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The Social Network and Attachment Bases of Loneliness

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University

by
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Abstract

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By David M. Ouellette

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This thesis tests Robert S. Weiss's 1973 theory of loneliness, which claims two types of loneliness: emotional and social. Emotional loneliness is the affective reaction to the absence of a close attachment bond. Social loneliness stems from inadequate integration into a social network. Undergraduate residents of a university dormitory completed questionnaires on loneliness, attachment, personality, and relationships with other dorm residents. Patterns of relational ties among participants were evaluated using social network analysis, specifically density, tie strength, and four forms of centrality. Results reveal that, while controlling for neuroticism, the network measure of outdegree and the two attachment dimensions accounted for more than half the variance in loneliness, $R = .73$. None of the three predictors intercorrelated significantly. A portion of loneliness is derived from one's internal attachment security and a separate portion is derived from the external features of one's social network integration.

1 Introduction

Loneliness is such a universal experience, seldom is it considered a psychological condition worthy of study. People usually consider it simply a part of life that must be endured. Telling a painfully lonely person that it happens to everyone and that it will pass is little salve. Historically, psychologists have considered loneliness such a mundane phenomenon, with obvious etiology and equally obvious solution, that it has eluded study. Only with the neo-Freudian emphasis on social development and interpersonal relations was loneliness even mentioned by psychologists, such as in the writings of Sullivan (1953), Heider (1958), and Fromm-Reichmann (1959).

Despite these early beginnings, most researchers have contented themselves with the assumption that loneliness is the reaction to not having enough friends or not having adequately close relationships with them. Up until 30 years ago, this facile interpretation had satisfied social scientists.

In 1973, Robert S. Weiss published a seminal book called *Loneliness: The Experience of Emotional and Social Isolation,* which spurred much research into the fundamental structure of loneliness itself. At its core, Weiss's argument is simple: There are two kinds of loneliness, emotional loneliness and social loneliness. This assertion flies in the face of folk psychology, which considers loneliness an open-and-shut case of a unitary affective reaction.

Weiss's abstract conception of loneliness is a deficit theory where loneliness is "being without some definite needed relationship or set of relationships" (p. 17). The unique characteristic of such a deficit theory is that, because the problem is the lack of

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something specific, only the restoration of that specific something will alleviate the problem. He notes that "random sociability" will not ameliorate the experience of loneliness and may in fact exacerbate it.

The definition of that missing something is what Weiss wrote about. His theory stems from the common observation that lonely people frequently appear to have no observable social deficits. Such as the lonely wives with loving husbands Weiss observed, there seems to be no discernible reason for loved and cared for people to feel disconnected from their social worlds. Weiss's argument is that these two types of loneliness arise from causes not easily within view of outsiders.

The kind of loneliness most people mean when they talk about their own experiences is *emotional loneliness,* characterized by the absence of a close, emotional bond with one other person. For adults, this bond often takes the form of a romantic attachment but a close friendship may also suffice. Weiss (1994) later argued that friendships rarely achieve the status of an attachment relationship. When people complain about the loneliness of being single, they are implicitly referring to this variety.

Weiss (1973) interviewed people who had recently lost a loved one, such as widows and widowers. These people still had their families, their children, and their friends. Nevertheless, the loss of people so central to their lives suggests that some need met by the spouse could not be fulfilled by anyone else. This absence of an attachment relationship, not merely its loss, lies at the heart of emotional loneliness.

However, Weiss also argued for the existence of another kind of loneliness: *social loneliness.* Inferred from a pilot study of married couples that had moved to Boston

(Weiss, 1973), social loneliness is the lack of integration into a social network. In his study of couples in Boston, the wives experienced "newcomer blues": they felt out of place and were homesick, despite having close and supportive relationships with their husbands. This point is important because it highlights the affective experience of loneliness while in the context of a loving relationship. Lay theories of loneliness are stymied by such an observation. In response, Weiss suggested that it is not enough to love and to be loved by an individual—the antidote to emotional loneliness—but one also needs to be a part of a meaningful social group.

At the core of the theory is the assumption that loneliness is not an outgrowth of individual distortions in social perception or of an unrealistically high need for companionship. Loneliness is the result of ordinary human needs that are not being met. In addition to elucidating the results of unmet needs, Weiss also explained how interpersonal relationships could satisfy those needs.

This thesis further explores Weiss's theory of loneliness. Founded upon the belief that social relationships provide something necessary, there will be a summary of Weiss's argument of the provisions of social relationships. The six provisions are grouped according to emphasis, either security or affiliation, which correspond to needs for attachment and needs for social integration.

In the absence of those provisions, either of two types of loneliness ensues. Emotional loneliness will be discussed first, as it is the most intuitive and theoretically established. Derived from Bowlby's (1969, 1973, 1980) theory of attachment and Weiss's (1974) three social provisions of security, emotional loneliness is characterized by beliefs

that the self is unworthy of love or that other people are untrustworthy as sources of love or both.

The next section will detail the course of social loneliness's conceptual development, with particular attention paid to the various methods of operationalizing "social integration." Based on the three social provisions of affiliation, social loneliness is characterized by a sense of not belonging to any meaningful social group. Recent theorists (Baumeister & Leary, 1995) have highlighted the importance of a sense of belongingness. While the principle of social integration is abstractly comprehensible, its empirical history is fragmented.

The present study attempts to redress shortcomings in previous research, so its summary is a necessary first step. This section will begin by delineating the shortcomings in assessing loneliness. Chief among these problems is the use of measurement instruments with inappropriate theoretical orientations. The most commonly used questionnaire assumes loneliness is a unidimensional construct, making it problematic for testing Weiss's two-dimensional theory.

The shortcomings in conceptualizing attachment will be presented next. Problems range from inconsistent numbers of attachment categories to whether there are categories at all. The unsettled question of the diagnostic structure of attachment makes instrument validation and comparison difficult.

This will be followed by the various ways researchers have operationalized social integration. Simply how many friends a person has was the original approach, but its inadequacy in summarizing such an amorphous social phenomenon has led to

substantially more sophisticated measures. Rather than merely study how much someone feels a part of a social group, newer approaches also consider the structural nature of the group itself.

The following chapter will summarize the research methods used in this study. Inherently observational, participants completed questionnaires pertaining to loneliness, attachment, personality, and their social relationships. Each measure will be explained separately. Results will be presented and discussed in terms of the original theory.

Six Social Provisions of Social Relationships

In 1974, Weiss elaborated on his idea of two types of loneliness. Because his theory suggests loneliness arises from relational deficits, it implies that relationships make certain provisions. Because the two types of loneliness cannot adequately compensate for each other, that further implies relationships provide two distinct things.

The first provision of social relationships is security. Weiss (1974) divides security into three relational provisions: attachment, nurturance, and guidance. The attachment provision is typically found in a romantic relationship or a very close friendship. The nurturance provision is characteristic of when an adult takes responsibility for the needs of a child, resulting in a sense of being needed. Finally, obtaining guidance from a trusted or authoritative figure is an issue of security and is reminiscent of the parent-child relationship.

While security is what these three provisions have in common, what differentiates them is the recipient and beneficiary (Weiss, 1998). In the pair bond relationship, the self and the other both serve as security providers and beneficiaries. In a nurturing relationship, the self is the provider and the other is the beneficiary. In the guidance relationship, the roles are reversed, with the self as the beneficiary and the other as the provider.

The second general provision of social relationships is affiliation, and its absence produces social loneliness. Weiss's (1974) taxonomy divides common interest into three

types of relational provisions: social integration, reassurance of worth, and a sense of reliable alliance. Social integration is based in a common-concern network, where individuals may share information and experiences and may exchange services. Reassurance of worth focuses on the individual's competence in a social role and is a characteristic of work relationships. Finally, the sense of reliable alliance, most often provided by kin, combats feelings of vulnerability and abandonment.

Weiss (1974) points out that these six provisions may have varying priorities across individuals and situations. He further argues that the absence of each provision results in unique cognitive and affective responses.

For the security category, its absence produces emotional loneliness, particularly if the attachment provision is unmet. Within this category, the lack of opportunities for nurturance produces feelings of existential meaninglessness, and the lack of guidance produces feelings of uncertainty and anxiety.

For the affiliation category, its absence results in social loneliness, particularly in the absence of integration into a social network. Within this category, the lack of self-worth produces low self-esteem, and the lack of reliable alliance produces feelings of vulnerability.

Weiss (1998) further distinguished between attachments and affiliations by their functioning. In terms of exclusivity, attachments tend to be exclusive while affiliations are often aggregative. At its core, attachment is about available security. But if one has to share an attachment figure, then that person is necessarily less available, an unsettling realization in times of need. This is the reason why attachment relationships, such as

romantic relationships, are so often exclusive. By contrast, affiliations are about integration into a cohesive network. More affiliations enrich the network, increasing its value in terms of its provision of friends, alliance, and guidance.

Group phenomena further attest to the differences between attachments and affiliations. Particular to affiliations, group behaviors such as stereotyping and in-group bias, suggest that social networks function differently than attachment relationships. Weiss (1998) emphasized the situation where, though competition may arise within a social network, it is quickly put aside when a unified front is needed. For example, siblings have their rivalries but come to each other's defense if the family itself is threatened. Further, there may be competition for a better job within an organization, but when the organization is undergoing straining times, everyone pulls together.

Another function that distinguishes attachments from affiliations is their persistence. Attachments are remarkably persistent, even when logic suggests termination of the relationship, as graphically demonstrated when abused children continue to love their violent parents. Affiliations, however, do not survive such threats. It is quite common for people to promiscuously pass in and out of friendship networks.

In a related vein, grief is universal at the loss of an attachment relationship but is less common or less intense with the loss of a friend. Finally, attachment relations, being reliable bonds, maintain themselves, but affiliations are often reinforced by the fear of appearing disloyal (Weiss, 1998). Overall, attachment relations and affiliations behave differently, suggesting that these two types of relationships are indeed distinct.

Emotional Loneliness

Claiming that people have a fundamental need for attachment was relatively new in 1973. The theory that the absence of an attachment relationship produces a specific type of loneliness was equally new, even avant-garde. Because of the close connection between the two theories, an essential step in testing Weiss's theory (1982, 1987) involves research on the relationship between attachment and loneliness.

Attachment Theory. Attachment theory began in 1944 with John Bowlby's study of children's relations to their caregivers, where he found an association between maternal separation and juvenile delinquency (Hazan & Shaver, 1994). Six years later, the World Health Organization invited Bowlby to report on the mental health of the children in London's orphanages. Building on his earlier research, he showed maternal separation was also related to risk of physical and mental illness in children.

Bowlby's psychoanalytic training proved inadequate to explain the phenomena. He turned to ethology for alternative explanations of similar behavior among nonhuman animals. Particularly in bird and mammalian bonding, Bowlby found how instinctual tendencies, when thwarted by an inadequate environment, distort development.

The core of attachment theory is that children instinctually want to be close to their caregivers during times of stress, and they want their caregivers to be responsive to their security needs. Unresponsive, inconsistent caregiving is a deleterious environment for child development, and attachment insecurity is the result.

That people have an attachment instinct is an evolutionary claim. In support of this claim, securely attached children respond to distress by seeking proximity to their primary caregiver. Children who were securely attached to their mothers during the Era

of Evolutionary Adaptation were more likely to survive such a vulnerable childhood thanks to the solicitation of their mother's protection. With such clear adaptive value, attachment was evolutionarily selected: children with it survived into adulthood to procreate, passing it on to the next generation. Those children without an "attachment instinct" were more defenseless and consequently less likely to survive and reproduce.

Attachment system. An invariant sequence of reactions characterizes children's separation from their primary caregivers: protest, despair, and emotional detachment (Bowlby, 1973; Hazan & Shaver, 1994; Simpson, 1990). When separated from its caregiver, the child responds by crying, actively searching for the caregiver, and resisting other people's attempts at soothing. Such expressions of distress usually bring the caregiver back.

However, if the separation persists, continued distress seems less likely to attract the caregiver and more likely to attract predators. Recall attachment is postulated to have developed during the Era of Evolutionary Adaptation, where predation was a daily reality. After extended caregiver absence, the child will cease its distress calls and become inactive and quiet. Bowlby termed this "despair," for it includes obvious expressions of sadness.

If the separation continues past the point of despair, the child will become emotionally detached. This final stage permits the child to resume normal activity without the caregiver and perhaps enables the search for a new attachment figure.

Bowlby (1973) argued that the development of the attachment system is based on three propositions. First, children who are confident in their attachment figures'

availability experience less chronic fear than those who are unsure. Second, such expectations about attachment figures are the product of repeated experiences during the sensitive period of childhood. After childhood, these expectations persist throughout the lifespan. Third, expectations accurately reflect the actual experiences of caregiver responsiveness and availability.

Thus repeated experiences yield persistent expectations. The attachment system, however, is more than accumulated expectations about caregivers. These expectations are elaborated into comprehensive mental representations of both other people and the self called *internal working models*. The model of others and the model of the self are conceptualized as two orthogonal dimensions. The model of others ranges from believing others are either reliable and trustworthy or unwilling to commit themselves to relationships. The model of the self ranges from believing the self is either friendly, good-natured, and likable or misunderstood, unconfident, and underappreciated (Simpson, 1990).

The various types of internal working models produce predictable patterns of behavior, which are often termed *attachment styles*. Developed using the Strange Situation paradigm, Ainsworth, Blehar, Waters, and Wall (1978) used two discriminant functions to derive three attachment styles: *secure, anxious/ambivalent,* and *avoidant.*

A securely attached child is distressed when separated from its mother but is comforted by her return. When she is present, a secure child explores its environment, using the mother as a secure base. Mothers of secure children are judged by observers as available and responsive while not being intrusive.

Insecurely attached children are subdivided into two categories. The anxious/ambivalent child is distressed upon separation but shows both anxiety and anger and other protest behavior upon the mother's return. When she is present, the anxious/ambivalent child is too preoccupied with its mother to explore its environment. Mothers are inconsistently responsive—sometimes unavailable, sometimes intrusive. In contrast, the avoidant child is not distressed by separation and rejects the mother upon her return. When she is present, the anxious/avoidant child shows emotional detachment from its mother, instead focusing on the environment but not exploring it as actively as a secure child.

Ainsworth et al.'s (1978) three-category model of attachment style is based on two, orthogonal dimensions, *avoidance* of intimacy and *anxiety* regarding abandonment. Researchers have noted that two dimensions make room for four categories, not three. These two dimensions correspond to Bowlby's original claim that internal working models are composed of a model of the self as either worth or unworthy of care and a model of other people as either responsive or unresponsive to security needs.

In studying children's reactions to the Strange Situation, Main and Solomon (1990) identified another category, *disorganized/disoriented,* characterized by the absence of a coherent strategy for managing anxiety. Such children display behaviors of both avoidant and anxious/ambivalent types.

Bartholomew and Horowitz's (1991) four-category model theorized an adult attachment style equivalent to the disorganized/disoriented childhood attachment style, which they called *fearful.* This style's most salient feature is a fear of rejection that

produces an avoidance of close relationships and is rooted in a sense of personal insecurity and distrust of others. In the four-category model of adult attachment, the secure category retains its name, but the others change. The avoidant style of childhood corresponds to the *dismissing* style of adulthood. The anxious/ambivalent style corresponds to *preoccupied*.

Note, however, that modern researchers have not found evidence of attachment taxonicity (Fraley & Waller, 1998). While the use of categories is common, some argue that attachment is better conceptualized as two continuous dimensions (Bartholomew & Horowitz, 1991) because forcing continuously distributed variables into categories destabilizes attachment classifications. Specifically, dichotomizing a normally distributed dimension on its mean produces a correlation of approximately .80 between the derived dichotomous variable and the original continuous variable, losing about 36% of the original variance. Statistical power suffers substantially, so the use of two dimensions is now preferred.

Child-adult attachment differences. Attachment researchers as well as Weiss claim that the attachment component of the human psyche does not disappear with the onset of adulthood but does change (Hazan & Shaver, 1994; Weiss, 1994). The adult expression of childhood attachment can be seen most readily in the drive for romantic attachment. Weiss (1982) has even argued that the capacity to feel emotional loneliness was evolutionarily selected for because it introduces pressures to search for more than just a sexual mate but an emotional partner. In the context of childrearing, this creates

attachments between the parents in addition to the parent and child. The result is a cohesive family, indeed a favorable situation for the child.

Despite the similarities between childhood and adult attachment, there are noteworthy differences (Shaver, Hazan, & Bradshaw, 1988). Attachment relationships between child and caregiver are complementary. The activation of the child's attachment system elicits the activation of the parent's caregiving system. Therefore, the parent provides but does not receive care (Hazan & Shaver, 1994). In contrast, adult relationships are more reciprocal, where both partners give and receive care. The caregiving and attachment systems are integrated in adult relationships in a more dynamic way than in parent-child relationships. Recall Weiss (1974) noted this in the three social provisions of security: attachment, which is dynamic; nurturance, where the self gives and the other receives; and guidance, where the self receives and the other gives.

Attachment's relation to emotional loneliness. With attachment firmly established as the basis of emotional loneliness in Weiss's theory, testable hypotheses are more easily derived. People who lose their attachment figures, regardless of the reason, should experience emotional loneliness, though not necessarily social loneliness. Among adults, a romantic partner is the most common form of attachment, though a "best friend" may also be an attachment figure. The absence of either should predict emotional loneliness. Finally, the prevalence of emotional loneliness should vary according to attachment style, with the insecure styles more likely to experience loneliness.

Tests of attachment and emotional loneliness. The attachment implications for those who lose their romantic partners were graphically demonstrated when Weiss interviewed widowers (1973), such as in the story of Mr. Neilson. He had five children, but giving birth to the sixth killed both child and mother. In addition to his children, he also had the companionship and assistance of his sister. During his day, he interacted with many people. After work, he met with friends at a local bar. By all accounts, Mr. Neilson, though still pained by the loss of his wife, had many close people in his life. Weiss claimed that the emptiness Mr. Neilson felt was because the single attachment figure in his life was gone. The many social relations he had would never be enough to palliate his loneliness, for as Weiss theorized, the loss of an emotional attachment can only be remedied by the introduction of another.

In a more nomothetic test of Weiss's idiographic case, Stroebe et al. (1996) measured the social and emotional loneliness of a German sample matched on marital status. Not surprisingly, widows had significantly greater emotional loneliness than those who were still married, but there was no difference between the groups in terms of social loneliness. Another study found that strong social support from family and friends did not alleviate loneliness among widows (Lopata, Heinemann, & Baum, 1982).

In support of the idea that the lack of an attachment figure predicts emotional loneliness, Russell et al. (1984) regressed the UCLA Loneliness Scale, the most commonly used measure, on to the attachment dimension of the Social Provisions Scale. The very strong results suggest that the greater the sense of emotional attachment, the less loneliness one will likely feel. The theory argues that romantic relationships are a

form of attachment; therefore, there should be an inverse relationship between romantic relationships and emotional loneliness. That is what Russell et al. found. Similar results were found in a path analysis that measured the presence of a romantic partner and emotional loneliness (Green, Richardson, Lago, & Schatten-Jones, 2001). Even the number of dates someone goes out on also negatively correlated with emotional loneliness (DiTommaso & Spinner, 1993).

Russell et al. (1984) provided a test of Weiss's causal model. Attachment processes are hypothesized to underlie emotional loneliness, and Russell et al. found that attachment (measured as a social provision) to be a very strong predictor of emotional loneliness. In terms of objective measurement, emotional loneliness should be negatively related to being in a romantic relationship, as was mentioned in the definition. Russell et al. also found this strongly predictive association. Satisfaction with one's romantic relationship also provides supportive evidence.

Attachment style itself also predicts loneliness. Using the three-category model of attachment, Hazan and Shaver (1987) found that secure people experienced the least loneliness, as measured with the revised UCLA Loneliness Scale, which does not distinguish between emotional and social loneliness. Not surprisingly, anxious/ambivalent respondents (roughly analogous to preoccupied attachment in the four-category model) experienced the most loneliness. Finally, avoidant (dismissing) people's level of self-reported loneliness fell between the other two. The authors, however, suggested that the reason the avoidant group was not as lonely as the

anxious/ambivalent group was because avoidant people are less likely to report negative aspects of themselves.

Using the Inventory of Parental and Peer Attachment (IPPA), there was a moderate relation between attachment insecurity and the UCLA Loneliness Scale (Larose, Guay, & Boivin, 2002). Another study that used the IPPA, but with a sample of elementary school children, found that dyadic attachments with best friends were negatively related to emotional loneliness, also a prediction of the theory (Chipuer, 2001).

Social Loneliness

While research on attachment has proceeded at an impressive pace, goaded largely by the theory's many successes, the other component of Weiss's theory of loneliness has fallen prey to methodological and analytical inadequacies. That social loneliness results from inadequate integration into a social network necessitates the difficult task of operationalizing "social network" and "integration." Perhaps even more distressing, this element of his theory did not rest on any empirically validated principles.

While Weiss proposed that lack of integration into a social network lies at the heart of social loneliness, he did not propose a theoretical framework for why. Even his theory of the social provisions of relationships (Weiss, 1974) simply asserts but does not provide a general explanation for why people have a drive to be part of a group. His model of the social provisions of relationships describes the functions of relationships in satisfying certain needs but does not address why those needs exist.

A theoretical basis. Filling this void, Baumeister and Leary (1995) advanced their belongingness hypothesis to provide a general theory to underlie the empirical research on affiliation. They argue that people feel loneliness when deprived of social integration because a drive to be part of a group is innate, a product of evolution. Such claims are difficult to support, but one requirement is universality. Their review of anthropological literature suggests that all human cultures have had some element of society.

A specific point in their hypothesis is that, during the Era of Evolutionary Adaptation, people who lived in small groups were more likely to survive and thus reproduce because such groups provide common defense. It is a well-supported observation that the tendency to affiliate increases during perceived threats (Rofé, 1984; Wisman & Koole, 2003). Stanley Schachter made a cognitive argument for why people affiliate during stressful situations, and others have extended his ideas, but these explications are unnecessary in evaluating the evolutionary argument. The key observation is that perceived threat provokes anxiety which induces a drive toward group membership, a clear group parallel to the attachment system. Just as attachment procures security for children, the belongingness hypothesis argues that the need for alliance procures security for everyone, and its absence is just as distressing. Weiss (1987) described social isolation as the realization of "being on your own, without allies, in a dangerous world" (p. 13.).

If Baumeister and Leary (1995) are correct in their hypothesis, then a sense of belonging would represent an affective dimension of social integration. In Hagerty and Williams's (1999) structural equation model, the sense of belonging powerfully predicted

loneliness. Similarly, Chipuer (2001) found that elementary school children's sense of connectedness to their school predicted their low social loneliness, as did their sense of connectedness to their neighborhood, beyond their dyadic attachments. Sense of belonging also buffered those with a family history of alcoholism from developing depression (Sargent, Williams, Hagerty, Lynch-Sauer, & Hoyle, 2002). These studies show that even a very diffuse operationalization of Weiss's concept of social integration produces results in line with his theory.

In principle, the opposite of a sense of belonging would be the sense of being intentionally excluded, which Weiss (1982) argued was an element of social isolation. He theorized that social isolation would result in activity aimed at regaining social integration. Such activity, if it is to be successful, requires sensitivity to social information. Gardner, Pickett, and Brewer (2000) found that, after experiencing social exclusion, participants showed a greater attention to and recall of explicitly social information. The existence of such a response implies the possible presence of a cognitive capacity to collect information necessary for social integration. Leary et al. (1995) have argued in their sociometer hypothesis that self-esteem serves as an early-warning indicator of possible social exclusion. These cognitive and affective observations show that people are sensitive to the possibility of losing their social integration, and, if they do lose it, they are equipped to begin reintegration. Such mechanisms serve the maintenance of one's social system, implying its fundamental importance.

Early tests of social loneliness. In testing Weiss's theory of social loneliness, it becomes necessary to quantify the idea of how integrated a person is into a social

network. Operationalizing "social integration" and what Weiss meant by "social network" have proven to be quite difficult. In one of the earlier attempts, Jones (1981) investigated loneliness and social contact. He asked the participants to keep a diary of their conversations across four days, similar to a suggestion Weiss himself later made (1987). He correlated various conversation parameters with scores on the UCLA Loneliness Scale (the first version from 1978). The largest loneliness correlations were with *diversity of interaction partners* for females and proportion of interactions with strangers for males.

Jones's measure of diversity is simply the number of people with whom one has interacted divided by the number of interactions. To say lonely females had a greater diversity of interaction partners means that they had few conversations with the same person, similar to the observation of male participants. One of the noteworthy relationships was between loneliness among males and the number of interaction partners. In other words, lonely men actually had more social contact than nonlonely men.

These results may appear to directly contradict Weiss's (1973) theorizing, but actually he argued that the chief response to social loneliness is a driving restlessness to "move among people, at least to come into the vicinity of sociable warmth" (p. 22). Jones's (1981) results are often used (i.e., Stokes & Levin, 1986) to show how mixed empirical results are on the relation of loneliness to social deficit because he found no difference in the overall amount of social contact between lonely and nonlonely people. However, what Jones measured was not what Weiss was talking about. This is a frequent

problem with research on social loneliness. Weiss said social loneliness is the result of not being a meaningful part of a cohesive social group. The number of conversations a person has does not reflect this at all.

An alternate interpretation of Jones's (1981) results is that he did find support for Weiss's (1973) claim about social loneliness. Specifically, Jones's measure of diversity of interaction partners was positively correlated with loneliness for both men and for women. Though this measure is relatively crude, a low diversity score means many conversations were repeatedly with the same group of people. Such a circumstance is suggestive of being integrated into a social network. Conversely, a high diversity score means talking to many people but rarely more than once, which suggests the desperate scramble for human contact Weiss predicted. Interpreted in this light, it is no surprise the correlations are so strong. This represents preliminary evidence of Weiss's concept of social loneliness.

What is needed to test Weiss's theory is an analysis of people's social networks. Williams and Solano (1983) investigated the social networks of lonely and nonlonely college students to determine differences. In terms of best friends (the top three in rank order), lonely, average, and nonlonely people did not differ in the number of reciprocal best friends. This reciprocation is a more sophisticated measure of social integration because it does not rely solely on the participants' possibly skewed social perception.

However, there was a very strong correlation between loneliness and intimacy with college best friends for females and for males. This indicates that, even though lonely people's best friends return the friendship choice as much as nonlonely people's

best friends, the lonely people perceive substantially less intimacy in those relationships. Further, when Williams and Solano contacted the nominated best friends, this perception of emotional distance was echoed by the best friends. This finding corroborates the accuracy of intimacy judgments lonely people make about their friendships, casting doubt on the claim that loneliness is a distortion in assessing relational closeness.

When Williams and Solano (1983) extended the range of friends beyond the top three in rank order to include the top 10, a new finding emerged. Lonely people overall had fewer reciprocated relationships than expected, while people with average loneliness did not differ from expectation. Interestingly, nonlonely people also had fewer reciprocations that expected. In sum, the people on the tails of the UCLA Loneliness Scale had fewer reciprocal friends than the middle group. This curvilinear relationship may explain why other researchers (Cutrona, 1982) have found no relationship between number of friends and loneliness.

Williams and Solano (1983) suggest the explanation that lonely people really do have fewer friends. Though nonlonely people also have fewer friends, those few relationships are very close, in keeping with the strong negative correlation between loneliness and intimacy. Buttressing this interpretation, Williams and Solano also calculated "popularity ratings," determined by the sum of how highly a participant ranked on nominated friends' rank-ordered list of friends. The correlation between this rating of popularity among one's friends and the UCLA Loneliness Scale was strongly negative, meaning the lonelier a person felt, the lower they were ranked as a friend. In contrast, nonlonely people were ranked highest by their friends. This evidence lends credence to

Weiss's (1973) idea that loneliness is a real social condition, rather that only a cognitive distortion. In fact, these data show that lonely people's assessment of the intimacy in their relationships is accurate, or at least that their friends concur.

A direct test of Weiss's typology came from Russell, Cutrona, Rose, and Yurko (1984). The authors used a large mail survey of university students to measure both social and emotional loneliness as well as affective and behavioral reactions. The participants also provided data on their social relationships, including their judgment on how well those relationships satisfied the six social provisions of relationships that Weiss (1974) articulated.

Russell et al. (1984) correlated scores with the UCLA Loneliness Scale and a measure they devised that distinguishes between social and emotional loneliness. They provided the following definitions of each type of loneliness and asked participants to endorse how much they felt that type of loneliness on a 9-point scale. This is their definition of social loneliness:

> A possible type of loneliness involves not belonging to a group or social network. While this may be a set of friends who engage in social activities together, it can be any group that provides a feeling of belonging based on shared concerns, work, or other activities.

And this is their definition of emotional loneliness:

> A possible type of loneliness is the lack of an intense, relatively enduring relationship with one other person. While this relationship is often romantic, it can

be any one-to-one relationship that provides feelings of affection and security.

(Russell et al., 1984, p. 1315)

The authors showed that the pattern of correlations suggests two distinct types of loneliness. Of the 20 items on the UCLA scale, the authors found six that had significantly different correlations with the two description endorsements.

Russell et al. (1984) also found evidence supporting Weiss's causal model of social loneliness, which underscores the importance of meaningful integration into a cohesive social group. Their objective measures, however, are not well aligned with the theoretical definition. The authors asked participants to indicate their number of close friends and casual friends as well as how often they had done something socially with a friend in the previous two weeks. Number of friends is not the same thing as being integrated into a social group. Despite this weakness, the authors did find that a composite score of the participants' social network did predict social loneliness. Satisfaction with their friendships also predicted social loneliness. These results are similar to what Cutrona (1982) found regarding frequency of contact with friends and satisfaction with friendships.

In addition to Weiss's causal model, Russell et al. (1984) also investigated the claim that the two types of loneliness have qualitatively different affective and behavioral reactions. The reactions to social isolation include "boredom, feelings of exclusion, and feelings of marginality" (Weiss, 1973, p. 20) as well as possible depression. Reactions to emotional isolation are a "hyperalertness" or "oversensitivity" toward others (Weiss, 1973, p. 21), which may be interpreted as social anxiety. Depression did predict social

loneliness, but anxiety did not, consistent with the theory. However, both anxiety and depression predicted emotional loneliness, complicating the interpretation. Weiss never explicitly precluded depression as a reaction to emotional loneliness; he only suggested that anxiety would be salient.

In general, Russell et al.'s (1984) study of the self-reported experience of loneliness supports Weiss's theory. These results are especially encouraging because they find objective evidence in social network characteristics as derived from the theory. They also support the affective and behavioral reactions Weiss predicted would result from particular social and emotional deficits. In sum, this study demonstrates substantial support for Weiss's theory across cognitive, affective, and behavioral domains.

Despite the strengths of Russell et al.'s (1984) study, and their finding significant results, there are serious shortcomings. Important constructs, though measured directly, were not measured adequately. Attachment style was not measured with a conventionally tested instrument. In fact, the instrument they used, the Social Provisions Scale, contains only two items for each of the six social provisions, and some researchers (Cutrona, 1982) have not found a significant relationship between the attachment provision and loneliness. Perhaps more important, Russell et al.'s measure of participants' social network was limited to network size and contact frequency. Though reasonable indicators of social status, they doe not reflect the cohesiveness of that network.

Social network analysis. One of the biggest obstacles in testing Weiss's theory is operationalizing "social integration." Its successful specification requires a reliable

method for identifying the social network, assessing its characteristics, and quantifying how much the individual is part of it. This is the domain of social network analysis.

While psychology primarily concerns itself with the individual, and sociology with the group, social network analysis concerns itself with the structure of relations among individual members of social groups. The unit of analysis is neither the individual nor the group but rather links among the individuals that form the group. It is the pattern of these links that provides social structure, much like the pattern of trusses that provides the structure of a bridge.

Network analysis began in the 1930s with the emigration from Nazi Germany of the gestalt psychologists Kurt Lewin, Jacob Moreno, and Fritz Heider. Wolfgang Köhler's gestalt theory emphasizes how thoughts are organized into structured systems, distinct entities in their own right, which in turn influence the perception of reality (Scott, 2000). As disciples of Köhler, these psychologists were especially attuned to the nature of structure and sought to explain social phenomena within this theoretical framework.

With the insight that a pattern of relations has its own properties, much in the same way that the whole is greater than the sum of its parts, Moreno investigated the pattern of relations among people. In 1934, he published one of the first works on social network analysis, *Who Shall Survive?: Foundations of Sociometry, Group Psychotherapy, and Sociodrama*, where he explored how psychological well-being relates to social network structure. Also in this work, Moreno invented a method to graphically represent the pattern of social relations called a *sociogram*. In a sociogram, the people are represented as points and relations among them as connecting lines. The

mathematical progenitor is called *graph theory* and was invented in 1736 by Swiss mathematician Leonhard Euler (Barabási, 2002).

In the same way Stevens (1946) elucidated the levels of measurement in experimental psychology, network analysis has its own four levels of measurement (Scott, 2000; Wasserman & Faust, 1994). Network data possess two properties: *numeration* and *directionality*. Numeration can be either *dichotomous* (also called *binary*), merely indicating the presence of absence of a relation, or *valued,* where the relational tie can be quantified. Common valued ties include the strength of a friendship, the degree of trust, the amount of money, and so on.

Directionality in network analysis often involves the "sending and receiving" of something, such as friendship choices or interpersonal power. When identifying the sender and receiver is substantively important, the tie can be *directed.* Otherwise, the tie is said to be *undirected*, which is most often found in relations that do not have obvious flow.

With an eye toward the pattern of relations among people and a theory of measurement to accommodate the data, social network analysis can potentially succeed where other approaches have failed. Some of the most common network analyses characterize how central individuals are to the group and are simply placed under the rubric of *centrality.*

Degree is the count of direct relational ties a particular person has. For example, in an office of 23 people, Alice may directly know nine people (called *alters* who collective form Alice's *neighborhood*), so her degree is nine. Exactly what kind of

relation to count is a substantive matter left to the investigator. One may instead count office relations where advice is sought from another. Perhaps a particular relation will only be counted if it is beyond some cut-off, such as the number of times two co-workers have had lunch together. One of the most common uses of degree is to count friendships, where degree serves as a vague measure of social expansiveness.

A shortcoming of degree is that it only considers ties that are adjacent to the focal subject (often called *ego*). Disregarding others in the network in this manner may be inappropriate, for relations can also have indirect effects.

Closeness is a measure that takes all network members (called *actors*) into account. Rather that just count the lines that connect ego to the immediately adjacent alters, as in degree, actor closeness follows the paths of connections throughout the entire network. The number of intermediaries necessary to connect ego to another actor is called *distance* and is part of the closeness calculation. Someone who is close to all others can quickly interact with anyone in the network. Such a central social location facilitates communication and exchange.

The potential for flow of anything in a network—friendship, influence, information, money, sex, disease—is an important consideration in network analysis. Degree only reflects local flow. Closeness is more global, but real-world network transmission seldom goes beyond a distance of three, rendering much closeness data irrelevant. While closeness attempts to locate those actors that can facilitate flow, another way to investigate network flow is to locate those actors that can inhibit it.

Betweenness is a form of centrality that quantifies "middle men" or brokers. For example, Alice needs to talk to Charlie, but she doesn't know him directly. A relation common to both is Bob. Therefore, the path between Alice and Charlie must go through Bob because he is in between. If Bob lies between many such dyads, who otherwise could not connect without him, Bob is said to have high betweenness centrality. If Bob is the one actor between two otherwise isolated groups, such as a union's shop steward is between labor and management, then this very high betweenness confers power to control the discourse between the two groups. Bob may be a peripheral player within each group, but due to his prime social location between groups, he is more important than one would think.

Degree, closeness, and betweenness are all measures of centrality. Though different in calculation, they often produce similar results, and that is because they all attempt to quantify the same general principle: how important to the group are the individuals who hold certain social positions. A problem with this approach is that it disregards how close-knit the group is. A person who has high closeness to a loose agglomeration of individuals is not really close to anyone. Being the only person between two groups that barely constitute groups confers little power because there is little discourse.

In the study of loneliness and social integration, it is not enough to quantify how much the individual is a part of the group. The nature of the group itself must also be considered. Perhaps the question is not how close but rather close to what?

Density and social loneliness. Stokes (1985) measured an aspect of the social networks of participants directly relevant to Weiss's theory. The issue at hand is how much of a group one's social network forms. Social network analysis provides various ways for determining this, but the simplest is the concept of egocentric network density.

If we conceptualize a group as a collection of people who know each other, then there should be relational ties among those people. The number of such ties gives *L*. The theoretical maximum number of such ties, where everyone knows everyone else in someone's personal network, is given by the formula $n(n - 1) / 2$, where n is the number of people in a personal network excluding ego. Density (Wasserman & Faust, 1994, eq. 4.3), denoted by Δ, is the ratio of how many ties are present relative to the maximum number possible:

$$\Delta = \frac{L}{n(n-1)/2} = \frac{2L}{n(n-1)}.$$

With directed data, there are two possible arcs for each pair of nodes, representing the two directions. Therefore, removal of the 2 in the equation produces the formula for directed density (Wasserman & Faust, 1994, eq. 4.10). Alternatively, directed data can be converted to undirected to simplify the analysis.

The inference from this is that, the higher the density in one's personal network, the more of a group one's friends form (Derlega & Margulis, 1982). Stokes argues that a high-density friendship network provides a "sense of community, a sense of belonging to a group" (p. 988), which is conceptually closer to what Weiss meant by social integration.

In addition to density, Stokes (1985) collected data about how often participants received social support, their network size, the percentage of relatives in the network, the number of confidants, and an index of self-disclosure. He also collected the personality variables of extraversion and neuroticism. Of the social network variables, density predicted UCLA loneliness strongest, a result replicated later (Jones & Moore, 1987). In the full regression model, only density and neuroticism remained significant. These results suggest that density and neuroticism make independent, direct contributions to predicting loneliness.

A hierarchical regression analysis revealed that social network variables mediate the relationship between extraversion and loneliness, such that extraverts are less lonely because they have larger, denser friendship networks. Further supporting Weiss's theory, Stokes (1985) reported a very weak relationship between the number of people to whom one feels close and loneliness. This indicates that loneliness is not simply having few friends, but that the structure among them is key.

Despite the many results supporting network density as a predictor of social loneliness, Berg and McQuinn (1989) have attempted to find a subset of one's social world that has stronger correlations. They hypothesized that the structural aspects of participants' self-reported social support network would be more predictive of loneliness. They also added the structural measure of *multiplexity,* which is defined as the number of supportive roles someone plays for a focal individual. A personal network with high mean multiplexity is one characterized by many supportive relationships. The authors found results similar to Stokes (1985), where density negatively correlated with the

revised UCLA Loneliness Scale. Density was the best predictor of loneliness in this study as well. Multiplexity weakly predicted loneliness only for men.

Bell (1991) explored the possibility that the density-loneliness correlation was an artifact of using college-age samples. He hypothesized that low network density would be more troublesome to younger people, drawing on developmental research showing that the peer group achieves maximum importance during this developmental stage of late adolescence. The relationship may not persist farther into adulthood. He also questioned the validity of the conventional formula for calculating density because it does not take into account the closeness of one's relationships.

In order to test the hypothesis that the importance of network density varies according to age, Bell (1991) used an older sample, mean age 41.8 (SD = 10.1). He also used another network measure in addition to the convention formula for density. Bell called his measure "average tie strength," which was calculated as the mean of the perceived closeness ratings among the participants' seven closest friends. He also computed "closeness" as the average personal dyadic closeness felt between the participant and the seven friends.

Bell's (1991) sample yielded density results similar to other researchers for both males and females. A hierarchical regression analysis confirmed that there was no support for the hypothesis that the importance of network density varies according to age. In terms of the strength of social relationships, average tie strength did show a slightly stronger correlation, but its relation with the conventional measure of density approached unity, suggesting that tie strength was no better than density at predicting loneliness.

Finally, Bell's hypothesis that closeness mediates the relationship between density and loneliness was not supported. Controlling for dyadic closeness did not alter the density-loneliness relationship.

The importance of group membership in alleviating social loneliness is important, but researchers have found a reciprocal relationship between loneliness and the group that casts doubt on the solution of simple group membership. Anderson and Martin (1995) investigated a path model where (a) one's communication motives lead to (b) a style of interaction involvement that predicts (c) loneliness, which in turn predicts (d) group satisfaction. A complex of communication motives loaded onto a single form of interaction involvement: responsiveness, which is defined as cognitively knowing what is appropriate to say and behaviorally being able to say it. Responsiveness had a moderately strong relationship to loneliness. The authors interpret this negative path to indicate that social skills deficits predict loneliness, suggesting that an attribute of the person not the situation can explain loneliness.

If loneliness really does spring from within, then simply placing a lonely person in a group will not reduce the loneliness. Anderson and Martin (1995) studied task groups formed in college classes. When lonely people were included in these task groups, the path analysis showed a very strong relationship between loneliness and group satisfaction. Lonely people perceived these groups negatively in terms of cohesion, consensus, and satisfactory communication. While at the same time, nonlonely people perceived these groups quite positively. The implication is that mere group membership is no solution to loneliness. In fact, the authors conclude that lonely people are unhappy

with their social interactions, and forcing them to interact with others will not change this.

Weaknesses of Past Research

    Loneliness measurement. The most often used instrument for measuring loneliness is the UCLA Loneliness Scale. Originally developed in 1978 by Russell, Peplau, and Ferguson, most research has used the revised scale (Russell, Peplau, & Cutrona, 1980). The primary criticism of the 1978 version is that all 20 items were negatively worded, such as "I lack companionship," "I feel left out," or "I feel isolated from others." The risk of using such an instrument is response set, where participants repeat their answers regardless of item content. The typical method for solving this problem is to intersperse negatively worded items as something of a "cognitive speed bump" to slow the participant and encourage actually reading each item.

    Composed of 20 items, half reflecting satisfaction with social relationships and half reflecting dissatisfaction randomly mixed together, the revised UCLA shows strong internal consistency, $\alpha = .94$ (Russell, Peplau, & Cutrona, 1980). Concurrent validity was assessed by correlations to a self-labeling index ($r = .71$), the Beck Depression Inventory ($r = .51$), and the State-Trait Anxiety Inventory ($r = .36$ with state anxiety). Additionally, the authors also found moderate to strong correlations with feeling abandoned, self-enclosed, and isolated. Also as expected, there were negative correlations with self-esteem ($r = -.50$), Eysenck and Eysenck Introversion-Extroversion ($r = -.46$), and affiliative tendency ($r = -.45$).In terms of behavioral verification of the revised UCLA Loneliness Scale's validity, single people who were not dating scored significantly higher

than those who were either dating or married. Further, loneliness was correlated with daily time spent alone ($r = .41$), weekend nights spent alone ($r = .44$), and fewer social activities with friends ($r = -.28$). Cutrona (1982) and Vaux (1988) also found a similar negative correlations ($r = -.30$ for both studies) between loneliness and frequency of contact with friends. Further, Allen and Oshagan (1995) used confirmatory factor analysis to test measurement invariance across various populations. Not only did they find a single factor, the factor loadings remained stable for samples regardless of age, race, SES , gender, marital status, education, and employment status. In sum, the revised UCLA Loneliness Scale has strong psychometric properties, and it has become the "standard" scale.

The scale's success led to its widespread use beyond the college student population on which it was developed. The most frequent complaint was that some items had confusing wording, particularly in studies of loneliness among the elderly, and this resulted in reduced reliability. In response, Russell (1996) simplified the UCLA Loneliness Scale and produced Version 3. This version is composed of 11 negatively worded items and 9 worded positively. It was tested using a variety of collection methods, including self-report, and interview. The scale developers also sampled more diverse populations, including nurses, teachers, college students, and the elderly.

Version 3 has reliability similar to the previous version. Positive correlations with other loneliness scales demonstrate convergent validity, and negative correlations with social support demonstrate discriminant validity. Many researchers (Cramer & Barry, 1999; Cramer, Ofosu, & Barry, 2000; DiTommaso & Spinner, 1993, 1997; Hoza,

Bukowski, & Beery, 2000; Marangoni & Ickes, 1989; Qualter & Munn, 2002) have criticized the UCLA Loneliness Scale for its assumption that loneliness is unidimensional. This critique is well founded, for the method for constructing the scale was to select items with high item-scale correlations, which typically results in an instrument with a single factor. Russell has stated that the UCLA Loneliness Scale was never designed to distinguish between types of loneliness (Russell, 1987).

Russell (1996) has argued that his scale measures a "unitary state, which can be reached via deficits in a variety of relationships and can have a variety of different consequences" (p. 30). His response to researchers who have found evidence for multidimensionality is that they are finding "method factors." Russell showed that a single, bipolar, global factor of loneliness emerged in his confirmatory factor analysis after including a method factor for the negatively worded items and a method factor for the positively worded items. However, in reviewing each item of the revised UCLA, 11 out of the 20 have significantly different correlations with a prototypical description paragraph of each of Weiss's types of loneliness as described earlier (Russell et al., 1984). Of these 11 items, five relate to social loneliness and six to emotional. On Version 3 of the UCLA, four out of five social loneliness items are negatively worded, and four out of six emotional loneliness items are positively worded. Russell required the use of "method factors" in order to produce a one-factor solution. But those method factors are confounded with social and emotional loneliness. This represents a serious problem with Russell's claim of a unitary factor structure.

Attachment measurement. In measuring the attachment basis of emotional loneliness, research on attachment is often cited but seldom are established attachment measures used. Most often the Social Provisions Scale's two attachment items are the indicators for this construct. Those two items follow: "I have a close relationship that provides me with a sense of emotional security and well-being." and "I lack a feeling of intimacy with one special person" (Cutrona, 1982).

The problem with this approach is that these two items do not really measure the attachment construct as delineated by theory (Hazan & Shaver, 1994; Zeifman & Hazan, 2000). Attachment theory postulates a categorical view, where a person's childhood experience influences their internal working models of relationships. These models are relatively stable and persist into adulthood.

The early prototypical model of attachment has three categories: secure, avoidant, and anxious/ambivalent. The secure style is comfortable being close to and mutually dependent on others. The avoidant style eschews such closeness with others, while the anxious/ambivalent style desires more closeness than others are typically willing to provide (Hazan & Shaver, 1987). In terms of loneliness, Hazan and Shaver found that securely attached people experienced the lowest amount of loneliness, and people with an anxious/ambivalent attachment style experienced the most. People with the avoidant attachment style fell in between.

One of the most interesting developments in attachment theory is the widespread adoption of a four-category model (Bartholomew & Horowitz, 1991). This conceptualization is based on two orthogonal dimensions: image of the self and image of

others. The resulting four categories can be interpreted in terms of the working model's positive-negative valence of these two dimensions.

The secure style tends to see others and the self positively. The dismissing style sees others negatively but the self positively, corresponding to the earlier avoidant category. Where the earlier model had anxious/ambivalent as a single category, Bartholomew and Horowitz's (1991) model splits it into two. The preoccupied attachment style is characterized by viewing the self negatively and others positively. This results in a striving for self-acceptance by attempting to obtain the acceptance of others. The fearful style has negative views of both the self and others.

Consistent with attachment theory, Bartholomew and Horowitz (1991) reported significant differences in friendship intimacy, where securely attached people had the highest intimacy, followed by preoccupied, then dismissing, and finally fearful. The only disadvantage to this study was that it did not measure loneliness directly.

Hudson and Ward (1997) did, however, use both a four-category model of attachment and measured loneliness directly. They found that secure and dismissing attachment styles reported significantly less loneliness than preoccupied or fearful. While this is consistent with attachment theory, the disadvantage of this study was its sample: rapists, child molesters, and nonsexual-violent criminals. Clearly this is a unique sample with limited generalizability, but the results do support the theory.

Social network analysis. Another weakness with previous research attempting to test Weiss's theory is the issue of integration into a social network. Early attempts operationalized the idea into very mundane measurements, such as frequency of contact

or number of friends. Later research tried to characterize the social network as a social support system. This tactic has produced useful results (Jones & Moore, 1987; Newcomb & Bentler, 1987; Priel & Shamai, 1995; Riggio et al., 1993; Vaux, 1988), but nothing substantial in terms of testing Weiss's theory.

It was not until researchers turned to social network analysis as an investigative technique did Weiss's idea find an appropriate analytic approach. Network density, one of the simplest and most frequently measured variables of social networks, is a strong mathematical reflection of social integration. The most common shortcoming with density research is that measurement is usually restricted to participants' perception of relations within their networks. Lonely people have been found to perceive social exchanges more negatively (Lakey & Cassady, 1990; Rotenberg, 1997), suggesting that uncorroborated self-report scales measure the subjective effects of loneliness rather that its objective circumstances. Bewer and Webster (1999) also found that simply forgetting people in one's network does influence the measurement of structural properties.

The solution to this problem involves more advanced network sampling techniques. Peer nomination and snowball sampling would provide more detailed views of the lonely person's personal network, but such techniques are notoriously labor-intensive. But with such samples, other parameters of the network would become available for analysis, such as reciprocity and quantitative measures of relational ties, in addition to objective verification of network structure. Finally, better sampling of personal networks allows for the use of other social network analyses, such as detecting membership in cliques and network position analysis. Though density has been a useful

variable, other structural analyses not available with traditional sampling techniques may provide deeper insight into social isolation.

Conceptualization

Social relationships provide for various human needs. In broad terms, the two most basic social needs are close attachment to one other person and meaningful integration into a social group. The absence of either of these will produce loneliness.

Not having a close attachment will influence attachment style. Emotional loneliness will be common among those with high attachment anxiety about abandonment, alternatively stated as a negative model of the self. This leads to the first hypothesis that attachment style will account for significant variance in emotional loneliness.

Not being a part of a group will disaffect the individual from larger society, producing social loneliness. With this operationalized as network density, this leads to the hypothesis that density will negatively correlate with social loneliness. Because what constitutes society and meaningful integration are themselves socially defined, those who are more collectivistic rather than individualistic will be more sensitive to low network density. Collectivism-individualism will mediate the relationship between density and social loneliness.

One of Weiss's (1973) original observations was the independence of these two types of loneliness. Therefore, social loneliness will not correlate with emotional loneliness. The proposed analytic strategy is multiple regression.

3 Method

Participants

The sampling strategy is largely determined by the most restrictive parameter of analysis, ego-centric network density. One of the terms of the formula for density is the total number of ties incident to each participant. While using snowball sampling to enumerate such an actor set is thorough, it is often prohibitively difficult. An alternative approach is to define an *actor set boundary* that makes it easy to locate participants. Further, an ideal boundary includes many if not all of each participant's incident relational ties. Pervious research has shown that among college students, dormitory residence is just such an actor set boundary (Festinger, Schachter, & Back, 1950; Martin, 1974).

Thus, all participants were recruited from the Virginia Commonwealth University Honors Dorm. This is a *realist* approach to boundary specification, where membership is perceived by the actors (Laumann, Marsden, & Prensky, 1989). There were approximately 180 total residents. The participants were undergraduate men and women in the University's Honors Program who lived in the West Grace Honors Dormitory. Only those who consented to participate were included. For those who wanted credit for participating in Psychology Department studies as a class requirement, the experimenter awarded one credit hour. This was the only compensation.

The final sample contained 69 participants. The full dataset has 49 women and 20 men. The mean age was 18.65 (*SD* = 0.60). For 94.2% of the sample, this was their first year at college. Racially, 3 identified as Black (4.3%), 49 as White (71%), 18 as Asian

(26.1%), 2 as Native American (2.9%), 2 (2.9%) as Hispanic, and 66 (95.7%) as not Hispanic.

Measures

Table 1 displays the mean, standard deviation, and (where appropriate) the internal reliability for all the major variables used in this investigation. The full text of all the measures can be found in Appendix A.

Experiences in Close Relationships. The Experiences in Close Relationships (ECR; Brenna, Clark, & Shaver, 1998) is a measure of adult attachment composed of two, orthogonal dimensions: Avoidance and Anxiety. The instrument consists of 36 items on a 7-point Likert scale anchored by *disagree strongly* and *agree strongly.* The ECR produces a score for each dimension. The Cronbach's α for the Avoidance dimension is .94 and for the Anxiety dimension is .91. An attachment categorization can also be computed based on the four-category model of attachment (Bartholomew & Horowitz, 1991). The four categories are (a) Secure, composed of low anxiety and low avoidance; (b) Dismissing, low anxiety and high avoidance; (c) Preoccupied, high anxiety and low avoidance; and (d) Fearful, high anxiety and high avoidance. In their comparative analysis of four common attachment measures, Fraley, Waller, and Brennan (2000) found that the ECR had the best psychometric properties.

UCLA Loneliness Scale. The UCLA Loneliness Scale is the most commonly used measure of loneliness. Originally developed by Russell, Peplau, and Ferguson (1978), the scale evolved from its little-used first version into the ubiquitous revised version (Russell, Peplau, & Cutrona, 1980). This study uses the latest Version 3 instrument (Russell,

1996). Conceptualized as a single, bipolar loneliness factor, the UCLA Loneliness Scale is composed of 20 items rated on a 4-point Likert scale (*never, rarely, sometimes, always*), producing a scale range of 20-80. Across four reliability studies, Russell found a coefficient α ranging from .89 to .94, and the test-retest reliability over one year was .73. The mean for undergraduate students was 40.08 (*SD* = 9.50, *N* = 487). Correlation with other measures of loneliness established convergent validity, and a confirmatory factor analysis supported its single factor structure with two method factors.

Big Five Inventory. The Big Five Inventory (BFI; Benet-Martinez & John, 1998) is a 44-item measure rated on a 5-point Likert scale (*disagree strongly* to *agree strongly*). It assesses personality using the five factor model, which posits the following fundamental dimensions of personality: extraversion, agreeableness, conscientiousness, neuroticism, and openness. Coefficient alphas ranges from .75 to .90 (*M* = .83), and the 3-month test-retest reliability range from .80 to .90 (*M* = .85). Intercorrelations among the dimensions is low (*r* = .19). High correlations with the Revised NEO Personality Inventory demonstrate convergent validity.

Social and Emotional Loneliness Scale. The Social and Emotional Loneliness Scale (SELSA; DiTommaso & Spinner, 1993) is distinguished from the UCLA Loneliness Scale in the underlying theoretical orientation. The UCLA claims a single-factor structure, but the SELSA is based squarely on Weiss's (1973) theory of two orthogonal factors comprising loneliness. The SELSA has 37 items split into two scales, 23 emotional items and 14 social items (range 14-9). The emotional scale is further subdivided into two subscales, 12 romantic items (range 12-84) and 11 family items

(range 11-77). The family item represent an extension to Weiss's original theory. All items are rated on a 7-point Likert scale (*strongly disagree* to *strongly agree*). Cronbach α for the three subscales range from .89 to .93. Correlations with other loneliness measures demonstrates convergent and discriminant validity.

Single-Item Self-Esteem Scale. The Single-Item Self-Esteem Scale (SISE; Robins, Hendin, & Trzesniewski, 2001) is, "I have high self-esteem," and is rated on a 5-point Likert scale anchored by *not very true of me* and *very true of me*. Cronbach's α cannot be computed on a single item, but there is a similar measure developed by Heise (1969), which resulted in a mean reliability of .75. Test-retest reliability was averaged across six assessments for a possible total of 15 time intervals, and the SISE score ($M = .61$) was similar to the Rosenberg Self-Esteem Scale score for the same samples ($M = .69$). The SISE had strong convergent validity with the full Rosenberg Self-Esteem Scale across genders, ethnicities, college students, and the larger community ($Mdn = .73$). There were also very similar correlations between the two instruments on self-evaluations in various domains (intelligence, verbal ability, social skills, attractiveness, etc.).

Loneliness prototypes. Also on the same Web page as the SISE for space reasons are two loneliness items. They are rated on a 9-point Likert scale anchored by *not very intensely* and *very intensely*. Participants are instructed to "Please indicate how intensely you feel the following types of loneliness." The first item says, "A possible type of loneliness is the lack of an intense, relatively enduring relationship with one other person. While this relationship is often romantic, it can be any one-to-one relationship that provides feelings of affection and security." The second items says, "A possible type of

loneliness involves not belonging to a group or social network. While this may be a set of friends who engage in social activities together, it can be any group that provides a feeling of belonging based on shared concerns, work, or other activities." These two items come from Russell et al. (1984, p. 1315) and are included for comparison to earlier studies.

Personal network. In order to measure each participant's personal network within the dorm, this Web page was constructed programmatically by listing all the names of all the participants in the dorm. Each name had a 9-point Likert scale anchored by *not at all close* and *extremely close.* The scale was presented in the form of "radio buttons" in a table (referred to as "circles" in the instructions). These were the instructions:

Below is a list of every student in the West Grace Honors Residence Hall who has agreed to participate in this study. Beside the name of each person you know, please click the appropriate circle to indicate how close you are to that person. *For those people you do not know, do not click any circle on that person's row.* The list is in alphabetical order by last name. You may also use your Web browsers search/find feature (Ctrl-f) to search this page for the names of people you know.

Not all West Grace residents are listed here. At the bottom, there are spaces for you to write in the names of the West Grace residents you know but who are not listed. If you accidentally click a circle of a person you don't know, you can clear the form and start over by going to the bottom of the page and clicking the button labeled "Clear Form."

This form of network measure is derived from Bell's (1991) "closeness" measure. In social network analysis terms, data obtained via this method are said to be directed and valued (Wasserman & Faust, 1994).

Because some people in the dorm did not participate, three blanks were provided for write-in nominations of other dorm residents who are not on the list. Note the list of names is not the entire census of the dorm; they are only the consented participants. There are also blanks for room number (for verification) and the 9-point closeness rating. These were the write-in instructions:

> Use these spaces to write in the names of the three West Grace residents you know best but whose *names are not listed above.* Please make sure the names you write in are not listed above. Fill in as much of the name as you can. If you write in any names, please also write in a Closeness rating, which ranges from 1 (not at all close) to 9 (extremely close). If you also know the room number, write that in as well.

Cultural Value Orientation. The Cultural Value Orientation measure (CVO; Gaines et al., 1997) is composed of three scales, two of which will be used, rated on a 5-point Likert scale anchored by *disagree strongly* and *agree strongly*. The Individualism scale measures the individual's orientation toward their own welfare and is composed of 10 items. The mean reliability coefficient α was .57 across five samples, and a confirmatory factor analysis yielded adequate fit for a single-factor model. The

Collectivism scale measures the individual's orientation toward the welfare of their larger communities. The mean reliability coefficient α was .76 across the same five samples.

Procedure

With a sample of 69, each having many relational ties, the amount of social network data could render a paper-and-pencil approach unwieldy. Therefore, an online survey with a database was used for data collection.

All measures were converted into Hypertext Markup Language (HTML) for Web presentation. A host is required for the Web site. The platform consisted of a server running the Linux operating system (kernel version 2.4.20), the Apache Web server (version 1.3.29), and the MySQL relational database (version 4.0.15). The application logic was coded in the PHP programming language (version 4.3.4).

In order to do research within a Virginia Commonwealth University dormitory, permission was obtained from the appropriate authorities from University Housing in addition to the Institutional Review Board. Recruiting participants was done in the lobby of the West Grace Honors Dorm. Each morning and afternoon for a week, a research assistant staffed a table and invited dorm residents to participate. Those who were interested signed an approved consent form and also gave their e-mail address.

The study began with the experimenter sending an automated e-mail to all participants with a link to the data collection Web site. For security reasons, each participant was sent a unique link generated programmatically. Clicking this link was the only way anyone could get inside the site. Only participants who signed the consent form received a link, so no one else on the Internet can get inside the site. Participants then

clicked the link, which authenticated them to the system, and then they were presented with the first of eight pages.

The first page contained demographic items. Its successful completion sent the participants to the following pages in order: ECR, UCLA, BFI, SELSA, SISE, network items, and the CVO. Each measure was presented on its own page. After completing each page, the participants clicked the "Continue" button, which sent that page's data to the database and presented the next page. This process continued until all measures have been visited. The participants were not required to fill out the forms completely or even at all, as the consent form explained. Clicking the "Continue" button was sufficient to proceed. At the end of the procedure, the participants were thanked.

4 Results

Before the hypotheses are tested, the results will begin with descriptive and psychometric properties reported on all measurement instruments. Recall that the criterion variable of loneliness was measured with three separate questionnaires: version 3 of the University of California at Los Angeles Loneliness Scale (UCLA), the Social and Emotional Loneliness Scale for Adults (SELSA), and Russell et al.'s (1984) single prototype items for social and emotional loneliness. Each was evaluated to determine which would be the best measure of loneliness, and that instrument was used for the remainder of the analyses.

The predictor variables were derived from the following instruments. The attachment dimensions of anxiety and avoidance come from the Experiences in Close Relationships (ECR). The Big Five personality factors come from the Big Five Inventory. Self-esteem was assessed with the Single-Item Self-Esteem scale (SISE). These and their respective subscales will be evaluated for internal reliability and compared to published validation samples to verify that this study's sample is consistent with similar samples.

After measurement issues have been explored, the social network analytic constructs will be explained and reported. Because these SNA computations serve as operationalizations for Weiss's hypothetical construct of social integration with regard to loneliness, each will be evaluated in terms of its association with that criterion. The attachment dimensions will be similarly evaluated as the causal construct of emotional loneliness.

Finally, the main hypotheses will be tested with a hierarchical regression analysis. The model will test attachment and social network integration as predictors of loneliness while controlling for personality characteristics. It is hypothesized that attachment and social integration will make their own unique contributions to accounting for the variance in loneliness.

Psychometric Properties of Predictor and Criterion Measures

For all the variables computed from published questionnaires, the descriptive results and internal reliabilities are reported in Table 1. Note that the Cronbach's α coefficients are all above .80, so all multi-item instruments had sufficient internal consistency reliability. Observe that for all 69 participants, there is very little missing data. Most measures contain 69 or 68 participants except for the SELSA Social subscale, which only had 67.

Table 1
Means, Standard Deviations, and Cronbach's α Scores for Measures of Loneliness, Attachment, and Personality

Measure	M	SD	Cronbach's α	N
UCLA	43.29	10.15	.93	69
SELSA Romantic	38.93	19.46	.94	68
SELSA Family	19.32	11.38	.92	68
SELSA Emotional	58.25	24.75	.92	68
SELSA Social	33.67	14.59	.94	67
ECR Avoidance	2.76	1.14	.95	69
ECR Anxiety	3.65	1.02	.89	69
BFI Extraversion	26.07	6.46	.89	69
BFI Agreeableness	34.54	5.26	.80	69
BFI Conscientiousness	30.87	6.57	.88	69
BFI Neuroticism	24.14	6.22	.85	69
BFI Openness	36.96	6.32	.82	69
SISE	3.40	1.10		68

Prototype Social	5.10	2.76	69
Prototype Emotional	4.88	2.79	69
Binary Outdegree	12.29	8.53	69

Note. UCLA = University of California at Los Angeles Loneliness Scale (Version 3), SELSA = Social and Emotional Loneliness Scale for Adults, ECR = Experiences in Close Relationships, BFI = Big Five Inventory, SISE = Single-Item Self-Esteem scale, and Prototype Social and Emotion from Russell et al., (1984).

Russell et al.'s loneliness prototypes. Recall that Russell et al. (1984) tested the separateness of social and emotional loneliness with type prototype items, which were included in the present study. They did not provide means and standard deviations for their prototype items for social and emotional loneliness, but they did report the correlation between the two items, and between the items and the UCLA-Revised (Russell, Peplau, & Cutrona, 1980). The present study's correlation between the social loneliness prototype and Version 3 of the UCLA (see Table 2) is similar to what Russell et al. found ($r = .47$). However, the present study's correlation between the emotional loneliness prototype and UCLA Version 3 is smaller than what Russell et al. found relative to the previous version of the UCLA ($r = .44$).

Most striking is the very large association between the two prototype items ($r = .63$, $p < .001$). This stands in contrast to Russell et al.'s (1984) reported correlation of .17. A more similar comparison study is Cramer and Barry's (1999) sample, which used Version 3 of the UCLA and Russell's prototypes, and they reported a correlation between the prototypes of .49. Cramer and Barry also reported means and standard deviations for both the emotional ($M = 5$, $SD = 3$) and social ($M = 4$, $SD = 2$) prototypes. Referring to Table 1, the present study's sample is significantly less emotionally lonely, $t(278) = 3.81$, $p < .05$, but is significantly more socially lonely, $t(278) = 2.50$, $p < .05$. It should be noted

that, though these are statistically significant differences, they are between single-item measures, which necessarily have reduced reliability.

Social and Emotional Loneliness Scale for Adults validation. The SELSA's initial validation study (DiTomasso & Spinner, 1992) used a college sample of 354. While DiTomasso and Spinner found sex differences on both the romantic and social subscales, the present sample showed no sex differences at all. For the romantic subscale, the mean score is 38.93 (SD = 19.46), which is significantly less lonely than the validation sample, $t(420)$ = 41.23, $p < .01$. For the family subscale, the present sample (M = 19.32, SD = 11.38) is slightly less lonely than the validation sample, $t(420)$ = 19.28, $p < .01$. In contrast, the present sample is significantly more socially lonely (M = 33.67, SD = 14.59) than the validation sample, $t(419)$ = 29.41, $p < .01$.

The internal consistency reported in the validation study for the romantic subscale was .93, and the family subscale was .89, and the social subscale was .91 (DiTommaso & Spinner, 1992). The Cronbach's α scores in the present study are slightly higher (see Table 1).

Because DiTommaso and Spinner's (1996) validation study compared the SELSA to Version 2 of the UCLA, and the present study used Version 3, the two cannot be compared. However, Cramer and Barry (1999) did a comparison of several loneliness measures, including the SELSA and Version 3 of the UCLA. See Table 2 for the correlation matrix between these two loneliness measures and Russell et al.'s (1984) two single-item prototype measures in the present study in the lower triangle and Cramer and Barry's matrix in the upper triangle.

Table 2

Correlation Matrix of All Loneliness Measures

Measure	1	2	3	4	5	6
1. UCLA		.50	.47	.77	.44	.50
2. SELSA Romantic	.39**		.22	.36	.63	.25
3. SELSA Family	.39**	.24		.55	.16	.23
4. SELSA Social	.73**	.21	.37**		.32	.44
5. Emotional Prototype	.35**	.35**	.18	.18		.49
6. Social Prototype	.45**	.04	.05	.35**	.63**	

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

As can be seen in Table 2, the pattern of intercorrelations among these loneliness measures and between samples suggests the present sample is similar to Cramer and Barry's (1999). Noteworthy differences are the present sample's small correlations between the SELSA romantic subscale and both the emotional loneliness prototype and the social loneliness prototype. The pattern of SELSA subscale intercorrelations is close to Cramer and Barry's sample, but it is closer to DiTommaso and Spinner's (1992) college validation sample, romantic-family ($r = .21$), romantic-social ($r = .26$), and family-social ($r = .37$).

For comparison to DiTommaso and Spinner's (1992) factor analysis of the SELSA items, a principal components analysis with Varimax rotation was performed.

They found three factors that accounted for 52.4% of the variance, while the present study found three factors that accounted for 61.42% of the variance. These results suggest that the present sample shows factorial invariance relative to the validation sample.

UCLA Loneliness Scale validation. Russell (1996) validated Version 3 of the UCLA Loneliness Scale with a college student sample of 487 that had a mean score of 40.08 (*SD* = 9.50) and Cronbach's α = .92. There is no mean difference between the present sample and Russell's college sample, *t*(554) = -0.23, *ns* (see Table 1). The skewness of the distribution of the present sample (.36) is similar to Russell's sample (.34). However, this sample is slightly less kurtotic (-.01) than Russell's (-.05).

The literature on loneliness and sex differences is substantially mixed. In Russell's (1996) study, the college sample showed men were significantly lonelier than women, but his other three samples (nurses, teachers, and the elderly) showed no sex difference. The current sample shows no sex difference, *t*(67) = 0.80, *p* = .43.

Researchers have questioned the factor structure of the UCLA Loneliness Scale. Russell (1996) has argued that the scale is unitary by design, reflecting a "common state we term loneliness" (p. 30). He compared the fit of three confirmatory factor analyses—(a) one global loneliness factor, (b) a method factor for positive items and another for negative items, and (c) all three factors combined. The three-factor solution fit best. Such a test cannot be performed with the current sample because the number of parameters to be estimated exceeds the degrees of freedom, preventing a solution from converging.

An exploratory factor analysis, however, supported Russell's (1996) findings. Three factors were extracted using principal components analysis and varimax rotation.

Because Russell's CFA model used three orthogonal factors, the present analysis used Varimax rotation to specify factor independence. The scree plot in Figure 1 suggests one factor is the best solution, accounting for 45.75% of the variance, though three more factors are greater than 1, each accounting for an addition 6% or 7% of the variance. This four-factor solution is similar to the results reported by Cramer and Barry (1999).
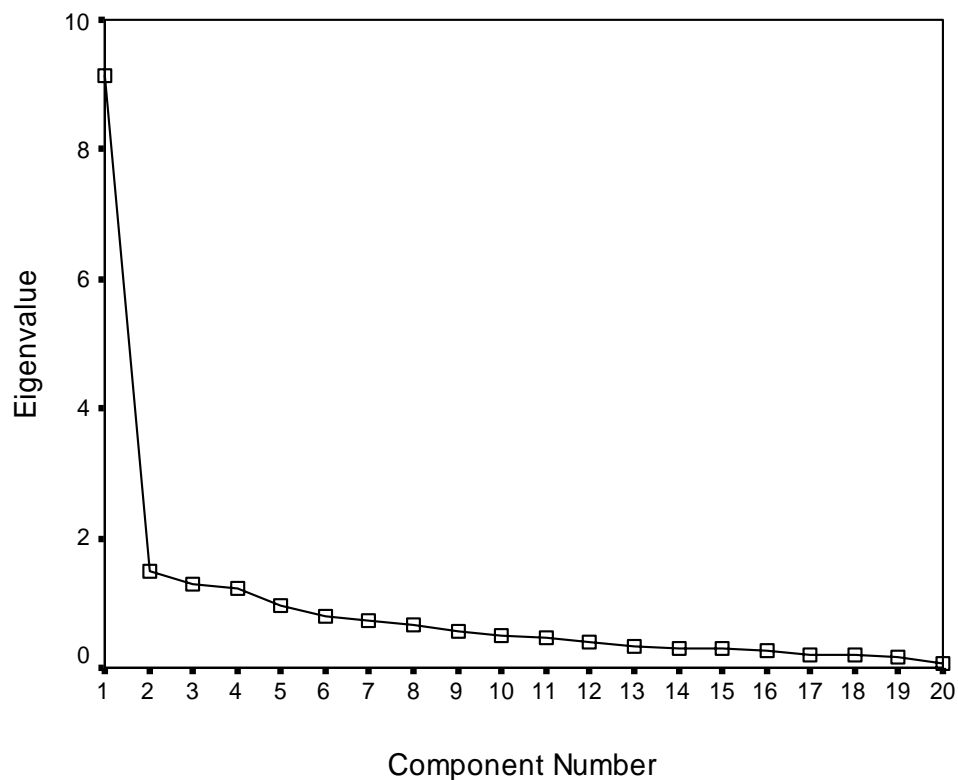

Figure 1. Scree plot of the eigenvalues of an exploratory factor analysis of the UCLA Loneliness Scale's items.

However, the rotated component matrix does not show simple structure (see Table 3).

Items 8, 12, 16, and 18 do not load strongly on a single factor.

Table 3
Rotated Component Matrixes of the UCLA Loneliness Scale With Three-Factor and One-Factor Solutions

Item	Three-Factor Solution			One-Factor Solution
	1	3	2	
1	.546	.306	.204	.605
2	.226	.154	.776	.715
3	.490	.080	.611	.757
4	.273	.309	.702	.753
5	.584	.122	.287	.620
6	.839	.019	.172	.679
7	.566	.050	.646	.820
8	.393	.380	.363	.634
9	.300	.639	.255	.592
10	.690	.123	.249	.667
11	.231	.507	.460	.635
12	.363	.270	.146	.433
13	.479	.061	.677	.786
14	.459	.328	.607	.821
15	.087	.100	.809	.626
16	.576	-.047	.538	.722
17	-.011	.847	-.095	.227
18	.278	.554	.552	.743
19	.717	.263	.220	.714
20	.688	.295	.230	.713

Note. Principal Components extraction with varimax rotation.

The loadings resulting from the principal components extraction of one factor,

also in Table 2, show all items load strongly onto a single factor, except for Item 17

("How often do you feel shy?"). While these results cannot be directly compared to a

CFA analyzing two method factors, they do show that the more parsimonious

interpretation of one factor is also adequate.

Big Five Inventory Personality validation. Relative to the Cronbach's α scores

reported in the literature (Benet-Martínez & John, 1998), the present sample's internal

consistently is slightly higher on all factors (mean α = .88) than in the validation sample

(mean α = .83).

Table 4

Intercorrelations Between the Big Five Inventory Factors in the Present Sample (Lower

Triangle) and the Benet-Martínez and John (1998) U.S. Sample

Personality Factor	E	A	C	N	O
Extraversion (E)		.14	.24	-.29	.25
Agreeableness (A)	.31*		.27	-.31	.05
Conscientiousness (C)	.33**	.36**		-.18	.08
Neuroticism (N)	-.31*	-.61**	-.33**		-.14
Openness (O)	.20	.22	.03	-.02	

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

The UCLA had the strongest pattern of correlations with the personality factors.

As expected, the BFI's neuroticism dimension correlated strongest with UCLA (see Table

5). However, for the SELSA social loneliness subscale, the largest correlation is with the

agreeableness factor. Of the significant personality relationships to loneliness,

agreeableness is more predictive than extraversion.

Table 5

Correlations Between the Big Five and Three Measures of Loneliness

Personality Factor	UCLA	SELSA Romantic	SELSA Family	SELSA Social
Extraversion	-.45**	-.21	-.17	.32**
Agreeableness	-.57**	-.28*	-.12	-.61**
Conscientiousness	-.38**	-.29*	-.12	-.26*
Neuroticism	.63**	.24	.21	.47**
Openness	.06	-.02	.02	-.12

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

Experiences in Close Relationships attachment validation. For the ECR, the

present study has slightly higher internal reliability for the two factors than reported by its

authors (Brennan, Clark, & Shaver, 1998). The ECR authors also report that the two

factors were largely orthogonal in their sample (r = .11), and this finding is replicated in

the present study (r = .09, p = .48). Unfortunately, the chapter that introduces the ECR

does not give a mean of standard deviation. Mallinckrodt and Wang (2004) provide such

data with their criterion sample of 399 U.S. undergraduate students.

For the Avoidance factor, the presents sample's mean (see Table 1) is not significantly different from Mallinckrodt and Wang's (2004) sample, $t(466) = 1.21$, *ns*. Similarly, the Anxiety dimension is not significantly different from the criterion sample, $t(466) = 1.33$, *ns*.

Single-Item Self-Esteem scale validation. Because the SISE only has one item, a reliability analysis cannot be performed without multiple time points. However, the reported mean (see Table 1) for the present sample is no different that the overall mean reported by the authors (Robins, Hendlin, & Trzesniewski, 2001), $t(574) = 1.31$, *ns*. Table 5 shows a similar pattern of correlations between the SISE and BFI in the present sample compared to an Internet sample of 241,154, where the Big Five measure was the NEO-FFI.

Self-esteem, as measured by the SISE, correlates with measures of loneliness, in particular the UCLA scale, $r = -.48$, $p < .001$. In Cutrona's (1982) sample, the correlation was -.49. Russell, Peplau, and Cutrona (1980) reported a correlation of -.49 between the Revised UCLA and social self-esteem. Brage, Meredith, and Woodward (1993) also found a similar relationship between another loneliness scale and the Rosenberg Self-Esteem Scale ($r = -.48$).

Self-esteem also correlates with the SELSA family subscale ($r = -.39$, $p = .001$) and the SELSA social subscale ($r = -.34$, $p = .005$). Surprisingly, there is no relationship between the SISE and the SELSA's romantic subscale.

Table 5

Correlations Among the Big Five and the SISE Compared to an Internet Sample

BFI Personality Factor	Robins et al.	Present Sample
Extraversion	.38	.36**
Agreeableness	.13	.23
Conscientiousness	.25	.29*
Neuroticism	-.50	-.41**
Openness	.17	.15

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

Instrument summary. After having reviewed the results of the psychometric properties of the various predictor and criterion measures, as well as their comparisons to validation samples, choices must be made about which measures to use in the main analysis.

Because the UCLA Loneliness Scale outperformed the other loneliness measures in terms of internal consistency reliability, simple factor structure, and prevalence in the literature, I will use it as my main criterion measure. Occasional comparisons to other loneliness scales will be made for verification purposes when results are close to nonsignificance.

In terms of personality, neuroticism has long been known to be the strongest predictor of loneliness, even stronger than extraversion. This observation suggests that loneliness is less about interpersonal interactions themselves and more about the affective

response to those relationships. However, neuroticism is an individual difference variable outside the theoretical model that does indeed correlate strongly with the criterion variable. Therefore, neuroticism is a nuisance variable, and I will control for it in the main analyses. Further, self-esteem will not be included, for it is a nonsignificant term in the full regression model. With these decisions, testing of Weiss's theory can begin with attachment and emotional loneliness.

Attachment

Weiss's theory claimed that emotional loneliness is rooted in the absence of an attachment bond. But the core of attachment theory is that people react differently to the absence or disruption of this close relationship. Indeed, attachment affects the capacity to even form intimate relationships. Therefore, insecure attachment should render close relationships less fulfilling and increase the likelihood of emotional loneliness.

Both attachment dimensions correlate moderately with UCLA loneliness, but the anxiety dimension ($r = .48$, $p < .001$) has a stronger relationship than the avoidance dimension ($r = .42$, $p < .001$). Because attachment is often conceptualized as a single construct, rather than its component dimensions, a hierarchical regression was performed to test for continuous interaction between the component dimensions.

In Step 1, both the avoidance and anxiety dimensions were entered. In Step 1 of the model, where UCLA loneliness was regressed on both attachment dimensions alone, $R^2 = .37$, $F(2, 66) = 19.33$, $p < .001$. Again, the anxiety dimension ($\beta = .44$) was a moderately strong predictor of loneliness while controlling for avoidance, $t(69) = 4.50$, p

< .001). The avoidance dimension (β = .38) was only slightly weaker, $t(69) = 3.89$, $p <$ .001.

Step 2 tested both dimensions and their product, the term that carries the interaction. The change in R^2 associated with the interaction in Step 2 was not significant, $F(1, 65) = 0.41$, $p = .53$. Of course, the regression coefficient of the product term ($\beta = -.29$) was also nonsignificant, $t(68) = -0.64$, $p = .53$. Therefore, the dimensions of attachment do not interact.

Social Network Analysis

Recall that Weiss (1973) never operationally defined the term "social network integration." This has allowed subsequent researchers the freedom to choose their own measures but has also burdened them with justifying each operationalization as a reasonable representation of the hypothetical construct. With that in mind, various social network measures of "social integration" will be reviewed and results provided. These analyses were carried out primarily with the social network analysis software Ucinet, version 6.60 (Borgatti, Everett, & Freeman, 2002).

Table 6

Means and Standard Deviations of Social Network Measures Used to Operationalized Social Integration

Social Network Measure	M	SD
Degree		
Undirected	18.96	9.91
Outdirected	12.29	8.47
Indirected	12.29	7.79
Density		
Undirected	34.41	7.99
Outdirected	39.52	13.09
Indirected	36.29	10.76
Betweenness	25.51	34.42
Closeness		
Undirected	57.75	6.09
Outdirected	48.75	10.89
Indirected	25.63	3.29
Eigenvector Centrality	0.10	0.06
Mean Tie Strength		
Outdirected	4.53	1.59
Indirected	4.93	1.52

Degree and its relationship to loneliness. Perhaps the simplest of all social network analytic measures is degree, one of many measures of centrality. The data can be analyzed three ways in terms of the direction of the ties: (a) consider only those ties in toward ego, (b) consider only those ties out from ego, or (c) consider all ties connected either to or from ego, called *undirected*. With the simplest form of data, where relational ties are undirected and without value, binary degree is the number of ties between ego and all alters. The present dataset, however, uses the most complex form of data. The origin and target of the tie are specified, yielding direction, referred to as outdegree for the number of ties ego sends and indegree for the number of ties ego receives from others. Ego further specifies the strength of the tie, yielding value. Due to the hierarchical

nature of these levels of measurement, analysis can be performed at all levels of complexity.

The mean undirected degree, that collection of alters without regard for the direction of the tie or its value, is given in Table 6. Undirected degree only indicates the amount of interaction involving an actor without regard for perspective. A more common simplification is to dichotomize the values, reducing the level of measurement to binary, while still retaining the directionality. The actors chose an average of 12 alters. The number of choices actors made ranged from 1 to 39. Reversing the direction, the mean binary indegree is necessarily the same as outdegree, but the standard deviation is slightly smaller (SD = 7.79), a phenomenon called *expansiveness bias* (Feld & Cartner, 2002). The number of choices received ranged from 1 to 38.

Using degree as a basic measure of social integration, I hypothesize a negative correlation between loneliness and degree. Using undirected degree, this hypothesis was supported, r = -.28, p = .019. Binary outdegree had a slightly stronger relationship to UCLA loneliness, r = -.30, p = .012, indicating that the self-reported number of friends as perceived by ego predicts loneliness. However, the hypothesized relation was not supported with binary indegree, r = -.12, p = .339. This finding suggests that the nominations of others have little impact on the experience of loneliness.

Density and its relationship to loneliness. Egocentric density is a proportion of the number ties present in each participant's personal network relative to the maximum possible. Table 6 shows that, when considering ties among the alters ego identifies as

friends, the number of alters is somewhat larger, though the paired-samples *t*-test indicates the difference is not significant, $t(63) = 1.73$, $p = .088$.

One of the central hypotheses of this study, that there would be a negative correlation between UCLA loneliness and outward density, was not supported, $r = .07$, $p = .59$. A power analysis reveals that, given the sample size and hypothesized moderate correlation of -.30, this study's power was .71, slightly below the recommended minimum power of .80 (Cohen, 1992).

Because this finding is at odds with much of the literature (Bell, 1991; Berg & McQuinn, 1989; Jones & Moore, 1987; Stokes, 1985, Stokes & Levin, 1986), I tested the hypothesis again using the SELSA as the loneliness measure. The lack of association persisted when loneliness is measured with the SELSA's emotional subscale ($r = 0.10$, $p = .41$) or social subscale ($r = -.04$, $p = .74$). There was no association with Russell's emotional loneliness prototype ($r = -.15$, $p = .22$) or social loneliness prototype ($r = .04$, $p = .74$). There was also no relationship between UCLA loneliness and undirected density ($r = 0.15$, $p = .12$) or in-directed density ($r = .03$, $p = .82$). In sum, there is no support for the density-loneliness correlation, even after calculating density three ways and measuring loneliness three ways.

Betweenness and its relationship to loneliness. Betweenness centrality is another possible operationalization for social integration in the sense that a high betweenness person is "in the middle of it all." People who connect otherwise separate subgroups are high in betweenness, and this position gives them the opportunity to control the flow of anything between the subgroups. Another way to think of betweenness is that it reflects

the degree to which people depend on the person in between in order to make network connections.

Calculated using binary, undirected data, betweenness begins by considering all geodesic paths connecting all dyads in the network. A geodesic path is the shortest path that connects two nodes while using each intermediary node only once. Consider actor *j*, who lies on some number of geodesic paths between actors *i* and *k*. If there are 20 geodesic paths connecting *i* and *k*, and 10 of those paths go through *j*, then the proportion of betweenness is 10/20 or .50. Sum this proportion of *j* for all *i* and *k* dyads in the network, and the result is an actor's betweenness.

Considering people with high betweenness as socially integrated, the hypothesis that undirected betweenness predicts UCLA loneliness was supported, $r = -.28$, $p = .018$. The negative association means that the more geodesic paths between dyads a person is on, the less lonely they feel.

Though betweenness was originally limited to undirected relations (Freeman, 1977), the concept has been extended to directed relations as well (White & Borgatti, 1994). Table 6 shows that mean directed betweenness is larger than undirected, yet the association with UCLA loneliness is smaller, $r = -.24$, $p = .044$.

Closeness and its relationship to loneliness. Closeness is conceptualized as how close all others in the network are to the focal person in terms of graph theoretic distance (Freeman, 1979). This extends the analysis of a node's positional power beyond the scope of those immediately adjacent (as with degree) or merely local (as with betweenness) to include the entire network. Someone with high closeness can reach most

other nodes easily. Its computation begins with the sum of geodesic distances between ego and all other nodes in the network, yielding *farness*. The reciprocal of farness, normed relative to the most central node, is closeness centrality (Hanneman, 2001). For directed data, closeness can be calculated separately for each direction. Shown in Table 6, mean in-closeness was smaller than out-closeness, and undirected was in between.

UCLA loneliness correlated moderately with out-closeness, $r = -.34$, $p = .005$, but not with in-closeness, $r = .21$, $p = .088$. This means that the closer ego is to all others in the network, in terms of graph theoretic distance originating from ego, the less lonely ego feels. By contrast, the closer others are to ego, again in graph theoretic distance, has no affect on ego's loneliness. Predictably, undirected closeness reduces the magnitude of this relationship, $r = -.29$, $p = .016$.

Eigenvector centrality and its relationship to loneliness. One of the chief shortcomings of Freeman's (1979) three original measures of centrality—degree, closeness, and betweenness—is that they were designed to be applied to binary networks. As a corrective, Bonacich (1987) created eigenvector centrality, or what is sometimes called *Bonacich centrality*. Not only does this take the value of relations into account, it actually measures the degree to which a popular or prestigious person is connected to other prestigious people. More formally, ego's eigenvector centrality is the sum of the value of all incident ties, recursively weighted by the alters' centralities.

The only disadvantage to this measure is that it requires the adjacency matrix be symmetrical. This study's sampling procedure allowed both members of a dyad to rate the tie's strength. Having two values per tie makes the adjacency matrix asymmetric.

This means that i's rating of the tie to j is independent of j's rating of the tie to i. Both members of a dyad have the opportunity to rate the tie. If both members of all dyads agree with their partners, then the matrix will be symmetrical, otherwise it will be asymmetrical. To symmetrize an adjacency matrix is to record only one value per dyad for all dyads, and the conventional value to use is the maximum of the two tie strength ratings (Hanneman, 2001). Given this, the mean eigenvector centrality can be found in Table 6.

Eigenvector centrality is a particularly sophisticated measure of social integration because it recognizes that the value of a relational tie depends on how "important" the alter is to the network. A person's eigenvector centrality is partly determined by the centrality of his or her friends. Having a high eigenvector centrality means being connected to well-connected people. It was hypothesized that people who are popular among other popular people would feel little loneliness, and unpopular or marginalized people would feel greater loneliness.

There is a nearly significant relationship between UCLA loneliness and eigenvector centrality, $r = -.23$, $p = .06$. Given the observed magnitude of this hypothesized relationship, the sample size, and $\alpha = .05$; the calculated power is .47. This means that, under these conditions, there was a 47% chance of correctly rejecting the null hypothesis. This is substantially below the conventional minimum of .80. Thus these null results are inconclusive.

Tie strength and its relationship to loneliness. Though social network analysis is a structuralist approach, the strength of the tie itself should also be considered. It stands to

reason that more socially integrated people have closer relationships with their friends. The value of tie strength in this study is the participants' ratings of how close they felt to their friends on a scale of 1 to 9 (see Table 6).[1]

It was hypothesized that participants who felt closer to their friends on average would feel less lonely. However, there was no relationship between self-reported mean out-tie strength and UCLA loneliness, $r = .03$, $p = .82$. There was also no association with in-tie strength, $r = -.07$, $p = .592$. The implication is that, when one's friends are taken as a group, how close ego feels to them does not predict loneliness. Further, how close they feel toward ego also does not predict loneliness.

As already mentioned in the note, mean tie strength for each participant was calculated by summing the self-reported tie strength values and dividing by the number of alters, which varied from one participant to the next. The free-choice paradigm allowed participants' to nominate as many or as few alters as they wished, which ranged from 1 to 39 ($M = 12.30$, $SD = 8.53$). Because these divisors were not the same across participants, they are not directly comparable. One solution to this problem is to standardize them in a way that simulates a fixed-choice paradigm. In such a scenario, the researcher would instruct the participants to pick their top seven friends (or some other

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[1] Because tie strength is not a standard feature of Ucinet, the procedure for computing it will be explained here. In the directed, valued adjacency matrix, the row mean is the out-directed tie strength (as reported by ego) and the column mean is the in-directed tie strength (as reported by the alters). Ucinet's adjacency matrix was exported to a text file, which was then imported into SPSS. Zero values were flagged as missing values. From there, the computation of new variables for the mean, degree (the number of ties, which is the divisor of the mean), and the standard deviation were computed. These are the row values. I transposed the matrix and repeated the computations to produce the column values. These new variables were then merged into the main working dataset for analysis.

arbitrary number) for tie strength evaluation. I chose to select both the top seven and top five friends for analysis (see Appendix B). I selected these numbers of alters to make my analyses comparable to earlier researcher (Bell, 1991). There were no significant relationships between tie strength with top five or top seven alters and loneliness.

Full Hierarchical Regression Model

The primary analysis consists of a multiple regression analysis of Weiss's model, where attachment and a measure of social network integration predict loneliness. The social network measure is binary outdegree, the simple self-reported number of friends in the dorm, which also correlated moderately with the UCLA ($r = -.30$, $p = .01$). Finally, the nuisance variable neuroticism needs to be controlled for because it correlates strongly with UCLA loneliness ($r = .63$, $p < .001$), similar to previous findings (Stokes, 1985).

In order to adequately test the theory, all of these variables need to be considered together. A hierarchical regression was performed with neuroticism entered in Step 1. In Step 2, attachment avoidance and anxiety and binary outdegree were entered together.

Table 7
Hierarchical Multiple Regression Analysis Predicting Loneliness

	Overall model			Standardized regression coefficients			
Step	R^2	Adj. R^2	F	Neuroticism	Attachment Avoidance	Attachment Anxiety	Binary Outdegree
1	.39	.39	43.48**	.63**			
2	.54	.51	18.70**	.37**	.28**	.27**	-.19*

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

Accounting for 39% of the variance in UCLA loneliness, neuroticism is a powerful individual difference variable (see Table 7). However, its standardized

regression coefficient is halved when the other predictors are entered in Step 2. The two attachment dimensions contribute equally, yet the social network measure of binary outdegree still accounts for a small-to-moderate amount of variance.

Given that the two attachment dimensions are orthogonal and neither correlates with binary outdegree, there is very little overlap between the predictors. As a measure of how much variance in each predictor is independent of the other predictors, the multicollinearity tolerances (interpreted as a proportion) are all well above the rule-of-thumb of less than .10, where multicollinearity is considered sufficiently problematic. The tolerances are neuroticism = .68, attachment avoidance = .89, attachment anxiety = .80, and binary outdegree = .93. This shows that each predictor is substantially independent of the others. Of greatest theoretical importance is that the social network measure is unrelated to the attachment or personality measures, consistent with Weiss's theory of two types of loneliness.

5 Discussion

Interpretation

The purpose of this study was to test Weiss's theory that there are two types of loneliness, each with its own cause. Emotional loneliness is thought to be rooted in insecure attachment, whereas social loneliness is thought to be rooted in inadequate social integration. I hypothesized that attachment would account for some of the variance in loneliness, reflecting the theoretical relationship between attachment and emotional loneliness. Outdegree, serving as my operationalization for social network integration, would also account for some of the variance in loneliness. I further hypothesized that, similar to the two types of loneliness, the two hypothetical causal pathways would be unrelated to each other and would thus account for largely unique portions of loneliness.

These results show that outdegree and attachment do indeed predict loneliness, even after controlling for neuroticism. Further, attachment and outdegree do not correlate, which is consistent with the theory of separate origins of loneliness.

It has been known since the theory's inception that attachment was the mechanism that underlay emotional loneliness. Bowlby even wrote the chapter "Affectional Bonds: Their Nature and Origin" in Weiss's (1973) book. In contrast, the precise operational definition of social integration is still a matter of debate. In this study, I tested six different social network measures for their capability to assess social integration in the context of loneliness: degree, density, betweenness, closeness,

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eigenvector centrality, and tie strength. Of these, degree was the strongest, most parsimonious solution: the more friends people say they have, the less lonely they feel.

Degree was evaluated in terms of whether ties were directed inward toward ego, outward originating from ego, and without regard for direction. Outdegree was found to be the strongest predictor of loneliness. In fact, indegree was not associated at all. This directional pattern was also found with closeness. The importance of the direction of the tie suggests perspective matters. The essential feature of social integration is that it must be from ego's perspective.

For example, social isolation within elementary school classrooms was best predicted by the number of positive choices given (liked to play with), which was stronger than the number of positive choices received (Van den Oord, Rispens, Goudena, & Vermande, 2000). A similar moderately negative correlation was found between self-reported network size and an alternate measure of loneliness (van Baarsen, Snijders, Smit, & van Duijn, 2001). It is not a new finding that loneliness affects social perception (Anderson & Martin, 1995). The consistent pattern of null results for ties directed toward ego suggests that loneliness as a social phenomenon is firmly seated in how individuals perceive their place in society, regardless of how society places the individual.

There are a number of reasons for this finding. A possibility is that one's social context has its maximum impact at close network distances. Degree is a myopic perspective. Limited only to one's friends, it does not reflect social structure either among one's friends or transitively among their friends. Degree is an isolated perspective.

Devoid of context, degree does not depend on whether ego and its alters are embedded in a dense network of camaraderie or a sparse system of alienation.

Another possible explanation is that people who self-report more friends are perhaps better liked by those friends. Carter and Feld (2004) found that network size correlates moderately with what they call positive regard. Well-liked people have more friends, so-called stars, so it seems natural that they would feel less lonely. I also find a moderate correlation between binary outdegree and mean inward tie strength (standardized at the top seven alters, $r = .28$, $p = .04$), but the relationship is stronger with mean outward tie strength, $r = .51$, $p < .001$. This interpretation is that, for people with many friends, they like their friends more than people with few friends.

Though the effect for degree is important, perhaps more important is the finding for direction of the tie. The reason for its importance is that it is consistent with other research that found a similar effect but for density. Recall that previous studies found a negative correlation between loneliness and personal network density, which is the extent to which one's friends know each other. This study also explored density but did not find the hypothesized relation, $r = .07$, $p = .59$. One possible reason for why is that the other studies measured perceived density—from ego's perspective only—but this study used actual density as reported by ego and by the alters.

Berg and McQuinn (1989) asked their participants to name their friends and to identify their relations among them. Density was calculated from these data, resulting in $r = -.41$ for men and $r = -.27$ for women. Bell (1991) also asked for the names of up to seven alters and for the participants' ratings of all 21 possible tie strengths. Again,

density is based strictly on the participants' perception and yielded $r = -.25$. Stokes (1985) asked participants to fill in the adjacency matrix of up to 20 of their friends and to indicate the relationships among them, which yielded $r = -.30$. Stokes and Levin (1986) used a similar procedure with the participants' top seven friends, $r = -.35$ for men and a nonsignificant $r = -.19$ for women. Jones and Moore (1987) used an adjacency matrix with an eight-week longitudinal sample, yielding $r = -.24$ at Time 1 and $r = -.23$ at Time 2. All of these studies used perceived density. No attempt was made to validate the perceptions by contacting the alters.

An important shortcoming present in much social network research is the way the network members are identified. Often, the name generator used is a free-recall task. However, this method of delineating personal networks is known to produce biased networks where the ego-alter tie is exceptionally strong and where the personal network is exceptionally dense (Marin, 2004). All the studies that found the density-loneliness correlation used free-recall name generators to construct the personal networks. This network measurement method inflates density.

This represents the third important finding in addition to degree and tie direction: Only perceived density is related to loneliness, not actual density. Though this study did not measure the perception of density, this study's measurement of all dyads from both members' perspectives allows for the conclusion that real, consensual density has no relationship to loneliness.

Consider the present study's finding that outdegree correlated with loneliness but indegree did not. In terms of density, perceived density as measured in previous studies

is most similar to outdegree, for both rely on ego's perspective for the judgment of social relations. Note that in these previous studies, perceived density correlated with loneliness in the same direction and magnitude as outdegree does in this study. In this sense, outdegree is functionally similar to perceived density in that both are the product of ego's social perception. This suggests that loneliness is related to social perception, not necessarily to any objective feature of one's social network. The fact that none of the inward-directed social network measures were related to loneliness represents a convergence of evidence that the external social world has little impact on loneliness. Rather it is how people perceive their place, regardless of what that actual social place is, that affects loneliness.

From these conclusions arises a philosophy of the individual and society far removed from the social realism envisioned by Emile Durkheim (1897/1951). He considered society an emergent entity, a powerfully coercive force to impinge upon individuals. His conception of *egoistic suicide* as resulting from the lack of integration into society is a more extreme case of social loneliness on the macrosystem level. With regard to loneliness in the present study, social realism must give way to social perception.

Society is the figment of the imagination of the person who perceives it. For those previous studies that investigated perceived density (Anderson & Martin, 1995; Bell, 1991; Berg & McQuinn, 1989; Jones & Moore, 1987; Stokes, 1985; Stokes & Levin, 1986), the lonely people thought their personal social worlds were fractionalized, and the nonlonely people considered their friends a friendly society. The essential question is

whether their perceptions were true. Is loneliness the result of objective social deficits? Or do lonely people see a bleak world of alienated individuals hopelessly disconnected from each other? This study attempted to answer the question by taking perspective into consideration.

From this study, lonely people reported having fewer friends, an effect of egocentric social perception. In a larger sense, the individual feels weakly connected to society. However, the number of people who counted ego a friend had no effect on ego's loneliness. Inurned to the friendly overtures of others, society had no impact on the individual.

Limitations

One of the chief limitations of this study is the small sample size. Because statistical power was reduced to .71, which is not too far below Cohen's conventional minimum of .80, it raises the possibility that the hypothesized relation between density and loneliness does exist but could not be detected. However, this null result should be considered especially inconclusive and not attributed to inadequate sample. The reason is because there is an important difference between this study and other studies that did find the density correlation: they used density as perceived by ego and this study used the perception of both members of every dyad. The lack of concordance between the present study and the literature could be due to the sample size or to the effect of verifying the relations among the alters. If the disappearance of the density correlation is due to verification, then that is itself the important finding that loneliness moderates social perception.

Related to sample size are the issues of network proportion and attrition. Given the Honors Dorm's approximate total census of 180, 108 were consented. Of those 108, 69 completed the study providing network data. Participants nominated 150 dorm alters, 42 of whom were never a part of this study. Participants identified these people as dorm residents who were their friends, but because they did not consent to participate, they were not considered in the density calculations or any calculations for that matter. Unfortunately, a missing-data analysis is impossible because we have no data whatsoever from these people.

Further, there were 39 people who consented to participate but did not. Of these, 25 did not even log in to the system. But of greatest concern with respect to the network analysis, 8 of the 39 stopped participation before they could provide network data and 6 completed the entire study without providing any network data at all. Imputing missing values in network data using exponential random graph models is at the cutting edge of mathematical research, and the authors admit its use is not ready for substantive research (Robins, Pattison, & Woolcock, 2004). Therefore, these people's data were not part of the analyses and represent an unfortunate missed opportunity.

The network boundary issue is one of the most vexing in social network analytic research (Laumann, Marsden, & Prensky, 1989; Koehly & Shivy, 1998). Typically, the researcher must choose an expedient: (a) use a naturally-isolated network, (b) use a snowball sampling procedure, or (c) attempt to randomly sample from a network.

Each of these approaches has its own hardships. There are very few truly isolated networks. Even prisoners have visitors. The problem with this approach is the

permeability of the network boundary. This would not be a problem if the personal friendship networks of everyone in the dorm were largely contained within the dorm. In fact, that was the not-unreasonable hope for this study (Festinger, Schachter, & Back, 1950).

The snowball sampling procedure has a built-in bias where respondents name the most important members of their personal networks, which in turn affects network structure at farther network distances, a phenomenon called the *ripple effect* (Newman, 2003). Names of friends are not forgotten at random, and forgetting has been shown to influence point centralities and density (Brewer & Webster, 1999). Finally, randomly sampling from a network differentially affects social network measures. For example, indegree is known to be robust even when calculated from a small subsample, but density becomes unstable rather quickly (Costenbader & Valente, 2003).

While it was obvious to me from the start that I could never get all of everyone's friends, I was hoping to at least get a larger proportion of the friendship network within the dorm. Having 42 nominated friends in the dorm who did not participate at all threatens the validity of the network measures.

Strengths

Despite this study's limitations, it also had many strengths. The use of the Honors dorm was a calculated risk that paid off. The hope was that most of the residents' friends would also be dorm residents, as has been found to be the case in the past (Festinger, Schachter, & Back, 1950). To testify to the legitimacy of defining the network boundary

as the Honors dorm, the entire sample forms a single weak component, a network structure where any person can reach any other person (see Figure 2).
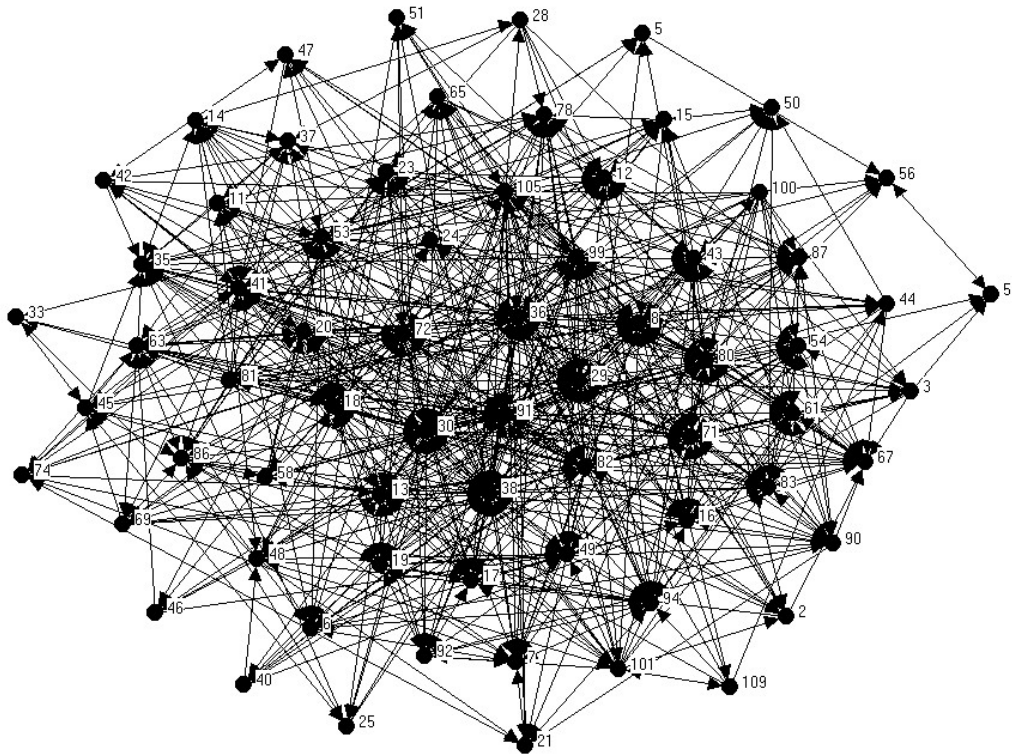

Figure 2. Full network graph forming one component.

Because previous studies used weak measures of loneliness, attachment, or the social network, it was planned from the start of this study to use the best measurement instruments available. The ECR has been confirmed as a high-performance research instrument. The UCLA also has strong psychometric properties, despite its unidimensional structure. Most important, the network was measured in such a way as to obtain data of the highest quality—directed and valued from all perspectives. It is this feature that allows for the distinction between social perception and social reality.

Directions for Future Research

The study of loneliness began with a slow start but is increasing in speed and sophistication. While there will always be issues with measurement and analytic techniques, progress is best defined by their refinement. To that end, future research should emphasize these two goals.

Though the argument for social and emotional loneliness rests on an evolutionary claim, this does not imply culture is irrelevant. With loneliness being a social phenomenon, it would stand to reason that what constitutes a loneliness-provoking circumstance would vary across cultures. If the idea of "drive to be socially integrated" is expanded to describe an entire culture, then perhaps that dimension corresponds to collectivism-individualism. Comparing loneliness across such cultures has shown significant differences (Malikiosi-Loizos & Anderson, 1999), where friendship reciprocation had a greater impact on loneliness in a collectivistic culture than in an individualistic culture. Further investigations may show that social integration means different things in different cultures, such as social responsibility (e.g., doing what is expected) or position in a social hierarchy (e.g., playing a role).

Another direction for future research is to study the course of loneliness across time. Some studies have done this. Parker and Seal (1996) found that network density tended to increase over time, but only for boys. Shaver, Furman, and Buhrester (1985) found that close dyadic relationships take substantial time to develop, but clique formation happens relatively quickly. Hays and Oxley (1986) found that the most adaptive outcomes were among participants whose networks were permeable

immediately after network disruption (i.e., coming to college) but later became stable. Perhaps network integration is more than incorporating the self into a social system, but the ability to actively construct an interconnected network among one's new friends.

Finally, future studies should explicitly compare social perception with reality. The question of perceived density versus consensual density is still open. If a perceptual bias lies at the core of loneliness, then direct laboratory testing of social perception is warranted. Lonely and nonlonely people should be compared on their ability to accurately detect social structure. Finally, the relationship between loneliness and a possible social perceptual bias is still correlational in nature. True experimental designs are necessary to determine causality.

These observations of social systems in action imply that loneliness is not a static individual difference or the product of a social circumstance. There is evidence for the claim of a dynamic relationship between how individuals are affected by their social situations, how they differentially perceive and alter their positions within the social system, and how they even manipulate the structure of the social network itself. Perhaps loneliness is not a state of being, but a process.

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Appendix A

The UCLA Loneliness Scale Version 3

The following statements describe how people sometimes feel. For each statement, please indicate how often you feel the way described by clicking the best response. Here is an example:

How often do you feel happy?

If you never felt happy, you would respond by clicking "never"; if you always feel happy, you would respond by clicking "always."

1 = Never
2 = Rarely
3 = Sometimes
4 = Always

1. How often do you feel that you are "in tune" with the people around you?
2. How often do you feel that you lack companionship?
3. How often do you feel that there is no one you can turn to?
4. How often do you feel alone?
5. How often do you feel part of a group of friends?
6. How often do you feel that you have a lot in common with the people around you?
7. How often do you feel that you are no longer close to anyone?
8. How often do you feel that your interests and ideas are not shared by those around you?
9. How often do you feel outgoing and friendly?
10. How often do you feel close to people?
11. How often do you feel left out?
12. How often do you feel that you relationships with others are not meaningful?
13. How often do you feel that no one really knows you well?
14. How often do you feel isolated from others?
15. How often do you feel you can find companionship when you want it?
16. How often do you feel that there are people who really understand you?
17. How often do you feel shy?
18. How often do you feel that people are around you but not with you?
19. How often do you feel that there are people you can talk to?
20. How often do you feel that there are people you can turn to?

Experiences in Close Relationships

The following statements concern how you feel in romantic relationships. We are interested in how you generally experience relationships, not just in what is happening in

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a current relationship. Respond to each statement by indicating how much you agree or disagree with it. Click the most accurate response.

1 = Disagree Strongly
2
3
4 = Neutral/Mixed
5
6
7 = Agree Strongly

1. I prefer not to show a partner how I feel deep down.
2. I worry about being abandoned.
3. I am very comfortable being close to romantic partners.
4. I worry a lot about my relationships.
5. Just when my partner starts to get close to me I find myself pulling away.
6. I worry that romantic partners won't care about me as much as I care about them.
7. I get uncomfortable when a romantic partner wants to be very close.
8. I worry a fair amount about losing my partner.
9. I don't feel comfortable opening up to romantic partners.
10. I often wish that my partner's feelings for me were as strong as my feelings for him/her.
11. I want to get close to my partner, but I keep pulling back.
12. I often want to merge completely with romantic partners, and this sometimes scares them away.
13. I am nervous when partners get too close to me.
14. I worry about being alone.
15. I feel comfortable sharing my private thoughts and feelings with my partner.
16. My desire to be very close sometimes scares people away.
17. I try to avoid getting too close to my partner.
18. I need a lot of reassurance that I am loved by my partner.
19. I find it relatively easy to get close to my partner.
20. Sometimes I feel that I force my partners to show more feeling, more commitment.
21. I find it difficult to allow myself to depend on romantic partners.
22. I do not often worry about being abandoned.
23. I prefer not to be too close to romantic partners.
24. If I can't get my partner to show interest in me, I get upset or angry.
25. I tell my partner just about everything.
26. I find that my partner(s) don't want to get as close as I would like.
27. I usually discuss my problems and concerns with my partner.
28. When I'm not involved in a relationship, I feel somewhat anxious and insecure.
29. I feel comfortable depending on romantic partners.
30. I get frustrated when my partner is not around as much as I would like.
31. I don't mind asking romantic partners for comfort, advice, or help.

32. I get frustrated if romantic partners are not available when I need them.
33. It helps to turn to my romantic partner in times of need.
34. When romantic partners disapprove of me, I feel really bad about myself.
35. I turn to my partner for many things, including comfort and reassurance.
36. I resent it when my partner spends time away from me.

The Social and Emotional Loneliness Scale for Adults

1 = Disagree Strongly
2 = Disagree
3 = Somewhat Disagree
4
5 = Somewhat Agree
6 = Agree
7 = Agree Strongly

SELSA Emotional Subscale
1. I am an important part of someone else's life.
2. I feel alone when I'm with my family.
3. No one in my family really cares about me.
4. I have a romantic partner with whom I share my most intimate thoughts and feelings.
5. There is no one in my family I can depend upon for support and encouragement, but I wish there were.
6. I really care about my family.
7. There is someone who wants to share their life with me.
8. I have a romantic or marital partner who gives me the support and encouragement I need.
9. I really belong in my family.
10. I have an unmet need for a close romantic relationship.
11. I wish I could tell someone who I am in love with that I love them.
12. I find myself wishing for someone with whom to share my life.
13. I wish my family was more concerned about my welfare.
14. I'm in love with someone who is in love with me.
15. I wish I had a more satisfying romantic relationship.
16. I have someone who fulfills my needs for intimacy.
17. I feel part of my family.
18. I have someone who fulfills my emotional needs.
19. My family really cares about me.
20. There is no one in my family I feel close to, but I wish there were.
21. I have a romantic partner to whose happiness I contribute.
22. My family is important to me.
23. I feel close to my family.
SELSA Social Subscale

1. What's important to me doesn't seem important to the people I know.
2. I don't have a friend(s) who shares my views, but I wish I did.
3. I feel part of a group of friends.
4. My friends understand my motives and reasoning.
5. I feel "in tune" with others.
6. I have a lot in common with others.
7. I have friends that I can turn to for information.
8. I like the people I hang out with.
9. I can depend upon my friends for help.
10. I have friends to whom I can talk about the pressures in my life.
11. I don't have a friend(s) who understands me, but I wish I did.
12. I do not feel satisfied with the friends that I have.
13. I have a friend(s) with whom I can share my views.
14. I'm not part of a group of friends, and I wish I were.

Individualism
1 = Disagree strongly
2 = Disagree
3 = Neither disagree nor agree
4 = Agree
5 = Agree strongly

1. I'm not to blame for others' misfortunes.
2. I feel that I'm the master of my own fate.
3. I really feel that the "pull yourself up by your bootstraps" philosophy makes a lot of sense.
4. These days, the only person you can depend upon is yourself.
5. I take great pride in accomplishing what no one else can accomplish.
6. I actively resist other people's efforts to mold me.
7. Before I can feel comfortable with anybody else, I must feel comfortable with myself.
8. I place personal freedom above all other values.
9. I know myself better than anyone else possible could know me.
10. I see nothing wrong with self promotion.

Collectivism

1. I don't feel that I'm a success unless I've helped others succeed as well.
2. I want the opportunity to give back to my community.
3. I'm the type of person who lends a helping hand whenever possible.
4. I consider myself a team player.
5. My major mission in life is striving for social justice for all.
6. My heart reaches out to those who are less fortunate than myself.
7. If another person can learn from my mistakes, I'm willing to share my ups and downs with that person so that he or she can do better.

8. It feels great to know that others can count on me
9. I have an important role to play in bringing together the peoples of the world.
10. I believe in the motto, "United We Stand, Divided We Fall."

The Big Five Inventory (BFI)

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 choose a number for each statement to indicate the extent to which you agree or disagree with that statement.

1 = Disagree strongly
2 = Disagree a little
3 = Neither agree nor disagree
4 = Agree a little
5 = Agree strongly

I see myself as someone who . . .

1. is talkative
2. tends to find fault with others
3. does a thorough job
4. is depressed, blue
5. is original, comes up with new ideas
6. is reserved
7. is helpful and unselfish with others
8. can be somewhat careless
9. is relaxed, handles stress well
10. is curious about many different things
11. is full of energy
12. starts quarrels with others
13. is a reliable worker
14. can be tense
15. is ingenious, a deep thinker
16. generates a lot of enthusiasm
17. has a forgiving nature
18. tends to be disorganized
19. worries a lot
20. has an active imagination
21. tends to be quiet
22. is generally trusting
23. tends to be lazy
24. is emotionally stable, not easily upset
25. is inventive

26. has an assertive personality
27. can be cold and aloof
28. perseveres until the task is finished
29. can be moody
30. values artistic, aesthetic experiences
31. is sometimes shy, inhibited
32. is considerate and kind to almost everyone
33. does things efficiently
34. remains calm in tense situations
35. prefers work that is routine
36. is outgoing, sociable
37. is sometimes rude to others
38. makes plans and follows through with them
39. gets nervous easily
40. likes to reflect, play with ideas
41. has few artistic interests
42. likes to cooperate with others
43. is easily distracted
44. is sophisticated in art, music, or literature

Please check: Did you write a number in front of each statement?

Social Network Measure

Below is a list of every student in the West Grace Honors Residence Hall who has agreed to participate in this study. Beside the name of each person you know, please click the appropriate circle to indicate how close you are to that person. For those people you do not know, do not click any circle on that person's row. The list is in alphabetical order by last name. You may also use your Web browsers search/find feature (Ctrl-f)to search this page for the names of people you know.

Not all West Grace residents are listed here. At the bottom, there are spaces for you to write in the names of the West Grace residents you know but who are not listed. If you accidentally click a circle of a person you don't know, you can clear the form and start over by going to the bottom of the page and clicking the button labeled "Clear Form."

1 = Not at all close
9 = Extremely close

Single-Item Self-Esteem Scale (SISE)

I have high self-esteem.

1 = Not very true of me
2 =
3 =
4 =
5 = Very true of me

Russell et al. (1984) Prototype Items

1 = Not very intensely
2 =
3 =
4 =
5 =
6 =
7 =
8 =
9 = Very intensely

Please indicate how intensely you feel the following types of loneliness.

1. A possible type of loneliness is the lack of an intense, relatively enduring relationship with one other person. While this relationship is often romantic, it can be any one-to-one relationship that provides feelings of affection and security.

2. A possible type of loneliness involves not belonging to a group or social network. While this may be a set of friends who engage in social activities together, it can be any group that provides a feeling of belonging based on shared concerns, work, or other activities.

Appendix B

```perl
#!perl -w
# This program is called top.pl.
# Integer argument for outdegree limit.
# @ARGV[0] holds the value of binary outdegree.

use DBI;
use strict;

# Number of closest alters I will select.
# Don't forget to change the filename.
my $LIMIT = $ARGV[0];

my $outfile = ">top${LIMIT}_output.txt";
open(OUT, $outfile);
select OUT;

# Connect
my $dbh = DBI-
>connect("DBI:mysql:database=psyc002_thesis;host=localhost",
                "psyc002_db", "poKoli10");
# Prepare a query.
my $sth = $dbh->prepare("
     SELECT DISTINCT t1.subject_id, t1.choice, t1.closeness
     FROM tie AS t1, tie AS t2
     WHERE t1.choice = t2.subject_id
     ORDER BY t1.subject_id, t1.closeness DESC
");

$sth->execute();

# DEBUG
my %numAlters;

# Set the counters.
my $subject_id = 0;
my $counter = 0;
# String that holds all of a single S's records.
my $num_subjects = 0;
my $record_group = '';

while (my $row = $sth->fetchrow_arrayref()) {
     if ($row->[0] != $subject_id) {
          # New subject.
          $record_group = '';
          $record_group = join("\t", @{$row}) . "\n";
          $subject_id = $row->[0];
          $counter = 1;
          # DEBUG
          $numAlters{$subject_id} = $counter;
     } elsif ($counter < $LIMIT) {
          # Same S but not enough records yet.
```

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```perl
                $record_group .= join("\t", @{$row}) . "\n";
                $counter++;
                # Exactly the right number of records.
                if ($counter == $LIMIT) {
                        print $record_group;
                        $num_subjects++;
                        $record_group = '';
                }
                # DEBUG
                $numAlters{$subject_id} = $counter;
        } else {
                # Same S but enough records collected.
                # Skip the remainder of this S's records.
                next;
        }
}

$sth->finish();
$dbh->disconnect();

close OUT;
select(STDOUT);

# DEBUG
my $line = 1;
my $dropped = 0;
foreach my $key (sort keys %numAlters) {
        print "$line:\t$key\t=>\t$numAlters{$key}";
        if ($numAlters{$key} < $LIMIT) {
                print " DROPPED\n";
                $dropped++;
        } else {
                print "\n";
                $line++;
        }
}
print "\nN\t= $num_subjects\n";
print "Ties\t= " . $num_subjects * $LIMIT . "\n";
print "Dropped\t= $dropped";
```