Mindful Communication in a Crisis: Communication Behaviors of Shared Mindfulness and Effective Pilot Decision Outcomes in Crisis Situations

Janice L. Krieger
MINDFUL COMMUNICATION IN A CRISIS: COMMUNICATION BEHAVIORS OF SHARED MINDFULNESS AND EFFECTIVE PILOT DECISION OUTCOMES IN CRISIS SITUATIONS

by

Janice L. Krieger

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Communication

Western Michigan University
Kalamazoo, Michigan
August 2003
ACKNOWLEDGMENTS

This thesis is the result of the input, effort and collaboration of many individuals on a number of levels. First, and foremost, I am deeply grateful to Dr. Julie Apker my thesis advisor. Her input and guidance has been invaluable in keeping me focused, on track and continually striving to put forth my best effort in the face of numerous obstacles. Most importantly, she provided space to disagree on an intellectual level, which I believe added rigor to the process; and in the end, a higher quality product.

Additionally, I am very honored and very much appreciate the contributions of my thesis committee members, Dr. Peter Northouse and Dr. Wendy Ford. Thank you for your guidance, input and probing questions particularly regarding the theoretical framework and the methodology. Your comments and critiques were always very targeted, and therefore, I could readily implement your feedback.

On a research resource level, I am indebted to the outstanding efforts and support of Agathe Krueger, Lincoln Township interlibrary loan librarian, who ferreted out literally scores of the most obscure articles and books and always got them ASAP!

Notwithstanding, I am very thankful to the WMU College of Aviation, and again, to many individuals who contributed their time and expertise to make this study possible. Thank you Gil Sinclair for the great job in creating the scenarios, effectiveness criteria, and evaluation criteria and always responding to the myriad of questions I posed. I'm grateful to Interim Dean, Robert Aardema and Interim Chair, Bill Rantz for giving me both access to your students and the facilities to conduct the study. I very much appreciate the time and efforts of James Barrowman in facilitating
the pilot study, providing me instructional tapes as learning tools about aviation, as well as allowing me to observe his aviation students in the simulator. Dr. Risukhin who helped me refine the research experiment process and work out the details of conducting the study onsite. Thank you Leisa Perry for being an internal contact for accurate information and to take care of various needs such as posting the research study notices. My thanks to Billy McCormick for discussing with me the flight crew's roles and how they are carried out in the day-to-day aviation environment; and moreover, allowing me to see it first hand via his students enacting those roles in the simulator. Most of all, I thank George McAndrews who saw the potential of this research, obtained the Dean's approval and provided his expertise and support throughout the entire process.

Finally, I thank those students who took the time and had the courage to participate in this study to further the research in their chosen field. Without them, this research would not have been possible. Therefore, this thesis is dedicated to those brave souls.

Janice L. Krieger
Despite the high reliability of current aeronautical technology and safety improvements, human error continues to be a factor in 60-80% of all aviation mishaps. Training to diminish potential errors is often based on analysis of faulty procedures, or lack of procedures without a systemic view including human factors such as communication, decision-making and interaction dynamics. This research explores the existence of the psychological construct of shared mindfulness and examines how it is communicatively constructed and enacted in a high reliability environment such as the aviation industry. The present qualitative study examines shared mindfulness in 10 aviation student dyads in a decision-making crisis situation to identify the communication behaviors of the construct and to determine whether shared mindfulness may lead to more effective pilot decision outcomes.

The study findings reveal both the existence of shared mindfulness as a communicative construct and identify seven inductively derived communication process categories that create shared mindfulness in a dyadic interaction. Additionally, the study findings show that those dyads that demonstrated more communication behaviors of shared mindfulness also made the most effective decisions.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>II. LITERATURE REVIEW</td>
<td>7</td>
</tr>
<tr>
<td>Theoretical Perspective and Strategic Communication</td>
<td>8</td>
</tr>
<tr>
<td>Mindfulness Research</td>
<td>11</td>
</tr>
<tr>
<td>Mindfulness Research in Business and Communication</td>
<td>11</td>
</tr>
<tr>
<td>Strengths and Weaknesses of Mindfulness Research</td>
<td>12</td>
</tr>
<tr>
<td>Mindfulness Gap</td>
<td>13</td>
</tr>
<tr>
<td>Black Hawk Shootdown - A Case Study of Moments of Mindlessness</td>
<td>15</td>
</tr>
<tr>
<td>Communication Analysis of the Black Hawk Incident</td>
<td>19</td>
</tr>
<tr>
<td>Tapping into Mindfulness</td>
<td>21</td>
</tr>
<tr>
<td>Definitional Issues</td>
<td>21</td>
</tr>
<tr>
<td>Conditions of Mindfulness</td>
<td>22</td>
</tr>
<tr>
<td>Mindfulness Inhibitors</td>
<td>24</td>
</tr>
<tr>
<td>Mindfulness Facilitators</td>
<td>27</td>
</tr>
<tr>
<td>Summary</td>
<td>29</td>
</tr>
</tbody>
</table>
### Table of Contents—continued

#### CHAPTER III. METHODOLOGY

- Setting and Participants
- Crisis Scenario
- Procedures
- Pilot Study
- Qualitative Analyses
- Coding
- Integration
- Dimensionalization
- Limitations of Methodology
- Summary

#### CHAPTER IV. RESULTS AND DISCUSSION

- Study Findings
  - Existence of Shared Mindfulness
  - The Construction of Shared Mindfulness in a Crisis Situation
  - The Relationship Between Shared Mindfulness and Decision Outcomes
- Scenario Results
- Examining the Qualitative Relationship of Shared Mindfulness to Effective Decisions
- The Effective Decision Makers - Dyads 5, 6 and 7
Table of Contents—continued

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative Analysis - Decision-making Stages</td>
<td>81</td>
</tr>
<tr>
<td>Discussion</td>
<td>86</td>
</tr>
<tr>
<td>Shared Mindfulness versus Collective Mind</td>
<td>86</td>
</tr>
<tr>
<td>Major Factors that Affect Shared Mindfulness</td>
<td>88</td>
</tr>
<tr>
<td>Summary</td>
<td>105</td>
</tr>
</tbody>
</table>

CHAPTER

V. CONCLUSIONS AND RECOMMENDATIONS                                      | 107  |
| Conclusions                                                            | 108  |
| Extending Mindfulness Theory                                           | 108  |
| Implications of Research Findings to Aviation Crisis Decisions         | 109  |
| Limitations and Future Directions                                      | 114  |
| Recommendations                                                        | 116  |
| Awareness                                                              | 116  |
| Education                                                              | 117  |
| Research                                                               | 120  |

APPENDICES

A. Scenario 1 (Scenario 1, Instructions, Decision Criteria and Effectiveness Rating) | 123  |
B. Scenario 2 (Scenario 2, Instructions, Decision Criteria and Effectiveness Rating) | 127  |
C. WMU College of Aviation Approval to Conduct Research                  | 131  |
D. Human Subjects Institutional Review Board Clearance                  | 133  |
E. Human Subjects Institutional Review Board Approved Consent Form      | 135  |
Table of Contents—continued

BIBLIOGRAPHY ............................................................................................................. 137
<table>
<thead>
<tr>
<th>Table Number</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Shared Mindfulness Communication Process</td>
<td>44</td>
</tr>
<tr>
<td>2</td>
<td>Typology of Shared Mindfulness Communication Behaviors</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>Dyad Interaction Decision Matrix</td>
<td>77</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

1. Salient Shared Mindfulness Communication Behaviors in the Decision Making Process Stages .......................................................... 82
CHAPTER I

INTRODUCTION

As our world grows increasingly complex, so do our organizational environments. Organizational members must deal with increasingly high levels of uncertainty, risk and distraction. In times of crisis, when precious resources and lives totter between disaster and survival, individuals must be able to make sense and act quickly, yet heedfully with mindful attention. Charles Perrow (1984) posits that crisis is associated with our growing technology and modern society's propensity to build more things "that can crash, burn and explode" (p.9). Both the growth and our dependence on bigger, more elaborate systems contribute to increased crisis vulnerability (Sellnow & Seeger, 2001).

Crisis is commonly defined as "a specific, unexpected, and non-routine event or series of events that create high levels of uncertainty and threaten or are perceived to threaten high priority goals including security of life and property or the general individual or community well being" (Seeger, Sellnow, & Ulmer, 1998, p. 233). Crisis initiates an instantaneous set of novel conditions that are driven by high levels of uncertainty about cause, blame and consequences. Stress and fear about the future is pervasive and intense (Sellnow & Seeger, 2001). It is precisely in this type of environment that mindfulness is both riveted to attention by the novelty of a situation while simultaneously distracted by its immediateness, intensity and pervasiveness.
High reliability organizations (HRO's) are those organizations that have zero tolerance for error. Members of these organizations must perform nearly error-free operations on a normal basis otherwise they have the potential of experiencing catastrophes. Conversely, high efficiency organizations are not preoccupied with perfection because their errors are not fatal (Weick & Roberts, 1993). The aviation industry is an HRO in which pilot/air crew/air traffic control must routinely perform error-free so as not to endanger the lives of those aboard the aircraft and on the ground.

A number of studies speak to the fact that pilot decision errors are a major factor in both commercial and military aviation accidents. In an exhaustive review of U.S. Navy/Marine Corps aviation accidents between January 1977 and December 1992, 5,008 mishaps were ascribed to either mechanical/environmental factors or human error. Interestingly, in 1977, there existed nearly a 1:1 ratio between accidents ascribed to human error vs. mechanical/environmental factors for both single and dual-piloted aircraft (Shappel & Wiegmann, 1996). However, by 1992, the ratio was 9:1 attribution to human error for single-piloted aircraft and 12:1 for dual-piloted aircraft. Chillingly, these statistics suggest that human error is not only a significant factor in aviation mishaps but in dual-piloted scenarios the human error factors increase rather than decrease.

Errors in pilot decision making are central to many aviation accidents. Diehl (1991) analyzed commercial airline and military accidents from 1987 to 1989 and found 56% of commercial airline and 53% of military accidents were the result of pilot
decisional errors. Shappell and Weigmann (1997) in a comprehensive study of 2,000
U.S. Naval aviation accidents, analyzed over 4,000 pilot-casual error factors affiliated
with those mishaps and found that judgment errors such as decision-making, goal­
setting and strategy-selection were associated with more major accidents. Conversely,
procedural and response performance errors were most likely to occur with minor
mishaps. Trollip and Jensen (1991) confirmed that most accidents are the result of a
series of poor decisions not a single bad decision. They referred to this phenomenon as
the "poor judgment chain" such that one bad decision increases the likelihood of
another.

Poor or inadequate communication is a common contributor to errors in pilot
or flight crew decision-making. An industry-wide study of aviation accidents revealed
that over 70% of the accidents were related to aircrew coordination and
communication issues (Lautman & Gallimore, 1987). High error crews demonstrated
difficulties in the areas of communication, crew interaction and integration (i.e., shared
mindfulness) rather than a lack of technical knowledge and skill (Smith, 1979).

Although the interaction among crew members has been viewed as a deterrent
to errors that may happen when an individual performs a task alone, unless the
communication within the interaction is mindful it does not lead to reduced error.
Skitka, Mosier, Burdick, and Rosenblatt (2000) in an automation related study of
omission and commission errors found that a second crewmember did not guard
against automation bias, which is a reliance on the automated control system decisions
rather than verifying the automated commands against other available data. A second
person did not decrease the tendency to incorrectly follow automated commands even when contradictory system information was present. Additionally, performers equally failed to notice and respond to system irregularities when not prompted by the system. Most importantly, although the airline industry has increasingly focused on interactional aspects in creating effective Crew Resource Management practices (CRM), the overarching premise of CRM has been stymied. In a study of the changes and nature of CRM since its inception in 1979, the authors posit that in the process of focusing on getting people to work together the objective of why it was important — to reduce the frequency and severity of crew-based errors has been lost (Helmreich, Merritt & Wilhelm, 1999). Thus, if crew members work together well but not mindfully, the human error factor remains an issue, and in some instances, actually increases.

Moreover, the repetitive, ritualized nature of most aviation communication can foster error through mindless overuse of familiar communication patterns. Steven Cushing (1994) in his book on the linguistic and cognitive factors associated with aviation safety, posits that the routine nature of most aviation communication, and particularly its repetitiveness, "... induces a degree of ritualization, with statements and situations losing their cognitive impact and participants falling into a pattern of simply going through the motions for their own sake" (p.46). Similarly, an analysis of en route operational errors and the impact of situational awareness of air traffic controllers revealed "unaware" controllers were likely to make two particular communication errors, incorrect readback of altitude information and failure to secure
a pilot acknowledgement of receipt of information (Durso, Truitt, Hackworth, Crutchfile & Manning, 1998).

The research reviewed here illustrates that communication and interpersonal interaction issues are significant factors in aviation error and subsequent poor pilot decisions in crisis situations. The study's rationale centers on the premise that poor pilot decision-making in crisis situations remains a significant factor in aviation mishaps, particularly in dual-piloted scenarios. I argue that communication behaviors which demonstrate "shared mindfulness" could enhance pilot interactions and potentially reduce pilot decision making errors.

The goal of this thesis is to examine the construct of mindfulness as it is enacted through pilot communication behaviors in a crisis situation. The objectives are to identify shared mindfulness in these situations and describe how it is communicatively constructed. In addition, this study examines whether a condition of shared mindfulness will lead to more effective pilot decision outcomes which could potentially result in reduced human error in aviation mishaps.

To explore these objectives, I ask the following research questions:

RQ1: What distinct communication behaviors might emerge in a crisis situation to reveal shared mindfulness?

RQ2: How does shared mindfulness relate to decision outcomes?

In Chapter Two, I use a social constructionist perspective as an overarching theoretical lens to situate mindfulness and strategic communication behaviors. I then provide a brief historical overview of the mindfulness research including strengths,
weaknesses and gaps in the current body of research. Thirdly, I focus on strategic versus scripted, routinized communication behavior as facilitating shared mindfulness. Subsequently, I examine the phenomenon and construct of mindfulness on the individual intrapersonal level and define what I have termed "shared mindfulness".

In Chapter Three, I explicate the research setting and participants, study procedures. The qualitative and quantitative analysis methods used to examine the construct of shared mindfulness within an aviation context. Chapter Four presents the study’s results and interpretation of findings in which I discuss the facilitators and inhibitors of shared mindfulness and the relationship of shared mindfulness to the decision making process and effective decision outcomes.

In Chapter Five, I offer conclusions on extending mindfulness theory and summarize the most salient findings to aviation. Additionally, I present recommendations for a three-fold strategy of pragmatic application and additional research in a aviation setting.
CHAPTER II

LITERATURE REVIEW

High reliability organizations, such as the aviation industry, are preoccupied with increasing the safety of their operations. A primary contributing factor to achieving this objective is the ability of the organization members to communicatively interact and interrelate their activities mindfully (Weick & Roberts, 1993; Weick, 2001; Weick & Sutcliffe, 2001). In crisis situations, when physiological and psychological impacts threaten to devour precious cognitive resources, maintaining mindful interaction is vital to making decisions that result in successful crisis resolution (Weick, 1995).

In this chapter, I first situate communication within a social constructionist framework. Next, I examine the construct of mindfulness at the intrapersonal and interpersonal levels, exploring strengths, weaknesses and gaps in the extant research. Further, I examine the Black Hawk shootdown case study to illustrate how communication is enacted mindlessly in a dual-piloted scenario. Finally, I explore the construct of mindfulness in terms of mindful conditions, facilitators and inhibitors. Ultimately, I provide the reader with a definitional consideration of “shared mindfulness” which places communication as a central process in the construction of mindful behavior.
Theoretical Perspective and Strategic Communication

The proposed study is grounded in a social constructionist perspective—an interpretive view of organizing as arising from moment-by-moment interactions as members talk in meetings, jointly coordinate tasks or tell stories—in effect—co-constructing meaning (Brown & McMillan, 1991; Kunda, 1992; Boden, 1994; Weick, 1995, Mumby, 2001). Weick & Roberts (1993) identify narrative skills as particularly salient to the process of interrelating and the development of a group's collective mind because they coordinate such elements as know-how, tacit knowledge, multiple causation, consequences and sequence into a "memorable plot" (p. 368). Hence, communication is constitutive, as members collectively construct a shared reality (Mumby, 2001).

Within this theoretical framework, a number of communication scholars suggest that all communication is either strategic or automatic in nature. According to Kellermann (1992) "strategic communication is explicitly chosen; automatic communication is implicitly activated" (p. 288). As such, strategic communication behaviors are deliberate, contemplative, controlled and purposeful. Whereas, automatic communication behaviors are more rote, unconscious, limited in option alternatives and less responsive (Kahn, 1990; Burgoon & Langer, 1993; Weick & Sutcliffe, 2001). Thus, communication strategically processed is more likely to be goal-focused, meaning-centered, contextually responsive and connective, in essence—communication conducive to mindfulness. Although communication automatically processed is likely to be scripted, procedural and content responsive, Langer (1989b)
contends that a mindful state can be operative even though rote communication subroutines are 'run through' automatically. For instance, such as in an aviation context, pilot acknowledgements of routine, repetitive altitude instructions from air traffic controllers. Therefore, the crucial element that determines a mindful state over a mindless state is whether one is engaged in "active and fluid information processing" that is context sensitive, open to diverse perspectives and able to draw novel distinctions" (Burgoon, Berger & Waldron, 2000, p. 106).

Burgoon et al. (2000) identified three possible communicative relationships between mindfulness/mindlessness and social interaction. First, verbal and nonverbal communication patterns may reveal the mindfulness/mindlessness of message senders and receivers at any given time via the absence or presence of "flexible, conditional, cognitively complex and creative thought processes on the part of the message producer or recipient" (p.107). For example, analysis of the cockpit recordings of the Tenerife air disaster of a Pan Am 747 and a KLM 747 which resulted in 583 deaths, revealed a lack of mindfulness in the verbal communication of the KLM pilot. Rather than hold at the end of the runway as he had been instructed, the KLM pilot started moving and reported, "we are now at take off." Both the traffic controllers and the Pan Am crew were uncertain as to the meaning of this ambiguous phrase. However, to clarify their own position, the Pan Am crew reported, "we are still taxiing down the runway." The impact took place less than 15 seconds later (Weick, 1990, p. 572). The KLM pilot's verbal communication demonstrated the absence of clear,
precise, standard and unambiguous language with which a more mindful message 
would have been encoded and an unfortunate accident averted.

Second, Burgoon et al. (2000) argue that communication itself may be the 
object of cognitive processes in both message creation (encoding) and message 
interpretation (decoding). This is demonstrated in an aviation context through the 
habituated, repetitious nature of most aviation communication. Cushing (1994) cites 
illustrative examples of incidents in which repetitious, habituated communication 
resulted in pilot errors. For example, in one incident an instructor pilot and his student 
when instructed by the controller to descend and maintain 12,000 feet, descended to 
10,000. Later, the instructor pilot explained the error by acknowledging that the 
controller may have said 12,000 but he was programmed by many previous fights for 
10,000 because 99 percent of all clearances in that area are to descend and maintain 
10,000. After numerous experiences of the same repetitive message the instructor 
mindlessly processed the communication and responded accordingly.

Third, communication may prompt mindful or mindless states (Burgoon et al., 
2000). Elements of a social interaction may intentionally or unintentionally modify the 
level of mindful processing of information. For instance, when a pilot communicates 
"we have an emergency" to ground control, the communication immediately prompts 
a mindful state on the part of the air traffic controller who must mindfully process the 
situation in order to respond to the emergency appropriately.
Mindfulness Research

Historically, research on mindfulness has focused in three areas: health, education and business, (Langer & Moldoveanu, 2000). The concepts of mindfulness and mindlessness were introduced to social psychology over 20 years ago and have been applied to such diverse areas as education research, psychopathology, political theory, and communication processes. Principal scholars in the mindfulness research literature include: Harvard professor of Psychology, Ellen J. Langer, Yale professor of Psychology, Robert J. Sternberg, University of Michigan professor of Organizational Behavior, Karl E. Weick, and Judee Burgoon, professor of Communication at the University of Arizona.

Mindfulness Research in Business and Communication

Within the business and communication sectors, mindfulness has been studied in such contexts as its impact sensemaking (e.g., Weick, 1990, 1993, 1995; Weick & Meader, 1993; Weick & Roberts, 1993; Weick & Sutcliffe, 2001); and newcomer information seeking behaviors (e.g., Louis, 1980; Miller, 1996; Casey, Miller, & Johnson, 1997). Additionally, Burgoon, Berger & Waldron (2000) studied the implications of mindfulness in relation to several social issues such as reducing stereotyping and cross-cultural misunderstanding. Timmerman (2002) investigated the moderating effects of mindlessness/mindfulness on media richness and social influence. King & Sawyer (1998) examined mindfulness/mindlessness in message production during interpersonal encounters. This line of communication scholarship suggests that communication is germane to the construction of a mindful/mindless state. For
example, Timmerman found in a mindless condition, only 16% of media use could be attributed to social influence constructs. Whereas, "... in the mindful condition, 35% of media use instances were predicted accurately by focusing upon whether or not direct statements about media use were present (Timmerman, 2002, p.121).

**Strengths and Weaknesses of Mindfulness Research**

A strength of the mindfulness body of research lies in its broad application to a number of areas and disciplines (i.e., communication, psychology, education, health, mass media, computer technology, business, political science). However, this breadth of application has generated multiple, and often conflicting perspectives regarding the definition and meaning of mindfulness. For example, the aviation literature depicts mindfulness in terms of situational awareness. Although a standard definition of situational awareness does not exist, it is frequently characterized as the perception of the elements in an environment contextually bound by time and space, the comprehension of their meaning, and the short-term projection of their future status (Durso, et al., 1998). In other words, it suggests a dynamic mental picture of shifting variable elements and their outcomes. Weick and Sutcliffe (2001) posit that individuals with a well-developed situational awareness continually make adjustments that preclude errors from accumulating and enlarging. They notice discrepancies while they are still traceable and can be isolated.

Despite a growing body of evidence, the belief that human interaction is, under certain circumstances, mindless, appears not to have sufficiently emerged in interpersonal communication education and practice to initiate a paradigm shift to
Langer's (1989a) theoretical perspective. Illustrative is that textbooks still use terms such as choosing and selecting but neglect to discuss the multitude of ways in which individuals engage in automatic, mindless message production (King & Sawyer, 1998).

Conversely, Langer's work has spawned scholarly critique. Her early work was criticized because of her position on the extent to which individuals act without a sense of awareness, yet she believes individuals should master their propensity toward automated behavioral responses through increased awareness and by avoiding "premature cognitive commitments and mindsets" (King & Sawyer, 1998, p. 2). Subsequent attempts to replicate the original Langer, Blank & Chanowitz (1978) study on behaviors performed mindlessly generated distinctly different findings (Folkes, 1985; Benassi, Mahler & Asdigian, 1993). Benoit and Benoit (1986) criticized Langer's research on the basis of both methodology and ecological validity but acknowledge her observation that most human behavior is basically mindless.

Moreover, divergent views exist as to whether mindfulness should be considered a cognitive ability, cognitive style or personality trait. However, Sternberg's (2000) review of the research suggests mindfulness/mindlessness is likely more akin to cognitive styles than to cognitive abilities or personality traits. At present, mindfulness is at the crossroads between cognition and personality and remains to be theoretically integrated into the broader theories of cognition and personality.

Mindfulness Gap

The phenomenon of mindfulness has implications for our current view of the mind and how we represent its connection to the brain. A preponderance of
researchers in this area have attempted to explain mental processes (e.g., Churchland, 1987; Boden, 1990) by using models of the mind that can be reduced to computational or algorithmic processes using elaborate computer science representations. Langer and Moldoveanu (2000) contend that these "metaphorical devices" cannot be disputed empirically as they have never been subjected to explicit empirical investigation. Inquiry based on the "mind-as-computer" metaphor reveals only whether our problem-solving processes diverge from the so-called metaphor. Therefore, the mind-as-computer model does not address the potential day-to-day processes that individuals use to solve common problems, as the expectation is that they are solved by algorithmic means. The authors purport this gap can be addressed in part by researching the nonalgorithmic dimensions of cognition through the phenomena of mindful engagement. Hence, they project that because of continued work standardization and routinization, even seemingly mindful roles such as that of the airline pilot or surgeon may become susceptible to moments or situations when they are not psychologically present.

Does this gap propose potential catastrophic implications to members of high reliability organizations? Consider the following statement by John M. Shalikashvili, Chairman of the Joint Chiefs of Staff in a July 7, 1994 cover Memorandum to the Secretary of Defense on the accidental shootdown of U.S. Black Hawks over Northern Iraq (Snook, 2000), one of the most high-profile accidents in recent military aviation history:
For over 1,000 days, the pilots and crews assigned to Operation Provide Comfort flew mission after mission, totaling over 50,000 hours of flight operations, without a single major accident. Then, in one terrible moment on the 14th of April, a series of avoidable errors led to the tragic deaths of 26 men and women of the American Armed Forces, United States Foreign Service and the Armed Forces of our coalition allies (p. 3).

The tragic Black Hawk shoot down occurred despite the most advanced technology and procedures, it was essentially the result of human error — moments of mindlessness. In the next section of this chapter, the Black Hawk incident is reviewed in more detail in order to explicate the effect of mindlessness in crisis situations in aviation.

Black Hawk Shootdown – A Case Study of Moments of Mindlessness

Scott Snook (2000), renders an account, from the two F-15 fighter pilots' perspective, of the fatal shootdown of the two U. S. Army Black Hawk helicopters carrying VIP's of the United Nations coalition to scheduled meetings with UN and Kurdish representatives in Northern Iraq. Snook takes a constructionist viewpoint and treats the shootdown as a "flow of experience to be interpreted rather than a decision to be analyzed" (p. 75). In the following, Snook looks at how the pilots personally and collectively constructed their reality.

Based on the Executive Summary of the Aircraft Accident Investigation Report, the causes of the shootdown are identified (p.68): (a) The F-15 pilots misidentified the Black Hawks; (b) The AWACS (Airborne Warning and Control System) failed to intervene; (c) Eagle Flight (Black Hawks) and their operations were
not integrated into the Task Force; and (d) The Identification Friend or Foe (IFF) systems failed.

Both pilots entered the tactical briefing on the morning of April 14, 1994 under the auspices of flying a combat mission in unfriendly skies. Collectively they walked through each stage of their upcoming flight to mentally run through each step of the mission. Their objective was to build a shared framework of expectations and beliefs about the predicted events of the morning.

Within this briefing there was no mention of the Black Hawks and their flight (Tiger) was listed as the very first mission. Their task was to enter the area (Northern Iraq) and, in military jargon, "sweep and sanitize" the area; therefore, the pilots did not expect to see any friendly aircraft (p.82). However, tactical change conditions emerge swiftly and the possibility of a last-minute mission due to a policy exception permitted an aircraft to enter the area prior to the fighter sweep which was not included in the briefing.

The last update sheet the pilots received before boarding their planes also made no mention of friendly aircraft in the area. In flight, the pilots contacted AWACS for a "picture call" which is a description of any aircraft in the area. Although AWACS was by this time aware of the friendly Black Hawks flying inside Northern Iraq, they provided no "picture" call to the pilots.

As the pilots cross the international border they immediately pick up radar indications of an aircraft presence in the area. The lead pilot engages the IFF system with no response. The aircraft, if friendly should be "squawking" Mode 1, code 52.
The pilot checks the other friendly mode which gives a brief one-second friendly response and disappears. Strange. He chalks it up to a momentary false reading which has happened in the past. He tries a second time. Another brief positive with a subsequent four or five seconds of negative. The lead pilot calls AWACS to confirm whether they have a contact—negative. He surmises that possibly the mountainous region has blocked their line-of-sight radar. He calls the wingman to check if it could possibly be road traffic and tries IFF—again negative.

A second time the lead pilot calls AWACS and reports the target's altitude, location and heading. The second pilot responds that he doesn't think it's road traffic while AWACS responds—"Hits there" rather than "Paint there" suggesting an unidentified contact not a friendly IFF response.

At this juncture, the lead pilot descends rapidly through 10,000 feet and is low to the ground which he is unfamiliar with doing. He identifies the aircraft from above, again an angle from which he has not been trained and identifies the aircraft as Soviet Hinds. He is sure, with no doubt that the aircraft are Hinds. He is mistaken. By this stage, the adrenaline is flowing and he has to pull up hard to avoid crashing into the mountains. The lead pilot requests confirmation from the second pilot, his wingman, who responds "Tally too." His response was an ambiguous nonstandard radio call. Unfortunately, each pilot interpreted "Tally two" differently. The lead pilot interpreted this statement as affirmation of his Hind identification; while the second pilot remembers it as just identifying two aircraft not as hostile nor as friendly, simply the number he saw.
Interestingly, the lead pilot is actually the junior member, the second pilot being the squadron commander. Although he technically outranks him, in this particular lead-wing scenario what the lead pilot says goes. This dyadic relationship stimulated a frightening degree of mindlessness and conformity. Langer (1989b) characterizes this mindless state as:

A state of reduced attention. It is expressed in behavior that is rigid and rule-governed rather than rule-guided. The individual becomes mindlessly trapped by categories that were previously created when in a mindful mode . . . We don't take in an awareness that things could be otherwise . . . mindlessness may be severely limiting (pp. 137-139).

Mindlessness traps the second pilot in the role of wingman; his communication responses are subsequently subjugated to a submissive acquiescence to the lead pilot's categorization of reality rather than actively processing all the incoming data that held an alternative option. Therefore, rather than question the lead pilot's assessment he conforms to it albeit using ambiguous terms.

The pilots' reality was socially constructed from within a mindset of a perceived hostile environment—a combat zone. From their initial pre-flight briefing and update sheets to their interaction with AWACS, the IFF system and with each other. In this pre-conditioned combat state, when the lead pilot identified the two helicopters as hostile the wingman expected them to be hostile, and subsequently made sense of the collection of ambiguous stimuli by creating the same sense of reality as the lead pilot. In this heightened and volatile arousal state, they exhibited their overlearned, overtrained, dominant response which was encoded as air-to-air combat; therefore, they engaged—"... quickly, mindlessly, professionally, and successfully—just the
way they were taught" (Snook, 2000, p.94). Thus, had mindful responses prevailed, this tragic accident could have been prevented, 26 lives would not have perished in a horrific fireball.

Communication Analysis of the Black Hawk Incident

Scripted, routinized communication behaviors dominate the tragic Black Hawk scenario. As a consequence, much of the communication behavior displayed by the pilots is automatic rather than strategic in nature. What is missing in such instances is the use of precise, descriptive and unambiguous terms. Further, the Black Hawk scenario illustrates that the interactions among the participants failed to demonstrate active processing and integration of new, incoming information.

Although scripted, routinized communication behaviors facilitate the transfer of information in an interaction they are ineffectual, particularly in crisis contexts, of inculcating shared meaning and shared mindfulness. They reflect mindless communicative behaviors because they are enacted with conscious attention to very few cues of those present in the environment. They are constrained by overlearned, single-category responses drawn from the past that represent a fraction of the total repertoire of communicative responses available within a contextual moment (Nass & Moon, 2000).

I propose that strategic communication behaviors are those that facilitate the use of precise, contextual language and promote interactions of active information processing in which participants co-construct reality based on shared meaning as a result of shared mindfulness. Thus, if in the fateful interaction before the shootout of
the Black Hawks, the wingman had responded to the lead pilot with precise language (not, "tally two") the lead pilot would have been alerted to the discrepant information present in the environment. Unfortunately, instead of actively processing the incoming information, the wingman relied on past categorizations which did not fit the current situation. Therefore, he responded ambiguously rather than stating precisely what his mind was perceiving at that moment. In those precious seconds before the haunting decision to shoot, the pilots might have co-constructed reality quite differently. The alternative information that suggested the Black Hawks were friendly and \textit{not} hostile was out there but was not confirmed because the lead pilot and wingman's scripted, routinized communication behaviors did not facilitate the creation of shared mindfulness; thus they co-constructed meaning mindlessly based on past, inaccurate information.

Langer & Piper (1987) describe mindlessness as characterized by a "rigid use of information during which the individual is not aware of its potentially novel aspects" (p. 280). Had the interaction contained elements of shared mindfulness, the pilots would have engaged in a process of creating new categories making finer and more precise distinctions in describing what they saw. Instead, they miscoded the situation and engaged in their highly skilled and trained combat behavior prematurely judging the targets as enemy. Forever lost is the moment of shared mindfulness that could have saved the Black Hawks. Sadly, it's been replaced by years of regret over executing an overlearned series of actions to shoot them down.
As the Black Hawk case study pointedly demonstrates, lethal consequences may ensue if communication behaviors in pilot interactions are enacted mindlessly. In the following section, I will review the intrapersonal and interpersonal dimensions of the construct of mindfulness including the facilitators and inhibitors of mindfulness.

Tapping into Mindfulness

Definitional Issues

Mindlessness entails minimal processing of information, as such, adjusting to new information and "behaving or thinking in a novel way" is excluded (Timmerman, 2002, p. 113). Mindlessness is a state in which one does not attend to pertinent or discrepant pieces of information in the environment, which results in more automatic or habituated responses with minimum attention to behavior. Therefore, new information is not processed; rather, previous scripts learned when "similar information was once new, are stereotypically reenacted" (Langer et al., 1978, p. 636).

In contrast, Sternberg (2000) articulates mindfulness according to Langer's (1997) definition as combining elements of (a) openness to novelty; (b) drawing distinctions; (c) awareness of different contexts; (d) sensitivity to multiple perspectives; and (e) situated in the present. In other words, mindfulness is a state in which individuals engage in active information processing while performing their current tasks. Individuals actively analyze, categorize and contemplate how and why distinctions may be present (Timmerman, 2002); consequently, they "derive behavioral strategies based on current incoming information" (Langer, Blank & Channowitz, 1978, p. 635).
Conditions of Mindfulness

Burgoon, Berger and Waldron (2000), based on a cadre of previous research (e.g., Langer, Blank & Chanowitz, 1978; Langer & Piper, 1987; Langer, 1989b; Motley, 1992; Burgoon & Langer, 1995), outline a diversity of conditions that may initiate thoughtful processing: (a) novel situations in which either there is no script or scripted behavior must become more effortful; (b) novel communication formats such as human-computer interaction; (c) interruptions caused by outside factors that disrupt script completion; (d) discrepant or suspicion-arousing cues such as interacting with a reportedly untrustworthy source, implausible message content or anticipating erroneous information; (e) conflict, inconsistency or confusion emerging among two or more message goals and/or how they are achieved; (f) experiencing a positive or negative consequence that is sufficiently distinctive from prior consequences (e.g., failure to fulfill a plan). Communication is integral to several of these conditions, particularly communication formats, message content, and source interactions.

Thus, situations typified by ambiguity and/or uncertainty will likely stimulate mindfulness such as encountering an unfamiliar setting or routine, failure to achieve goals, thwarting of a planned course of action, or anticipating detrimental effects to one's proposed actions. In these instances, interactants should become more mindful of their own and others behavior (Burgoon et al., 2000).

The conclusion is that mindfulness keeps us situated in the present, open to and actively processing information particularly in novel situations while vigilantly responding to differences and discrepancies in both the information and the
surrounding environment. Consequently, interactants are fluidly adjusting their communicative behaviors according to current environmental and informational conditions. Hence, in a mindful state, individuals are "more sensitive to the ambiguous and conditional nature of the world—that knowledge and understanding are always in flux" (Richhart & Perkins, 2000). Drawing on enhanced attentional proclivities individuals can 'fill in the gaps' and make sense of the world.

This literature suggests that communication is central to mindfulness. Ultimately, I argue that the dyadic interaction provides the setting in which the communicative behaviors of mindfulness evolve into shared mindfulness.

However useful, past work in mindful research does not acknowledge the joint construction of a mindful state through the process of human interaction. To view mindfulness as it occurs within an interpersonal interaction, the elements of mindfulness as they relate to an involved state must be definitionally articulated. If mindfulness represents the active information processing on the individual intrapersonal level, shared mindfulness represents this activity on the interpersonal interaction level. Therefore, I propose the following definition:

Shared mindfulness is a state of mindfulness achieved conjointly whereby, in their communicative interactions, the individuals involved are in an active state of attending, responding and perceiving information correctly. As a result, they are continually updating, attuned and open to incoming data that is unexpected, disconfirming, improbable, implicit and/or contested.
Mindfulness Inhibitors

Mindfulness is stifled by three factors: (a) overlearned behavior; (b) premature cognitive commitment; and (c) over-dependence on existing categories (Langer, 1989a).

Overlearned (Scripted Communication) Behavior

Langer (1997) posits that one of the most salient inhibitors to mindfulness is related to an automatic communication behavior through scripting — overlearning basic skills. Thus, she questions whether we limit ourselves by practicing to the level of overlearning. Or, do we "freeze our understanding" of a new skill without first trying it out in multiple contexts or adjusting it at different stages to our own strengths and experiences (p. 13). For example, Parker-Haney's (cited in Prinzo & Morrow, 2000) study on the use of grouped formats in Air Traffic Control (ATC) messages, found that highly practiced airline pilots derived little to no benefits in using grouped formats because the pilots tended to translate grouped formats into the more familiar sequential pattern. As a consequence of years of practicing the same numerical patterning without variance, they were unable to adjust their overlearned behaviors.

In high reliability organizations overlearned scripts and procedures are likely to cause people to lose sight of the individual components (steps) that make up the skill as they combine into bigger and bigger units. Consequently, they may find it difficult to make small adjustments because the individual components are basically lost. However, it is by "varying and adjusting these pieces that we can improve our performance" (Langer, 1997, p. 18).
Hence, overlearning the basics may cause us to slip into ingrained habits (Langer, 1997) or what Weick (1993; 1995) calls overlearned responses in a crisis rather than what the present situation demands. Further, Langer suggests that "learning the basics in a rote, unthinking manner almost ensures mediocrity" (p. 14). HRO's eschew mediocrity, yet they remain committed to overlearned scripts and procedures which in a crisis can prove woefully insufficient and potentially catastrophic. Weick (1993) noted in the case of the Mann Gulch fire disaster that smokejumpers couldn't rely on their specialized firefighting knowledge to save them from the deadly fire. Only those smokejumpers who were adept at viewing the situation as novel and responding in new and creative ways to the crisis survived.

**Premature Cognitive Commitment**

Undervaluing doubt is another means by which individuals inhibit mindfulness which, in turn, impacts their sensemaking capabilities. To doubt is to see the discrepancy between the current or obvious view and the potential alternative explications. Weick (1995) argues that what is critical to sensemaking about expectations is that expectancy is related to conformity and discrepancy. Therefore, if all is in conformity, we adjust and may stop noticing. Thus expected events are processed swiftly and sometimes inaccurately or solely on what is considered the appropriate interpretation or action. Conversely, if an individual will mindfully view a situation (demonstrating the attributes of mindfulness) they are more apt to notice discrepancy — i.e., divergence from the norm, inconsistent data or alternative possibilities for action. Moreover, in a premature cognitive commitment condition,
individuals operate without a category system such that all information folds into a single category from which classifications are made (Timmerman, 2002). Timmerman purports the consequence is that in encountering an initial set of circumstances without actively attempting to interpret details, one may perceive a single solution and mindlessly follow that option.

**Over-dependence on Existing Categories**

Individuals rely on existing categories when they inflexibly categorize observations placing them within a predetermined set of interpretations; consequently, when existing categories are consistently overapplied, the outcome is that the same interpretations are used without considering variabilities in the current context (Timmerman, 2002). For example, upon receiving a routine report, if the recipient has previously identified the content of no value, future reports will probably be similarly categorized and potentially left unread.

Weick and Sutcliffe (2001) contend that when individuals are operating mindfully, they update their understanding of an unfolding situation by fundamentally *reworking* the ways they label and categorize what they see. To do this, the authors maintain they do three things. First, they look at how much information is discarded when a specific event is viewed as "an instance of a class of events with similar characteristics" (p.45). The upshot is that while categories provide a sense of control and predictability about what will happen so that individuals can plan their actions without treating every situation as unique, categorization simultaneously edits everything the individuals involved see. Consequently, what is new and novel about
the environment, the situation, the people involved may go unnoticed, as people are fixated on the rigid dimensions of the category.

Second, Weick and Sutcliffe argue that individuals monitor how categories influence expectations. Expectations and categories are intimately associated such that each helps define the other. For example, "... if I label someone an expert, I expect that this person will have the answers and require less monitoring and be a good person to copy when I'm trying to figure out how to act" (Weick & Sutcliffe, 2001, p. 45). Thus, these expectations may materialize or they may not. When individuals rework expectations in this manner, they are trying to determine whether and how expectations help them manage the unexpected. Ultimately upon reflection, they "may differentiate those expectations, replace them, supplement them, consolidate them or discard the whole category" (p. 45). Finally, individuals check whether their categories are still plausible or have become outdated, and thus, should be discarded or improved (Weick & Sutcliffe 2001). The continued reliance on improbable or invalid distinctions practically ensures trouble because individuals actually know less about what is happening than they think they do.

**Mindfulness Facilitators**

It follows that fostering mindful learning will enhance sensemaking rather than constrain it. Mindfulness is essential to effective sensemaking (Weick, 1993; 1995; Weick & Sutcliffe, 2001) and the desired outcome of heedful action (Weick & Roberts, 1993; Roberts & Bea, 2001). Weick (1995) describes the process of sensemaking as placing what one has noticed (i.e., cue, stimuli) which tend to be
present moments of experience into a framework, which are usually past moments of socialization. This process of framing by connecting past to present enables individuals to comprehend, understand, explain, attribute, extrapolate or predict what was heretofore purely subjective and without any tangible form. To engage in sensemaking is to construct a relation between these two moments that creates meaning.

Langer (1997) suggests that to learn mindfully is to value the contingent "context-dependent nature of our world" and the benefits of uncertainty (p.15). It should be noted that although Langer approaches mindfulness from a psychological perspective, the facilitators she highlights are essentially communicative in nature. For example, she argues that mindful learning can be facilitated through conditional teaching (efforts to prevent premature cognitive commitment) such as giving students mindful instructions that allowed for alternative or additional methods for solving problems including questions that required students to extrapolate beyond the information provided and to use it innovatively. Another method involved presenting students figures (i.e., study results) with the main variables reversed and required students to explain the so-called facts. These techniques present terms and objects as tentative rather than absolute which leads to improved problem solving and better retention of material (Demick, 2000).

In their experimental study of conditional instruction in mathematics, Richhart and Perkins (2000) coupled the concept of mindfulness with disposition. They provide prescriptions to enhance mindfulness as a trait over passive and superficial learning in students through three instructional venues: (a) looking closely; (b) exploring
possibilities and perspectives; and (3) introducing ambiguity. Again, these are communicative behaviors. Consequently, the body of research clearly supports that communication plays a significant role in both the state and trait of mindfulness.

Summary

As HRO's continue to relentlessly focus on maintaining nearly error-free operations through proactively managing the unexpected, Weick and Sutcliffe (2001) argue that their success can be largely attributed to their efforts to act mindfully. By this they mean that on an organizational level, they are organized such that they have an increased capability to notice the unexpected while it is unfolding and halt its development. Operationalizing this capability depends on the type and quality of interactions within the organization (Weick & Roberts, 1993). The literature reviewed in this chapter shows the complexity and broad application of the mindfulness construct; it's strengths, weaknesses and the gaps in the current research. Further, it demonstrates how mindfulness is communicatively enacted as well as the facilitators and inhibitors of mindfulness.

The extant research provides a theoretical framework in which to explore the communication behaviors of shared mindfulness in crisis situations and understand connections between shared mindfulness and decision outcomes. In the next chapter, I describe this study's design and discuss the methods and procedures used to examine shared mindfulness within an aviation context.
CHAPTER III

METHODOLOGY

This exploratory study examines construct of shared mindfulness as it is enacted through communicative behaviors at the interpersonal level in crisis situations. The study objective is to identify shared mindfulness in these situations and describe how it is communicatively constructed. My proposition is that shared mindfulness will be demonstrated when individuals in a dyadic interaction, depending on the level of their cognitive and physical involvement, engage in particular communicative behaviors. Further, I propose that in an aviation context, shared mindfulness will lead to more effective pilot decisions in crisis situations, and thus potentially reduce human error in aviation mishaps. Accordingly, my objective is to: (a) identify and describe the communication behaviors of shared mindfulness; (b) develop a typology of the communicative behaviors of shared mindfulness; and (c) investigate whether those behaviors yield more effective pilot decision outcomes in crisis situations. This chapter provides a detailed consideration of an experimental study that explore these premises and stated goals. First, the participant population and setting are described; second, methods of data collection and qualitative analysis are presented. Lastly, limitations of the methodology are explored.

To address the stated research goals, participants responded to crisis scenarios in which the participant interaction was videotaped to capture both verbal and nonverbal interaction aspects. Second, the videotaped interactions were qualitatively
analyzed to identify the communicative behaviors of shared mindfulness and participant decision outcomes were rated for effectiveness.

Setting and Participants

The research was conducted at the Western Michigan University (WMU) Aviation Center located at W. K. Kellogg Airport in Battle Creek, Michigan. The center is among the top-ranked training centers in the United States with more than 900 students enrolled in its aviation programs. The facilities include three main buildings including the Aviation Education Center with classrooms and a computer laboratory. This setting was chosen because the aviation school primarily trains pilots and mechanics to become members of high reliability organizations (HRO's). According to aviation school officials, a majority of the student body will choose careers within the aviation industry as pilots for one of the major commercial airlines such as American or United.

Study participants were comprised of a voluntary sample of 20 students (10 dyads) of the school's currently enrolled male and female senior-year aviation student population in the Aviation Flight Science program Line Oriented Flight Training (LOFT) classes. This selection criterion was based on faculty and instructor assessments that senior year students possess a richer repertoire of behaviors and more flight experience (R. Rantz personal communication, January 19, 2003). Hence, they have sufficient knowledge and expertise to capably perform the assigned roles of captain and first officer in the critical incident scenarios. In particular, the LOFT classes were chosen because these classes are focused on Crew Resource Management
(CRM), which centers on crew interaction and communication. Participants were senior level students in the aviation program. Of the 20 student participants, eighteen were male and two were female with one student of international origin.

Crisis Scenario

The crisis scenario is a widely used instrument to evaluate specific effective and ineffective behaviors of air pilots in flight training schools, and historically had its inception in the field as an outgrowth of the critical incident technique (Dewine, 1994). From this perspective, the crisis scenario is used to elicit concrete examples of effective and ineffective behavior in any context. According to Hargie and Tourish (2000), the manner in which "out of the ordinary" events are experienced are central to judgment information and reflect attitudes that later influence "how future encounters are seen, categorized and responded to...[while offering]... practical insight into key areas of both good and dysfunctional performance" (p. 131). This method was first used to investigate the particular competencies of air pilots during World War II.

For the objective of this specific study, the crisis scenario was chosen because of its practicality and utility to simulate a novel situation. Specifically, the scenario presents a dilemma that requires participants to utilize interaction and communication behaviors to seek an appropriate solution within a compressed timeframe. Thus, the crisis scenario provides a set of environmental conditions designed to elicit either effective or ineffective participant interaction and communicative behaviors in a crisis setting.
This study used two crisis scenarios developed by a Western Michigan University aviation instructor based on a typical senior-year aviation student's knowledge level and flight experience. The content of each scenario is based on an actual incident reported in the NASA Aviation Safety Reporting System (ASRS) anonymous incident reporting database. These particular scenarios have never been used in the WMU Aviation School prior to the current study. The first scenario depicts a flight situation in which an on-time departure is crucial despite adverse weather conditions (see Appendix A). The second scenario involves an in-flight engine failure with an inexperienced First Officer onboard (see Appendix B). The objective of these scenarios is to thrust the interactants into a novel situation, which cannot be resolved via "checklist" procedures. In other words, the dilemma requires action outside of the scope of standard, routine procedures, yet is still within the parameters of the knowledge and skill level of a senior-year student pilot.

Procedures

In cooperation with the Western Michigan University Aviation School, the research was conducted in an Education Center classroom. The 9:00 a.m. Thursday, 12-student LOFT class and the 3:30 p.m. Wednesday, 25-student LOFT class were selected for participation by the Acting Department Chair, Bill Rantz based on the aforementioned criteria.

The week prior to data collection, I attended both class sessions to announce the study and invite students to participate. At this session, I provided the students with an informed consent form to review in order provide sufficient time to consider
participation before the scheduled class the following week. Ultimately, I enlisted 20
students' participation in order to achieve 10 dyads. Students that agreed to participate
signed the informed consent form prior to data collection.

The crisis scenario interactions were conducted in a separate classroom set up
with myself as a crisis scenario administrator, videocamera and a videographer to
record each dyadic interaction. The administrator randomly assigned students into
pairs. Fourteen students (7 dyads) participated from the Wednesday LOFT class and
six students (3 dyads) participated from the Thursday LOFT session. Volunteers left
the LOFT classroom one dyad at a time, participated in the dyadic interactions in the
crisis scenario classroom, and returned to the LOFT classroom. This procedure
continued in both the Wednesday and Thursday sessions until all 10 dyads had
completed the crisis scenario interactions.

Student dyads participated in two cases involving crisis situations. Each dyad
was given one minute and forty-five seconds to read the critical incident crisis
scenario; the scenario administrator randomly assigned the role of Captain and First
Officer to participants. The role assignment was followed by a two-minute videotaped
interaction to generate a decision response to the crisis; decision effectiveness was
evaluated based on instructor developed effectiveness criteria (see Appendices A and
B). A two-minute timeframe was selected based on the premise that it provides
sufficient time to initiate interaction and discussion while retaining a sense of
immediacy and the urgency to act (personal communication, Gil Sinclair, January 16,
2003). Thus, to simulate these physiological and psychological aspects of a crisis
environment, the timeframe has been significantly compressed to induce elements of stress such that the interactants feel pressured to make decisions and act quickly with little information. A two-minute timer was visible in the background as the dyads interacted. The scenarios introduced elements that may provoke relationship conflict which could induce additional emotional and cognitive stress. For example, in Scenario 1 an ontime departure is crucial for the crew's customer, consequently, conflict could arise if one crewmember views the customer's needs as primary and the other crewmember views those needs as jeopardizing flight safety.

This process was repeated for the second scenario. The scenario administrator assigned each participant the opposite role played in scenario one. The rationale for role-switching is to determine whether participants demonstrate more or less mindfulness in playing one role over the other. All dyad interactions were videotaped and transcribed by the researcher. Transcribing the tapes yielded 37 pages of single-spaced data, which was qualitatively analyzed for major themes.

Pilot Study

Prior to conducting the study, a pilot study using the aforementioned procedures was conducted at the WMU Aviation Education Center with one voluntary dyad. Pilot study participants were senior-year aviation students enrolled in the Jet Orientation Course. The students were randomly selected. They happened to be available the day the chief flight instructor, James Barrowman, had a timeslot available to conduct the pilot. The dyad had comparable, knowledge skills, and behaviors as the target study participants. The purpose of this pilot study was to test the research
design procedures and refine the scenarios. As a result of the pilot study feedback, three changes were made to the study procedures. First, the time to read each scenario was shortened from two minutes to one minute and forty-five seconds. The pilot dyad suggested this change because they believed it would allow sufficient time for the dyads to read the scenario but would prevent them from starting to think through what they would do before discussing it with their partner.

Second, the pilot study dyad suggested adding some distractions such as interrupting the crew as they were deliberating to more closely simulate the actual environment. For instance, other flight crew members such as a flight attendant could interrupt aircrews in a crisis situation. Additionally, they suggested adding other distractions such as noises and background talking. Lastly, they suggested color-coding the scenarios and instructions to facilitate efficiency and to avoid any confusion. All three suggestions were implemented into the research study procedures.

Qualitative Analyses

This study used guidelines outlined by Glaser and Strauss' (1967) to analyze the communication behaviors in the 20 videotaped interactions. Analysis of the data followed a grounded theory approach which is a general methodology for building theory (Strauss & Corbin, 1990). The main feature of this approach involves a "method of constant comparative analysis" (Glaser & Strauss, 1967, p. vii). Therefore, it is frequently known as the constant comparative method. In this study, I compared my observations of participant interactions against each other and the initial, étic framework of characteristics of the shared mindfulness. Subsequently, I constantly
returned to the data to determine any themes/or unifying properties. Finally, data were
categorized into a typology of shared mindfulness communication behaviors.
Additionally, I analyzed the interaction decision outcomes for effectiveness per the
decision effectiveness criteria and explored any linkages from my observations to
resultant effective decision outcomes. My specific coding procedures are described
below.

Coding

Comparing Incidents Applicable to Each Category

In the first stage of the grounded theory approach, each data-text incident was
coded into as many categories of analysis as is plausible as categories and/or data
emerge in an existing category (Glaser & Strauss, 1967). A new incident was
continually compared with those that have already been assigned to the same category
to determine its goodness of fit. The central properties of each category were
confirmed by going back through the data multiple times. Subsequently, the total
number of categories stabilized as most incidents are accounted for or remain uncoded
because of their lack of relevance (Lindlof & Taylor, 2000). As a result, this process
stimulates "thinking in terms of the full range of types or continua of the category, its
dimensions, the conditions under which it is pronounced or minimized, its major
consequences, its relations to other categories, and its other properties" (Glaser &
Strauss, 1967, p.106). This iterative process results in the development of a judgment
informed by theory.
Two types of coding were utilized in this stage—open coding also known as étic a deductive approach, and in vivo coding referred to as emic, an inductive approach (Lindlof & Taylor, 2000). Open coding involves the preliminary, unconstricted coding of data from texts (e.g., documents, transcriptions, prior theory) delineating that which suggests a category. Whereas in vivo coding involves terms used by the interactants themselves (i.e., videotaped interaction). This method of coding is useful because "instances of vivid language not only anchor conceptual categories, they also serve as category names and supply quotes for the research narrative" (Lindlof & Taylor, 2000, p. 220).

Integration

Integrating Categories and Their Properties

In this stage of the coding process, after multiple comparisons of incident with incident, properties were discovered via accumulated knowledge which are defined as explicit decision rules and account for the category's defining properties. This process involves axial coding which is the use of codes that create connections among categories which, in turn, either suggest a new category or a theme that extends across multiple categories. In most instances, axial coding collapses the number of categories identified through open coding and integrates them into broader categories. Hence, integration is the process of changing the character of categories from a collection of incidents into theoretical constructs. Most important, even at higher levels of category abstraction, the categories remain grounded in data. (Lindlof & Taylor, 2000).
Dimensionalization

The dimensionalization process was the final stage in the process of coding, categorization and conceptual development. After a category was defined, the next step is to explore its characteristics along a dimension. Dimensionalization centers on finding the key variations (dimensions) of each construct by constant comparison of the incidents that constitute that category/construct. At this point in the grounded theory process, the category set becomes "theoretically saturated" (Glaser & Strauss, 1967, p.10). Consequently, new incidents offer little added value to the concepts. Later modifications were mainly centered on integrating property details into a major taxonomy of interrelated categories and reduction due to "underlying uniformities in the initial set of categories or their properties" (p.10). The result is theory formulation with a smaller group of higher level concepts.

The coding process generated 24 themes. Through constant comparative analysis of the transcript, the videotapes and the shared mindfulness étic framework, I explored categories and subcategories of communication processes by looking at relationships between the transcript interaction discourse, the context, the étic shared mindfulness framework, the interpersonal interaction verbal and nonverbal behaviors, and my reflections on the data. As a result of this constant comparative analysis process, the 24 themes were reduced to seven process categories of communication behaviors of shared mindfulness as well as subprocess categories for each category.

Subsequently, I created a thematic memo for each process category, explicating category and subprocess category definitions, communication behavior
descriptions, exemplary quotes and reflective comments to support the theme. Throughout this process, I constantly looped back comparing themes with the transcript, videotape and my own reflective comments.

Typology

The end process of coding and memo writing was a typology or taxonomy which provides a comprehensive classification of the shared mindfulness phenomenon. As stated previously, typologies are derived either emically, that is the cultural interactants supply the category types and even the names, or étically, derived from the "analyst's own conceptual resources" ... and "properties and types are reasoned in a deductive manner from prior theory" (p.231). Analyses in the current study utilize elements of both an *emic* and *étic* perspective.

In the following section, the limitations of the study methodology are explicated.

Limitations of Methodology

Because of the exploratory nature of this research, some of the following limitations may be overcome with further research.

The incident scenario design unlike a simulator design, cannot duplicate the environmental stress-inducing factors associated with a crisis, and thus may not truly represent the physiological and psychological elements representative of interactants in crisis situations.

Further, the use of aviation students versus pilots may impact the degree of mindfulness assessed due student participants' lack of previous actual flight experience and exposure to real crisis situations. For example, student pilot participants will not
have the knowledge, full repertoire of behaviors or experience with crisis situations as the general experienced pilot population.

Because the typology of shared mindfulness communication behaviors was developed on the basis of one aviation context-bound study, the findings can not be generalized beyond that specific context.

Finally, explicitly because of this research study's exploratory nature, more research is needed to corroborate the findings in terms of identifying the communication behaviors of shared mindfulness in various aviation and participant settings as well as diverse contexts outside of aviation.

**Summary**

In sum, this chapter describes the methodological framework and procedures used to investigate the construct of shared mindfulness in crisis aviation situations. The goal of the research design and analysis process was to identify the specific, enacted communication behaviors that demonstrate shared mindfulness and explore whether those behaviors lead to more effective pilot decision making. The following chapter presents the results and discussion of this research.
CHAPTER IV

RESULTS AND DISCUSSION

In this chapter, I explore my study findings by addressing my two research questions beginning with the fundamental premise of whether shared mindfulness does exist. Subsequently, I describe the characteristics of shared mindfulness as constructed in a crisis situation; and third, I explore how shared mindfulness relates to decision outcomes. Finally, I discuss the findings in terms of linkages to the current body of mindfulness research, various patterns and connections that emerged from the data as well as what was "missing" or appeared to hinder the construction of shared mindfulness in the dyadic interactions.

Study Findings

Existence of Shared Mindfulness

The findings of the 20 aviation dyadic interactions indicate that shared mindfulness does exist under some conditions. I found that the presence of shared mindfulness was contingent on the enactment of specific communication behaviors. Those specific behaviors are addressed in the findings of my first research question. In the aviation crewmember interactions I observed, primarily three conditions: (a) overt dominance; (b) precognitive commitment; and (c) non-positive reasoning strategies appeared to inhibit the formation of shared mindfulness.
These inhibitive conditions are addressed in the discussion of the individual shared mindfulness communication behaviors.

The Construction of Shared Mindfulness in a Crisis Situation

In this section, I explore the communication categories comprising the construct of shared mindfulness that emerged from the interaction analysis data. The following seven inductively conceptualized categories depict the communication behaviors associated with the construction of shared mindfulness in a dyadic interaction: (a) seeks information; (b) reasons from a positive perspective; (c) perceives multiple perspectives; (d) projects thoughts and feelings; (e) mindfully acknowledges partner communication; (f) uses participative language; and (g) demonstrates fluid turntaking (see Table 1). Table 1 outlines these seven categories and their subprocesses.
Table 1

Shared Mindfulness Communication Process

<table>
<thead>
<tr>
<th>Process Category</th>
<th>Subprocess Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Seeks Information</td>
<td>• Input/opinion</td>
</tr>
<tr>
<td></td>
<td>• Clarification</td>
</tr>
<tr>
<td></td>
<td>• Correction</td>
</tr>
<tr>
<td></td>
<td>• New/discrepant information</td>
</tr>
<tr>
<td></td>
<td>• Disconfirming information</td>
</tr>
<tr>
<td>2. Reasons from a Positive Perspective</td>
<td>• Looks at what is available and feasible</td>
</tr>
<tr>
<td></td>
<td>• Discrepant/disconfirming data</td>
</tr>
<tr>
<td></td>
<td>• Compare and contrast data</td>
</tr>
<tr>
<td>3. Perceives Multiple Perspectives</td>
<td>• Other orientation</td>
</tr>
<tr>
<td></td>
<td>• Openness to environmental stimuli</td>
</tr>
<tr>
<td></td>
<td>• Uses multiple data inputs</td>
</tr>
<tr>
<td></td>
<td>• Perceives options/alternatives</td>
</tr>
<tr>
<td>4. Projects Thoughts and Feelings</td>
<td>• Veralize thoughts</td>
</tr>
<tr>
<td></td>
<td>• Veralize feelings</td>
</tr>
<tr>
<td></td>
<td>• Feeling and visual expression</td>
</tr>
<tr>
<td>5. Mindfully Acknowledges Partner</td>
<td>• Simple acknowledgement</td>
</tr>
<tr>
<td>Communication</td>
<td>• Substantive acknowledgement</td>
</tr>
<tr>
<td>6. Uses Participative Language</td>
<td>• Conditional</td>
</tr>
<tr>
<td></td>
<td>• Inclusive</td>
</tr>
<tr>
<td>7. Demonstrates Fluid Turntaking</td>
<td>• Takes appropriate turn in conversation</td>
</tr>
<tr>
<td></td>
<td>• Clarifies, builds and extrapolates on information</td>
</tr>
</tbody>
</table>

In the ensuing explication, I address each of the communication categories individually; however, they exist interdependently with some overlapping, and at times, are present simultaneously (see Table 2). Table 2 provides the process category definition for each shared mindfulness communication behavior as well as identifies specific communication behaviors.
Table 2
Typology of Shared Mindfulness Communication Behaviors

<table>
<thead>
<tr>
<th>Process Category</th>
<th>Definition</th>
<th>Communication Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Seeks Information</td>
<td>Interactants seek information in the interaction via seeking their partner's input or opinion, clarifying or confirming their partner's communication including correcting erroneous information. Interactants notice new and/or missing information as well as identify information that contests or casts doubt on the available data.</td>
<td>- Seeks input or opinion of partner</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Seeks clarification or confirmation of information from partner</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Provides correct information when partner gives erroneous information or misspeaks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Identifies/verbalizes new or missing (discrepant) information (i.e., it doesn't give our directional flight anywhere)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Identifies/verbalizes information that contests or casts doubt (disconfirming) on the preferred decision option</td>
</tr>
<tr>
<td>2. Reasons from a Positive Perspective</td>
<td>Demonstrates reasoning that focuses on what is available and feasible while noticing and incorporating discrepant and/or disconfirming information and comparing that data against the proposed option(s).</td>
<td>- Presents thoughts, ideas, input and opinion from a perspective of what is available and possible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Notices and accepts discrepant and disconfirming information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Compares and contrasts data</td>
</tr>
<tr>
<td>3. Perceives Multiple Perspectives</td>
<td>Interactants demonstrate the ability to perceive multiple information inputs, conditions, alternatives and people perspectives. In so doing, they remain open to novelty actively processing the current state, yet can sustain attentional focus to the task.</td>
<td>- Able to view the situation, condition, data from an other orientation (e.g., crew member, customer)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Awareness of environmental stimuli</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Seeks and incorporates multiple data inputs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Perceives options/alternative courses of action</td>
</tr>
<tr>
<td>4. Projects Thoughts and Feelings</td>
<td>Interactants verbally and nonverbally project their thoughts and feelings in an interaction to engender accurate, real-time, mutual understanding.</td>
<td>- Interactants speak their thoughts out loud, using precise, concrete terms, allowing the other person to see/experience their thought processes real-time as opposed to only verbalizing the result of their thought process (i.e., verbally walk through the individual steps of a procedure or reconstructing a task; identifies missing data, discrepancies and disconfirming information)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Uses diagrams, figures or body movements to accurately translate verbal message by a pictorial representation of the information presented in crisis</td>
</tr>
</tbody>
</table>
**Seeking Information**

Information seeking involved obtaining information in an interaction via seeking a partner's input or opinion, clarifying or confirming information including correcting erroneous information. Interactants noticed new and/or missing information as well as identified information that contested or cast doubt on the available data.
Requests for Input/Opinion. Requests for input most frequently centered on the Captain giving an initial overview of the crisis situation including a proposed action to resolve the issue and then requesting the First Officer's input or opinion. To illustrate, the Captain in Dyad 4 (4:13), Scenario 2, provided his initial reasoning for landing at the small, glider airport as opposed to the major airport and then requested the First Officer's input.

Captain: "So you know how to glide this thing right down in there because you've done it before (speaking forcefully and pointing his pen toward the First Officer and then pointing to the virtual airport where they would land). "OR (emphasis) we could go to the major airport (pause) but we might not make it" (again pointing his pen in staccato movements in the air in the same rhythm as his words). I say we go to the small airport (points to the virtual airport, smiles and looks directly at the First Officer). "What do you think?"

In addition, both the Captain and First Officer requested each other's opinion in terms of whether proposed actions were feasible, to check the accuracy of data and to identify the nature of a problem. For example, the First Officer in Dyad 2 (2:4), Scenario 1, asks the Captain for his opinion on the feasibility of taxiing to runway 08 by a certain time, "Is it possible to taxi here by 2:00 (p.m.) and take off?" Also, illustrative is the Captain's request in Dyad 2 (2:7), Scenario 1, for the First Officer's opinion on the nature of the problem in taking off a specific runway. "With that 10-minute taxi we should be there by 2:10 (p.m.), (we) shouldn't have any problems taking off avoiding 26. Do you know what the problem is taking off 26?"

Through soliciting each other's input and opinion, dyads gained both factual information and the other person's perspective of the situation, which at times, was diametrically opposed to their own interpretation of the "facts." Because of the
hierarchical nature of most aviation crew interactions, this behavior was observed infrequently overall and was conspicuously absent in the presence of overt dominance behaviors by one or both of the interactants, particularly the Captain. For instance, in Dyad 3 (3:8), Scenario 1, the First Officer tries three times to engage the Captain in seeking discrepant information after they have make their decision. After the second instance, the Captain responds facetiously in a sarcastic tone, "After you've asked me twice!" Consequently, he refuses to engage in further information seeking or accept input from the First Officer regarding his concerns about the decision.

Clarification/Correction. Interactants asked each other to confirm either the accuracy or their impression of the data captured from their initial reading of the scenario. To illustrate, in the following example, the Captain seeks clarification, "That tailwind component, was the off 08?" (7:24). Or, again, the Captain inquiring, "The winds are at 260 at 5, right?" (4:11). In instances where an interactant misspoke or gave incorrect data, the other interactant verbally corrected the mistake. For instance, in scenario two, the Captain in Dyad 3 (3:9) misspeaks:

Captain: "Ah . . . 31,000 miles."

First Officer: (Corrects him) "31,000 ft, 30 miles."

Captain: "Yeah, that's what I meant."

Clarification and correction behaviors assisted the dyads in ensuring they correctly perceived the current situation and had accurate information with which to make an effective decision.
Notices Discrepant/Disconfirming Information. Noticing new/discrepant information involved identifying, and verbalizing to one's partner, new and/or missing information. While disconfirming information involved identifying and verbalizing to one's partner information that contested or cast doubt on the proposed decision option.

The majority of information-seeking behaviors observed in the interactions occurred via identifying new, discrepant or disconfirming information in the environment. Particularly salient is that when the discrepant or disconfirming information was brought into the discussion, most often, neither interactant actually used that information to affect the decision outcome. It appeared they just discarded information that didn't fit. They did not engage in any reworking of how they labeled and categorized the information.

Excerpt 3:8, Scenario 1, is illustrative of how most of the dyads identified discrepant and disconfirming information. Usually, this type of information was introduced into the discussion after the dyad had agreed on a course of action and then was prompted by the administrator that there was still time left for deliberation. One interactant, frequently the partner who was not as actively engaged in the problem solving earlier in the interaction, would speak up and introduce discrepant or disconfirming information. Unfortunately, the individual who had been the most active problem-solver was usually not open to processing this new incoming data. As a result, the dyad discarded the information. Interestingly, in multiple instances, had the
discrepant or disconfirming information been processed by the dyad, it would have led them to make the most effective decision.

First Officer: (introducing new information that he appears to think is disconfirming) "I think it's pretty windy."

Captain: "We can take off at 10 (knot tailwind); it's only 5, it's no big deal. We can make it."

First Officer: (still looking for discrepant information) "Unless there is something we are missing (pause), then that's what we are going to do."

(Administrator) "You still have time."

First Officer: "Ok, what are we missing?"

Captain: (not answering seriously, he laughs) "After you've asked me twice!"

First Officer: (The Captain has made his decision but the First Officer keeps trying to draw him back into discussion as it appears he is wondering if they've left something out.) "It's something about the . . . "

Captain (talks over First Officer) "Air Force 1; but, I don't know how that really affects us."

First Officer: "The last paragraph . . . "

Captain: "Said something about Air Force 1 (and being) pretty concerned about taking off." (Buzzer sounds to end time for discussion.)

In the above example, Dyad 3 made a decision to depart from runway 08. The First Officer realizes it's quite windy which could affect the takeoff. If the Captain would have seriously considered and accepted the discrepant information the First Officer noticed, they might have concluded that they could depart off runway 26, leave ontime and make a right turn to avoid the thunderstorms which was the most effective decision.
In summary, the data from this study suggest that information seeking is an essential building block in the construction of shared mindfulness. Those dyads demonstrating high information seeking behaviors ultimately obtained more and better information in terms of precise data. This data rich environment provided a more accurate depiction of the current state and, consequently, optimized their ability to make the most effective decision.

Reasons From a Positive Perspective

This process involved reasoning and supporting one's position by focusing on what was available and feasible while simultaneously noticing and incorporating discrepant and/or disconfirming information, and comparing that data against the proposed option(s).

I observed that interactants primarily reasoned using the following strategy perspectives: (a) positive (defined above); (b) negative - reasoning and supporting one's position by focusing on what is lacking and potentially not possible or feasible in the less preferred option while contrasting and weighing it against only the positive aspects of the preferred option; (c) non-fact based - focusing and evaluating data from an emotional perspective such that the individual is inflexible when presented with logical facts that support an opposing view or position and will not accept or process discrepant and/or disconfirming information; and (d) question-based - reasoning and supporting one's position primarily by providing input via questions (e.g., "Is that the best option though? Or just not take off?"{2:5}); or seeking input via broad, non-specific questions (e.g., "See anything wrong with that?"{5:17}). Those dyads
primarily using strategies other than a positive strategy did not achieve shared mindfulness in their interactions, but rather in many instances, created a shared mindlessness.

Several dyads used a positive reasoning strategy very effectively. For example, Dyad 6 (6:21), Scenario 2, illustrates how interactants reason from a positive perspective by using the available information that the small glider field is within gliding range, and that the alternative, the major airfield may not be because of the headwind component. Afterward, they introduce both disconfirming and discrepant information to compare the options and ultimately choose the glider field. What is of critical importance, is that when they reason from a positive perspective, they are open to noticing discrepant and disconfirming information; and therefore, although they state a preferred decision option, they remain open to changing it.

Captain: (Available Information) "I'd say that's definitely within the gliding range. The other one might be outside the gliding range because of that headwind component. I'd say stick with the best field you got and make a nice, easy landing on it."

First Officer: (Introduces Disconfirming Information) "I've seen the field before and I agree to make a landing there if we are sure we can make it."

Captain: (Incorporates Disconfirming Information) "The type of plane will go in there" (demonstrates with his left hand an airplane landing). 

First Officer: (Discrepant Information) "Yeah, I think we have enough runway there. I think we can make a safe landing—so I'm not concerned."

Captain: (Available Information) "It's got a 3,000 ft. cloud base; you've been there; you've got gliding experience. It might be pretty good. You've been practicing those power off 180's (uses a hand gesture to indicate the type of landing)."

First Officer: "Yeah."
Captain: "You're pretty good at it."

First Officer: (Comparing Options) "If we make good on the landing we don't need all those emergency services."

Captain: (Comparing Options) "A safe landing here would be better than an emergency landing at a major airport trying to get to threshold and landing short . . ."

In addition, I noticed a pattern that when interactants reasoned from a positive perspective their decision explication contained more detailed fact-supported reasons for their decision. For instance, the above discussion yielded the following decision explication (Dyad 6, Scenario 2, Decision: 6:23).

Captain: "Our decision will be to go to the smaller civilian airport because we believe it's a smaller aircraft we're flying that can land on that strip. Since he's (First Officer) familiar with the airport and believes that's doable. It has a 3,000 foot cloud base so it's got a nice base to it and we can call up civilian authorities on the ground and maybe get some assistance if it's needed. But gliding from 31,000 feet, we have plenty of time to dump any fuel that we need to and set up for it appropriately; make sure (that) we are in the right spot; plenty of time to restart the engines without trying to strain the aircraft; figure a nice safe landing at a small airport is better than a . . . (First Officer finds the word) . . . stretching it. (Captain continues) . . . than a stretched crashed landing short of a major (airport)."

If interactants reason from a positive perspective they appear both to notice discrepant and disconfirming information as well as to incorporate that information into the decision criteria. Moreover, if either of the interactants has engaged in precognitive commitment (deciding on and verbalizing a course of action primarily based on how they categorized the available information —i.e., usually using only one element as the evaluative criteria without any or sufficient discussion with a partner), using a positive reasoning strategy seems to help them remain open to changing their
initial decision option in light of the incorporation of the discrepant and/or
disconfirming information.

For instance, in Scenario 1, Dyad 7 (7:24), it appears the First Officer has
engaged in precognitive commitment and chosen runway 08 as the preferred course of
action based on very little information. However, the dyad is using positive reasoning
such that when the Captain introduces disconfirming information, the First Officer
accepts it and uses it to further deliberate. Ultimately, they chose the most effective
option, runway 26.

Captain: (Available Information) "Alright, what do you think? There's a
thunderstorm 2-3 miles out."

First Officer: (Available Information) "We have to come around here real quick
(uses his pen to illustrate the path of the plane on his notepad) and that way
we'll save our taxi time to runway (0)8."

Captain: (Disconfirming Information) "That's a problem too much crosswind"
(simultaneously shaking his head no).

First Officer: (Incorporates Disconfirming Information) "That's right; so we
couldn't do that. So get here by 2:00 p.m. (pointing to the illustration on his
notepad). By 2:10 (p.m.) it's closed."

Captain: (Available Information) "So we have 15 minutes to taxi to runway
26."

First Officer: "OK."

Captain: (Discrepant Information) "We'll have five minutes to see if the
weather is still going."

First Officer: (Discrepant Information) "Ok (looks puzzled). Was there a
question on this problem?"

Captain: (Incorporates Discrepant Information) (shakes head "no" and smiles)
"Just to see what kind of scenario would work? So I would say taxi to runway
26; hold tight; see what the weather is doing, and within five minutes, we can make the departure if the thunderstorms move in."

First Officer: We can take the departure and go back around that way (points with his pen on his notepad). I think that's perfect."

Captain: (Discrepant Information/Comparing Options) "That tailwind component...was that off 08?"

First Officer: (Available Information) Nods head affirmatively. "The wind is 260."

Captain: "Correct."

First Officer: "Ok. At 05."

Captain: "It will take 20 minutes to taxi down there maximum; Sounds doable to me; let's do it! Gives us time for a cup of coffee then. Excellent."

From my observations, using a positive reasoning strategy during the decision-making and decision outcome process appeared to be the most salient factor in the formation of shared mindfulness among the interactants. Dyads using a positive strategy in the deliberative process demonstrated more openness to noticing and incorporating discrepant and disconfirming information. Additionally, they tended to compare and contrast potential decision options; whereas, those dyads using alternative strategies were much less likely to engage in comparing and contrasting the decision options. Most often, because they had engaged in precognitive commitment and determined a sole solution and mindlessly followed that option.  

**Perceives Multiple Perspectives**

Perceiving multiple perspectives is characterized by an ability to perceive and incorporate multiple information inputs, conditions, alternatives and perspectives. In
so doing, the interactants remain open to novelty, actively processing the current state, yet can stay focused on the task.

**Other Orientation.** Interactants demonstrated an *other orientation* when they perceived a situation from a perspective outside of their own such that they could figuratively place themselves in someone else's "shoes" and consider the information from that position. For instance, in the following decision explication excerpt Dyad 5 (5:17), Scenario 1, the Captain explains the dyad's rationale for its decision to depart from runway 26. The Captain demonstrates that this crew looked at the situation from the perspectives of safety, their client and Air Force 1 as well as their own.

Captain: "We are going to go ahead with the original departure on runway 26, and then climb and make a 180 to avoid the storm. That way we don't have the 20-minute that taxi which would put us there at 2:05 (p.m.); the airport is going to close in 10 minutes which could prevent us at the 2:10 (p.m.) time for Air Force 1. So we're going (to go) ahead and get there early and see where the storm is at; and if its two-to-three miles away, we still have enough time to get airborne and execute a turn to avoid the storm. ... That way we satisfy our client and Air Force 1 and the safety of the flight."

Similarly, the Captain in Dyad 9 (9:34), Scenario 2, discusses with the First Officer the time constraints associated with attempting to glide to the major airport from their own perspective as well as Air Traffic Control (ATC). "We can call ATC and they can help us out. . . . It appears we still have enough time to glide to the major terminal; that makes a better situation if an accident occurs (to) make sure we have enough runway to get it on the ground . . . . It's time critical also for the ATC to get on the ground." Or in this instance, Dyad 3 (3:12), Scenario 2, the First Officer demonstrates a customer perspective in discussing the implications of landing at the
glider airport versus the major airport. "... My concern would be passengers on
board, that if there are any problems that (we) would get them to the airport."

Awareness of Environmental Stimuli. Interactants demonstrated an awareness
of environmental stimuli by the ability to sustain their attentional focus in an
interaction, yet be aware of and process distractions in the environment.

Interactants demonstrated this ability in varying degrees in the interactions.
For instance, Dyad 5 (5:18), Scenario 2, the First Officer while outlining the
procedural steps to land at the glider field was interrupted by the Administrator;
consequently, he responded to the distraction yet was able to regain his focus and
complete his thought.

First Officer: "There's no approach; but I will go ahead and call emergency
services and tell them we are going to go for the glider field." (Administrator
interrupts, "Is that pen working for you?") "Yeah. (acknowledges question,
looks up and then continues with his train of thought) I'll go ahead. . . and get
the crash emergency services ready for us for our arrival."

Likewise, Dyad 6 (6:20), Scenario 1, the First Officer immediately refocused
his attention and completed his thought after being distracted by the researcher.

First Officer: "So we can start taxiing in five minutes or take 26 without
missing the thunderstorms (is distracted and looks up as the researcher
comments on the noise a plane is making while taking off outdoors; then
returns to his thought) or be delayed five minutes and miss the
thunderstorms."

Through sustaining an aware as opposed to a rigid focus in an interaction,
individuals noticed distractions, interruptions and inconsistencies in the environment,
acknowledged them and apparently made a judgment call as to their level of
importance to disrupt the current activity. Conversely, those individuals that
maintained a rigid focus during an interaction, appeared oblivious to distractions, interruptions and inconsistencies, and therefore, did not perceive potentially critical incoming data.

Seeks and Incorporates Multiple Data Inputs. The process of seeking and incorporating multiple data inputs involved interactants both soliciting and providing as much information, from as many sources as possible, and incorporating these multiple inputs into the deliberation discussion. Therefore, interactants incorporated the factual data gathered from their notes (e.g., 31,000 feet altitude; 30 miles from nearest airport; 3,000 foot ceiling {7:26}), used diagrams drawn from the data (e.g., "We have to come around here real quick" . . . uses his pen to illustrate the path of the plane on his notepad . . . "and that way we'll save our taxi time to runway (0)8." {7:24}), processed the discrepant and disconfirming information noticed in the discussion (e.g., "Does it say what kind of plane we are in?" {1:2}) and considered emotional data (e.g., What does your gut tell you?" {7:26}), projectory data (e.g., " . . . small field is that like Kalamazoo, Hastings?" {4:12}) and sensory data (e.g., "I would definitely go to the smaller airport because I have glider experience myself and I know that once you see familiar territory you know distance and can gauge(it)." {7:26}).

Dyad 7 (7:26), Scenario 2, provided the most illustrative example of seeking and incorporating multiple data inputs. The Captain looks at the available information — i.e., the altitude, distance from the nearest field, etc. and makes an initial decision to go to a small, glider field. They continue to process the available information but also
notice and incorporate the discrepant information (i.e., they don't know the length of
the glider field) and remain open to the possibility that the discrepant information may
disconfirm the Captain's preferred option. They evaluate and compare options until
they appear to have used all the information they had available to them (what they
recorded). The Captain seeks emotional data and asks the First Officer, "What does
your gut tell you?" rather than trying to elicit the First Officer's agreement with his
preferred option.

Captain: (Available Information/Discrepant Information/Emotional Data)
"Okay, we are at 3,1000 ft; it doesn't say anything about the glide range. And
let's see (pause) it's 30 miles from the nearest field. One mile per gliding per
thousand feet. 3,000-ft ceiling—looks like a crappy situation."

First Officer: " Yeah" (nods his head affirmatively).

Captain: (Compares Options/Sensory Data) "The major problem is it's more
than 35 minutes to the major airport and emergency facilities are at the major
airport. This guy has glider experience and he has the local airport. It seems
almost like a no . . . a no . . . problem . . . situation. I would definitely go to the
smaller airport because I have glider experience myself and I know that once
you see familiar territory you know distance and can gauge . . . (Captain
doesn't finish the sentence; First Officer glances away from the Captain's
notepad and down at his own notes while the Captain continues) . . . although
the emergency facility won't be so close."

First Officer: (Discrepant Information possibly Disconfirming/Visual Data)
"My only problem with that is knowing the runway length there." (First Officer
puts his finger on Captain's notepad and repeatedly hits his finger on the pad to
emphasize his point. The Captain looks directly at the First Officer as he
speaks and is listening attentively.) "We know for sure that the runway length
is suitable for . . ."

Captain: (Discrepant Information/Emotional Data) (Interrupts) "What kind of
aircraft are we flying, did you catch that?" (Threws up his hands). "I didn't
catch that."

First Officer: (Available Information/Projectory Data) "Something that gets to
31,000 feet."
Captain: "Yeah." (Rubs the back of his head thoughtfully.)

First Officer: (Discrepant Information) "If there's suitable runway I agree with you that that's the best place to land but . . . "

Captain: (Compares Options/Visual Data) (Interrupts) "But if we have a major headwind and not too much gliding experience; trying to reach . . . that's the other thing that's a problem" (he continues scratching the back of his head and looks frequently at the First Officer who keeps his eyes on the Captain's notepad but nods affirmatively) "I mean think about . . ." (First Officer is looking at his notepad and Captain now glances at First Officer's notes).

First Officer: (Available Information) "Think about . . . it says we have 5 minutes before it's out of range."

Captain "Yeah we . . ."

First Officer: (Available Information) (Talkover) "Like I said we have that headwind component."

Captain: (Emotional Data) "Yeah, we've got to make a decision quick. What does your gut tell you?"

First Officer: (Visual Data/Projectory Data) I'd say we do that" (pointing to the Captain's notepad); "If not, we may not make it to the major airfield."

As this scenario illustrates, shared mindfulness appeared to be facilitated in those interactions in which interactants analyzed projectory and sensory data along with the concrete, factual data available in the environment. In addition, they shared emotional data with their partner and sought this type of sensory/emotional data from their partner.

Perceives Options/Alternatives. Interactants perceive possibilities and choices beyond a single course of action or a sole solution to a problem. Dyad 6 (6:20), Scenario 1, illustrates how the interactants initially perceived both options, runway 08 and runway 26, as possible choices using the available information of the departure
time, tailwind, taxi time and the thunderstorm, and incorporating the discrepant information, which was whether they could start taxiing within 5 minutes. Then they compared the available and discrepant information against the proposed options to decide which runway they would choose.

Captain: "Alright, so basically our choices are to leave, to leave in under 10 minutes . . . "

First Officer: (Available Information and Discrepant Information) "And start to taxi in 5 minutes then we can make it through the tailwind landing, which is in our minimums. It's doable as long as we are ready to taxi in 5 minutes.

Captain: (Incorporates Discrepant Information) "But then there's the thunderstorms 2-3 miles out there one way . . . So . . . so we can either taxi out there to get away from the thunderstorm, or . . . which will make a longer taxiing time; but we want to get off before."

First Officer: (Uses Discrepant Information to Compare Options) "So we can start taxing in five minutes or take (runway) 26 without missing the thunderstorms, or be delayed five minutes and miss the thunderstorms.

Captain: "I'd say if we are ready to taxi lets (do it)."

First Officer: "Yeah, we might as well go taxi out (on runway 26); get everyone there; everyone's happy, as long as we are ready to taxi rather than be delayed."

Overall, perceiving options/alternatives behavior appeared quite lacking in most dyads because usually one or both interactants engaged in precognitive commitment. Consequently, the dyad perceived a single solution and focused on and committed to a sole course of action without exploring other alternatives or possibilities.

In summary, interactants who demonstrated the ability to perceive multiple perspectives were the most cognizant of and most accurately depicted the current
state. Although unfortunately, the ability to perceive multiple perspectives was the skill most often absent in the dyadic interactions, it appears to be the one of the most potent elements in creating shared mindfulness within an interaction.

**Projecting Thoughts and Feelings**

The communication behavior of projecting thoughts and feelings involved interactants verbally and nonverbally projecting their thoughts and feelings in an interaction to engender accurate, real-time, mutual understanding.

**Verbalizes Thoughts.** In verbalizing thoughts, one or both interactants speak out loud, using precise, concrete terms, what they are thinking allowing the other person to see/experience their thought processes real-time as opposed to only verbalizing the result of their thought process (i.e., verbally walk through the individual steps of a procedure or reconstructing a task; verbally identify missing data, discrepancy and/or disconfirming information).

Verbalizing one's thought processes was crucial in creating shared meaning in an interaction and functioned as precursor to the formation of shared mindfulness. For instance, verbalizing one's thoughts functioned as a means to check for congruence in how both interactants viewed the current situation. In Dyad 5 (5:17), Scenario 1, after the Captain voices his concern about the thunderstorms and the timing of Air Force 1's arrival, the First Officer concurs that he was thinking the same thing (but had not verbalized it). Congruence from this perspective refers to both partners accepting and incorporating discrepant and disconfirming information to achieve a shared understanding. Unlike groupthink, in which members demonstrate congruence in their
thinking that is not tempered by accepting discrepant and disconfirming information; therefore, it can lead to faulty decision making because it is not based on an accurate perception of the current reality (Janis, 1972; Neck & Manz, 1994).

Captain: "No, I agree the thunderstorm is 2 to 3 miles away and there's plenty of time to get out of its way. If it takes longer to taxi because of the thunderstorm, he (Airforce 1) may be upon the airport by the time we are ready to take off."

First Officer: "Yes, that's the same question I was thinking too. The thunderstorm could be moving faster and something could happen along our taxiway."

Similarly, in Scenario 2, Dyad 5 (5:18) again demonstrates congruence in their thoughts which created shared meaning in the interaction.

Captain: "Yeah (looks intently at his notepad and leans back) but they're not sure to me if you can make the long one; you might have to land on the field; we may have a soft landing."

First Officer: "Yeah" (looks in Captain's direction).

Captain: "If it's not long enough . . . (Captain is speaking as though he is thinking aloud and is more animated with more intonation) . . . you may just slide of the end of it rather than come up short . . . "

First Officer: " (Interjects) . . . that's what I was thinking" (nodding his head in agreement).

Thinking out loud appeared to act as a mechanism to stimulate the awareness of discrepant or disconfirming information. For example, by giving voice to his thoughts the Captain in the above scenario becomes aware of fundamental elements that are lacking for which they must be prepared.

Captain: "Sounds good. We don't know what runway they have; we'll get some weather for that field to know what runway they have to follow the normal pattern."
First Officer: "Yeah."

Captain: "We don't have any reverse thrust. We may not have any emergency services."

Additionally, verbalizing one's thoughts facilitated the process of reconstructing a procedure based on the implications of the crisis situation. This real-time reconstruction process is illustrated by the Captain in Dyad 6 (6:22), Scenario 2, as he verbally reconstructs the task procedures for a safe landing at the glider airport.

Captain: "So we can still call in the local ambulance, the local fire department (First Officer nods affirmatively and says . . . "yeah") and they can provide some assistance if we need it. Call them on Air Traffic Control; try to restart the engines—maybe dump some fuel on the way down. Be a little more relaxed after this and maybe try to stretch it out."

**Feeling and Visual Expression**

Feeling and visual expression involved interactants using verbal and nonverbal gestures and body movements to emphasize the importance of critical information or to facilitate understanding in an interaction.

**Verbal/Nonverbal Feelings.** Verbal/nonverbal feelings involved interactants speaking or demonstrating with nonverbal gestures their feelings in order to emphasize, bring attention to or acknowledge the importance of an element they believed to be critical to making an effective decision. For example, the following excerpt illustrates all three of these dimensions as the Captain and First Officer discuss the implications of landing on the glider field (Dyad 8 {8:30/31}, Scenario 2).

Captain: "We've got five minutes before we have to make a choice. So you have experience at this gliding airport?"
First Officer: "Yeah. First concern I have is runway length; obviously it's not that long; we are not going to have, since all our engines are out, we aren't going to have any reverse thrust."

Captain: "That's an excellent point, that's an excellent point!"

First Officer: "Also, I'm concerned with the fact that, if we could manage to get it down, I'm guessing it is probably a soft field or a small field; we are going to need emergency equipment."

Likewise, in the following example, the Captain verbalizes a feeling statement such that it prompts the dyad to notice a discrepant element they hadn't considered before in the decision-making criteria (Dyad 9 {9:33}, Scenario 1).

Captain: "I just worry about the takeoff power, 260 5 is . . . "

First Officer: "Considering we don't know what type of plane we are flying."

Nonverbal projection of feelings included such gestures as facial expression and hand movements. The following examples are illustrative of the various nonverbal gestures used to convey feeling in the interactions that helped the dyads create shared meaning which facilitated the development of shared mindfulness. In Dyad 7 (7:24), Scenario 1, the First Officer emphasizes his confusion, "Ok (looks puzzled). Was there a question on this problem?" The Captain in Dyad 7 (7:26), Scenario 1, expresses his surprise at not having noted a crucial piece of data, "What kind of aircraft are we flying, did you catch that?" (Throws up his hands.) "I didn't catch that."

Visual Representation. Visual representation involved interactants using diagrams, figures or body movements to accurately translate the verbal message by a pictorial representation of the information under discussion.
Visual representation was particularly useful to clarify verbal statements of fact that included directional elements, distance and altitude. For example, the Captain illustrating the direction of the thunderstorms on runway 26 (Dyad 8 {8:29}, Scenario 1).

Captain: "If we use 26 it will be two to three miles this way" (illustrates the direction of the storms on his notepad).

First Officer: "Ok. I see what you are saying. We could go this way and avoid the thunderstorms . . . "

Again, in Dyad 9 (9:32), Scenario 1, the Captain visually illustrates the direction and angle of the turn they must execute in order to avoid the thunderstorms. "I don't feel like that won't give us enough time to turn, so I don't have a problem with using runway 26" (illustrates with his pen the 'turn' they need to make with the aircraft).

Diagrams, as visual representations, appeared to be a significant factor in creating a shared accurate depiction of the current state as illustrated by the Captain's decision explication in Dyad 7 (7:25), Scenario 1.

Captain: "We did a little figuring—we did a little diagram out here (shows notepad and demonstrates with his pen) thunderstorms are out here; we can come back around on our departure to avoid the thunderstorms if we have to; also, our aircraft wouldn't be able to take off that way; plus the time constraints."

Altogether, verbally and nonverbally projecting one's thoughts and feelings in an interaction facilitated shared mindfulness, particularly if the individual used precise, concrete, descriptive terms and reinforced the transmission of his/her thought processes via a visual representation. When interactants verbalized their thoughts and
feelings, as opposed to just the results of their thoughts, the other individual could clearly follow the development of their reasoning so that the subsequent conclusions drawn appeared more credible and plausible to their partner. In effect, this produced a real-time, base knowledge that could be used by both parties to further deliberate.

**Mindful Acknowledgement of Partner Communication**

During an interaction, mindful acknowledgement of partner communication is characterized by interactants acknowledging each other's message was both received and critically processed.

**Simple Acknowledgement.** Acknowledgement was enacted in two forms. In some cases, interactants demonstrated active listening to indicate they "heard" their partner or provided a simple acknowledgement such as *yes* or *no* in response to a question. This form of acknowledgement was the most common in the dyadic interactions. The following examples illustrate simple acknowledgement.

Dyad 1 (1:1) Scenario 1:

Captain: "We're going to take runway 26, you agree?"

First Officer: "Yeah."

Dyad 1 (1:2), Scenario 2:

Captain: "Does it say what kind of plane we are in?"

Captain: "No."

Dyad 9 (9:32), Scenario 1:

Captain: The airport is closing at 2:10 (p.m.). Just taxiing to the runway 26 is going to take us 10 minutes. So we don't want to risk —ah risk —not being able to take off. Even with the thunderstorm two or three miles upwind, I don't
feel like that won't give us enough time to turn; so I don't have a problem with using runway 26.

First Officer: (Nods his head affirmatively throughout the explanation and says, "yeah" intermittently.)

Here, simple acknowledgement functioned as a communication tool to let the other partner know he/she was being "heard" and that the other interactant was actively following the discussion.

**Substantive Acknowledgement.** Interactants substantively acknowledged partner communication by providing a verbal response that indicated they had not only received the message but that it had been critically processed. To illustrate, Dyad 5 (5:17) Scenario 1, provides a sequence of acknowledgement in which the Captain explains his decision and requests feedback from the First Officer. In acknowledging the Captain's communication, the First Officer responds substantively confirming what he "heard" as the Captain's explanation and demonstrating that he had critically processed that information by including the time factor to taxi. Subsequently, the Captain substantively acknowledges the First Officer's communication.

Captain: "My decision is going to be to go ahead with the planned departure on runway and just execute a 180 to avoid the thunderstorm. And we will be out of the range of Air Force 1 at the proposed arrival time. Any questions or comments?"

First Officer: (Acknowledgement and processes information) "No, I agree the thunderstorm is 2 to 3 miles away and there's plenty of time to get out of its way. If it takes longer to taxi because of the thunderstorm (glances at Captain and the Captain nods his head) he (Air Force 1) may be upon the airport by the time we are ready to take off."

Captain: (Acknowledgement and processes information) "Yes, that's the same question I was thinking too. The thunderstorm could be moving faster and something could happen along our taxiway. That's a pretty long taxi. Go ahead
and get ready for the 26 departure, it's only a 10-minute taxi. Ok, good. Go ahead and tell the tower we are going to take departure on 26."

Dyad 7 (7:24), Scenario 1, provides a good illustration of a sequence of acknowledgement that includes both simple and substantive patterns. These behaviors appear to trigger information processing such that the interactants engage in information seeking behaviors that surface critical information into the deliberation process.

Captain: "Alright, what do you think? There's a thunderstorm 2 to 3 miles out."

First Officer: (Acknowledgement and processes information) "We have to come around here real quick (uses his pen to illustrate the path of the plane on his notepad) and that way we'll save our taxi time to runway (0)8."

Captain: (Acknowledgement and processes information) "That's a problem too much crosswind (simultaneously shaking his head no"

First Officer: (Acknowledgement and processes information) "That's right; so we couldn't do that. So get here by 2:00 p.m. (pointing to illustration on his notepad). By 2:10 (p.m.) it's closed."

Captain: "So we have 15 minutes to taxi to runway 26."

First Officer: (Acknowledgement) "OK."

Captain: "We'll have five minutes to see if the weather is still going."

First Officer: (Acknowledgement) "Ok (looks puzzled). Was there a question on this problem?"

Captain: (Acknowledgement and processes information) " (shakes head no and smiles) . . . just to see what kind of scenario would work? So I would say taxi to runway 26; hold tight; see what the weather is doing, and within five minutes, we can make the departure if the thunderstorms move in."

First Officer: (Acknowledgement and processes information) "We can take the departure and go back around that way" (points with his pen on his notepad). I think that's perfect."
Captain: "That tailwind component—was that off 08?"

First Officer: (Acknowledgement and processes information) Nods head affirmatively. "The wind is 260."

Captain: (Acknowledgement) "Correct."

First Officer: (Acknowledgement) "Ok. At 05."

Captain: "It will take 20 minutes to taxi down there maximum; Sounds doable to me; let's do it! Gives us time for a cup of coffee then. Excellent."

Partner acknowledgement of communication not only helps the flow of communication in an interaction but also appears to initiate the processing and incorporating of the information into the deliberation process. Otherwise, the information seems to be "put out there" but remains unrecognized as input by both parties.

Mindful acknowledgement appears to be a very salient component in creating shared mindfulness in an interaction. I noticed a pattern that if an interactant acknowledged his/her partner's communication via a substantive comment that demonstrated he/she not only heard what the other interactant said, but was able to discern the intended meaning and verbalized that understanding, then shared mindfulness was facilitated. Thus, it appeared that to the degree interactants mindfully acknowledged each other's communication substantively, the higher the level of shared mindfulness was created in the interaction.
**Participative Language**

Interactants used language that emphasized the tentative, conditional nature of information and the environment, and demonstrated through the use of inclusive terminology, joint ownership in the decision-making process.

**Conditional Language.** Conditional language involved individuals presenting thoughts, reasons, opinions and suggestions using conditional terminology (i.e., "We could go for the major airport but we might not be able to make it" \(4:13\)). Expressing information conditionally fostered a discussion environment that allowed for differing views and opinions along with an awareness of the contingent and ever-changing nature of environmental conditions (i.e., "... the thunderstorm could be moving faster ..." \(5:17\)). For example, in Dyad 5, (5:17), Scenario 1, the Captain makes an initial decision to depart on runway 26 and avoid the thunderstorms and then requests input from the First Officer. The First Officer agrees, with the Captain's assessment and decision, but provides a caveat in conditional terms. "No, I agree the thunderstorm is two to three miles away and there's plenty of time to get out of its way. If it takes longer to taxi because of the thunderstorm, he (Airforce 1) may be upon the airport by the time we are ready to take off." The conditional language of the First Officer's response is non-threatening but simultaneously alerts the Captain to a potential issue in regard to the chosen decision option. Thus, the Captain responds, "Yes, that's the same question I was thinking too. The thunderstorm could be moving faster and something could happen along our taxiway."
From my observations of the crew interactions, if one interactant introduced new information using conditional language, the other interactant was more open to receiving it, processing it and incorporating it into the decision-making criteria as long as the information was not presented in a hesitant or questioning manner. For instance, in the following excerpt (Dyad 6 {6:21}, Scenario 2), the Captain proposes landing at the glider airport. The First Officer conditionally concurs with the proposition based on new information he brings into the decision-making process. This information prompts the Captain to consider another new element, the type of plane they are flying and incorporate it into the deliberation process.

Captain: "I'd say that's definitely with the gliding range. The other one might be outside the gliding range because of that headwind component. I'd say stick with the best field you got and make a nice, easy landing on it."

First Officer: "I've seen the field before and I agree to make a landing there if we are sure we can make it."

Captain: "The type of plane will go in there" (demonstrates with his left hand an airplane landing).

First Officer: "Yeah, I think we have enough runway there. I think we can make a safe landing—so I'm not concerned."

**Inclusive Language.** Individuals used inclusive language when they provided their input, opinions, statements and questions using "we" language over "I" or "You" language. Using inclusive terms was a particularly salient communication behavior, especially in the Captain's role, as it was a vital element in engendering a joint decision-making environment. For example, a Captain initiating a discussion using non-inclusive language such as "I'm going to the smaller field" precipitated a very defensive response from the First Officer in the interaction (Dyad 1 {1:2}, Scenario 2).
First Officer: (Disagrees —speaking in a more defensive tone and suggesting he is surprised by the decision.) "Really? I say the major. I mean it's in range; if you look at it on the performance chart, it takes in headwind and the right cruise so we are not at maximum weight and range is always calculated at maximum weight (Captain nods his head affirmatively) —so we're going to be underweight. And it's says we're within range, because there's a headwind component on the automatic range chart."

An inclusive approach by the Captain in the following excerpt, Dyad 10 (10:36), Scenario 2, fostered a more participative environment in which both the Captain and First Officer provided their input freely and non-defensively.

Captain: "Well we're gliding; we are 30 miles from that small civilian airport. you are familiar with the airfield and gliding. And, ah—we could possibly not make the major —civilian—major airport with emergency services. The best opportunity would probably be to go into the small civilian airfield and just put it down; why try and crash it."

First Officer: "Yeah."

Captain: "We are pushing gliding limits (to get to the major airport)."

First Officer: "Sounds good, since we need 28,000 ft to get below the clouds."

Captain: "Umhum."

First Officer: "And we have 30 miles to get there; and we don't know how fast we are going."

Captain: "Yeah."

First Officer: "We don't know what our descent rate is."

Captain: "Huh, we need to figure out our descent rate."

Those dyads that used conditional and inclusive language liberally, also appeared to demonstrate more joint ownership of their decision. For example, Dyad 6, Scenario 2, Decision: 6:23, demonstrated joint ownership of the decision as both the
Captain and First Officer participate in the decision explication using inclusive terms rather than just the Captain explaining the decision rationale as was the normal pattern.

Captain: "Our decision will be to go to the smaller civilian airport because we believe it's a smaller aircraft we're flying that can land on that strip. Since he's (First Officer) familiar with the airport and believes that's doable. It has a 3,000 foot cloud base so it's got a nice base to it and we can call up civilian authorities on the ground and maybe get some assistance if it's needed. But gliding from 31,000 feet, we have plenty of time to dump any fuel that we need to and set up for it appropriately; make sure (that) we are in the right spot; plenty of time to restart the engines without trying to strain the aircraft; figure a nice safe landing at a small airport is better than a . . ."

First Officer: "Stretching it."

Captain: "Than a stretched crashed landing short of a major (airport)."

Administrator: "Why did you make this decision?"

First Officer: "Because we know we can make that field and its better to make a landing at a field we know we can get to than to try to make a landing at a field we might not be able to get to. Plus, we have that headwind component.

Captain: "Because this field is better than a row of trees before a major airport."

Those interactants that stated their input and opinions using conditional language facilitated a discussion environment in which both partners appeared to share their thoughts and opinions more freely without positioning their comments within defensive language nor did they resort to more dominant communicative behaviors such as using a forceful or sarcastic tone of voice. Couching statements, questions and observations, particularly in the initial discussion phase, in conditional and inclusive terms allowed the other interactant room to disagree or bring into the discussion information that refuted or contested the reasoning of the partner. This factor tended to prevent interactants from immediately viewing the situation from one perspective
(engaging in precognitive commitment). Consequently, interactants remained open to sharing all the available data before determining a course of action rather than viewing one factor (e.g., emergency services) as determining the course of action. When interactants engaged in the latter activity, they rolled all information into one category (i.e., how it facilitated the need for emergency services) rather than seeing distinctions in the data which Langer (1997) identifies as central component of mindfulness (i.e., a controlled landing on a glider field within in a reachable distance is safer than an airfield a further distance that has emergency services).

**Fluid Turntaking**

Fluid turntaking was represented by interactants engaging in a ping-pong pattern of participation in which both partners add, clarify, confirm or seek information in the discussion and build on and/or extrapolate beyond the information of the other. It was often characterized by interactants finishing each other's sentences or completing a thought so that their pattern of thinking demonstrated congruence.

The following example Dyad 6, (6:21), Scenario 2, illustrates how both interactants added, clarified and built on information through fluid turntaking that resulted in congruence (shared mindfulness) in their thinking.

Captain: "Alright, so basically our choices are to leave (pause) to leave in under 10 minutes . . ."

First Officer: (Completes Thought/Builds on Information) " . . . and start to taxi in 5 minutes then we can make it through the tailwind landing, which is in our minimums. It's doable as long as we are ready to taxi in 5 minutes.

Captain: (Adds/Builds on Information) "But then there's the thunderstorms 2 to 3 miles out there one way; so we can either taxi out there to get away from
the thunderstorm; or, which will make a longer taxing time, but we want to get off before.

First Officer: (Clarify) "So we can start taxing in five minutes or take (runway) 26 without missing the thunderstorms, or be delayed five minutes and miss the thunderstorms."

Captain: "I'd say if we are ready to taxi lets (do it)."

First Officer: (Confirms) "Yeah, we might as well go—taxi out; get everyone there; everyone's happy, as long as we are ready to taxi rather than be delayed."

Captain: (Congruence) "Yes, that's what I thought we don't want to be delayed if Air Force 1 arrives."

Additionally, Dyad 5 (5:18), Scenario 2, illustrates fluid turntaking. After making the decision to land at the small, glider field, the Captain and First Officer fluidly take turns verbally walking through reconstructing the task procedures.

Captain: "Why don't you look up if they have an approach there (civilian airport), what the mile is?"

First Officer: (Confirms/Builds on Information) "There's no approach. But I will go ahead and call emergency services and tell them we are going to go for the glider field. I'll go ahead and notify the (unintelligible word) to get the crash emergency services ready for us for our arrival."

Captain: (Adds Information/Extrapolates/Congruence) "Sounds good. We don't know what runway they have. We'll get some weather for that field to know what runway they have to follow the normal pattern."

Fluid turntaking appeared to promote shared mindfulness because it facilitated a communication environment in which the interactants could participate and deliberate using the maximum amount of information because they were both adding, clarifying, confirming and seeking information. This process allowed the individuals to build on each other's information and extrapolate beyond the available information to
create a plausible scenario or restructure a procedure based on the crisis situation. As a result, they appeared more open to seeing various options and alternatives as opposed to a sole course of action because they are maximizing the amount of data they noticed and incorporated into the deliberation process. Demonstrating fluid turntaking in an interaction appeared an effective means to avoid the pitfall of precognitive commitment.

The Relationship Between Shared Mindfulness and Decision Outcomes

The final research question in this study examined connections between shared mindfulness and decision outcomes. To address this question, dyads' decisions were rated for their effectiveness by aviation instructor-developed decision criteria. The following Decision Matrix (see Table 3) summarizes the effectiveness rating of each dyad's decision in the two scenarios.

Table 3
Dyad Interaction Decision Matrix

<table>
<thead>
<tr>
<th>DYAD #</th>
<th>SCENARIO 1 - DECISION OPTIONS</th>
<th>SCENARIO 2 - DECISION OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 - Effective</td>
<td>2 - Less Effective</td>
</tr>
<tr>
<td>D-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D-2</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>D-3</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>D-4</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>D-5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D-6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D-7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D-8</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>D-9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D-10</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
Scenario Results

Scenario 1

According to the Western Michigan University (WMU) aviation instructor who created the scenarios, Scenario 1 had three plausible decision options which are presented in order of their effectiveness: (1) take off on runway 26 and avoid the thunderstorm; (2) take off 08, the wind is within limits; and (3) delay the take-off. The aviation instruction also provided the following decision effectiveness ratings and explanations.

Scenario 1 Decision Effectiveness Rating, Decision 1 = Effective: Gets the airplane off on time without having to rush and it should be no problem.

Decision 2 = Less Effective: Taking off downwind is fine, but if the storm (now behind them) produces a microburst then the tailwind would become excessive and they would likely run off the end of the runway.

Decision 3 = Ineffective: Though it is nice and safe, they would not have achieved maximum effectiveness - i.e., their boss's deal would fall through!!! It is possible to get an effective result by going for Decision 1 and safety still isn't compromised.

Five dyads (half the total number of dyads) made the most effective decision to depart on runway 26; four dyads made a less effective decision a departure on runway 08; and one dyad an ineffective decision to delay the take off.

Scenario 2

The WMU aviation instructor determined that scenario 2 had two possible decision options: (1) put the airplane on the ground at nearest suitable airport (small civilian airfield 30 miles away); (2) attempt to make it to the major airfield. The decision effectiveness ratings and explanations for Scenario 2 are as follows:
Scenario 2 Decision Effectiveness Rating. **Decision 1 = Effective:** The safest option is to find somewhere well within gliding range and put the aircraft on the ground. If the small airfield is suitable for landing then it should be used regardless of whether or not it has full facilities.

**Decision 2 = Ineffective:** An attempt to make the major field is likely for all the wrong motives—the desire for full facilities. This is a risk assessment problem—weighing the risks of landing at an airfield without full emergency facilities versus the risk of trying to stretch a glide and make it to one that does. The FIRST RISK is that if the landing does not go well then there may be a few injuries which will require treatment. The SECOND RISK is that the airplane may not make it due to an unseen headwind; in which case, the airplane will land/crash somewhere else resulting in likely death and serious injury among countless individuals (on the ground as well as in the airplane).

In Scenario 2, five dyads made an **effective** decision, while the other five dyads made an **ineffective** decision.

Examining the Qualitative Relationship of Shared Mindfulness to Effective Decisions

In the following section, I examine the relationship of shared mindfulness to effective decision outcomes. While I explore this relationship from a qualitative perspective, I also incorporate some very basic quantitative measures to provide additional insights.

**The Effective Decision Makers - Dyads 5, 6 and 7**

Overall, Dyads 5, 6 and 7 achieved the **most effective** ratings in both scenarios, and thus, scored the highest of all the dyads in decision outcome effectiveness. As to the relationship between shared mindfulness and effective decision outcomes, from a quantitative perspective, I calculated some basic frequency counts. For instance, of the 46 illustrations of shared mindfulness behaviors used as exemplars in this current
In reviewing the seven communication process categories that emerged from the data, in four of the seven categories over half of the shared mindfulness communication behaviors identified in the dyadic interactions were attributed to the interactants in Dyads 5, 6 and 7. Particularly salient is that 75% of the reasoning from a positive perspective communication behaviors, 86% of the turntaking behaviors, 52% of perceiving multiple perspectives behaviors and 52% of projecting thoughts and feelings behaviors of the total number of dyads are represented within Dyads 5, 6 and 7. This finding is particularly important because a positive reasoning perspective was the most critical factor to fostering shared mindfulness. Moreover, this limited quantitative perspective lends support to the qualitative findings suggesting that the communication behaviors of shared mindfulness identified in the dyadic interactions lead to more effective decision outcomes.

Altogether, the communication behaviors identified as facilitative of shared mindfulness appear curative for what Janis (1983) argues are symptoms of defective group decision-making: (1) incomplete review of alternatives; (2) incomplete examination of objectives; (3) failure to examine the risks of the preferred option; (4) lack of reappraisal of initially rejected alternatives; (5) poor information seeking; (6) selective bias in processing available information; and (7) failure to construct contingency procedures.

In the next section, I will look qualitatively at how the dyads, particularly 5, 6 and 7 demonstrated these behaviors throughout the decision making process stages.
Qualitative Analysis - Decision-making Stages

From my observations of crew interactions in an aviation context, the interactants approached decision-making in a crisis situation in three distinct cognitive stages: (a) situational analysis; (b) active problem solving; and (c) decision outcome (see Figure 1).

Overall, the seven process categories of communication behaviors are not particularly associated with one stage another but rather are present throughout the decision-making process. However, I did note that in each of the sequences of cognitive activity, shared mindfulness was created to the degree the interactants displayed specific communication behaviors of shared mindfulness.

The situational analysis stage was a preliminary discussion phase. In this stage, the crisis situation is articulated and the issues, problems as well as potential solutions are identified. For those interactants that approached this phase as an interactive discussion, which I refer to as a joint situational analysis, shared mindfulness was largely facilitated by the presence of the following communication behaviors: (a) reasoning from a positive perspective; (b) perceiving multiple perspectives; (c) using participative language; (d) seeking information; and (e) fluid turntaking. Noteworthy is that Dyads 5, 6 and 7—the dyads that reached effective decision outcomes in both scenarios—demonstrated the highest levels of positive reasoning, perceiving multiple perspectives and fluid turntaking which are critical behaviors in this stage.
Dyads that interactively engaged in a situational analysis tended to create an optimal environment for a discussion that allowed for use of all the available data particularly if both interactants were reasoning from a positive perspective. This involved an open discussion and assessment of the current crisis situation. A phenomenon that was usually determined by the Captain's approach to the situational analysis discussion. This observation is consistent with concurrence seeking, or as Maier (1950) posits, there is a pressure in any group toward consensus of views unless the leader deliberately encourages alternative perspectives. How Captains presented information, their reasoning perspective, was critical to creating an accurate
perception of the current state. Those Captains who provided their view of the situation conditionally without expressing (concrete) commitment to a sole course of action provided optimal opportunity for an interactive situational analysis to occur.

I observed that one of the primary inhibitors of an interactive joint situational analysis was precognitive commitment (frequently on the part of the Captain) that was based on the premise of making a quick decision over a right decision. This mentality led interactants to perceive a sole solution; and therefore, they did not engage in the second stage, active problem-solving. Instead, they looked for data to support their decision option and discarded discrepant/disconfirming information without processing it.

Another extremely critical element in this stage was that the Captain facilitate turntaking. Overt dominance, particularly on the part of the Captain, would preclude turntaking and thus all the available information would not be put forth in the discussion. Overt dominance significantly impacted the formation of shared mindfulness in the situational analysis stage because it did not provide opportunity for substantive contribution by the other interactant.

In the active problem-solving stage, interactants discuss how to resolve the problem they identified in the situational analysis stage. Here they discussed the pros and cons of the possible alternatives. In this stage, especially important communication behaviors of shared mindfulness were identified as: (a) reasoning from a positive perspective; (b) seeking information, particularly noticing and accepting discrepant and disconfirming information; (c) acknowledging partner communication; (d) projecting
thoughts and feelings, and (e) perceiving multiple perspectives. Information seeking behaviors in the form of seeking input, noticing and incorporating discrepant and disconfirming information into the decision-making criteria were crucial to engendering shared mindfulness. Once more, what emerged from the data is that Dyads 5, 6 and 7 exhibited more of these behaviors (positive reasoning, projecting thoughts and feelings and perceiving multiple perspectives) than the other interactant pairs.

Acknowledgement of communication by responding substantively was critical in the problem-solving stage from the perspective of creating mutual understanding and an accurate depiction of the current state. Again, how they presented information (their reasoning strategy), whether they verbalized their thoughts so that their partner could follow their reasoning was extremely salient. Similarly relevant was projecting one's thoughts and feelings by verbally forming ad hoc procedures via walking through a proposed scenario including giving voice to one's concerns and reservations concerning the potential options. germane to the problem-solving stage was that interactants perceived and incorporated multiple data inputs in order to facilitate an effective decision outcome.

I observed that if one interactant demonstrated precognitive commitment early in the discussion and did the majority of the problem-solving, they tended to utilize a negative reasoning strategy and normally would not accept or incorporate any discrepant, additional or disconfirming information verbalized by their partner in the decision-making process. Contrarily, individuals who did not demonstrate precognitive
commitment and did not engage as actively as their partner in the problem-solving stage, after the decision was confirmed, these individuals remained open to disconfirming, new or discrepant information regarding the decision and frequently became most actively engaged at this stage while their partner demonstrated the lowest involvement after having made a decision, and would only give reasons that supported the decision.

Finally, in the decision outcome stage, if interactants jointly participated in the previous two stages, they normally actively participated in joint ownership of the decision. In this stage both participants provide input and take turns adding to the reasoning of the other partner in describing their rationale for their decision. Particularly evident in this stage were the communication behaviors of: (a) using participative language; (b) fluid turntaking; (c) seeking information; and (d) reasoning from a positive perspective. This phase was characterized by the use of inclusive "we" language in the decision explication in which interactants take turns building on or adding to each other's comments and thoughts. Consequently, their decision explanation incorporated the reasoning and input of both participants and that reasoning was congruent. Importantly in this final stage, two of the four critical communication behaviors, fluid turntaking and positive reasoning are those exhibited most frequently by Dyads, 5, 6 and 7.

In summary, those dyads that displayed the behaviors of shared mindfulness did lead to more effective decision outcomes. Throughout the three stages of the decision making process, Dyads 5, 6 and 7 demonstrated more shared mindfulness behaviors
which were instrumental to effective decision making. Therefore, I argue the research supports that the seven process categories of communication behaviors created shared mindfulness in an interaction to the degree that both interactants actively engaged in all three stages of the decision-making process. Thus, both partners actively participated in problem-solving in which they jointly contributed to accurately describing the current state and jointly demonstrated ownership of the decision outcome. Overall, Dyads 5, 6 and 7 demonstrated more of the behaviors of shared mindfulness and participated jointly to a larger degree in all of the decision making process stages, and ultimately, made the most effective decisions.

Discussion

This study sought to explore the existence of the concept of shared mindfulness, identify the communication behaviors associated with this psychological construct and investigate whether this phenomenon has an impact on effective decision outcomes. To achieve these objectives, I looked at communication in an aviation crisis context outside of the bounded episodes of performing routine procedures. In the following discussion, I examine whether shared mindfulness is a unique concept and discuss various patterns, connections and missing links that emerged from the data. Lastly, I consider shared mindfulness as a bridge between the decision process and decision quality.

Shared Mindfulness versus Collective Mind

studied collective mental processes and defined the collective mind as enacting a common environment in which individuals acquire a single transactive memory system in which each person is responsible for remembering his or her own part. In a transactive memory system, people retain related information in different locations such that when they exchange pieces of information, specific details and dissimilar ideas, they frequently perceive higher-level themes or generalizations that make the details and disparate pieces fit together. These collective mental processes are primarily enacted via the communication processes of the group members (Wegner, Giuliano & Hertel, 1985).

Are shared mindfulness and the collective mind the same concept by a different name? The current research study’s findings suggest that shared mindfulness is not the same construct as the collective mind. Rather, shared mindfulness is focused on individuals perceiving an accurate environment through sharing similar, disparate, discrepant and disconfirming information via specific communication behaviors that facilitate a shared mindful state. The focus of shared mindfulness is accurate perception so that the environment enacted is current, precise and factual. Whereas collective mind is focused on a common environment based on how the individuals in the group define it. This is evident in Janis's (1972) research on groupthink in which the group defines the current environment but it is based on the inaccurate perceptions of the individual members. In contrast, shared mindfulness is predicated upon an accurate depiction of the environment via an attending state of perceiving that is continually open to incoming data.
Shared mindfulness is more akin to Weick and Roberts (1993) definition of acting heedfully based on Ryle's (1949) explication, "People act heedfully when they act more or less carefully, critically, consistently, purposefully, attentively, studiously, vigilantly, conscientiously, pertinaciously (p. 361)." Weick and Roberts contend that the more individuals interpersonally act with heed the more developed is the collective mind. The upshot is the greater the capacity of the group to comprehend unexpected events that happen instantaneously and make better decisions. I suggest that the interpersonal development of shared mindfulness is requisite in order for individuals to act with heed. In this capacity, shared mindfulness functions as the prerequisite for creating a collective mind that is based on accurate perceptions rather than a common environment.

Major Factors that Affect Shared Mindfulness

The results of this study point to several overall key facilitators of shared mindfulness in an interaction as well as identify the primary inhibitors within an aviation context that sabotage it. By exploring these factors, we can better understand how shared mindfulness is connected to effective decision-making outcomes. Shared mindfulness appeared to be significantly enhanced in an interaction when the following elements were present: (a) interactants reasoned from a positive perspective; (b) interactants adeptly perceived and incorporated multiple perspectives; (c) interactants projected their thoughts and feelings in precise, concrete terms and used conditional terminology to describe the current state; and (d) interactants substantively acknowledged partner communication. Conversely, the presence of the following
behaviors either significantly hindered or precluded the formation of shared mindfulness in an interaction: (a) precognitive commitment; (b) non-positive reasoning strategies; and (c) overt dominance. Next, I address each of the above shared mindfulness facilitators separately. Specific inhibitors are addressed as points of contrast to the facilitator being discussed.

Reasoning is Pivotal

The perspective from which interactants reasoned was the single most important factor in whether shared mindfulness was facilitated in the interaction. As the study findings illustrate, if interactants reasoned from a positive perspective they noticed and incorporated both discrepant and disconfirming information. This behavior was especially paramount if either interactant had engaged in precognitive commitment because using a positive reasoning strategy helped the dyad remain open to changing their initial decision option in view of the discrepant and/or disconfirming information.

Conversely, if interactants reasoned from a negative perspective, they normally had engaged in precognitive commitment in which they had decided on a course of action based on one element as the primary evaluative criteria (i.e., the thunderstorm or emergency services) to the exclusion of other salient elements. Thus, they were less apt to notice discrepancy, disconfirming information or alternative possibilities for action. Hence, as Langer (1997) and Timmerman (2002) argue, they were operating without a category system such that all information would fold into a single category (e.g. thunderstorm) from which classifications were made. After having encountered
the new situation without actively attempting to interpret the details, they perceived only a single solution and mindlessly followed that option.

According to Weick and Sutcliffe (2001), in reasoning from a negative perspective, the interactants were not operating mindfully because they did not rework the ways they labeled and categorized what they saw. Rather, they discarded the information rather than process it and use it to further deliberate. In instances where one interactant used a positive reasoning strategy and the other a negative reasoning strategy, it appeared the person using a negative strategy was more likely to use non-fact based reasoning and emotional reasoning to support his/her position particularly if overt dominance behaviors were present. Additionally, he/she appeared unwilling to incorporate any discrepant or disconfirming information that would contradict the preferred course of action.

These positive and negative thought patterns are similar to what Manz (1992) suggests as **opportunity thinking** and **obstacle thinking**. Whereas opportunity thinking focuses on opportunities, beneficial challenges and constructive patterns of dealing with trying situations, obstacle thinking is focused on negative aspects such as reasons to give up or retreat from a problem altogether.

Dyad 4 (4:13), Scenario 2, provides a telling example that illustrates a full spectrum of facilitative and inhibitive communication behaviors (i.e., mixed reasoning strategies, precognitive commitment, overt dominance) that impacted the formation of shared mindfulness in this interaction.
In this dyad, the Captain was reasoning from a positive perspective considering both the available information and the discrepant information that was potentially disconfirming. The Captain acknowledged all of the First Officer's statements whether he agreed with them or not; moreover, he accepted her information and used it to change his decision (even though he had actually proposed the most effective option). But, unfortunately, he did not question her further about information she rejected, such as the headwind, which might have reversed the decision in his favor.

However, the First Officer was reasoning from a negative perspective; she utilized non-fact based reasoning, supporting her position by focusing on one element that was lacking, the emergency services at the smaller glider field. The First Officer did not acknowledge some of the Captain's questions or appear to take in information that contradicted her position (landing at the major airport). She made up her mind very early (precognitive commitment) and did not change her position based on any additional information from the Captain.

This was a very interesting interaction from an overt dominance perspective. The Captain clearly dominated the conversation verbally and nonverbally. He used several nonverbal power strategies such as maintaining eye contact; taking up a larger space; talking loudly but in a very measured tone. He invaded the First Officer's space and used intimidation tactics by utilizing a sarcastic tone at times and using his pen to wave it in her face.

On the other hand, the First Officer, although her nonverbals indicated she was intimidated by the Captain (i.e., her downward glance, her nervous hand movements
confined to a restricted space away from the Captain), she readily verbalized her disagreement and utilized overt dominance behaviors such as talkovers and nonacknowledgement of her partner's communication. As this was a male/female dyad with the female in the First Officer subordinate role, what, if any, gender/role nuances might have been present is unclear. Not surprisingly, this dyad made the ineffective decision to land at the major airport. The Captain begins the discussion from a positive perspective providing an overview of the available information.

Captain: "Alright, this is the situation." (Speaking forcefully) "Our engines are out; they are not restarting; we are 31,000 ft (using hand gestures for emphasis) and the small airport is 30 miles (points in front of him with pen) that way and we can get there within gliding range" (First Officer nodding affirmatively at different points indicating attentive listening.)

The First Officer begins reasoning from a negative perspective looking only at what is lacking.

First Officer: "But we aren't going to have any emergency vehicles or any emergency services when we get there" (says strongly while pointing her finger in the direction they have decided is the virtual airport under discussion).

Again, the Captain brings into the discussion positive information.

Captain: "But you have glider experience" (again forcefully looking directly at the First Officer and pointing his pen for emphasis).

First Officer: "Right."

Captain: (Available Information/Disconfirming Information) "So you know how to glide this thing right down in there because you've done it before (again very forcefully and pointing his pen toward the First Officer and then pointing to the virtual airport where she would land). "OR (emphasis) we could go to the major airport (pause) but we might not make it" (again pointing his pen in staccato movements in the air in the same rhythm as his words). I say we go to the small airport (points to the virtual airport, miles looks directly at the First Officer) "What do you think?"
The First Officer has engaged in precognitive commitment in which she is beginning to view all information through a single lens, the emergency services, folding all information into that category.

First Officer: "I would say go to the large airport" (looking directly at Captain, her voice is measured but sure and getting a little higher pitched).

Captain: "You want to go to the large one?"

First Officer: (Available Information) "Because we have all those emergency services waiting for us" (spreads out her hands).

The Captain brings in discrepant and disconfirming information but the First Officer is not accepting it and will only look at information that supports landing at the large airport.

Captain: (Discrepant Information) "Even though a headwind . . ."

First Officer: (Discrepant Information not incorporated into reasoning) (Talks over Captain) "Even if we were a little short . . . who knows there may be a huge highway . . . you know they could clear off."

At this juncture, the Captain's verbal and nonverbal behaviors become increasingly dominant. The First Officer's verbal and nonverbal behaviors are outwardly more submissive but yet are defiant. She is sending an incongruent verbal/nonverbal message to the Captain. The Captain makes several attempts to reintroduce discrepant information but becomes increasingly frustrated that the First Officer has engaged in precognitive commitment and will not accept and incorporate his input.

Captain: (Discrepant Information) "Or a huge building!" (The Captain keeps waving his pen in front of the First Officer's face. They have angled their bodies toward each other and are both quite animated at this point.)

First Officer: "True" (speaks softly).
Captain: (Reintroduces Discrepant Information) (The Captain is fidgeting in his chair while looking at the First Officer. The First Officer is not making eye contact rather she is looking down at her lap) "Ok. Let's think about this logically. Do we know what the headwind is? We don't know what the headwind is." (The Captain displays more aggressive body movements by moving more into the First Officer's personal space.)

First Officer: (Discrepant Information not incorporated into reasoning) (First Officer doesn't acknowledge the Captain's question) "Is the runway even big enough for us to get in there even if we glide down?"

Captain: (Looks directly at First Officer and says very forcefully) "I don't know. "That's the thing" (points his pen for emphasis).

After several more attempts to incorporate the discrepant information (i.e., the headwind) and the disconfirming information (i.e., we may not make it to the major airport), the Captain changes his decision after forcing the issue with the First Officer to acknowledge that she doesn't want to land at the small, glider field.

Captain: "Just say 'no'" (speaks loudly and forcefully; but is looking at the First Officer with a faint smile; his nonverbals are not congruent).

First Officer: "Okaay ... NO!" (The First Officer is nervously shaking her hand; looks at Captain) "Ok, we can't go there. Well ..."

Captain: "Let's go the major airport ... AND LAND (somewhat sarcastic tone) ... safely."

First Officer: "Sounds good." (The First Officer is looking downward and smiling uncomfortably, avoiding eye contact with the Captain and is speaking softly and rather meekly.)

Captain: "Try to get there at least" (somewhat sarcastically hitting his notepad on his knee repeatedly). "If we can't, then we don't. Oh well—but we are going to try; we are going to try to get there." (He holds up his fist and he is moving animatedly in his chair and is speaking loudly.)

As illustrated in the above excerpt, precognitive commitment seemed to be the most frequent cause of interactants choosing an alternative reasoning strategy from
which to support their position. Further, I noted a variant of precognitive commitment which I refer to as a *quick decision mentality* over a right decision mentality.

Individuals who engaged in this phenomenon appeared to focus solely on the time element of the crisis situation such that they were more concerned with making a quick decision before any or sufficient discussion with their partner rather than a right decision by adequately and accurately assessing the situation. Therefore, these individuals immediately decided on a course of action and reasoned solely from this option not accepting or processing alternative courses of action.

Interestingly, overt dominance behaviors appeared to hinder the creation of shared mindfulness even in the presence of positive reasoning because they stifle the other party's full participation and discrepant/disconfirming information, while recognized, is not incorporated into the decision-making criteria. Therefore, the interactants' decision-making quality is negatively impacted because they are not using all the information available to them to make the best decision. When an interactant was interrupted or talked-over mid-sentence and did not finish the thought, then, many times, that idea was lost. Unfortunately, that information might have been vital, discrepant or disconfirming information but remained "unprocessed" and consequently, could not be used in the deliberative process.

**Using a Kaleidoscopic Perspective**

Interactants who adeptly perceived multiple perspectives were the most cognizant of and most accurately depicted the current state. Although the ability to perceive multiple perspectives was a powerful element in creating shared mindfulness
it was significantly absent within the interactions. One reason why this behavior was not as evident might be due to the extensive routine, procedural-type training of flight crews in which they learn specific behaviors and task sequences in which there is a sole, pre-defined solution and only one "right" way to accomplish the task.

Consequently, for the most part, flight crews do not engage in viewing situations, problems or environments from a variegated perspective because most routine situations and environments contain a pre-set protocol of requisite behaviors and procedures. After multiple iterations of these "scripted" routines, when confronted with a unique, unscripted situation it may be they are depending on their existing categories from which to view the novel stimuli. For instance, in Scenario 1, 4 out of the 10 dyads chose the less effective decision to depart from runway 08. The aviation instructor in developing the decision effectiveness criteria notes that because the aviation student participants lack experience with thunderstorms, they will most likely choose this option because the winds are within limits. In essence, they will tend to categorize all information within an existing, familiar category rather than look at the novelty of the situation and look outside of that category for possible alternative options.

Those with the ability to see multiple perspectives seemed to be able to cognitively recognize the current state as outside the parameters of a script; and consequently, mentally acknowledged the novelty of the situation which prompted them to begin looking outside of their existing categorized schemas for the most effective option. In a study involving drawing distinctions about classical music, rap, a
football game and paintings, Brown & Langer (cited in Langer, 1992) found that considering multiple perspectives (in the form of drawing novel distinctions) resulted in improved retention and better liking of the target information. In a crisis situation, recalling critical pieces of information is crucial to making an effective decision.

Similarly, as Weick (1993) explains in the case of the Mann Gulch incident, 13 smokejumpers died because they didn't recognize until it was too late that they were not fighting the normal 10:00 fire. Their leader, Wag Dodge, did recognize it as a dangerous, non-routine fire, and based on the uniqueness of the situation, he looked outside of his existing categories of firefighting knowledge and found a novel option that was unknown at that time, he built an escape fire. He used his knowledge of fires—that they require a flammable material, and in those few seconds, he extrapolated beyond that knowledge and came up with a novel idea to remove the flammable material by burning it before the fire reached them; thereby, lessening the heat intensity. But when he ordered the men to lie down in the escape fire they refused and ran. Thirteen of the 15 who fled perished in the fire. Those who fled could not get beyond their categorized, scripted knowledge of firefighting and recognize that the current reality demanded a novel response.

For the majority of interactants in this study, with scripted behavior pretty much precluded because of the novelty of the crisis scenario, they resorted to precognitive commitment folding most of the information into one category (e.g., timing issue, availability of emergency services) and based their reasoning on this one salient factor to the degree that they folded all other information into that category and
information that did not fit was simply discarded. Such that when the Captain
questions the First Officer after they decide to land at the major airport, "What
happens if we don't make it?" Neither interactant actively processed this information
because it did not fit into the category of their decision criteria for choosing the major
airport. Amazingly, they just discarded the information thereby increasing the
likelihood of a catastrophic error in judgment that might result in a crash landing short
of the major airport. As a consequence, in the presence of disconfirming data
interactants normally did not change their decision.

The outcome of not perceiving multiple perspectives is that interactants engage
in two behaviors which Langer (1997) describes as strongly inhibiting mindfulness:
premature cognitive (precognitive) commitment and an overdependence on existing
categories which causes the interactants to disregard critical information.

**Speaking Thoughts and Feelings Aloud, Precisely and Conditionally**

The most important impact of interactants speaking their thoughts and feelings
aloud using precise, concrete terms appeared to be that it led to mutual understanding
quickly, which is critical in a crisis situation. This type of "thinking aloud" allowed the
other interactant to see/experience the partner's thought processes real-time. This
fostered mutual understanding from the perspective of having a base-knowledge of
where the other person was coming from in his/her reasoning so that conclusions
drawn from the reasoning were more credible and plausible.

Those individuals who actively engaged in this activity demonstrated a greater
propensity to construct an ad hoc procedure in which they walked through the steps of
reconstructing the tasks required to accomplish the decision option. Additionally, they appeared more apt to notice discrepant and disconfirming information and incorporate it into their plausible scenario planning. Thus, those dyads who actively voiced their thoughts and feelings created the most accurate depiction of the current state as well as the projected state because they mentally constructed it by verbally walking through the reconstruction of the tasks to achieve it. In doing so, they became aware of what was lacking or prohibitive to successfully accomplishing the goal. This aspect of perceiving multiple perspectives is most closely related to aviation's situational awareness in which individuals perceive and comprehend the meaning of the elements in an environment and can project their short-term future status. Utilizing this awareness, Weick and Sutcliffe (2001) contend that individuals fluidly make adjustments that impede errors from accumulating and enlarging. Research in the area of thinking aloud pair problem solving (TAPPS) supports this supposition. A fundamental element of TAPPS is verbalization. The technique is based on the premise that when working dyadically, verbalization of inner thoughts makes explicit the problem solving reasoning of the interactants thereby helping them to monitor their reasoning and identify errors.

In a study of the effect of TAPPS on troubleshooting ability using aviation technician students, Johnson and Chung (1999) found that TAPPS pairs solved 34 problems in four hours versus 30 problems in five hours for the non-TAPPS pairs. Overall results indicated those dyads using the TAPPS strategy completed the problem-solving task in a shorter period of time. Additionally, they solved individual
problems within the task in less time while gaining more experience in solving problems than pairs not using the technique. Moreover, there was a significant difference in the ability of TAPPS dyads to recognize the existence of faults in the system.

Although, a number of interactants in the current study demonstrated the behavior of speaking their thoughts and feelings aloud, in many instances it was not effective for two reasons. If interactants voiced their thoughts in a hesitant or questioning manner it did not facilitate shared mindfulness in the interaction as the other interactant did not appear to accept or process or give credence to information when presented in this manner; consequently he/she did not incorporate the information into the decision deliberation process.

Secondly, if interactants did not verbalize their thoughts and feelings in precise, concrete language ease of understanding was not achieved. To illustrate, in Dyad 7 (7:26), Scenario 2, within the same interaction, the Captain speaks his thoughts aloud in one instance precisely and in other instance, imprecisely.

Precise:

Captain: "Okay, we are at 3,1000 ft; it doesn't say anything about the glide range. And lets see (pause) it's 30 miles from the nearest field. One mile per gliding per thousand feet. 3,000-ft ceiling—looks like a crappy situation."

Imprecise:

Captain: "But if we have a major headwind and not too much gliding experience ...trying to reach that other thing (major airport) that's a problem (scratches the back of his head and looks at the First Officer; the First Officer rests his eyes on the Captain's notepad but nods affirmatively) I mean think about...it says we have a headwind component."
As illustrated above, projecting one's thoughts and feelings aloud without couching these statements in precise, concrete terms makes it much more difficult to achieve mutual understanding. For instance, the ambiguous phrase, "trying to reach that other thing" could have been interpreted a number of ways by the First Officer so it is not precisely clear what the Captain is referring to in this statement.

In an aviation context, it appears particularly important to use precise, concrete, standard terms so that an accurate description of the human and environmental conditions is presented. This is similar to the medical field in which a medical doctor conducting a surgical procedure must use precise, concrete, standard terms so that there is no confusion or misunderstanding among the medical team which might precipitate a potential fatal error to the patient undergoing the operation.

Using conditional language acknowledges the temporary, ever-changing nature of environmental conditions and thus it appeared to prompt mindfulness on the part of the interactants. I noticed that it was especially crucial for the Captain to use conditional and inclusive (we) language, particularly in the situational analysis phase, as the Captain and First Officer were less likely to engage in precognitive commitment in which they would fold all information into one category and fail to make critical distinctions or notice discrepancies and inconsistencies that could prove to be fatal errors.

Burgoon, Berger & Waldron (2000) identified conditional thought processes as one of three communicative relationships conducive to mindfulness in social interactions. It appears that the use of conditional language initiates mindfulness
because it stimulates interactants to notice discrepancies and inconsistencies. Further, introducing information conditionally has been found to prompt individuals to use that information in a creative manner (Langer, 1992), a potentially life-saving ability in a nonscripted crisis situation.

Moreover, in the presence of overt dominance, conditional language can be used as an assertive but non-threatening communicative tool. For example, as earlier noted in the results section, the First Officer provided a conditional response that alerted the Captain to a potential issue that the thunderstorms might be moving in faster than they had anticipated which could impede their taxi to the runway.

From a hierarchical perspective, using conditional language on the part of the Captain appeared to "level the playing field" and create a non-defensive environment such that it provided space for the subordinate to disagree or voice an alternative viewpoint. On the part of the subordinate, using conditional language was both an assertive but non-threatening approach to presenting one's input or opinion.

**Acknowledging Communication Substantively**

Although acknowledgement was the communication behavior exhibited most often in the study interactions (72 occurrences), most of those instances were simple acknowledgement (yes/no) rather than substantive.

Of import is that in those interactions in which the interactants made less effective or ineffective decisions, there was a pattern of acknowledgement but the acknowledgement was terse (i.e., responding to a question with a simple "no" without any supporting reason or explanation); thus, it did not lead to a large degree of shared
mindfulness because it did not allow the other interactant to understand how or why the other person reached that particular conclusion based on the available data. Or, if the acknowledgement was couched in abstract terms (e.g., {2:4} "It might be bad" — what might be bad, the 'it' was not defined).

For the most part, interactants demonstrated acknowledgement of partner communication but what was lacking was mindful acknowledgement that would be conducive to creating shared mindfulness. Mindful acknowledgement not only acknowledges the communication but it responds to the substance of the message communicated demonstrating that the partner has perceived and critically processed the intended meaning of the message. However, interactants primarily engaged in mindless acknowledgement in which they merely acknowledged that they heard the message but not that they had critically processed it to ensure understanding so that they could use that information to further deliberate.

Mindless acknowledgement was observed in three forms: (a) lack of critical thinking - partner communication is acknowledged but the interactants are not perceiving the environment accurately because they do not seek out any discrepant or disconfirming information; hence, they are communicating without utilizing critical thinking skills; (b) tangential response - the interactant acknowledges the other's communication but does not respond to the substance of that communication; or, (c) dominance - one interactant is displaying overt dominance and pressuring the partner into agreement.
The result of mindless acknowledgement was that the interactants would achieve congruence in their thought patterns but it was shared mindlessness. As illustration, Dyad 2 (2:6), Scenario 2, created shared mindlessness in which they did not perceive the environment accurately because they did not process the disconfirming information such as there was a headwind which meant they might not make it to the large airport. Additionally, they did not actively process the discrepant information. They didn't know the size of the glider field, they just guessed. Further, they didn't know the size of the plane. Thoughtlessly, they make no attempt to factor these elements into the decision criteria.

Captain: "You know the gliding field. But, personally, I wouldn't want to land a big plane at a glider airport."

First Officer: "Yeah. Are we going to land a 777 at Hastings?" (spoken in a sarcastic tone).

Captain: "No, not really, and it says it's five minutes out of gliding range and there is a headwind component; but, I would rather go to the emergency field."

First Officer: "Yeah, I would too; (laughs) well—it depends, small field is that Kalamazoo? Hastings?"

Captain: "I think it would be more like Hastings for gliding."

Those interactants who demonstrated substantive acknowledgement significantly enhanced the critical processing of information within the interaction which functioned to surface important elements that otherwise might have been overlooked.
Summary

This chapter explored research questions regarding the existence and nature of shared mindfulness as well as the connection of shared mindfulness to effective decisions. Findings also suggest that shared mindfulness exists under certain conditions and that shared mindfulness in enacted through a variety of complex communication behaviors. Further, study results support an affirmative response to the degree that individuals participate jointly in the three stages of the decision-making process. Overall, those dyads that exhibited the highest levels of shared mindfulness communication behaviors also made the most effective decisions.

In an aviation context, in which the decision process is no longer a solo but a shared activity, shared mindfulness provides a means to connect the decision process to decision quality. The communication behaviors associated with shared mindfulness identified in this study can provide a bridge to achieving effective decision outcomes.

Although the communication behaviors of shared mindfulness occur throughout the decision-making process, some are more salient in a particular stage and/or role in that phase than others. For example, conditional language occurs throughout the decision-making process but it is particularly significant in the situational analysis stage. Moreover, it is especially important in the Captain's role how information is initially presented and assessed. Therefore, it is valuable for interactants to understand how the communication behaviors of shared mindfulness occur throughout the decision process and how specific behaviors impact certain stages and roles in that process.
In the final chapter of this thesis, I will summarize conclusions and provide some practical suggestions for implementation of the findings.
CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this qualitative research project was to extend the psychological construct of mindfulness by exploring it from a communication perspective. Specifically, this study investigated the existence, creation and maintenance of shared mindfulness in aviation cockpit crisis situations. Chapter One presented the study’s rationale and research questions. Chapter Two provided a detailed review of the literature which provided the theoretical foundation for the study. Here, I drew upon scholarship from the disciplines of communication, psychology, management, and aviation. Building upon this past research, Chapter Three outlined the methodological framework and procedures of this study. Chapter Four presented my research results, specifically describing a seven-theme typology of shared mindfulness consisting of definitional properties and associated communication behaviors. Further, this chapter provided primarily qualitative evidence linking the enactment of shared mindfulness to more effective decision-making processes in crisis situations. Here, in Chapter Five, I present conclusions and recommendations for both theory and practice based on the study findings.
Conclusions

Extending Mindfulness Theory

In this research, I ventured into an, as yet, uncharted territory of mindfulness theory (Langer, 1989a), the construct of shared mindfulness. Fundamentally, this study sought to explore a different perspective of mindfulness — the conjoint mindful state created through interaction which has not been previously studied. Past research has indicated the psychological characteristics of the trait and state of mindfulness, yet researchers have not fully considered the importance of communication in the construction of mindfulness. The study findings support the extension of mindfulness theory from the individual cognitive level to the interpersonal communicative level and highlight the salience of symbolic interaction to the mindfulness process. This research indicates that shared mindfulness does exist and is constructed by individuals via specific communication behaviors.

Expanding the definition of mindfulness to include shared mindfulness opens new venues for expanding theory in terms of understanding how mindfulness operates at an interpersonal level. Increased knowledge and understanding of mindfulness as an interactively shared process can significantly impact multiple areas of import such as group performance, organizational communication and decision-making processes. For example, this study's findings illustrate that shared mindfulness is an important factor to the enactment of effective decision-making in crisis situations. Shared mindfulness may yield similar utility when exploring the decision-making activities of other types of organizational situations.
This research creates a communicative bridge from the cognitive construct of shared mindfulness to its enactment in the environment via discursive processes. As a consequence, the communication behaviors of shared mindfulness identified in this study directly translate the theoretical, conceptual framework into application. Future lines of interpersonal research in this area may include providing in-depth situated knowledge of how shared mindfulness is communicatively enacted in other dyadic situations as well as larger group contexts.

Perhaps most noteworthy, in high reliability organizations (HRO's) such as the aviation and technology industries, extending mindfulness into shared mindfulness provides a venue to move beyond habitual, scripted performance in which each performance is merely a reproduction of the last. In mindful performance, every action is modified or varied as required based on the previous action (Ryle, 1949; Weick & Roberts, 1993). Consequently, rather than relying on drill and repetition, shared mindfulness at a communicative level, allows individuals to conjointly create a current, precise, factual environment. The results of shared mindfulness have the potential to yield positive organizational and individual outcomes, such as reduced human error, increased performance, and higher quality of work production.

**Implications of Research Findings to Aviation Crisis Decisions**

The communication behaviors explicated in this study provide a rich repertoire of interpersonal communication tools to create shared meaning at an interaction level. Ultimately, the enactment of these behaviors may create a shared mindful state so essential to effective crewmember performance.
Aviation research shows that over 70% of aviation mishaps are related to crewmember coordination and communication issues rather than a lack of technical skill (Lautman & Gallimore, 1987; Smith, 1979). Further, in dual-piloted scenarios error ratios have increased rather than decreased (Shappel & Wiegmann, 1996). Moreover, the industry acknowledges that the basic premise of Crew Resource Management (CRM) to reduce the number and severity of aircrew errors has been thwarted (Helmreich, Merritt & Wilhelm, 1999). A focus on crew coordination and participation, if lacking in mindfulness, will not reduce error. Overall, this situation suggests that even a small improvement in crew interaction and communication will have a significant impact.

One of the most important findings from this study is the centrality of dyadic reasoning to the facilitation of shared mindfulness. Overall, the three dyads that made the most effective decisions visibly and consistently exhibited positive reasoning behaviors during the crisis scenarios. This finding is particularly salient in impacting what Trollip and Jensen (1991) refer to as the poor judgement chain which is the result of a series of bad decisions or errors rather than one bad decision.

According to the current study findings, the perspective from which individuals reason during the phases of the decision-making interaction determines how open and accepting they are of inconsistent, discrepant and disconfirming information. Ignoring or discarding this type of vital information will lead to inaccurate assumptions, guesses and probabilities over factual realities that could result in a series of decisional errors, which ultimately may be catastrophic. This result is supported by Durso, Truitt,
Hackworth, Crutchfield, and Manning's (1998) study of air traffic controller operational errors and situational awareness. Findings showed that "aware" controllers made significantly more thinking mistakes (i.e., poor judgement, reasoning, erroneous assumptions) than attentional, perception or memory mistakes. In other words, even in a mindful state, if individuals reason from a non-positive perspective, it leads to mindlessness and results in error.

The results of this study further found that the most problematic effect was that precognitive commitment functioned as a two-headed dragon in inhibiting the formation of shared mindfulness in interactions. Interactants who engaged in precognitive commitment generally used a non-positive reasoning strategy (negative, non-fact based, questioning) and were not able to perceive multiple perspectives. As a result they tried to fit all the available data into one salient category (i.e., the availability of emergency services) and discarded any information that did not fit in that category. Therefore, participants were operating from the dangerous perspective of thinking they knew more than they actually did. The result was that they did not have an accurate perception of the current state.

Communication behaviors were identified in the findings as having a facilitatory effect in precluding interactants from engaging in precognitive commitment: using conditional language, verbalizing thoughts, and fluid turntaking. First, presenting thoughts, opinions and viewpoints in conditional language, particularly in the Captain's role, created an environment in which both participants were able to share information freely and non-defensively which also tempered exhibiting overt dominance behaviors.
Additionally, it allowed the partner to disagree or bring into the discussion information that refuted or contested the reasoning of the other partner. Consequently, if one partner was reasoning from a negative perspective, when information was presented conditionally, the other partner could identify the fallacy in the reasoning in a non-defensive, non-threatening but assertive manner. This allowed the other party to "save face" because his/her viewpoint was positioned conditionally such as: "the thunderstorms might be moving faster and cause a delay" or "we could land at the major airport if the headwind component isn't a significant factor." The outcome was that more discrepant and disconfirming information was brought into the discussion so that interactants were making a decision based on an accurate perception of the current state.

Secondly, verbalizing one's thought processes precisely and in concrete terms allowed the partner to "see" or experience the other interactant's thought processes real-time. With this base knowledge of where the other person was cognitively coming from, it assisted the dyad in creating shared meaning and mutual understanding quickly. Moreover, two processes stimulated two essential functions that prohibited precognitive commitment. Thinking aloud acted as a mechanism to stimulate an awareness of discrepant or disconfirming information and also prompted the dyad to verbally reconstruct the task procedures per the contingencies of the crisis situation. The ability to reconstruct the task environment was critical in demonstrating to the dyad whether they had chosen the most effective decision option.
Finally, fluid turntaking inhibited precognitive commitment because it minimized overt dominance behaviors (e.g., talkovers, interruptions); therefore, it allowed for full participation by both parties in the deliberative process. Interactants were using the maximum amount of data because they were both adding, clarifying and seeking information. Consequently, interactants could build on each other’s information and extrapolate beyond the available information which facilitated scenario planning and restructuring procedures based on the crisis situation. As a result, interactants were more open to seeing various options and alternatives as opposed to one course of action because they maximized the amount of data they noticed and incorporated into the deliberative process.

With increasing globalization and the rise of company takeovers and mergers in the aviation industry, more and more cockpit crews represent diverse cultures. The results of this study may also prove beneficial from an intercultural Crew Resource Management level. Several of the communication behaviors identified in this study as facilitatory to creating shared mindfulness are culture-inclusive of high power distance and collectivistic cultures. For instance, using conditional language is non-threatening to a high power distance hierarchical structure. Perceiving multiple perspectives is germane to collectivistic cultures which emphasize interdependence and valuing the input of the group. A defined set of specific communication behaviors is supportive of high uncertainty avoidance cultures such as many Latin American countries. Concurrently, for low uncertainty avoidance cultures like the U.S., the ability to work outside of the box in terms of making fluid adjustments due to situational demands is
enhanced through the communication behaviors of shared mindfulness because they facilitate an accurate perception of the current state.

**Limitations and Future Directions**

Because of this study's exploratory nature, more research is needed to corroborate the findings in terms of identifying the communication behaviors of shared mindfulness in diverse contexts outside of aviation. Therefore, because the typology was developed on the basis of one aviation context-bound study, the findings can not be generalized beyond that specific setting. In the future, this study could be extended to other aviation contexts to explore the influence of varying research sites, different participants, scenarios etc.

Additionally, study interactants were senior-level aviation students not experienced pilots who represent the majority of cockpit crews currently flying our world’s airspace. Although they had a base knowledge of aviation, they lacked the full repertoire of behaviors, knowledge and experience of the general pilot population. Consequently, communication behaviors conspicuously absent in the study interactions such as information seeking behaviors and substantive acknowledgement may not represent the level of these communication behaviors present in the general pilot population. Future research should investigate the experienced pilot population to determine the generalizability of the communication behavior findings across both the inexperienced and experienced pilot populations.

Although attempts were made to simulate the aviation crisis environment, participants were not interacting in the actual (simulated cockpit) environment which
may have impacted their ability to respond cognitively and physiologically to the crisis as they would if they had been in more realistic crisis conditions. Additional research in the simulated environment could more closely duplicate the aircrew's physical environment and determine any cognitive and/or physiological mitigating effects on interactants.

Two of the 10 dyads were gender mixed and one dyad was interculturally mixed. These characteristics may also have impacted the interaction dynamics, and therefore, affected the communication behaviors of the interactants. Gender and cultural dynamics were outside of the scope of the current study, but what effects these dynamics have on the aircrew's ability to communicatively create shared mindfulness is a salient consideration for future study.

Lastly, the current study centered on the interactants' conjoint state of mindfulness. Although I collected data via the Personal Outlook Scale that measures the individual's propensity to mindfulness or a disposition of mindfulness, analysis of the data was beyond the scope of the current study. Future research could explore whether those interactants in dyads who exhibited high levels of the communication behaviors of shared mindfulness (e.g., findings indicated they also made the most effective decisions) or state of mindfulness also exhibit the trait or disposition of mindfulness.

In sum, this study sought to determine whether shared mindfulness exists in an interaction and identify the communication behaviors of that psychological construct.
The findings indicate seven process categories of communication behaviors are associated with the construction of shared mindfulness in an interaction.

Through examining these communication behaviors in an applied setting, we can enhance our understanding of how salient psychological constructs such as shared mindfulness are communicatively enacted in the environment. As a result, we advance theory building; and simultaneously, put shoes on the theory in the form of specific enactment behaviors in the environment.

Recommendations

Based on the study findings, I propose a three-pronged strategy for practical implementation of the communication behaviors of shared mindfulness in an aviation setting: (a) awareness; (b) education; and (c) research.

Awareness

Overall, of primary import is to increase aircrews' awareness of both how and what they communicate. Before aircrews can operate with conjoint mindfulness, they need to understand how their verbal and nonverbal communication impacts their ability to create an environment conducive to shared mindfulness. This study shows that the interactants reasoning perspective, whether they verbalize their ideas, how they categorize information, and if they use precise, concrete, standard terminology to express their thoughts, is particularly important in the decision-making process.

Fundamentally, this awareness deals with a basic mindset change in how individuals view their communication and its impact on effective decision making and overall successful performance. Therefore, the emphasis should not be on rote
application but on mindful application. For example, a rote application would emphasize, "In this situation, I specifically say this or that. "Whereas a mindful approach would question, "In this phase of the decision making process, am I reasoning positively? Am I too focused on one element instead of looking at all the possible alternatives? Have I presented my viewpoint conditionally without talking over or interrupting my partner?" Therefore, awareness is central to individually and organizationally shifting the mental model from a rote to a more mindful pattern of behavior.

**Education**

Unfortunately, educational avenues tend to nurture passivity and superficial learning based on rote behavior, or in other words, they instill mindlessness (Langer, 1997). Harvard University researchers, Ritchhart and Perkins (2002) define mindfulness as "a facilitative state that promotes increased creativity, flexibility and use of information, as well as memory and retention" (p.29). Further, they contend that mindfulness depends on the flexible transfer of skills and knowledge to new contexts in conjunction with the ability to think both critically and creatively. As a consequence, instructional settings need to instill a disposition toward mindfulness that goes beyond a set of instructional techniques. Richhart & Perkins (2002), posit that dispositional mindfulness consists of three elements: (a) *sensitivity* - an alertness to occasions for engaging in a particular behavior; (b) *inclination* - the motivation necessary to carry out the behavior; and (c) *ability* - the capability to carry out a behavior. To cultivate a disposition to mindfulness requires attention to developing these elements in students.
For example, the aviation instructional setting could benefit from investigating and applying instructional techniques that go beyond the scripted, rote instructional formats to those which inculcate mindfulness.

Ritchhart and Perkins (2002) identify three practices that can facilitate developing the dispositional elements of mindfulness in students. The current study findings identified communication behaviors of shared mindfulness that were lacking in the interactions which correspond to the following identified practices of: looking closely, exploring possibilities and perspectives and introducing ambiguity. For example, looking closely refers to cultivating an openness to new information from a sensitivity perspective. Thus, looking closely addresses an area significantly lacking in the current study interactions, information seeking behaviors particularly in being open to discrepant and disconfirming information. Langer (1997) describes an instructional technique based on the idea of looking closely that was developed by Jerry Avorn of Harvard Medical School. Students are given the results of a research study with the main variables reversed and then are required to provide an explanation for the so-called "facts." For the most part, the greater number of reasons students generate to support the facts the more apt they are to believe them. In seeking to justify the results, the students box themselves into a single view (precognitive commitment). Having used this technique in the classroom herself, Langer observes that when students are told the facts are actually the opposite of what was presented, they get the point without further discussion.
Exploring possibilities and perspectives has to do with adopting another's perspective and considering alternative possibilities. Again, this dispositional mindfulness element corresponds to another communication behavior significantly absent in the study findings, perceiving multiple perspectives which involves such elements as an other orientation and the ability to incorporate multiple data inputs.

Finally, introducing ambiguity involves dealing with situations that involve vague, unknown, half-formed, or rapidly changing elements. These types of situations remove us from our comfort zone of the familiar. In order to instill mindfulness in ambiguous situations requires learning to look at the situation from a conditional rather than an absolute manner. Information is presented in a conditional as opposed to an absolute format. For instance, identifying the stress of urban life as this "may be" or "could be" the cause of urban flight. In the current research study, conditional language is a communication behavior that was particularly potent in creating shared mindfulness in the interactions and was a powerful deterrent to individuals engaging in precognitive commitment and overt dominance behaviors, the primary inhibitors of shared mindfulness.

Implementing a more mindful instructional environment requires a shift in the student's role from a passive learner of rote memorization to an active learner of making sense of the situation and responding accordingly via flexibly appropriate behaviors over rigid, rote behaviors. Of course, this does not mean the eradication of routine, procedural instruction but rather the introduction of mindful instruction so that aviation students learn to respond within their existing category systems, but also
are taught how to look outside of them, and can do so, when necessary, particularly in crisis situations.

Research

As the body of aviation research clearly articulates, communication and mindfulness are critical to successful Crew Resource Management (CRM) (Lautman & Gallimore, 1987; Palmer, Lack & Lynch, 1995; Chute & Weiner, 1996; Durso, Truitt, Hackworth & Crutchfield, 1998; Helmreich, Merritt & Wilhelm, 1999; Skitka, Mosier, Burdick & Rosenblatt, 2000). Error-free performance in a high reliability organization is not an option, it's the only means of survival. The typology of communication behaviors of shared mindfulness identified in this study as well as the relationship demonstrated between those exhibiting these behaviors and consequently making more effective decisions, points to the importance of continuing this line of communication research within the aviation industry.

Developing further understanding of not only the state of mindfulness, but the dispositional or trait of mindfulness, could provide a means to develop effective crew resource management measures to identify those individuals who interactively exhibit high levels of shared mindfulness; and therefore, demonstrate the greatest propensity to construct an accurate current state. Perceiving an accurate current state is critical to effective decision making, particularly in a group context and in a non-scripted situation.

In addition, outside of aviation, this study has broader application to further the extant communication research and could significantly contribute to expanding our
understanding in various areas. For example, of import to crisis communication, this study identifies crucial communication behaviors within interactions that facilitate the creation of shared meaning and ultimately, to perceiving an accurate shared state which is vital in crisis situations. Future research could explore the behaviors of shared mindfulness as they relate to crisis communication overall as well as in venues outside of high reliability organizations. Or specifically, shared mindfulness communication behaviors as they contribute to different stages of crisis communication planning such as contingency planning, logistics planning or crisis response planning.

From a decision-making perspective, this study looked at the discourse within a dyadic decision-making process and identified those specific communication behaviors in the formation of shared mindfulness that significantly impact each stage of the process. Continuing this line of communication research may further identify specific discursive tools and practices to achieve effective decision outcomes by connecting shared mindfulness to decision quality.

In conclusion, the exploration of shared mindfulness revealed the importance of communication in the enactment of this construct in the environment and its implications to effective decision outcomes. Viewing shared mindfulness from a communicative perspective offers important pragmatic and theoretical applications. First, by demonstrating its existence and identifying the communication behaviors in the construction of shared mindfulness. Second, by promoting awareness of those behaviors facilitatory and inhibitive to the formation of shared mindfulness in an interaction. Third, creating a mindful learning environment conducive to shared
mindfulness via mindful instruction. Lastly, continuing the various strains of research on shared mindfulness mentioned in this study including investigating the dispositional aspect of mindfulness as it relates to the creation of shared mindfulness in interactions.
Appendix A

Scenario 1 (Scenario 1, Instructions, Decision Criteria and Effectiveness Rating)
You are the Captain and First Officer of a Corporate Jet just about to taxy for runway 26 at the airport used by your company. There will be no delay on your departure if you taxy by 2.00pm, because it is a 10 minute taxy and at 2.10pm the airport will be closed for two hours because Air Force 1 is due to arrive with the President on board. You have also been made acutely aware, by the company owner who is sitting in back in the passenger cabin, that an on-time departure is crucial to winning a huge new contract that may save the company from bankruptcy.

You notice a thunderstorm about 2-3 miles off the up-wind end of the runway, i.e. 2-3 miles from the threshold of runway 08. You could possibly execute a tailwind take-off on 08, but the wind is reported as 260/05 and you have a maximum permissible tailwind component of 10 kts. You are also very aware that to get to runway 08 would require a long and time consuming taxy, up to 20 minutes, so if you are going to do this you will need to taxy even sooner.

The time is now 1.45pm.
SCENARIO 1 INSTRUCTIONS

(The scenario administrator will randomly assign the role of Captain and First Officer to each participant)

Introduction Script

Hello, I am your scenario administrator. Thank you for being willing to participate in this experiment. If at any time during the experiment you wish to cease participation you may freely do so by requesting the experiment be stopped. You may then leave and return to your classroom without any personal repercussions or impact to your LOFT class grade, as this experiment is not related to your classroom performance.

Instruction Protocol

I am going to give you a scenario. You will have 1 minute and 45 seconds to read the scenario. You may not speak with your team member while reading the scenario, but you may take notes, if you'd like. At the buzzer, you must stop reading and give the scenario back to me.

At 1:45 minute buzzer:

Administrator: OK, STOP; GIVE ME THE SCENARIO PLEASE

(Interactant I) Assume the Role of Captain (or 1st Officer)
(Interactant II) Assume the Role of First Officer (or Captain)

You have two minutes to discuss what you are going to do and make a decision. What do you say or do to resolve this situation?
You may now begin (Administrator starts two-minute timer)

At the two-minute buzzer:

Administrator says: OK, STOP.

Administrator to ask the interactants the following questions.
1. What is your decision?
2. Why did you make that decision?
3. Did you agree?

Administrator: We are now ready to complete scenario two.
SCENARIO 1
DECISION CRITERIA AND EFFECTIVENESS RATING

They should discuss motives first — "Hey, the cards are on the table".

The issue of being on time is really not a significant factor—going for either runway could achieve that.

Overriding issue should be SAFETY.

Decision Options/Effectiveness Rating

1. Take off on runway 26 and avoid the thunderstorm.

2. Allowing for the fact that participants have little if any knowledge of aviation—in particular, thunderstorm hazards—they will probably choose the 08 take-off. The wind is within limits.

3. Delay the take-off.
Appendix B

Scenario 2 (Scenario 2, Instructions, Decision Criteria and Effectiveness Rating)
You are cruising at 31,000ft when all engines stop. The Captain attempts to relight them without success and set up an all engines failed range descent.

Your position is 30 miles from a small civilian airfield used mainly for gliding which has a cloud base at 3,000ft. The airfield is familiar to the First Officer. The nearest major airfield with full emergency facilities is on the extreme limit of your gliding range, and you would have a head-wind component to reach there.

The 1st Officer is inexperienced on type, but has gliding experience. However, you also recognise that the nearest major airfield has full emergency services but your are not convinced the aircraft could reach the major civilian airfield.

In just 5 minutes time, the major airfield will be out of gliding range.
SCENARIO 2 INSTRUCTIONS

(The scenario administrator will assign the opposite roles to the participants in the second scenario. The role of CAPTAIN to the participant who played the role of 1st Officer in the first scenario and FIRST OFFICER to the participant that played the role of Captain in Scenario 1)

Instruction Protocol
I am going to give you a scenario. You will have to 1 MINUTE & 45 SECONDS to read the scenario. You may not speak with your team member while reading the scenario, but you may take notes, if you'd like. At the buzzer, you must stop reading and give the scenario back to me.

At 1:45 Minute buzzer:

Administrator: OK, STOP; GIVE ME THE SCENARIO PLEASE

(Note: Administrator ensures interactants are assigned opposite roles to that of the first scenario)
(Interactant I) Assume the Role of Captain (or First Officer)
(Interactant II) Assume the Role of First Officer (or Captain)

You have two minutes to discuss what you are going to do and make a decision. What do you say or do to resolve this situation?
You may now begin (Administrator starts two-minute timer)

At the two-minute buzzer:

Administrator says: OK, STOP.

Administrator to ask the interactants the following questions.
1. What is your decision?
2. Why did you make that decision?
3. Did you agree?

Exit Script:

Thank you for your participation. Do not say anything about this exercise to others when you return to class.
SCENARIO 2
DECISION CRITERIA AND EFFECTIVENESS RATING

Again, watch for motives. Does the 1st Officer want to go to the nearest airfield just to show what he can do? Or is it because he feels it's safer?

They should always arrive at the SAFEST option.

Decision Options/Effectiveness Rating

1. Put the airplane on the ground at nearest suitable airport (small civilian airfield 30 miles away).

2. Attempt to make it to the major airfield.
Appendix C

WMU College of Aviation Approval to Conduct Research
February 11, 2003

Robert Aardema, Interim Dean
William Rantz, Interim Chair
College of Aviation
Western Michigan University
237 N. Helmer Road
Battle Creek, MI 49015

Re: Approval to Conduct Research at WMU College of Aviation

We agree to support the efforts of Jan Krieger, WMU Communication Graduate Student, in her thesis program and grant our approval for her research on the Communication Behaviors of Shared Mindfulness to be conducted at the College of Aviation in the March/April 2003 timeframe. We agree to support the research study in the following manner.

**People Resources.** We will provide the following:
- People resources in terms of access to a voluntary sample of 30 senior-year participants of two LOFT classes (9:00am Thursday/3:30pm Wednesday sections) at the Aviation Education Center.
- An instructor resource to develop effective decision criteria and clarify technical language.
- Informational contact, Lisa Perry for any questions regarding onsite facilities, students, procedures, etc.

**Facility Resources.** We will provide the following:
- Classroom space to the conduct study in terms of use of LOFT classrooms to conduct the study survey questionnaire and an additional classroom to conduct the videotaped dyadic interactions.

Upon completion of the study, Jan Krieger will provide the WMU College of Aviation a detailed report of the study findings and any appropriate recommendations/conclusions based on the study data.

Robert Aardema, Interim Dean
Western Michigan University College of Aviation

William Rantz, Acting Faculty Chair
Western Michigan University College of Aviation
Appendix D

Human Subjects Institutional Review Board Clearance
Date: March 25, 2003

To: Julie Apker, Principal Investigator
    Jan Krieger, Student Investigator for thesis

From: Mary Lagerwey, Chair

Re: HSIRB Project Number: 03-03-05

This letter will serve as confirmation that your research project entitled “Shared Mindfulness Communication Behaviors in Effective Pilot Decision-making” has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: March 25, 2004
Appendix E

Human Subjects Institutional Review Board Approved Consent Form
Consent Form

Principal Investigator: Julie Apker, Ph.D.
Co-Principal/Student Investigator: Jan Krieger

You are invited to participate in an important research project entitled "The Communication Behaviors of Pilot Interactions in a Crisis Situation." The purpose of this experiment is to identify the communication behaviors in crew interactions in a crisis situation to determine whether those communication behaviors have an impact on effective pilot decision outcomes.

You will be asked to participate in two videotaped crisis scenario interactions with another aviation student. In each crisis scenario you will first read through the scenario and then you will be asked to discuss the problem with your partner, and subsequently, to make a decision as to what you will do to solve the problem.

By reading and signing an informed consent statement, you are agreeing to participate in this study. Participants help is appreciated but not necessary. Participation is strictly voluntary. An alternative assignment/activity will be provided if participants do not choose to be involved in the study. There will be no prejudice or penalty if you choose not to participate or if you choose to stop your participation once you have started. If you decide to participate, the investigators will keep confidential all information related to this research study to the extent permitted by applicable laws and regulations. This information will be kept in a locked office of one of the researchers for at least three years.

Your participation is valuable as it will help us make recommendations on communication practices that may lead to more effective decision making; and ultimately, to reduced crew error in crisis situations. In addition, study participants may benefit by potential improvements within their work environments based on the results of the study.

As in all research, there may be unforeseen risks to the participant. You may choose to stop your participation at any time. There will be no adverse effects in your class if you decide not to participate. A possible benefit to participating in this study is that your input will help further the knowledge of communication behaviors in crew interactions and how they impact effective decision outcomes in crisis situations. You will be compensated for your participation by being eligible for a drawing of one winner of a $50 American Express Check. Approximate odds of being the drawing winner are 1 in 30. In addition, refreshments will be provided upon completion of your participation in the experiment.

If you have any questions, please contact Dr. Julie Apker at (269) 387-3140 or Jan Krieger at (269) 428-5247. Concerns or questions about the study can also be directed to Mr. William Rantz, Interim Chair, College of Aviation at (269) 964-6993. Participants may also contact the chair of the WMU Human Subjects Institutional Review Board at (269) 387-8293 or the WMU Vice President for Research at (269) 387-8298.

This document has been approved for use for one year by the WMU Human Subjects Institutional Review Board as indicated by the stamped date and signature of the board chair in the upper right corner. You should not participate in this project if the corner does not have a stamped date and signature.

Your signature below indicates you have read and/or had explained to you the purpose and requirements of the study and that you agree to participate.

Signature ___________________________ Date ___________________________

Your signature also indicates you understand that your participation will be videotaped and that the videotape will be used for research purposes.

Signature ___________________________ Date ___________________________
BIBLIOGRAPHY


