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The Longitudinal Effects of Self-Monitoring and Locus of Control on Social Network
Position in Friendship Networks

THESIS

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AFIT/GEM/ENV/06M-11

DEPARTMENT OF THE AIR FORCE
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AFIT/GEM/ENV/06M-11

THE LONGITUDINAL EFFECTS OF SELF-MONITORING AND LOCUS OF
CONTROL ON SOCIAL NETWORK POSITION IN FRIENDSHIP NETWORKS

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the
Degree of Master of Science in Engineering Management

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March 2006

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Abstract

The purpose of this research was to identify how enduring personality characteristics predict a person's location in a network, locations which in turn affect outcomes such as performance. Specifically, this thesis examines how self-monitoring and locus of control influence an individual's location in a friendship social network over time. Hierarchical Linear Modeling (HLM) was used to analyze 28 groups of students and instructors at a military training course over six and one half weeks. Self-monitoring predicted betweenness centrality in five of six time periods while locus of control predicted betweenness centrality in three of six time periods. The moderation of self-monitoring on locus of control also determines social network centrality. A longitudinal analysis suggested that self-monitoring was not related to the rate of increase of centrality over time.

Organizational leaders may benefit in better identifying influential social network employees by their personality make-up and assigning them where their impact will be most valuable.

AFIT/GEM/ENV/06M-11

To my Wife, the Twins, Baby Bean, Mom and Dad

Acknowledgments

First off I need to thank God, since through Him all things are possible. An infinite 'thank you' goes to my wife for taking care of the twins and home while I toiled at the Kava House (coffee shop). I also want to express my sincere gratitude to my advisor, Major Kent Halverson, for his leadership in this thesis effort. His expertise was only surpassed by his tireless guidance and encouragement.

Gary J. Moore

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THE LONGITUDINAL EFFECTS OF SELF-MONITORING AND LOCUS OF CONTROL ON SOCIAL NETWORK POSITION IN FRIENDSHIP NETWORKS

1. Introduction

When investigating an organization, the make-up of the informal relationships can be just as important as the formal relationships defined by the structure of its organizational chart. Information flows in a casual manner through the informal structure which may not flow through the formal structure (Cross & Parker, 2004). This is facilitated by those individuals that have developed social ties that help them gain access to information and others within the organization. These individuals position themselves in key, central locations, with many contacts at several levels and across divisions of the organization (Brass, Galaskiewicz, Greve, & Tsai, 2004) facilitating the exchange of knowledge when compared to others that have few contacts and limited access to potentially valuable information. These positions, either central, periphery, or somewhere in between, represent the network location an individual occupies in a given social network. The ties of these individual network locations make up the overall structure or configuration of a social network (Borgatti & Foster, 2003).

Termed social networks, it is the social structure between actors, mostly individuals or organizations, which indicate the ways in which they are connected through various

social intimacies varying from the unfamiliar, the casual acquaintance, or the strongest of unions (Freeman, 2000). These informal relationships in the organization can critically influence performance (Cross & Parker, 2004). Brass (1984) found strong relations between the relative positions of employee's networks, specifically the number of contacts that account for access to people and control of resources, and the perceptions of influence by supervisors. Another study found that social network locations of masters of business administration students affected both their attitudes and grades (Baldwin, Bedell, & Johnson, 1997). Yet another study showed how individual network location was a critical factor for good group performance (Yang & Tang, 2004). Researchers are suggesting that managers refocus attention from restructuring their companies to mapping these informal relationships which would harness the real power in their organization (Casciaro & Lobo, 2005; Krackhardt & Hanson, 1993; Kleiner, 2002). These informal networks are highly adaptive and can work across divisional boundaries to get work done quickly (Krackhardt & Hanson, 1993). Even the popular press has taken note in a *Forbes* magazine article suggesting companies get an expert to scientifically analyze their staff to expose entrusted relationships that are critical to inspiring innovation and developing knowledge capital (Ferguson, 1997).

Although it is important to study the consequences of network locations, it is equally essential to examine the antecedents that bring a person to a particular network location. The previous body of knowledge in social networks focuses more on consequences of network structure and not the antecedents (Mehra, Kilduff, & Brass, 2001). Research has started to shift, however, examining the ways that networks actually form and the way an individual attains his or her position in the network. This line of

research started with Burt, Jannotta, and Mahoney (1998) who identified that individual personality make-up varies with structural holes, which is a specific element of network structure. However, the researcher's use of a commercial human resource consulting firm's personality instrument makes it difficult to make parallel arguments with more commonly accepted personality constructs. Another effort exploring these types of questions emphasized individual differences. Klein, Lim, Saltz, and Mayer (2004) found that demographic characteristics like race and gender, along with personality and values, influence an individual's position in a network.

Broad personality traits have been studied by Klein et al. (2004) using the five factor model. However, Kalish and Robins (2006) argue that the "big five may be too diffuse to capture specific behavioral outcomes." Researchers have already begun to test more specific personality constructs such as locus of control (Kalish & Robins, 2006) and self-monitoring (Kalish & Robins, 2006; Mehra et al., 2001).

Mehra et al. (2001) performed a study on members of a high-technology firm and focused on self-monitoring as a predictor of centrality. However, the most recent research by Kalish and Robins (2006) replicated a portion of Mehra et al.'s study but did not find links between self-monitoring and social network location. Kalish and Robins did discover that other psychological predispositions (i.e. extraversion, neuroticism, and locus of control) explained a significant proportion of the variance in network structure. This effort follows the Mehra et al. suggestion that encouraged further research into the personality factors that influence how people create their social ties. Kalish and Robins also advocate the use of more specific psychological constructs in determining social network location and incorporated the construct of locus of control in their study. This

study will focus on the two personality constructs of self-monitoring and locus of control as antecedents to social networks.

Examining personality as an antecedent to network structure is an increasing aspect of social network analysis literature. While researchers have called for more research in this area (Mehra et al., 2001; Klein, Lim, Saltz, & Mayer, 2004; Kalish & Robins, 2006), these same researchers have also asked for subsequent efforts to explore the influences that personality plays in the development of network structure over time. Social networks are dynamic, changing as the situation evolves. Various personalities like self-monitoring and locus of control are introduced at different times influencing the informal network structure, potentially interacting differently at distinct points in time. The previous work will be taken a step further by looking at the importance of the longitudinal effects on certain personality constructs. Of the numerous personality constructs to consider, self-monitoring is quite susceptible to longitudinal effects. Snyder (1987) asserts that self monitoring theory predicts how an individual shapes their social world noting that high self-monitors may take time observing others before making social contacts. Mehra et al. (2001) argued that the personality construct of self-monitoring is of progressive interest to social networkers since it demonstrates predictable patterns of variability across situations amongst differing individuals. The dynamic influence of self-monitoring on social network position can only be investigated through a longitudinal effort. Moreover, the targeted stimulus of self-monitoring on the social network development may preeminently be studied in a group of new comers where the network positions of the members are essentially the same.

With the absence of longitudinal data, Mehra et al. (2001) acknowledged the importance of time by testing the interaction between organizational tenure data and self-monitoring when predicting individual informal social network location. They did find that different levels of self-monitoring determine network location over time. Similarly, Kalish et al. (2006) acknowledged “longitudinal analysis of complete networks is what is ultimately required” to understand the association between network structure and psychological variables. Multiple data points obtained while a network develops may reveal how personality traits influence the development of informal social structure.

Since time may moderate the influence of personality on social network position, the interaction of differing personalities may too effect social network position. In the effort to advance the understanding of specific personality antecedents on social network position one could study the moderating effects of two related constructs. A study on moderator and mediator variables explained that the predictive efficacy of both traits and attitudes improves when self-monitoring is used as a moderator (Baron & Kenny, 1986). An interesting complication that has yet to be considered is the interaction of personality traits such as self-monitoring and locus of control and the implications to social network position. Previous research reveals that these two personality constructs have consistently shown low correlations and may interact to influence social interaction (Hamid, 1989). Another hypothesis has been supported that self-monitoring will moderate the relationship between locus of control and speaking up in the work place (Premeaux & Bedeian, 2003). Although relationships between social interaction, speaking up, and social network position could be conjectured, a specific analysis of any moderating effects could reveal a better understanding of social network development.

Social network research has started to shift from consequences of network position to the antecedents that bring individuals to that position. Broad personality constructs and a few specific personality traits have been considered in a small number of cross-sectional studies. This study will consider the effect of time on self-monitoring as well as potential interaction effects of self-monitoring and locus of control in determining an individual's location in a social network.

2. Literature Review

2.1. Introduction

This paper discusses social network formations by focusing on the widely used personality constructs of self-monitoring and locus of control as network antecedents. Most importantly, several network data points will be examined to observe the longitudinal effects of personality traits on social network location. Before the temporal aspects of the study are discussed, a theoretical background of social networks is provided. This is followed by a discussion of the literature that has identified the antecedents of network position, namely, personality. Finally, the dynamic nature of networks is discussed.

2.2. Social Networks

Social network analysis finds its origins in social psychology groups and anthropological studies under the work of Radcliffe-Brown (Radcliffe-Brown, 1940). The British social anthropologist coined the concept of 'social structure' and studied ideas of 'interlocking' relations and the 'web' of social life. In later work, Manchester University researchers furthered this social understanding with observations of African tribal societies and rural British towns (Barnes, 1969). They applied mathematical models to this social theory and focused on the importance of informal relations in social systems. However, the lineage of social network analysis has two other strands with the work of sociometric analysts (Moreno, 1934) and Harvard researchers (White, 1970). The sociometric analysts explored the tools of graph theory and applied them to small groups. The Harvard researchers examined the formation of 'cliques' and interpersonal relations.

Although the social network analysis history dates back to the 1940s, it was not until the 1960s when the current method using mathematical models was developed by Harrison White and his protégés at Harvard. The Harvard breakthrough exposed two mathematical innovations: (1) algebraic models of groups using set theory to model kinship and (2) multidimensional scaling (White, 1970). The past quarter century's worth of social network research has established its audience in management journals (Brass et al., 2004). Social network research has exponentially increased due to the shift away from individualist explanations toward relational understandings (Borgatti & Foster, 2003).

Social network analysis has developed into an interdisciplinary behavioral science specialty where social actors are observed to be interdependent and their links have important consequences (Freeman, 2000). Social networks are a series of informal relationships where actors (people, teams, organizations, etc.) are linked to one another to facilitate the exchange of task and social information. Much of the real work that is accomplished in an organization is done in the invisible informal organization where individuals have control of information that can cut through normal procedures (Cross & Parker, 2004). A study of a federal agency found that structural position as measured by network centrality relates independently and significantly to others' perceptions of the individuals' control as defined by the influence the person has in everyday activities (Brass & Burkhardt, 1993). Another social network study found that centrality independently predicted an individuals' workplace performance. An employee more central in the organization ranked higher on supervisory ratings than those on the

periphery (Mehra et al., 2001). Understanding these social links could help companies nurture and support the informal organization (Krackhardt & Hanson, 1993).

Social links determine the varying locations a person will reside in each network; specifically ones that are either center or on the periphery. Individuals who occupy central informal positions in organizations are potentially powerful since they may have access and power over resources that others on the periphery do not have (Brass et al., 2004). Centrality has been conceptually clarified and synthesized into three measures: degree (number of contacts), betweenness (extent to which a particular point lies 'between' the various other points in the graph), and closeness (extent to which a person lies at short distances to many other people in the network) (Freeman, 1978). Degree centrality is a measure of activity where the number of other individuals in a network is directly connected. "In-degree" centrality specifically notes the scope to which people in the network identify a primary individual as one of their contacts in that network whereas "out-degree" centrality defines the extent that an individual identifies others in their network (Cross & Parker, 2004). Current research in social network antecedents has used varying measures of network structure with Klein et al. (2004) using in-degree centrality, Mehra et al. (2001) performing betweenness centrality, and Kalish et al. (2006) introducing a new triad census method.

Every organization has several overlapping social networks where social actors play very different roles in each setting at the same time. The actors within these networks play several different roles simultaneously to permit the flow of information, affect, influence, material goods, and social support (Cross & Parker, 2004). A set of links of a given type (e. g. friendship) makes up a binary social relation where each

relation defines a different network; a friendship (people you choose to enjoy informal activities) network is distinct from an advice, adversarial, or trust network, although they may sometimes be interrelated (Borgatti & Foster, 2003). For example, Krackhardt and Hanson (1993) helped a California-based computer company devise a stronger competitive strategy by employing the strengths of the informal organization. The CEO wanted to move the company in a new direction and involved the employees in the planning process. He chose an eight year company veteran with proven expertise and credibility to be the team leader. Surprisingly, however, after a couple of months little progress was made. A clearer picture of the group dynamics was needed so a social network analysis was performed and focused on two distinct networks: advice and trust. It was revealed that the team leader held a central position in the advice network which meant that others went to him for technical support. However, he had only a single link in the trust network to another individual. This led the CEO to believe this lack of trust had been the roadblock to success. Ultimately the CEO referred to the trust network and appointed another person, who was central in the trust network, to co-lead the effort with the technical team leader. Because the employees believed that the more trustworthy leader would have their best interests in mind, people became more open to the changes. After a couple of months, progress was made due to the analysis of the informal social network (Krackhardt & Hanson, 1993). These networks provide individuals with opportunities as well as constraints on behavior (Freeman, 2000).

This study will focus on the implicitly discretionary friendship network where individuals have choice of others to interact with. The benefits of a central position in such a network would be a larger number of resources and diversity of information

(Baldwin et al., 1997). Mehra et al. (2001) and Klein (2004) incorporated this type of network in their research because of its discretionary nature.

The friendship network has powerful consequences since it can provide access to information and people. This network describes the ties of affection and camaraderie that link team members (Baldwin et al., 1997). A friendship network is developed from individual choices which could lead to structurally advantageous positions leading to new contacts with varying information and resources (Mehra et al., 2001). This study acknowledges that there are many networks as identified in the current literature and does not attempt to resolve any differences. The friendship network has simply been chosen since it represents a highly discretionary network that can bring benefits to an individual when considering varied information and resources.

2.2.1. Antecedents to Social Networks

Borgatti et al. (2003) points out that antecedent research on social networks has been limited due to the focus on consequences to establish legitimacy in the field, however, acknowledging that the volume is increasing rapidly. While this paper centers on personality antecedents, researchers have studied other antecedents such as similar demographic characteristics and values (Klein et al., 2004). Brass et al. (2004) observed antecedents of interpersonal networks by studying personality antecedents and demographics as well as physical proximities of actors and formal organizational structures. Not only did the Brass et al. (2004) study look at interpersonal networks, it also examined the antecedents of inter-unit and inter-organizational networks' organizational characteristics. The following highlights the most recent research considering personalities antecedents at the interpersonal level.

Mehra et al. (2001) collected friendship network, personality, and performance data from an established 116-member high-technology firm (Mehra et al., 2001). These researchers compared workflow and friendship networks. They reported that “chameleon-like high self-monitors were more likely than true-to-themselves low self-monitors to occupy central positions in social networks (Mehra et al., 2001, p.121).” A second hypothesis was also supported showing that high-self monitors would traverse various social worlds over time becoming more central across the entire network while low self-monitors cultivated fewer contacts.

Klein et al. (2004) studied the relationship between individual’s demographic characteristics, values, and personality and their centrality in their teams’ friendship, advice, and adversarial networks. Data from 900 respondents in 96 randomly assigned teams over two time points spanning five months was collected (Klein et al., 2004). These work teams provided a pseudo sterile environment where individuals may not have had previous relations with others in the group. It was found that previous relationships could alter the true influence of personality as the antecedent of the formation of the team’s social network structure. The multi-team analysis also eliminated the concern of single source bias by utilizing several data points. The “big-five” personality instrument (Goldberg, 1990) was used, finding that individuals who were low in neuroticism became high in advice and friendship centrality. Although the step in acquiring data from two time points may enhance confidence in research conclusions, more data points could provide more significant longitudinal insight.

The most recent effort in the prediction of network structure comes from Kalish et al. (2006) in which they introduce a new triad census method to examine personal

networks of strong and weak ties. Their research suggests that psychological predispositions such as extraversion and neuroticism explain a significant proportion of variances in social networks (Kalish & Robins, 2006). Their research also utilized a wider range of psychological constructs such as locus of control.

2.2.1.1. Self Monitoring

Of the various personality constructs to be studied as antecedents such as the big five (Klein et al., 2004), researchers have routinely chosen the specific construct of self-monitoring, unfortunately without replication (Mehra et al., 2001; Kalish & Robins, 2006). The self-monitoring construct was developed by Snyder (1987) to explain the differences in how people observe, regulate, and control their expressive behavior and self-presentation in varying social situations and interpersonal relationships. High self-monitors are highly attuned to their social surroundings and adjust their behavior according to situationally specific norms. Low self-monitors do not have the skill or the desire to regulate their self presentation (Snyder, 1987). The high self-monitor asks, “What is called for here?” whereas the low self-monitor asks, if anything, “What would be most like me here?” (Dabbs, Evans, Hopper, & Purvis, 1980).

There have been critics to the validity of this construct when considering dimensionality and its use as a discrete class variable (Miller & Thayer, 1989), but at the same time acknowledge that self-monitoring is a widely used personality measure for research (Briggs & Cheek, 1988). However, a recent meta-analytic investigation concluded that the self-monitoring personality construct has relevance in organizations and encouraged researchers to consider how self-monitoring helps shape who succeeds and leads in organizations (Day, Schleicher, Unckless, & Hiller, 2002).

Research has shown that high self-monitors, with chameleon like ways of altering their behavior to each situation, will span group boundaries (Kilduff & Day, 1994) increasing their number of ties in their social network. Even a controlled group of 15 individuals would have cliques within the larger group where boundaries may be spanned. High self-monitors are more skilled in social interaction (Furnham & Capon, 1983) and shape their surrounding social world differently than individuals who are low self-monitors (Snyder, 1987). Collaboration and compromise are tools that high self-monitors are more likely to use in conflict resolution (Baron, 1989). High self-monitors have the innate ability to traverse a social web of acquaintances (Snyder & Gangestad, 1986) possibly becoming more central in a group of individuals. Low self-monitors prefer to stick to a clique of friends and maintain a narrow social world (Snyder, 1987). Since these outcomes are similar to centrality, one may expect a similar relationship with social network location and the effects of self-monitoring. High self-monitors tend to build acquaintances with varying backgrounds (Snyder, 1987). A person may have a friend that he chooses to hunt with, a different one for poker, and yet someone else to attend a football game with. High self-monitors choose a spectrum of friends that fit their particular skill set for a specific agenda (Snyder & Gangestad, 1986). A low self-monitor, in contrast, would cultivate a narrower basis of friends and spend time with these few over many activities regardless of their proficiency or interest in a particular event. It would seem that high self-monitors would nurture a larger number of relationships, thus becoming more central in their social world as opposed to low self-monitors.

Hypothesis 1: Self-monitoring is related to friendship network betweenness centrality in the long term.

2.2.1.2. Locus of Control

Locus of control construct was originally defined by Rotter (1966), who suggested varying degrees of the individual perception that consequences are due to one's own behavior versus that of outside forces that are uncontrollable. Individuals with an internal locus of control believe that an event is contingent on their behavior. Individuals with an external locus of control believe that chance, fate, and luck have more of an effect on outcomes and act more passively.

This concept concerns the level at which an individual's actions can influence what happens. People with an internal locus of control tend to be more successful in achieving desired goals (Findley & Cooper, 1983). Internals tend to express more political behaviors and will attempt to influence other people while seeking out more information and knowledge than their external counterpart (Rotter, 1966). Internals attempt to control their environment in important life situations (Rotter, 1966) positioning themselves to have more of an influence on desired outcomes. In order for an internal to maintain this control it would seem that they would need to be in the best position to exercise any influence. A central position in a social network where many individuals can be contacted and manipulated may be where an internal would be found.

Researchers have found that central network positions are associated with power in interpersonal networks (Brass, 1984; Krackhardt, 1990). Power is found in individuals who are able to control relevant resources (Brass et al., 2004). Similarly, one researcher affirmed that personal power can best be described by the extent to which individuals

have either an internal or external locus of control (Colwill, 1987). Individuals with an internal locus of control are active agents and masters of their fate having the ability to influence their environment (Rotter, 1966). This suggests that individuals with an internal locus of control tend to have a high conscious value for power. A related study of managerial entrepreneurs supports this assertion where clusters of individuals with high conscious value for power also indicated the highest internal locus of control traits (Langan-Fox & Roth, 1995). This implies that an individual's locus of control is associated with power and leads to social network position.

Kalish et al. (2006) supported the hypothesis of locus of control as an antecedent of social networks in his research by referring to Burt et al. (1998). A non-standard psychological instrument, a multiple-item human resource consulting instrument, utilized in the Burt et al. (1998) study did echo locus of control theory where internals believe that they are in control and externals feel that chance governs. One observation may be that of an individual with an internal locus of control; "Respondents in entrepreneurial (relations to otherwise disconnected social groups) networks claim the personalities of people who are the authors of their own world," whereas the following may be that of an individual with an external locus of control; "Respondents in constrained (relations primarily to immediate social group) networks claim the personalities of people living in a world created by others (Burt, Jannotta, & Mahoney, 1998, p. 76)." Although Burt et al. (1998) did find personality distinctions linked with network structure as previously stated, the initial hypothesis of Kalish et al. (2006) could not support the association between locus of control and network structure. Further examination of individual locus of control and social network location may resolve any disparities.

Hypothesis 2: Locus of Control is related to friendship network betweenness centrality in the long term.

2.2.1.3. Interaction Effects of Self-Monitoring and Locus of Control on Social Networks

Research on the relationship between self-monitoring and locus of control has consistently shown low correlations (Hamid, 1989). However, Hamid et al. (1989) found distinct social interaction patterns of individuals of high and low self-monitoring and either an external or internal locus of control. Hamid (1989) provided evidence that the interaction of self-monitoring and locus of control highly influences a person's social interaction patterns. Respondents were classified into four quadrants: High self-monitoring and internal locus of control, high self-monitoring and external locus of control, low self-monitoring and internal locus of control, and low self-monitoring and external locus of control. It appeared that external high self-monitors sought more contacts than high and low internal self-monitors (Hamid, 1989). Hamid (1989) measured social interaction patterns in a similar method to social network analysis by asking the subject to recall each encounter with another person. When substituting social networks for social interaction patterns, a relationship may be determined on the influence of these two personality constructs in the development of a social world. Interaction affects of self-monitoring and locus of control on the behavior of "speaking up in the workplace" have been observed (Premeaux & Bedeian, 2003). Considering the interaction effects on such types of organizational communication, we are likely to observe similar interaction effects in the development of social networks since such developments are dependent on communication. Research suggests that self-monitoring

does effectively moderate other constructs when considering behavioral consequences since it differentiates people who either express inner feelings or act according to different situations (Snyder, 1987). This indicates that the interaction of self-monitoring with another personality construct should affect a consequence such as social network position.

Hypothesis 3: Self-monitoring will moderate the relationship between internal locus of control and friendship network final betweenness centrality, such that as self-monitoring increases, so does the relationship between locus of control and social network centrality.

2.2.1.4. Social Networks in a Temporal Framework

Researchers have emphasized the temporal nature associated with the development, maintenance, and erosion of networks (Kalish & Robins, 2006; Klein et al., 2004; Mehra et al., 2001; Borgatti & Foster, 2003). That is, there are several organizational and psychological processes that play out over time which lead to an individual's position within a network. Unfortunately, few researchers have been able to incorporate this idea into their studies. It may be as Borgatti et al. (2003) suggests that the field of social networks is relatively new and although it is important to observe how networks change over time, researchers had to legitimize network variables by first focusing on outcomes.

The self-monitoring construct suggests that individuals have varying skills in the observation and self-regulation in response to the social environment. High self-monitors may adapt to varying situations based on social cues (Snyder, 1987). During the development and progression of a social network the specific location an individual obtains at any given moment may be influenced by the group's dynamics. A truly high

self-monitor may inherently traverse from a peripheral to a central location over time as that individual adapts to the social environment just as a chameleon changes its color over time. Although not social network specific, some studies have looked at the link of self-monitoring over certain periods (Douglas & Gardner, 2004; Blakely, Andrews, & Fuller, 2003).

Longitudinal analysis of self-monitoring on self-directed work teams show that managers use changing influential tactics at the individual level as time goes on (Douglas & Gardner, 2004). This implies that self-monitoring attributes in social situations, much like social network development, are more apparent over time. An exploratory analysis by Douglas & Gardner (2004) suggests that high as opposed to low self-monitors increased their usage of soft influence tactics over time, while the behavior of low self-monitors remained unchanged throughout the study (Douglas & Gardner, 2004). Another longitudinal study, by focusing on the relationship between self-monitoring and organizational citizenship behavior (OCB), suggests that high self-monitors are more likely to help co-workers and communicate with them to improve performance (Blakely et al., 2003). This temporal study provided evidence of the stability of the relationship between OCB and self-monitoring which suggests research using self-monitoring as a predictor should consider longitudinal effects.

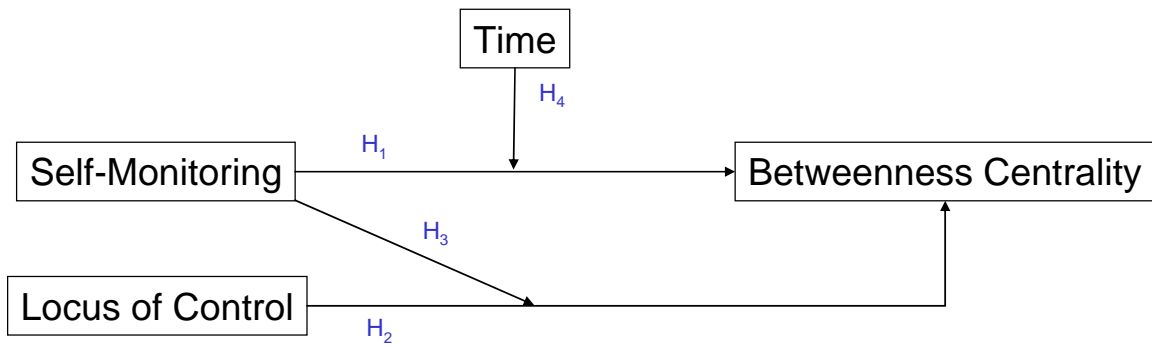
High self-monitors will typically invest considerable effort to observe and understand others in search of information to aid them in choosing their own self-presentations (Snyder, 1987). In a newly formed group low self-monitors may initially gain a higher rate of contacts while the high self-monitor “feels out” individuals over time before developing their social worlds. High self-monitors may invest an elevated

amount of time, over their low self monitor counterparts, perceiving the many characters and their respective personalities to determine what role would be best in the particular setting. High self-monitors may avoid being type-cast so they would be more free to make an assortment of contacts at a later date when the time has come to call upon these acquaintances. While the high self-monitor purposefully sits on the fringe of the network during the formation of a group, the low self-monitor does not execute a waiting period in making contacts and may disproportionately have a higher amount of friends, at least initially. This leads to the final hypothesis considering the social networks in a temporal framework.

Hypothesis 4: Self-monitoring is related to the rate of increase in friendship network betweenness centrality in the short term, with low self-monitoring resulting in higher initial rates of increase than those of high-self monitors.

This analysis attempts to further recognize the influence of personality as an antecedent to social network position and the model tested is shown in Figure 1. Contrary conclusions regarding the impact of self-monitoring and locus of control on individual position will be given another perspective in hypotheses one and two. Hypothesis three reasons the interaction effects of self-monitoring and locus of control on social network position. Finally, hypothesis four will confront previous requests in studying social network position in a temporal framework.

Figure 1: Model



3. Methodology

3.1. Sample

The sample population included students enrolled in the Air Force Senior Non-Commissioned Officer Academy (AFSNCOA) and their respective instructors at Maxwell AFB, AL. The AFSNCOA is a level of professional military education with a mission to prepare senior military enlisted members to fulfill future responsibilities as senior leaders in their respective career fields. The AFSNCOA offers 6 ½ -week courses, incorporating both education and training aimed at U.S. military enlisted leaders in the E-7 to E-9 pay grades (or equivalent allied nation members).

3.2. Structure/Organization

The AFSNCOA is organized into groups of approximately 12-16 people who report to an instructor on the academy faculty. AFSNCOA group instructors are skilled, certified, and knowledgeable military professionals. Instructors may be members of any branch of the armed services with a few international exchange instructors. Instructors are AFSNCOA graduates and have completed Academic Instructor School.

3.3. Demographics

In the sample, 86 percent of the students were male. Their ages ranged from 32 to 55 with an average of 40 years. Students were 74.6 percent white, 16.5 percent African American, 3 percent Asian, and 6 percent other. The U.S. Air Force had the largest representation of students with 85.1 percent followed by the U.S. Air Force Reserve and National Guard with 8 percent. The remainders belonged to the U.S. Army, U.S Navy,

U.S. Coast Guard, or foreign military. Over 33 percent of the students held bachelors, masters, or doctorate degrees. Students with associate's degrees were the largest contingent with a 52.5 percent representation. Finally, 12.6 percent had some college with 1.8 percent only having high school diplomas. Students were randomly assigned to groups but structured to ensure similar demographic and career field diversity across the groups.

3.4. Procedure

Network and personality data were collected using a self-report paper-based questionnaire. Demographic data were made available by the AFSNCOA from student application information. The total sample size was 406 students and 32 group instructors in 28 training group. There was predominantly one instructor per group; however four groups had an assistant instructor. Groups averaged 15 students. Data were collected on day 2 and then at weekly intervals thereafter, resulting in seven times during the 6 ½-week training course to support this longitudinal study. The first survey was used as a baseline to determine if people in each group had any previous relationships with their group mates prior to the training. Each week, for the next six weeks, the respondents completed a social network instrument. The surveys were administered by the researcher and simultaneously disseminated to respondents by group leaders at one designated time. Respondents sealed their completed surveys in envelopes separated by group as provided by the researcher. Respondents were aware that the survey was completely voluntary and could decline response at anytime. Unfortunately, three of the 28 groups did not respond to either survey six or seven so their cases were eliminated before analysis. This narrowed the sample to 389 individuals in 25 groups.

3.5. Measures

3.5.1. Social Networks

At each survey time, friendship relations data were collected using a roster method. Respondents looked down a list of names of people in his or her group and responded to statements to determine the strength of relationships with each student. Participants were asked to respond with their relations with others during the past week. Statements included (1) "I spend time in social-oriented activities with this person (dining out, movies, sports, etc.)." and (2) "I 'hang out' with this person." Responses ranged from 1 "Not at all" to 5 "Frequently." The responses of these two questions were averaged to create the friendship network adjacency matrix. The Cronbach's alpha for the instrument was .72 in this study.

3.5.2. Response Rate

Surveys measuring network relationships were collected at seven times with the following response rates: time 1: 91 percent; time 2: 92 percent; time 3: 97 percent; time 4: 89 percent, time 5: 86 percent, time 6: 79 percent; and time 7: 75 percent. Previous research indicates an 80 percent response rate is ideal in social network research (Wasserman & Faust, 1994).

3.5.3. Betweenness Centrality

Betweenness centrality denotes the extent to which an individual lies 'between' other people in the network (Freeman, 1978). Betweenness centrality measures how much a person in a structurally advantageous social network location and connects otherwise unconnected individuals (Cross & Parker, 2004). A higher betweenness score indicates the degree that an individual acts as an intermediary of others on a team.

Betweenness centrality scores were calculated for each group at every time interval using a procedure in the network program UCINET VI (Borgatti, Everett, & Freeman, 1999). However, first the data had to be dichotomized to accommodate the formula for the calculations. Responses of three and above were given the value of one to designate a relationship while responses below three were given the value of zero indicating no relationship. Betweenness centrality takes into account the distance between two points and measures the shortest path, also known as 'geodesic', that connects them (Scott, 2000).

3.5.4. Self-Monitoring

The 18-item self-monitoring scale was administered (Snyder & Gangstad, 1986). It was a true-false version that asks questions such as "I find it hard to imitate the behavior of other people" and "At parties and social gatherings, I do not attempt to do or say things that others will like." The KR-20 for the instrument was .72 in this study.

3.5.5. Locus of Control

Rotter's (1966) Locus of Control scale was used. It was a 29 item instrument that measures a participant's belief that he or she can control events that affect them. Respondents are asked to mark one of two choices for each item that best fits their preference. For example, (a) "Sometimes I can't understand how teachers arrive at the grades they give," or (b) "There is a direct connection between how hard I study and the grades I get." The Cronbach's alpha for the instrument was .70 in this study.

3.5.6. Density

As will be discussed in the following analysis section, a unique group-level effect occurs for each group. The effect of person's personality traits will depend on the

distinct make-up of that group. Since each group is different, certain group level variables must be controlled for such as density. Density was a group level measure expressed as a percentage. With valued data, the numerator is the number of connections multiplied by its corresponding value, over the denominator being the highest multiplicity actually found in the network (Scott, 2000). This measure can vary from 0 (no connected individuals) to 1 (max number of connected individuals) (Cross & Parker, 2004).

3.6. Analysis

Behavioral and social data generally have a nested structure (Raudenbush & Bryk, 2002). Individuals in this sample are nested within 28 separate groups where these groups are nested within the overall course for this term. This sample includes a first-level, individual model, nested within a second-level, group model. Due to the multi-level nature of the data, hierarchical linear modeling (HLM) was used to test each hypothesis. Multilevel modeling, including hierarchical linear modeling (Raudenbush & Bryk, 2002) or random coefficients modeling, is a form of hierarchical regression analysis. HLM was used to control for the nested structure of the data that may have influenced the within-group effects. Individuals may act differently given the group setting. The dependent variables were an individual's betweenness centrality at the group level while each group's unique density contributed to second level effects. HLM involves simultaneously estimating several regression equations for the dependent measure. To test the first two hypotheses, self-monitoring (SM) or locus of control (LoC) entered at the first level of analysis as follows:

$$\text{Level 1: } Y = B_0 + B_1 * \text{SM (or LoC)} + R$$

where Y was the normalized betweenness centrality of a student within his group; B0 (the intercept) represented the mean betweenness centrality of the group; B1 represented the regression coefficient for an individual's level of self-monitoring (or LoC); and R represented the individual error term, that is the deviation of a member from his or her group score.

In the second-level model (i.e., group-level mode), the influence of the group level effects of density on an individual's betweenness centrality score was tested. The dependent variables were the intercept and slope from Level 1 Model and the independent variable (Density) was the level of group density. Thus,

$$\text{Level 2: } B0 = G00 + G01*(DENSITY) + U0$$

$$B1 = G10 + G11*(DENSITY) + U1$$

where G00 (i.e., level-2 intercept) represented the grand mean normalized betweenness and G01 was the slope of the regression line representing the strength and direction of association between the level-1 predictor variable (either self-monitoring or locus of control) and normalized betweenness centrality; U0 represented the level-2 random error that captured the deviation of B0 (mean group betweenness centrality) from the grand mean normalized betweenness; U1 represented the level-2 random error that captured the deviation of B1 (mean group self-monitoring or LoC) from the grand mean self-monitoring or LoC.

Hypothesis 3 was tested similarly to the two previous hypotheses. However, self-monitoring, locus of control, and their interaction term was tested at level 1. Level 2 followed a similar suit with density contributions controlled for with each level 1 predictor variable as shown:

$$\text{Level-1: } Y = B_0 + B_1*(SM) + B_2*(LOC) + B_3*(SMXLOC) + R$$

$$\text{Level-2: } B_0 = G_{00} + G_{01}*(DENSITY) + U_0$$

$$B_1 = G_{10} + G_{11}*(DENSITY) + U_1$$

$$B_2 = G_{20} + G_{21}*(DENSITY) + U_2$$

$$B_3 = G_{30} + G_{31}*(DENSITY) + U_3$$

HLM allows a graphical presentation which can show the moderation of the two predictor variables and its influence on betweenness centrality.

Hypothesis 4 was tested by comparing the mean betweenness centrality scores of both high and low self monitors at each time period. A two-way repeated measures ANOVA was used since the dependent variable, betweenness centrality, was related to the betweenness centrality measurements at each time. The self-monitor score was partitioned to high and low at the median score. At the early stages of the course, Time 2 and 3, the hypothesis suggested the low self-monitors' mean betweenness centrality to be higher than that of the high self-monitors. A transition should take place at some point in time when the high self-monitors' mean betweenness centrality should surpass the low self-monitors mean betweenness centrality. Theoretically high self-monitors tend to initially observe their environment before making contacts in their social worlds (Snyder, 1987).

In order to remove the effects of instrument scaling, HLM coefficients were standardized by converting coefficients to standard deviation units. This is done by multiplying the HLM coefficient by the standard deviation of each predictor and dividing by the standard deviation of the outcome variable (Hox, 2002).

4. Results

Table 1 shows the means, standard deviations, reliabilities, and correlations among the measures. Self-monitoring and locus of control were significantly related to normalized betweenness centrality at various time periods. Each normalized betweenness centrality measurement was significantly, positively correlated at each time period.

Table 1: Means, standard deviations, and correlations^a among the measures.

Variable	n	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12
1. Self-Monitoring	438	0.37	0.17	(.72)											
2. Locus of Control	438	0.65	0.16	.02	(.70)										
3. Self-Monitoring X Locus of Control	438	0.24	0.13	.88**	.45**										
4. Race	437	0.75	0.44	.04	.04	.05									
5. Gender	437	0.86	0.35	.03	.03	.04	.10*								
6. Age	436	40.14	3.82	-.10*	.09*	-.04	.05	-.06							
7. Normalized Betweenness Centrality Time 2	438	1.43	3.71	.03	-.10*	-.03	.02	-.03	-.07						
8. Normalized Betweenness Centrality Time 3	438	2.10	4.03	.16**	.03	.17**	.04	.04	-.07	.21**					
9. Normalized Betweenness Centrality Time 4	438	1.74	3.33	.11*	-.02	.09*	.04	.02	-.22**	.28*	.35**				
10. Normalized Betweenness Centrality Time 5	425	1.60	3.02	.08*	.07	.12**	.10*	.05	-.08	.20**	.34**	.53**			
11. Normalized Betweenness Centrality Time 6	408	1.56	2.80	.03	.12*	.09*	.02	-.01	-.07	.19**	.31**	.44**	.43**		
12. Normalized Betweenness Centrality Time 7	408	1.37	2.70	.07	.06	.11*	-.06	-.06	-.10*	.29**	.18**	.39**	.45**	.50**	

^a Reliabilities (KR-20 for Self-monitoring and Cronbach's alpha for Locus of Control) appear in parentheses on the diagonal.

Self-monitoring and Locus of Control variables were standardized

Race: 1-white, 0-other

Gender: 1-male, 0-female

** Correlation is significant at the 0.01 level (1-tailed).

* Correlation is significant at the 0.05 level (1-tailed).

4.1. Hypothesis 1 and 2

Social network analysis research has now started to look at the antecedents that predict an individual's location in a social network (Borgatti & Foster, 2003). As hypothesized, self-monitoring was significantly, positively related to betweenness centrality at time seven with a HLM coefficient of .71 ($p < .05$) (Table 2). While only results from time seven are highlighted here, results were consistent with five of six other time periods for self-monitoring as a predictor (Table 4). This indicated that high self-monitors were more central in the friendship network than low self-monitors. Density, γ_{01} , was positive and significant, showing that if the group is dense, betweenness centrality should increase. The second density, term, γ_{11} , which was the interaction between self-monitoring and density, was negative and significant. This signified that a dense group would decrease the influence of self-monitoring on betweenness centrality.

Table 2: Two-level model of the influence of Self-Monitoring and Density on Normalized Betweenness Centrality, Hypothesis 1.

HLM Coefficient	Normalized Betweenness Centrality Time 7	
	<u>Raw</u>	<u>Standardized</u>
Intercept – γ_{00}	-1.51 (1.35)	---
Density – γ_{01}	.98* (.49)	.16
Self-Monitoring – γ_{10}	11.18* (5.43)	.71
Density – γ_{11}	-3.97* (1.91)	-.65

Note: ** $p < .01$, * $p < .05$. Raw refers to raw HLM coefficients. Standard errors are in parenthesis.

Locus of control was significantly, positively related to friendship betweenness centrality at time seven with a HLM coefficient of .79 ($p < .05$) (Table 3). Similarly to self-monitoring, though not as consistent, locus of control showed similar results at three of six time periods (Table 4). However at time one, the sign of the coefficient was negative. The analysis shows that in general, individuals with an internal locus of control tend to be more central in the friendship network than those with an external locus of control.

Table 3: Two-level model of the influence of Locus of Control and Density on Normalized Betweenness Centrality, Hypothesis 2.

	Normalized Betweenness Centrality Time 7	
	<u>Raw</u>	<u>Standardized</u>
Intercept – γ_{00}	-5.63** (2.13)	---
Density – γ_{01}	2.38** (.73)	.39
Locus of Control – γ_{10}	13.27** (3.90)	.79
Density – γ_{11}	-4.63** (1.34)	-.76

Note: ** $p < .01$, * $p < .05$. Raw refers to raw coefficients. Standard errors are in parenthesis.

Table 4: Standardized HLM coefficients

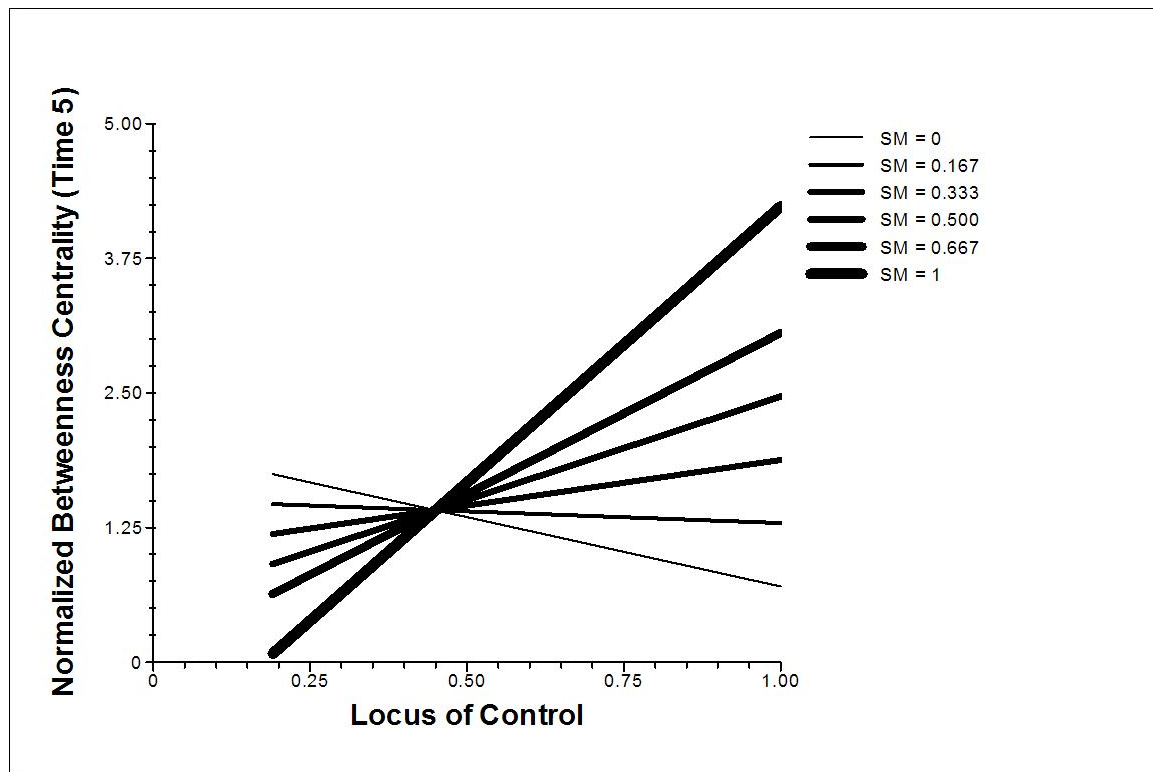
Variable	T 2	T3	T4	T5	T6	T7
Self-Monitoring		1.13*	.94**	1.02*	1.27**	.71*
Locus of Control	-.60*			.52*	.83*	.79**

Note: ** $p < .01$, * $p < .05$.

4.2. Hypothesis 3

Hamid (1989) and Premeaux (2003) suggested that self-monitoring and locus of control have an interaction affect on certain social situations. Hypothesis 3 tested the extent to which self-monitoring moderated the relationship between locus of control and social network location. Time five showed the best fit for each predictor variable (self-monitoring, locus of control, their interaction, and density) using the complete model. Figure 2 suggests that self-monitoring moderated the relationship between locus-of-control and betweenness centrality in the friendship network. This supported hypothesis three illustrating that self-monitoring will moderate the relationship between locus of control and friendship network betweenness centrality. However, it is opposite to the direction as hypothesized. Figure 2 shows that a high self-monitor (SM=1) with an internal locus of control (LoC=1) will have the most normalized betweenness centrality. A low self-monitor (SM=0) with an internal locus of control (LoC=1) will not have as much betweenness centrality.

Figure 2: Interaction of self-monitoring and locus of control

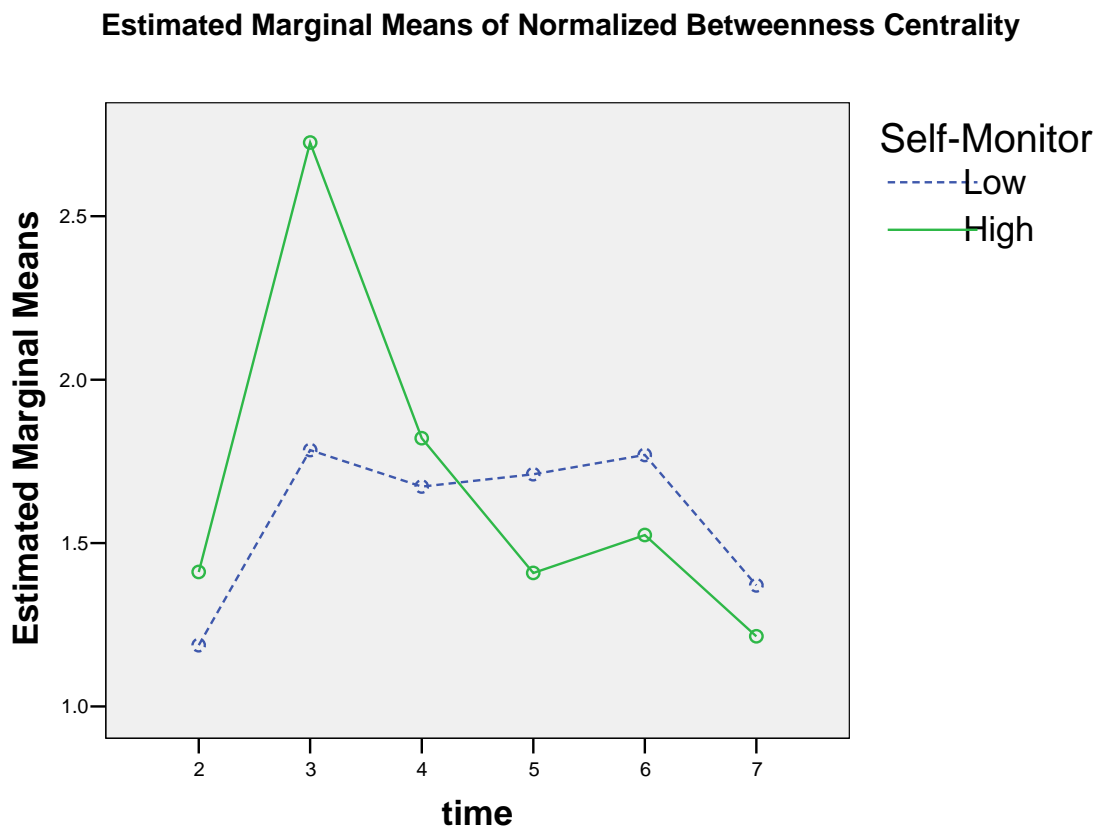


4.3. Hypothesis 4

Self-monitoring theory suggests that there may be a relationship between the influence of self-monitoring on an individual's social environment over time (Snyder & Gangestad, 1986). High self-monitors may take time to observe their environment before making any social connections. A low self-monitor may not hold back in making acquaintances and should initially be more central in their social network than a high self-monitor. Over time the high self-monitors social skills should surpass the low self-monitor and become more central over time. Contrary to hypothesis 4, there was not a significant difference between high and low self-monitors in their mean betweenness centrality over time according to the two-way repeated measures ANOVA. The

hypothesis that low self-monitors would be more central initially while high self-monitors become would become more central over time was not supported. Although not significant, figure 3 shows the comparison between high and low self-monitors betweenness centrality over time.

Figure 3: Self-monitoring effects on normalized betweenness centrality over time



5. Discussion

The purpose of this research was to identify how enduring personality characteristics predict a person's location in a network, locations which in turn affect outcomes such as performance. Specifically, this thesis examined how self-monitoring and locus of control influenced an individual's location in a friendship social network over time.

Previous research by Kalish et al. (2006) could not replicate the findings by Mehra et al. (2001) that linked self-monitoring with betweenness centrality. However, this study found a significant relationship at five of six points in a longitudinal study. Kalsih et al. (2006) suggested that self-monitoring may be a valued skill in situations where an individual was required to work with designated individuals, meaning individuals have less discretion on the relationships they form within a structured work group with little or no option to leave or break the relationship. This may have been the case in this sample where students were assigned to specific groups, working side by side with one another over a course of several weeks, none of whom had the option of leaving the group.

Locus of control theory suggests that internals attempt to control their environment in important life situations (Rotter, 1966) positioning themselves to have more of an influence on desired outcomes. This study supported this suggestion as locus of control did influence betweenness centrality in three out of the six time periods. The influence of locus of control was even more significant as time drew to the end of the course when many performance measurements and group projects take place. An increased sense of urgency on part of those with an internal locus of control influenced them to "play all their cards" as the impending evaluations drew near. Individuals with an internal locus of

control may have taken a more central role in their informal friendship relationships to help influence the outcomes and ratings. Although a friendship network was measured, the strength of these relationships could transfer to the classroom when team projects and group ratings are assessed. Early on as seen in time two, the network was very immature and undeveloped. Students were three days into the course and may have not developed strong social networks.

Baron (1986) suggested that the use of self-monitoring as a moderator will improve the predictive efficacy of both traits and attitudes. The moderation of self-monitoring and locus of control did have a significant effect on betweenness centrality at Time 5. This particular time period may have been key since it takes time for individual personality effects to be measured. Later times had a drop off in responses and those who did respond tended to “fire wall” answers providing an inaccurate picture. Although the moderation was significant, it was opposite of the hypothesized outcome. A high self-monitor (whose social skills span boundaries) with an internal locus of control (who attempt to control their environment) had the highest betweenness centrality. The effect was positive showing that as high self-monitoring became more of a moderating factor on locus of control, the normalized betweenness centrality so too increased. In the classroom environment where group projects and peer ratings determine an individual’s class standing, this phenomena does make sense. An internal locus of control individual may position themselves to have the most influence on a given outcome, but it was the combination of high self-monitoring skills and internal locus of control that may have the most effect on betweenness centrality. Looking at the other extreme at an external locus of control individual revealed that an external high self-monitor would be less central

than in external low self-monitor. A high self-monitor who constantly observed their environment and taking social cues tended to not engage in social actions that make them more central if their external locus of control trait dominates. An external locus of control, high self monitor may feel that they can not do things to change their performance outcomes so it would be best in this situation to remain on the periphery of this network.

Snyder (1989) suggested that high self-monitors take time to observe their environment and with time will use those social cues to make contact with other as time progresses. The research did not support the hypothesis that there was a difference in how self-monitoring affects the development of network position over time. The idea was that high self-monitors would be observing their environment early as they acquired social cues of what the situation called for and then move into more central locations in the social network that span social partitions. The hypothesis suggested that high self-monitors would initially tend to be not as central as low self-monitors but that high self-monitors would become more central over time. The students at the Senior Non-Commissioned Officer Academy interact for a relatively short six and a half weeks. This accelerated pace may not allow for one to measure the affects of self-monitoring over time. These students have had years of professional military education and know what it takes to become a distinguished graduate. Students have a general idea that peer ratings and group performance scores are dependent on the quality and quantity of social interaction patterns. Personality antecedents on network location, such as self-monitoring, may not be as easy to discern when individuals take an active step in getting to know their classmates early on as to influence their class standing.

Another reason why the longitudinal affect was not seen in this study could be attributed to the sample itself. Military students at this academy already knew the typical social norms of military courses before arriving. Personality characteristics such as self-monitoring may not be as distinct when the environment was already familiar. High self-monitors are known for their “chameleon” like skills, adapting to their surroundings, especially the unfamiliar. The common military setting for a senior military student was not a situation that allowed for self-monitoring skills to be brought out.

5.1. Limitations

Although 28 groups with 406 students initially participated in the study, lack of responses in the latter surveys resulted in the utilization of only 25 groups with 389 students in the analysis. Week after week students were asked to voluntarily answer questions about their friendship network. Some students who did turn in a weekly survey would not respond to a statement for every student in their group. The question arose of how to deal with this missing data when calculating network variables such as betweenness centrality and density. There was no way for the social network program, UCINET, to handle missing data. Borgatti (personal communication), social network analysis expert, was consulted as how to deal with this problem. He offered a couple of solutions to include deleting the nodes that did not respond and calculating betweenness centrality on the remaining nodes. The other option, which was used in this study, was to allocate a zero if the person failed to give a valued answer response for a specific individual. This allowed for the responses that were given to still be used, but may have underestimated betweenness centrality. Another limitation was in the calculation of betweenness centrality and density using valued data. For these variables to be

calculated, the social network data had to be dichotomized. Experts agreed that there was no one best way to dichotomize data suggesting that it is up to discretion of the researcher (Borgatti et al., 1999; Scott, 2000). For this research a dichotomized value of one was given to responses 3 “Sometimes”, 4 “Fairly Often”, and 5 “Frequently”. A value of zero was given to responses 1 “Not at All” and 2 “Once in a while”.

A major limitation in hypothesis 4 (the effects of self-monitoring over time) was the lack of a method that could account for second-level group effects over time. HLM successfully controlled for second level effects in the other hypotheses which were measured at one point in time. Results may have been different if group level affects could have been controlled for over time.

5.2. Suggestions for Future Research

The weekly surveys may have lead students to become disinterested in the later parts of the survey. Four data points evenly split over the course instead of seven may be a better balance between acquiring the longitudinal data points and fighting apathy. Also, the longitudinal effects of personality may be better measured in a situation that lasted longer than six weeks.

This effort focused on the influence of personality antecedents on centrality within a bounded group. Future research could study groups that span organizational boundaries. Personality attributes may have more of an affect when one must work with the unfamiliar, sometimes distant, groups within an organization.

A similar study could be performed on a sample that was not already familiar with the environment they were placed in. Military members put into a common military course did not allow for personality influences to be highlighted. Placing these same

individuals in an alien environment like a reality television show may emphasize skills like high self-monitoring.

5.3. Conclusion

This research studied how individual's personality predicted social network location. Organizational leaders can use these findings to better identify employees who are more likely to span social boundaries and be intermediaries of information. When leaders assign individuals to projects that call for them to be central in a particular network, they could look at a person's personality make up as a deciding factor. Also, the employee can benefit from these findings recognizing that their own personality traits influence their location in a social network. Although their personality may not lend itself to becoming central in a network, they could choose to alter their behavior if the desired outcome called for them to be more central.

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REPORT DOCUMENTATION PAGE

*Form Approved
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1. REPORT DATE (DD-MM-YYYY) 23-03-2006		2. REPORT TYPE Master's Thesis		3. DATES COVERED (From – To) Jun 2005 – Mar 2006	
4. TITLE AND SUBTITLE The Longitudinal Effects of Self-Monitoring and Locus of Control on Social Network Position in Friendship Networks			5a. CONTRACT NUMBER		
			5b. GRANT NUMBER		
			5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Moore, Gary J., Captain, USAF			5d. PROJECT NUMBER		
			5e. TASK NUMBER		
			5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S) Air Force Institute of Technology Graduate School of Engineering and Management (AFIT/EN) 2950 Hobson Way WPAFB OH 45433-7765				8. PERFORMING ORGANIZATION REPORT NUMBER AFIT/GEM/ENV/06M-11	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The purpose of this research was to identify how enduring personality characteristics predict a person's location in a network, locations which in turn affect outcomes such as performance. Specifically, this thesis examines how self-monitoring and locus of control influence an individual's location in a friendship social network over time. Hierarchical Linear Modeling (HLM) was used to analyze 28 groups of students and instructors at a military training course over six and one half weeks. Self-monitoring predicted betweenness centrality in five of six time periods while locus of control predicted betweenness centrality in three of six time periods. The moderation of self-monitoring on locus of control also determines social network centrality. A longitudinal analysis suggested that self-monitoring was not related to the rate of increase of centrality over time. Organizational leaders may benefit in better identifying influential social network employees by their personality make-up and assigning them where their impact will be most valuable.					
15. SUBJECT TERMS Social Networks, Self-Monitoring, Locus of Control					
16. SECURITY CLASSIFICATION OF: Unclassified		17. LIMITATION OF ABSTRACT		18. NUMBER OF PAGES	
REPORT	ABSTRACT	c. THIS PAGE	UU	19a. NAME OF RESPONSIBLE PERSON	
U	U	U		Kent C. Halverson, Maj, USAF (ENV)	
				19b. TELEPHONE NUMBER (Include area code)	
				(937) 255-3636, ext.4709 ; e-mail: kent.halverson@afit.edu	