duration of each relationship, closeness of the tie, relationship quality, satisfaction with quality and socio-emotional multiplexity).

2.2.3.2.1 Network Size and Density

Calculation of both network size and network density was conducted using R 4.1.1. (RStudio Team, 2021) and the 'egor' 1.21.1 package (Krenz et al., 2021). Network size was defined as the sum of all the alters (friends, acquaintances, and romantic/sexual partners) an individual listed in their social network. The sociogram template provided through Network Canvas allowed participants to make connections between alters who know each other to assess network density (Figure 1A). During the sociogram task participants were instructed to place all individuals they listed in the name generators section on the diagram and to "connect any two people that would spend time together without you being there". Calculating network density involves dividing the number of reported ties (i.e., "edges") between alters over the total number of possible ties within the network.

2.2.3.2.2 Tie Strength

In addition to assessing network density, the sociogram task (Figure 1A) allowed participants to sort their alters based on how close they felt towards each one. As such, I edited the sociogram to include a cross in the center. Participants were informed that closer placement of an alter to the center cross would indicate a closer ego-alter relationship. Closeness of each tie was also measured using a quadrant task (Figure 1B) in which participants were instructed to place individuals on a diagram based on (1) how

close they feel towards each alter and (2) how close they THINK each alter feels towards them. For the purposes of this thesis, analyses focus on how close the participant (ego) feels toward each alter. Relationship quality and satisfaction with that quality was assessed using a second quadrant task (Figure 1C). My measure of tie strength is a composite score of self-reported relationship closeness, relationship quality and satisfaction with that quality. To calculate tie strength, I converted participants' perceptions of relationship quality, satisfaction with that quality and relationship closeness to z-scores. These items were then summed to gain an overall measure of tie strength and a constant was added to ensure positive values and thus scores ranged from 0 to 16 with higher values indicating greater tie strength. This variable appears in all subsequent analyses that include tie strength.

Network Canvas outputs the *x*- and *y*-coordinates for the placement of each alter on a diagram. The center of the sociogram diagram receives the coordinates (0.5, 0.5). The distance of each alter node from the center coordinate was calculated using the following formula (1):

$$D = \sqrt{dx^2+dy^2} \quad . \quad (1)$$

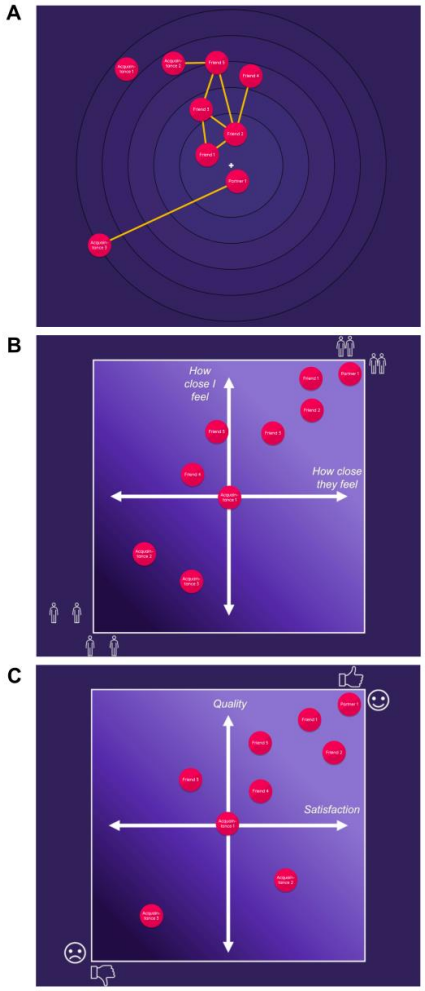

Figure 1. Network Canvas. A) Participants placed each of their alters on a sociogram. The closer an alter was placed to the cross, the closer the participant viewed their relationship with that alter. B) Relationship Closeness: Participants placed each alter in the diagram quadrants based on how close they feel towards that alter, and how close they think that alter feels towards them. C) Relationship Quality and Satisfaction: Perceived relationship quality and satisfaction with relationship quality.

The distance of the alter from the center coordinate (*D*) on the sociogram task was calculated in R.4.1.1. (RStudio Team, 2021) by finding the square root of the sum of the squared difference between the *x*-value of a particular alter and *x*=0.5 (*dx*) and the squared difference between the *y*-value of a particular alter and *y*=0.5 (*dy*). This process generated one score for each alter. These data were then reverse scored to produce scores in which higher values indicate greater closeness. In the closeness quadrant task and relationship quality quadrant task, closer and higher quality relationships were placed closer to the top of the screen and therefore received smaller values on the *y*-axis. To aid in the interpretation of these data, on these tasks, *y*-axis values were reverse-scored so that higher *y*-values indicate closer relationships and greater satisfaction with relationship quality. In the relationship quality quadrant task, more satisfying relationships were placed closer to the right of the screen and thus received greater values on the *x*-axis. Thus, higher *x*-values indicated greater satisfaction with a given relationship's quality.

2.2.3.2.3 Socio-emotional Multiplexity

Social-emotional multiplexity was determined by calculating the total number of social-emotional roles an alter fulfills. Role selection for the social-emotional multiplexity question included: (1) sharing social activities (2) discussing personal matters (3) emotional support (4) non-emotional support [e.g., helping you study for a test, driving you somewhere, loaning you money] (5) sharing success and happy events (6) sharing failures and unhappy events. The first four roles were assessed during the sociogram task in which participants were instructed to select alters that fulfilled a particular role (e.g., "Select **ALL** individuals you share social activities with"). For the last two roles, participants were directed across 2 different pages on the network survey that asked them to indicate which alters fulfil each role by placing that alter in a bin. A total socio-emotional multiplexity score was calculated to determine the total number of roles each alter fulfills (ranging from 0 to 6). Ego-alter relationships in which the alter fulfills more than one role are considered socio-emotionally multiplex with a greater number of roles fulfilled indicating greater multiplexity.

2.2.3.3 Co-rumination Questionnaire Follow-up

The last section of the network survey included 2 follow-up questions to the CRQ that participants completed in Qualtrics before beginning the network survey. Participants were given the following instructions “How much time do you spend discussing negative feelings, personal problems, and issues with other people with each of the individuals in your network? Place each person into the category that best describes how often this happens when you chat.” Participants then had the opportunity to place the alters they listed in the name generator within one of five categories ranging from [1] “Never” to [5] “Almost always”. Participants were also asked about the topics they typically address when discussing personal problems and negative feelings with their alters. Participants were presented with the following topics: (1) problems with friends, (2) problems with peers, (3) problems with romantic/sexual partners, (4) problems with family, (5) problems with school/work, (6) experiences with microaggressions and (7) other problem(s) not listed above. Participants were given the following description of microaggressions: “A comment or action that subtly expresses prejudiced attitudes towards members of a marginalized group (Meriam-Webster Dictionary, n.d). Microaggressions can include prejudice based on ethnicity, race, gender, sexual orientation, area of study etc.”.

2.2.4 Network Management Inventory – Short Form (NMI-SF)

The shortened version of the Network Management Inventory (Gillath et al., 2008) was used to assess network management behavior. The full Network Management Inventory has been previously used in a sample of young adults (Gillath & Selcuk, 2008) and has been used to compare network management skills in both young and old adults (Gillath et al., 2011). In this questionnaire, participants are instructed to think about how they typically behave during major life changes (e.g., going to a new school) when answering questions that assess their tendency to maintain, initiate and dissolve social ties. The NMI-SF contains 15 items that assess each of the three facets of network management: (1) initiation (2) maintenance (3) dissolution. To better assess my hypotheses, participants answered network maintenance questions in two parts (Appendix D) to assess individual scores for maintenance of *close* old network members and maintenance

of *distant* old network members (e.g., “I regularly get in touch with my… (a) closer old social network members (b) more distant old social network members). This modified version of the NMI-SF thus included 20 items. There were four questions assessing relationship initiation, five questions assessing maintenance of close network ties, five questions assessing maintenance of distant network ties, and six questions assessing dissolution of ties. Participants responded using a 7-point Likert scale ranging from strongly disagree (1) to strongly agree (7) with the middle value (4) representing neutral/mixed viewpoints. Higher scores indicated greater initiation, maintenance, or dissolution. Acceptable internal consistency was found across all four subscales of the revised questionnaire with alphas ranging from .75 to .87.

To examine the extent to which participants prioritize the maintenance of close ties over more distant ties I determined the difference between total scores on the close-tie maintenance subscale and the distant-tie maintenance subscale of the NMI-SF (i.e., maintenance prioritization). Total distant-tie maintenance was subtracted from total close-tie maintenance. The computed variable was identified as *maintenance prioritization* where higher values indicated a greater tendency to prioritize the maintenance of close ties over more distant ones. Several participants had negative values on this measure.

2.2.5 Hospital Anxiety and Depression Scale (HADS)

The Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) is a 14-item self-report questionnaire assessing depressive symptoms and anxious symptoms. The questionnaire includes seven statements that assess depressive symptoms (e.g., “I feel as if I am slowed down”) and seven statements that assess anxious symptoms (e.g., “I get sudden feelings of panic”). Participants rated each statement using a 4-point Likert scale to describe how often they experience a particular symptom. Higher totals on the depressive symptoms subscale (i.e., HADS-D) indicate higher levels of depressive symptoms while higher totals on the anxious symptoms subscale (i.e., HADS-A) indicate greater anxious symptoms. The HADS-D and HADS-A show high correlations (Bjelland et al., 2002) with other depression and anxiety measures. Acceptable internal consistency was found across both the HADS-D (α = .71) and the HADS-A (α = .82).

2.2.6 Big Five Inventory (BFI)

For exploratory purposes, a measure of personality was included in the study to assess potential associations between co-rumination and the big five personality dimensions. To assess personality, participants completed The Big Five Inventory (BFI; John & Srivastava, 1999) which is a 44-item self-report measure of the Big Five personality dimensions (Goldberg, 1993). As such, the BFI measures: (1) extraversion vs. introversion, (2) agreeableness vs. antagonism, (3) conscientiousness vs. lack of direction (4) neuroticism vs. emotional stability and (5) openness vs. closedness to experience. This measure was included for exploratory purposes. Acceptable internal consistency was found across all five subscales with alphas ranging from 0.72 to 0.87.

2.3 Procedure

All measures were completed via Qualtrics and the Network Canvas Interviewer in individual rooms in a laboratory setting to allow participants to receive help from a trained experimenter during the task. After providing informed consent, participants were directed to the demographics questionnaire and CRQ on Qualtrics. Participants were subsequently guided through the network survey by the Network Canvas Interviewer. Once the network survey was complete, participants were redirected to Qualtrics where they completed the NMI-SF, the HADS and the BFI, before being thanked and dismissed.

2.4 Data Analysis

In the current study, results were considered statistically significant at $p < 0.05$. Effect sizes were interpreted when applicable using the guidelines outlined by Cohen (1988). Data analysis was conducted in R 4.1.1. (RStudio Team, 2021). The confirmatory analysis scripts are available on the study's OSF page.

2.4.1 Missing Data

Listwise deletion was used when individuals had more than 20% missing data across the entire study ($n = 3$) or did not provide information on key network-level variables (e.g., relationship quality; $n = 2$). For self-report measures, missing data was handled using

case mean substitution as suggested by Fox-Wasylyshyn & El-Masri (2005) for self-report measurements. The average rate of missing data across self-report measures in this study was 0.23 items per person (SD=0.58). In case mean substitution, a participant's average score on the items they have completed within a measure is used to replace missing values on that measure. Mean substitution was only used when fewer than 60% of the items on a measurement for a given participant was missing and when fewer than 15% of the cases within a variable were missing. After conducting the listwise deletion mentioned above, all remaining participants with missing data met the requirements for mean substitution. Utilization of case mean substitution, given these constraints, has shown correlations of .95 between original and estimated data (Fox-Wasylyshyn & El-Masri, 2005).

2.4.2 Covariates

Females appear to be at an increased risk of co-rumination and internalizing symptoms (Calmes & Roberts 2008; Tompkins et al., 2011). Moreover, males tend to report greater social isolation during their first semester of university (Liu et al., 2019). For this reason, I examined potential gender differences within my sample concerning the following key variables: co-rumination, network management skills (initiation, dissolution, and prioritization), network size/density, tie strength, multiplexity, depressive symptoms and anxious symptoms. I conducted several t-tests to compare means between participants identifying as men versus women (Table 2; Figure 2). I only used male and female categories for gender identity, as the sample of individuals who selected other gender identities (e.g., genderqueer, non-binary, etc.) was too small (n = 6) to analyze.

Women and men significantly differed across total co-rumination and average tie strength assigned to alters in their network. Women reported a significantly greater tendency to co-ruminate across relationships (t[450] = -2.55, p = 0.01, d = 0.27) and greater anxious symptoms (t[450] = -6.24, p < 0.001, d = 0.67) than did men. Additionally, men had significantly higher average ego-alter tie strength within their network (t[450] = 3.23, p < 0.001, d = -0.35) compared to women. Thus, gender was a covariate in analyses that included either co-rumination, anxious symptoms, or tie strength as a variable.

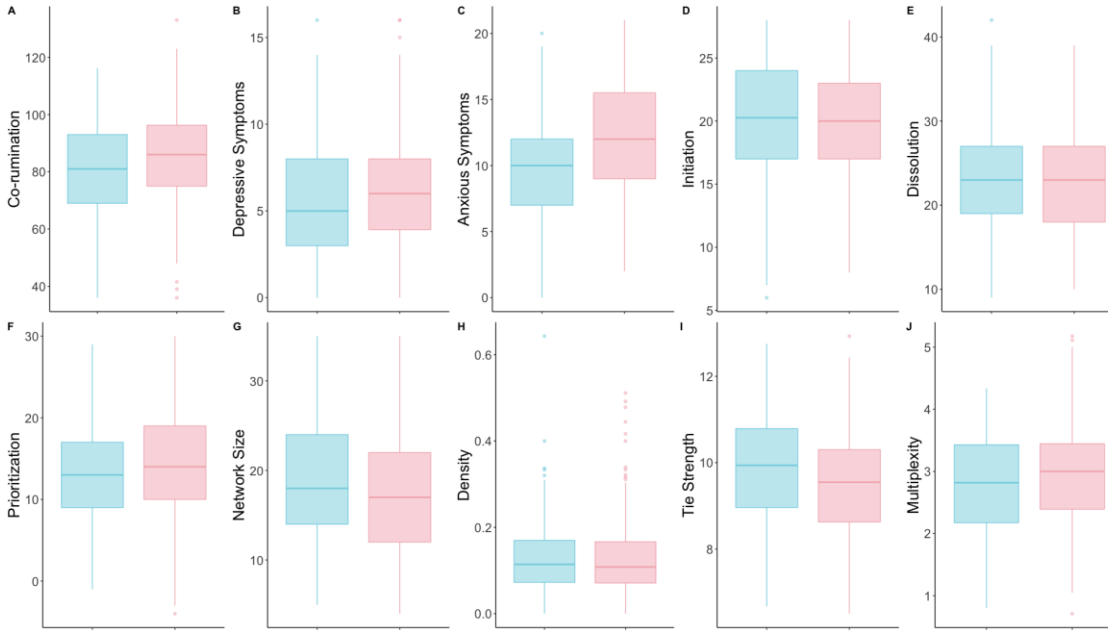

Figure 2. Gender differences across key variables. Box plots showing gender (men = blue, women = pink) differences in A) co-rumination, B) depressive symptoms, C) anxious symptoms D) tie initiation, E) tie dissolution, F) maintenance prioritization, G) network size, H) density, I) average tie strength across network, J) average multiplexity across network. Boxes represent the interquartile range (IRQ; Q_1 to Q_3) and the center line within the boxes represents the median. Whiskers represent variability outside the IRQ, and outliers appear as individual dots.

2.4.3 Multilevel Models: Hypothesis I

To assess whether individuals with a greater tendency to co-ruminate view their co-ruminative ties as particularly close, high quality, satisfying (HIA) and fulfilling (HIB) I used a multilevel modelling approach to compare characteristics between egos and their relationships (see Perry et al., 2018). As such, the multilevel model involved relationships nested within an ego. Typically, multilevel modelling in social network analyses involves an independent variable at the alter level (Level 1) and an independent variable at the ego level (Level 2). In this study, an ego's tendency to co-ruminate (ego co-rumination) served as the Level 2 variable and the frequency of co-rumination within a particular relationship (co-rumination with tie) was the Level 1 variable. As significant gender

Table 2.

T-tests comparing men and women across key variables

	Men (n = 117)		Women (n = 335)		t(450)	p	Cohen's d
	M	*SD*	*M*	*SD*			
CRQ	80.81	16.95	85.23	15.88	-2.55	0.01*	0.27
HADS-D	5.76	3.68	6.10	3.27	-0.94	0.35	0.10
HADS-A	9.59	4.10	12.34	4.10	-6.24	<0.001***	0.67
NMI-I	20.16	5.06	20.04	4.33	0.24	0.81	-.03
NMI-D	23.19	6.53	22.85	6.16	0.50	0.62	-.05
NMI-P	12.73	6.44	13.98	6.92	-1.72	0.09	0.18
Network Size	18.46	7.03	17.81	6.64	0.90	0.37	-0.10
Network Density	0.14	0.09	0.12	0.08	1.30	0.20	-.14
Average Tie Strength	9.91	1.23	9.50	1.18	3.23	0.001**	-0.35
Average Multiplexity	2.79	0.80	2.96	0.79	-1.95	0.05	0.21

Note. CRQ = Co-rumination Questionnaire; HADS-D = Hospital Anxiety and Depression Scale: Depression; HADS-A = Hospital Anxiety and Depression Scale: Anxiety; NMI_I = Network Management Inventory: Initiation; NMI_D = Network Management Inventory Dissolution; NMI_P = Network Management Inventory: Prioritization.
*p<0.05, **p<0.01, ***p<0.001

differences exist across co-rumination scores, gender was treated as an additional Level 2 predictor. The first model examined the influence of both Level 1 and Level 2 predictors on tie strength. I hypothesized (HIA) that individuals with a greater tendency to co-ruminate tend to do so with individuals they view as particularly strong ties. I also examined how socio-emotional multiplexity relates to co-rumination using the same set of Level 1 and 2 predictors, with multiplexity as the outcome variable. I hypothesized (HIB) that individuals with a greater tendency to co-ruminate tend to do so in relationships that they find more socially and emotionally fulfilling (i.e., multiplex).

As per Nezlek (2011), my Level 1 (co-rumination with tie) and Level 2 (ego co-rumination) variables were centered based on either the grand mean (ego co-rumination) or group mean (co-rumination with tie) before being entered into my models. As a first

step, I analyzed the unconditional (random-intercepts) models for the maximum likelihood estimates of the dependent variable (either tie strength or socio-emotional multiplexity) and variance estimates of Level 1 and Level 2. If I found variance at both the between-ego and within-ego levels, I ran the random intercept model with the addition of my Level 1 predictor (co-rumination with tie). I then ran two additional random intercept models with both the Level 1 predictor (co-rumination within tie) and Level 2 predictors (ego co-rumination and gender) as well as an interaction between my Level 2 predictors. I used this procedure to examine both tie strength and socio-emotional multiplexity as distinct outcome variables.

2.4.4 Mediation Models: Hypotheses II & III

2.4.4.1 Co-rumination, Network Management Skills and Network Size (HII)

No study has sought to examine how an individual's tendency to co-ruminate might mediate their network management behaviours. Hypothesis II therefore tests whether differences in network size and density based on self-reported co-rumination might be mediated by the tendency to prioritize close over more distant ties, the tendency to dissolve ties, and reduced tie initiation. I began by examining the conditions needed for mediation to occur (see Baron & Kenny, 1986). Specifically, I tested for the direct effects of co-rumination on the tie initiation and dissolution subscales of the NMI-SF, as well as my calculated maintenance prioritization score using regression analyses. Similar regression analyses were also used to examine the relationship between co-rumination and my network size and network density metrics.

I predicted that co-rumination would be significantly and negatively associated with tie initiation, network size and network density. Additionally, I predicted that co-rumination would be significantly and positively associated with tie dissolution and maintenance prioritization. I predicted that maintenance prioritization would also be associated with lower tie initiation and greater tie dissolution and these behaviours would be associated with smaller network size. This idea is consistent with previous research showing that

both initiation and dissolution are associated with network size such that initiation is associated with a larger network and dissolution is associated with a smaller network (Gillath et al., 2017). Assuming these basic conditions were met, I predicted that the association between co-rumination and network size would be at least partially mediated by a unique pattern of network management behaviours.

Contrary to prediction, my analyses failed to reveal significant direct paths for the variables of interest. Therefore, I followed my pre-registered analysis plan and refrained from testing for mediation in the proposed pathways. The results from the regression analyses assessing associations between co-rumination, network management skills and network characteristics can be found below. When necessary (i.e., when looking at gender as a covariate), I compared linear models hierarchically.

Co-rumination, Network Size and Depressive Symptoms (HIII)

As above, I assessed the direct effects of co-rumination and network size on depressive symptoms through regression analyses. I predicted that co-rumination would be associated with greater depressive symptoms and that this effect would be partially mediated by smaller network size. Again, analyses revealed that I did not have the sufficient direct paths between variables to conduct the mediation analyses. The results from the regression analyses assessing co-rumination, depressive symptoms and network size appear below. Again, I compared linear models hierarchically when considering gender as a covariate.

Chapter 3

3 Results

Using a cutoff criterion of ± 2 for skewness, as suggested by Hahs-Vaughn & Lomax (2020, p.128-130), all outcome variables were within the bounds of normality (skewness values ranging from -0.29[*SE* = 0.21] to 1.70 [*SE* < 0.01]). As noted above, the pre-registered conditions for conducting the proposed mediation analyses were not met. Therefore, no mediation models were tested. The results from the linear regressions used to test the direct effects involved in my proposed mediation models can be found below.

3.1 Tie Strength (Hypothesis IA)

To assess whether greater levels of co-rumination within a particular relationship would be associated with greater tie strength I used multilevel modelling (Table 3). The intercept-only model assessed the effect of the ego on tie strength without predictors. Tie strength across egos was significantly different than zero (γ_{00} = 9.55, 95% CI [9.45, 9.66], $p < 0.001$). I found variance in tie strength both between (σ^2 = 0.803) and within egos (i.e., between an ego's alters; σ^2 = 10.50), though the variance was larger at the alter-level. Results suggest a correlation between alters nested within a given ego on tie strength (ICC = 0.071).

To compare models, I calculated differences in fit (-2LL) between a model and its subsequent model and then compared this to a chi-square distribution of significance. Model 1 including ego-alter co-rumination yielded better fit than the intercept-only model ($p < 0.001$) and Model 2 (including ego co-rumination and gender) yielded a better fit than Model 1 ($p < 0.001$). Model 3 (including the interaction term) did not fit the data better than Model 2 (R^2 = 0.52, p = 0.31). In support of my hypothesis, higher co-rumination within a relationship (β = 1.99, $p < 0.001$) predicted tie strength. That is, for each unit increase in ego-alter co-rumination, tie strength increased by approximately 2. Moreover, identifying as a man positively predicted tie strength (β = -0.38, p = 0.003), such that men reported greater tie strength than women (Figure 3). An ego's general tendency to co-ruminate (β = 0.001, p = 0.62) did not predict tie strength.

3.2 Socio-emotional Multiplexity (Hypothesis IB)

To assess my hypothesis that greater levels of co-rumination within a particular relationship would be associated with greater socio-emotional multiplexity (i.e., an alter fulfills a greater number of socio-emotional support roles) I tested a similar series of models including multiplexity as the dependent variable (Table 3). The intercept-only model assessed the effect of the ego on multiplexity without predictors. Multiplexity across egos was significantly different from zero (γ_{00} = 2.67, 95% CI [2.79, 2.94], p < 0.001) and variance in multiplexity occurred both between egos (σ^2 = 0.382) and within egos (i.e., between an ego's alters; σ^2 = 4.326), though again, the variance was larger at the alter-level. Results suggest a correlation between alters nested within a given ego regarding multiplexity (ICC = 0.081).

I found that Model 1 including ego-alter co-rumination as a single predictor fit the data better than the intercept-only model (p < 0.001) and Model 2 (with ego co-rumination and gender) was a better fit than Model 1 (R^2 = 0.58; p < 0.001). Model 3 (including the interaction term) did not add to the overall fit (p = 0.31). In support of my hypothesis, higher co-rumination within a given ego-alter relationship (β = 1.36, p < 0.001) predicted greater socio-emotional multiplexity (Figure 3). However, neither an ego's general tendency to co-ruminate (β = 0.0003, p = 0.90), nor gender (β = 0.14, p = 0.11) predicted multiplexity.

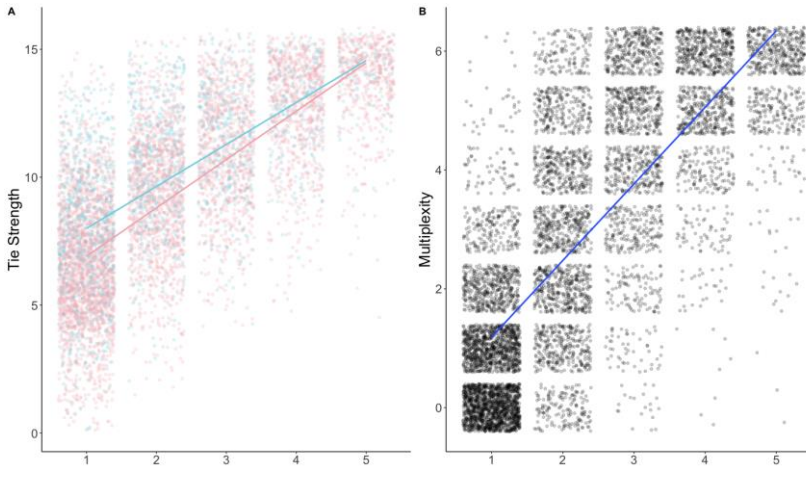

Figure 3. Associations with co-rumination in ego-alter relationships. A) Associations between tie strength and co-rumination within a particular relationship across gender [men = blue, women = pink]; B) association between multiplexity (i.e., number of socio-emotional roles fulfilled) and ego-alter co-rumination

Table 3.

Multilevel Modeling Assessing Relationship Characteristics

	DV: Tie Strength				DV: Multiplexity			
Parameters	Intercept-only	Model 1	Model 2	Model 3	Intercept-only	Model 1	Model 2	Model 3
Fixed Effects								
Intercept (γ_{00})	9.55	9.58	10.24	10.26	2.87	2.90	2.67	2.70
Ego-alter Co-rumination (γ_{10})		1.99***	1.99 ***	1.99 ***		1.35***	1.36***	1.36***
Ego Co-rumination (γ_{01})			0.001	0.01			<0.001	0.01
Gender (γ_{02})			-0.38 **	-0.39 **			0.14	0.12
Ego Co-rumination x Gender (γ_{03})				-0.005				-0.007
Random Effects								
Residual (σ^2)	10.50	4.33	4.32	4.32	4.33	1.47	1.47	1.47
Intercept (τ_{00})	0.80	1.13	1.11	1.11	0.38	0.53	0.52	0.51
Model Summary								
R-squared		0.5167	0.5199	0.5200		0.5746	0.5783	0.5789
Deviance statistic (-2LL)	43086	34972	34640	34639	35824	26516	26253	26252
Number of estimated parameters	3	5	7	8	3	5	7	8

Note. Mode 1 = level 1 predictor (ego-alter co-rumination) on DV; Model 2 = level 2 predictor + level 2 predictors (ego co-rumination and gender); Model 3 = level 1 predictor + level 2 predictors + interaction between level 2 predictors. R-squared refers to the R-squared for the entire model. Women = 0, Men = 1.
*p<0.05, **p<0.01, **p<0.001.

3.3 Network Management Skills (Hypothesis II)

To test how different network management skills related to network size and co-rumination, I conducted regression analyses (Figure 4). Contrary to hypotheses, analyses revealed a significant but weak positive association between tie initiation and co-rumination (F[1, 450] = 4.14, β = 0.03, p = 0.04, R^2 = 0.007). Despite significant gender differences in co-rumination behavior, gender did not interact with co-rumination (β = -0.02, p = 0.48) in predicting initiation (F[3, 448] = 1.62, p = 0.18, R^2 = 0.004). As anticipated, an individual's tendency to initiate ties was significantly associated with network size (F[1, 456] = 12.24, β = 0.24, p < 0.001, R^2 = 0.024), such that tie initiation accounted for 2.4% of the variance in network size across the sample. Network size was not associated with maintenance prioritization or tie dissolution (p-values > 0.15). Neither co-rumination nor the co-rumination x gender interaction significantly accounted for variance in maintenance prioritization or tie dissolution (p-values > 0.29).

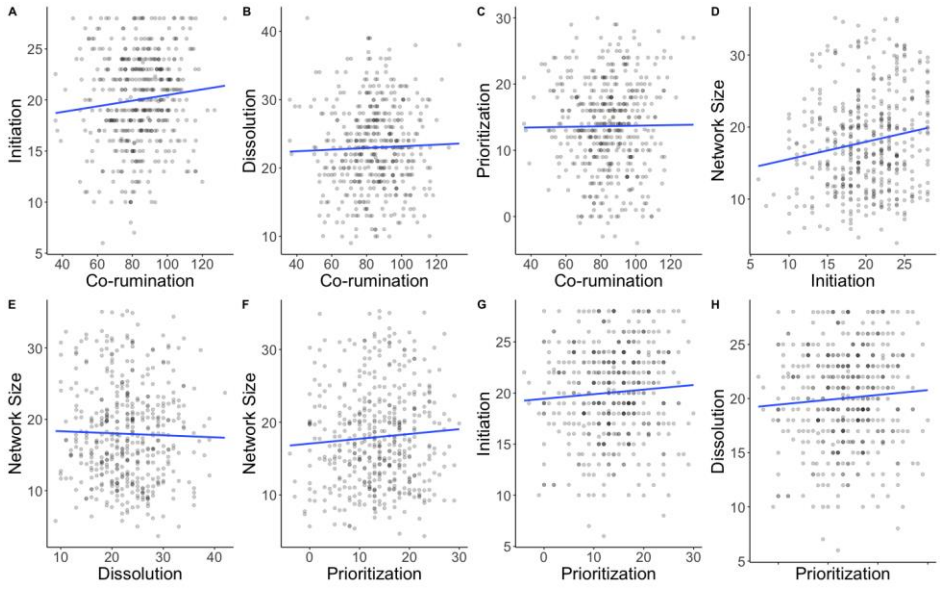

Figure 4. Linear models assessing associations between co-rumination and network management skills. Scatter plots depicting associations (including the lines of best fit) between A) co-rumination and tie initiation; B) co-rumination and tie dissolution; C) co-rumination and maintenance prioritization; D) tie initiation and network size; E) tie dissolution and network size; F) maintenance prioritization and network size; G) maintenance prioritization and tie initiation (Appendix D); H) maintenance prioritization and tie dissolution (Appendix D).

3.4 Network Structure (Hypothesis III)

Participants, on average, listed about 18 alters (*SD* = 6.76; 11 friends, 6 acquaintances and 1-2 romantic/sexual partners) in their network. The average density of networks within the sample was 0.13 (*SD* = 0.08). Given that density ranges from 0 to 1, a value of 0.13 indicates that on average, networks within the sample were relatively sparse (Tabassum et al., 2018). My hypothesis that individuals with a greater tendency to co-ruminate would report smaller and more sparse networks was not supported (Figure 5). That is, I found no significant association between co-rumination (nor any interaction between co-rumination and gender; *p*-values > 0.77) and network size (F[1, 450] < 0.001, p = 0.99, R^2 = - 0.002) or network density (F[1, 450] = 0.017, p = 0.90, R^2 = - 0.002).

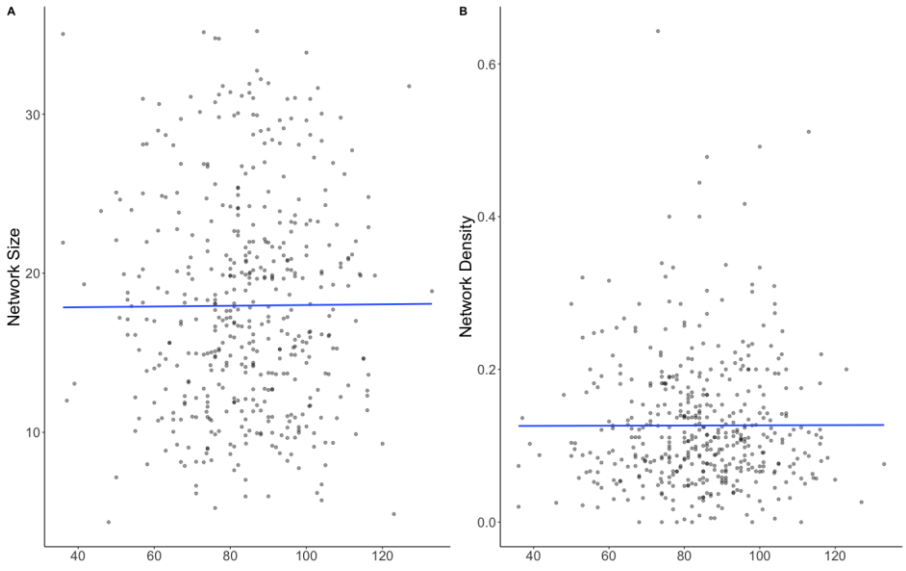

Figure 5. Linear models assessing associations between co-rumination and network characteristics. Scatter plots depicting associations between A) co-rumination and network size; B) co-rumination and network density.

3.5 Depressive & Anxious Symptoms (Hypothesis IV)

In support of my hypotheses and previous literature (Rose, 2002), co-rumination was weakly and positively associated with depressive symptoms (F[1, 450] = 6.19, β = 0.02, p = 0.01, R^2 = 0.011; Figure 6). The gender x co-rumination interaction did not significantly predict depressive symptoms over and above the effect of co-rumination

(ΔR^2 = 0.01, p = 0.09). Thus, only co-rumination was a significant predictor of depressive symptoms. However, analysis suggested that co-rumination accounted for only 1.1% of the variance in depressive symptoms, indicating a small but significant effect. I found no significant association between depressive symptoms and network size (F[1, 456] = 1.09, p = 0.30, R^2 < 0.001).

Co-rumination and gender (i.e., identifying as female) predicted anxious symptoms above and beyond the effect of co-rumination alone (ΔR^2 = 0.069, p < 0.001). The inclusion of an interaction between co-rumination and gender did not provide any significant change in fit (ΔR^2 = 0.006, p = 0.07). Thus, both co-rumination (β = 0.04, p < 0.01) and gender (β = 2.58, p < 0.001) were significant and independent predictors of anxious symptoms, accounting for 9.6% of the variance in these symptoms within the sample (F[2, 449] = 25.01, p < 0.001, R^2 = 0.096).

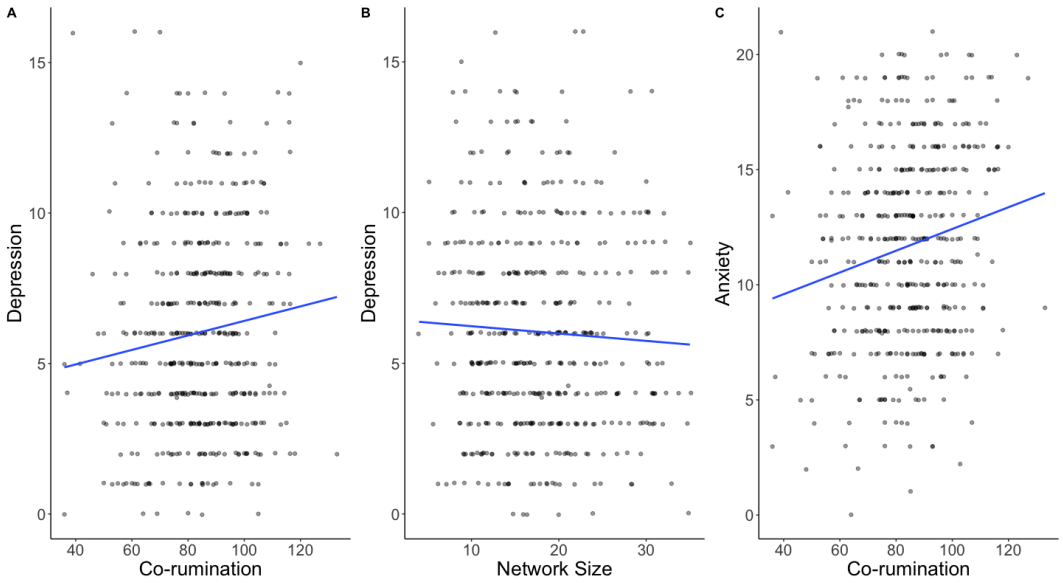

Figure 6. Linear models assessing associations with mental health symptoms. Scatter plots depicting associations between A) co-rumination and depressive symptoms; B) network size and depressive; C) co-rumination and anxious symptoms

Chapter 4

4 Exploratory Analyses

I conducted several exploratory analyses to further examine the influence of co-rumination on various relationship- and individual-level factors. These analyses are in addition to my preregistered hypotheses and serve as preliminary findings for future research.

4.1 Gender Differences in Tie Strength

Research shows that women tend to have stronger ties (Nakash et al., 2021) within their networks and higher relationship satisfaction (Demier & Orthell) compared to men. Thus, it was peculiar that I found that men as opposed to women reported greater tie strength within their network. To determine why my results might differ from previous findings, I further explored tie strength across men and women.

Tie strength was a composite score (see Methods) calculated by summing the standardized values of various measures assessing an individual's perceptions of the relationships (i.e., quality, satisfaction with quality and closeness) within their network. Thus, I examined potential gender differences across participant's average rating of relationship quality, satisfaction with that quality and closeness (both on the sociogram and quadrant tasks). Men and women did not significantly differ in the average quality of relationships within their network ($t[450] = 1.79$, $p = 0.07$, $d = -0.19$) however men reported feeling more satisfied with that quality compared to women ($t[450] = 2.60$, $p = 0.01$, $d = -0.28$). Men, on average, reported significantly greater closeness within their relationships on both the sociogram ($t[450] = 2.15$, $p = 0.03$, $d = -0.23$) and quadrant task ($t[450] = 3.56$, $p < 0.001$, $d = -0.38$). To further probe gender differences across relationship perceptions, I looked at the distribution and variance of scores for each alter in an individual's network across men and women (Figure 7). Levene's tests revealed that across all four measures of relationship perceptions, variance was unequal between the two groups (i.e., men vs. women, p-values < 0.001). I then visually explored the distribution of scores across alters between men and women (Figure 7). Women appeared

to have a larger frequency of low scores across relationship perceptions compared to men. Additionally, men tended to have a larger frequency of mid- to high-scores across relationship perceptions compared to women.

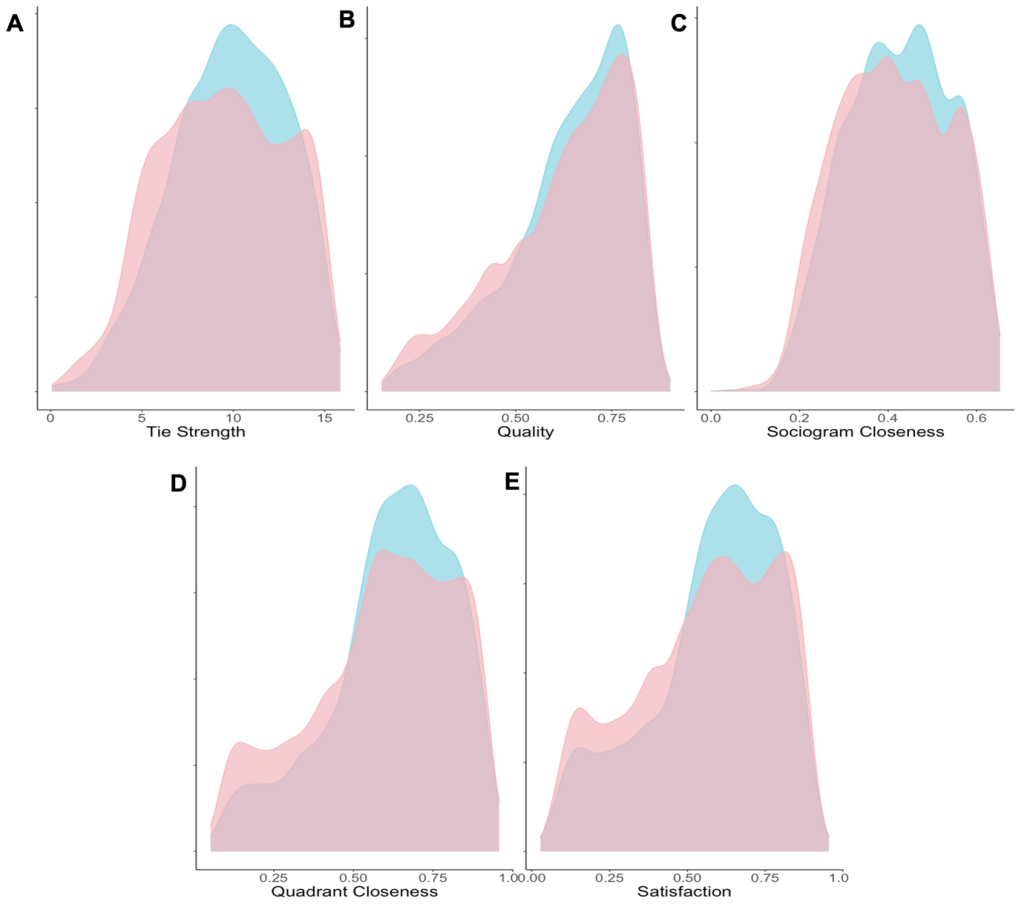

Figure 7. Distributions of relationship-level variables in men and women. Plots depicting the density of scores (*y*-axis) between men (blue) and women (pink) across A) tie strength; B) relationship quality; C) closeness as measured by the sociogram task; D) closeness as measured by the quadrant task; D) satisfaction with relationship quality.

4.2 Influence of Co-ruminative Partner

Given the significant findings in the confirmatory analyses assessing the influence of co-rumination on tie strength and multiplexity, I wanted to explore the influence of relationship type (friend, acquaintance, and romantic/sexual partner) on these two

outcomes. As in my confirmatory analyses I assessed an intercept-only model and then ran three subsequent models: Model 1: inclusion of both level 1 predictors (ego-alter co-rumination and relationship type), Model 2: level 1 predictors + level 2 predictors (ego co-rumination and gender), Model 3: level 1 predictors + level 2 predictors + level 1 interaction between predictors. Information pertaining the intercept-only models for each outcome can be found in the previous chapter.

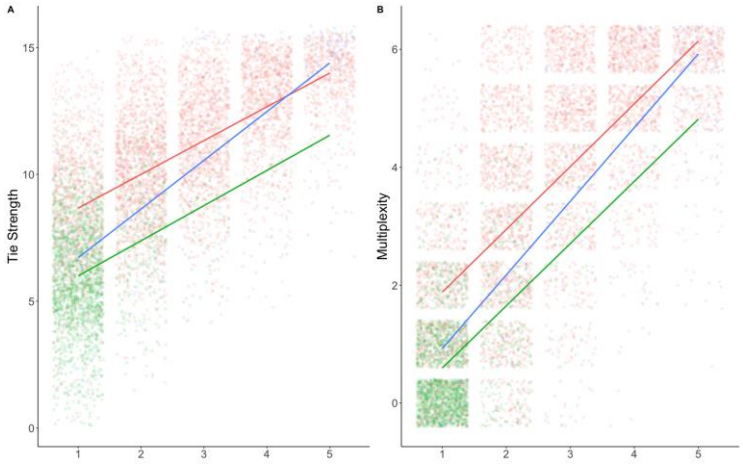

Figure 8. Associations with co-rumination levels across different ego-alter relationship types. Association between relationship specific co-rumination and A) tie strength as well as B) multiplexity across relationship type (i.e., friend [red], acquaintance [green] and romantic/sexual partner [blue]).

Regarding tie strength, I found that Model 1 including both level 1 predictors fit the data better than the intercept-only model ($p < 0.001$). Model 3 (R^2=0.58) including both level 1 and level 2 predictors as well as the interaction between my level 1 predictors fit the data better than both Model 1 ($p < 0.001$) and Model 2 ($p < 0.001$). Again, ego-alter co-rumination ($\beta = 1.04$, $p < 0.001$) and ego gender ($\beta = -0.29$, $p = 0.02$) were found to be significant predictors of tie strength. Relationship type ($\beta = -1.39$, $p < 0.001$) and its interaction with ego-alter co-rumination ($\beta = 0.51$, $p < 0.001$) were significant predictors of tie strength (Figure 8). Specifically, tie strength appears to be influenced the most by co-rumination when this behavior occurs within romantic/sexual relationships. Moreover, individuals reported the greatest tie strength in romantic/sexual relationships that involved higher levels of co-rumination.

In my analyses of socio-emotional multiplexity, Model 1 fit the data better than the intercept-only model ($p < 0.001$). Model 3 (R^2=0.62) fit the data better than both Model 1

($p < 0.001$) and Model 2 ($p < 0.001$). As in the confirmatory analyses, ego-alter co-rumination was a significant predictor of multiplexity ($\beta = 0.92$, $p < 0.001$). Unlike previous confirmatory analyses, ego gender was found to be a significant predictor of multiplexity such that being a woman predicted multiplex relationships within one's network ($\beta = 0.19$, $p = 0.03$). Both relationship type ($\beta = -0.81$, $p < 0.001$) and its interaction with ego-alter co-rumination ($\beta = 0.21$, $p < 0.001$) were significant predictors of multiplexity (Figure 8). Multiplexity appeared to be influenced by ego-alter co-rumination relatively evenly across relationships though slightly more in romantic/sexual relationships. Friendships with higher levels of co-rumination were the most multiplex out of the three relationship types.

4.3 Co-rumination & Mental Health in Marginalized Groups

Both co-rumination topic and personal factors such as gender have been found to influence co-rumination's effect on socio-emotional outcomes (Rudiger & Winstead, 2012; Barstead et al., 2013). However, studies directly examining co-rumination in individuals from diverse groups (e.g., people of colour, LGBTQ+, etc.) is limited. Nonetheless, research that has assessed the influence of co-rumination within marginalized groups suggests that this behaviour may have some beneficial effects when the topic of co-rumination pertains to issues the group faces (Hacker et al., 2016). For example, individuals in marginalized groups are often victims of microaggressions (Nadal et al., 2016; Sue et al., 2007). Like co-rumination, experiences with microaggressions are associated with depressive and anxious symptoms (Nadal et al., 2016; Sue et al., 2007), though social support may act as a protective factor (Matijczak et al., 2020). Given that co-rumination is a form of social support, I explored whether co-rumination about experiences with microaggressions buffered the association between this behaviour and mental health (i.e., depressive and anxious) symptoms in people of colour and queer folks.

My total sample (N=458) included 53 queer folks and 268 people of colour. Using regression analyses, I assessed associations between an individual's tendency to co-

ruminate and mental health symptoms in a queer subsample (n = 53) and a subsample consisting only of people of colour (n = 268). Furthermore, I explored whether microaggressions as a co-rumination topic interacted with an individual's co-rumination tendency in predicting depressive and anxious symptoms. Models were compared hierarchically using ANOVAs.

Neither co-rumination nor the co-rumination x microaggression interaction significantly accounted for variance in depressive symptoms in either queer folks (p-values > 0.10) or people of colour (p-values > 0.09). However, co-rumination was found to be significantly and positively associated with anxious symptoms in both queer folks (F[1,51]=4.50, p=0.04, R^2 = 0.06) and people of colour (F[1,266]=6.36, p=0.01, R^2 = 0.02).

Within queer folks the association between co-rumination and anxious symptoms was moderated by whether individuals co-ruminated about microaggressions (Figure 9). Specifically, higher levels of co-rumination were associated with lower levels of anxious

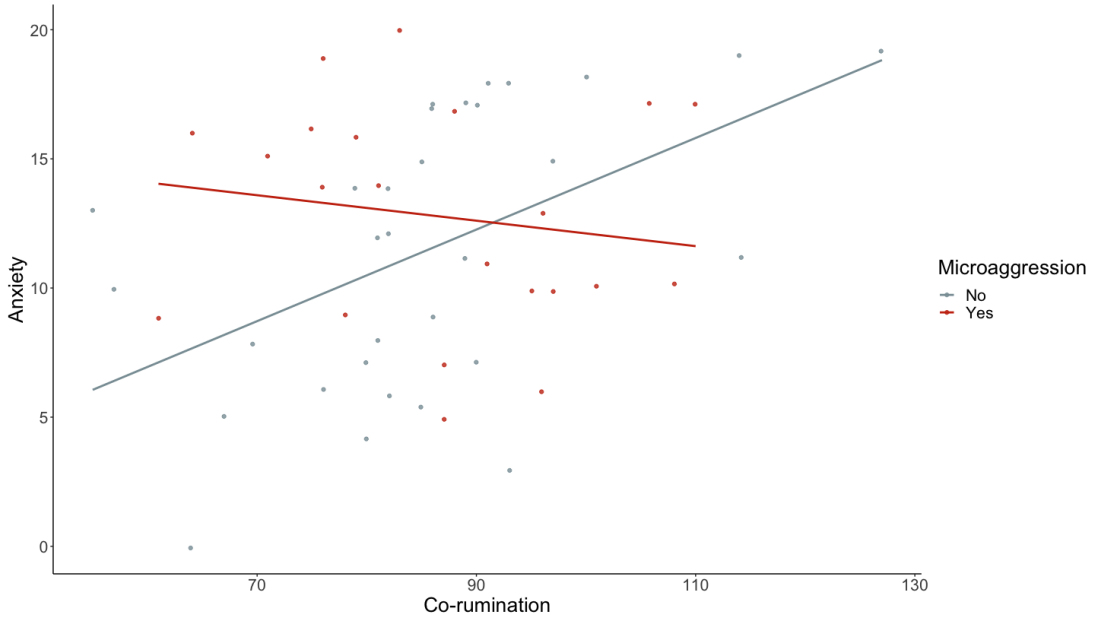

Figure 9. Co-rumination, anxious symptoms, and discussion of microaggressions in queer folks. Associations with anxious symptoms and an interaction between co-rumination levels and the discussion of microaggressions as a co-ruminative topic.

symptoms when microaggressions were discussed, and higher levels of anxious symptoms when they were not (F[3,49]=4.00, p=0.01, R^2 = 0.15). This interaction was significant above and beyond the effect of co-rumination (ΔR^2 = 0.12, p < 0.001). This suggests that co-ruminating about microaggressions may help to reduce anxious symptoms in queer folks – although this result should be treated with caution due to the small sample of participants within this group.

In people of colour, co-rumination and microaggressions predicted anxious symptoms above and beyond the effect of co-rumination alone (ΔR^2 = 0.022, p = 0.01). The inclusion of an interaction between co-rumination and microaggressions did not provide any significant change in fit (ΔR^2 = 0.001, p = 0.05). Thus, both co-rumination (β = 0.04, p = 0.02) and microaggressions as a co-rumination topic (β = 1.35, p = 0.01) were significant and independent predictors of anxious symptoms, accounting for 3.9% of the variance in these symptoms within the sample of people of colour (F[2, 265] = 6.42, p = 0.002, R^2 = 0.039).

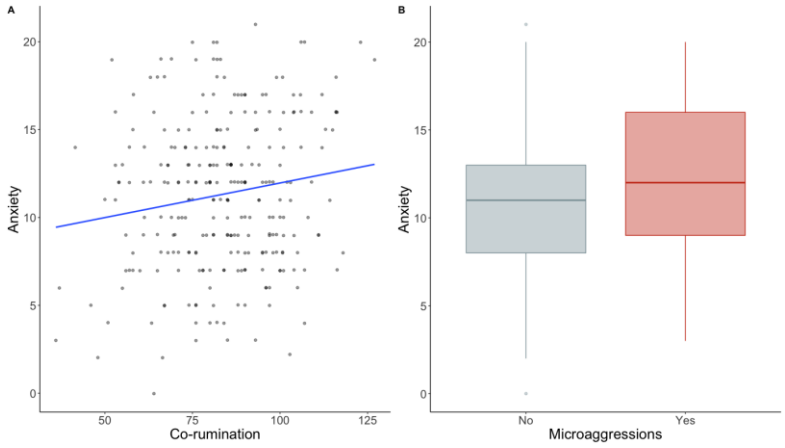

Figure 10. Co-rumination, anxious symptoms, and the discussion of microaggressions in people of colour. Associations between A) co-rumination and anxious symptoms as well as B) discussion of microaggressions and anxious symptoms in people of colour.

4.4 Discussion Topic Across Co-rumination Levels

Whether or not individuals with low, moderate, or high co-rumination tendencies differ in the topics which they discuss has yet to be explored. Thus, I used Pearson's chi-square test to compare three groups (i.e., high, moderate, and low co-ruminators) across co-

rumination topic. I used standard deviations to create the groups such that those in the high co-rumination group had CRQ totals 1 or more standard deviations above the mean, those in the moderate group had CRQ totals within 1 standard deviation above or below the mean and those in the low group had CRQ totals 1 or more standard deviations below the mean.

Results from the chi-square analyses can be found in Table 4. A significantly larger proportion of individuals with a high tendency to co-ruminate reported discussing problems about friends ($\chi^2[2, 458] = 11.46$, $p = 0.003$), peers ($\chi^2[2, 458] = 9.67$, $p = 0.008$) and partners ($\chi^2[2, 458] = 7.82$, $p = 0.02$) compared to those with a low or moderate tendency to co-ruminate. A significantly larger proportion of individuals with a moderate tendency to co-ruminate reported discussing problems with family members ($\chi^2[2, 458] = 8.91$, $p = 0.01$) compared to those with a low or high tendency to co-ruminate. No significant differences were found across groups in their endorsement of discussing school/work problems ($\chi^2[2, 458] = 1.88$, $p = 0.39$), experiences with microaggressions ($\chi^2[2, 458] = 5.98$, $p = 0.05$), or other problems not listed ($\chi^2[2, 458] = 1.66$, $p = 0.44$) as co-rumination topics. Across all three groups over 94% of individuals

Table 4.

Discussion topic across co-rumination levels

Topic	Low Co-rumination $n = 71$		Moderate Co-rumination $n = 316$		High Co-rumination $n = 71$		χ^2
	%	#	%	#	%	#	
Friend Problems	78.87	56	90.19	285	95.77	68	11.46**
Peer Problems	66.20	47	79.11	250	87.32	62	9.67**
Partner Problems	54.93	39	68.99	218	76.06	54	7.82*
Family Problems	60.56	43	77.53	245	76.06	54	8.91*
School/Work Problems	94.37	67	96.52	305	98.59	70	0.39
Microaggressions	32.39	23	32.91	104	47.89	34	0.05
Other	18.31	13	15.19	48	21.13	15	0.44

*$p<0.05$, **$p<0.01$, ***$p<0.001$

reported discussing school/work problems, representing the most common topic of discussion across individuals. However, this is not surprising as all participants were in the process of adjusting to the academic demands of university life.

4.5 Co-rumination & Personality

To date, no study has examined how facets of an individual's personality may relate to their tendency to co-ruminate. Thus, I conducted regression analyses to examine whether any of the Big Five personality dimensions significantly associated with co-rumination.

Similar to the confirmatory analyses in Chapter 3, I removed individuals that were 3 or more standard deviations above or below the mean (i.e., outliers) across the five personality dimensions. Following the removal of outliers (n = 5) I was left with a sample of 453 participants. Co-rumination was significantly and positively associated with neuroticism ($F[1,451]=28.17$, $p < 0.001$, $R^2 = 0.058$) which accounted for 5.8% of the variance in co-rumination scores. Neither openness, agreeableness, conscientiousness nor extraversion were significantly associated with co-rumination (p-values > 0.21).

Chapter 5

5 Discussion

Since its conceptualization (Rose, 2002), research has found strong associations between co-rumination and internalizing symptoms (Spendelow et al., 2017). Moreover, research indicates that while co-rumination is associated with positive relationship qualities (Ames-Sikora et al., 2017), it may contribute to social difficulties outside co-ruminative relationships (Rose et al., 2017). This study expanded on findings showing that co-rumination is associated with more social difficulties (Starr & Davilla, 2009; Tompkins et al., 2011) by examining the social impacts of co-rumination via social network analysis. I assessed the potential influence of co-rumination on broad social network characteristics (i.e., network size and density; HII), within particular relationships (i.e., tie strength and multiplexity; HI), and network management skills during the transition to university. I also examined potential associations between co-rumination and internalizing symptoms during this transition (HIII). In addition to my preregistered hypotheses, I conducted several analyses that further explored associations between co-rumination and both relationship- and individual-level factors.

5.1 Relationship-level Characteristics

Evidence suggests that co-rumination is robustly associated with positive relationship-level outcomes (Rose 2002; 2007), thus I predicted that co-rumination within a relationship would be associated with greater tie strength (HIA). Indeed, across an individual's social network, a greater tendency to co-ruminate within a particular relationship was associated with greater tie strength. That is, individuals tended to co-ruminate in relationships they viewed as particularly close, satisfactory, and high quality, supporting the idea that co-rumination is associated with positive relationship-level outcomes (Felton et al., 2019; Starr & Davila 2009). Furthermore, these findings highlight that the association between co-rumination and positive relationship perceptions is generalizable across a variety of relationships within an individual's social network.

Analyses also revealed that men reported greater tie strength across their network compared to women. One potential explanation for this finding is that the men in the sample simply did not list as many weak ties as women did. However, it is possible that men and women evaluate their relationships differently, contributing to the tie strength disparities found in this study.

Women tend to have higher expectations of their friends (Hall, 2010) and are more critical of friendship rule violations (e.g., cancelling plans, sharing a secret with others, etc.; Felmlee & Muraco, 2009). Discrepancies between an individual's relationship ideals and actual relationship characteristics contribute to lower levels of relationship satisfaction (Demir & Orthell, 2008). Indeed, I found that while men and women did not differ in the average quality of the relationships within their network, women were significantly less satisfied and displayed greater variance in satisfaction across relationships. Women also showed greater variance in their ratings of quality across their network indicating that they may be more hesitant to qualify a relationship as high quality, potentially due to discrepancies between their ideal and real relationships. Thus, the friendships women form during the university transition may on average fail to meet their ideals, resulting in lower satisfaction and greater variance in quality, even though some of these relationships may meet expectations over time.

Women and men tend to use different qualifiers for relationship closeness. For example, more women than men identify self-disclosure, provision of help and support, as well as expressed feelings of warmth and caring through verbal and nonverbal cues as indicators of closeness in a relationship (Parks & Floyd, 1996). While these aspects of friendships are important to men, women tend to prioritize them more (Zarbatany et al., 2004). The gender differences seen in the identification of closeness cues and need for intimacy may have an impact on closeness perceptions in new relationships. Given that I surveyed participants in the early stages of their university relationships, it is possible that the new friendships women are forming have yet to display cues for closeness. Thus, disparities between men and women's qualifiers for "close" relationships and the time at which I surveyed participants may have contributed to the gender disparities in closeness across one's social network.

Co-rumination may have also contributed to the lower average tie strength found across women's networks. Women tend to both ruminate (Johnson & Whisman, 2013) and co-ruminate (Tompkins et al., 2011) more than men. I found that individuals with a high tendency to co-ruminate discuss relationship (i.e., peer, friend, and romantic/sexual partner) problems more than those with a low to moderate co-rumination tendency. Thus, it is possible that when women co-ruminate in their close relationships about external relationship problems, these discussions drive lower evaluations of such relationships. Indeed, both rumination and co-rumination are associated with negative emotions and negative thinking patterns (Rudiger & Winstead, 2013; Watkins & Roberts, 2020). Thus, the potential gender differences in average tie strength across a network may in part be due to differences in relationship evaluations which are further exacerbated by co-rumination pertaining problems with peers, friends, and partners.

Both multiplexity and co-rumination within a relationship tend to be associated with positive relationship evaluations thus, I predicted that co-rumination would occur more often in socio-emotionally multiplex relationships (HIB). I found support for this hypothesis such that individuals tended to co-ruminate in relationships that fulfilled a greater number of socio-emotional roles. These results indicate that relationships where co-rumination occurs often provide a variety of other forms of socio-emotional support such as tangible support (e.g., helping an individual study) or sharing successes and happy events and may therefore be perceived as closer. Furthermore, the association between co-rumination and socio-emotional multiplexity provides insight into potential similarities between co-ruminative partners.

Previous literature suggests similarities in co-ruminative partners in terms of how they engage in this behavior (Schwartz-Mette & Rose, 2012), suggesting that co-rumination tendencies may be a friendship selection factor. As individuals in multiplex relationships tend to have similar characteristics, the results of this study indicate that co-ruminative partners may be similar in ways beyond their co-ruminative engagement. Furthermore, greater multiplexity within a relationship contributes to increases in similarity over time (Mesch & Talmund, 2006). Thus, co-ruminators may share certain characteristics that signal the potential for co-ruminative conversations and eventual friendship, which may

further enhance their similarity. Examining the social cues that co-ruminators send and receive while co-ruminating would allow for a better understanding of the effects of co-rumination on friendship formation.

5.1.1 Broad Network Characteristics and Network Management Skills

Previous literature has found that individuals with a greater tendency to co-ruminate report social difficulties outside of the relationships in which they co-ruminate (Starr & Davilla, 2009; Tompkins et al., 2011). Thus, I hypothesized that individuals with a greater tendency to co-ruminate would have difficulties developing their social network during their transition to university. Specifically, I predicted that co-rumination would be associated with a greater tendency to dissolve ties, prioritize the maintenance of close ties, and a reduced tendency to initiate new ties along with smaller network size and density (HII). Co-rumination was only found to be positively associated with tie initiation though given that it only accounted for 0.7% of the variance in initiation, it is unlikely to have practical significance for network management. None of the proposed hypotheses regarding co-rumination and network management skills or network size/density were supported. These null findings indicate that having a greater tendency to co-ruminate may not put an individual at risk during the flurry of network building that occurs during first few months of university.

One potential explanation for these null findings is that individuals' scores on the network management inventory may not reflect their actual behaviour. Longitudinal analyses would best reveal participants' tendency to initiate, maintain and dissolve ties while elucidating potential discrepancies between perceived and actual network management skills. Moreover, it is possible that while individuals may make attempts to initiate and maintain ties, these attempts may not be successful. This may be especially true for co-ruminators as they tend to be less socially accepted (Tompkins et al., 2011).

In addition, the findings that co-rumination was not associated with network size or density during the university transition may indicate that the negative influence of co-rumination on peer interactions may not occur during the initial network development

stage and instead may develop over time. During the first few months of university, social life may be somewhat more structured in that students are provided with numerous opportunities to form relationships through orientation, sport, extracurricular, and residence activities. Participation in such activities is associated with feelings of social connectedness and support and have been shown to ease the university transition while enabling the formation of deep social relationships (Evensen, 2017; Andre et al., 2017). Beyond orientation, residence and floor-wide events facilitated by the university (e.g., floor dinners, movie nights, etc.) may further contribute to new social tie formation. In the context of this structured activity, co-ruminators may have similar network building strategies to those with less tendency toward this behaviour. However, during the second semester and beyond, organized activities tend to decrease. In accord, over the course of one's first year in an undergraduate program the number of new acquaintances met by students in residence decreases over time (Hays & Oxley, 1986). Given robust evidence that intimate self-disclosure is associated with liking (e.g., Collins & Miller, 1994; Sprecher et al., 2013; Tal-Or & Hershman-Shitrit, 2014), it is possible that co-ruminators make fast friends because of their willingness to discuss negative feelings and problems during a stressful university transition. However, as time goes on, their peers may grow tired of these repetitive, frequent, and negative discussions, which may result in tie dissolution. Additionally, the frequent discussion of personal problems and negative feelings may result in empathetic distress in their friends further driving tie dissolution (Smith & Rose, 2011). Finally, co-ruminators themselves may dissolve ties when they find themselves unable to reciprocally co-ruminate. Thus, individuals with a high tendency to co-ruminate may indeed be at risk for social network difficulties, however these challenges may not occur until after the initial first semester social network boom. Longitudinal network analysis studies examining peer perceptions, co-rumination and network development over time would help uncover how co-rumination affects network development and whether co-ruminators or non-co-ruminators are responsible for actively dissolving these network ties.

5.1.2 Internalizing Symptoms

Consistent with hypotheses (HIII), co-rumination was significantly associated with higher levels of depressive and anxious symptoms. These findings support the well-established link between co-ruminative tendencies and internalizing symptoms (Spendelow et al., 2017). The impact of co-rumination tendencies on depressive and anxious symptoms did not appear to vary across gender as some previous findings have found (Rose et al., 2007; Calmes & Roberts 2008). However, these findings do support a recent meta-analysis suggesting that the association between co-rumination and internalizing symptoms does indeed not differ between men and women (Spendelow et al., 2017). Thus, both women and men that frequently co-ruminate with their confidants may be equally at risk for developing internalizing symptoms.

Contrary to my hypotheses (HIII) and previous literature (Domènech-Abella et al., 2019; Wildes et al., 2002), depressive symptoms were not associated with network size. Again, these null findings may reflect the social conditions of the first few months of university, in which people have many structured opportunities to meet friends and make acquaintances. These network building activities may buffer the associations between co-rumination, depressive symptoms, and network size during the first semester of university. However, as these organized activities slow down and cease, links between depressive symptoms and network size may re-emerge.

5.1.3 Exploratory Findings

Several studies have examined the influence of co-rumination across a variety of relationship types (e.g., Ames-Sikora, Donohue& Tully et al., 2017; Barstead et al., 2013; Calmes & Roberts, 2008), however none have looked at this association across an individual's entire social network. Thus, I explored whether co-rumination levels within a particular relationship and relationship type (i.e., friend, acquaintance, romantic/sexual partner) predicted tie strength and socio-emotional multiplexity. Across all relationship types, co-rumination within that relationship was associated with increases in tie strength and multiplexity. However, these associations appeared to be strongest for romantic/sexual relationships. These findings suggest that co-rumination may be a critical

process in romantic/sexual relationships that drives perceptions of closeness, quality and satisfaction and is associated with the number of socio-emotional roles that a relationship fulfills. Interestingly, at high levels of co-rumination friendships were the most multiplex, indicating that individuals in these relationships take on a large number of socio-emotional roles. Given its role in friendships and romantic/sexual relationships, future research should examine whether socio-emotional multiplexity mediates the previously established association between co-rumination and empathetic distress (Smith & Rose, 2011).

The majority of studies examining co-rumination and psychological outcomes have focused on the costs as opposed to potential benefits of co-rumination. Given that researchers have suggested individuals from marginalized groups may benefit from co-ruminative discussions involving problems faced by groups members, I explored the influence of co-ruminating about microaggressions in queer folks and people of colour.

Unlike the total sample, co-rumination was not found to be associated with depressive symptoms in either queer folks or people of colour. Moreover, no significant interaction between microaggressions and co-rumination was found. These findings suggest that co-rumination within these groups is not associated with an individual's depressive symptoms. Future research should further examine the mechanisms that drive associations between microaggressions and depressive symptoms in a larger sample to create a better understanding of this process and advise interventions.

In both samples, co-rumination was positively associated with anxious symptoms. However, only in the queer sample did discussions about experiences with microaggressions moderate the association between co-rumination and anxious symptoms. Specifically, I found that when individuals with a high tendency to co-ruminate do so about experiences with microaggressions, they had lower anxious symptoms compared to those that did not discuss that topic. Given the small sample size and cross-sectional design, these results should be interpreted cautiously. Specifically, these results do not determine whether co-rumination decreases anxious symptoms in queer folks over time. However, the findings of this study do provide preliminary

evidence that co-rumination may be an effective coping strategy for queer folks, however not for people of colour, that are experiencing microaggressions. Future research should examine the role of co-ruminative partner identity (i.e., whether the individual they are co-ruminating with shares the same racial/ethnic or queer identity) on co-rumination pertaining microaggressions. Additionally, future work should further explore the role of social support in buffering the association between anxious symptoms and microaggressions in people of colour. Finally, research examining co-rumination about microaggressions would benefit from a longitudinal design to determine the predictive value of this behaviour on the mental health of queer folks and people of colour.

Another gap in the co-rumination literature is understanding what topics individuals typically co-ruminate about. I found that a larger proportion of individuals with a high tendency to co-ruminate discussed peer, friend and romantic/sexual partner problems compared to those with low to moderate co-ruminative tendencies. These results suggest that interpersonal problems are a key discussion topic during co-rumination. This focus on interpersonal issues may predict later social network difficulties, especially if one's co-ruminative partner is encouraging tie dissolution. Another interesting finding was that across all three levels of co-rumination, school/work problems were the most common topic of discussion. Specifically, over 96% of all participants within the sample reported discussing school/work when sharing personal problems and negative feelings with confidants in their network. Thus, the majority of participants were experiencing problems with school and work within their first semester of university and turned to their social network to discuss these issues.

Finally, I examined associations between co-rumination and the Big Five personality dimensions as this has yet to be explored in the literature. Co-rumination was only found to be associated with neuroticism such that individuals that endorsed higher neuroticism reported a greater tendency to co-ruminate. These results are unsurprising given that both constructs are robustly associated with anxious and depressive symptoms (Spendelow et al., 2017; Lahey, 2009).

5.2 Limitations and Future Directions

One obvious limitation of this study is its cross-sectional design, which is highly dependent on the timing of data collection and cannot show change over time. Nonetheless, this study provides valuable information about co-rumination and social network building. Specifically, although I failed to support the idea that co-rumination is a risk factor for social difficulties, it does suggest that at least during students' first few months at university, even co-ruminators show typical network development patterns. This is important because it suggests that social difficulties may not affect initial network building but instead that the effects of co-rumination on network development may be more likely to appear over a longer timescale. Future work involving longitudinal designs would help elucidate such network processes.

Another important limitation to this study is that students may have faced relationship challenges due to Ontario's COVID-19 restrictions on social gatherings. Although the university campus supported a fully immersed on-campus experience, masking requirements and other public health measures may have interfered with at least some network management behaviors. Future research might validate these findings in the context of new samples of participants making the transition to university in future years.

5.3 Conclusion

This study provides a critical look at the impact of co-rumination on social network building during the initial transition to university. Although I found that more co-rumination within specific relationships was associated greater tie strength and multiplexity, I did not find much evidence for the anticipated social difficulties associated with the tendency co-ruminate (Rose et al., 2017; Tompkins et al., 2011). Instead, at this initial network creation stage of network development, people who co-ruminate may not experience difficulties in the highly socially structured context of university residence living and orientation. This surprising finding is important because it shows that the tendency to co-ruminate may have a more developmental element to it, which unfolds over longer time periods when relationship maintenance may be placed more firmly in

participants' own hands. Future research in this area should therefore focus on examining these associations from a longitudinal perspective.

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Appendices

Appendix A: Ethics, consent/letter of information & debriefing

Western Research

Date: 9 September 2021

To: Dr. Erin Heerey

Project ID: 118902

Study Title: Social Networks and Relationships

Application Type: NMREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 01/Oct/2021

Date Approval Issued: 09/Sep/2021 13:00

REB Approval Expiry Date: 09/Sep/2022

Dear Dr. Erin Heerey

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

This research study is to be conducted by the investigator noted above. **All other required institutional approvals and mandated training must also be obtained prior to the conduct of the study.**

Documents Approved:

Document Name	Document Type	Document Date	Document Version
NetworkInterview	Interview Guide	01/Jul/2021	1
AdvertPAID_V02	Recruitment Materials	08/Aug/2021	2
AdvertWEB_V02	Recruitment Materials	08/Aug/2021	2
Questionaires_V03	Online Survey	26/Aug/2021	3
Debriefing_V02	Debriefing document	26/Aug/2021	2
AdvertSONA_V02	Recruitment Materials	08/Aug/2021	2
LOI_PAID_V03	Implied Consent/Assent	26/Aug/2021	3
LOI_SONA_V03	Implied Consent/Assent	26/Aug/2021	3

No deviations from, or changes to the protocol should be initiated without prior written approval from the NMREB, except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario. Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB. The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Ms. Katelyn Harris , Research Ethics Officer on behalf of Dr. Randal Graham, NMREB Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Project Title: Social Networks and Relationships

Document Title: Letter of Information

Research Team: Dr. Erin Heerey, PhD ([redacted]; Principal Investigator)
Ms. Samantha Jones ([redacted])

Invitation to Participate: You are being invited to participate in a research study investigating individual differences in how people manage and build their social networks. You are being invited to participate because you responded to a SONA advertisement for this study.

Why is this study being done? The purpose of this study is to understand how individual differences relate to the structure of people's social networks and relationships within those networks.

How long will you be in this study? Participation takes about 90 minutes and the session will take place in the laboratory.

What are the study procedures? If you decide to participate, we will ask you to:

- Provide demographic information (e.g., age, gender) so researchers can examine characteristics of the study's sample
- Complete a series of questionnaires assessing aspects of personality, communication styles, and psychological well-being
- Complete a guided social network interview examining how you build relationships (e.g., friendships) within your personal social network

What are the risks and harms of participating in this study? This is a low-risk study and there are no known harms to participating. The main risks to you are that 1) you may feel uncomfortable answering some of the questions on the questionnaire or guided interview. If this occurs, you may skip those items. 2) Some questions may bring up negative feelings. If this occurs, you may skip these items and/or terminate your participation in the study. If COVID-19 safety restrictions allow, a fully vaccinated experimenter will be available to answer any questions you have at any point in the study in person. Alternately, the experimenter can establish a video link with you from another lab room to answer your questions (the video session will not be recorded).

What are the benefits of participating in this study? Other than that you might find it interesting, there is no direct benefit to you for participating in this study. However, your participation might help us to understand how individual differences relate to social network structures and relationships.

How will participants' information be kept confidential? All information that we obtain from you is confidential. Questionnaire information and task results will be collected using a unique participant code (below), which will never be linked to your name. Furthermore, the email address you have provided to us will not be retained nor will it be linked to any identifiable information. The data will only be identified by your Participant ID code.

Your responses to our questionnaires will be collected anonymously through a third party, secure online survey platform called Qualtrics. Qualtrics uses encryption technology and restricted access authorizations to protect the privacy and security of all data collected and retained, including personal information. In addition, Western's Qualtrics server is in Ireland, where privacy standards are maintained under the European Union's General Data Protection Regulation, which is consistent with Canada's privacy legislation. Please refer to Qualtrics' Privacy Policy (https://www.qualtrics.com/privacystatement/) for more details about Qualtrics' information management practices. The data will then be exported from Qualtrics and securely stored on Western University's server. The collected data will be stored electronically in password-protected, encrypted files for 7 years, per Western University guidelines. While we do our best to protect your information, there is no guarantee that we will be able to do so.

Usually, it is only the research staff that will have access to the data. However, representatives of The University of Western Ontario Non-Medical Research Ethics Board may require access to your study-related records to monitor the conduct of the research. In addition, in the interest of promoting research transparency and facilitating independent scrutiny of our data, anonymized data from the study will be uploaded onto the lab's Open Science Framework (OSF) site (osf.io/p6n3b) and made available to interested scientists. These public data will use an anonymous study ID that will never be able to be linked back to you personally. This ID will be generated using a random number generator and will thus be different than the participant ID you received today. Moreover, all of the names of individuals you list in the Network Survey will be changed to Friend 1, Acquaintance 1, Partner 1, etc., accordingly. Please note that these anonymized data may be used by either current or other researchers to answer future research questions that are not related to the specific aims of this study. By consenting to participate, you are agreeing to this possibility. If study results are published, no information that identifies you will be included.

Can participants choose to leave the study? Participation in this study is voluntary. You are free to withdraw from the study at any time and without penalty, even after the research has concluded but only up until the point of publication. You do not need to provide a reason. You may withdraw from the study by emailing the experimenter (see details above) or by contacting Dr. Erin Heerey ([redacted]) and submitting your participant code as it appears below. If you choose to withdraw from this study prior to publication, all data associated with your code will be fully removed from any data sets and destroyed.

Are participants compensated for their time? This is a 90-minute study. If you are an Introductory Psychology student (Psychology 1002 or 1003), you will receive 1.5 SONA credits for participating. If you are participating in the context of a different class, you will receive compensation based on the information provided in the course syllabus. If you have any questions about the compensation, please review your course syllabus or contact the instructor.

What are the rights of participants? Your participation in this study is voluntary. You may decide not to be involved. Even if you consent to participate, you have the right to not answer individual questions or to withdraw from the study at any time. If you choose not to participate or choose to leave the study, it will have no effect on your academic standing. If new information is learned during the study that might affect your decision to stay in the study, we will inform you of this. You do not waive any legal right by consenting to the study.

Whom do participants contact for questions? If you would like more information, or a summary of study results, please contact Dr. Erin Heerey via email ([redacted]) or phone [redacted].

If you have any questions about your rights as a research participant or concerns about the conduct of this study, you may contact The Office of Human Research Ethics [redacted], email: [redacted]

If you choose to participate, your participant code is: SNR-_____

Please affirm (say "yes" to) the following items:

Affirming these items will indicate that you consent to participate.

- I have read and understood the Letter of Information.
- Any questions I chose to ask have been answered to my satisfaction.
- I understand that I may withdraw from the study at any time and do not need to provide a reason for doing so.
- I understand that I may withdraw from the study by emailing Dr. Heerey my participant code.
- I understand that I am free to skip any questionnaire items that I do not wish to answer.
- I am aware that my anonymized data will be uploaded onto the lab's Open Science Framework site (OSF) to promote research transparency and verification.
- If I consent to participate, I promise that I will participate conscientiously and to the best of my ability.
- I consent to participate.

A copy of this letter will be emailed to you.

DEBRIEFING FORM

Social Networks and Relationships

The purpose of this research is to understand how certain characteristics and social interaction styles relate to an individual's social network and the relationships within that network.

To answer this question, you completed a series of questionnaires which assessed aspects of your social interaction style, personality and psychological well-being. You also completed a social network interview which assessed the relationships and structure of your personal social network. We will be examining whether we can predict social network structure and psychological well-being based on how you answered the questionnaires.

Ultimately, this research will help us to understand how individual traits impact an individual's social network structure as well as the quantity and quality of the relationships within them. This research will help us to understand the impact that personality and social interaction style have on components of an individual's social network. Furthermore, this study will help us understand how differences in social network characteristics may relate to psychological well-being.

If you have questions or would like more information, please email Dr. Erin Heerey ([redacted]) If you would like to learn more about the study results, we would be happy to provide them once data collection is complete. Note that we will only be able to provide you with general results and will not be able to tell you about your data specifically. Please email Dr. Erin Heerey at the email address above if you wish to receive a study summary. If you are worried about any symptoms you have been experiencing, please talk with someone who is qualified to help. You may make an individual counseling appointment by attending the walk-in clinic at Western University Psychological Services ([redacted]) or you may phone a help line (e.g., Good2Talk [[redacted]]; Reach Out (London) [[redacted]]).

Here are some references if you would like to read more.

Gillath, O., Karantzas, G. C., & Selcuk, E. (2017). A net of friends: Investigating friendship by integrating attachment theory and social network analysis. *Personality and Social Psychology Bulletin*, *43*(11), 1546-1565.

Rose, A. J. (2002). Co–rumination in the friendships of girls and boys. *Child development*, *73*(6), 1830-1843.

Felton, J. W., Cole, D. A., Havewala, M., Kurdziel, G., & Brown, V. (2019). Talking together, thinking alone: Relations among co-rumination, peer relationships, and rumination. *Journal of youth and adolescence*, *48*(4), 731-743.

Thank you for participating! A copy of this form will be emailed to you.

Appendix B: Qualtrics Questionnaires

Email

In an attempt to remain paperless, we will send you an email with the letter of information you just read. You will also receive a debriefing form upon completion of the study.

Please provide your WESTERN STUDENT EMAIL below:

Demographics

Please tell us a little bit about yourself through the following questions:

How old are you in years?
What is your year of study?

First year
Second year
Third year
Fourth year
Fifth year and beyond

Did you move away from home to attend university/college?

Yes
No

**If yes…*
Have you made a permanent move back home since initially moving away?

Yes
No

Please select the identity which best describes you:

***Cisgender:** an individual's gender identity aligns with their sex assigned at birth
***Transgender:** an individual's gender identity is different from their sex assigned at birth

Cisgender Woman
Cisgender Man
Transgender Woman
Transgender Man
Non-binary
Two-spirit
Gender queer
Other gender not specified here: _____
Prefer not to say

Please indicate your sexual orientation:

Heterosexual
Gay/Lesbian
Bisexual
Other sexual orientation not specified here: _____
Prefer not to say

Please select all ethnic/racial identities that apply to you:

White
South Asian (e.g. East Indian, Pakistani, Sri Lankan, etc.)
Chinese
Black
Filipino
Latin American
Arab
Southeast Asian (e.g. Vietnamese, Cambodian, Laotian, Thai, etc.)
West Asian (e.g. Iranian, Afghan, etc.)
Korean
Japanese
Indigenous
Other ethnicity/race not listed here: _____

Co-rumination Questionnaire

Rose, A. J. (2002). Co–rumination in the friendships of girls and boys. *Child development*, *73*(6), 1830-1843.

The following statements describe ways in which problems are discussed between two individuals. For this section, please think about how you **typically** behave when discussing personal problems or feelings with a non-family member individual (e.g., friend, acquaintance, partner) in your life. In this survey, we will be referring to those individuals as a **confidants**.

Please read each statement carefully and use the scale provided to indicate how true you feel each statement is.

Not at all true				Really true
1	2	3	4	5

We spend most of our time together talking about problems that my confidant(s) or I have
If one of us has a problem, we will talk about the problem rather than talking about something else or doing something else
After my confidant(s) tells me about a problem, I always try to get her/him/them to talk more about it later
When I have a problem, my confidant(s) always tries really hard to keep me talking about it
When one of us has a problem, we talk about it for a long time
When we see each other, if one of us has a problem, we will talk about the problem even if we had planned to do something else together
When my confidant(s) has a problem, I always try to get her/him/them to tell me every detail about what happened
After I've told my confidant(s) about a problem, she/he/they always tries to get me to talk more about it later
We talk about problems that my confidant(s) or I are having almost every time we see each other
If one of us has a problem, we will spend our time together talking about it, no matter what else we could do instead
When my confidant(s) has a problem, I always try really hard to keep her/him/them talking about it
When I have a problem, my confidant(s) always tries to get me to tell every detail about what happened
We will keep talking even after we both know all of the details about what happened
We talk for a long time trying to figure out all the different reasons why the problem might have happened
We try to figure out every one of the bad things that might happen because of the problem

We spend a lot of time trying to figure out parts of the problem we can't understand
We talk a lot about how bad the person with the problem feels
We'll talk about every part of the problem over and over
We talk a lot about the problem in order to understand why it happened
We talk a lot about all of the different bad things that might happen because of the problem
We talk a lot about parts of the problem that don't make sense to us
We talk for a long time about how upset it has made one of us with the problem
We usually talk about that problem every day even if nothing new has happened
We talk about all of the reasons why the problem might have happened
We spend a lot of time talking about what bad things are going to happen because of the problem
We try to figure out everything about the problem, even if there are parts we may never understand
We spend a long time talking about how sad or mad the person with the problem feels

Network Management Inventory

Gillath, O., Johnson, D. K., Selcuk E. & Teel, C. (2011). Comparing old and young adults as they cope with life transitions: the links between social network management skills and attachment style to depression. *Clinical Gerontologist, 34*(3), 251-265.

When people deal with major life changes (e.g., starting a new school or job, moving to a new city), changes in relationships with individuals in your life (i.e., social network members) are normal. Please tell us what happens to your relationships with your social network members when you deal with major life changes. Please respond to each statement by indicating how much you agree or disagree with it using the scale provided.

Disagree strongly			Neutral/mixed			Agree strongly
1	2	3	4	5	6	7

When I deal with major life changes…

I add new people to my social network
I regularly get in touch with old social network members but only if I was close to them
I regularly get in touch with old social network members regardless of how close we were
I lose people from my social network
I like meeting new people
I only tend to keep in contact with old social network members I was close with
I tend to keep in contact with many people from my old social network even if we weren't especially close
I lose touch with people in my social network
I make new friends
I only turn to old social network members I was close with for support
I turn to friends and acquaintances from my old social network when I am in need of support
The closeness I feel toward my social network members decreases
It is easy for me to let go of old friends
I prefer to keep in touch only with old friends and not old acquaintances
I like keeping in touch with old acquaintances as well as old friends
I disconnect from my friends
It is easy for me to add new people to my social network
I only phone, text or email old social network members I was close with
I phone, text or email a variety of people from my old network regardless of how close we were I feel comfortable letting my old network fade

Hospital Anxiety and Depression Scale (HADS)

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta psychiatrica scandinavica, 67*(6), 361-370.

Please read each statement and select the reply which comes closest to how you have been feeling in the **past week**.

I fell tense or 'wound up':

Most of the time
A lot of the time
From time to time, occasionally
Not at all

I still enjoy the things I used to enjoy:

Definitely as much
Not quite so much
Only a little
Hardly often

I get a sort of frightened feeling as if something awful is about to happen:

Very definitely and quite badly
Yes, but not too badly
A little, but it doesn't worry me
Not at all

I can laugh and see the funny side of things:

As much as I always could
Not quite so much now
Definitely not so much now
Not at all

Worrying thoughts go through my mind:

A great deal of the time
A lot of the time
From time to time, but not too often
Only occasionally

I feel cheerful:

Not at all
Not often
Sometimes
Most of the time

I can sit at ease and feel relaxed:

Definitely
Usually
Not often
Not at all

I feel as if I am slowed down:

Nearly all the time
Very often
Sometimes
Not at all

I get a sort of frightened feeling like 'butterflies' in the stomach:

Not at all
Occasionally
Quite often
Very often

I have lost interest in my appearance:

Definitely
I don't take as much care as I should
I may not take quite as much care
I take just as much care as ever

I feel restless as if I have to be on the move:

Very much indeed
Quite a lot
Not very much
Not at all

I look forward with enjoyment to things:

As much as I ever did
Rather less than I used to
Definitely less than I used to
Hardly at all

I get sudden feelings of panic:

Very often indeed
Quite often
Not very often
Not at all

I can enjoy a good book or radio or TV program:

Often
Sometimes
Not often
Very seldom

Big Five Inventory

John, O. P., & Srivastava, S. (1999). The Big-Five trait taxonomy: History, measurement, and theoretical perspectives . In L. A. Pervin & O. P. John (Eds.), Handbook of personality: Theory and research (Vol. 2, pp. 102–138). New York: Guilford Press.

Here are a number of characteristics that may or may not apply to you. For example, do you agree that you are someone who likes to spend time with others? Please select a number next to each statement to indicate the extent to which you agree or disagree with that statement.

Disagree strongly	Disagree a little	Neither agree not disagree	Agree a little	Agree Strongly
1	2	3	4	5

I see myself as someone who…

Is talkative
Tends to find fault with others
Does a thorough job
Is depressed, blue
Is original, comes up with new ideas
Is reserved
Is helpful and unselfish with others
Can be somewhat careless
Is relaxed, handles stress well
Is curious about many different things
Is full of energy
Starts quarrels with others
Is a reliable worker
Can be tense
Is ingenious, a deep thinker
Generates a lot of enthusiasm
Has a forgiving nature
Tends to be disorganized
Worries a lot
Has an active imagination
Tends to be quiet
Is generally trusting
Tends to be lazy
Is emotionally stable, not easily upset
Is inventive
Has an assertive personality
Can be cold and aloof
Perseveres until the task is finished
Can be moody

Values artistic, aesthetic experiences
Is sometimes shy, inhibited
Is considerate and kind to almost everyone
Dose things efficiently
Remains calm in tense situations
Prefers work that is routine
Is outgoing, sociable
Is sometimes rude to others
Makes plans and follows through with them
Gets nervous easily
Likes to reflect, play with ideas
Has few artistic interests
Likes to cooperate with others
Is easily distracted
Is sophisticated in art, music and literature

Appendix C: Network Interview

Complex Data Collective. Network Canvas: Software to Simplify Complex Network Data Collection. 7 2016. For reference, see https://networkcanvas.com

In the next section of this study you will answer questions about the relationships you have with your friends, acquaintances and any romantic or sexual partners. This social network interview will be completed on a computer-based software that the experimenter will start for you once you have watched the video below. Please press "play" to view the video containing an overview and instructions for the tasks in the interview.

Once you have finished watching the video please let the experimenter know you are ready to begin the social network interview.

[Video 1 (An overview of the network interview)]

Please watch the following video for instructions on how to complete the first task. If you have any questions please raise your hand and an experimenter will be with you shortly. You may return to this video at any time throughout the interview.

[Video 2 (Instructions on how to list individuals in their network)]

Friend

An individual with whom one has a mutual bond of affection/liking

Acquaintance

An individual that one knows casually or is familiar with but who is not considered a friend

Romantic and/or Sexual Partner

An individual with whom one is romantically intimate and/or engages in sexual activity with

Please list up to 20 FRIENDS/10 ACQUAINTANCES/5 ROMANTIC/SEXUAL PARTNERS that you interact with either in-person or virtually (i.e., video calls, social media etc.) on a regular basis.

What is this person's name? Please use a unique name/nickname/initial such that no names or initials are repeated throughout the lists. Please only list each individual in your life ONCE. These names/nicknames should allow YOU to identify each person but should not allow another person (e.g. a member of the research team) to do so. Do NOT include any relatives.

Please confirm this individual is a
FRIEND/ACQUAINTANCE/ROMANTIC/SEXUAL PARTNER:

[Toggle button]

Please indicate this person's gender identity:

Female

Male

Non-binary

Other gender identity not specified here

Prefer not to say

Do you live with this individual?

Yes

No

If yes please specify (e.g., share a house with, roommate etc.)

*For romantic/sexual partners only…

How long have you been engaging in this type of relationship with this individual?

Less than 1 month

1-6 months

6-12 months

1-4 years

5+ years

Please select the option which best describes your relationship:

Hooking up/Friends with Benefits/Casual Sexual Partners

Dating

Committed relationship

Other

Where did you meet each individual?

School

Work

Hobby/club/sports team

Volunteering

Through a mutual friend or acquaintance

At a social event (e.g., party, night out, orientation social, etc.)

Other; please specify

For how long have you known each individual?

< 1 week

1-2 weeks

2-4 weeks

1-6 months

6-12 months

1-4 years

5+ years

How frequently do you interact with each individual (in person, social media, texting, calls, etc.)?

Less than monthly

Monthly

Few times a month

Weekly

Daily

Unsure

[Video 3 (instructions for completing the diagram)]

Use the diagram to show how close you feel towards each person (the closer they are to the center [indicated by the cross], the closer you feel towards them).

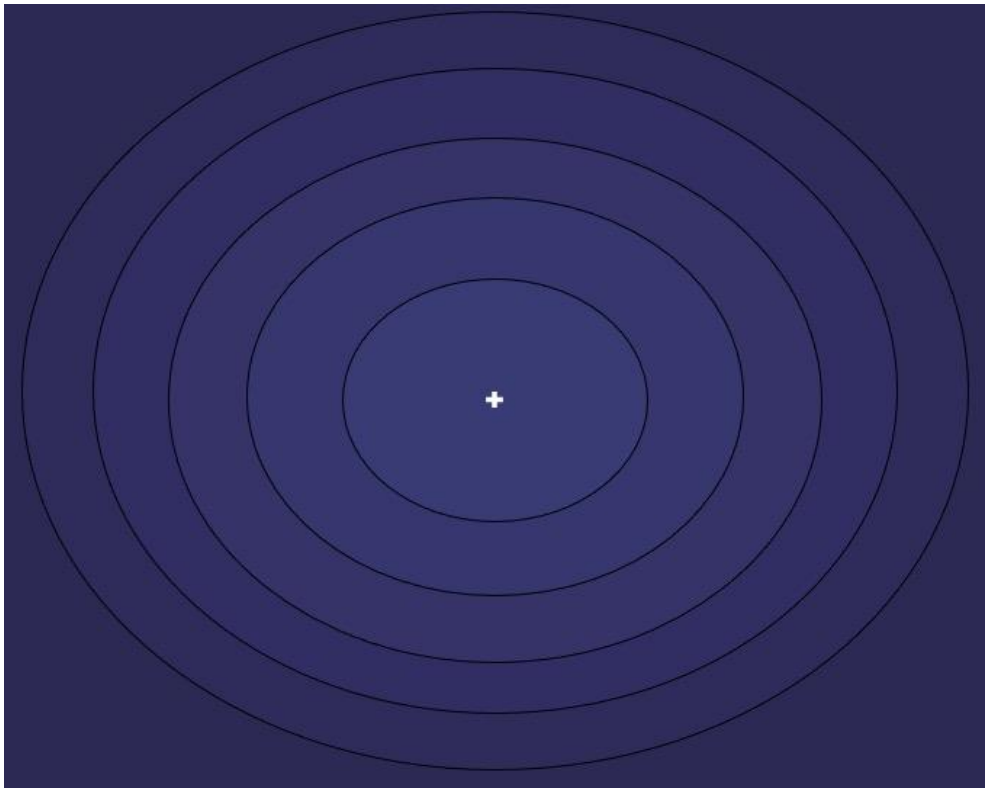
Next, connect any two people that would spend time together without you being there.

Select **ALL** individuals you share social activities with (e.g., grabbing coffee, going to a bar/party etc.).

Select **ALL** individuals you discuss personal matters with

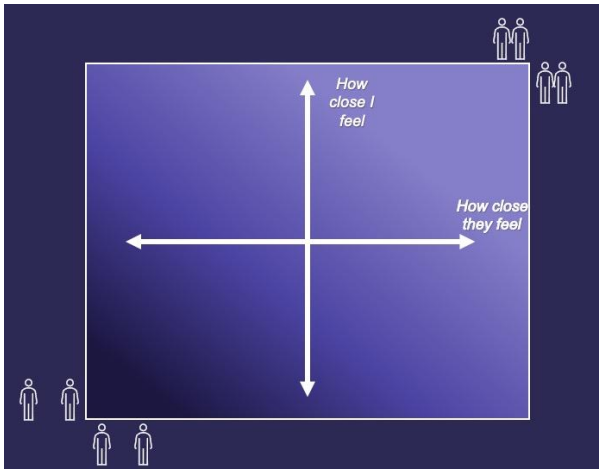
Select **ALL** individuals that provide you emotional support

Select **ALL** individuals that provide you NON-emotional support (e.g. helping you study for a test, driving you somewhere, loaning you money etc.).



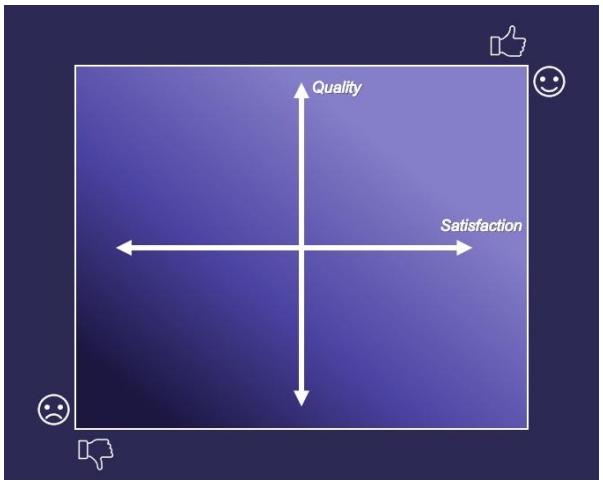
[Video 4 (instructions for completing the diagram)]

Please place individuals on this diagram based on how close you feel towards them and how close you **THINK** they feel towards you.



[Video 5 (instructions for completing the diagram)]

Please place individuals on this diagram based on how good you feel your relationship is, in terms of satisfaction and quality.



Do you share and talk about SUCESSES and HAPPY events with this individual?

Yes

No

Do you share and talk about FAILURES and UNHAPPY events with this individual?

Yes

No

Co-rumination Follow-up

Thinking back to what you said in the previous section regarding the discussion of personal problems and feelings with individuals in your life, how well do yours answers describe your interactions with each individual?

Not well at all

Slightly well

Moderately well

Very well

Extremely well

Thinking back to what you said in the previous section regarding the discussion of personal problems and feelings with individuals in your life, what topics do you typically speak about? Select ALL that apply.

If there is a type of problem you typically discuss that is not listed, please select other.

For reference, a micro-aggression is defined as “a comment or action that subtly expresses prejudiced attitudes towards members of a marginalized group (Meriam-Webster Dictionary)”. Micro-aggressions can include prejudice based on ethnicity, race, gender, sexual orientation, area of study, etc.

Please select all topics that apply:

Problems with friends

Problems with peers

Problems with romantic/sexual partners

Problems with family

Problems with school/work

Experiences with micro-aggressions

Other

Appendix D: Analysis of Modified Network Management Inventory – Short-Form

The original Network Management Inventory – Short Form (Gillath et al., 2008) includes the following three subscales: (1) tie initiation, (2) tie maintenance and (3) tie dissolution. In order to assess how individuals maintain different relationships (close vs. distant) participants answered the tie maintenance questions in two parts: (1) tie maintenance of *close* old network members and (2) tie maintenance of *distant* old network members. The modified tie maintenance items can be found below.

As the maintenance prioritization subscale was a created for the purposes of this study, I explored whether scores on this subscale were associated with the original tie initiation and dissolution subscales of the NMI. Analyses revealed neither tie initiation (F[1, 456] = 2.12, β = 0.04, p = 0.15, R^2 = 0.002) nor tie dissolution (F[1, 456] = 0.42, β = 0.03, p = 0.52, R^2 = - 0.001) was significantly associated with maintenance prioritization.

1. I regularly get in touch with old social network members but only if I was close to them.
2. I regularly get in touch with old social network members regardless of how close we were.
3. I only tend to keep in contact with old social network members I was close with
4. I tend to keep in contact with many people from my old social network even if we weren't especially close.
5. I only turn to old social network members I was close with for support.
6. I turn to friends and acquaintances from my old social network when I am in need of support.
7. I prefer to keep in touch only with old friends and not old acquaintances.
8. I like keeping in touch with old acquaintances as well as old friends.
9. I only phone, text or email old social network members I was close with.
10. I phone, text or email a variety of people from my old network regardless of how close we were.

Appendix E: Supplementary Results

Table 1.

Descriptive Statistics Across Key Variables

	Mean	*Median*	*SD*	*Min*	*Max*
CRQ	84.22	85.0	16.34	36.0	133.0
HADS-D	6.03	6.0	3.37	0.0	16.0
HADS-A	11.68	12.0	4.28	0.0	21.0
NMI_I	20.04	20.0	4.53	6.0	28.0
NMI_D	22.98	23.0	6.24	9.0	42.0
NMI_P	13.65	14.0	6.87	-4.0	30.0
Network Size	17.97	17.0	6.76	4.0	35.0
Network Density	0.13	0.11	0.08	0.0	0.65
Average Closeness – Sociogram Task	0.42	0.42	0.04	0.26	0.53
Average Closeness – Quadrant Task	0.69	0.69	0.08	0.38	0.82
Average Relationship Quality	0.63	0.63	0.07	0.42	0.84
Average Satisfaction with Quality	0.57	0.56	0.09	0.30	0.85
Average Tie Strength	9.60	9.64	1.21	6.50	12.93
Average Multiplexity	2.91	2.94	0.81	0.71	5.18
Average Ego-alter Co-rumination	2.27	2.25	0.47	1	4

Note. Descriptive statistics across key variables within entire sample (N = 458). SD = Standard Deviation; CRQ = Co-rumination Questionnaire; HADS-D = Hospital Anxiety and Depression Scale: Depression; HADS-A = Hospital Anxiety and Depression Scale: Anxiety; NMI_I = Network Management Inventory: Initiation; NMI_D = Network Management Inventory: Dissolution; NMI_P: Network Management Inventory: Prioritization. Relationship-level variables (i.e., closeness, relationship quality etc.,) were averaged for each individual (e.g., the average relationship quality for alters in a participant's network).

Table 2.

Bivariate Correlations of Key Variables

	Network Size	Network Density	CRQ	HADS-D	HADS-A	NMI-I	NMI-D	NMI-P	Average Tie Strength	Average Multiplexity
Network Size	-	-0.39***	0.01	-0.05	-0.07	0.16**	-0.03	0.07	-0.23***	-0.34***
Network Density	-0.39***	-	0.00	0.02	0.08	-0.07	-0.06	0.01	0.13**	0.23***
CRQ	0.01	0.00	-	0.12*	0.18***	0.10*	0.03	0.01	0.01	0.02
HADS-D	-0.05	0.02	0.12*	-	0.48***	-0.22***	0.16**	-0.06	-0.13**	-0.04
HADS-A	-0.07	0.08	0.18***	0.48***	-	-0.17***	0.09	-0.04	-0.06	0.08
NMI-I	0.16**	-0.07	0.10*	-0.22***	-0.17***	-	-0.01	0.07	0.11*	0.07
NMI-D	-0.03	-0.06	0.03	0.16**	0.09	-0.01	-	0.03	-0.18***	-0.14**
NMI-P	0.07	0.01	0.01	-0.06	-0.04	0.07	0.03	-	-0.04	0.03
Average Tie Strength	-0.23***	0.13**	0.01	-0.13**	-0.06	0.11	-0.18***	-0.04	-	0.46***
Average Multiplexity	-0.34***	0.23***	0.02	-0.04	0.08	0.07	-0.14**	0.03	0.46***	-

Note. Bivariate correlations across key variables within entire sample (N = 458). CRQ = Co-rumination Questionnaire; HADS-D = Hospital Anxiety and Depression Scale: Depression; NMI_I = Network Management Inventory: Initiation; NMI_D = Network Management Inventory: Dissolution; NMI_P: Network Management Inventory: Prioritization. Relationship-level variables (i.e., closeness, relationship quality etc.,) were averaged for each individual (e.g., the average relationship quality for alters in a participant's network). $p < 0.05$ *, $p < 0.01$ **, $p < 0.001$***

Table 3.

T-tests comparing 17 year-olds and 18-22 year-olds across key variables

	17 year-olds (n = 65)		18-22 year-olds (n = 393)		t(456)	p	Cohen's d
	Mean	*SD*	*Mean*	*SD*			
CRQ	81.37	17.13	84.69	16.18	-1.52	0.13	0.2
HADS-D	6.32	3.67	6.00	3.33	0.74	0.46	0.1
NMI_I	19.60	4.49	20.12	4.54	-0.87	0.39	0.1
NMI_D	24.56	5.66	22.71	6.30	2.21	0.03*	0.3
NMI_P	13.24	6.73	13.72	6.90	-0.52	0.61	0.1
Network Size	18.40	6,94	17.89	6.73	0.46	0.58	0.1
Network Density	0.13	0.08	0.13	0.09	0.46	0.64	0.1
Average Tie Strength	9.48	1.14	9.62	9.64	-0.87	0.38	0.1
Average Multiplexity	2.87	0.77	2.91	2.94	-0.39	0.70	0.1

Note. SD = Standard Deviation; CRQ = Co-rumination Questionnaire; HADS-D = Hospital Anxiety and Depression Scale: Depression; NMI_I = Network Management Inventory: Initiation; NMI_D = Network Management Inventory: Dissolution; NMI_P: Network Management Inventory: Prioritization. *****$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Equations for Main Regression Analyses

Below are the regression equations for the main analyses (Hypotheses II & III) without gender as a covariate. Note that the first term in each regression equation represents the intercept and the second term is the slope multiplied by the effect of the independent variable plus the error.

Equation 1.

$$Tie\ Initiation = 17.84 + 0.03(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 4.512)$

Equation 2.

$$Tie\ Dissolution = 21.93 + 0.01(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 6.254)$

Equation 3.

$$Maintenance\ Prioritization = 13.96 - 0.004(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 6.822)$

Equation 4.

$$Network\ Size = 13.13 + 0.24(Tie\ Initiation) + \varepsilon$$

where $\varepsilon \sim N(0, 6.675)$

Equation 5.

$$Network\ Size = 18.62 - 0.03(Tie\ Dissolution) + \varepsilon$$

where $\varepsilon \sim N(0, 6.762)$

Equation 6.

$$Network\ Size = 17.06 + 0.07(Maintnenace\ Prioritization) + \varepsilon$$

where $\varepsilon \sim N(0, 6.749)$

Equation 7.

$$Network\ Size = 18.0 - 0.0002(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 6.749)$

Equation 8.

$$Network\ Density = 0.12 - 0.00003(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 0.085)$

Equation 9.

$$Depressive\ Symptoms = 3.98 + 0.02(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 3.357)$

Equation 10.

$$Network\ Size = 18.55 - 0.10(Depressive\ Symptoms) + \varepsilon$$

where $\varepsilon \sim N(0,6.756)$

Equation 11.

$$Anxious\ Symptoms = 7.74 + 0.05(Co - rumination) + \varepsilon$$

where $\varepsilon \sim N(0, 4.206)$

Curriculum Vitae

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Publications & Presentations:

Jones, S. M., & Heerey, E. A. (2022). Co-Rumination in Social Networks. *Emerging Adulthood*, 21676968221111316.

Jones, S.M. & Heerey, E.H. (May 2022). Co-rumination and Developing a Social Network in First Year University. Poster presentation at the Applied Psychological Science 2022 Conference. Chicago, Illinois.

Jones, S.M. & Heerey, E.H. (May 2022). Co-rumination and Mental Health in Queer Folks: An Exploratory Study. Poster presentation at Western University's 2022 Queer Research Day. London, Ontario.