3-2008

Physical Attractiveness, Social Network Location, and Performance in the Military

Janell M. Lott

PHYSICAL ATTRACTIVESS, SOCIAL NETWORK LOCATION, AND PERPORMANCE IN THE MILITARY

THESIS

Janell M. Lott, Second Lieutenant, USAF

AFIT/GEM/ENV/08-M12

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GEM/ENV/08-M12

PHYSICAL ATTRACTIVESS, SOCIAL NETWORK LOCATION, AND PERFORMANCE IN THE MILITARY

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

Janell M. Lott

Second Lieutenant, USAF

March 2008

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

AFIT/GEM/ENV/08-M12

PHYSICAL ATTRACTIVESS, SOCIAL NETWORK LOCATION, AND PERFORMANCE IN THE MILITARY

Janell M. Lott, BS
Second Lieutenant, USAF

Approved:

//signed//	28 Feb 2008
Kent C. Halverson, Lt Col, USAF (Chairman)	date
//signed//	28 Feb 2008
Daniel T. Holt, Lt Col, USAF (Member)	date
//signed//	28 Feb 2008
Alexander J. Barelka, Maj, USAF (Member)	date

AFIT/GEM/ENV/08-M12

Abstract

The purpose of this research was to provide insight into the effect of physical attractiveness on social network location and performance in a military environment. This study sought to prove five hypotheses, which were introduced through a comprehensive literature review, regarding the many interactions between physical attractiveness, social network location, and objective and subjective performance ratings. Specifically, a mediation and moderation model were proposed to capture the relationships between the three variables. For mediation, a causal relationship was found from physical attractiveness to centrality to performance. In other words, physical attractiveness influences centrality, which in turn influences performance. Moderation results suggest that physically attractiveness influences the relationship between social network centrality and both objective and subjective performance. In other words, physical attractiveness appears to hinder the relationship between centrality and performance such that more attractive individuals with high centrality perform worse than less attractive individuals of similar centrality.

To my mom and dad, the greatest parents and best friends a girl could ever have

Acknowledgments

First and foremost, I would like to express my gratitude to my faculty advisor, Lt. Col. Kent Halverson, for his leadership, guidance, and support in this thesis effort. I would also like to thank my committee members, Lt. Col. Daniel Holt and Maj. Alexander Barelka, for their time and feedback. Thanks to Maj. David Fass and Maj. Sonia Leach for their input on mediation and moderation. Finally, I would like to thank my professors and fellow classmates for making this such a memorable first assignment.

Janell M. Lott

Table of Contents

List of Figures

List of Tables

PHYSICAL ATTRACTIVESS, SOCIAL NETWORK LOCATION, AND PERFORMANCE IN THE MILITARY

I. Introduction

Recently, researchers have investigated the extent to which individual differences serve as meaningful antecedents of social network location. This work has linked dispositional variables, such as self monitoring and locus of control (e.g. Mehra, Kilduff, & Brass, 2001; Moore, 2006), as well as demographic variables, such as gender (Combs, 2003; Ibarra, 1992; Mulford, Orbell, Shatto, & Stockard, 1998), race (Combs, 2003), and education (Ibarra, 1992), to network location. Generally, these findings have indicated that individual differences contribute to the location that one attains in a network. Little attention, however, has been paid to the relationship between physical attractiveness and network position, although this link has been implied (Mulford et al., 1998). This lack of attention is surprising because network location (e.g. Balkundi & Harrison, 2006; Ibarra, 1993) and attractiveness (Borgatti, 2006c; Langlois et al., 2000) have both been found to be important indicators of organizational outcomes.

Specifically, an individual's attractiveness plays a significant role in formal organizational outcomes, such as selection, promotion, and pay (Hurley-Hanson & Giannantonio, 2006; Tahmincioglu, 2007). Not only are attractive people seen as more competent, but more positive traits are credited to attractive people (Hope & Mindell, 1994; Horsten & Blevins, 2002; Kanazawa & Kovar, 2004; Langlois et al., 2000; Mulford et al., 1998). It may be possible that network location and physical attractiveness work in concert with one another to facilitate these formal organizational outcomes.

Accordingly, this study investigates how physical attractiveness affects centrality within a social network and how this proposed relationship, in turn, influences performance. Specifically, this study will introduce both a mediation and a moderation model using two social networks: friendship and task. To do this, data were collected from 406 active duty military members in twenty-eight groups at a leadership development program. This context represents a unique opportunity, where many of the potential confounding variables, such as personal dress and grooming, are relatively controlled. From this environment, new insights into the mechanisms behind attractiveness, network centrality, and organizational outcomes may be revealed.

II. Literature Review

Introduction

While early social network analysis focused on the consequences of social networks, such as performance, recent analysis has shifted to antecedents, or causes, of social networks (Borgatti & Foster, 2003). This study incorporates both antecedents (i.e., physical attractiveness) and consequences (i.e., performance) of social network location. This chapter will begin with a discussion on the proposed antecedent, physical attractiveness, and its relationship to performance. The discussion will then move to social networks and network centrality after which mediation and moderation models will be introduced.

Physical Attractiveness

Attractiveness and centrality, which is discussed in the following section, have been found to be important sources of power (Borgatti, 2006c). Generally, two types of attractiveness are studied by researchers: physical attractiveness (e.g. Umberson & Hughes, 1987) and facial attractiveness (e.g. Dickey-Bryant, Lautenschlagar, Mendoza, & Abrahams, 1986; Langlois et al., 2000; Mueller & Mazur, 1997; Nash, Fieldman, Hussey, Leveque, & Pineau, 2006). Physical attractiveness encompasses ideas such as height and weight (Swami, Greven, & Furnham, 2007; Wiederman & Hurst, 1998; Collins & Zebrowitz, 1995), while facial attractiveness is mostly concerned with ideas such as symmetry and averageness (Rhodes, 2006).

While a formally established definition of attractiveness does not exist due to its subjective nature (Umberson & Hughes, 1987), which is consistent with the adage "beauty is in the eye of the beholder," research has shown that different cultures (Kanazawa & Kovar, 2004; Langlois et al., 2000; Rhodes, 2006) and genders (Rhodes, 2006) agree on what is and is not attractive (as cited in Umberson & Hughes, 1987). Some standards of beauty appear to be innate (Kanazawa & Kovar, 2004), triggering favorable responses when one interacts with those that are attractive. In experiments conducted on infants as young as two months, for instance, babies tended to look at more attractive faces longer and were more social with attractive strangers (Langlois et al., 1987). However, socially accepted norms appear to date back to ones childhood (Langlois et al., 2000). According to Langlois et al., (2000), more attractive children are judged more favorably and treated better, which suggests differences in traits and behaviors of attractive and unattractive individuals. These differences in treatment stem from stereotypes and social norms, which are carried into adulthood (Langlois et al., 2000).

Most of the research on attractiveness has focused on mate selection or sexual experience (e.g. Badgett & Folbre, 2003; Langlois et al., 2000; Rhodes, 2006; Wiederman & Hurst, 1998). Research has shown that individuals attribute positive qualities to attractive people, such as better physical health (Langlois et al., 2000) and greater ability and success (Umberson & Hughes, 1987). Additionally, attractiveness has been studied in organizational contexts (e.g. Badgett & Folbre, 2003; Dickey-Bryant et al., 1986; Drogosz & Levy, 1996) where it has been associated with high occupational competence (Dickey-Bryant et al., 1986; Langlois et al., 2000), better jobs, higher promotion rates, and more compensation (Hurley-Hanson & Giannantonio, 2006; Nash et al., 2006). If physical attractiveness can influence some subjective outcomes in an organization, then physical attractiveness is likely to influence subjective measures in a leadership development course setting.

> Hypothesis 1a. *Controlling for gender, physical attractiveness is positively related to subjective performance ratings*.

While one would not expect physical attractiveness to influence objective outcomes, such as performance on a cognitive multiple choice test, some research has indicated that individuals who are physically attractive are also more intelligent than unattractive people (e.g. Kanazawa & Kovar, 2004). Foremost, intelligence is another positive characteristic attributed to more physically attractive people (Davis, Claridge, & Fox, 1999; "Hiring practices," 2007). This attribution can be traced back to one's childhood, where parents and other adults have been shown to spend extra time with more attractive children and treat them better (Langlois et al., 2000). In a meta-analysis compiled by Langlois et al., (2000), this special treatment was correlated with higher academic and developmental competence. Additionally, Kanazawa and Kovar (2004) investigated the proposed idea based on four empirically supported hypotheses that suggest that more intelligent men are likely to attract more attractive women, and their subsequent mating is likely to result in offspring that inherit the traits of both intelligence and beauty. Considering this, it is likely that a natural selection process may systematically influence offspring such that more attractive individuals also possess greater intelligence. Applying this concept to this study, attractive individuals should perform better than less attractive individuals on objective tests in a leadership development course.

Hypothesis 1b. *Controlling for gender, physical attractiveness is related to objective performance ratings.*

Introduction to Social Networks

Since the conceptualization of social networks by sociologist Jacob Moreno in the 1930s (Mehra, Smith, Dixon, & Robertson, 2006; Wasserman & Faust, 1994), the concept has been used in a variety of applications, including: tracking the spread of AIDS (Borgatti, 1995), following trade and communication along Russian rivers (Pitts, 1979), disrupting terrorist networks (Borgatti, 2006d), and placing Southern socialites at events based on historical data (Borgatti, 2006b). More practically for organizational researchers, social networks have been used to predict economic and team performance (e.g. Balkundi & Harrison, 2006; Uzzi, 1996; Mehra et al., 2006), examine the importance of leadership and its effectiveness (e.g. Balkundi & Kilduff, 2005; Brass & Burkhardt, 1992; Hanneman & Riddle, 2005), and better understand knowledge management (e.g. Borgatti & Foster, 2003; March, 1991).

A social network consists of a set of actors and the ties representing some relationship among these actors (Wasserman & Faust, 1994). Within an organizational context, these networks emerge from within formally established hierarchical structures as employees interact socially (Balkundi & Kilduff, 2005). Researchers suggest that these networks emerge because human beings are naturally social where they seek friendships (Kilduff & Tsai, 2003; Mehra, Kilduff, & Brass, 1998). In addition to basic human nature, a meta-analysis conducted by Brass et al., (2004) identified many other antecedents to social networks, including actor similarity, personality, organizational structure, and proximity.

While recent research has been devoted to antecedents of social networks, more studies concern consequences of these networks (Borgatti & Foster, 2003; Brass, Galaskiewicz, Greve, & Tsai, 2004). Due to their membership in these networks, individuals gain such benefits as higher job satisfaction and lower turnover; greater power and influence; better job opportunities, such as recruitment, pay, and promotion; and greater individual, group, and organizational performance (Brass et al., 2004).

This study will include two types of social networks: friendship and task. Friendship networks, also referred to as expressive networks (e.g. Ibarra & Andrews, 1993), are used by members for social support (Baldwin, Bedell, & Johnson, 1997). Consequently, these ties are strong and often used (as cited in Ibarra & Andrews, 1993). Task networks, also called advice networks (e.g. Sparrowe, Liden, & Kraimer, 2001) and instrumental networks (e.g. Ibarra & Andrews, 1993), emerge from resource and information sharing that are used to accomplish work related to one's job (Baldwin, Bedell, & Johnson, 1997; Sparrowe et al, 2001). As such, these ties are weaker than friendship ties (as cited in Ibarra & Andrews, 1993).

Centrality

Centrality indicates how actors are strategically located within a network (Wasserman & Faust, 1994). Central members have more access to and control over unique resources (Ibarra, 1993) and information (Brass & Krackhardt, 1999), and, thus, will have the most ties, power, and influence (Brass & Burkhardt, 1992; Hanneman & Riddle, 2005; Wasserman & Faust, 1994). Because of this, centrality is one of the most widely used tools used in social network analysis (Borgatti, Carley, & Krackhardt, 2006;

Everett & Borgatti, 1999). The four most common centrality measures are: degree centrality, eigenvector centrality, closeness centrality, and betweenness centrality (Borgatti et al., 2006).

Degree Centrality

One's network centrality has been operationalized several different ways. Degree centrality is a measure of the number of ties associated with an actor (Wasserman & Faust, 1994). Out-degree centrality, which shows the number of outgoing ties from an actor, reveals influential actors (Hanneman & Riddle, 2005). An outgoing tie is characterized by the number of relationships that one member of a network perceives with other members of the network. For example, if Sam indicates he is friends with seven members of the network and the values are dichotomous (i.e., a relationship exists or does not exist), Sam would have an out-degree centrality of seven.

In-degree centrality, which shows the number of incoming ties to an actor, is associated with prominence, prestige, and popularity (Hanneman & Riddle, 2005). According to Hanneman and Riddle (2005), these advantages are made available because an actor with many ties has more individuals with whom to associate. An incoming tie is characterized by the relationships that other members of a network associate with one member. For example, if five members of a network indicate they are friends with Sam and the values are dichotomous, Sam would have an in-degree centrality of five. Again, since popularity has been shown to be related to physical attractiveness, in-degree centrality is an appropriate selection to measure degree centrality in this study.

Degree centrality is the most common type of centrality and is associated with popularity (Balkundi & Kilduff, 2005; Borgatti, 2006a). Research has linked popularity to more physically attractive individuals (e.g. Hosoda, Stone-Romero, & Coats, 2003). Additionally, in a study conducted by Costenbader and Valente (2003), in-degree centrality measures for incomplete networks (i.e. when response rates are not 100%) were more highly correlated with the actual social network (i.e. 100% response rate) than other centrality measures. Thus, degree centrality is an appropriate measure of centrality for this study.

Eigenvector Centrality

An actor will have high eigenvector centrality if he or she is connected to other nodes that are central (Wasserman & Faust, 1994). For example, if Ben is the most in-degree central member of a task network, and Jason is best friends with Ben, then Jason will have a high eigenvector centrality. Eigenvector centrality is most commonly used to examine the spread of diseases, such as AIDS (Borgatti, 1995; Borgatti, 2005). In this context, a person who is connected to other nodes who have many sex partners will have a higher chance of contracting the disease.

While eigenvector centrality has been most popularly used to track the spread of diseases, such as AIDS (Borgatti, 1995), it could also be used in the context of an educational environment. For example, in a network where information sharing occurs, such as an academic environment, being connected to central others increases ones wealth of knowledge, thus making him or her more central (Bonacich & Lloyd, 2004).

Unlike other centrality measures, eigenvector centrality is able to depict interactions throughout the entire network (Bonacich, 2007; Costenbader & Valente, 2003). In two distinct articles, Bonacich explains that one's popularity is influenced by relationships to other popular members (Bonacich, 2007; Bonacich & Lloyd, 2004). Once again, because popularity is associated with more attractive individuals, eigenvector centrality is a logical measure of centrality for this study. Consequently, this study will focus on degree centrality and eigenvector centrality.

Antecedents to Centrality

While previous centrality research has attributed the powerful position to such attributes as prestige (Ibarra, 1993; Wasserman & Faust, 1994), tenure (Ibarra, 1993), and education (Ibarra, 1992), physical attractiveness might also influence this position. Moreover, R.S. Burt discovered that attractiveness is used to advance in organizations (as cited in Brass, Galaskiewicz, Greve, and Tsai, 2004).

So, why would more attractive individuals be more central within a social network? The definition of the word is a logical place to begin ones' argument. The American Heritage Dictionary (2008) defines *attractive* as either "having the power to attract" or "pleasing to the eye or mind; charming." Therefore, from the very definition, the word implies drawing something near or causing it to approach.

While this relationship between attractiveness and social network position has been implied (e.g. Mulford et al., 1998), it has not been directly studied. Mulford et al. (2004) discovered that more attractive people have more opportunities for social interactions, have greater social influence, and are more likely to get other individuals to cooperate with them because of the positive attributes that are attributed to them. These biases and stereotypes are fueled by the premium that the media places on attractiveness (Kanazawa & Kovar, 2004). In fact, Singh (2004) says that not only do others treat attractive people more favorably, but the attractive individuals actually adopt many of the characteristics that are attributed to them, which describes a self-fulfilling prophesy. Perhaps others are attracted to physically attractive individuals in hopes that they will have access to their unique resources, such as social connections, or other positive characteristics.

> Hypothesis 2a. *Controlling for gender, physical attractiveness is positively related to centrality in a friendship network.*

> Hypothesis 2b. *Controlling for gender, physical attractiveness is positively related to centrality in a task network.*

Consequences of Centrality

As previously mentioned, members who hold central positions within networks tend to have more power and influence over other members and the network as a whole due to their interconnectedness (Brass & Burkhardt, 1992). These members have more access to and control over unique resources (Ibarra, 1993), such as information (Brass et al., 2004; Brass & Krackhardt, 1999). The rationale is that an individual who maintains relationships with others who possess different information sets will have this additional information available to him to her. A similar result can be expected among students in an academic setting.

Many studies have linked centrality and individual performance (Brass et al., 2004). In fact, a study conducted by Sparrowe, Liden, and Kraimer (2001) showed that a supervisors' performance rating (i.e. subjective performance rating) was positively related to centrality. Therefore, similar results should be expected among military students in a leadership development course setting.

Hypothesis 3a. *Social network centrality is positively related to objective individual performance ratings.*

Hypothesis 3b. *Social network centrality is positively related to subjective individual performance ratings.*

Mediation Model

Considering previous discussion of the relationship between physical attractiveness and centrality, as well as physical attractiveness and both objective and subjective performance ratings, the potential for a mediating mechanism exists. Therefore, it is important to better understand and distinguish the direct and indirect effects between the constructs. Complete mediation would indicate that any effect of physical attractiveness on performance is due to the individual's position in the social network. The first set of hypotheses below includes objective performance as the dependent variable.

Hypothesis 4a. *Network centrality in friendship networks mediates the relationship between physical attractiveness and objective performance ratings.*

Hypothesis 4b. *Network centrality in task networks mediates the relationship between physical attractiveness and objective performance ratings.*

The next set of hypotheses uses subjective performance as the dependent variable.

Hypothesis 4c. *Network centrality in friendship networks mediates the relationship between physical attractiveness and subjective performance ratings.*

Hypothesis 4d. *Network centrality in task networks mediates the relationship between physical attractiveness and subjective performance ratings.*

Figure 1 below summarizes the models used to test Hypotheses 1 through 4.

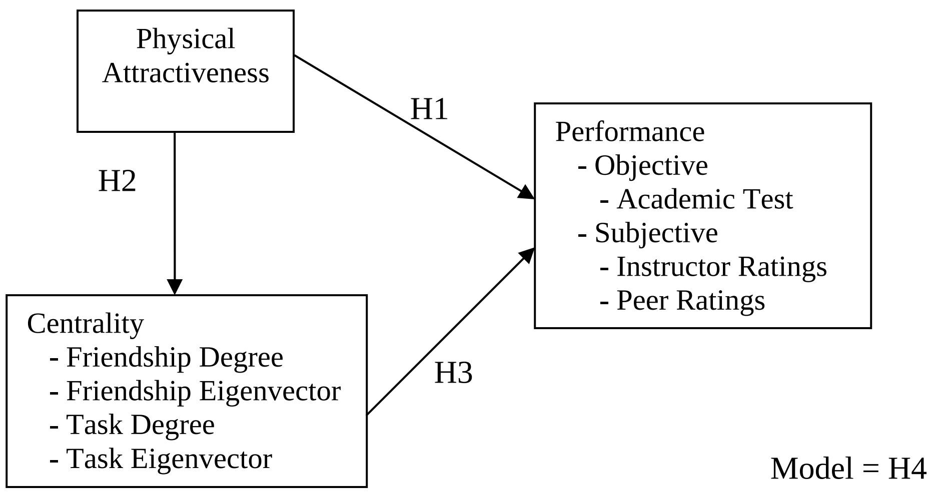


Figure 1 . Mediation model of the relationship between Physical Attractiveness, Centrality, and Performance

Moderation Model

Considering previous discussion of the relationship between physical attractiveness and centrality, as well as physical attractiveness and both objective and subjective performance ratings, the potential for a moderation mechanism exists. The moderation model suggests that both physical attractiveness and social network position are necessary for an individual to achieve better objective and subjective performance ratings. In other words, only the most physically attractive individuals may be able to take advantage of the benefits garnered from central social network positions.

Figure 2 below, which summarizes the model used to test Hypothesis 5, proposes that the relationship between social network location and performance may differ based on an individual's physical attractiveness. For example, centrality may more favorably affect performance ratings for individuals who are physically attractive compared to those who are not as attractive. According to Hosoda, Stone-Romero, and Coats (2003), many factors have been shown to moderate the relationship between physical attractiveness and occupational outcomes. As such, centrality could be one factor involved in the moderating relationship.

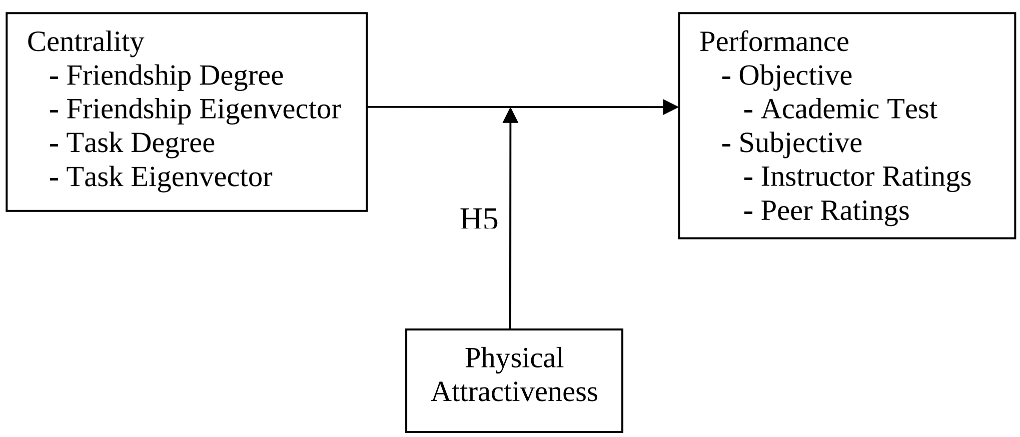


Figure 2. Moderation model of the relationship between Physical Attractiveness, Centrality, and Performance

The first set of hypotheses below includes objective performance as the dependent variable.

Hypothesis 5a. *Physical attractiveness moderates the relationship between network centrality in friendship networks and objective performance ratings.*

Hypothesis 5b. *Physical attractiveness moderates the relationship between network centrality in task networks and objective performance ratings.*

The next set of hypotheses uses subjective performance as the dependent variable.

Hypothesis 5c. *Physical attractiveness moderates the relationship between network centrality in friendship networks and subjective performance ratings.*

Hypothesis 5d. *Physical attractiveness moderates the relationship between network centrality in task networks and subjective performance ratings.*

III. Method

Participants

A group of 440 senior enlisted active duty military members attending a 7-week leadership development course were invited to participate with only 406 participating. The purpose of the course was to prepare these members for more advanced leadership positions. Ages ranged from 32 to 55 years, with an average age of 40. Of the 406 students, 79.3% were male, 8.3% were female, and 12.4% did not respond. Ethnically, the students were 68.4% Caucasian, 15.0% African American, 1.8% Asian, 7.1% other, and 7.7% did not respond. All participants had a high school diploma; 17.5% had some college; 48.9% had associate's degrees; 18.6% had bachelor's degrees; 7.0% had a master's degree; and 8.0% did not respond. These statistics closely align with 2007 U.S. Air Force service demographics for enlisted members (AFPC Release, 2007). A majority of the students (79%) were members of the U.S. Air Force; 13% were members of other military components, such as the National Guard, U.S. Army, U.S. Navy, U.S. Coast Guard, and foreign services; and 8% did not respond.

These 406 personnel were systematically assigned to one of 28 groups of 12 to 16 members each. The group assignment process attempts to make all groups as homogeneous as possible across the standard demographic variables as well as occupations.

Voluntary surveys were administered to each of the 28 groups throughout their 7-week course. The final sample used in the analysis was reduced to 247 personnel in 25 groups due to non-response on the physical attractiveness measure (see Results and Analysis below).

Procedure

Seven surveys in total were administered over a six week period to measure changes in social networks over time. Each week, the respondents were asked questions about the friendship and task networks in their specific group. At week 7, the respondents were given a physical attractiveness scale (Goldberg, 2007). Surveys were handed out by the group leader, and, once completed, were placed in a sealed envelop and returned to the researcher. Response rates for the surveys were: 91% for week 1, 92% for week 2, 97% for week 3, 89% for week 4, 86% for week 5, 79% for week 6, and 75% for week 7. For survey data, these response rates were much higher than the average 30% (Alreck & Settle, 2004); and a response rate of 80% is considered good enough to accurately depict the social network (Sparrowe, Liden, & Kraimer, 2001).

Measures

Physical Attractiveness

Physical attractiveness was measured with items from the International Personality Item Pool developed by Goldberg (Goldberg, 2007). The scale consisted of 9 items, where 6 were positively worded and 3 were negatively worded: (1) “Am considered attractive by others,” (2) “Attract attention from the opposite sex,” (3) “Have a pleasing physique,” (4) “Like to look at my body,” (5) “Like to look at myself in the mirror,” (6) “Like to show off my body,” (7) “Don’t consider myself attractive,” (8) “Dislike looking at myself in the mirror,” and (9) “Dislike looking at my body.” Participants provided responses on a Likert–type scale: 1 = “Strongly Disagree,” 2 = “Disagree,” 3 = “Not Sure/Don’t Know,” 4 = “Agree,” and 5 = “Strongly Agree.” The reliability coefficient (Chronbach's alpha, α) for this scale is 0.87 (Goldberg, 2007), and the reliability within the sample of 247 personnel was 0.873.

Network Centrality

As noted, centrality was measured using a group roster survey. Each week for 7 weeks, respondents received a survey that asked them to indicate the strength of their relationships to other members of their group, including group instructor. The scale consisted of 5 items and measured two types of social networks: friendship and task. The friendship network was measured with two-items: (1) "I spend time in social-oriented activities with this person (dining out, movies, sports, etc.)," and (2) "I enjoy hanging out with this person." Similarly, the task network was measured with two items: (1) "I spent time on work-related tasks with this person (projects, studying, etc.)," and (2) "I go to this person for work-oriented advice." Participants were instructed to provide a response from a Likert scale: 1 = "Strongly Disagree," 2 = "Disagree," 3 = "Not Sure/Don't Know," 4 = "Agree," and 5 = "Strongly Agree." The reliability coefficient (Cronbach's alpha, α) was 0.72 for the friendship items and was 0.74 for the task items.

Data from the social network instrument for seven time periods was entered into UCINet 6 for Windows (Borgatti, Everett, & Freeman, 2002), forming a symmetric adjacency matrix. UCINet software allows a researcher to perform special calculations, such as centrality, on social network data. This software calculates in and out-degree centrality by summing the values originating from (outgoing ties) and ending at (incoming ties) each individual actor.

In order to calculate eigenvector centrality, the data must be symmetric. The symmetry rule chosen by the researcher assigned the larger of X_{ij} and X_{ji} to both values. In other words, if person *i* indicated the strength of the relationship between *i* and *j* to be a 3, but person *j* indicated a strength of 5, UCINet kept the value of 5.

Performance

Because the goal of the 7-week course was to foster leadership development, ratings were obtained to show that learning was occurring. An academic multiple choice test, which covered leadership and management principles taught throughout the 7-week course, measured student performance objectively.

In addition to the objective academic test, instructor and peer points were measured subjectively at the end of the 7-week course. The evaluation criteria for these two subjective ratings were: leadership/ followership, teamwork, goal accomplishment, and professional conduct on and off duty. Instructors were told to disperse 45 points among the members of their group. Students could receive 0 to 15 points from the instructor in 5 point increments. A student receiving 15 points was considered a good leader, while a student receiving 0 points was not. In addition to the instructor rating, students evaluated the top three performers among the peers in their group. A first place vote received 5 points, second place got 3 points, and third place obtained 1 point. These individual ratings were summed to obtain a final overall student rated score.

Analysis

Data collected for this study consisted of individuals nested within groups. In addition, weekly social network data were obtained from each individual, resulting in repeated measures. These repeated measures can be considered nested within each individual. Together, these two types of nesting required a multi-level analysis. Therefore, hierarchical linear modeling (HLM) (Bryk & Raudenbush, 1992) was necessary to test the proposed hypotheses. HLM allows researchers "to formulate and test hypotheses about how variables measured at one level affect relations occurring at another" (Bryk & Raudenbush, 1992; 6). In other words, traditional analysis is not ideal since the observations may not be independent (i.e. students in a flight will be more similar to each other than students in another flight). Through HLM, several regression equations for the dependent variable are estimated simultaneously.

In order to test the five hypotheses, two different multi-level analyses were specified: a 2-level model and a 3-level model. For the 2-level model, the first level of analysis for each individual student was:

$$Y_{ij} = \beta_{0j} + \beta_{1j}\,(Gender) + \beta_{2j}\,(PA) + \beta_{3j}\,(Cent) + \beta_{4j}(PA \times Cent) + r_{ij} \qquad (1)$$

where Y_{ij} is the subjective (or objective) performance rating for student i within group j; β_{0j} represents the average performance of group j; β_{1j} is the predicted effect of gender on performance ratings; β_{2j} is the predicted effect of physical attractiveness (*PA*) on performance ratings; β_{3j} is the predicted effect of centrality *(Cent)* on performance ratings; β_{4j} is the predicted effect of the interaction between physical attractiveness and centrality *(PA × Cent)* on performance ratings; and, r_{ij} is the level-1 random error.

At the second level, variables were added to account for group level effects on performance.

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(Group\ Size) + \gamma_{12}(Density) + u_{1j} \quad (3)$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(Group\ Size) + \gamma_{22}(Density) + u_{2j} \quad (4)$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}(Group\ Size) + \gamma_{32}(Density) + u_{3j} \quad (5)$$

$$\beta_{4j} = \gamma_{40} + \gamma_{41}(Group\ Size) + \gamma_{42}(Density) + u_{4j} \quad (6)$$

where γ_{00} is the average performance rating for all groups; γ_{10} is the predicted effect of gender on performance; γ_{11} is the predicted effect of the cross-level interaction between gender and group size on performance; γ_{12} is the predicted cross-level interaction between gender and density on performance; γ_{20} is the predicted effect of physical attractiveness on performance; γ_{21} is the predicted cross-level interaction between physical attractiveness and group size on performance; γ_{22} is the predicted cross-level interaction between physical attractiveness and density on performance; γ_{30} is the predicted effect of centrality on performance; γ_{31} is the predicted cross-level interaction between centrality and group size on performance; γ_{32} is the predicted cross-level interaction between centrality and density on performance; γ_{40} is the predicted effect of the interaction variable on performance; γ_{41} is the predicted cross-level interaction between the interaction variable and group size; γ_{42} is the predicted cross-level interaction between the interaction variable and density; and u_{xj}'s are the level-2 random effects.

Other 2-level models used for analysis were simpler variations of this one. Additionally, some of the second-level equations differ slightly from ones actually used in HLM because in some cases *Group Size* and *Density* were not appropriate predictors of *Physical Attractiveness* and *Gender* and returned "near singularity" error messages. It is also important to note that *Group Size* and *Density* are not important in any of the five proposed hypotheses; however, they are included because the social structure in which a member is embedded may influence how attractiveness is perceived.

A level-3 model was specified to include repeated weekly centralities nested within each individual, which were, in turn, nested within a group. The level-1 model is:

$$Y_{ijk} = \pi_{0jk} + e_{ijk} \qquad (7)$$

where Y_{ijk} is centrality; π_{0jk} is the mean centrality for students *j* within groups *k*; and e_{ijk} is the level-1 random effect. The second level equation for student effects is as follows:

$$\pi_{0jk} = \beta_{00k} + \beta_{01k}(Gender) + \beta_{02k}(PA) + r_{0jk} \qquad (8)$$

where β_{00k} is the mean centrality over 6 weeks of student *j* within group *k*; β_{01k} is the predicted effect of gender on student centrality; β_{02k} is the predicted effect of physical attractiveness (*PA*) on student centrality; and r_{0jk} is the level-2 random effect.

At the third level, variables were added to account for group level affects on the individual students. Specifically, two variables were added to the model to account for level-3 effects that could influence the relationship between student centralities at seven different time periods.

$$\beta_{00k} = \gamma_{000} + \gamma_{001}(Group\ Size) + \gamma_{002}(Density) + u_{00k} \qquad (9)$$

$$\beta_{01k} = \gamma_{010} + \gamma_{011}(Group\ Size) + \gamma_{012}(Density) + u_{01k} \qquad (10)$$

$$\beta_{02k} = \gamma_{020} + \gamma_{021}(Group\ Size) + \gamma_{022}(Density) + u_{02k} \qquad (11)$$

where γ_{000} is the grand mean centrality over all times of all students in all groups; γ_{001} is the predicted effect of group size on centrality; γ_{002} is the predicted effect of density *(Dens)* on centrality; γ_{010} is the predicted effect of gender on centrality; γ_{011} is the predicted effect of the cross-level interaction between group size and gender on centrality; γ_{012} is the predicted effect of the cross-level interaction between density and gender on centrality; γ_{020} is the predicted effect of physical attractiveness on centrality; γ_{021} is the predicted effect of the cross-level interaction between group size and physical attractiveness on centrality; γ_{022} is the predicted effect of the cross-level interaction between density and physical attractiveness on centrality; and u_{0jk}'s are the 3-level random effects. Again, some of the third-level equations differ slightly from ones actually used in HLM because in some cases *Group Size* and *Density* were not appropriate predictors of *Physical Attractiveness* and *Gender* and returned "near singularity" error messages.

IV. Results and Analysis

Due to the large amount of data presented, the descriptive statistics are presented in two parts. Table 1 shows the descriptive statistics for the variables used in both the 2-level and 3-level HLM models. The sample sizes of some variables differ from the models due to the pairwise deletion of cases caused by missing scores on other variables.

Table 2 shows the reliabilities and bivariate correlations among the 2-level HLM model variables. Most centrality measures (Variables 7 through 22) were significantly related to each other. This was expected among friendship and task networks since they both are measuring positive interpersonal interactions among groups that are relatively confined during the entire program. Another possible explanation for the high correlations is autocorrelation, in which the centrality measures at a given period of time are influenced by the measures at the preceding time.

Standardized HLM coefficients were calculated by multiplying the raw HLM coefficient by the standard deviation of each independent variable and dividing by the standard deviation of the dependent variable (Hox, 2002).

Table 1. Descriptive Statistics for 2-Level HLM

	Variable	N	Minimum	Maximum	Mean	Std. Deviation
1	Gender	406	0.00	1.00	0.13	0.34
2	Pre-test	404	0.00	87.92	57.77	17.36
3	Post-test	401	64.25	99.03	86.57	5.68
4	Instructor Points	406	0.00	15.00	3.10	4.82
5	Peer Points	440	0.00	63.00	8.22	10.71
6	Physical Attractiveness	248	1.00	5.00	3.22	0.74
7	Friendship Degree Centrality Time 3	437	5.00	53.50	31.88	7.75
8	Friendship Eigenvector Centrality Time 3	437	0.03	0.40	0.25	0.05
9	Task Degree Centrality Time 3	437	3.50	50.50	33.42	6.55
10	Task Eigenvector Centrality Time 3	437	0.02	0.40	0.25	0.04
11	Friendship Degree Centrality Time 4	436	8.00	51.50	32.75	8.77
12	Friendship Eigenvector Centrality Time 4	436	0.07	0.41	0.25	0.05
13	Task Degree Centrality Time 4	436	11.00	49.00	32.58	7.60
14	Task Eigenvector Centrality Time 4	436	0.09	0.41	0.25	0.04
15	Friendship Degree Centrality Time 5	435	1.50	52.50	31.44	10.89
16	Friendship Eigenvector Centrality Time 5	435	0.01	0.54	0.25	0.06
17	Task Degree Centrality Time 5	435	2.00	53.00	31.94	10.43
18	Task Eigenvector Centrality Time 5	435	0.07	0.59	0.25	0.05
19	Friendship Degree Centrality Time 6	408	1.00	53.00	31.86	10.43
20	Friendship Eigenvector Centrality Time 6	408	0.01	0.44	0.25	0.06
21	Task Degree Centrality Time 6	408	1.00	48.50	31.24	10.23
22	Task Eigenvector Centrality Time 6	408	0.01	0.54	0.25	0.05

Table 2. Correlations for 2-Level HLM

	Variables	1	2	3	4	5	6	7	8	9	10	11
1	Gender	-										
2	Pre-test	-0.02	-									
3	Post-test	-0.06	0.06	-								
4	Instructor Points	0.20**	0.01	0.21**	-							
5	Peer Points	0.08	0.01	0.25**	0.48**	-						
6	Physical Attractiveness	0.04	-0.14*	-0.21**	-0.09	-0.03	-	(0.87)				
7	Friendship Degree Centrality Time 3	-0.02	-0.21**	0.09*	0.03	0.17**	-0.02	-				
8	Friendship Eigenvector Centrality Time 3	-0.01	0.08	0.02	0.12**	0.28**	0.08	0.24**	-			
9	Task Degree Centrality Time 3	0.02	-0.18**	0.14**	0.08	0.14**	-0.14*	0.73**	0.02	-		
10	Task Eigenvector Centrality Time 3	0.02	0.07	-0.01	0.11*	0.18**	-0.07	0.03	0.69**	0.02	-	
11	Friendship Degree Centrality Time 4	-0.04	-0.19**	0.09*	0.03	0.16**	-0.02	0.79**	0.28**	0.60**	0.06	-
12	Friendship Eigenvector Centrality Time 4	0.05	0.03	0.00	0.13**	0.24**	0.07	0.27**	0.76**	0.00	0.48**	0.34**
13	Task Degree Centrality Time 4	0.01	-0.18**	0.11*	0.09*	0.20**	-0.11*	0.63**	0.14**	0.71**	0.05	0.83**
14	Task Eigenvector Centrality Time 4	0.10**	0.00	-0.04	0.12**	0.23**	-0.03	0.08	0.58**	-0.03	0.64**	0.13**
15	Friendship Degree Centrality Time 5	-0.02	-0.10*	0.08	0.03	0.14**	-0.03	0.64**	0.22**	0.42**	0.06	0.82**
16	Friendship Eigenvector Centrality Time 5	0.06	0.05	0.04	0.15**	0.25**	0.05	0.24**	0.65**	0.00	0.48**	0.31**
17	Task Degree Centrality Time 5	0.01	-0.11*	0.09*	0.05	0.14**	-0.09	0.55**	0.08*	0.51**	0.00	0.75**
18	Task Eigenvector Centrality Time 5	0.05	0.00	0.04	0.16**	0.22**	0.04	0.11**	0.52**	0.00	0.55**	0.16**
19	Friendship Degree Centrality Time 6	-0.03	0.01	0.09*	0.04	0.15**	-0.09	0.49**	0.30**	0.34**	0.14**	0.66**
20	Friendship Eigenvector Centrality Time 6	0.01	0.01	0.06	0.20**	0.26**	0.08	0.25**	0.64**	0.05	0.48**	0.29**
21	Task Degree Centrality Time 6	-0.02	0.00	0.13**	0.07	0.17**	-0.14*	0.41**	0.20**	0.43**	0.13**	0.60**
22	Task Eigenvector Centrality Time 6	0.01	0.03	0.08	0.22**	0.26**	0.03	0.14**	0.53**	0.06	0.57**	0.17**

Table 2 Continued. Correlations for 2-Level HLM

	Variables	12	13	14	15	16	17	18	19	20	21	22
1	Gender											
2	Pre-test											
3	Post-test											
4	Instructor Points											
5	Peer Points											
6	Physical Attractiveness											
7	Friendship Degree Centrality Time 3											
8	Friendship Eigenvector Centrality Time 3											
9	Task Degree Centrality Time 3											
10	Task Eigenvector Centrality Time 3											
11	Friendship Degree Centrality Time 4											
12	Friendship Eigenvector Centrality Time 4	-										
13	Task Degree Centrality Time 4	0.16**	-									
14	Task Eigenvector Centrality Time 4	0.75**	0.08*	-								
15	Friendship Degree Centrality Time 5	0.27**	0.73**	0.12**	-							
16	Friendship Eigenvector Centrality Time 5	0.78**	0.16**	0.64**	0.28**	-						
17	Task Degree Centrality Time 5	0.12**	0.85**	0.06	0.91**	0.13**	-					
18	Task Eigenvector Centrality Time 5	0.59**	0.13**	0.66**	0.14**	0.83**	0.10*	-				
19	Friendship Degree Centrality Time 6	0.34**	0.62**	0.18**	0.82**	0.34**	0.80**	0.20**	-			
20	Friendship Eigenvector Centrality Time 6	0.70**	0.15**	0.60**	0.31**	0.79**	0.16**	0.64**	0.35**	-		
21	Task Degree Centrality Time 6	0.21**	0.70**	0.14**	0.76**	0.23**	0.86**	0.16**	0.93**	0.25**	-	
22	Task Eigenvector Centrality Time 6	0.56**	0.13**	0.66**	0.22**	0.69**	0.15**	0.73**	0.26**	0.86**	0.24**	-

Individual Level Analysis

Hypothesis 1

It was hypothesized that physical attractiveness would positively influence subjective (Hypothesis 1a) and objective (Hypothesis 1b) performance ratings. Physical attractiveness was only significantly related to objective performance ratings 1 out of 16 times (Refer to Tables 3 through 6); however, physical attractiveness was significantly related to instructor points 11 out of 16 times and peer points 10 out of 16 times. These results had more significant cases when eigenvector centrality was used. Therefore, there was partial support that more physically attractive individuals receive higher ratings from instructors and their peers, but little to no support that physical attractiveness influences academic test scores. Note that the researcher considered a hypothesis to be partially supported if more than 50% of values were significant. Any values less than 50% were determined to have little to no support.

Hypothesis 2

It was hypothesized that physical attractiveness would positively influence one's centrality in friendship (Hypothesis 2a) and task networks (Hypothesis 2b). Results indicate that physical attractiveness was significantly, positively related to friendship degree centrality, with a standardized HLM coefficient of 0.57 ($p<.05$), and task degree centrality, with a standardized HLM coefficient of 0.05 ($p<.01$) (Refer to Table 7). However, results using eigenvector centrality were not statistically significant. Therefore, Hypotheses 2a and 2b were partially supported.

Table 3. 2-Level HLM model with Friendship Degree Centrality

Performance	Time 3		Time 4		Time 5		Time 6	
	Raw	Std.	Raw	Std.	Raw	Std.	Raw	Std.
Post Test (Objective)								
Gender - γ_{10}	-0.84		-0.65		-0.82		-0.62	
	(1.05)		(1.05)		(1.06)		(1.01)	
Physical Attractiveness - γ_{20}	1.47		0.93		0.36		1.02	
	(2.23)		(1.55)		(1.16)		(0.93)	
Centrality - γ_{30}	1.27		1.72†	2.66	1.81*	3.47	1.97**	3.62
	(1.23)		(1.12)		(0.78)		(0.70)	
Centrality*Physical Attractiveness - γ_{40}	-0.55†	-3.09	-0.66*	-4.16	-0.61**	-4.04	0.70**	5.90
	(0.37)		(0.32)		(0.21)		(0.19)	
Instructor Points (Subjective)								
Gender - γ_{10}	2.97*	0.21	2.97*	0.21	2.98*	0.21	3.14*	0.22
	(1.37)		(1.34)		(1.35)		(1.34)	
Physical Attractiveness - γ_{20}	3.65†	0.56	1.46		1.96*	0.30	1.32**	0.20
	(2.62)		(1.21)		(1.06)		(0.50)	
Centrality - γ_{30}	1.70†	2.73	1.38*	2.51	1.58*	3.57	0.90	
	(1.04)		(0.73)		(0.74)		(0.74)	
Centrality*Physical Attractiveness - γ_{40}	-0.47†	-3.11	-0.30		-0.37†	-2.89	-0.24	
	(0.30)		(0.25)		(0.23)		(0.24)	
Peer Points (Subjective)								
Gender - γ_{10}	2.66		3.04†	0.10	2.76		2.72	
	(2.28)		(2.29)		(2.36)		(2.28)	
Physical Attractiveness - γ_{20}	4.71		2.11		-2.37		4.79**	0.33
	(5.49)		(4.13)		(2.27)		(1.72)	
Centrality - γ_{30}	4.19*	2.56	2.46†	2.01	0.97		1.75*	1.70
	(2.46)		(1.82)		(1.41)		(0.95)	
Centrality*Physical Attractiveness - γ_{40}	-0.76		-0.45		0.15		-0.40†	-1.79
	(0.69)		(0.52)		(0.34)		(0.30)	

Note: † $p<.10$
* $p<0.05$
** $p<.01$
Standard errors are in parentheses.
Gender: 0 = male, 1 = female
Raw refers to raw HLM coefficients.
Std. refers to standardized HLM coefficients.

Table 4. 2-Level HLM model with Friendship Eigenvector Centrality

Performance	Time 3		Time 4		Time 5		Time 6	
	Raw	Std.	Raw	Std.	Raw	Std.	Raw	Std.
Post Test (Objective)								
Gender - γ_{10}	-0.79 (1.00)		-0.67 (-1.07)		-0.75 (1.06)		-0.76 (1.04)	
Physical Attractiveness - γ_{20}	2.18 (5.20)		-1.09 (2.67)		-3.72* (1.65)	-0.48	0.35 (0.79)	
Centrality - γ_{30}	39.54 (94.70)		30.37 (87.01)		54.54 (88.75)		78.49 (79.88)	
Centrality*Physical Attractiveness - γ_{40}	-24.58 (27.04)		-23.14 (24.23)		-29.44 (24.44)		-34.74† (22.10)	-2.39
Instructor Points (Subjective)								
Gender - γ_{10}	3.22* (1.35)	0.23	3.14* (1.34)	0.22	3.16* (1.37)	0.22	3.11* (1.37)	0.22
Physical Attractiveness - γ_{20}	5.47** (2.17)	0.84	3.92* (2.26)	0.60	2.40† (1.45)	0.37	2.06* (0.96)	0.32
Centrality - γ_{30}	118.18* (68.20)	1.23	80.62 (70.43)		92.35 (79.39)		48.59 (58.55)	
Centrality*Physical Attractiveness - γ_{40}	-31.20† (21.03)	-1.62	-19.88 (22.04)		-24.56 (25.12)		-11.58 (17.82)	
Peer Points (Subjective)								
Gender - γ_{10}	3.48† (2.41)	0.11	3.55† (2.42)	0.11	3.17† (2.40)	0.10	2.80 (2.33)	
Physical Attractiveness - γ_{20}	12.69* (6.06)	0.88	10.14* (4.81)	0.70	10.02* (4.38)	0.69	8.78** (2.13)	0.61
Centrality - γ_{30}	162.09 (144.26)		43.37 (110.24)		21.22 (108.68)		20.70 (115.87)	
Centrality*Physical Attractiveness - γ_{40}	-44.90 (47.26)		-12.28 (34.38)		-5.77 (36.03)		-7.10 (34.34)	

Note: † $p<.10$
* $p<0.05$
** $p<.01$
Standard errors are in parentheses.
Gender: 0 = male, 1 = female
Raw refers to raw HLM coefficients.
Std. refers to standardized HLM coefficients.

Table 5. 2-Level HLM model with Task Degree Centrality

Performance	Time 3		Time 4		Time 5		Time 6	
	Raw	Std.	Raw	Std.	Raw	Std.	Raw	Std.
Post Test (Objective)								
Gender - γ_{10}	-1.24		-0.94		-0.94		-0.86	
	(1.05)		(1.11)		(1.09)		(1.01)	
Physical Attractiveness - γ_{20}	2.27		-1.09		0.57		1.23†	0.16
	(4.65)		(1.65)		(2.09)		(0.75)	
Centrality - γ_{30}	2.01		1.25*	1.67	2.22**	4.08	2.17**	3.91
	(1.66)		(0.66)		(0.95)		(0.88)	
Centrality*Physical Attractiveness - γ_{40}	-0.58		-0.35*	-1.96	-0.65*	-4.15	-0.73**	-5.97
	(0.53)		(0.15)		(0.27)		(0.25)	
Instructor Points (Subjective)								
Gender - γ_{10}	2.52*	0.18	2.56*	0.18	2.93*	0.21	3.01*	0.21
	(1.33)		(1.32)		(1.35)		(1.33)	
Physical Attractiveness - γ_{20}	-0.12		1.06		-1.56		1.24**	0.19
	(3.14)		(0.91)		(2.16)		(0.49)	
Centrality - γ_{30}	0.84		1.37*	2.16	0.48		0.89	
	(1.28)		(0.59)		(1.04)		(0.90)	
Centrality*Physical Attractiveness - γ_{40}	0.02		-0.18		0.02		-0.22	
	(0.38)		(0.16)		(0.33)		(0.29)	
Peer Points (Subjective)								
Gender - γ_{10}	1.26		1.66		2.02		2.21	
	(2.14)		(2.36)		(2.35)		(2.19)	
Physical Attractiveness - γ_{20}	3.20		2.64		-2.14		4.76*	0.33
	(6.06)		(2.58)		(5.01)		(2.08)	
Centrality - γ_{30}	5.41*	3.31	3.72**	2.64	1.73		2.41*	2.30
	(2.82)		(1.27)		(2.66)		(1.23)	
Centrality*Physical Attractiveness - γ_{40}	-0.55		-0.35		0.11		-0.47	
	(0.78)		(0.30)		(0.60)		(0.37)	

Note: † $p<.10$
* $p<0.05$
** $p<.01$
Standard errors are in parentheses.
Gender: 0 = male, 1 = female
Raw refers to raw HLM coefficients.
Std. refers to standardized HLM coefficients.

Table 6. 2-Level HLM model with Task Eigenvector Centrality

Performance	Time 3 Raw	Time 3 Std.	Time 4 Raw	Time 4 Std.	Time 5 Raw	Time 5 Std.	Time 6 Raw	Time 6 Std.
Post Test (Objective)								
Gender - γ_{10}	-0.92 (1.02)		-0.67 (1.10)		-0.76 (1.09)		-0.80 (1.02)	
Physical Attractiveness - γ_{20}	0.84 (2.81)		-1.01 (3.26)		-1.40 (1.09)		0.32 (0.69)	
Centrality - γ_{30}	12.63 (104.18)		54.21 (74.81)		63.76 (93.97)		34.03 (79.01)	
Centrality*Physical Attractiveness - γ_{40}	-20.93 (30.40)		-30.67† (20.78)	-1.24	-31.76 (26.88)		-23.10 (21.73)	
Instructor Points (Subjective)								
Gender - γ_{10}	3.11* (1.30)	0.22	3.03* (1.36)	0.21	3.15* (1.34)	0.22	3.03* (1.37)	0.21
Physical Attractiveness - γ_{20}	4.65** (1.75)	0.71	3.24 (2.88)		2.83* (1.61)	0.43	1.72* (0.82)	0.26
Centrality - γ_{30}	94.49† (73.41)		80.62 (70.43)		51.30 (98.40)		24.74 (64.30)	
Centrality*Physical Attractiveness - γ_{40}	-24.12 (23.13)		-19.88 (22.04)		-12.28 (30.97)		-4.84 (20.11)	
Peer Points (Subjective)								
Gender - γ_{10}	3.55† (2.41)	0.11	3.31† (2.31)	0.11	3.36† (2.36)	0.11	2.56 (2.30)	
Physical Attractiveness - γ_{20}	15.11* (6.51)	1.04	15.45* (6.51)	1.07	11.90* (4.81)	0.82	8.72** (2.10)	0.60
Centrality - γ_{30}	238.64† (164.80)		126.14 (101.27)		21.22 (108.68)		-1.40 (112.74)	
Centrality*Physical Attractiveness - γ_{40}	-66.11 (52.47)		-33.87 (31.78)		-5.77 (36.03)		-0.73 (33.54)	

Note: † p<.10
* p<0.05
** p<.01
Standard errors are in parentheses.
Gender: 0 = male, 1 = female
Raw refers to raw HLM coefficients.
Std. refers to standardized HLM coefficients.

Table 7. 3-Level HLM model of the influence of Physical Attractiveness on Centrality, controlling for Gender, Group Size, and Density

Centrality	Friendship Degree		Friendship Eigenvector		Task Degree		Task Eigenvector	
	Raw	Standard	Raw	Standard	Raw	Standard	Raw	Standard
Gender – γ_{01}	7.82		0.13		10.34		0.12	
	(10.61)		(0.11)		(9.48)		(0.14)	
Physical Attractiveness – γ_{02}	6.75*	0.57	0.02		6.20**	0.50	0.01	
	(2.82)		(0.04)		(2.23)		(0.06)	

Note: † p<.10
* p<.05
** p<.01
Standard errors are in parentheses.
Gender: 0 = male, 1 = female.
Raw refers to raw HLM coefficients.
Standard refers to standardized HLM coefficients.

Hypothesis 3

It was hypothesized that centrality would positively influence objective (Hypothesis 3a) and subjective (Hypothesis 3b) performance ratings, as much previous social network literature has already supported. Results partially indicate that higher *degree* centrality leads to higher scores on objective academic tests and subjective ratings from instructors and peers (Refer to Tables 3 through 6), but little to no support when *eigenvector* centrality was used in place of degree centrality. Thus, Hypotheses 3a and 3b are partially supported.

Hypothesis 4a

It was hypothesized that centrality in a *friendship* network would mediate the relationship between physical attractiveness and *objective* performance ratings. Physical attractiveness and friendship degree centrality were not both significant at any times (Refer to Tables 3 and 4), which is a requirement of the Baron and Kenney causal steps for mediation (Kenny, 2008). However, since the interaction terms were significant, it is possible that a mediation effect is present. Refer to Table 8 for the results obtained from the Sobel Test Calculator for the Significance of Mediation (Soper, 2008). When degree centrality was used as the mediator, the sobel test statistic was significant 3 out of 4 times (Times 4, 5 and 6); however, the sobel test statistic was not significant when eigenvector centrality was the mediator. Therefore, there is partial support for this hypothesis.

Hypothesis 4b

It was hypothesized that centrality in a *task* network would mediate the relationship between physical attractiveness and *objective* performance ratings. Physical attractiveness and task degree centrality were both significant at time 6; however, the two variables were not significant at any other times (Refer to Tables 5 and 6). Refer to Table 8 for the results obtained from the Sobel Test Calculator for the Significance of Mediation (Soper, 2008). Similar to the results of Hypothesis 4a, when degree centrality was used as the mediator, the sobel test statistic was significant 3 out of 4 times (Times 4, 5 and 6); however, the sobel test statistic was not significant when eigenvector centrality was the mediator. Therefore, there is partial support for this hypothesis.

Hypothesis 4c

It was hypothesized that centrality in a *friendship* network would mediate the relationship between physical attractiveness and *subjective* performance ratings. Physical attractiveness and friendship centrality were both significant 4 out of 16 times (Refer to Tables 3 and 4). Refer to Table 8 for the results obtained from the Sobel Test Calculator for the Significance of Mediation (Soper, 2008). When degree centrality was used as the mediator, the sobel test statistic was significant 5 out of 8 times; however, the sobel test statistic was not significant when eigenvector centrality was the mediator. Therefore, there is little to partial support for this hypothesis.

Hypothesis 4d

It was hypothesized that centrality in a *task* network would mediate the relationship between physical attractiveness and *subjective* performance ratings. Physical attractiveness and centrality were both significant at time 6 for peer points (Refer to Tables 5 and 6). Refer to Table 8 for the results obtained from the Sobel Test Calculator for the Significance of Mediation (Soper, 2008). When degree centrality was used as the mediator, the sobel test statistic was significant 4 out of 8 times; however, the sobel test statistic was not significant when eigenvector centrality was the mediator. Therefore, there is little to partial support for this hypothesis.

Hypothesis 5a

It was hypothesized that physical attractiveness would moderate the relationship between centrality in a *friendship* network and *objective* performance ratings. All four friendship degree centrality interaction terms, measured longitudinally across times 3 to 6 were significant (Refer to Tables 3 and 4), and 1 of 4 eigenvector centrality interaction term was significant. This suggests partial support for the presence of a moderating mechanism.

Hypothesis 5b

It was hypothesized that physical attractiveness would moderate the relationship between centrality in a *task* network and *objective* performance ratings. 3 of 4 friendship degree centrality interaction terms and 1 of 4 eigenvector centrality interaction terms was significant (Refer to Tables 5 and 6). Therefore, there is partial support for the presence of moderation mechanism.

Hypothesis 5c

It was hypothesized that physical attractiveness would moderate the relationship between centrality in a *friendship* network and *subjective* performance ratings. 3 of 8 interaction terms in the degree centrality friendship networks were significant and 1 of 8 terms was significant in the eigenvector centrality network (Refer to Tables 3 and 4); however, these were only significant for $p<.10$. Thus, there is little to no support for this hypothesis.

Hypothesis 5d

It was hypothesized that physical attractiveness would moderate the relationship between centrality in a *task* network and *subjective* performance ratings. No interaction terms in the task networks (degree and eigenvector) were significant (Refer to Tables 5 and 6); therefore, this hypothesis was not supported.

Since it is difficult to interpret interaction terms alone, the relationship between centrality and performance ratings for more attractive and less attractive individuals was plotted using ModGraph (Jose, 2003). All significant interactions are displayed in Figure 3, and they show an obvious trend that physical attractiveness is consistently attenuating the centrality × performance interacting relationship.

Table 8. Sobel Test Statistics (STSs)

Performance	Time 3	Time 4	Time 5	Time 6
	Sobel Test Statistic	Sobel Test Statistic	Sobel Test Statistic	Sobel Test Statistic
Friendship Degree Centrality				
Post Test (Objective)	0.95	1.29†	1.67*	1.82*
Instructor Points (Subjective)	1.35†	1.48†	1.59†	1.08
Peer Points (Subjective)	1.39†	1.18	0.66	1.46†
Friendship Eigenvector Centrality				
Post Test (Objective)	0.32	0.29	0.39	0.45
Instructor Points (Subjective)	0.48	0.46	0.46	0.43
Peer Points (Subjective)	0.46	0.31	0.18	0.17
Task Degree Centrality				
Post Test (Objective)	1.11	1.57†	1.79*	1.84*
Instructor Points (Subjective)	0.64	1.78*	0.46	0.93
Peer Points (Subjective)	1.58†	2.02*	0.63	1.60†
Task Eigenvector Centrality				
Post Test (Objective)	0.10	0.16	0.16	0.16
Instructor Points (Subjective)	0.17	0.16	0.16	0.15
Peer Points (Subjective)	0.17	0.17	0.13	-0.01

Note: † p<.10
* p<.05
** p<.01

Figure 3. Moderation by Physical Attractiveness

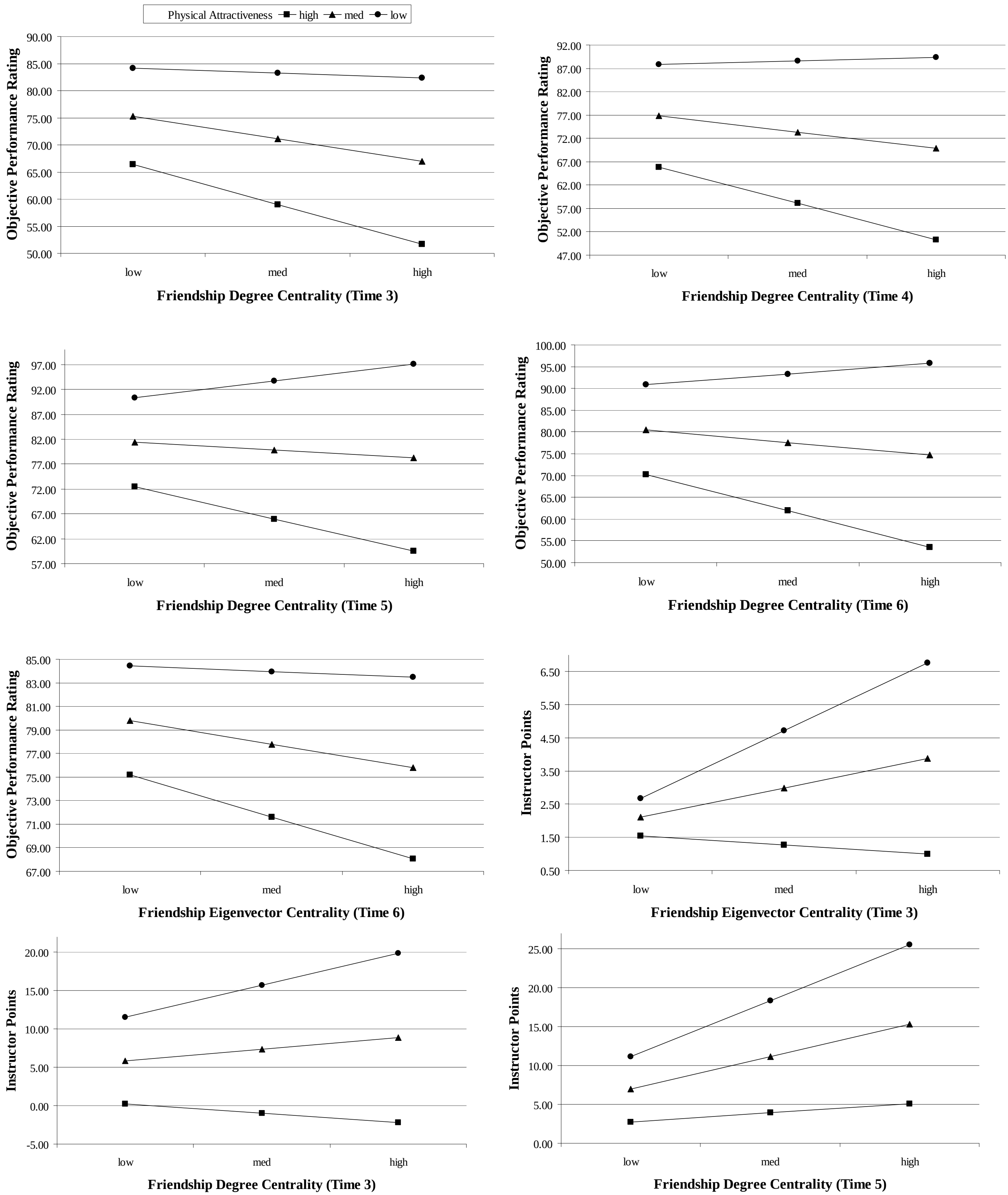
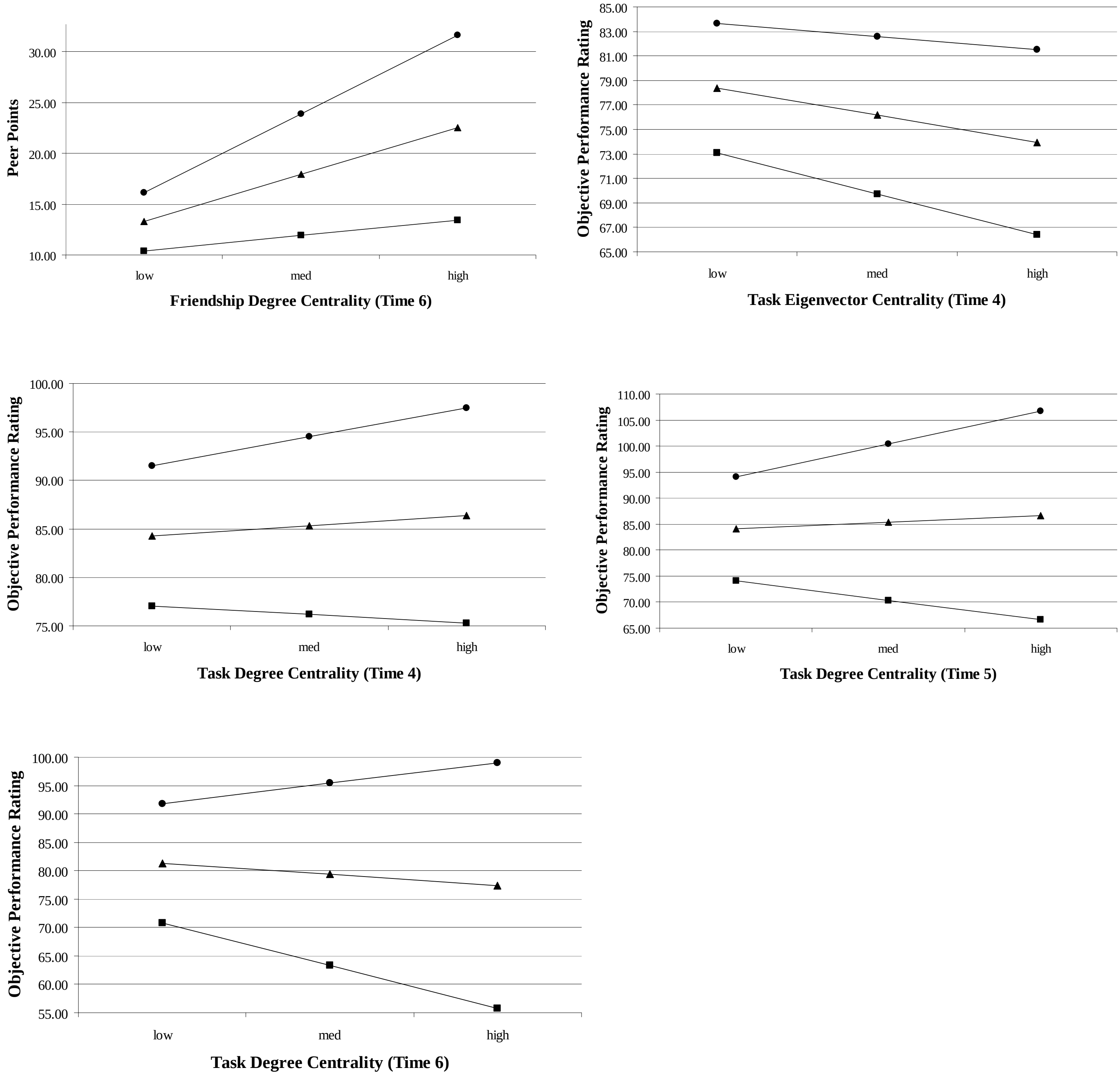


Figure 3 cont. Moderation by Physical Attractiveness



In all of the plots, the three displayed lines were not parallel, which indicates a statistical moderating interaction (Jose, 2003). This is further supported by the statistically significant gammas for the interaction variables shown in Tables 3 through 6 above. The diagrams in Figure 3 show that, in general, physical attractiveness has a negative effect on the relationship between centrality and objective and subjective performance. This suggests that for the individuals who are less physically attractive, their centrality should help them with performance, while those who are more physically attractive may be hindered by their centrality and its effect on performance. However, a couple of diagrams for subjective performance ratings indicate that for less physically attractive individuals, the relationship between centrality and subjective performance is much stronger than that of more physically attractive individuals (Instructor Points at Time 5 and Peer Points at Time 6). In other words, the members' physical attractiveness is a non-issue since it does not help and does not hurt subjective performance points; the member would receive these points either way.

Table 9 summarizes the results of the proposed hypotheses.

Table 9. Hypotheses Support Summary Table

Hypothesis		Significant # Degree Centrality	% Significant Degree Centrality	Significant # Eigenvector Centrality	% Significant Eigenvector Centrality	Support?
1a. Controlling for gender, physical attractiveness is positively related to subjective performance ratings.	Instructor Points: Peer Points:	4/8 2/8	50% 25%	7/8 8/8	87.5% 100%	Partial
1b. Controlling for gender, physical attractiveness is positively related to objective performance ratings.		1/8	12.5%	1/8	12.5%	Little to No
2a. Controlling for gender, physical attractiveness is positively related to centrality in a friendship network.		1/1	100%	0/1	0%	Partial
2b. Controlling for gender, physical attractiveness is positively related to centrality in a task network.		1/1	100%	0/1	0%	Partial
3a. Social network centrality is positively related to objective individual performance ratings.		6/8	75%	0/8	0%	Partial
3b. Social network centrality is positively related to subjective individual performance ratings.	Instructor Points: Peer Points:	4/8 6/8	50% 75%	2/8 1/8	25% 12.5%	Partial
4a. Network centrality in *friendship* networks mediates the relationship between physical attractiveness and *objective* performance ratings.		3/4	75%	0/4	0%	Partial
4b. Network centrality in *task* networks mediates the relationship between physical attractiveness and *objective* performance ratings.		3/4	75%	0/4	0%	Partial
4c. Network centrality in *friendship* networks mediates the relationship between physical attractiveness and *subjective* performance ratings.	Instructor Points: Peer Points:	3/4 2/4	75% 50%	0/4 0/4	0% 0%	Little to Partial
4d. Network centrality in *task* networks mediates the relationship between physical attractiveness and *subjective* performance ratings.	Instructor Points: Peer Points:	1/4 3/4	25% 75%	0/4 0/4	0% 0%	Little to Partial
5a. Physical attractiveness moderates the relationship between network centrality in *friendship* networks and *objective* performance ratings.		4/4	100%	1/4	25%	Partial
5b. Physical attractiveness moderates the relationship between network centrality in *task* networks and *objective* performance ratings.		3/4	75%	1/4	25%	Partial
5c. Physical attractiveness moderates the relationship between network centrality in *friendship* networks and *subjective* performance ratings.	Instructor Points: Peer Points:	2/4 1/4	50% 25%	1/4 0/4	25% 0%	Little to No
5d. Physical attractiveness moderates the relationship between network centrality in *task* networks and *subjective* performance ratings.	Instructor Points: Peer Points:	0/4 0/4	0% 0%	0/4 0/4	0% 0%	No

V. Discussion

The purpose of this research was to identify the effect of an individual's physical attractiveness on social network location and individual performance. Specifically, this study introduced a mediation and moderation model to capture the complex interacting nature between the two variables, and all five hypotheses were at least partially supported. Results indicate that more physically attractive individuals received higher ratings from instructors and their peers (Hypothesis 1a), but there was no indication that physical attractiveness influences academic test scores (Hypothesis 1b). Physical attractiveness positively influences a members centrality in a friendship (Hypothesis 2a) and task network (Hypothesis 2b) for degree centrality but not eigenvector centrality. Centrality was shown to positively influence objective (Hypothesis 3a) and subjective (Hypothesis 3b) performance ratings for degree centrality but not eigenvector centrality.

Mediation implies a causal sequence among physical attractiveness, centrality, and performance. In other words, an indirect effect would indicate that physical attractiveness influences centrality, and centrality influences performance. A sobel test was used to determine the significance of the indirect effect, and results partially indicate that centrality in both a *friendship* (Hypothesis 4a) and *task* network (Hypothesis 4b) would mediate the relationship between physical attractiveness and *objective* performance ratings for degree centrality but not eigenvector centrality. Additionally, results show little to partial support that centrality in both a *friendship* (Hypothesis 4c) and *task* network (Hypothesis 4d) would mediate the relationship between physical attractiveness and *subjective* performance ratings for degree centrality but not eigenvector centrality.

Moderation means that the effect of centrality on performance would depend on physical attractiveness. Results partially indicate that physical attractiveness would moderate the relationship between centrality in a *friendship* network and *objective* (Hypothesis 5a) and *subjective* (Hypothesis 5b) performance ratings. The presence of a moderating mechanism was stronger for degree centrality than eigenvector centrality. Additionally, results show little support that physical attractiveness would moderate the relationship between centrality in a *friendship* network and *subjective* performance ratings (Hypothesis 5c), and there is no support that physical attractiveness would moderate the relationship between centrality in a *task* network and *subjective* performance ratings (Hypothesis 5d).

Closer examination of the moderation models presented in Figure 3 allows for possible speculation into the causes of certain trends. The diagram of Objective Performance Ratings versus Friendship Degree Centrality (Time 3) shows all three lines having negative slopes. This indicates that as a members' centrality increased, objective multiple choice test score decreased, regardless of physical attractiveness. However, this effect was greater for more physically attractive individuals. This could indicate that more physically attractive individuals received more attention from their peers and more peers. This translates into more time spent interacting, which takes time away from studying.

The plot of Instructor Points versus Friendship Degree Centrality (Time 3) shows the slope of the line for less attractive individuals is positive, while the slope of the line for more attractive individuals is negative. This indicates that physical attractiveness changes the direction of the relationship between centrality and objective performance ratings. The negative line for attractive individuals could be caused because an instructor's perception of that member's centrality being a result of good looks only, and, therefore, undeserved. Conversely, the positive line for less attractive individuals could indicate that the flight instructors viewed them as more deserving of their central positions since they were able to achieve these powerful positions despite their low attractiveness. This would indicate that something else, such as extroversion, charisma, or intelligence, caused their success.

The diagram for Peer Points versus Friendship Degree Centrality (Time 6) shows all three lines having positive slopes. This indicates that an individual will receive points from his or her peers regardless of physical attractiveness. Perhaps in an academic environment, physical attractiveness is a non-factor because these individuals want to judge others solely on how they perform, since that is how they would want to be judged by others.

A particularly interesting trend to note is the discrepancies between degree and eigenvector centrality, which can be seen in Tables 3 through 8 and Figure 3. Specifically, in Tables 3 through 6, the interaction term (Centrality × Physical Attractiveness) was more significant a greater number of times for degree centrality than eigenvector centrality for both friendship and task networks. Similarly, in Table 7, physical attractiveness is significant for degree centrality but not eigenvector centrality, and in Table 8, the sobel test statistics were often significant for degree centrality, but were not significant for eigenvector centrality at all. Likewise, the diagrams in Figure 3, look different for degree centrality at a particular time versus eigenvector centrality. For example, the plots of Objective Performance Ratings versus Task Centrality (Time 4) have different trend lines for degree and eigenvector centrality. This could be due to the instability of eigenvector centrality across different sample sizes, as studied by Costenbader and Valente (2003). In their study, Costenbader and Valente (2003) examined the correlations between the actual network and the sampled networks using several different centrality measures. Additionally, they discovered that in-degree centrality consistently had higher correlations than other types of centrality, such as eigenvector. Since the response rate in this study was not 100%, the eigenvector centrality results may be skewed.

Another interesting result indicates that for both degree and eigenvector centrality in both types of networks (friend and task), women received higher performance ratings from their instructors (Refer to Tables 3 through 6), and in almost all tests gender was significant. This result is rather surprising since, in a military environment, when there is less variation in appearance among members (as cited in Mueller & Mazur, 1997), women are not as free as women in corporate organizations to present a feminine image because of regulations that encourage uniformity. In fact, research has shown that less attractive women have more advantages than attractive women in jobs that are traditionally thought to be for men, such as the military (Drogosz & Levy, 1996; Chia, Allred, Grossnickle, & Lee, 1998). However, the higher performance ratings from instructors could be due to the fact that attractiveness is a quality that has been shown to be more valued in females than males (Mulford et al., 1998; Kanazawa & Kovar, 2004; Singh, 2004; Horsten & Blevins, 2002; Wiederman & Hurst, 1998). Furthermore, women may have an advantage over men due to their recognition of the importance of looks (Tahmincioglu, 2007). Of course, another plausible explanation for the women receiving higher ratings from their instructors is that they actually were better performers than the men in this academic environment.

Limitations

The biggest limitation in this study is the use of a self-reported physical attractiveness instrument. First, most measures that use self-reported physical attractiveness scales are actually measuring personality characteristics, such as narcissism and self-esteem (Gabriel, 1994; Longo & Ashmore, 1995), and not actual physical attractiveness. Second, although physical attractiveness is often used when making initial judgments and perceptions about people (Umberson & Hughes, 1987), for this study, the physical attractiveness scale was included at the end of the last survey on week 7. In a professional environment, where members expect to be rated solely on their job performance, physical attractiveness could be perceived as superficial or irrelevant. This was confirmed by editorial comments provided by respondents in the survey margins, which, in general, read, “I don’t think these are appropriate questions for a team performing environment.” Additionally, survey fatigue appeared to heighten this effect, as made evident by only 247 of the original 406 students responding to the measure, yielding a response rate of 60.84%. Third, since attractiveness is seen as a socially desirable personal attribute, especially for women (Longo & Ashmore, 1995; Mulford et al., 1998; Swami et al., 2007), the potential exists for self-reporting bias. In fact, research has shown that subjects tend to rate themselves higher than they would rate others (Mulford et al., 1998), with men giving themselves higher ratings than females (Mulford et al., 1998). Furthermore, if less attractive individuals were offended by the scale, attractive people may be over represented in the sample, thus creating range restriction caused by systematic non-response. However, considering the sensitive nature of the variable and the measures used, researchers decided to measure physical attractiveness at the end of the study to avoid any negative perceptions of the instrument, which could have effected subsequent measures.

Suggestions for Future Research

First, a similar study could be administered in the exact same environment; however, instead of using a self-rated physical attractiveness scale, another measure could be used. For example, multiple members could rate their peers' attractiveness. Furthermore, future research could span a more diversified sample, such as non-military and ages (starting at age 18). Physical attractiveness may have a greater effect on a younger, non-uniformed, group of civilians. This leads to the possibility of a similar study being conducted outside of an academic environment. Finally, perhaps the nine items of the physical attractiveness scale would be more appropriate in an every day working environment, where groups are not as bounded and performance is measured for longer than 6 weeks. This would allow researchers to study the relationships between physical attractiveness, social network location, and performance in a more natural environment.

Conclusion

This research studied how an individual's physical attractiveness influenced social network location and objective and subjective performance ratings. Military members can use these findings to better understand the pivotal role that physical attractiveness plays in their environment. Additionally, members who are more physically attractive than others, or at least think they are, could strategically use their looks to their advantage to acquire a central social network position, increasing their chances of better performance.

Bibliography

Anonymous. (2007, December 22 to 2008, January 4). To those that have, shall be given. *The Economist*. 53-54.

AFPC Release No. 068. (2007). *Service demographics offer snapshot of force.* (October 24, 2007). Retrieved May 8, 2007, from http://ask.afpc.randolph.af.mil/pubaffairs/servicedemographics.asp.

Alreck, P. L., & Settle, R. B. (Eds.). (2004). *The Survey Research Handbook* (3rd ed.). New York, NY: The McGraw-Hill Companies.

Attractive. (n.d.). *The American Heritage® Dictionary of the English Language, Fourth Edition*. Retrieved February 12, 2008, from Dictionary.com website: http://dictionary.reference.com/browse/attractive.

Badgett, M. V. L., & Folbre, N. (2003). Job gendering: Occupational choice and the marriage market. *Industrial Relations, 42*(2), 270-298.

Balkundi, P., & Harrison, D. (2006). Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. *Academy of Management Journal, 49*(1), 49-68.

Balkundi, P., & Kilduff, M. (2005). The ties that lead: A social network approach to leadership. *The Leadership Quarterly, 16*, 941-961.

Bonacich, P. (2007). Some unique properties of eigenvector centrality. *Social Networks, 29*, 555-564.

Bonacich, P., & Lloyd, P. (2004). Calculating status with negative relations. *Social Networks, 26*, 331-338.

Borgatti, S. (2006a). *Centrality*, MB 874, Social Network Analysis, Gatton College of Business and Economics. University of Kentucky, Fall 2006.

Borgatti, S. (1995). Centrality and AIDS. *Connections, 18*(1), 112-115.

Borgatti, S. (2005). Centrality and network flow. *Social Networks, 27*, 55-71.

Borgatti, S. (2006b). *Data collection for complete networks*, MB 874, Social Network Analysis, Gatton College of Business and Economics. University of Kentucky, Fall 2006.

Borgatti, S. (2006c). *Dependency theory*. MB 874, Social Network Analysis, Gatton College of Business and Economics. University of Kentucky, Fall 2006.

Borgatti, S. (2006d). Identifying sets of key players in a social network. *Computational & Mathematical Organization Theory, 12,* 21-34.

Borgatti, S. P., Carley, K. M., & Krackhardt, D. (2006). On the robustness of centrality measures under conditions of imperfect data. *Social Networks, 28*(2), 124-136.

Borgatti, S., Everett, M., & Freeman, L. C. (2002). *UCINET 6 for windows: Software for social network analysis*. Harvard: Analytic Technologies.

Borgatti, S., & Foster, P. (2003). The network paradigm in organizational research: A review and typology. *Journal of Management, 29*(6), 991-1013.

Brass, D. J., & Burkhardt, M. E. (1992). Chapter 7: Centrality and power in organizations. In N. Nohria, & R. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. 191-215). Boston: Harvard Business School Press.

Brass, D. J., Galaskiewicz, J., Greve, H. R., & Tsai, W. (2004). Taking stock of networks and organizations: A multilevel perspective. *Academy of Management Journal, 47*(6), 795-817.

Brass, D., & Krackhardt, D. (1999). Chapter 9: The social capital of twenty-first-century leaders. In J. G. Hunt, & R. L. Phillips (Eds.), *Out-of-the box leadership challenges for the 21st century army* (pp. 179-194)

Bryk, A. S., & Raudenbush, S. W. (1992). In Foster D. S., Leeuw J. D. (Eds.), *Hierarchical linear models: Applications and data analysis methods*. USA: SAGE Publications, Inc.

Chia, R. C., Allred, L. J., Grossnickle, W. F., & Lee, G. W. (1998). Effects of attractiveness and gender on the perception of achievement-related variables. *Journal of Social Psychology, 138*(4), 471-477.

Collins, M. A., & Zebrowitz, L. A. (1995). The contributions of appearance to occupational outcomes in civilian and military settings. *Journal of Applied Social Psychology, 25*(2), 129-163.

Combs, G. (2003). The duality of race and gender for managerial African American women: Implications of informal social networks on career advancement. *Human Resource Development Review, 2*(4), 385-406.

Costenbader, E., & Valtente, T. W. (2003). The stability of centrality measures when networks are sampled. *Social Networks, 25*, 283-307.

Davis, C., Claridge, G., & Fox, J. (1999). Not just a pretty face: Physical attractiveness and perfectionism in the risk for eating disorders. *International Journal of Eating Disorders, 27*(1), 67-73.

Dickey-Bryant, L., Lautenschlagar, G., Mendoza, J., & Abrahams, N. (1986). Facial attractiveness and its relation to occupational success. *Journal of Applied Psychology, 71*(1), 16-19.

Drogosz, L., & Levy, P. (1996). Another look at the effects of appearance, gender, and job type on performance-based decisions. *Psychology of Women Quarterly, 20*, 437-445.

Everett, M., & Borgatti, S. (1999). The centrality of groups and classes. *Journal of Mathematical Sociology, 23*(3), 181-201.

Goldberg, L. R. (2007). *International personality item pool: A scientific collaboratory for the development of advanced measures of personality traits and other individual differences.* Retrieved July 13, 2007, from http://ipip.ori.org/.

Hanneman, R. A., & Riddle, M. (2005). *Introduction to social network methods*. Riverside, CA: University of California, Riverside.

Hiring practices influenced by beauty. (2007). *Physorg.com*, December 8, 2007 from www.physorg.com/news116169372.html.

Hope, D., & Mindell, J. (1994). Global social skill ratings: Measures of social behavior or physical attractiveness? *Behaviour Research and Therapy*, *32*(4), 463-469.

Horsten, H., & Blevins, A. (July 26, 2002). *Determined physical attractiveness in terms of personality traits.* Retrieved July 25, 2007, from http://jrscience.wcp.muohio.edu/humannature01/FinalArticles/DeterminedPhysicalAttract.html

Hosoda, M., Stone-Romero, E. F., & Coats, G. (2003). The effects of physical attractiveness on job-related outcomes: A meta-analysis of experimental studies. *Personnel Psychology, 56*(2), 431-462.

Hox, J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah, NJ: Lawrence Erlbaum.

Hurley-Hanson, A., & Giannantonio, C. (2006). Recruiters' perceptions of appearance: The stigma of image norms. *Equal Opportunities International, 25*(6), 450.

Ibarra, H. (1992). Homophily and differential returns: Sex differences in network structure and access in an advertising firm. *Administrative Science Quarterly, 37*(3), 422-447.

Ibarra, H. (1993). Network centrality, power, and innovation involvement: Determinants of technical and administrative roles. *Academy of Management Journal, 36*(3), 471-501.

Ibarra, H., & Andrews, S. (1993). Power, social influence, and sense making: Effects of network centrality and proximity on employee perceptions. *Administrative Science Quarterly, 38*(2), 277-303.

Jose, P.E. (2003). *ModGraph-I*. Retrieved January 11, 2008, from http://www.victoria.ac.nz/psyc/staff/paul-jose/files/modgraph/modgraph.php.

Kanazawa, S., & Kovar, J. (2004). Why beautiful people are more intelligent. *Intelliegence, 32*, 227-243.

Kenny, D.A. *Mediation*. Retrieved January 10, 2008, from http://davidakenny.net/cm/mediate.htm.

Klein, K. J., Lim, B., Saltz, J. L., & Mayer, D. M. (2004). How do they get there? an examination of the antecedents of centrality in team networks. *Academy of Management Journal, 47*(6), 952-963.

Langlois, J. H., Roggman, L. A., Casey, R. J., Ritter, J. M., Rieser-Danner, L. A., & Jenkins, V. Y. (1987). Infant preferences for attractive faces: Rudements of a stereotype? *Developmental Psychology, 23*(3), 363-369.

Langlois, J., Kalakanis, L., Rubenstein, A., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin, 126*(3), 390-423.

Lincoln, J. R., & Miller, J. (1979). Work and friendship in organizations: A comparative analysis of relational networks. *Administrative Science Quarterly, 24*, 181-199.

Longo, L., & Ashmore, R. (1995). The looks-personality relationship: Global self-orientations as shared precursors of subjective physical attractiveness and self-ascribed traits. *Journal of Applied Social Psychology, 25*(5), 371-398.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organizational Science, 2*(1), 71-87.

Mehra, A., Kilduff, M., & Brass, D. J. (1998). At the margins: A distinctiveness approach to the social identity and social networks of underrepresented groups. *Academy of Management Journal*, *41*(4), 441-452.

Mehra, A., Kilduff, M., & Brass, D. J. (2001). The social networks of high and low self-monitors: Implications for workplace performance. *Administrative Science Quarterly, 46*(1), 121.

Mehra, A., Smith, B., Dixon, A., & Robertson, B. (2006). Distributed leadership in teams: The network of leadership perceptions and team performance. *The Leadership Quarterly, 17*, 232-245.

Moore, Gary J. *The longitudinal effects of self-monitoring and locus of control on social network position in friendship networks.* MS thesis, AFIT/GEM/ENV/06M-11. Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB, OH, March 2006 (ADA446188).

Mueller, U., & Mazur, A. (1997). Facial dominance in *homo sapiens* as honest signaling of male quality. *Behavioral Ecology, 8*(5), 569-579.

Mulford, M., Orbell, J., Shatto, C., & Stockard, J. (1998). Physical attractiveness, opportunity, and success in everyday exchange. *American Journal of Sociology, 103*(6), 1565-1592.

Nash, R., Fieldman, G., Hussey, T., Leveque, J., & Pineau, P. (2006). Cosmetics: They influence more than caucasian female facial attractiveness. *Journal of Applied Social Psychology*, *36*(2), 493-504.

Pitts, F. (1979). The medieval river trade network of Russia revisited. *Social Networks, 1*, 285-292.

Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology*, *57*, 199-226.

Singh, D. (2004). Mating strategies of young women: Role of physical attractiveness. *The Journal of Sex Research, 41*, 43-54.

Soper, D.S. (2008). *Sobel Test Calculator for the Significance of Mediation*. Retrieved 11 Jan 2008, from http://www.danielsoper.com/statcalc/calc31.aspx.

Sparrowe, R. T., Liden, R. C., & Kraimer, M. L. (Apr 2001). Social networks and the performance of individuals and groups. *Academy of Management Journal, 44*(2), 316-325.

Swami, V., Greven, C., & Furnham, A. (2007). More than just skin-deep? A pilot study integrating physical and non-physical factors in the perception of physical attractivene. *Personality and Individual Differences, 42*, 563-572.

Tahmincioglu, E. (2007). *Power of attraction still rules in workplace: Good-looking bosses considered more competent, MSNBC survey finds.* Retrieved March 5, 2007, from http://www.msnbc.com/id/17369873/.

Umberson, D., & Hughes, M. (1987). The impact of physical attractiveness on achievement and psychological well-being. *Social Psychology Quarterly, 50*(3), 227-236.

Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review, 61*(4), 674-698.

Wasserman, S., & Faust, K. (1994). *Social network analysis: Methods and applications* (15th ed.). New York, New York: Cambridge University Press.

Wiederman, M., & Hurst, S. (1998). Body size, physical attractiveness, and body image among young adult women: Relationships to sexual experience and sexual esteem. *Journal of Sex Research, 35*(3), 272-281.

Vita

Second Lieutenant Janell M. Lott graduated from Alamo Heights High School in San Antonio, Texas, in 2002. She entered Southern Methodist University in Dallas, Texas, and graduated with a Bachelor of Science degree in Mechanical Engineering with a math minor in May 2006. On the same day, she was commissioned as an Air Force officer through AFROTC at the University of North Texas in Denton, Texas. Lieutenant Lott was sent TDY to Air and Space Basic Course at Maxwell AFB, Alabama, en route to her first assignment as a graduate student at the Air Force Institute of Technology. Upon graduation in March 2008, she will be assigned to Tyndall AFB, Florida, to begin her civil engineering career with the Air Force.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
27-03-2008	Master's Thesis	August 2006 – March 2008

4. TITLE AND SUBTITLE
Physical Attractiveness, Social Network Location, and Performance in the Military

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Lott, Janell, M., Second Lieutenant, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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/08-M12

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
THIS SPACE INTENTIONALLY LEFT BLANK

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 provide insight into the effect of physical attractiveness on social network location and performance in a military environment. This study sought to prove five hypotheses, which were introduced through a comprehensive literature review, regarding the many interactions between physical attractiveness, social network location, and objective and subjective performance ratings. Specifically, a mediation and moderation model were proposed to capture the relationships between the three variables. For mediation, a causal relationship was found from physical attractiveness to centrality to performance. In other words, physical attractiveness influences centrality, which in turn influences performance. Moderation results suggest that physically attractiveness influences the relationship between social network centrality and both objective and subjective performance. In other words, physical attractiveness appears to hinder the relationship between centrality and performance such that more attractive individuals with high centrality perform worse than less attractive individuals of similar centrality.

15. SUBJECT TERMS
Organizations (Military), Performance (Human), Networks, Group Dynamics, Physical Attractiveness

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			Kent C. Halverson, Lt Col, USAF (ENV)
U	**U**	**U**	**UU**	68	**19b. TELEPHONE NUMBER** *(include area code)* (937)255-3636, ext 4709 e-mail: Kent.Halverson@afit.edu