

A Nonlinear Approach to Gender Bias in Leadership Emergence Perceptions

by

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(ABSTRACT)

The purpose of the present study was to examine the perceptual processes associated with gender differences in leadership emergence recognition. Prior research has indicated that females are less likely to be identified as an emerging leader, even when they display identical leadership behaviors as that of their male counterparts. Unlike most of the previous research performed in this area which has obtained only static snapshots of leadership recognition, the present study used a nonlinear dynamic modeling technique, called cusp catastrophe theory. It was predicted that a nonlinear model would account for more variance than a linear model. Furthermore, it was also predicted that participants would be more resistant to recognizing a female as an emerging leader, as compared to a male. This effect was expected to be greater for male participants than female participants. Participants included 19 organizational members, who watched videos of either a male or female emerging as the leader of a four-person group. Participants recorded their perceptions of leadership through a dynamic measure. In accordance with cusp catastrophe theory, results were analyzed using the program GEMCAT II (General Multivariate Methodology for Estimating Catastrophe Models). Contrary to expectations, none of the predictions were supported. It is suggested that this was primarily due to methodological issues, rather than the relevance of cusp catastrophe modeling for leadership perceptions. Recommendations for future work in this area are provided.

TABLE OF CONTENTS

Chapter		
I.	INTRODUCTION AND LITERATURE REVIEW	1
	Pipeline Effect.	3
	Leadership Behaviors.	4
	Perceiver Stereotyping.	7
	Summary.	14
	Cusp Catastrophe Model.	16
	Hypotheses.	18
II.	METHODS.	19
	Participants.	19
	Stimuli.	19
	Measures.	20
	Procedure.	22
III.	RESULTS.	23
IV.	DISCUSSION.	30
	Findings.	30
	Limitations.	35
	Conclusion.	36
V.	REFERENCES.	37
VI.	TABLES.	45
VII.	FIGURES.	51
VIII.	APPENDICES.	54
	Appendix A: General Leadership Impression (GLI)	54
	Appendix B: Supplementary Information.	55

LIST OF TABLES

TABLE 1. 45
Number of Prototypical Leadership Behaviors by Manager and
Vignette Nnumber for Female Emergent Leader Condition

TABLE 2. 46
Mean Dynamic Leadership Ratings by Emerging Leader
Condition and Vignette

TABLE 3. 47
Last Value Dynamic Leadership Ratings by Emerging Leader
Condition and Vignette

TABLE 4. 48
Descriptive Statistics for Male and Female Leaders by
Condition

TABLE 5. 49
Correlations between Dynamic Rating for Vignette 9 and GLI
Ratings for Male and Female Leader by Condition

TABLE 6. 50
Results from GEMCAT II

LIST OF FIGURES

FIGURE 1.....	51
Screen display of dynamic measure	
FIGURE 2.....	52
Bimodality of Dynamic Leadership Ratings in Vignette 5	
FIGURE 3.....	53
Unimodality of Dynamic Leadership Ratings in Vignettes 1 & 9	

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

The number of women in the national workforce has dramatically increased in recent decades, with women now constituting approximately 47% of all United States workers (U.S. Bureau of Labor Statistics, 2001). In addition, women are increasingly more apt to be positioned as managers in corporate America. They currently comprise 45% of management and administration, as opposed to a mere 18% in 1972 (U.S. Bureau of Labor Statistics, 2001). Furthermore, the educational status of women has also improved, with women possessing 51% of the bachelor degrees and 45% of the advanced degrees that have been awarded (U.S. Bureau of the Census, 2000).

Despite these apparent gains in gender equality, there remains a disparity between the representation of women in the workforce and those in higher positions of leadership. While the amount of women in lower level management has significantly increased in the last decade, few women are able to advance to upper level management (Mann, 1999; Neft & Levine, 1997). In Fortune 500 companies, women comprise only 4% of top officers and 0.4% of CEO positions (Catalyst, 2000). Even when they are able to attain executive positions, women are more likely to experience lower compensation, mobility, and authority than their male counterparts (Lyness & Thompson, 1997) and are contained in a smaller number of occupations (Federal Glass Ceiling Commission, 1995).

Numerous explanations have been proposed to account for the inability of women to progress to the upper echelons of corporate America. Some argue that there is a “pipeline problem,” suggesting that an inadequate number of women with the necessary education and managerial experience are present to promote to upper level management (Forbes, Piercy, & Hayes, 1988). Others have suggested that the actual leadership behaviors of the women are deficient. Proponents of this perspective indicate that

women do not equally emerge in mixed sex groups (Walker, Ilardi, McMahon & Fennell, 1996), compounded by the fact that their behaviors tend to be more person, rather than task-oriented (Eagly & Karau, 1991).

In juxtaposition to the emphasis on the leader, still others assert that bias on the part of the perceiver is primarily responsible. In this case, the metaphor of the “glass ceiling,” is cited to convey the elusive, yet discriminatory barrier that often prevents women from reaching upper level management positions (O’Leary & Ickovis, 1992). Those who support this stance reference the discrepancy in both the amount and types of behaviors necessary for women to be perceived as equally competent or leader-like (Boldry, Wood, & Kashy, 2001; Carli & Eagly, 1999; Yoder, 2001; Yoder, Schleicher, & McDonald, 1998). In response to these inconsistencies in leadership perceptions for male and female leaders, implicit leadership theory is often cited as a possible explanation. Implicit leadership theory proposes that only when leaders are congruent with followers’ leadership prototypes will they be recognized as a leader (Lord, DeVader, & Alliger, 1986). Research indicates that prototypes for successful leaders are more often perceived to equate with males rather than females, thereby making it more difficult for females to be recognized as leaders (Hall, Workman, & Marchioro, 1998; Heilman, Block, Martell, & Simon, 1989; Deal & Stevenson, 1998). To supplement the propositions of implicit leadership theory, categorization theory further suggests that when the category of a leader does not coincide with the category of a target, the perceiver is more likely to resist the categorization process and therefore either delay or avoid identification of the leader. Thus, greater congruence between prototypes of males and leaders will result in increased accessibility and speed in identifying men as leaders (Nye & Forsyth, 1991; Hall, Workman & Marchioro, 1998). In contrast, females may need to demonstrate greater levels of leadership behaviors to be similarly recognized. Based on the assertions

of implicit leadership theory and categorization theory, the present study will explore the perception process of participants in the recognition of male and female leaders.

Prior work has suggested that the leadership perception process often is not a continuous, linear process. As supported by categorization theory, when leadership perceptions do not confer with established prototypes, perceivers may be more resistant to leader recognition. This delay in recognition will result in a discontinuous process (Brown, Marchioro, Tan, & Lord, 1998). Despite this, most prior research on leadership has used only static measures of leadership to assess perceptions, thereby failing to examine the process in its entirety. Therefore, the present study will examine differences in leadership perceptions based on gender using a nonlinear dynamic modeling technique, called cusp catastrophe theory. This advanced methodology will enable a better understanding of the holistic process of leadership recognition based on gender differences. In addition, the present study will be the first in this area to use organizational employees rather than undergraduate students as participants, thereby further offering a more accurate picture of workplace leadership perceptions.

Pipeline Effect

The pipeline effect proposes that an adequate amount of time is necessary to allow for women to progress through the ranks of management. Therefore, only after a proportional number of women are in management will stereotypes be reduced, and women able to advance to upper level positions (Forbes, Percy, & Hayes, 1988). Theorists in align with the pipeline effect also propose that as more children are raised in a society where it is acceptable for women to be employed, or with working mothers themselves, there will be a reduction in the stereotypical bias often thought as influential in the inability of women to be promoted. While this theory remains popular among male CEO's (Ragins, Townsend, & Mattis, 1998), its credibility has been eradicated by the

substantial number of women in lower level management. Thus, it is evident that even as the pipeline is saturated with women, they still encounter difficulty in progressing beyond the lower tiers of leadership, thereby eliminating the pipeline effect as a plausible explanation.

Leadership Behaviors

Leadership Emergence. Research has provided support for the hypothesis that women are less likely to emerge in a group than men (Walker, Ilardi, McMahon & Fennell, 1996). A meta-analysis by Eagly and Karau (1991) analyzed the results of 58 studies, finding a small to moderate tendency for men to emerge as leaders in mixed-sex groups more often than women on both a broad measure of leadership and a task-oriented measure of leadership. This effect was found to be only weakly moderated by task type, revealing that women were only slightly more likely to emerge when the task was clearly feminine, while men almost exclusively emerged when the task was distinctly masculine. These results suggest that leadership emergence is most often considered in terms of task-oriented contributions (Carli & Eagly, 1999).

Hegstrom and Griffith (1992) confirmed similar findings for mixed-sex dyads, paired according to levels of dominance. When both sexes were matched on levels of dominance, the man was more likely to emerge. Yet, even in dyads where the man was low in dominance and the woman was high in dominance, the man and woman were only equally likely to emerge. Other studies have shown that men in mixed-sex groups make more task suggestions (Wood & Karten, 1986), talk more (Carli, 1989; Dovidio, Brown, Heltman, Ellyson & Keating, 1988; Tannen, 1990), and display greater visual dominance than women (Ellyson, Dovidio, & Brown, 1992).

Leadership Effectiveness. While men and women display clear differences in emerging leadership, research shows little variation between the sexes in terms of their

effectiveness. A meta-analysis by Eagly, Karau & Makhijani (1995) revealed that men and women display equally effective leadership behaviors. They also note that once women can obtain a leadership position, such as when the position itself is assigned, they are ranked equivalently to that of their male counterparts (Eagly et al., 1995; Heilman, Block, Martell & Simon, 1989; Martell, Parker, Emrich, & Crawford, 1998). A recent meta-analysis by Eagly, Johannesen-Schmidt, and van Engen (2003) indicated that women are more likely to display transformational leadership styles and to display more contingent reward behaviors, which are positively associated with leadership effectiveness. In contrast, their male counterparts were more likely to display active and passive management by exception, aspects of transactional leadership that are not predictive of leadership effectiveness. Thus, research indicates that females are at least as effective as males in terms of their leadership abilities.

Sex Differences in Leadership Styles. Differences in leadership styles between men and women may contribute to disparities in perceptions of leadership. Findings suggest that men more often display a task-oriented, or agentic, approach to leadership, including behaviors such as making problem-focused suggestions, speaking assertively, influencing others, and initiating activities related to the assigned task (Eagly & Johannesen-Schmidt, 2001). In contrast, women tend to employ a more person-oriented, or communal approach, exhibiting behaviors that enhance the relational and interpersonal dynamics of the group, supporting others, while not drawing attention to themselves (Carli & Eagly, 1999; Eagly & Johannesen-Schmidt, 2001; Eagly, Wood & Diekmann, 2000). Research also reveals that the more task-oriented behaviors displayed within a group, the greater the likelihood of being considered the emerging leader (Stein & Heller, 1979), thereby implying an additional explanation for the lack of identification of leadership emergence among women.

Influence Tactics. Women experience unique challenges that are not faced by men, as they attempt to influence others. Evidence suggests that not only are these leadership styles descriptive in nature, but also prescriptive, resulting in harsh consequences when violated (Heilman, 2001; Ridgeway, 2001). Women displaying behaviors that violate their prescribed gender role are disliked by others (Butler & Geis, 1990; Carli, 1995, 1998, 2001) and viewed as less influential (Carli, 1990, 1999, 2001). A recent study revealed that when a woman's success was unclear because her performance had yet to be reviewed, she was considered less competent, but more likeable. When her performance was reviewed and she was highly successful, she was subsequently rated highly competent, but not likeable (Heilman, Wallen, Fuchs & Tamkins, 2001).

Behaviors that prove beneficial for men in being recognized as a competent leader have the opposite effect when used by women. While self-promotion tends to increase perceptions of competency (Jones & Pittman, 1982), Rudman (1998) found this to be more complex for women. When selecting partners for a Jeopardy simulation, male participants who had nothing to gain from having a competent partner, liked a self-promoting woman less and considered her less hireable than a self-effacing woman, even though she was considered to be more competent. Whether they gained from having a competent partner or not, female participants considered a self-promoting woman less likable and hireable than a self-effacing woman. Other research has substantiated these findings, indicating that women who attempt to display competency through self-promotion are liked less and hired less than are men performing the same strategy (Rudman & Glick, 2001). Eagly, Makhijani and Klonsky (1992) found that women who displayed directive, task-oriented behaviors were rated less favorably, while men were rated equivalently whether they displayed task or person-oriented behaviors. Carli (1990)

found that women who appeared tentative and uncertain were more influential with a male audience than assertive and confident women, even though the tentative woman was thought to be less intelligent, competent and knowledgeable than the assertive woman. Therefore, substantial evidence suggests that women are caught in a double bind. By only performing communal behaviors, they are less likely to be perceived as a leader. Yet, displaying agentic behaviors does not result in positive outcomes as it does for men, but rather has detrimental effects such as reductions in a woman's influence and likeability.

Thus, while research does lend credence to the limited emergence of women in mixed sex groups, it also suggests that even when women display equally effective leadership abilities and identical behaviors, they may not be judged comparable to their male counterparts. Therefore, further exploration of the contributing effects of the perceiver may be instrumental in understanding the lack of female advancement to upper levels of leadership.

Perceiver Stereotyping

While much of the research on leadership has focused on recognizing the traits of effective leaders, more recent work has acknowledged the bi-directional nature of the leader-follower relationship, thereby noting the critical role of perceivers in the identification and development of leaders. Brown and Lord (2001) argue for the importance of moving beyond first order constructs pertaining to leader behaviors, and instead delving further into the underlying processes affecting the perceiver within the context of the leader relationship. Despite equality in leadership effectiveness, women are often perceived as being less leader-like than their male peers, thereby suggesting the role of stereotypic biases in preventing women from achieving leadership positions.

Double standards for competence. Substantial findings have suggested women are far less likely to be considered a leader or competent, even when having identical objective performance as their male peers. For instance, research shows that work products are judged inferior when thought to be produced by a woman rather than a man (Heilman, 1983, 1995; Nieva & Gutek, 1980; Swim, Borgida, Maruyama, & Meyers, 1989). In addition, identical behaviors may be interpreted differently based on which sex performs them. For example, waiting to make a decision was found to be prudent when done by a man, but indecisive or passive when done by a woman (Taylor, Fiske, Etcoff, & Ruderman, 1978). Boldry, Wood and Kashy (2001) further explored sex based perceiver stereotypes in their work with members of the corps of cadets. Participants were asked to rate themselves and each member of their class, with whom they had extensive contact, on fourteen traits that were associated with success in the corps, such as leadership, motivation, diligence, integrity, dedication, etc. Participants were also assessed based on objective performance indicators, such as physical training scores, GPA,, and rank position. The researchers found that even while there were no objective performance differences between male and female cadets, females were perceived by male cadets as having lower motivation and leadership abilities. Other research has revealed that an undervaluing of the contributions of a woman is not only done by her male peers, but also by the woman herself. For instance, a study by Carli (1989) found that women rated the quality of their ideas lower after interacting with a mixed-sex group than they did after collaborating with a same-sex group.

Other research suggests that unless followers are made aware of the skills of a leader, they are less likely to be influenced by a woman than a man. A study by Yoder, Schleicher, and McDonald (1998) appointed a woman as leader of a male group to perform a lost-on-the-moon exercise. Prior to the group meeting, the woman came to a

training session, in which she was told the solutions and rationales behind each decision. Although appointed the leader in both conditions, in only one condition was the group made aware of the leader's training. Although the woman's performance on the task was better in both conditions, only the group that was made aware of her training had a better overall task performance. Thus, Yoder (2001) suggests that only when followers are made conscious of the expertise of their female leader will they be more receptive to her directing.

When women are promoted in an organization or display successful performance, often attributions are made to minimize these accomplishments. This is especially the case when the evaluation criterion is subjective or vague, as is most often the case in higher-level leadership positions (Heilman, 2001). A recent series of studies has also revealed that women are more likely to suffer with group, rather than individual, evaluations. In a group situation, women's success may be more easily attributed to external factors, rather than her actual performance, and therefore her competence may be easily minimized (Heilman, Haynes, & Goodman, 2001). Women's success in an organization may also be attributed to having relationships with those in positions of power, rather than her individual capabilities (Heilman & Stopeck, 1985).

Due to different evaluations of similar performance, researchers have hypothesized a shifting standards model used to assess the performance of men and women, where what is considered a high level of competence needs to be higher for women than men (Carli & Eagly, 1999). This model proposes that women are held to a lower minimum standard than men because they are presumed to be less competent, yet a higher confirmatory standard to prove they are equally as capable. In a study by Biernat and Kobrynowicz (1997), participants were asked to record the minimum number of job relevant skills they would require of both a male and female job candidate. Both men

and women set lower standards for female candidates than they did for males. However, when asked what skill level would be required to ascertain if the candidate “had the ability to perform the job,” a higher standard was set for women than for men. Other research affirms that women are held to higher standards than men to prove that they are highly competent (Foschi 1989, 2000). This is also the case with leadership behaviors. Brown, Marchioro, Tan & Lord (1998) revealed that followers required women to display a greater amount of leadership behaviors than men in order to be classified as a leader. Thus, research suggests that there is a clear incongruence between being a woman and being perceived as a leader, thereby indicating that the two may often not be associated together.

Implicit Leadership Theories. The discrepancy between the actual leadership behaviors of women, and their relative difficulty in being recognized as leaders may be better understood through implicit leadership theories. Research shows that people have well-defined schemas involving perceptions of leadership, as well as characteristics and behaviors that differentiate leaders (Lord, Foti, & DeVader, 1984). According to Lord, DeVader, and Alliger (1986) followers only allow a person to lead when the individual corresponds with their view of a leader, thereby emphasizing the reciprocal nature of the leader-follower relationship. These leadership structures are broad, multidimensional cognitive structures. These highly interconnected structures may be domain and culture specific, and tend to be stable, yet not static (Brown & Lord, 2001; Gerstner & Day, 1994; Nye, 2002). Instead, they are formidable to new information, task alterations, and changing goals (Brown & Lord, 2001). In addition, implicit leadership theories have both universal descriptors, shared by most people, as well as components that are unique to the individual. Due to the importance of leadership prototypes in identifying leaders, it

is crucial to examine differences between the application of these prototypes to men and women.

Substantial research has found that most people share leadership prototypes that are more often associated with what has traditionally been considered masculine traits, such as dominance and aggression. Offermann, Kennedy, and Wirtz (1994) found that cognitive leadership structures that pertained to business were composed of eight broad dimensions, including sensitivity, dedication, tyranny, charisma, attractiveness, masculinity, intelligence and strength. Thus, research shows that tyranny and masculinity are two factors that are essential to leadership prototypes in either an eight or six factor structure (Offermann, et al. 1994; Epitropaki, in press). Further research suggests that dominance is one of the key components that comprise most implicit leadership theories (Lord, DeVader & Alliger, 1986; Smith & Foti, 1998).

Other findings suggest that implicit leadership theories may be biased against women. Repeated studies reveal that when people think about managers, they are more likely to think of males. Work done by Schein revealed that both male (1973) and female (1975) managers perceived attributes associated with managerial success to be possessed more by men than women. Schein had participants respond to 92 descriptive terms (SDI), by asking how characteristic on a 5-point scale each term was of men in general, women in general, and successful middle managers. Characteristics of successful middle managers were more likely to be attributed to men in general than to women in general. This finding was later replicated with male managers only (Brenner, Tomkiewicz, & Schein, 1989; Heilman, Block, Martell, & Simon, 1989). Other research shows that stereotypical male qualities are thought necessary to be a successful executive (Martell, Parker, Emrich, & Crawford, 1998).

Similar research by Deal and Stevenson (1998) used college students, instead of managers. They again found that both male and female subjects generally agreed on the characteristics of a prototypical manager and male manager, but significantly differed in their perceptions of a female manager. Male participants were more likely than female participants to have negative views of female managers, describing them less often as ambitious, authoritative, competent, direct, firm, intelligent, objective, sophisticated, or well informed. However, male subjects were far more likely than female subjects to describe female managers as bitter, likely to dawdle and procrastinate, deceitful, easily influenced, frivolous, hasty, nervous, passive, quarrelsome, reserved, shy, having a strong need for social acceptance, timid, uncertain and vulgar. Thus, substantial empirical evidence suggests that implicit leadership theories of men in particular may be biased against women, such that attributes associated with leadership are not associated with women.

Hall, Workman, and Marchioro (1998) further substantiate these findings. After being divided into four-person, mixed-sex groups and being instructed to complete two tasks, participants were asked to rate each of their group members in terms of perceived competence and leadership emergence. The researchers found that men were more likely to emerge than women, but that this relationship was mediated by perceived capabilities. Specifically, males were more likely to be perceived as dominant, ambitious, and extroverted than females, with these abilities having a direct influence on leadership emergence. Due to the fact that participants interacted only for a short period of time (approximately twenty minutes), it seems likely that the perceived attributes of the group members were due more to the perceivers' implicit leadership theories than to the actual attributes of the participants. Therefore, the work of Hall et al. (1998) further indicates that there may be greater congruence between males and leadership prototypes.

Thus, research involving implicit leadership theories suggests that individuals have prototypes of effective leaders. Leadership prototypes have characteristics that often are considered more masculine in nature, or may be associated with men more than women, depending on the sex of the perceiver. Implicit leadership theories provide insight for further understanding why women are often not recognized as leaders, despite performing similar behaviors as men.

Not only are leadership prototypes more often associated with men, but they also play an important role in the recognition-based perceptual processes of identifying a leader, as accounted for by Lord's proposal of leadership categorization theory (Hall & Lord, 1998; Lord, Foti & DeVader, 1984). The theory suggests that individuals create complex, hierarchal structured leadership categories as part of their implicit leadership theories. Distinctions between categories are based on leadership prototypes. These categories are then used to discriminate leaders from non-leaders in diverse situations, as observations are cataloged based on their congruency with category prototypes (Nye, 2002). The more closely the target individual matches the perceiver's leader prototype, the more likely they are to be identified as a leader. Nye and Forsyth (1991) support the processes underlying categorization theory, with their work using undergraduate business students. After endorsing leadership prototypes, participants were asked to evaluate male or female leaders who differentially displayed behaviors related to those prototypes. Results indicated that greater correspondence between the individual's prototype and the leader's attributes resulted in more favorable evaluations of the leader. This was found to especially be the case for male participants. Thus, Nye and Forsyth (1991) conclude this to be supportive of a leadership categorization model, and highlight the importance of considering participant sex.

Taken together, implicit leadership theories and categorization theory may provide additional insight into the lack of recognition of women as leaders. If there is greater congruency between men, or masculine attributes, and the perceiver's implicit leadership theories, it is more likely that both knowledge structures are housed within the same category. Natural inclusion within the same category makes recognition of male leaders far more likely and prompt than that of their female peers, whose sex is incongruent with the leadership category (Nye & Forsyth, 1991; Hall, Workman & Marchioro, 1998). Therefore, evidence suggests that women must display more leadership behaviors than their male counterparts to be recognized as a leader due to the lack of congruency between females and leadership prototypes (Brown et al., 1998).

Summary

Numerous explanations have been employed to account for the lack of women in upper level leadership positions. Some have suggested that there simply are not enough women in the pipeline that advances to upper level leadership. However, the saturation of women in lower level management within the past decade has proved this to be untrue (Martell, Parker, Emrich, & Crawford, 1998). Another potential rationale is that while women are known to be equally effective leaders when the position is assigned, they do not display comparable levels of emergent behaviors. Research has substantiated this hypothesis, indicating that women do not emerge as regularly in mixed sex groups, and when they do, they often display more communal based behaviors which are not as often associated with perceived emergence (Carli & Eagly, 1999; Eagly & Johannesen-Schmidt, 2001; Walker, Ilardi, McMahon & Fennell, 1996).

Yet, while this explanation provides partial understanding of the dynamics underlying the lack of women in leadership, it clearly does not account for the phenomenon in its entirety. This is seen by the fact that even when women do display

identical behaviors to that of their male counterparts, such as self-promotion or task oriented direction, these behaviors are interpreted by followers differently for men than women (Heilman, 2001). Thus, women are actually penalized for producing the same behaviors that assist a male in being recognized as a leader (Heilman, Wallen, Fuchs & Tamkins, 2001). Therefore, the role of perceiver stereotypes is increasingly being accepted as influential in the lack of female advancement. Research suggests that there are clearly double standards for competence. Women who produce equivalent levels of objective performance may be regarded as having lower motivation and leadership abilities, and their competency may be minimized unless formally recognized (Boldry, Wood, & Kashy, 2001; Yoder, 2001; Yoder, Schleicher, & McDonald, 1998). In addition, research indicates that there are shifting standards for identifying competence between sexes, with women having a lower minimal standard to be recognized as potentially competent, yet a higher confirmatory standard to be deemed as equally adept as their male peers (Biernat & Kobrynowicz, 1997; Carli & Eagly, 1999). Therefore, these disparities in leadership perceptions between men and women indicate the possibility that perceivers have leadership prototypes that are more congruent with men than women, as outlined in implicit leadership theory. This is partially demonstrated by the inclusion of masculinity and dominance in most leadership factor structures (Offermann, Kennedy, & Wirtz, 1994; Smith & Foti, 1998). Furthermore, research reveals that reported characteristics of successful managers more often equate with characteristics of men than women. This has been found to be especially the case for male participants, thereby indicating the prototypes of leaders and females may be the least congruent for male perceivers.

Categorization theory further suggests that when the category of a leader is divergent to the category of a target, the perceiver is far more likely to resist the

categorization process, thereby delaying identification of the leader. Thus, greater congruence between males and leadership prototypes results in increased accessibility and speed in identifying men as leaders (Nye & Forsyth, 1991; Hall, Workman & Marchioro, 1998). Subsequently, it may be necessary for females to display greater amounts of leadership behaviors in order to be similarly recognized. This may be especially the case when the perceivers are male, as evidenced by research that indicates that men are less likely to associate women with success as managers. Thus, it is beneficial to explore the identification process of men and women as leaders to determine potential perceptual differences.

Cusp Catastrophe Model

Although categorization theory clearly describes an ongoing process, most studies that explore leadership perceptions use only static measures. These singular measures are unable to recognize the changes and time differentials that may occur within the perception process, and are therefore insufficient. Consequently, more researchers are recognizing the need to incorporate dynamic nonlinear modeling techniques into their studies to more fully understand social processes, such as leadership perceptions. Cusp catastrophe modeling is one such form that is most pertinent to the study at hand.

Cusp catastrophe theory directly corresponds with research done with connectionist cognitive architectures. An understanding of connectionist cognitive architectures indicates that perceptions are not static representations from memory, but rather an interpretative process based on current contextual stimuli, activated interpretations, and the strength of nodes that form the knowledge structure (Brown et al., 2000; Smith, 1996). These nodes act as processing vehicles that serve to transmit activation or inhibition of new information (Smith, 1996). Connectionist networks continuously act as new stimuli are encountered, allowing a differential weighing of the

information that enables the interpretative process. Based on this understanding, leadership categorization involves the process of integrating new stimuli into the established connectionist networks associated with leadership.

Similarly, cusp catastrophe modeling describes this process in terms of attractors and trajectories. In this form of modeling, the cusp surface is three-dimensional, and depicts the changes that potentially occur between two stable states of behavior through trajectories that fluctuate across time. In this case, the trajectories model leadership perceptions. Where the trajectories join or terminate is referred to as the attractor regions, which are responsible for influencing the quality of the phase space. A single attractor suggests the use of a single category in the perception process, and results in gradual changes as new information is interpreted. In juxtaposition, numerous attractors indicate competitive interpretations, resulting in discontinuous change as individuals move from one category, or attractor region, to other competing categories (Brown et al., 1998). Attractors are strongest when the schemas they represent are used more frequently or are easier to access because of their congruency with the target. Strong attractors make it more difficult to shift from one to another, thereby resulting in sudden and discontinuous change.

Of the seven different types of catastrophe modeling, cusp catastrophe is the most appropriate for the current study primarily based on the number of attractors believed to be influencing perceptions. In this case two attractors are expected to be operating –male and female emerging leaders. Furthermore, the cusp model contains three parameters, consisting of two independent and one dependent parameter. The two independent parameters include asymmetry and bifurcation, each of which has a unique effect on the dependent variable, or in this case, the dynamic leadership ratings. Asymmetry refers to the separation between the two attractors in the phase space, causing the system to switch

between the competing attractors. Movement along the asymmetry parameter results in changes on the dependent variable. The bifurcation, or second independent parameter, acts as a moderator between the asymmetry and dependent parameters by determining whether the system displays continuous or discontinuous change as it shifts between attractors.

The presence of several distinct characteristics, referred to as flags, help to determine if the cusp model is appropriate (Gilmore, 1981). These flags include bimodality, discontinuous change, heteroscedasticity, and hysteresis.

Hypotheses

Based on previous findings of leadership perceptions within the application of cusp catastrophe theory, it is hypothesized that:

1. The cusp catastrophe model is an appropriate model for understanding the process of leadership perceptions. The cusp catastrophe surface will provide a more suitable model than that of a linear surface.
2. Participants' perceptions will reflect the influence of two strong attractors for the male and female leader at various points throughout the duration of the video.
3. Greater congruency between males and leadership prototypes will result in more continuous change of participants' perceptions when watching a male emerge as a leader. In contrast, less congruency between females and leadership prototypes will result in greater discontinuous change in participants' perceptions as they watch a female emergent leader.
4. The effect expected in hypothesis four will be greater for male participants than for female participants.

The current research provides several critical contributions to enhance past findings. As previously mentioned, few studies have incorporated nonlinear dynamic modeling techniques in their examination of leadership perceptions. Of those that have (Brown et al., 1998; Hanges, Lord, Day, Sipe, Gradwohl, & Brown, 1997), only college students have been used as participants. Thus, this study investigates leadership perceptions in the entirety of the process, rather than mere static snapshots. Furthermore, it explores the applicability of these findings to the workplace through the use of organizational members.

CHAPTER 2

METHODS

Participants

Participants included nineteen Caucasian employees (9 males, 10 females) of various organizations from the mid-Atlantic region. The significant majority of the participants worked in the technology and pharmaceutical industries. Employees ranged from a variety of organizational positions, although a noteworthy percentage (47%) reported positions in management. Seventy-nine percent reported having at least a four year college degree, with 21% of those also reporting a Masters degree. Employees ranged in age from 24 to 60 years old, with 53% being forty years or older. Seventy four percent of participants reported being employed by their currently employee for ten years or longer. Forty seven percent of participants reported having a female supervisor, and of those, 44% reported having worked for their female supervisor for five years or longer. A large number of observations (mean=600) were collected from each participant across the nine vignettes.

Stimuli

Participants watched one of two audiovisual tapes that were previously developed by Hanges et al. (1998). The segments consisted of nine vignettes (each four minutes in duration), which depicted four mutual fund managers (two males, two females) working through decision-making tasks. The interactions between the managers were meant to display prototypical leadership behaviors, as detailed by Lord, Foti, and DeVader (1984). In one tape, a male initially displayed more leadership behaviors in the beginning vignettes (1-4), but a female manager progressively displayed more leadership behaviors in the later vignettes (6-9). Thus, in this tape the female is depicted as the emerging leader. The second tape reveals exactly the opposite, such that the female manager initially conducted herself as the leader (vignettes 1-4), but the male manager increasingly demonstrated more leadership behaviors (vignettes 6-9), thereby becoming the emergent leader. The behaviors done by both emergent leaders were identical, so that only the sex of the leader varied between videos. In addition, vignette 5 of both videos depicted an equal number of leadership behaviors for both the male and female leaders. Both videos also showed the two managers who were not the primary targets displaying consistently low levels of leadership behaviors across the nine vignettes.

The study consisted of a two by two between subjects design, with gender of emergent leader (male, female) crossed with gender of participant (male, female).

Measures

General Leadership Impression. The perception of leadership emergence was measured by the General Leadership Impression (GLI), which consists of five items rated on a five point Likert scale, ranging from (1) “nothing” to (5) “extreme amount”. An example of an item includes, “To what degree does (group member name) fit your image of a leader?” An additional two items were included in the measure, “How much did this member encourage the contributions of other group members,” and “How much did this

member contribute to the discussion in a meaningful way.” Participants provided ratings for each of the four group members at the conclusion of watching the ninth vignette. Prior studies have shown the GLI scale to display a strong internal consistency of .88 (Lord et al., 1984; Smith & Foti, 1998; Zaccaro et al., 1991). An internal consistency of .92 was found in the current study.

Dynamic measure of leadership. As they watched the video, participants used an accompanying mouse program to record the strength and direction of their perceptions of leadership. A screen was visible, which included only the four managers’ names from the video. As they watched, participants were instructed to move the computer cursor toward the individual’s name they most perceived as the leader of the group at that time. They were also told that the distance of the cursor from the name should reflect the strength of that person’s leadership. Furthermore, participants were told that they could move the cursor as much or little as they desired in order to convey their perceptions of the leadership for the group. Each time the mouse was moved, the computer program recorded the x- and y-location of the cursor in terms of pixels once per second. The dependent measure reflected the distance between names, and was calculated by the Euclidian distance between the cursor and the two target leaders’ names (Bob and Sue). The female target distance was subtracted from the male target distance, so that large positive values indicated the cursor was closer to the male leader name, while large negative values indicated the cursor was closer to the female leader name. Thus, large positive values suggest greater perceived male emergence, while large negative values designate greater perceived female emergence.

Supplementary Information. Additional information was collected from participants, including their age, sex, ethnicity, highest level of completed education, tenure with the company, position in the company, years of experience in the field,

whether they previously have worked for a female manager, and the amount that they currently worked in teams.

Procedure

After being asked to complete the anonymous study, participants were referred to a web site on the World Wide Web. Each participant was told a standard password to gain access to the contents of the site, which consisted of detailed instructions, both digitized video segments, the mouse program, and the included measures.

Upon entering, the web site assigned participants to an emerging leader condition based on their gender. In accordance with this assignment, participants were instructed to watch one of the two video segments. They were told that the video consisted of four people working on group decision-making tasks, and that they were to determine whom the leader of the group was throughout the video. As they watched the video, the dynamic measure was used to record the location of their mouse, in relation to the group members' names on a smaller screen. Participants were told to move the mouse cursor toward the name of the person they most perceived as the leader of the group, so that the distance of the cursor from the target reflected the strength of their opinion. Thus, the closer the mouse was to the person's name, the more certain the participant was of their leadership within the group. They were also informed that they could move the mouse as much or as little as they wished throughout each video vignette. Dynamic ratings were collected each time the mouse was moved throughout the duration of the video. After watching all nine vignettes, participants were also asked to complete a set of included measures. Both the data from the dynamic ratings and the additional measures were automatically saved by the web site.

CHAPTER 3

RESULTS

The observed x , y coordinates that were collected within each vignette per person were transformed into the dynamic measure through a series of calculations. First, the following formula was used to calculate the root mean squared distance from the x , y location to the symbol on the screen representing the male leader:

$$\text{Leader}_m = \sqrt{(x_o - x_m)^2 + y_o - y_m)^2}$$

where x_o and y_o represent the observed x , y coordinates, and x_m and y_m represent the location of the symbol for the male leader on the screen. A similar formula was used to calculate the root mean squared distance from the x , y location to the symbol representing the female leader:

$$\text{Leader}_f = \sqrt{(x_o - x_f)^2 + y_o - y_f)^2}$$

where x_o and y_o represent the observed x , y coordinates, and x_f and y_f represent the location of the symbol on the screen for the female leader. These values were subtracted from one another, such that high positive values indicated strong perceptions of leadership for the male, while high negative values indicated strong perceptions of leadership for the female. Descriptive statistics for the mean of the dynamic ratings (root mean square difference) per vignette are provided in Table 2. These can be compared to the descriptive statistics for the last dynamic rating (or last observation) within each vignette, as displayed in Table 3. The mean dynamic rating was believed to be a more accurate representation of the directional trend of the data, and was therefore used in the most of the subsequent analyses, with the exception being the data used for the primary GEMCAT analyses. This data included a sampling of the dynamic ratings throughout each vignette (described in detail below). To ensure that the mean dynamic rating did not

offer a better model fit than the sampling of dynamic ratings, supplementary analyses were performed comparing the two, as later discussed.

Further calculations needed to be made in order to reduce the total number of dynamic ratings to the sampling that could be used in subsequent analyses. Five dynamic ratings per vignette per person (45 dynamic ratings per person) was deemed an appropriate number of observations, after critically evaluating the data. Due to the fact that there was significant variability across participants, five observations per vignette per person allowed for the inclusion of several participants that may otherwise have been removed. In order to obtain these five dynamic values, the total number of observations within each vignette for each person was divided by five. This value was then used as a counting reference to obtain five dynamic values that were equally dispersed throughout each vignette for each person. Thus, the same procedure was performed 171 times. This offered a more accurate representation of the change occurring through the vignette, while reducing redundancy between observations. These values were used as the dynamic measure in the analyses involving the GEMCAT II program.

Participants completed the GLI after the ninth vignette. The means and standard deviations for the GLI for the male and female leaders by condition are shown in Table 4. It is evident that values represented relatively high indications of perceived leadership for both the male and female leader. Contrary to expectations, higher values were attributed to the male leader in the female emerging condition, and to the female leader in the male emerging condition. Also, standard deviations indicate that a greater range of scores occurred for the male leader in both conditions. The GLI was correlated with the mean dynamic rating from the total set of dynamic ratings for the last vignette (9) only. The correlations between this dynamic rating and the GLI ratings for the male and female leaders per conditions are provided in Table 5. In the male emerging condition, a

correlation of .24 was found between the male leader and the dynamic measure, and .54 between the female leader and the dynamic measure. In the female emerging condition, a correlation of .56 was found between the male leader and the dynamic rating, and -.06 between the female leader and the dynamic measure. Due to the small sample size, none of these correlations were significant.

A series of analyses were performed to test each of the hypotheses. Hypothesis one refers to the appropriateness of the cusp catastrophe model, which is indicated by the presence of one or more of four possible flags (Gilmore, 1981). The first potential flag, bimodality was believed to be strongest during the fifth vignette when two strong attractors were expected to be influencing participants' ratings, and weakest near vignettes one and nine when only one attractor was expected to be influencing participants' ratings. To test this, a series of three histograms were drawn for each participant (57 in total) to depict the distribution of the complete set of dynamic ratings in vignettes one, five and nine, thereby illustrating the modality of each (see Figure 2 & 3). Two judges appraised the modality of each of the histograms. In contrast to what was expected, only 31.6% of the histograms for vignette five evidenced bimodality. The judges showed agreement in 95% of the cases. Thus, contrary to expectations, the presence of the bimodality flag was not found to be present.

The second potential catastrophe flag is discontinuous change. To test this, the mean of the total set of dynamic leadership ratings within each vignette was calculated by participant. Following this, the change in average outcome ratings between consecutive vignettes was computed by participant. Participants' largest rating change was compared to their mean rating change. A significant paired sample t-test supported the existence of discontinuous change across participants ($t(18) = 8.006, p < .01$).

The third catastrophe flag is heteroscedasticity, which refers to the presence of anomalous variance. This is indicated by the variance estimates for each vignette being significantly different from one another. Testing the third catastrophe flag was done by first calculating the variance of each participant's dynamic rating for the total set of dynamic ratings per vignette. These variances were subsequently averaged across participants to obtain a single variance estimate for each of the vignettes. Contrary to expectations, Hartley's F-test for variance homogeneity indicated that the variance between the vignettes did not significantly differ ($F\text{-max} = 2.12$), thereby suggesting that the third catastrophe flag was not present.

The fourth potential flag is hysteresis, however the first three catastrophe flags are those that are used in initially indicating the presence of a cusp catastrophe model (Brown et al., 1998). Based on the above results, two of the three necessary flags were not found, thereby offering preliminary evidence that the cusp catastrophe model was not present in the current study.

Hypothesis one also examines whether the catastrophe surface is a better fitting model than a linear surface. To test this, a program named GEMCAT II: A general multivariate methodology for estimating catastrophe models (Lange, Oliva, & McDade, 2000; Oliva, Desarbo & Jedidi, 1987) was used. Using a hybrid approach that incorporates two algorithms, Downhill Simplex and Powell's Conjugate Gradient method, GEMCAT II provides a method of testing catastrophe models containing multivariate variables while permitting a priori model specifications. To test the hypotheses, a model was entered that included a participant sex factor (male/female), an emerging leader condition factor (male/female), a vignette factor (1-9 vignettes), and the dependent dynamic measure (5 ratings).

The first hypothesis stated that the cusp catastrophe model would account for more variance than a linear model. To test hypothesis one, a 2 (participant sex) x 2 (emerging leader condition) x 9 (vignette) x 5 (dynamic rating) repeated measures ANOVA was performed. The between subject factors included participant sex and emerging leader condition, while the within subject factors included the vignette number and the dynamic ratings. An eta-squared value of .062 was found for the main effects of this model, thereby indicating that a linear model accounted for only 6.2% of the variance in the dependent variable, which should be considered a weak effect size. This value was compared to a pseudo- R^2 that was computed by the appropriate Sums of Squares obtained by the GEMCAT II program. The pseudo- R^2 for the present model was calculated to be $7.70E-10$, which demonstrates that the cusp model accounts for virtually no variance in the dependent model. GEMCAT II also provides a pseudo- R^2 for the X, Y, and Z parameters in terms of the overall cusp catastrophe model fit. Along with the pseudo- R^2 , a pseudo-F test is provided (Table 6). Both the pseudo- R^2 and the pseudo-F were negative for all three parameters. Lange et al. (2000) recommend that when these values are negative, the possibility that the data conforms to a cusp catastrophe model should be rejected offhand. Thus, hypothesis one, which states that the catastrophe model would be a better model than that of a linear model, was not found to be true. Neither a linear nor a cusp catastrophe model proved to account for significant variance in the dependent variable.

Hypothesis two predicted that the participants' perceptions would reflect the influence of two strong attractors, represented by the male and female emerging leaders, to varying degrees as they watched the video. It was expected that the vignette factor would significantly load on the asymmetry parameter. However, this was not found to be the case. GEMCAT II provides an Assigned Statistical Level (ASL), which is a

distribution free test of the statistical significance of the indicator weight. The ASL values are provided in Table 6. The indicator weight for the vignette factor on the asymmetry parameter (ASL=.93) was not significant. Therefore, hypothesis two was not supported.

Hypothesis three suggested that there would be greater discontinuous change in the female emerging leader condition as compared to the male emerging leader condition. Therefore, it was expected that the condition factor would significantly load on the bifurcation parameter. Again, this was not the case, as the ASL value (ASL=1.0) was not significant. Thus, hypothesis three was also not supported.

Hypothesis four suggested that the effect predicted in hypothesis three would be stronger for male participants than for female participants. Based on this, it was expected that the participant condition would also load significantly on the bifurcation parameter. However, again this was not the case. The ASL value (ASL=1.0) was not significant, thereby indicating that hypothesis four was not supported.

GEMCAT II also provides a relative bias estimate that is useful in understanding the estimation process performed by the program. The relative bias is a measure of the relationship between the plugin value of the parameter estimate (θ) to the mean value of the parameter estimate of all bootstrapped values. A low relative bias indicates that the plugin value of θ is an acceptable estimate of the corresponding population parameter. Lange et al. suggest that values below 15% should be categorized as low. In the current study, the relative bias was considered low for all of the parameters, except for the fifth value of the dynamic measure (see Table 6). This suggests that the lack of model fit was not due to the program being unable to estimate the parameters, but rather to the inappropriateness of the cusp catastrophe model for the data.

In addition to the prior analysis, a series of exploratory analyses were also performed to assess whether additional models may provide different results. Several varying models were run using the GEMCAT II program. For instance, instead of having five dynamic measures as the dependent variable, an overall mean dynamic response per vignette per person was included in the model. However, this did not offer improvements to the model, but instead maintained a poor fit, while increasing the relative bias estimates so that most of the values were over the acceptable cutoff point. In addition, the sex of the participants' manager was also loaded on the bifurcation parameter. This was done because of the large percentage of participants who reported having a female manager, and the possibility that this factor was acting as a moderator. However, this model was also no better in improving the fit of the data, but maintained unacceptable pseudo-R² values and insignificant ASL loadings. The vignette factor, condition factor and participant factor were also included as indicators of parameters other than those originally hypothesized. For example, in several combinations of models, the vignette factor was loaded on the bifurcation parameter (y) rather than the asymmetry parameter (x). Another model was run in which all the factors were loaded on each possible parameter. Likewise, for several of the models, a constant was added. Various combinations of models were performed, but again, this did not increase the fit of the model. In all cases, the pseudo-R² values maintained their negativity, and in most cases, the relative bias of the parameters increased. Of all of the models run, the lowest relative bias was found in the primary analysis.

CHAPTER 4

DISCUSSION

The purpose of this study was to explore potential gender biases in leadership perceptions using a nonlinear dynamic modeling approach. Prior research on implicit leadership theory has demonstrated that prototypes associated with successful leaders are more similar to prototypes associated with males rather than females, thereby making it more difficult for females to be perceived as leaders (Hall et al., 1998, Heilman et al., 1989). Likewise, previous research on categorization theory has indicated that incongruence among prototypes result in greater resistance in the categorization of leaders, thereby causing a delay in the recognition of female leaders, when they are even identified (Nye & Forsyth, 1991; Hall et al., 1998). Although this work offers valuable insight in understanding the recognition process of emerging leaders, the vast majority of research in this area uses only static measures, which are unable to fully encapsulate the perceptual processes involved. Work by Brown et al. (1998) and Hanges et al. (1997) has demonstrated that a nonlinear dynamic approach may be better able to reflect the differences associated with gender biases in leader recognition. Therefore, the present study attempted to further the paucity of work done in this area by further exploring leadership perceptions in terms of catastrophe modeling. Likewise, this research also enhanced the little work that has been done in this area by being the first study to use organizational members as participants.

Findings

The present study predicted that a cusp catastrophe surface would be a better fitting model for leadership perceptions of a male and female leader than that of a linear surface. Likewise, it was further expected that participants' perceptions would reflect the presence of two strong attractors as they watched a series of vignettes where both the

male and female emerged strongly at differing points. Based on this, it was expected that the vignette factor would significantly load on the asymmetry parameter. Contrary to what was hypothesized, the cusp catastrophe theory did not account for more variance in leadership perceptions than that of a linear surface. In fact, the cusp catastrophe model accounted for virtually no variance in the dependent measure. Instead, the linear surface accounted for more variance than the cusp catastrophe surface, although this effect size was also small. Likewise, the vignette factor did not significantly load on the asymmetry parameter, thereby offering no support for the presence of two competing attractors. These findings contradict the work of Hanges et al. (1997) and Brown et al. (1998), who demonstrated that a catastrophe model was more appropriate for the study of leadership perceptions than a linear model. Prior research has also shown that when observed leadership behaviors match categories of leadership, recognition of the leader occurs more swiftly (Nye & Forsyth, 1991; Hall et al., 1998). When observed leadership behavior do not coincide with established leadership categories, it is more likely that the perceptual process will be delayed, thereby resulting in more abrupt, discontinuous changes (Brown & Lord, 2001), that are modeled more effectively with a cusp catastrophe surface. This is believed to occur when the presence of two strong, competing attractors are influencing perceptions, as in the case with two emerging leaders (Brown et al., 1998). Thus, the results from the current study do not comply with previous research.

It was also predicted that the sex of the emergent leader would act as a moderator, indicated by the condition factor loading on the bifurcation parameter. A significant body of research has indicated that prototypical leadership behaviors have greater correspondence to male prototypes than female prototypes (Deal & Stevenson, 1998; Martell et al., 1998), and that females are less likely to be perceived as having the

necessary attributes of a leader (Boldry et al., 2001; Heilman et al., 2001, Yoder et al., 1998). Therefore, it was expected that participants watching a female leader should display greater discontinuity in their perceptual process, due to the incongruence between categories of females and leaders. However, this hypothesis was also not supported, as the emerging leader condition did not significantly load on the bifurcation parameter. This suggests that differential effects were not found in the perception of leadership based on the gender of the emerging leader.

The fourth hypothesis predicted that the sex of the participant would also act as a moderator, and therefore load on the bifurcation parameter. Prior research has supported differences in the recognition of male and female leaders based on the gender of the perceiver. Although research indicates that women may also negate the leadership behaviors of females (Carli, 1989; Rudman, 1998), several studies have shown that male participants are less likely than female participants to associate leadership behaviors with women (Boldry et al., 2001; Deal & Stevenson, 1998). Therefore, it was expected that the discontinuous change that was predicted to occur in the recognition process of female leaders would be greater in the male participant condition. However, this also was not found to be true, as the participant condition did not significantly load on the bifurcation parameter.

Although the predictions of the present study were not supported, the value of a nonlinear approach to leadership perceptions should not easily be dismissed. The fact that neither a cusp surface nor a linear surface accounted for significant variance and the lack of theoretical rationale for other catastrophe models, suggests that other potential factors may be influencing the results rather the inappropriateness of the cusp model or the inaccuracy of the additional hypotheses.

There is a strong probability that the results found were a function of the current methodology. Although having a website that concurrently housed the digitized videos, the dynamic measure, and the additional measures was clearly a technological advancement that permitted the use of organizational members as participants, it offered little control over the results. For instance, this methodological format made it impossible to monitor the activity of the participants. Perhaps participants were differentially motivated to participate in the study. Although it was possible to distinguish participants who did not fully view each vignette segment and therefore to eliminate their data from the study, it was not possible to guarantee that while the video was playing, participants were engaging in the process. Likewise, although comprehensive instructions were provided on the site, it was also not possible to ensure that participants were not confused or generally less comfortable using a computer, as both of these may have potentially affected their dynamic measure responses. Thus, there are numerous factors that may have biased the data collection process. This problem was further aggravated by the limited number of participants, which prevented the deletion of data that looked suspect.

Based on prior research that supports the contribution of cusp catastrophe modeling in leadership perception research and a strong body of work supporting the additional hypotheses, further work in this area is highly recommended. In the future, it would be beneficial to replicate the current study using employees from an organization in which it was possible to monitor their participation. Having a proctor would reduce the possibilities for confusion, while ensuring the engagement of the participants.

The scores on the GLI also provide interesting findings. The means across conditions for both the male and female leader are relatively high, thereby suggesting that both are being perceived as leaders. However, the standard deviations are considerably

higher for the male in both conditions, indicating greater variability in the male GLI ratings as compared to the female. Again, this is somewhat opposite that which was expected. Although some participants are strongly viewing the male as the leader, others are not strongly recognizing him as the leader, relative to the totality of GLI ratings. This differential viewing would have been more in line with the hypothesized effects if it had occurred for the female leader, based on research that indicates more variability in females being perceived as leaders (Deal & Stevenson, 1998; Heilman et al., 1989).

Another noteworthy finding was the fact that higher means were found for the male and female leader in the opposite condition from that anticipated. The male had significantly higher GLI ratings in the female emerging condition. Likewise, the female had significantly higher GLI ratings in the male emerging condition. The GLI was also more strongly correlated with the dynamic rating in the opposite conditions than expected, although none of the correlations were significant. It is possible that these effects may have occurred as a result of a primacy effect, in that the person initially perceived as the leader was more likely to maintain this recognition, despite the subsequent emergence of another person. Reviewing the study, it was probable that the directions pertaining to the GLI were underspecified. In order to be able to correlate the GLI with the last dynamic rating, participants should have been told more directly to rate the managers based on their opinion of their leadership emergence in the last vignette only. With the current set of directions, it is impossible to discern whether participants were rating the managers based on the last vignette or the collective set of vignettes. Based on the results, it seems probable that they were rating the managers from their overall sense of displayed leadership. If that is the case, the fact that the male and female leaders were rated so equitably is clearly noteworthy. Although contrary to expectations, this suggests that both the male and female leaders were equally perceived as leaders

based on their initial leadership behaviors. This would also indicate that greater weight is placed on the person who initially emerges as the leader in the overall recognition process. However, the ambiguity involving the directions of the GLI, makes it difficult to make firm conclusions.

Limitations

Clearly, a limitation of the study is the lack of control possible when using the current methodology without any additional supervision, as previously discussed. Therefore, future research should incorporate some form of monitoring into the existing methodological framework. In addition, it would be beneficial to have a larger number of participants to ensure that the sample is indeed an accurate representation of the population. Likewise, a greater sample size would also allow for the possibility of removing aberrant data, although it is believed that this would be less necessary if the overall process was monitored. In addition, future work should strive for greater racial diversity among participants. The current study was only able to explore the perceptual processes of Caucasian organizational members, which clearly does not provide an accurate representation of the workforce. Therefore, future work with participants of different races would be highly warranted. In addition, the directions for the GLI should be more clear in regards to the time frame that participants should be using to make their evaluations, which would allow stronger conclusions to be made in terms of the relationship between the GLI and dynamic measure.

A final recommendation involves the data collection format. Rather than having the dynamic measure collect the axis locations each time the participant moves their mouse, it would instead be better for the axis location to be collected once per second. This would provide greater uniformity on the number of dynamic observations collected across participants. Due to the fact that GEMCAT II requires an equal number of

observations to be entered per participant, the current study was only able to enter five observations per vignette per person (a total of 45 observations across the nine vignettes). Although this offers a dynamic approach to participants' perceptions, a greater number of observations would be helpful in providing a more precise model.

Conclusion

The direction of the current research is clearly a necessary step forward in the literature on leadership perceptions. It is highly beneficial to study gender biases in the leadership perceptual process in terms of nonlinear modeling, of which cusp catastrophe theory tends to be the most relevant. Only then can a comprehensive understanding of the processes be gained. Likewise, the use of organizational employees as participants is also a necessary addition to the research done in this area, as it provides a clearer understanding of the factors that may be influencing perceptions and offers greater applicability of the findings to the workforce. Future research should continue in the direction of the present study after making minor changes to the current methodology.

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Table 1. Number of Prototypical Leadership Behaviors by Manager and Vignette
Number for Female Emergent Leader Condition

Vignette	1	2	3	4	5	6	7	8	9
Manager 1 (male)	12	12	12	12	12	9	7	5	3
Manager 2 (female)	3	5	7	9	12	12	12	12	12
Manager 3 (male)	3	3	3	3	3	3	3	3	3
Manager 4 (female)	3	3	3	3	3	3	3	3	3

Table 2. Mean Dynamic Leadership Ratings by Emerging Leader Condition and Vignette

Vignette	Female Emerging Condition		Male Emerging Condition	
	Mean	SD	Mean	SD
1	122.74**	218.12	-157.83**	137.18
2	53.58	151.38	-50.45	127.81
3	-16.59	139.62	-23.43	79.04
4	54.53	206.04	-106.11	178.74
5	-29.13	122.55	-13.44	139.82
6	-9.55	150.56	4.21	114.40
7	-55.46	116.43	9.63	71.80
8	-80.13**	131.26	128.52**	119.94
9	-112.34**	154.21	91.11**	134.64

N=19

Note. High positive scores indicate high leadership emergence for the male leader, high negative scores indicate high leadership emergence for the female leader.

***p*<.01

Table 3. Last Value Dynamic Leadership Ratings by Emerging Leader Condition and Vignette

Vignette	Female Emerging Condition		Male Emerging Condition	
	Mean	SD	Mean	SD
1	-24.78*	232.45	-229.29*	52.68
2	-40.69	257.70	-185.99	205.11
3	-90.59	243.69	-191.65	93.27
4	-98.43	232.19	-160.88	197.75
5	-52.38	236.46	-226.86	82.40
6	-65.43	230.08	-152.23	229.13
7	-134.96	135.22	-186.28	115.48
8	-93.85	246.78	-55.43	200.46
9	-191.09	191.53	-9.35	233.09

N=19

Note. High positive scores indicate high leadership emergence for the male leader, high negative scores indicate high leadership emergence for the female leader.

* $p < .05$

Table 4. Descriptive Statistics for Male and Female Leaders by Condition

	Male Emerging Condition	Female Emerging Condition
Male Leader	Mean = 3.97 SD = .75	Mean = 4.29 SD = .69
Female Leader	Mean = 4.03 SD = .31	Mean = 4.21 SD = .38
	<i>N</i> = 10	<i>N</i> = 9

Table 5. Correlations between Dynamic Rating for Vignette 9 and GLI Ratings for Male and Female Leader by Condition

	Male Emerging Condition	Female Emerging Condition
Male Leader	.238	.556
Female Leader	.542	-.064
	<i>N= 10</i>	<i>N=9</i>

Table 6. Results from GEMCAT II

Var	Description	Plugin	Mean	RelBias%	ASL(P>0)	
X-1	Vignette	205858.62	188180.69	-3.8742	.9300	
Y-1	Participant	23259.32	23171.92	-.3772	1.0	
Y-2	Condition	35928.35	35420.03	-1.4351	1.0	
Z-1	Dynamic2	-0.0396	-0.0446	-11.2048	.0200	
Z-2	Dynamic3	-.0181	-.0180	.6881	.1750	
Z-3	Dynamic4	.0259	.0266	2.6171	.8800	
Z-4	Dynamic5	-.0171	-.0141	20.8628	.2350	
----fixed-----						
Z-1	Dynamic1	1.000	1.000	-0.00E+00	1.000	

		<u>Sums of Squares</u>	<u>Pseudo-R²</u>	<u>df1</u>	<u>df2</u>	<u>Pseudo-F</u>
X		4.831066E+0013	-278.7896	6	164	-27.2356
Y		8.205275E+0010	-164732.28	6	164	-27.332
Z		9.598315E+0006	-1408243836.36	6	164	-27.333

Figure 1. Screen display of dynamic measure

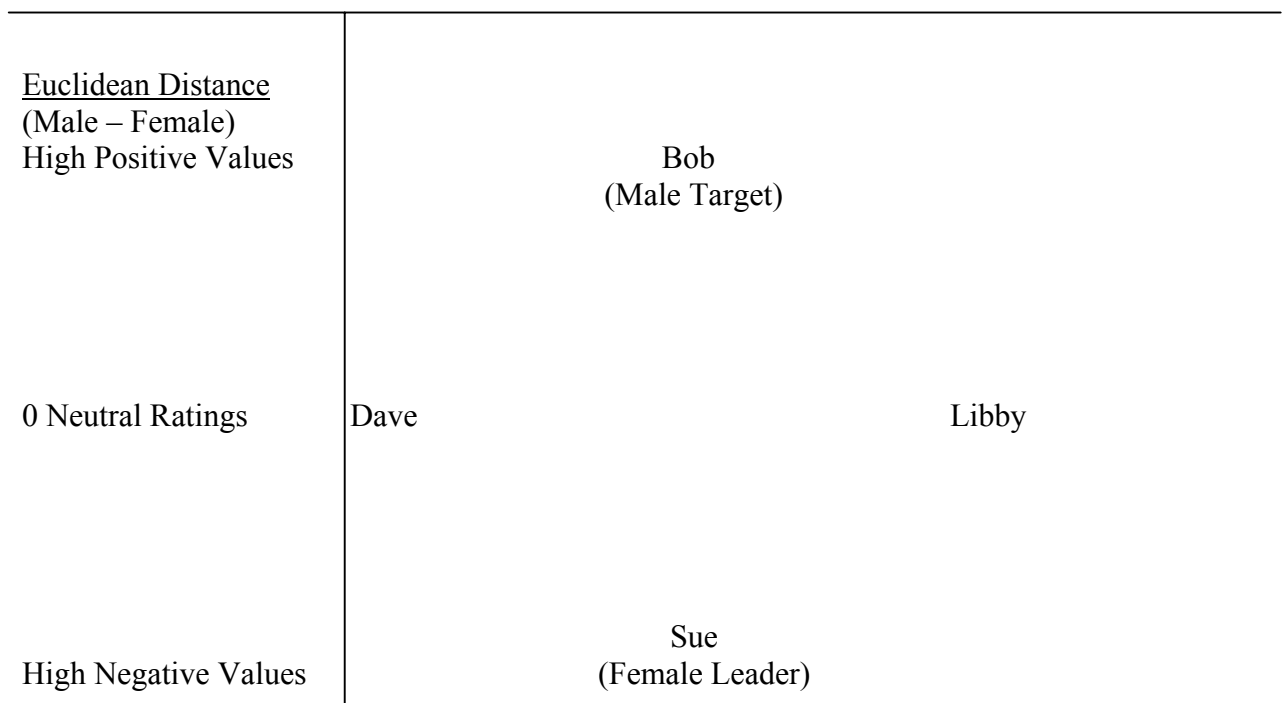


Figure 2. Bimodality of Dynamic Leadership Ratings in Vignette 5

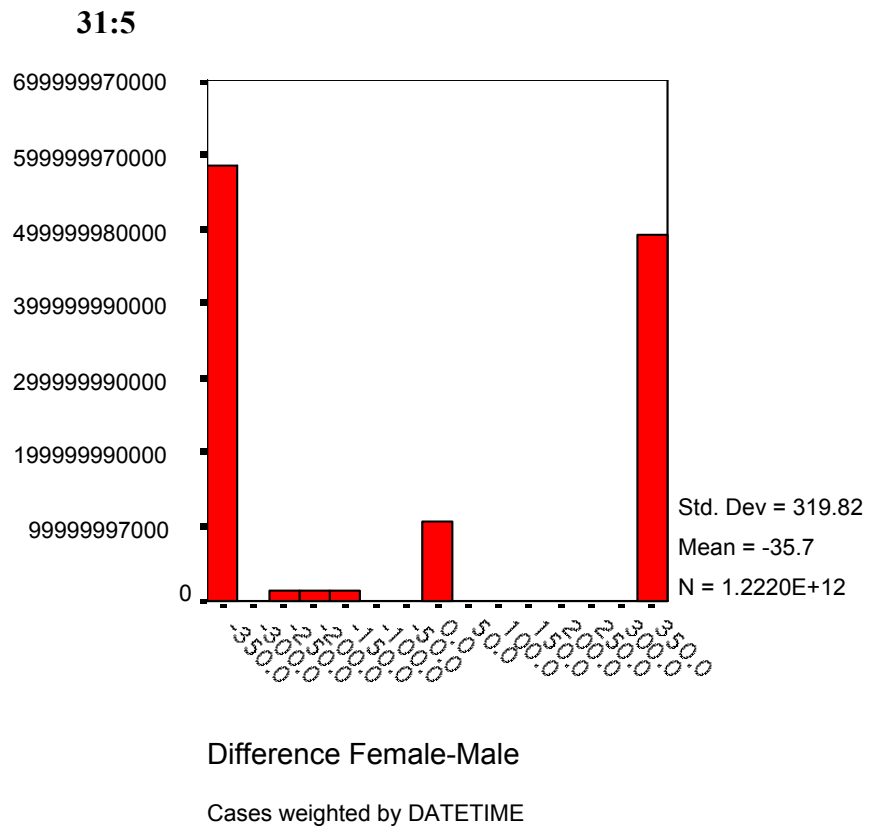
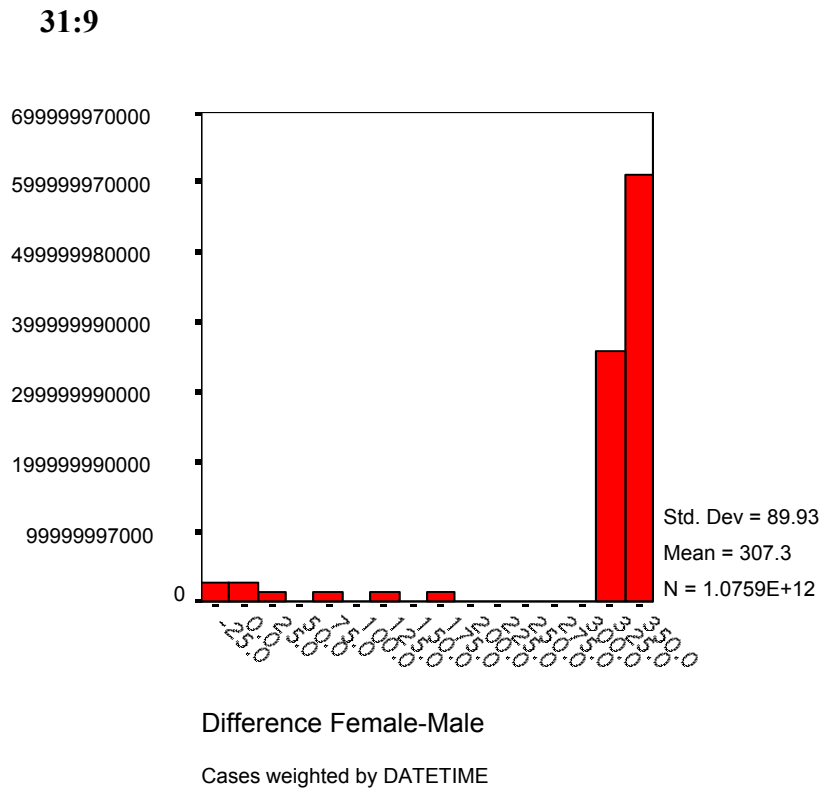
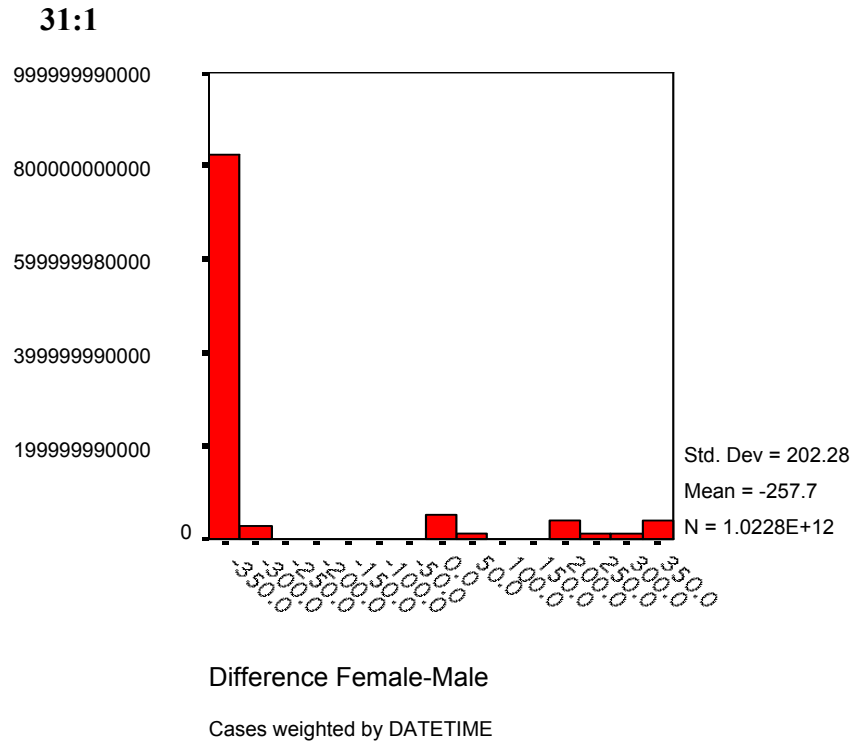


Figure 3. Unimodality of Dynamic Leadership Ratings in Vignettes 1 & 9



Appendix A

General Leadership Impression (GLI)

The following questions concern your feelings towards and evaluations of the manager named, (manager's name). Please check the answer that reflects your feelings.

1. How much did this member contribute to the effectiveness of the task?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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2. What degree of influence did this member exert in determining the final outcome of the task?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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3. How much leadership did this member exhibit?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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4. How much control over the group's activities did this member exhibit?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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5. If you had to choose a leader for a new task, how willing would you be to vote for this member as the leader?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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6. How much did this member encourage the contributions of other group members?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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7. How much did this member contribute to the discussion in a meaningful way?

Extreme Amount	Substantial Amount	Moderate Amount	Very Little	Nothing
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Appendix B

Supplementary Information

Please answer the following questions. Either type or place a check next to your response.

1. How old are you? _____
2. What is your gender? ___Male ___Female
3. What is your ethnicity?
___ a. Caucasian / White
___ b. African American / Black
___ c. American Indian
___ d. Asian American / Asian
___ e. Hispanic
___ f. Other
4. What is the highest level of education that you completed?
___ a. Some High School
___ b. Graduated High School
___ c. Some college classes
___ d. Two year degree
___ e. Four year degree
___ f. Other: _____
5. How many years have you been working for your current employer? _____
6. Have you previously worked for a female supervisor? _____
If so, for how long? _____
7. What is your current job position? _____
8. How often do you work in a team to perform your job?
___ a. Over 75% of the time
___ b. 50-75% of the time
___ c. 25-50% of the time
___ d. Less than 25% of the time

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WORK / RESEARCH EXPERIENCE

- Office of Academic Assessment, Virginia Tech.** 2003-Present
Responsible for the development, analysis and evaluation of University programs, including such tasks as: conducting focus groups, constructing surveys, utilizing and maintaining university assessment databases, developing and deploying online assessments, performing extensive statistical analyses on assessment data, composing detailed reports, collaborating with faculty and administration, and presenting results with recommendations to colleagues.
- Graduate Teaching Assistant, Department of Psychology, Virginia Tech.** 2001-2003
Teaching assistant for undergraduate and graduate Research Methods courses and recitation instructor for Introductory to Psychology courses.
Responsibilities included: working with faculty, constructing and presenting lecture material, producing and grading measures of student learning, and calculating grades.
- Smith Scholar Intern, Department of Psychology, Messiah College.** 2000-2001
Single student recognized by the faculty and administration to receive private grant to fund individual research. In addition to private research, other responsibilities included: conducting interviews, developing assessment instruments, partnering with faculty, networking with community and educational administrators.
- Science and Engineering Apprentice Program, George Washington University.** 1994-1997
Selected and funded by George Washing University to be professionally mentored in the context of the Army Research Laboratory (ARL).
Responsibilities included: collecting and analyzing technical data, conducting scientific research, composing and orating technical reports, database programming, and designing and developing branch website.

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PRESENTATIONS

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Advanced Psychometric Theory
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Research Methods
Industrial Psychology
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Organizational Psychology I (Motivation)
Organizational Psychology II (Leadership)
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Measurement Theory
Personality Processes
Developmental Psychology

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REFERNCES

Available upon request