LAW ENFORCEMENT DECISION MAKING DURING CRITICAL INCIDENTS: A THREE-PRONGED APPROACH TO UNDERSTANDING AND ENHANCING LAW ENFORCEMENT DECISION PROCESSES

LAURA A. ZIMMERMAN

Department of Psychology

APPROVED :

_____
Roy S. Malpass, Ph.D., Chair

_____
Harmon M. Hosch, Ph.D.

_____
Christian A. Meissner, Ph.D.

_____
Osvaldo F. Morera, Ph.D.

_____
S. Fernando Rodriguez, Ph.D.

_____
Pablo Arenaz, Ph.D.,
Dean of the Graduate School

For Virginia VandenBergh, thank you for giving me strength and courage.
For Devroux MacKay, I did it for both of us.

LAW ENFORCEMENT DECISION MAKING DURING CRITICAL INCIDENTS: A THREE-PRONGED APPROACH TO UNDERSTANDING AND ENHANCING LAW ENFORCEMENT DECISION PROCESSES

by

LAURA ANN ZIMMERMAN, B.A., M.A.

DISSERTATION

Presented to the Faculty of the Graduate School of

The University of Texas at El Paso

in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

Department of Psychology

UNIVERSITY OF TEXAS AT EL PASO

May 2006

ACKNOWLEDGMENTS

First, I would like to acknowledge Dr. Roy Malpass, who provided immeasurable support and guidance throughout my graduate career. His experience and advice provided a road map, without which I would not have been able to navigate successfully though graduate school. I would also like to thank my dissertation committee: Dr. Harmon Hosch, Dr. Chris Meissner, Dr. Oswaldo Morera, and Dr. S. Fernando Rodriguez, for their valuable advice and support during the dissertation process. In addition, my sincerest gratitude goes to Vince Pokluda and the staff at the El Paso County Sheriff's Academy who allowed me to enter their world and gave me an education in police training and operations. In addition, thank you to the El Paso County Sheriff's Department and El Paso Police department for allowing me to conduct my dissertation research. Special thanks goes to Deputy Robert Horstman, for providing advice and assistance as both a peace officer and an academic. Further, thanks goes to Dr. Karol Ross of Klein Associates, for her invaluable guidance as I embarked on this new area of research. My overall academic and professional development was greatly enhanced by the ongoing support and friendship of Dr. Chris Meissner, Dr. Otto MacLin, Dr. Steve Clark, Dr. Colin Tredoux, and Dr. Dawn McQuiston-Surrett. Further thanks goes to Lisa Topp, Mary Rigoni, Alex McNeal, and Jessica Belisle, their assistance with interviewing and data processing made this project possible. On a personal note, I would like to thank Dr. Dolores Hernandez and Dr. Tanya Taylor, my closest friends, who stood with me through good times and bad, offering inspiration, advice and camaraderie throughout graduate school. Also, my family, Barbara Murphy, Robert Zimmerman, and Marni Zimmerman, who have continually supported me throughout my winding life journey.

ABSTRACT

Decisions made by police officers in dynamic situations with ambiguous information, time pressure, and high-stakes outcomes, are often attributed to intuition and more precise explanations about what led to these decisions are often not offered. Perhaps this is because little is known about the factors that contribute to officers' decisions, or about how experience influences those decisions. This study investigated how novice and experienced police officers processed information and determined courses of action when making decisions during high-stakes critical situations. Thirty-five peace officers from El Paso County Sheriff's Office and El Paso Police Department participated in this three-part study. Officers participated in (a) live simulated training scenarios, (b) a post-event interview, designed to gather in-depth information about decision making processes, and (c) a cognitive skills training course designed to improve ability to make decisions during critical incidents. Analysis of interview data revealed differences between novice and experienced officers. Experienced officers tended to focus on assessing the situation and applying mental models to the situation, while novice officers focused on procedures, the subject's and their own actions. Detailed explanation of police decision processes and decision tasks are presented, along with implications for future research and training.

TABLE OF CONTENTS

Chapter 1

INTRODUCTION

Threat assessment and crisis aversion have become focal points of both federal and local law enforcement in the wake of the 9/11 terrorist attacks. Law enforcement agencies have been striving in the years since 9/11 to improve their ability to determine when an attack is about to take place, to recognize when an attack is underway, and to respond in an effective manner. This stems not only from reaction to the response on 9/11, when decision making was severely hindered by lack of information and communication, but also because there has been a shift in law enforcement duties from fighting street crime to proactively securing the U.S. from international and national terrorist actions. The extreme circumstances of 9/11 highlighted the importance of effective decision making during critical incidents and has made it necessary for law enforcement officers to go beyond making decisions about traditional criminal activities. They must now also be proficient in assessing terrorist threats and threats to national security (The 9/11 Commission Report, 2004).

Still, the more common decisions made by local law enforcement agencies in response to daily crises can be just as crucial as national security issues. Police commanders must decide how to handle hostage situations, armed robberies, kidnappings, bomb threats, riots, and mass shootings. Police officers on patrol must handle spur-of-the-moment dynamic situations such as robberies-in-progress, street fights, domestic disturbances, and suicide threats. They must also make decisions about when to pull over vehicles or stop-and-search suspicious people, and when to use varying degrees of force. The action-choices police make in these situations are relevant to the current social climate. Community fear of terrorism can lead police to overreact to innocuous situations, or the community may be prone to blaming police for not preventing violent situations

that do occur. These conditions may lead the public to express hostility or pessimism toward police who take proactive actions to protect the public from potential threats.

Intuition. For the reasons stated above, it is vital to understand and explain law enforcement decision making processes during high-stakes situations. Law enforcement officers often make spontaneous decisions that are exceedingly accurate yet are difficult to explain in concrete terms. Good intuition is often the only explanation immediately available. Later reflection may reveal that concrete cues were present, and although officers were not consciously aware of them, these cues played a part in their holistic assessment of the situation. Noticing these cues allows for recognition of familiar and typical patterns that are associated with action choices and likely outcomes. Intuition is a package of cues, perceptual processes, situation recognition, and action-choice evaluations that make up the components the decision making process. The information used to make intuition-based decisions is processed instantaneously and often outside conscious awareness (Klein, 1998). This package of information can be decomposed, evaluated, and enhanced, giving voice to the previously mysterious outcomes attributed to intuition. An understanding of these processes would enable law enforcement officers and agencies to make decisions that are more efficient and this knowledge would enable agencies to develop training that facilitates officer development from novice to expert.

Naturalistic Decision Making. In a specialized area of decision making research called *Naturalistic Decision Making* (NDM), researchers have focused on understanding the decision making processes of domain experts in crisis situations. This field has defined an important new area of research by developing concepts and methodologies with which to study expert decision makers in naturalistic, real-time, high-stakes, crisis environments (Salas & Klein, 2001). The NDM paradigm can readily be applied to the domain of law enforcement, but this has yet to be

done. Because the law enforcement domain and its relationship to NDM remains unexplored, a model of law enforcement officer decision making has not been created and methods designed to improve cognitive decision making in law enforcement situations has not been fully developed.

The purpose of the current study was to investigate law enforcement decision making processes during high-stakes critical incidents, with the intention of developing methodologies for obtaining decision-maker knowledge, specifying the decision processes of novice and experienced police officers, and developing training courses to teach officers methods to improve their decision processes. The first section of this paper describes the NDM paradigm by presenting background information on the development of the NDM domain, and by discussing previous NDM research. The second section discusses the role of expertise within the NDM paradigm by incorporating research and theory from the expertise literature. In the third section, a framework for assessing police decision making processes is presented. This section describes the three components of the current study: observation during simulation exercises, in-depth post-event interviews, and decision making training. The fourth section presents the methods, results, and discussion.

1.1 Naturalistic Decision Making

Background

Naturalistic Decision Making (NDM) research focuses on decision making during real-time, dynamic events that have high-stakes outcomes. Researchers have observed domain experts in naturalistic environments such as military combat, aviation emergencies, and fire-fighting situations, but few, if any, have observed law enforcement officers during similar crisis incidents.

Decision making is a process that people engage in when they must determine a course of action based on their perceptions of the current situation. From their interpretation of the situation, they contemplate a variety of options, choose the best option, and then engage in a chosen course of action. For example, a police officer makes a routine traffic stop and the motorist suddenly gets out of the car and, for no apparent reason, becomes belligerent. The officer must decide whether to negotiate with the motorist or use force to subdue the motorist. In most NDM situations, there is only limited time to determine what is occurring, and there is rarely time to evaluate different courses of action. However, in these circumstances, the consequences resulting from choosing particular courses of action are often severe.

This type of decision-making scenario diverges from scenarios typically presented in traditional decision-making research. Decision making research has historically focused on how people make decisions in contrived laboratory environments. Under laboratory conditions, participants typically have a clear idea of the task, a full set of decision choices to pick from, and encounter relatively little risk if they make the wrong decision (Abelson & Levi, 1985; Flin, 1996). Traditional decision making research has contributed to a general understanding of the cognitive process, judgments, biases, knowledge requirements, and decision tendencies of decision makers in idealized situations. However, this traditional work has left uncovered the processes that contribute to making decision in ambiguous, dynamic, and time-pressured, situations (Lipshitz, Klein, Orasanu, & Salas, 2001).

History. The NDM perspective grew from a lack of knowledge about this specialized and highly applied type of decision making. When people need to make decisions in high-stakes situations, a diverse set of factors must be considered during the decision making process. Researchers began to hypothesize that high-stakes decision situations are so fundamentally

different from the situations presented in most decision making research that decision processes would also necessarily be different (Cohen, Freeman, & Thompson, 1998; Lipshitz, et al., 2001). The focus of the NDM perspective was on the decision *process*, rather than input/output relationships and probabilistic predictions of outcomes, and thus considered a process model rather than a structural model (Abelson & Levi, 1985; Lipshitz, et al., 2001). Initial observations seemed to indicate that decision makers in naturalistic situations tended to make their decisions in an effortless, high-speed, and automatic manner (Klein, 1998; Klein, Calderwood, Clinton-Cirocco, 1986). This behavior was different from decision maker behavior in laboratory settings. Clearly, exploration of these differences was necessary.

The researchers who initially investigated NDM conducted a variety of field observations and interviews in an attempt to understand real-world decision makers. Early NDM research took place in environments such as firegrounds, airline flight decks, hospital trauma units, naval warship command centers, nuclear power plants, oil refinery platforms, and weather forecasting centers (see Flin, 1996; Pliske & Klein, 2003, for summaries of these works). These works identified the factors that tend to be present in most naturalistic environments during high-stakes events and attempted to define the cognitive processes used to make critical decisions. A common finding among these studies was that even though decision makers did not have time to deliberate on all available options, and they were often under stress dealing with ambiguous and changing situations, they often made decisions that yielded positive outcomes.

Klein, et al. (1986) conducted the first NDM study investigating fireground commanders' decisions in time-pressured situations. Researchers asked these firefighters to tell stories about non-routine wildfire and urban fire incidents. The original goal of this study was to determine the number of decision options the commanders would contemplate before initiating a course of

action. The hypothesis was that decision makers would consider only two options, their favorite option and an option to compare to their favorite option. It was hypothesized that, instead of evaluating all possible options, decision makers would make a gut level choice and then justify their choice by comparing it to another option (Klein, 1998). The first thing Klein and colleagues noticed when interviewing the fire commanders was that they did not seem to compare *any* choices. Instead, the commanders would claim that they "just knew" the correct course of action. Many commanders reported that they did not make decisions at all; that there was no time for deliberation and the solution was usually obvious. This led researchers to believe that decision makers were using a non-deliberative decision process. It also brought forth the notion of intuition and the need to understand the processes behind expert decision making (Klein, 1998).

Characteristics of naturalistic decision making situations: By studying decision making in specific domains, researchers were able to understand the context-specific demands on the decision makers. In addition, these works indicated that certain characteristics seem common across these naturalistic domains. Field observations of actual crisis incidents revealed that the following 10 factors typically characterize naturalistic decision making (c.f. Flin, 1996):

1) Ill-defined goals and ill-structured tasks
2) Uncertainty, ambiguity and missing data
3) Shifting and competing goals
4) Dynamic and continually changing conditions
5) Action feedback loops (real-time reactions to changed conditions)
6) Time pressure (time constraints)
7) High stakes (risk)
8) Multiple players (team factors)
9) Organizational goals and norms
10) Experienced decision makers

The combination of these characteristics makes NDM situations easily identifiable and introduces unique contextual demands into the decision making situation. Researchers of traditional decision making have long investigated decision making under *uncertainty* (Cannon-

Bowers, Salas, & Pruitt, 1996). In the traditional sense, a decision task is uncertain when the outcome probabilities are unknown. In many situations, the decision maker cannot identify any, or all, possible outcome alternatives. This has lead researchers to expand the definition of uncertainty to include uncertainty about the nature of the problem, uncertainty about the action-choice alternatives, and uncertainty about the outcome results (Abelson & Levi, 1985). Lipshitz and Strauss (1997) classified uncertainty as inadequate understanding, undifferentiated alternatives, and lack of information. They found that the subjective aspects of the situation, such as inadequate understanding and undifferentiated alternatives played a bigger role in uncertainty than did objective aspects, such as lack of information. According to Lipshitz and Strauss, uncertainty stalls action by interjecting doubt and lack of clarity in the decision process. Uncertainty may slow down the decision process and decrease the quality of decisions. However, within the NDM paradigm, uncertainty does not necessarily have an adverse affect on decisions. Klein (1998) contends that once the inevitableness of uncertainty is accepted, decision makers can focus on the task of using the information that is available to reach effective decisions. The more experienced the decision maker, the more apt they are to effectively handle decision making under uncertainty.

These definitions of uncertainty encompass *ill-defined tasks and ill-defined goals*, another characteristic of NDM. When a decision maker encounters a task with *ambiguous or missing data*, they cannot structure the goals or efficiently frame the task, which leads to uncertainty. Decision makers encounter these conditions in many decision-making situations, even those that do not include the other NDM characteristics. It is the addition of the other characteristics that distinguish NDM situations from more mundane ill-defined decision making situations.

A distinct characteristic of NDM situations is the *dynamic* nature of the tasks. Unlike the stable, unchanging tasks presented in traditional decision making research, most real-world tasks change as they unfold (Cannon-Bowers, et al., 1996). Often, *changes occur continuously*, rapidly, and dramatically. The decision maker must process these changes and factor them into the decision process and outcome goals. For example, when in the process of determining how best to stop a fire and prevent loss of life and property, fire-ground commanders must also deal with changes in fire patterns, weather patterns, manpower, and resource losses. Because the situation is dynamic, decision makers must *shift their goals* to accommodate the changing conditions. In the fire-fighting example, changes in wind direction may cause the goal to change from putting out the blaze to retreating and saving lives. The decision maker may also encounter *competing goals*, such as whether to delegate valuable resources to stop a fire that will quickly destroy a large number of residences or to focus these resources on one apartment engulfed in flames because a resident may still be in there. In cases such as these, the decision maker can only meet one goal and thus, must weigh the outcome options simultaneously.

During dynamic events, individuals make decisions in order to change the situation while it is still in progress. Not all decisions are made with the intent to resolving the task, instead many decisions are made in order to clarify the situation or influence the task conditions in a positive manner (Kaempf, Klein, Thordsen, & Wolf, 1996). The changes introduced by these interim decisions must be factored back into the task constructs. When this processing occurs, the decision maker is engaging *action feedback loops*. Action feedback loops incorporate action consequences arising during the task into ongoing action plans (Cannon-Bowers, et al., 1996).

Two factors that combine with the above-mentioned characteristics to make NDM situations distinctive are time pressure and high stakes. *Time pressure* is a key component of

NDM. Unlike traditional decision making situations, and many real-world situations, where time constraints do not factor into the decision process, NDM processes are understood in the context of time pressure. Duration of the event, time delays between the receipt of incoming information, tempo of information processing, feedback latency, and temporal order of the events, can all influence time pressure. When decision makers have limited time to make decisions, they do not have opportunity to evaluate their action choice prior to acting. Time pressure can distort perceptions of events and alter subsequent outcome predictions, which may influence planning and course-of-action decisions (De Keyser & Nyssen, 2001). The influence of the characteristics described above on decision quality is mediated by how much time is allowed for the decision maker to achieve a positive outcome.

Coupled with time pressure in most NDM situations are potentially *high stakes* outcomes, such as loss of life. High-stakes situations introduce risk factors that the decision maker weighs into the action-choices. The presence of time pressure and high stakes put severe constrictions on the decision process, making the cost of deliberation and choice evaluation prohibitively high compared to the costs of engaging in actions that may do little more than prevent the worst outcomes (Cohen, Freeman, & Wolf, 1996). As will be discussed below, weighing the costs of deliberation compared to the costs of action is a key process in NDM.

To overcome processing disadvantages when making decisions under these constraints, decision makers use their existing knowledge about the task to react quickly and efficiently. The NDM paradigm measures the influence of *expertise* on decision processes and outcomes. Understandably, the people charged with making decisions in many NDM environments are considered experts in their fields. The level of expertise varies among decision makers and influences decisions processes. A large body of work outside the NDM literature has investigated

expert cognitive processing and decision making (see, for example, Ericsson & Smith, 1991; Vicente & Wang, 1998, for reviews). NDM studies that vary levels of expertise tend to show differences in decision processing based on experience (Klein, 1998). Discussion of expertise and NDM will take place in a separate section below.

The remaining two characteristics are important factors in the NDM paradigm but go beyond the scope of this paper. *Team factors* play an important role in many NDM situations, including many policing situations. Group decision processes encompass many additional processes not under study here, thus this factor is not investigated here. Similarly, *organizational goals and norms* can greatly influence the action choices made in NDM situations. Police organizations, along with the judicial system and political organizations, can exert influence on the decisions made by police officers. Organizational goals and norms, along with team factors, are important variables to study in the future, but are not included in this project.

Decision Processing: The Recognition Primed Decision Model. Findings from NDM studies indicate that domain-experts tend to make decisions automatically, without considering all possible options. Decision makers quickly evaluate one option and imagine implementing it. If they foresee problems, they modify their plan and then implement the course of action that will suffice to avert the crisis (Salas & Klein, 2001). The decision makers in these studies generally focus on assessing the situation instead of comparing possible choice options. They tend to use mental simulations and built stories to evaluate the potential success of their chosen action (Flin, 1996). The *Recognition-Primed Decision (RPD) model* describes this decision process by distinguishing three levels of processing (Klein, 1998; Klein, et al., 1986).

Level 1 shows the decision process when a simple match is made between the situation and the action choice. The decision maker recognizes the situation as typical and implements a

typical action. Embedded in this assessment is the decision maker's recognition of important and typical cues, which generate expectancies about what should happen next. Based on these expectancies, plausible goals for the current situation and the typical course of action come to mind. From this assessment, the correct course of action becomes clear and is implemented (Flin, 1996; Klein, 1998).

Level 2 represents decision making when the situation is not so easily recognized or matched to internal representations. If the situation is unfamiliar or ambiguous, the decision maker cannot rely on recognition; instead, they must assess and comprehend the novel aspects of the situation (Phillips, Klein & Sieck, 2004). This level of the RPD model focuses on situation assessment. In this case, the decision maker uses feature-matching and story-building to evaluate the best fitting interpretation of the situation. When the decision maker uses feature-matching, they match a set of observed cues to familiar situations and diagnose the situation. When the decision-maker uses story-building, they make inferences to fill in missing information and create a coherent story of the situation. By matching mental models to the situation, decision makers are able to explain the causes of an event and predict outcomes. Building stories is necessary when there is not enough information is available to match features to internal representations (Kaempf, et al., 1996). The story-building concept stems from jury decision-making research, in which jurors create coherent stories of crime incidents, filling in the blanks of the cases presented to them in court. In Pennington and Hastie (1986; 1988), jurors constructed stories in order to make sense of the evidence and to figure out what must have happened during the crime. Jurors had no experience with the incidents they were required to decide upon, thus they would necessarily need to construct stories to make sense of the evidence.

Kaempf, et al. (1996) studied the decision strategies used by antiair warfare personnel on a U.S. Navy AEGIS cruiser. The researchers interviewed thirty-one expert naval personnel about challenging incidents they had experienced and coded the incidents according to the actions taken and to shifts in situation assessment. Data revealed that officers reported more instances of situation assessment than decisions about courses of action. As defined by the authors, *situation assessment* consists of the perception of elements within the environment, the comprehension of their meaning, and understanding of their anticipated status in the near future. Researchers determined that most of the situations were assessed using feature-matching processes (87%), as opposed to a story building process (12%; 1% were not identified by either process), indicating that the decision makers relied on their internal representations built from experience.

Level 3 diagrams the processes of decision makers who are able to assess the situation but the best course of action is not immediately clear, so they must further evaluate their action choice. When individuals make action choices, they mentally simulate the possible results of implementing the action. They build stories to generate expectancies about what is likely to occur if they engage in a particular action and they attempt to determine if the actions will go according to plan, or if problems will arise that lead to undesired results. By taking time to imagine implementing the action sequence, the decision maker may find that the course of action will not work. They must then alter the action choice in some way or chose another course of action (Flin, 1996; Klein, 1998). Mental simulation is a useful tool decision makers use to incorporate known information with conjecture about what may happen (Klein, 1998; Phillips, et al., 2004). By envisioning what may happen, decision makers predict the course of events, identify potential problems, and create alternative action plans.

Research has generally found that experienced decision makers focus on situation assessment more than on action choices (Flin, 1996; Kaempf, et al., 1996). Evaluations of decision outcomes has revealed that decision makers do not necessary choose the best, or optimal, solution. Instead, they tend to choose the solution that would *suffice* to resolve the crisis in a *satisfactory* manner. They tend to seek solutions that will *satisfice* (Simon, 1990).

Satisficing. In ambiguous and highly complex situations, exhaustive searches through choice options are not always possible and may have detrimental consequences. Instead, decisions that lead quickly to satisfying outcomes allow for resolutions that may not be optimal, but are nonetheless acceptable. In time-limited environments, the optimal solution may not be attainable given the task constraints, and if the situation is dynamic, the optimal solution may change as events unfold, leaving the decision maker to redefine goals and reconsider the acceptableness of the outcome possibilities (Gigerenzer & Todd, 1999; Simon, 1990; Todd & Gigerenzer, 2003). Thus, the search process – the assessment of the situation – is based on current outcome goals, which may place quick decisions over highly accurate decisions. The outcome goals define outcomes that are acceptable, such as saving a life even if there is collateral damage or bodily injury without death. These outcome goals guide the search process and set a stop-search rule (Todd & Gigerenzer, 2003).

Goodrich, Stirling, and Boer (2000) state that finding a "good enough" solution entails weighing the *costs and benefits* of each option under consideration. When reaching a solution that satisfices, particularly in time-pressured situations that have unclear parameters and are dynamic, the costs of continuing to search may outweigh the costs of stopping. Finding an optimal solution under these circumstances could be too costly compared to the benefits of selecting the option that is good enough. The decision maker determines what qualifies as a good

enough solution in a particular situation by weighing outcome success (accuracy) with possible undesirable consequences (liability). In order to produce an outcome that satisfices, two elements factor into the decision process. Simon (1990) likened these two elements to the two blades on a pair of scissors. One blade is the 'structure of the task environment' and the other is the 'computational capabilities of the decision maker.' An experienced decision maker has the computational capabilities to evaluate the costs of assessment compared to the costs of action and uses the constraints and affordances in the environment to make this determination.

Cohen, et al. (1996) introduced *the quick test* as a method for evaluating the costs of further assessment (called 'critiquing and correcting') compared to the costs of immediately choosing a solution that will satisfice. This test developed out of Cohen, et al.'s *recognition/metacognition* (R/M) model, which focuses on situation recognition and the evaluation process that decision makers engage in after recognition occurs. Similar to level 2 of the RPD model, when the recognized situation contains novel or ambiguous information, the decision maker builds stories to understand the situation. With the R/M model, these stories are then evaluated through a process of critiquing the solution in the context of current information, and checking incomplete and conflicting arguments in order to insure a satisfactory outcome. If problems with the solution are revealed in this critique, the decision maker attempts to correct these problems. The decision maker may seek more information, adjust assumptions, or shift attention to other aspects of the problem. In time-pressured situations, this process of critiquing and correcting cannot last long. How long this process can last is based on elements of the decision task. The quick test provides a method for evaluating the utility of critiquing and correcting in a given situation. When the benefits of critiquing and correcting outweigh the costs, this critical thinking will take place. However, if the costs outweigh the benefits, the decision

maker will take action without critical assessment. Instead of spending time determining whether there is time to evaluate the plan, the quick tests provides the decision maker with three questions intended to quickly direct the decision process in the most cost-effective direction. The three questions are: 'Is the cost of delay acceptable?' 'Is the cost of an error high?' and 'Is the situation unfamiliar or problematic?' (Cohen, et al., 1998). If the answer to *any* one of these questions is 'no' then the decision maker engages in immediate action. If the answer to *all* of these is 'yes' then the decision maker engages in critical thinking (Cohen, et al., 1996; Cohen et al., 1998). The quick test is included in the cognitive skills training course used in this research.

Previous NDM Research

Given the nature of the dynamic situations described above, NDM research has centered on observational studies in field settings rather than experimental laboratory research. The methods employed by NDM researchers typically include interviewing decision makers about previously experienced events, staging live scenarios, or using storyboard diagrams and written scenarios (Hoffman, Shadbolt, Burton, & Klein, 1995; Salas & Klein, 2001). Data are often obtained by observing decision makers in action, by having decision makers verbally explain their decision processes in real-time, and by extensively interviewing decision makers after the decision process has ended. Occasionally studies have included control groups and have manipulated variables, but largely NDM studies have been descriptive in nature (Lipshitz, et al., 2001; Pliske & Klein, 2003)

Observational studies. Observational studies are particularly useful when gathering information about an unexplored area (Cooke, 1994). In the naturalistic decision making field, initial understanding of real-world decision making occurs by observing decision makers in action. The domains under study vary greatly, from chess playing to life-and-death military

battles and aviation emergencies. Understandably, it is not possible to observe all of these situations directly. It would severely hinder the data collection process if researchers had to sit and wait for critical fires and nuclear catastrophes to happen, or for the enemy to attack our military troops (Klein, 1998). Therefore, researchers present decision makers with realistic scenarios designed to mimic real-world events (e.g., Jones & Endsley, 2000; Kirschenbaum, 2001; Miller, 2001; Randel & Pugh, 1996). From observations, it is possible to gather information about decision maker behavior that may indicate underlying cognitive processes. However, observations do not provide an in-depth understanding of the cognitive processes behind these behaviors (Cooke, 1994). One purpose for making observations is to gain general understanding of the domain of interest. With this initial understanding, it is possible to develop the tools necessary to delve further into domain-specific decision processes. Researchers, such as the ones cited above, use the information gathered from observations to construct interview techniques and practice scenarios that most efficiently tap into decision domains and decision maker cognitive processes.

Retrospection. Researchers also rely on anecdotal stories of crisis events. During intensive interview sessions, decision makers provide retrospective accounts of critical incidents. Researchers in the NDM domain have progressively developed and refined interview techniques that use cognitive probes to tap into decision makers' understanding of situations and their internal decision processes. These techniques, derived from the critical incident technique developed by Flanagan (1954), are designed specifically to aid storytellers in verbalizing their prior decision processes.

A variety of cognitive task analysis methods have been developed (Hoffman, et al., 1995; Hoffman, Crandall, & Shadbolt, 1998). Researchers have evaluated whether the cognitive task

analysis is an effective method for gathering decision maker knowledge and have generally found these methods useful for obtaining cognitive information, particularly when seeking initial understanding of cognitive processes and task demands in newly explored domains (Cooke, 1994). In a study of firefighters, those in the structured interview condition reported more information about the cues they attended to compared to those in the unstructured interview condition. The information obtained was more specific, more detailed, and more often linked to specific actions and plans (Crandall, 1989). Additional research has shown cognitive task analysis methods to be reliable for gathering knowledge in studies that have assessed expertise in areas such as emergency medical technicians and military situations (Hoffman, et al., 1995).

The specific technique used in this study is the *critical decision method* (Klein, Calderwood, & MacGregor, 1989). The critical decision method (CDM) is a semi-structured interview technique that uses a four-step knowledge elicitation process to capture the knowledge of domain experts in real-world situations (Hoffman, et al., 1998). Researchers initially used the CDM to elicit knowledge about prior personal experiences. Decision makers such as emergency medical dispatchers (Wong & Blandford, 2001), military officers (Fallesen & Pounds, 2001; Kaempf, et al., 1996; Lipshitz & Strauss, 1997), and firefighters (Klein, et al., 1986) have been asked to recount prior critical decision situations. However, researchers are increasingly using the CDM to interview decision makers after participating in structured simulations (e.g., Miller, 2001; Randel & Pugh, 1996; Roth, Lin, Kerch, Kenney, & Sugibayashi, 2001). This allows researchers to write specific variables into the decision making situations and allows for more control over the settings under study. Because multiple decision makers encounter the same events it is possible to make between-subjects comparisons.

A recurring issue in NDM research is the reliance researchers have on self-reports and the possible introduction of bias into the results (Hoffman, et al., 1995; Hoffman, et al., 1998). Because retrospective knowledge elicitation methods, such as CDM, rely on human memory and self-report, some researchers have criticized these data collection methods. The main argument is that people do not have adequate introspective ability to report on their cognitive processes, and that retrospective verbal reports can be biased (Ericsson & Simon, 1993; Nisbett & Wilson, 1977). Nisbett and Wilson (1977) argue that because people do not have access to their cognitive processes, they will make implicit assumptions based on a priori theories about their responses to stimuli. Although this sometimes results in accurate reporting of higher mental processes, it will also lead to inaccuracies. Ericsson and Simon (1993) dispute these contentions and argue that the accuracy of verbal reports depends on the method of knowledge elicitation used and that effective knowledge elicitation allows people to report on specific cognitive processes. In defending NDM researchers' reliance on verbal reports, Lipshitz, et al. (2001) point out that Nisbett and Wilson (1977) did not evaluate verbal reports of *events* for accuracy. They agree that people cannot state why they used specific reasoning processes and claim that NDM research avoids such questions. Similar to Ericsson and Simon, they state that methods such as CDM can enhance report accuracy by boosting memory recall. Hoffman, et al., (1995) claim that it may be useful to distinguish between various levels of introspection as a way to categorize and evaluate expert ability. They also point out that knowledge elicitation techniques are intended to aid decision makers in recalling events, not in making judgments *about* their mental processes.

Some researchers claim that it is necessary to employ knowledge elicitation techniques in order to gather unconscious knowledge and strategies (c.f. Hoffman, et al., 1995). Others argue that retrospective accounts have advantages over other methodologies for obtaining introspective

information. Real-time reporting methods, such as think-aloud methods may result in inadequate information elicitation, especially if the expert is involved in a complex task that has high cognitive demands (Cooke, 1994, Ericsson & Simon, 1993). Observations require interpretation of behaviors but do not provide insight into internal processes (Cooke, 1994).

Military Research. The types of decisions made by military personnel are similar to those made by police. Both soldiers and police must detect and respond to enemy actions quickly and accurately while considering the safety of civilians and their own welfare. The increased reliance on local law enforcement to secure the nation against direct terrorist actions has blurred the lines between military and law enforcement, increasing the similarity between these two bodies in the types of training needed. Similarly, the move of military battles from jungles and deserts to urban environments has further blended these two domains (Phillips, et al., 2001).

The U.S. military long ago recognized the need to understand and improve decision maker performance and has contracted psychology researchers to investigate the dynamics of decision making in military environments with the goal of assisting military personnel when making decisions in crisis situations. This work has lead to training and the implementation of programs to aid troops in multiple branches of the military (i.e., Cannon-Bowers & Salas, 1998; Fallesen & Pounds, 2001; Kaempf, et al., 1996; Phillips, et al., 2001). The valuable information obtained from conducting NDM research and training in military environments is likely to be found by conducting similar work in law enforcement environments.

Miller (2001) sought to understand military strategic planning and conducted CDM interviews with Air Force and Navy personnel followed by simulation exercises. The gathered information revealed several characteristics present in quality plans, such as considerations of risk, coordination issues, flexibility, communication of intent, and the ability to measure the

progress of plan implementation. It was also important for planners to evaluate the plan, both during plan development and once the entire plan was constructed. This information aided the researcher in developing a computerized planning system that assisted decision makers to evaluate plans, allocate resources, and estimate feasibility, effectiveness, and threat.

In Kaempf et al. (1996), the majority of the action choices made by U.S. Navy personnel, were decided upon for purposes other than making an incident ending decision. Purposes for actions were to gather more information, to prepare and better position themselves for future developments, and to ensure the availability of resources. In only 4% of the decisions made did naval officers compare multiple action choice options, the rest of the time they reported recognizing the situation and implementing a course of action with no comparison of options. They did not tend to evaluate their action choices before implementing them (78%), although some (18%) did use mental simulation to imagine the possible outcomes of their action choices (the other 4% compared options). The authors concluded that the decision makers matched patterns of cues previously learned to features observed in the environment and used this understanding to determine an action choice.

Military training. Based on information obtained in studies like the ones discussed above, researchers have developed and tested training programs in order to assist military personnel make effective decisions. For instance, Pliske, McCloskey, & Klein (2001) evaluated the usefulness of a training program termed Decision Skills Training. The authors conducted 1-2 day workshops and asked U.S. Marine Corps officers and squad leaders, along with U.S. Navy pilots to evaluate the course components. This course consisted of presenting paper-and-pencil *decision making games* to students, who made decisions about the ambiguous scenarios presented. Students critiqued their decisions, discussed the cues they attended to and why certain actions

were chosen. They also envisioned that the plan failed and discussed what went wrong. Finally, they interpreted commander's intent and assessed miscommunications and misperceptions of intent. Students rated these exercises as very useful, with medium to high expectations that they would use these components in the future. Students found it particularly useful to hear the decisions others made during the decision making games and valued the opportunity to practice making and evaluating decisions.

Phillips, et al. (2001) conducted a cognitive task analysis of Army Military Operations in Urban Terrain (MOUT) experts in order to assess decision requirements and training needs of military personnel during urban warfare situations. From the information obtained, the researchers constructed a Decision Skills Training program specifically for MOUT situations. They determined the essential decision points in typical building clearance operations (securing the parameter, approaching the building, clearing the building, etc) and focal points of situation awareness (maintaining the enemy's perspective, maintaining the big picture, projecting into the future). Detailed decision skills training along with training tools were developed and implemented. This extensive information gathering and training program provided the military with new tools for increasing decision making ability during MOUT operations.

Decision making training has been shown to enhance critical thinking skills and improve decision making ability during high-stakes events (Cohen, et al., 1998; Fallesen & Pounds, 2001; Hoffman, et al., 1998). Cohen, et al. (1998), developed Critical Thinking Training to train active-duty naval officers. They presented officers with a computerized scenario in which they made hostile-intent assessments of an approaching enemy ship. Results revealed that, compared to untrained officers, the officers who had critical thinking training were considered more accurate and showed a significant increase in the number of factors considered in the assessment of intent,

and also in the number of conflicting pieces of evidence identified, explanations produced, and alternative assessments generated.

The training components presented in critical thinking training are very similar to those used in decision skills training. In critical thinking training, stories are constructed and evaluated by testing assumptions, accounting for all observed events, and explaining evidence and alternative assumptions and events. Cohen, et al. (1998) developed the hostile-intent story template to assess enemy intent. After evaluating the construction of these stories, decision makers critique the plausibility of the story and play devil's advocate by developing alternative explanations. They also evaluate the costs of further evaluation compared to the costs of quick action. The current study utilized a mix of decision skills training and critical thinking training components, and created a course designed specifically for law enforcement officers.

Decisions about behavior. Law enforcement officers must often assess situations that involve the behavior of other people (suspects, bystanders). This is different from work done in many other NDM domains, where evaluation has generally focused on equipment failure (airplanes, oilrigs), fire patterns, and weather patterns. Decision makers in military situations, also assess human behavior patterns, but these are generally of the enemy as an entity, as in battlefield or enemy warship and aircraft movement. The ability to assess and predict human behavior is vastly more complex than predicting the behavior of non-human entities. Humans interact socially and interpret intentions and actions based on their own previous experiences, their emotions before and during the event, their mental state, personality traits, and previous knowledge or misinformation (Feldman, 2004; Forsythe, 2004; Hunter, Hart & Forsythe, 2000).

Shanteau (1992), made the differentiation between making 'decisions about things' vs. making 'decisions about behavior'. He found that those who made decisions about things

(weather forecasters, test pilots, chess masters) performed well, whereas people who made decisions about behavior often exhibited poor performance (clinical psychologists, court judges, parole officers). He found that the task characteristics determined good or poor performance. If the tasks were dynamic, unique, unpredictable, and decision aids and feedback were unavailable, then decision performance was poor. He concluded that if the task characteristics were changed, expert performance would improve. Changes may be made by increasing the use of feedback, enhancing the ability to decompose the problem, and by training decision makers to use decision aids. The training presented here introduced the use of feedback and decisions aids to officers as methods for enhancing decision skills.

1.2 Expertise and NDM

As stated above, expertise is a key component of the NDM paradigm. Expert decision makers are often perceived as possessing an uncanny ability to know exactly what to do during critical events. They seem to have a highly tuned intuition that enables them to perceive situations and respond quickly and accurately (Klein, 1998). Often, these experts cannot say what factors caused them to react and have difficulty in explaining why they reacted in a particular manner. For example, when police officers stop and search someone, find drugs or an illegal weapon and then later have trouble explaining why they had probable cause. This lack of explanation can lead to trouble in court or when handling citizen complaints.

Expert cognitive processing. Within psychology, researchers often explain intuition in the context of expertise. Research shows that experts tend to build mental models that develop into short-cuts, or heuristics, that can later be used to make quick decisions. Mental models provide decision makers with a mental representation of the decision task. These mental models help decision makers describe, explain, and predict the situation (Goodrich, et al., 2000; Rouse &

Morris, 1986). Because experts have these mental models, they are able to perceive situations more efficiently and respond faster than novices who must filter through every bit of information before assessing and acting on the situation (Klein, 1998). According to Goodrich, et al., (2000), mental models provide the context with which decision makers interpret and respond to the surrounding environment. Decision makers construct mental models from previous domain-specific experiences, which provide them with a representative model of the external world (Goodrich, et al., 2000; Phillips, et al., 2004). Decision makers incorporate into their mental model, factors from the current environment that convey the course-of-action solution.

Fowlkes, Salas, Baker, Cannon-Bowers, & Stout (2000) evaluated the situation assessment abilities of instructor and student helicopter pilots in the military. Instructors identified more situational cues than did students when assessing the situation. The authors made a distinction between the types of mental models pilots were likely to utilize during their assessments. They compared instructors and students use of declarative models (concepts, facts, rules), procedural models (sequence, timing of activities, aircraft position, emergency procedures), and strategic models (strategies for applying knowledge to current situation, state, plan, and deviations). Results revealed that instructors focused on strategic concerns, spending time developing strategies for completing the task based on incoming information. Students focused on procedural models by identifying "how-to" aspects of the task and completing checklists.

Experts possess a substantial amount of domain relevant knowledge, and when confronted with problems, they must modify their mental models to fit the novel aspects of the problem. Experts usually accomplish this by engaging in self-reflective cognitive processing. To illustrate this idea, Pliske, Crandall, and Klein (2004) examined highly skilled and lower-skilled weather forecasters. They found that, while processing weather information, highly skilled forecasters

tended to evaluate their approach to the task continuously, while lower-skilled weather forecasters did not tend to engage in these self-reflective activities. Highly skilled forecasters also tended to notice typical and atypical patterns at greater rates and were more proficient at organizing incoming information and forming visual mental representations of their forecasts.

A comparison of inexperienced and experienced automobile drivers also revealed differences in the cognitive skills utilized while assessing situations and determining courses of action (Klein, Vincent, & Isaacson, 2001). The cues utilized by newer drivers tended to be simple and procedurally based, while long-term drivers attended to complex cues in the driving environment. Long-term drivers also tended to focus on strategies for avoiding risk and showed greater tendency to anticipate actions others may take based on current cues. The authors discussed how driver ability develops through assimilation and accommodation. In assimilation, decision makers apply their current knowledge to new environmental information. In accommodation, decision makers adjust cognitive structures to fit with new environmental input. Assimilation of environmental contexts contributes to effective situation assessment. If a driver does not adapt to the driving context, situation assessment will be limited. The authors make an interesting point by stating that decisions appear intuitive because decision makers have assimilated and accommodated many experiences, which allows them to adapt with ease to current situations.

Randel and Pugh (1995) assessed differences in the decision making characteristics of expert, intermediate, and novice electronic warfare technicians from the U.S. Navy. Results showed that experts focused on assessing the situation and did not take much time to deliberate on how to react. Novices, on the other hand, spent more time deciding on a course of action and were more concerned with taking the right action. Experts and novices attended to the same cues,

but experts tended to combine these cues in a more efficient manner. The authors concluded that experts and novices may use the same heuristics, but experts know better how to apply the heuristics to the situation.

Researchers map out these expert-novice differences by conducting cognitive task analyses in various domains. The expert ability of law enforcement officers has not been systematically drawn out nor has the expertise paradigm from traditional psychological research been applied to the law enforcement domain. The current research attempted to characterize law enforcement expertise by establishing criteria to differentiate law enforcement decision making on an expert-to-novice continuum. Besides providing information about decision making processes, CDM interviews provided insight into differences in cognitive processing based on levels of law officer experience.

Expert development. Much research has examined how expertise develops (Ericsson & Charness, 1994; Ericsson, Krampe, & Tesch-Römer, 1993; Ericsson & Smith, 1991). According to Ericsson and colleagues, outstanding performance comes about when a person has obtained domain specific skills. These skills are not natural traits. Instead, development of these skills occurs through repeated and lengthy exposure to a specific skill set, indicating that individuals acquire expertise in domain specific contexts and experts acquire skills by doing tasks that promote learning in their domain of specialty. Vicente and Wang (1998) reviewed the expertise literature and concluded that experts acquire skills by adapting to environmental constraints. Experts develop the ability to use *affordances*, or opportunities provided by the environment, to achieve goal-directed action. When processing information, experts attend to relevant information while filtering out irrelevant information. This efficient information processing leads to quick and accurate decisions. Skilled decision makers are also better able to seek out relevant

information and use *leverage points* to progress a situation to the desired end. Affordances involve the perception of environmental elements and insight about the situation, while leverage points provide information about the effects achieved by a chosen course of action (Klein, 1998). Leverage points are affordances that provide focus and direction to the decision maker.

Doane, Sohn, & Jodlowski (2004) compared expert and novice airline pilots' ability to anticipate consequences of actions. As will be discussed below, this type of forward reasoning is an important component of expert processing (Patel & Groen, 1991). Doane, et al., found that pilots were more sensitive to changes that were inconsistent with typical aircraft control actions. Results showed that experts responded faster to situation changes. This research also investigated pilots' use of mental models about how aircrafts typically react to their manipulation of the controls. The researchers compared the reliance on mental models to the use of situational models, defined as an integration of mental models with environmental conditions, in this case with current flight status. Situational models are similar to the perception of affordances and use of leverage points discussed above. They found that both novice and expert pilots relied on mental models more than situational models. They concluded that the static nature of the tasks presented in this study limited use of situational information by not allowing pilots to process dynamic information.

Based on findings in the expertise research literature, Ericsson and Charness (1994) suggest that when decision makers instantly form representations of the problem in their minds it cues expert knowledge, allowing experts to make quick and accurate decisions. Experts tend to use forward reasoning whereas novices use backward reasoning. In a study of medical experts, Patel and Groen (1991) found forward reasoning to be highly correlated with diagnostic accuracy. Forward reasoning is similar to mental simulation processes used by decision makers in level

three of the recognition primed decision model (Klein, 1998), in which decision makers reason from facts to a hypothesis by integrating information into the problem task and then formulating goals. When reasoning backward, the decision maker reasons from the hypothesis to a fact, starting with goals and trying to incorporate incoming information into those goals (Ericsson & Charness, 1994; Patel & Groen, 1991).

Another important factor in expert skill development is the use of feedback. *Feedback* is said to be an essential component of efficient decision making and necessary for the development of expertise in a given domain (Klein 1998, Shanteau, 1992). Research has found that people who are developing expertise tend to seek out feedback after performing tasks. Sonnentag (2001) compared the processes by which moderate- and high-performing professional software developers completed typical design tasks. Results showed that high-performers sought significantly more feedback from team leaders and coworkers. They sought the opinions of team members and spent more time reviewing and exchanging information. The author concluded that this feedback aids the decision maker in gaining more experience by providing information about errors and inadequate performance. Moderate performers did not seek out feedback as often and more likely missed opportunity to learn and improve their performance.

A goal of this work is to explicitly direct the skill development of novices in a manner similar to expert skill development, thus, it is important to differentiate between those considered novices and experts. By evaluating individuals with varying levels of expertise, it is possible to understand the skill development process and teach these skills to novices (Hoffman, et al., 1998). Dreyfus and Dreyfus (1986) proposed a five-stage model of skill acquisition to describe how decision making processes develop as experience increases. The first level of this model is the ‘novice’ level, in which the decision maker recognizes objective facts about the situation and

applies “context-free” rules to the task. When decision makers apply rules across situations, without considering the unique aspects of the situation, inadequate performance often results. Novices also tend to focus on discrete cues and perform singular acts instead of perceiving the situation as a whole and acting with an overarching strategy. In the second stage, ‘advanced beginner,’ performance becomes marginally acceptable. The decision maker begins to recognize meaningful elements of specific situations, and applies basic context-specific rules, or “situational” rules of behavior. While these decision makers are able to recognize important information, they may ignore the importance of these cues and may not yet be able to incorporate them into decisions. In these two stages, decisions makers recognize learned components of the situation and apply rules and procedures with little flexibility or violation of these rules.

In the “competent” stage, performance becomes more streamlined and efficient. The decision maker is able to decompose the situation into discrete units and assess small sets of information in order to plan courses of actions. They are more proficient at prioritizing tasks and are able to think about the situation as a whole. They begin to engage in some rule-breaking behavior in order to accomplish tasks, yet they are still unable to differentiate among the most important cues or react to incoming demands. By the “proficient” stage, decision makers are able to perceive the situation as a whole, and recognize important patterns in an intuitive manner. Rules become less important, and decision makers become more flexible and react quicker to incoming information. They focus on long-term goals and understand when situations may require different actions, however they must still analyze the situation in order to determine a course of action. In the “expert” stage, action become automatic as decision makers intuitively recognize situations and match them to previous experiences. They are able to factor in novel aspects of the situation and have access to a broad range of mental models and large repertoire of

action choices. They use mental simulation to predict events and the outcome of actions, are able to use leverage points to their advantage, and can deal with uncertainty by story-building and actively seeking information. Action becomes fluid and intuitive and decision makers have trouble describing their decision process, which have now become automatic (Dreyfus & Dreyfus, 1986; Ross, Phillips, Klein, & Cohn, 2005). This model has been used to describe the skill-development of airline pilots, nurses, automobile drivers, and chess players and was applied to the decision processes of police officers in this study.

Errors in expert decisions. It is also important to understand spur-of-the-moment decisions that do not result in the desired outcome. Research has shown that inadequate decisions are usually a result of poor situation assessment rather than poor action-choice decisions (Flin, 1996). Studies of errors in NDM environments have revealed that it is not usually initial assessments of the situation that are faulty, instead it is inadequate assessments of changing situations that result in disastrous outcomes. As the situation changes, decision makers sometimes fail to take the significance of the changes into account, leading them to remain on their chosen course of action.

Weick (2001) conducted a case study of wildfire disasters in which firefighters died with all their equipment and tools still in hand. This is significant because if the firefighters had dropped their tools and equipment as they retreated, they likely would have survived. Even when commanded to drop their equipment, many did not respond and maintained their tools. Weick attributed this type of error to the inability to abandon routine plans combined with deficient situations assessment and failure to anticipate consequences. Under these conditions, either decision makers fail to take appropriate action or they take action that allows them to continue on the same, now inappropriate, course of action.

Similar to firefighters, examination of aviation accidents revealed pilots' failure to change courses of action after the action-choice was no longer appropriate (Orasanu, Martin, & Davison, 2001). Analysis of 37 airline accidents revealed that the majority of errors made were errors of omission; meaning they failed to do something that should have been done. These omission errors happened in situations where pilots continued with their course of action although evidence indicated that a change in action was necessary. The pilots inadequately assessed the situation, relying instead on familiar mental models to guide them through the situation. The authors attributed these errors to contexts where specific situational factors interact with individual cognitive factors, such as ambiguity, dynamic risks, organizational and social pressures, and stress. For instance, when cues that indicate a problem exists are not clear cut (ambiguity), or the risk of not changing plans is underestimated (dynamic risks), decision makers are less likely to change their course of action.

The outcomes of these situations indicate that decision makers made errors. Note that these "errors" were fatal - they did not satisfice. When evaluating the accuracy of decisions made in NDM environments, it is not possible to make dichotomous right-wrong assessments. Instead, decision makers evaluate errors on a continuum from optimal to worst-case (often fatal) outcomes. For example, a routine traffic stop escalates to the point where a passenger pulls a gun on an officer and after many verbal commands to drop the weapon the officer shoots the passenger. This is not an optimal outcome, but the officer, his backup officer, and the civilian driver are unharmed at the end of the incident. The outcome satisfices and the officer's actions are not considered an error although alternative action choices exist that may have led to a more optimal end. Similarly, other action choices may have led to further injury or fatalities, a worse outcome, but perhaps not an erroneous outcome. Much research has evaluated errors made by

experts according to traditional decision making literature. Weiss and Shanteau (2004) make the differentiation between experts' evaluations of errors and researchers' evaluations of errors. They state that while experts try to avoid big mistakes, researchers tend to search for the "correct answer." Experts show little concern for minor deviations from the optimal outcome, but researchers find deviations from optimality a major source of concern.

By assessing errors made by air traffic controllers when assessing situations, Jones and Endsley (2000) developed a taxonomy of situation assessment errors. They presented to participants scenarios containing cues likely to be overlooked, interpreted incorrectly, or used to make inaccurate outcome predictions. The main error that occurred was that controllers failed to comprehend the significance of perceived cues, rather than missing cues or making inaccurate predictions. The situation error taxonomy presented the factors that contributed to these three types of errors. For instance, at *level 1* - failure to perceive the situation correctly, decision makers may fail to observe the data or may misperceive the data. At *level 2* - improper integration or comprehension of the situation, decision makers may use an incorrect mental model or rely too heavily on default values when evaluating the perceived cues. At *level 3* - incorrect projection of future actions of the system, decision makers may lack the proper mental model or over-project current trends.

1.3 A Framework for Assessing Police Decision Making Processes

While NDM researchers use observational methods to reveal behavioral indicators of decision making processes, they use intensive interview techniques such as the *critical decision method* to learn about decision-maker cognitive processes. Training, such as *critical incident decision skills training,* is intended to increase the quality of decision makers' situation assessment and develop their domain expertise. This section provides background information

about the three information-gathering components used in this study and describes the purpose for their use.

Observation: The Simunition® Training System

Simunition® is an increasingly popular training tool used internationally by a wide variety of law enforcement agencies. Developed by SNC Technologies, Inc. for use by the military and law enforcement, Simunition® engages officers in live scenarios with others who act as perpetrators and bystanders. Participants assess danger levels and make use-of-force decisions using non-lethal marking cartridges (similar to paint-ball) in their firearms. Because all participants are in danger of being hit by non-lethal fire during these scenarios, they face an experience that creates realistic emotional, cognitive, and behavioral reactions. During Simunition® training, trainers can observe and evaluate officer reactions to events. Officers receive performance feedback in an effort to improve tactical decisions and actions, and reduce future errors that, in the real world, could cost lives or impact careers.

Simunition® provides officers with true-to-life practical experience in dealing with threatening and crisis situations. These simulations are considered more effective than lecture courses or typical gun range practice for preparing officers for duty on the streets. This training is also unique because, unlike current computer simulation programs, it offers unlimited scenario possibilities, ranging from, for example, traffic stops and serving arrest warrants to school shootings and terrorist attacks. Instead of confronting computer simulated criminal offenders who are pre-programmed with a limited repertoire of reactions, officers in Simunition® exercises confront live actors. This dynamic allows for actions and reactions to flow directly from each situation. Additionally, these scenarios can be conducted in a multitude of settings such as office

buildings, abandoned buildings, schools, buses, airplanes, and neighborhoods (Murray, 2004; SNC Technologies Inc., 2002).

There exists in some environments, such as military battle, trauma units, and fire grounds, the realistic possibility that decision makers will actually encounter the situations under study. In other fields, such as airline flight decks, nuclear power plants or other industrial environments, there is much less likelihood that a crisis may actually occur. Although decision makers may never actually encounter potential "worst-case" scenarios, they still must be prepared to deal with these events. Policing situations encompass both types of possibilities. Traffic stops, robberies-in-progress, drug busts, domestic violence, and assaults occur in the daily lives of police officers. These frequently mundane situations can escalate to critical levels at any moment. Police officers train for other events that they may never actually encounter in the span of their careers. Terrorist actions, hostage situations, and active shooters (shooters that are in the progress of harming victims, such as school and office shootings) are relatively rare events, but officers must be prepared to deal with these events if they do occur.

These potential threats highlight the importance of frequent training and practice in dealing with a wide variety of situations. As discussed above, experts tend to acquire specialized skills through training and practice that they then incorporate with real-life experiences and generalize to various domain specific situations (Ericsson & Charness, 1994; Patel & Groen, 1991). When decision makers lack real experiences to reflect on and gain feedback on, there is little opportunity to improve their performance. Structured simulations allow officers to evaluate their action choices, receive feedback, and develop first-hand experience. Engaging in simulated events provides officers with opportunity to engage in low-probability incidents that they must nonetheless continually be prepared to handle (Shiver, Martin & Flin, 2004).

Use of Simunition® in this project. Because opportunities to observe actual incidents are rare, if not impossible, researchers have focused on using simulated scenarios to observe and make realistic evaluations of decision makers. Forsythe (2004) discussed the importance of including human behavioral variables in computer simulation programs for law enforcement, but this computer-based simulation technology is not yet available. Limitations in simulation software have held back in-depth empirical evaluations using computerized simulations. Simunition® offers a way to present and study the effects of behavioral variations on decision making and presents a unique opportunity to simulate real-life events in controlled settings. Scripted scenarios can incorporate factors such as personality characteristics, personal and cultural histories, misconceptions and misunderstandings, and psychological and physical impairments, thereby adding these important dimensions to police training. The current research used Simunition® to present realistic scenarios to participants in order to observe their decisions and actions.

While Simunition® may enhance officer decision making by providing *practical skills training*, it does little to systematically enhance *critical thinking ability*, which is a necessary component in expert decision making. Critical thinking involves the ability to assess thoughts and actions in an analytical manner and be cognizant of the reasons behind particular decisions. For this reason, Simunition® alone is not sufficient to develop a framework for understanding law enforcement decision making. Additional elements are needed to tap into the cognitive processes of these decision makers. Simunition® provides a tool for presenting ambiguous and dynamic situations and NDM provides tools for understanding and enhancing decision maker reaction to these situations.

Interview: Critical Decision Method (CDM)

NDM researchers developed the CDM specifically to aid in overcoming memory loss and to enhance introspective awareness (Hoffman, et al., 1998). This interview technique is particularly useful for retrieving information about decision processes after critical incidents and is meant to be adapted to specific domains. Researchers construct domain-specific interview formats by utilizing information obtained in observations and through conversations with subject matter experts (Hoffman, et al., 1998; Klein, 1998).

In the CDM, interviewers engage decision makers in multi-trial retrospection of previously experienced critical incidents. This retrospection is guided by probe questions specifically designed to identify important cues, decision points, and action plans (Hoffman, et al., 1998). To obtain different types of information, a series of recall 'sweeps' are used to guide the decision maker as they recount the incident multiple times (Appendix A and B). The probe questions produce information about patterns of cues, the use of information to solve problems, and the use of situational elements to make decisions (Militello, 2001). In the current study, CDM techniques were structured around the decision demands of policing situations.

CDM techniques are similar to those used in eyewitness interview research. For example, research has found the cognitive interview to be effective in enhancing eyewitness recall of information about event and person details (Fisher & Geiselman, 1992: Hoffman, et al., 1998). Context reinstatement techniques, in particular, tend to enhance recall of descriptive information (Geiselman, Fisher, MacKinnon, & Holland, 1986; Zimmerman, 2003). Context reinstatement involves providing people with cues about the to-be-remembered event in order to facilitate recall of the event. The CDM enhances recall by providing participants with multiple opportunities to recount the event, thus reinstating context in a slow and systematic manner. The post-scenario interviews conducted in typical Simunition® training classes are informal and

relatively unstructured. Semi-structured interview methods, such as CDM, help participants engage deeper recollection and analysis of their decision strategies, cognitive processes, and outcome consequences (Hoffman, et al., 1995; Pliske & Klein, 2003).

Decisions makers can gain insight about their decision processes through CDM interviews, but this is in an indirect learning method. Although CDM engages participants in critical thinking activities, it is designed to be an information-gathering tool, rather than a tool to enhance cognitive skills, therefore it is useful to add a cognitive skills training course into a training program.

Training: Critical Incident Decision Skills (CIDS) Training

The purpose of CIDS training is to enhance decision maker ability in critical situations and to develop novice skills to expert levels. This training was structured from the critical thinking training and decision skills training models and used deliberate practice and feedback to compile extensive 'experience banks,' build mental models, and develop metacognitive skills (Pliske & Klein, 2003; Appendix C). Instructors provided participants with feedback after they engaged in various decision tasks and participants had opportunity to assess their own and others' decisions, thus developing self-assessment skills.

In the first traffic stop example presented, in which the motorist inexplicably became belligerent (p. 5), if the officer had prior decision making training, he may better recognize factors that indicate the motorist is a threat and more quickly determine the situation is dangerous. He would more readily shift his goals from issuing a traffic citation to protecting his own safety, and more accurately make the decision to either use verbal negotiation to calm the motorist or draw a weapon and use force. The officer would later be able explain why a particular course of action was chosen and be able to assess that choice.

Combining observation, interviews, and training creates a three-pronged training course: (a) practical/tactical skills, (b) information and knowledge gathering, and (c) cognitive skills training. The purpose of this 3-pronged approach is to enable participants to optimize their decision making abilities, make better cognitive and tactical decisions, build expert knowledge and skills, and become more aware of decision cues and their thought process while making decisions.

1.4 Project Goals

This project had three goals:

1. Create a framework for analyzing law enforcement decision-making processes in potentially threatening situations and during crisis incidents.
2. Compare and contrast the decision making ability of experienced and novice law enforcement officers in general, and also before and after Critical Incident Decision Training.
3. Introduce and further develop training that combines tactical (Simunition®) and cognitive (CIDS) training to police agencies.

Hypotheses

Hypothesis 1: It was predicted that differences in decision processes would be exhibited by experienced and novice police officers during Simunition® exercises and from CDM interviews.

Hypothesis 2: It was predicted that both experienced and novice decision performances would be enhanced after CIDS Training.

Chapter 2

METHOD

2.1 Pilot Study

A pilot study was conducted in order to obtain a preliminary understanding of police decision making. Officers were interviewed about their decision processes while they watched a video of potentially life-threatening event. From these interviews, the researcher examined experience-related differences in the situation assessments and decision choices made by participants. This research attempted to classify decision processes and determine whether officers with a moderate to high level of experience differed from officers with little experience in the cues they attended to, their outcome predictions, and their action-choices.

Officers viewed a videotape of an actual traffic stop and answered a series of questions at three pre-determined stopping-points in the video. The video depicted a scene that began as a routine traffic stop, with an officer pulling over a motorist, but escalated to the point where weapons were drawn and the officer shot the motorist. This procedure was derived from research presented by Dominguez (2001) and Dominguez, Flach, McDermott, McKellar, and Dunn (2004). The purpose of this pilot study was to provide insight into police decision processes and to gather information to use for developing interview and training procedures (see Appendix D for research protocol).

2.2 Main Study

Participants

Thirty-five law enforcement officers (Male = 32, Female = 3) from the city and county of El Paso, TX participated in this study for state-sanctioned academy course credit. Twelve officers were from the El Paso County Sheriff's Office, 19 officers were from the El Paso Police

Department, and four officers were from other agencies (Immigrations and Customs Enforcement, Horizon City, TX Police Department, Anthony, TX Police Department). The average age of experienced officers was 42 years (range 29 to 59) and the average age of novice officers was 32 years (range 22 to 47). Twenty-eight participants were Hispanic and seven were non-Hispanic White. Because this was a qualitative study, the number of participants was smaller than is traditionally found in quantitative research. The objective was to gather the breadth of information available and once the data gathering stopped yielding new information, data collection became redundant and unnecessary. Unlike in quantitative analysis, where averages and similarity in responses are analyzed, qualitative assessment seeks to demonstrate a dimensional range of variation in the data. Once the data becomes redundant, the variables of interest are considered "saturated" and further participants are not needed (Strauss & Corbin, 1998). Thus, continued monitoring of the data indicated that data collection had reached the necessary number of participants.

Participants were recruited by general announcement through the county peace officer e-mail system, where classes are regularly announced. In addition, commanding officers recruited officers during their shifts and allowed them to participate during their regular shift hours. Officers received 20-hours academy course credit for participating in this study. The researcher consulted with officers (not participating in this study) who were considered knowledgeable and experienced in law enforcement training to provide evaluations of the scenarios and to assist in constructing and teaching course material. These officers also assisted in project planning, scenario development, and structuring course goals and objectives[1]. The use of subject matter

[1] Officers from the El Paso County Sheriff's Office who assisted with the planning and implementation of this project were Vince Pokluda, Academy Director; Deputy Robert Horstman; Deputy Jamey Olmstead; Deputy Rudy Liggins; Sgt. Robert Flores; and Deputy Paul Soria. Officers from the El Paso Police Department S.W.A.T. unit who assisted were Sgt. David Ransom, Officer Mario Flores, and their team.

experts is useful for evaluating methods and data when those conducting the research are not experts in the domain under study, as was the case in this study (Cooke, 1994; Fowlkes, et al., 2000).

Study Design

This study compared experienced officers to novice officers and compared pre-training interviews to post-training interviews. The dependent variables included differences in decision making processes between experienced and novice officers and changes in decision making processes before and after training. Processing differences and changes may occur in decision components such as situation assessment, action choices, and decision points. Dependant variables were evaluated based on information gained in the pilot study.

Time 1. The researcher observed participants as they engaged in a Simunition® training scenario and then interviewed participants using the Critical Decision Method (CDM). Following CDM interviews, all participants attended Critical Incident Decision Skills (CIDS) Training.

Time 2. After completing CIDS Training, participants completed another Simunition® training scenario and CDM interview. Two different scenarios were presented and counterbalanced across Time 1 and Time 2.

Materials and Procedure

Assigning participants to conditions. The researcher assigned participants to conditions based on their self-reported years of experience as police officers. Interviewers did not know each participant's experience level during the interview session, although some participants did reveal information about their prior experiences and years in law enforcement during the interview and were not prohibited from doing so. Interviewers, however, did not actively seek out this information.

Objective measures of experience. Several sources of information were used develop criteria for experience levels. Research on expertise indicates that years of experience alone does not provide an accurate determination of experience (Ericsson & Charness, 1994). Participants provided demographic data that provided further understanding their experience levels. Both the El Paso County Sheriff's Office and El Paso Police Department utilize a certification process, which calculates years of experience, hours of law enforcement education, and hours of academic education. Certification levels are: Basic (1 yr experience/400 hrs education), Intermediate (2yrs experience/2400 hrs education through 8 yrs experience/400 hrs education), Advanced (6 yrs experience/2400 hrs education through 12 yrs experience/800 hrs education), and Master (10 yrs experience/4000 hrs education through 20 yrs experience/1200 hrs education). The number of participants at each certification level was as follows: Basic = 9, Intermediate = 8, Advanced = 8, Master = 8. Two participants did not have a certification level because they worked for a federal law enforcement agency.

Also factored into classification was prior military experience, because officers with only a few years of police experience may have military (including military policing) experience. Four participants with basic certification had between four and ten years military experience, as did four participants with intermediate certification, one participant with advanced certification, four participants with master certification, and one participant who was a federal agent.

Observation: Scenario development and administration. The researcher observed decision maker behavior as they participated in Simunition® scenarios. The scenarios used in this project highlighted the variables of interest, such as ambiguous and inconsistent information, expectancy violations, and situational changes. Officers who were not participating in the study assisted in developing two realistic scenarios. One scenario pertained to a possible kidnapping and the other

scenario involved a sexual assault in progress (Appendix E). These scenarios were presented at Time 1 and Time 2 and were counterbalanced across both sessions. Participants performed their scenarios individually and participated in each scenario one time. The El Paso County Sheriff's Office and El Paso Police Department regularly use Simunition® in training courses (i.e., traffic stops, active shooters) and instructors from these agencies administered the Simunition® scenarios to participants. They facilitated the sessions, acted as safety officers, performed the role of the 'bad guy,' and videotaped the sessions.

Simulations were video recorded in order to identify behavioral information such as decision points and actions taken. Observations introduce an additional data collection method into the research design. This is beneficial because it allows for information obtained during the interviews to be crosschecked with actual actions during the event. In this way, internal consistency of self-reports can be evaluated (Williamson, Ranyard, & Cuthbert, 2000).

Interview procedure. The goal of the CDM interview technique was to elicit the maximum amount of information about critical incident decision processes. This study utilized a template of the CDM interview procedure developed by Hoffman, et al. (1998) as a foundation to develop a domain-specific interview procedure (Appendix A and B). Immediately following the simulation, participants left the scenario site and drove to the interview site. The delay between participating in the scenario and being interviewed was not recorded. However, given the distance between the two sites, the delay was estimated to be approximately 10 minutes. A few participants had to wait for an interviewer, thus the delay was longer. The maximum delay was approximately 45 minutes.

The lead researcher and two research assistants conducted the CDM interviews. During the interviews, participants provided explanations about their experiences during the Simunition®

exercises. Each participant was interviewed separately in private interview rooms. The interviews were conducted in different environments than the scenario, however interview procedures such as the CDM actively employ techniques to mentally reinstate context (Hoffman, et al., 1998). Research has found that eliciting memories by mentally reinstating context can be as effective as physically returning to the location of the original incident (Krafka & Penrod, 1985; Smith, 1988). All interview sessions were recorded using digital recorders and downloaded into computers for transcription and coding. From the obtained data, specifications and conclusions were made about law enforcement decision making processes, domain knowledge, reasoning processes, task options, and decision cues.

CIDS Training. The researcher developed training techniques with the purpose of enhancing the decision quality of both experienced and novice officers. This project utilized the critical thinking training template developed by Cohen, et al. (1998) and decision skills training techniques developed by Pliske, et al. (2001). Participants' decision making was assessed before and after training, allowing the researcher to evaluate the effectiveness of the course. The researcher incorporated knowledge obtained from pilot data, the NDM literature, and law enforcement officers into the CIDS Training lesson plan (Appendix C). The goal of this course was to improve decision maker ability to recognize and assess situations, plan courses of actions, evaluate their actions, and verbalize the reasoning behind their actions (Cohen, et al., 1998; Cohen, et al., 1996).

Personnel at the Sheriff's Academy assisted in conducting the training course. The 8-hour course took place at the El Paso County Sheriff's Academy and officers received state approved course credit for participating. The training course incorporated lecture, critiques of actual videotaped situations, feedback about decisions presented in class, class discussion, and decision

making games. Participants watched videos and discussed the actions of the officers and suspects, assessing cues, various action choices, and possible reasons why the situations ended with a loss of life. In addition, participants played decision making games, which are detailed paper-and-pencil policing scenarios of varying degrees of difficulty. These decision making games were adapted from decision making games constructed for military training (Phillips, et al., 2001). Participants read a scenario and had two or three minutes to decide on a course of action. Then they presented and justified their choice to the class and received feedback.

Questionnaires. A series of questionnaires were administered to participants in order to gather background information, information about participants' prior experiences, and opinions about the Simunition scenarios, the interview, and the CIDS training course content.

Analysis

Qualitative research is a particularly appropriate method of analysis for identifying concepts in unexplored domains. Investigation of new domains should start out with broad questions that do not restrict the discovery process (Strauss & Corbin, 1998). The current study tied NDM theory with a previously unstudied decision maker domain. The purpose of this study was to develop techniques and procedures for gathering and analyzing information about police decision processes. This is only the first step in understanding these processes and it precedes steps that will codify and quantify this information. At this stage it was difficult to know which variables were important, what components made up these variables, or what factors contributed to their variation (Strauss & Corbin, 1998). If a researcher narrowly defines the variables of interest during the exploratory phases of a program of study, much information will remain undiscovered. A fundamental understanding of domain components and concepts is necessary before more predictive, narrowly defined analysis is performed. Once concepts are delineated

and coding systems have been developed, then testing of specific hypotheses under controlled conditions can begin to take place.

The purpose of qualitative research is to explore a concept in depth, rather than exploring relationships among chosen variables and testing hypotheses (Strauss & Corbin, 1998). Although hypotheses were stated for this study, the conceptualization and 'testing' of these hypotheses was an in-depth descriptive analysis. In qualitative assessments, it is important to maintain objectivity and sensitivity. *Objectivity* is attained by thinking comparatively across properties and dimensions of categories, by gathering data on the same event in different ways, by seeking multiple viewpoints of an event, and by checking assumptions and interpretations against alternative explanations. *Sensitivity* allows the researcher to perceive meaning and develop insight by seeing beyond obvious interpretations (Strauss & Corbin, 1998). Qualitative analysis allows the researcher to understand what events mean to participants, the context within which participants act, and the processes that lead to specific outcomes (Maxwell, 2005).

Manipulation checks. The purpose of using multiple data collection methods (interviews, observations) in this work was to provide means for crosschecking data from one mode of knowledge elicitation with others in order to track consistency in reporting or to uncover potentially biased reporting. The technique of assessing information obtained from a variety of sources, called triangulation, allows for a more in-depth understanding of decision processes, at both a behavioral level and a cognitive level (Maxwell, 2005). Interview data was crosschecked with observational data (videos) in determine how consistent participants were in reporting actual behaviors during the event.

To confirm that the scenarios presented to participants were realistic, participants were asked if the scenarios challenged them to make a tough decision, and they rated how challenging,

realistic, and stressful each scenario was on a scale of 1 (not at all) to 10 (extremely). The majority of participants indicated that the decisions made in the "kidnapping" scenario were tough, and the average ratings for challenging was 7.70, realistic 8.45, and stressful 7.05. The decisions made for the "sexual assault" scenario were also considered tough, and the average ratings for challenging was 7.71, realistic 8.59, and stressful 7.56. To understand the usefulness of the interview technique, participants rated on a scale of 1 to 10 how easy or difficult it was to answer the questions (M = 3.79), and how useful each segment of the interview was in helping them communicate their actions and decisions (time-line, M = 7.91; probe questions, M = 7.98; what-if's, M = 8.11).

Observation analysis. Each session was recorded with a digital video camera and then coded to track behavioral indicators of decision processes, such as how the officer entered the room and approached the subject, vocal levels and tone-of-voice, and conversation between the participant and subject.

Interview analysis. Interview data was broken down into categories and sub-categories. The two major categories were *assessing the situation* and *planning/selecting a course of action*. Analysis of the data revealed sub-categories under each of these categories, along with information about the structure of the decision processes. Finally, detailed categories of information were created that focused on discrete variables of interest (Appendix F). This method of categorization is similar to the categorization process reported by Wong and Blandford (2001). Final analysis of the content of these smaller categories revealed information about the decision processes of experienced and novice participants and enabled comparison of content across experience levels.

Training analysis. Comparisons between pre-training and post-training scenarios and interviews revealed any differences in decision processes due to training. Analysis of experienced and novice officers provided information about any differential effects of the training on these two groups.

Chapter 3

RESULTS AND DISCUSSION

In the results and discussion section, data is presented in four segments. *Segment one*, the pre-analysis section, discusses *pilot data* findings and discusses the process of classifying *expert categories. Segment two* presents data from the interview analysis. This segment is divided into two sections, one presenting data about *assessing situations*, and the other about *planning and choosing a course of action*. The course of action section presents information about *major decision points, the decision to approach the subject, shoot/no shoot decisions,* and *decisions about behavior*. Following the course of action section are sections discussing the differences in *decision making before and after CIDS Training* and analysis of the *observation data*.

3.1 Pre-analysis

Pilot data

Results from the pilot study revealed differences in the decision processing of more and less experienced police officers. Both groups discussed the cues they used to evaluate the situation, but experienced participants often expanded on these comments by suggesting courses of action and by making evaluative comments. Experienced officers tended to rely on mental models to quickly recognize what was occurring during the traffic stop, for instance by predicting what action the motorist was going to take, or by suggesting that the officer in the video made the traffic violation stop with the underlying motive of looking for drugs. These mental models may allow officers to recognize the video situation as typical and relate it to prior experiences and expected outcomes. Novice participants would more often indicate, “something is not right” without elaborating. They generally focused on procedural concerns, such as safety issues and tactical rules. Both groups of participants relied on verbal and nonverbal cues to assess the

situation, however, experienced participants provided greater detail and offered inferences about what these cues indicate. Novice participants relied more heavily on what the motorist said and, although they mentioned nonverbal behavior, they were less likely to provide details. For instance, while novice participants tended to observe that the motorist "was nervous," and discussed the safety procedures they would follow as a result, the experienced participants would state, "he's nervous, like fidgeting, crossing arms, looking around, wringing hands." Experienced participants would then explain the likely causes of this behavior, such as, the motorist was hiding a crime or that he was thinking about attacking the officer or running away.

The results of the pilot study provided information about the context-specific cues and procedural issues that are important in policing domains, such as behavioral cues and procedural concerns when entering situations or interacting with subjects. In addition, these data provided information about common mental models accessed during events and clarified the range of possible action choices officers may take during different stages of events. These cues were used in later analysis as a guide to determine various levels of experience according to the five-stage model of skill acquisition (below). Interviewers used this information to structure context-specific probe questions during the interview procedure (Appendix B).

Expert categories

Assessment of participants' background information indicated that dividing subjects into experienced and novice categories did not provide a clear distinction between these groups. Some officers assigned to the novice group (1-3 yrs experience) actually had prior experience at other police departments, or extensive military experience. Some officers reported years of experience that fit within the novice or experienced (8+ yrs) categories, but a post-data-collection review of officer records revealed that some officers actually had between four and seven years

experience. In addition, the range of experience for the experienced group was eight years to 29 years. If combined into one category, the expertise development that takes place during these years may go undetected.

To better understand differences in decision making based on experience, participant interviews were analyzed and categorized using Dreyfus and Dreyfus' (1986) *five-stage model of skill acquisition.* Ross, et al. (2005) specified the knowledge and performance elements that exist during each stage of this model, and the researcher categorized the interviews according to these elements. The lead researcher identified participant comments as 'strategic,' 'situation assessment,' 'alternative situation,' 'change in situation,' 'alternative action,' 'change in action,' 'mental model,' 'mental simulation,' 'information-seeking,' 'procedural,' 'action,' and 'self-evaluation.' The interviews that contained a greater amount of the first nine elements listed were considered more experienced. However, simply counting these elements would not have been indicative of each skill level, instead comments were evaluated in the context of other comments. This provided a greater sense of how extensively each participant processed the situation.

Participant interviews from Time 2 were rated and compared to Time 1 interviews, and 11 participants had different ratings, going up or down one skill level. Nine of these were rated at a higher skill level at Time 2. Most of these participants had ratings at Time 1 and Time 2 that were on the cusp of being assigned to the next level. The lines between these categories need to remain fluid in order to understand the development that takes place as decision makers transition from one skill-level to another. Because these changes in ratings were slight, there is a possibility they were due to transient performance differences rather than fundamental changes in decision processes. In addition, independent coders did not validate the categorization process used here, thus no strong conclusions were made and these findings were not attributed to

training effects. Perhaps once a systematic and streamlined classification system is developed, data will replicate this trend and allow for stronger conclusions to be made.

All but three participants originally assigned to in the novice group were rated at the 'advanced beginner' or 'competent' skill level. All participants in the experienced group were rated at either the 'competent,' 'proficient,' or 'expert' skill level. Three participants in the novice group were rated at the 'proficient' level. These three participants each had more than three years of experience in law enforcement, and two of them had over eight years military experience. Those rated at the 'competent' skill level came from both the novice and experienced groups. The average years of experience for those at the 'competent' level was 4.5 years (range: 1 to 9 yrs). The average years of experience for the other levels were 'advanced beginner,' two years (range: 1 to 3.5 yrs); 'proficient,' 13 years (range: 4 to 28 yrs); 'expert,' 21.5 years (range: 11 to 26 yrs). Participants' skill level was compared to their law enforcement certification level (see above). This categorization revealed a similar pattern between these two classification methods, which indicates that there may be a correlation between the factors considered when determining certification level and the cognitive components found at each skill level.

This correlation should be considered with caution, given that classifying participant skill levels using the actual data presents a non-independent comparison. Until more advanced research identifies and provides clear definition of objective measures of experience, only a preliminary delineation of expertise development can be sketched. The objective measures presented in this study, such as years of experience, certification level, and prior military experience, factor into this development, however, these measures do not clarify or define the components that factor into decision processing as expertise develops. Future researchers should develop independent measures and objective rating procedures of these decision processes. From

this initial classification, further specification of officer decision processes can be developed and may aid in understanding any elements that did not fit with the model and provide information about how and why the processes develop in the manner indicated by this initial classification.

Discussion below retains the original factor labels of 'novice' and 'experienced.' Results reported for the *novice group* include data from those at the 'advanced beginner' level (n = 7). Results for the *experienced group* include data from those rated at the 'expert' level (n = 5) and 'proficient' level (n = 13). Examples from the 'competent' level (n = 10) illustrate decision processing at a stage of skill development between the other levels.

3.2 Interview Analysis

Interview data were categorized according to the structure outlined in Appendix F. The findings presented below focus on experienced/novice differences that occur at various levels of the decision making process. Data consisted of statements that illustrate components of police decision processes and reveal concepts that contribute to the understanding of this domain. The purpose of this analysis was to discover variables of interest and explore how they vary along a continuum.

Assessing the situation

Evaluation of the interviews revealed contextual differences in the situation assessment processes of participants. Experienced participants focused heavily on describing their assessment of the situation, while novices focused heavily on describing their actions and the actions of the subject[2]. For instance, when asked what their first impression of the subject was, an 'advanced beginner' participant said:

> He was pretty loud, I couldn't see him. That's why I wanted to know where he was, I was telling him to come out so I could see him. I didn't really know what was going on with

[2] The word 'subject' is use to describe the role-player in the scenarios. This is the word police officers use when they refer to people they encounter who are not suspects, victims, or witnesses.

> him, but I needed to see where he was and if he was hiding anything. He was hiding behind the file cabinets so I couldn't tell what was going on with him, if he was injured, why he was upset.

In this example, the participant described how he or she could not adequately assess the situation and did not provide any possible explanations for what could be going on and remained focused on his/her actions and the subject's actions. In contrast, an 'expert' participant provided an interpretation of the subject's behavior and made a prediction about what may occur next:

> The suspect was very highly agitated because he stepped out and confronted, well it was more of a mutual confrontation. At that point, he wasn't trying to hide but he was being very loud and he was completely disregarding all of my commands, knowing he had a gun pointed at him and he didn't seem to care, so he was very irrational. At that point I thought he was going to try and make me shoot him, it wasn't going to end very quickly.

As demonstrated in this example and the next example, experienced participants provided more contextually rich descriptions, often providing descriptions of how situations usually proceed (mental models), interpretations of behaviors, and predictions about future actions and outcomes. When discussing how the subject did not comply with commands to put his hands up, a 'proficient' participant stated:

> You know, most individuals, when you say "put your hands up against the wall," they will go up to the wall. If they refuse to do that, it means you've got an irate person who is upset at something, not necessarily at you. And, usually it's at you because you represent the government, you represent what he's against. So, he was irate at everybody, but he's going to take it out on me because I'm the one there right now, I'm in uniform, so he's upset at the uniform.

Novice participants also described how things usually go, but in reference to context-free procedures, such as this 'advanced beginner' participant who said:

> I just wanted him to comply with my verbal commands to let me see his hands. Once he showed me his hands, then I probably would have got him in the kneeling position, hands on top of his head, and then I would have searched him to make sure he doesn't have any weapons on him. After that I would have set him down, I would have asked for identification and then called it in to make sure he's not wanted or anything.

The above two examples illustrate differences in the mental models used by novice and experienced participants and is similar to previous findings in which experienced participants used mental models to describe, explain, and predict elements of the situation (Goodrich, et al., 2000; Phillips, et al., 2004; Rouse & Morris, 1986). Experienced participants in this study often related the current situation to situations they encountered in the past, or to typical situations. For instance, participants used mental models to conjecture why the subject was not complying, what may be the source of the subject's behavior, what the lack of crime scene evidence might mean, and how the subject might react to participant actions. Novice participants provided textbook-type procedural descriptions of how they dealt with the situation, while experienced participants provided descriptions of the strategic maneuvers used to negotiate through the situation and deal with the subject. The use of strategic models increased during the 'competent' stage, where participants used simple strategic models, but rarely with further interpretation or prediction of future events (mental simulation). When discussing the option to retreat from the situation, a participant at the 'competent' level stated:

> So, I was prepared to, if he kept walking toward me, I would retreat back to the entrance, that way we maintained that distance and not allow him to get any closer, that's what I was trying to do maintain the distance between us and also try to get in there, find concealment if he did turn around.

This participant was able to think about long-term goals and possible action choices and started to use mental simulation but then fell back to talking about procedural issues and actions. In contrast, an 'expert' participant applied a strategic model for retreating, used mental simulation to determine this was an unsafe course of action, and made interpretations about how this action would influence the subject:

> I really didn't have time to retreat, because if I retreated I wouldn't be able to see him and he could have shot me in the back. And by me moving back, it was probably just going to

> escalate things because now the guy is going to think that I'm walking away or give him more reason to, or build up his self-confidence.

The procedural descriptions provided by novices supports previous research comparing instructor and student helicopter pilots and research comparing long- and short-term drivers, which found that novices tend to rely on procedural models when assessing tasks and experts tend to use strategic models to assess the situation and avoid risk (Fowlkes, et al., 2000; Klein, et al., 2001).

Previous research has indicated that experts and novices often attend to the same cues, but experts tend to combine these cues more effectively (Randel & Pugh, 1996). In the current study, experienced participants provided detailed descriptions of their situation assessments, whereas novices tended to mention discrete cues with less detail about the meaning and implications of those cues. For example, during one of the scenarios, the subject would tell participants that he just got out of prison. Most participants acknowledged this cue, but the interpretation and probable implications of this information varied among the groups. Many novices acknowledged that this information led them to believe that the subject may be dangerous. Experienced, and some 'competent' participants, would elaborate by making statements such as, "he on parole so he's a convicted felon, which means he's not a nice person, he could be dangerous," and "I don't want to ask him what he was in prison for, it will just agitate him more." Or, in one example given by a 'proficient' participant:

> He's been in jail, he understands that if he doesn't follow our commands, we're going to progress our use of force….I've even said before "you know the game' and they're like "ya." It does concern you because once someone like that, who knows the system, challenges you or resists you, it's probably going to be bad.

This participant matched the current situation to previous experiences, applied a typical course of action, then discussed the implications of the subject's actions and made a prediction.

In contrast, novice participants would acknowledge this cue, but would not incorporate it into their decision process. For example, one 'advanced beginner' mentioned the "jail" cue but did not provide an interpretation of this cue. Instead this participant remained with on the same procedural course of action without incorporating this new information and adjusting the action:

> He was telling me, "I don't want to go to jail, I just got out, I'm not going back." I'm all like "we'll talk about it, let me see your hands right away. We'll talk about it after I'm secure, let me secure you for my safety as well as yours."

In cases such as this, the participant would sometimes continue approaching the subject as if the subject had not made such a statement. Experienced participants would sometimes react by taking cover or by seeking more information from the subject, such as where he was living or how he traveled to the location. This indicates that novice participants have some level of understanding that this cue is important, but lack ability to incorporate this incoming information into their situation assessment and adjust their course of action.

Previous research has found that experts tend to focus on assessing situations whereas novices focus on determining what action to take (Kaempf, et al., 1996; Randel & Pugh, 1995). The data presented here do not provide confirmation of this conclusion. As stated above, experienced participants focused on assessing the situation, elaborating with possible explanations about what they perceived, and what actions they would take in various situations. However, it is not so clear that novices focused on determining a course of action. Instead, they tended to fall back on taking prescribed procedural actions, such as the correct procedures for clearing a room or for approaching and securing a subject. Some seemed focused on the goal of subduing the subject and thus, did not seem to engage in any assessment, for instance, to determine if the subject was a suspect or innocent bystander, and proceeded to walk directly up to the subject and attempt to handcuff or search him. Occasionally novice officers would make

comments such as “He wasn’t complying, I’m thinking ‘now what am I supposed to do?’” indicating they were unsure of what to do at various points in the scenario, but this was not a major trend in the data. Instead, novices seemed focused on taking actions that followed the procedures they were previously taught.

Plan and select a course of action

Experienced officers tended to change their course of action in response to changes in the environment. Instead of deliberating about changing their actions, they seemed to react in a fluid manner, while novices tended to either ignore or note the changed condition but not change actions. For instance, when discussing how to interact with an uncooperative subject who suddenly turned suicidal by holding a gun to his head, a novice participant stated:

> I was telling him “I can’t just shoot you for no reason, you haven’t shot me or anybody else, things aren’t that bad, just put the gun down” and he just kept going on about how he wanted to end his life, talking about his family and troubles….So now you’re thinking “what do I do next, he’s not cooperating?” I wanted him to put the gun down, calm him down, but he wouldn’t calm down.

This participant did not seem to have a mental model for how to deal with an uncooperative, suicidal subject and was not altering his or her course of action to attain the goal of getting the subject to calm down. This participant attempted to reason with the subject, telling him that it was “against the rules” to shoot because the subject had not shot at anyone, thus maintaining very rule-based reasoning. In contrast, an experienced participant stated:

> He’s still pacing back and forth, he’s got a gun to his head, he’s saying “my family,” I just caught “family” very briefly and I thought obviously his family means something to him so that’s what I’m going to go after.….What I did was drop my voice way down and started asking about his family…. If you can play on his emotions for his family, all of the sudden he realizes he’s hurting someone besides himself, so I went after that and it ended up working.

This experienced participant recognized the cue "family," interpreted what this cue meant to the subject, and reacted in a fluid manner, changing his or her course of action from giving commands to discussing family in a calm, quiet manner.

Results indicate that experienced participants were using forward-reasoning to determine courses of action. As Klein (1998) discussed, forward-reasoning is similar to using mental simulation to assess the outcome possibilities of certain actions. Experts use their elaborate mental models to run mental simulations that describe, explain, and predict situations (Phillips, et al., 2004). For instance, this experienced participant used mental simulation to *describe* what they might encounter when entering the situation:

> If somebody had already been in there, they have the upper hand on you because they know the layout, the exits, or they just got that information and you don't. You're going into the unknown, it's the unknowns that mess you up, he could have jumped out of anywhere.

To *explain* the presence of two relevant cues, a backpack and a knife, this experienced participant used mental simulation:

> There wouldn't be a knife laying in the center of the floor of a vacant warehouse, and of course, there's not going to be a backpack laying there. It just sort of corroborates what you're there for, you've got a student that was taken from UTEP, there is a good chance that a female student was carrying her backpack with her. In a public place, probably the easiest way to get control of somebody would be with a knife without drawing so much attention.

To *predict* the outcome of a specific course of action, this participant mentally simulated the prospect of bullets going through the file cabinets he or she was using for cover:

> I may have retreated a little, because I think there was better cover by the wall. But, if he moves the same way then my view was blocked again. So, I don't know, that would have been a real hard decision to make. I mean they don't necessarily shoot by the rules, me, I wouldn't have shot through the file cabinets. And the reason I wouldn't have is because what if the girl is behind it. I can't see where I'm shooting at.

This last example illustrates decision making at *level 3* of the recognition-primed decision (RPD) model, which occurs in situations where there is understanding of the situation but the best course of action is not clear, so decision makers mentally simulate possible outcomes of certain actions (Klein, 1998). Research indicates that while experts use forward-reasoning, novices use backward-reasoning (Patel & Groen, 1991) There was indication that novices tended to use backward-reasoning by attempting to make data (what they were seeing in the environment) fit their hypothesis (predictions about what was going to happen). For instance, in general, officers tend to enter situations with the hypothesis that people will comply to their commands. In the scenarios presented in this study, the subject did not comply with the participants' commands, violating expectancies about how things should go. Many participants noted that most civilians comply when confronted by an officer, especially an officer with a gun in his hand. When dealing with the non-compliant subject, novice (and many competent) participants tended to maintain their current course of action to make the subject comply, thus neglecting information that, when incorporated into their assessments, would provide an alternative course of action option, such as negotiating with the subject, gathering more information about the situation, or taking cover with increased protection.

Major decision points. Within each scenario, four major decision points were identified: entering the room, approaching the subject, interacting with the subject, and engaging with force or otherwise resolving the situation. The focus of this paper is on experienced/novice differences in decision processing, thus an extensive analysis of each decision point is not provided here. However, it is informative to discuss one decision point in order to illustrate the scope of police decision processes and to further highlight experienced/novice differences, thus the decision to approach the subject will be discussed.

Approaching the subject. Once participants entered the building, they began searching for the perpetrator and victim, or anyone else who may be present. Eventually, participants located the subject and approached him. Many critical decisions are involved in approaching a subject prior to any actual interaction (conversation, physical contact). The participant must determine a safe route to the subject, a location for safe and effective cover, when to reveal their presence to the subject, a safe stopping distance from to the subject, the time they should spend searching the surrounding environment, and whether their weapon should be drawn.

The majority of participants approached the subject cautiously, with their weapon drawn and in view, using varying amounts of cover, giving a cursory look around the room as they proceeded, and announcing their presence at the start of the approach. However, there was variability within each of these sub-decisions. For instance, when choosing cover some officers took the first cover that was available even if the cover offered less protection. Others identified the most protective cover even if they took greater risk in getting to that cover. A quick cost/benefit analysis must take place when deliberating between these two options in order to determine if immediate cover with the loss of later safety is more beneficial than loss of immediate safety (while going a greater distance) to obtain better cover. Decision makers can use the *quick test* questions (see above) to evaluate this decision; 'Is the cost of delay acceptable?', 'Is the cost of an error high?', and 'Is the situation unfamiliar or problematic?' (Cohen, et al., 1996; Cohen, et al., 1998). With both courses of action, the cost of error was high, and the situation was unfamiliar and problematic, however the cost of delay varied with each action choice. If the cost of delaying action in order to search for better cover is not acceptable, then the decision maker should take immediate cover. If the cost of delay is acceptable, for instance if the

suspect was not an immediate threat, then the decision maker can engage in critical thinking, in this case by determining safer locations for cover.

Variation within other sub-tasks also existed, such as whether to continue a detailed search of the room, risking potential aggressive action or escape by the subject, or to approach the subject quickly, risking missing another subject in the room. Some participants stayed a rooms-length away from the subject while others stopped within a few feet of the subject.

Shoot/no shoot decisions. The decision when to shoot an armed subject is a complex one in which the decision maker must notice the cues that indicate a subject is about to shoot. Participants needed varying amounts of information to reach a decision threshold that indicates they should fire their weapons. Thirteen participants fired their weapons before the subject did, and two of these participants fired first in both scenarios. Five were at the 'competent' skill level and four where at the 'proficient' skill level, and two each were at the 'advanced beginner' and 'expert' levels. In most of these incidents, the participant determined that the subject was about to pull a weapon out and point it at the participant. The major cues that played into this assessment were that the subject was reaching into his clothing "to grab something," he was suddenly ducking behind cover, and he was making a motion to turn the gun from his head to the participant. These participants indicated that they did not wait until they saw the gun pointed at them to fire, claiming that it would be too late at that point and they would be shot.

The majority of participants did not fire their weapon until after the subject fired. The main reason participants gave for waiting was that they did not have legal cause to shoot until the gun was pointed directly at them. Some participants were taken by surprise when the subject fired, and some felt they would get the first shot off if the gun turned on them, however, this ended up not often being the case. More often, the subject would fire before the officer had time to react,

indicating that officers sometimes overestimated their reaction time. Seven participants resolved one of their scenarios without gunfire (competent = 2, proficient = 3, expert = 2). These officers engaged in negotiation and convinced the subject to surrender. Four 'competent' participants in one of their scenarios and one 'advanced beginner' participant in both of his/her scenarios, either tackled the subject or grabbed the gun from the subject's hand. These shooting decisions reveal that the 'competent' participants tended to engage in more risky actions than did those in the other groups, either by shooting without seeing a gun pointed at them, or by tackling the subject. At this skill-development stage, decision makers are beginning to draw on earlier experiences, however, they still lack the ability to gauge what information is important. Although this is the stage where decision makers become more organized, they also start breaking rules in order to accomplish their goals (Dreyfus & Dreyfus, 1986). At earlier stages, participants are more concerned about not breaking rule or using force when it is not justified. At later stages, participants are more likely to choose options other than firing, such as taking cover and negotiating.

Trends in shoot/no-shoot decisions based on experience are difficult to track in these data. In these live simulations, the subject was allowed to vary his actions and reactions in response to the participant's actions, thus shoot/no-shoot decisions were not always required. In addition, external circumstances sometimes determined the outcome, such as when safety was an issue or when the weapons jammed. It is interesting to note that the three experienced officers who had a weapon jam continued with the role-play. One participant cleared the jam and shot the suspect, one fooled the subject into thinking the gun still worked and subdued him, and the other was observed by the subject trying to clear the jam and was shot. The two novice officers who had weapon jams discontinued the role-play because of the malfunction. This illustrates the fluidity

with which experienced officers adapt to unforeseen events, whereas the novice officers did not have a mental model for the situation and simply ceased the role-play.

Decisions about behavior. As stated in the introduction, police officers must assess the behavior of other individuals in order to make sense of situations. This study is uncommon in that it looks at decision-makers' interactions with other humans during critical incidents, rather than with non-human entities, such as equipment failures, fire patterns, and aircraft or watercraft movement. The NDM characteristic where this factor seemed to have the most influence was in how participants dealt with uncertainty. As stated previously, in critical environments, it is necessary for decision makers to accept uncertainty as inevitable in order to make effective decisions (Klein, 1998). Analysis of these interviews revealed that participants expected a high degree of uncertainty when encountering potentially threatening individuals and not only accepted this uncertainty, but also adapted to functioning in such environments. For instance, participants often made comments such as "I didn't know what to expect, he could do anything," or "it's an unknown environment, you don't know who you are going to encounter." Because of this uncertainty, participants often thought in terms of the worst-case scenario, such as "I always expect the worst," "I assume everyone is armed," "everyone is a suspect, until I can determine otherwise." In addition, they entered the situation with a heightened alert and caution level, such as "I always enter unknown environments with my gun drawn" and "I would not approach a subject without knowing what was in his hands."

This a priori expectation of danger perhaps influenced novice participants decision processes more so than experienced participants as illustrated by novice participants' tendency to direct their actions toward securing the subject, even after incoming information indicated that the subject might not be the criminal perpetrator. Experienced participants dealt with uncertainty

by actively seeking out information about the situation (questioning the subject) or by reading the cues that were available (backpack, no victim) and filling in missing information with information from their experience banks (Pennington & Hastie, 1986; 1988).

As illustrated above, experienced participants tended to focus on assessing the situation and using mental models to make interpretations. This represents decision making at *level 2* of the RPD model, where decision makers continue to assess ambiguous situations until they reach a threshold of comprehension that results in a clear action choice (Klein, 1998). Because the scenarios presented in this study contained a large amount of uncertainty, participants were less likely to recognize the situation and react in a typical manner, as happens in *level 1* of the PRD model. If participant had access to more information, decision processing may have occurred at this level. Interviewers asked participants what information would have been helpful to have going into the situations. Some common responses were that it would have been useful to have a description of the perpetrator or victim, information about the subject's criminal history, more information about the crime, information about the perpetrator's relationship to the victim, diagrams of the buildings they entered, and information about any mental illness or substance abuse issues the subject may have had. In future scenarios, it would be informative to vary the amount of information given to officers in order to demonstrate decision making at different levels of the RPD model.

Another unique factor discovered in these results is the notion of influencing outcomes by changing the mental processes of another person, in contrast to influencing environmental processes, as in other domains (manipulation of aircraft, steps to control fire patterns, etc). For instance, an experienced participant stated:

> I just kept trying to talk to him, get a feel for him, to maybe bring him down because he was very upset. I figured if I ask him about this lady and trying to take care of my

> business, maybe it would deflect some of his anger of being homeless, of being just out of prison, no place to stay…. But I guess that is why I was doing that, get him away from his personal stuff and make him feel like he was helping me.

Another experienced participant stated:

> He was overwhelmed, scared, trying to call someone on the phone, so why feed his fear. "Hey, come downstairs, you can use my phone, we'll call whoever you want." And asking his kids names, because just thinking of his kids in the sense of "they're going to hate me," it's like getting tunnel vision. So I wanted him to snap him out of it, try to get him to think rational.

Certainly, more research and systematic investigation is needed to understand how decision makers' influence on other peoples mental processes factor into critical incident decision making. In other domains, techniques are used to influence people, such as sales, politics, or even during police interrogations. However, there is little understanding about the use of such techniques in high-stakes critical environments, such as the patrol situations investigated here. One area of policing, hostage negotiation, actively employs persuasion techniques intended to influence peoples' behaviors, however, no known studies have assessed these techniques in the context of the NDM paradigm.

3.3 Decision Making Before and After CIDS Training

No readily apparent differences were found when comparing participant interviews across Time 1 and Time 2. For instance, comparisons were made of participants' assessment of the subject's behavior (physical, verbal, and nonverbal cues). In CIDS Training, the perception, verbalization, and interpretation of behavioral cues were a major area of focus. After actual incidents, officers often justify their actions by claiming that the suspect was "aggressive" or "hostile" or that the suspect was "acting suspiciously" or making "furtive movements." These non-elaborative descriptions provide little justification for their actions and officers sometimes find themselves in trouble when confronted by superiors or by defense attorneys in court.

Therefore, teaching participants to notice the cues that led to their conclusions about suspects' behaviors, and also to verbalize what specific cues factored into their decisions, was a focal point of the class. Analysis revealed no reliable changes between the first and second interview in how participants described or interpreted the subject's behavior. Below are examples given by experienced and novice participants during their second interview. The interviewer asked them to elaborate on their behavioral descriptions and one novice participant stated:

> I: When you say he was agitated or aggravated in some way, what lead you to believe this?
> P: Well, the point that he's just walking back and forth and he's upset. He's pacing and looks nervous, to me that just told me that something is obviously bothering him. But I wasn't too sure, I was telling him, "come over here, let's talk about it" but he wouldn't listen to me.

This participant provided a vague description of the nervous behavior and provided a broad interpretation of the suspect's behavior, but then went back to describing his or her own actions. An experienced officer stated:

> I: So you said his voice, he sounded angry and maybe disoriented. What about his voice made you think that?
> P: Well, his voice just was angry "no, I'm not going to put the cell phone down. I don't have any reason to live, I've lost everything" so I knew he was very upset and, at that particular point he really wasn't thinking about any consequences of his actions, he was just upset and he was going to react out of anger or out of emotion.

This participant did not describe voice qualities as asked, but instead provided a detailed interpretation of the suspect's behavior. Both these participants gave similar descriptive responses during their first interviews. Although the experienced participant provided a response that was more interpretive and predictive, he or she did not elaborate on the vocal qualities that lead to the conclusion the subject was angry and disoriented. Access to the specific nonverbal body movements and tone of voice cues that factor into these assessments seemed difficult for most participants. Participants put the package of cues together and concluded that the subject

was “nervous” or “aggressive”, but found it difficult to parcel out the factors that played into these assessments. Being able to specify the components in this package and being able to verbalize these cues would greatly enhance officers’ abilities to justify their actions after questionable incidents. Training in this area would help novices learn what cues are important and unimportant, and help experienced officers parcel out and articulate their intuitive assessments of subjects’ behaviors.

Four experienced participants and two participants at the ‘competent’ level did report utilizing some of the knowledge obtained in class during their second scenario. Two participants discussed how the class helped them to stay calm and more focused during the second simulation. Four participants mentioned using strategies aimed at changing the probable actions of the subject. Another focal point of CIDS Training was how to assess a situation with the goal of determining what subjects would do next, and then take action to interrupt the subjects’ thought processes and thwart their intended course of action (Coram, 2004; Murray, 2004). This strategy of “thinking ahead of the enemy” was met favorably by participants, and indicated that officers in general, may not receive training in strategies to “outmaneuver the enemy” as is found in military environments. Application of these strategic concepts to policing environments may enhance police abilities, particularly when paired with cognitive skills training.

As discussed by Shanteau (1992), decision aids and feedback may improve performance when making decisions about behavior. This class offered a variety of feedback techniques and attempted to provide participants with expanded mental models and a larger repertoire of action choices. Although comparison across Time 1 and Time 2 did not show a reliable change in decision processes, participants’ comments about the lecture content and class exercises were very positive. Besides the strategic decision making material, participants found viewing video

tapes of actual officer incidents and discussing the suspects' and officers' actions most helpful. In addition, they found that class discussions provided them with new and valuable information about other participants' experiences. Class discussion consisted of participants sharing their experiences and talking about alternative action choices in a variety of situations. It is possible to develop or expand mental models simply by hearing other people's stories, and many participants stated that hearing how other participants have handled or would handle particular situations provided them with insight and ideas they had not previously thought of. These comments are similar to comments made by students after decision skills training in Pliske, et al. (2001). The Time 2 interviews did not indicate a fundamental change in decision processes however it may be that the "experience banks" of these participants were expanded, and the concepts and ideas introduced in the class will be applied to future policing incidents. This class would benefit from further development, likely by introducing components that promote regular feedback and sharing of experiences.

3.4 Observational data

Video recordings of the scenarios were reviewed in order to detect inconsistencies in the interview data. Participants' verbal reports were highly consistent with the observational data. Particularly, the conversation details and environmental cues reported by participants were reflected in the videos. However, some actions were not always discernable from the interview data. For instance, the interview data did not indicate the speed at which participants approached the subject or how close they got to the subject when they first entered the room. Even when details about the approach were reported, it was often unclear how quickly the approach to the subject was, or how safe the approach was. This is important because when officers approached very quickly and stopped within a few feet of the suspect, often with gun pointed and without the

use of cover, it indicated their lack of situation assessment and the use of a predetermined course of action. In some instances, this quick approach prompted the subject to react by immediately drawing his weapon, thus changing the scenario content. This happened in eight scenarios, four times with novice officers, two with 'competent' officer, and two with 'proficient' officers. In four scenarios, 'experts' barely entered the room and instead interacted with the subject from the entryway. These participants stated generally that it was unsafe and unnecessary to go into the room, especially without backup (entering without backup was almost unanimously determined to be a bad idea). As mentioned above, there were times when less experienced participants seemed to act almost impulsively whereas experienced participants demonstrated more control. This was more apparent in the observations.

Another action that was difficult the judge from the interview data was the level at which participants negotiated with and attempted to "talk down" the subject. Many officers stated that they tried to negotiate with the subject. From the videos, it was apparent that some "negotiation" was little more than yelling, "we'll get you some help, just put the gun down." Those who used true negotiation tactics to talk the subject into surrendering were all experienced participants (n = 7). As one novice officer stated when discussing how he dealt with the suicidal subject, "they don't train you how to speak to people, I mean, you're given courses on proper etiquette, ethics, and stuff, but in a situation like that, no one is trained for that." It was apparent from the videos that some participants did not have the mental models for negotiating. In other instances, participants maintained their original course of action to subdue the subject even when cues indicated that negotiation might work.

3.5 Summary of Results

Two major categories of decision processing were discussed: situation assessment and planning/selecting a course of action. Analysis revealed differences between novice and experienced officers in how they assess situations. Experienced officers directed most of their attention to assessing the situation and tended to provide more elaborative descriptions of their assessment processes, applying mental models to make interpretations about the situation and predictions about where the situation may lead. Novices tended to focus on procedural issues, describing the actions they took, or intended to take, along with the actions of the subject. When presented with new information during the event, experienced participants tended to change their course of action in response to the new information, whereas novice participants tended to remain on the same action course. Experienced participants sometimes engaged in mental simulation as a way to predict the outcome of actions, and they seemed to rely often on mental models to gain understanding of the situation at hand and predict what at might be encountered.

These findings tend to fit with results presented in studies conducted with expert decision makers in other critical incident domains. This work also presented some novel findings relevant to this specific domain. First, this research revealed information about decision processes when having to decide a course of action based on another persons' behavior. Instead of having a high need to interpret human behavior, participants seemed to accept the uncertainty surrounding the subject's behaviors, motives, and intentions, and did not tend to seek out information to ease the uncertainty. Uncertainty exists in other critical incident domains, but uncertainty seems highly prevalent, yet expected and accepted, in policing domains. Second, participants sometimes used tactics aimed at manipulating the thought processes of the subject. Instead of only using tactics to alter the physical environment, some participants attempted to manipulate the cognitive environment in order to achieve their goals. This tactic may not be unique to policing domains,

but assessment of policing situations has afforded a novel look at the use of strategy to influence of human behavior and shape decision parameters.

Results did not reveal reliable or systematic change in the decision process of participants before and after CIDS Training. Although some differences were hoped for, it is not surprising that a one-day class was not a strong enough manipulation to produce noticeable change in behavior. The expertise literature states that it is through repeated exposure to a variety of domain-specific incidents and consistent feedback about performance that expertise develops (Ericsson & Charness; Klein, 1998; Shanteau, 1992). Although CIDS Training did highlight these elements, results indicate that it may be necessary to implement continual training procedures where mental models are introduced and feedback about performance is given on a regular basis.

Observational data revealed information that was not available in the interview data. Information about the amount of negotiation engaged in by the participant and the speed and distance at which the participant approached the subject, was generally vague in the interview reports, yet was readily observable in the videos. To understand these factors in future interviews, specific questions should be directed at gathering this information.

Chapter 4

GENERAL DISCUSSION

This study introduces a three-pronged approach to understanding and enhancing police officer decision processes. By incorporating observation, interviewing, and training into a research frame, it is possible to gain a broad understanding of police decision making. Additional understanding of decision processing and expert development is attained by comparing novice and experienced police officers. This study uses qualitative analysis to uncover the breadth of decision maker knowledge, to define the contextual information used by police decision makers when assessing situations, and to define possible courses of action that are considered more and less optimal. At a theoretical level, this study replicates findings about experienced decision makers in other domains and introduces variation that may be specific to policing domains or domains with similar elements to those found in the scenarios presented in this study.

Limitations. Researchers have sometimes criticized verbal report data as an unreliable form of data collection (Nisbett & Wilson, 1977). Others have argued that when using knowledge elicitation techniques, verbal reports produce reliable information about the specific cognitive processes used by decision makers to process information (Ericsson & Simon, 1993; Hoffman et al. 1995). The CDM interview used in this study facilitates "progressive deepening" by leading the participant "deeper" into the event during each subsequent stage of the interview (Hoffman et al., 1998). Differences in observation and interview data do not necessarily indicate that participants incorrectly report information, instead it may indicate that these participants did not focus on these actions or did not factor them into their processing of the situation. For instance, participants may have said they "tried to talk to the participant" when in reality, they continually yelled commands at the participant, or they stated that they approached the subject but did not

provide enough descriptive information for the interviewer to realize they approached in a swift and threatening manner. Because this is an evolving methodology, this information, now that it has been identified as an important factor in the decision process, will be probed for in future interviews. The CDM interview allows interviewers to elicit knowledge about elements of the decision environment and about the mental models and practical experiences of participants. As indicated by the examples above, when mental models are not available, no amount of questioning could draw out the information. Given the wealth of data that was obtained in this project, it is reasonable to conclude that the CDM interview was a useful method for eliciting decision maker knowledge.

A single researcher coded the data presented in this study, thus inter-rater reliability could not be provided. The lead researcher had sufficient knowledge of the policing domain and enough understanding of both the naturalistic decision making literature and the expertise literature to identify important variables within the interview data and draw systematic conclusions. This research attempted to identify the concrete elements of expert knowledge that exists in the policing domain, as defined generally in other domains. As an exploratory study, an open analysis with a broad-to-specific categorization process was necessary to draw out important information (Strauss & Corbin, 1998). At this stage of analysis, it was not possible to define adequately these categories or to structure purely objective rating criteria. However, now that these categories are drawn out and the unique elements likely to be found in each category are specified, the next stage of analysis should involve objective classification using independent raters and codified classification schemes. With clear definition of these categories and full specification of the dimensions of these categories, it will be possible to verify the coding schemes presented here, and replicate these findings (Berg, 2001).

Theoretical implications. This project is important from a theoretical perspective because it illustrates concepts from the NDM and expertise literature by applying true-to-life examples of police decision processing. This work contributes to the field of knowledge by expanding the NDM literature to another critical incident domain, and demonstrates the generalizability of some results brought forth in studies of other domains. In addition, this work contributes to a small but growing body of research that uses live simulations to obtain data from multiple participants who have experienced the same situation.

By classifying interviews according to the five-stage skill acquisition model, concrete examples of decision making processes were provided at each level, which then allowed for comparison of police decision processes at various levels of experience. This study provides an initial categorization of police decision processes, and is only the first step in defining the complexities and nuances that occur at every point in the decision process. In addition, it provides initial understanding of the factors that lead to and enhance the development of expertise in policing domains.

Applied implications. From an applied perspective, this research provides a framework for analyzing police officer decision processes. The scenarios, interview, and class content were developed from models introduced in other domains and crafted to fit into the policing domain. Because this material was developed for policing environments, it can be altered to fit other areas within law enforcement, such as incidents involving team activities, incidents handled by commanders, and incidents that require interagency cooperation.

The CDM interview formulated in this project is constructed to be domain specific but is generalizable across various situations within this domain. This interview can be used during any Simunition® or other simulation training exercise and can be used after actual critical incidents to

gather information about the incident and the actions of officers. Police officials can use the information obtained from the CDM interview to answer questions about, and to justify, the actions of officers, which is particularly important during police shooting investigations and in the courtroom.

The information provided during the interviews can also be used to increase knowledge about decision maker development and decision making processes, for instance by demonstrating how novices remain on one course of action or have limited mental models that they can apply to novel or unexpected situations. These deficiencies can be remedied by providing less experienced officers with multiple action choices using simulations, decision making games, and by providing these officers with continuous feedback and opportunity to hear how more experienced officers would handle such situations. With understanding of how expertise develops over time, a systematic training program can be constructed to progressively enhance decision maker knowledge in a manner that is appropriate to their cognitive abilities. For instance, an officer who focuses on procedural concerns may need to maintain that focus because those actions are not yet automatic, thus their training should not push them past that focus until those skills have been adequately developed. It is maintained, however, that with cognitive skills training, this development can occur at a pace that is more rapid than would be with only natural development.

Future studies. Continued investigation of decision making performance will be necessary to fully understand this domain. The data presented here represent a general categorization of information. Now that these larger categories are delineated, it will be possible to specify sub-decision points and perhaps quantify certain elements of the decision process. For instance, predictive statements, use of feature-matching and story building strategies, use of leverage

points and affordances, and meta-cognitive statements, can be identified, as has been done in other research domains (Dominguez, 2001; Dominguez et al., 2004; Kaempf, et al., 1996). The next step would be to embark on this type of microanalysis, in order to parcel out further the general decision categories and skill-level differences in decision making.

Further analysis of the data presented here will include a systematic classification of the elements that make up each category identified in this work. Researchers use *decision requirement tables* to categorize the cognitive demands of given tasks. Typically, each decision requirement table centers around one decision requirement and describes the cognitive components that contribute to that decision, such as the critical decisions and judgments necessary to that decision, the challenges and cues unique to that decision, and the strategies employed by the decision makers (Phillips, et al., 2001; Wong & Blandford, 2001). These decision requirement tables are particularly useful to decision makers in specific domains, however researchers can use these tables to identify factors that may be systematically studied in the future. Decision requirement tables will be produced for police decision makers and to advance this research to more specified levels. Additional analysis will include objective evaluation of the observational data. Police officers from other areas may observe the videos and rate experience using only behavioral indicators. Researchers can then compare these ratings to the interview data to assess whether the behavioral indicators correlate with interview ratings.

Quantification can also be achieved by utilizing computer technology. Computerized programs that adequately represent human behaviors are continuing to be developed (Forsythe, 2004). This study provides information about the variety of subject behaviors and characteristics that officers expect to be present in certain situations, along with unexpected or inconsistent behaviors and characteristics. Researchers can program these factors into computerized “bad

guys" and measure, for instance, participants' use of these cues, their perception of inconsistent (or useless) information, and their disregard for important information presented in the scenario or for changes in the situation (Jones & Endsley, 2000). In addition, with computer scenarios, researchers can present and control for factors such as nonverbal cues and micro-expressions in computer scenarios. In Simunition® scenarios, researchers cannot script in these factors, due to the safety helmets and protective clothing, and because of the natural distances between the participant and role-players. In computerized scenarios, distances and viewing conditions can be varied and, when specific elements are programmed into computerized scenarios, the number of times they are presented, along with the duration of presentation can be systematically measured. In addition, researchers can use computer simulations to track latency data and eye-tracking data.

Although computers provide some advantages, there are still advantages to using live simulations. Because Simunition® scenario possibilities are unlimited they can be scripted based on the types of decision questions under study. NDM research using Simunition® can be extended to include group scenarios, multi-agency scenarios, terrorist attacks, hostage situations where negotiators and S.W.A.T. personnel must interact, border protection issues, plane hijackings, and situations with boundary conditions such as budgetary or equipment limitations, or external pressure from administrators or political factions. Live simulations provide officers with opportunity to practice their tactical skills and can be used to sharpen cognitive skills. Along with post-scenario interviews, officers can be stopped mid-scenario and asked about their thoughts, assessments, and action choices, and trainers provide suggestions and feedback (Murray, 2004). This allows officers to adjust their behaviors and incorporate new actions into their experience banks by actually performing the actions. Additionally, decision making under a variety of social, political, psychological, and personal constraints can be addressed, which

provides researchers with opportunity to study how decision makers assess and decide courses of action based on the behavior of other humans rather than non-human entities.

The potentially widespread application of this research highlights the importance of this program of research on multiple levels and in multiple domains. This research used three techniques for understanding and enhancing police decision making and demonstrated how these three components: observation, interviewing, and training, can be used to identify the factors that make up police officer decisions and be used to potentially advance the knowledge of less experienced officers to more experienced levels. This study brings forth a framework with which to study police decision makers and presents the knowledge obtained from these decision makers. In addition, it presents a new, more rounded method for training police by combining tactical and cognitive training into one program. It is hoped that such knowledge and training will assist officers when making decisions, when justifying actions, and in the end, will save lives.

REFERENCES

Abelson, R.P. & Levi, A. (1985). Decision making and decision theory. In G. Lindzey & E. Aronson (Eds.), *The Handbook of Social Psychology: Vol. 1. Theory and Method* (3rd ed., pp. 231-309). New York: Random House.

Berg, B. L. (2001). *Qualitative research methods for the social sciences.* Needham Heights, MA: Allyn and Bacon.

Cannon-Bowers, J.A. & Salas, E. (1998). *Making decisions under stress: Implications for individual and team training.* Washington D.C.: American Psychological Association.

Cannon-Bowers, J.A., Salas, E., & Pruitt, J.S. (1996). Establishing the boundaries of a paradigm for decision-making research. *Human Factors, 38*, 193-205.

Cohen, M.S., Freeman, J.T., Thompson, B. (1998). Critical thinking skills in tactical decision making: A model and a training strategy. In J.A. Cannon-Bowers & E. Salas (Eds.), *Making decisions under stress: Implications for individuals and team training* (pp. 155-189). Washington DC: American Psychological Association.

Cohen, M.S., Freeman, J.T., & Wolf, S. (1996). Metarecognition in time-stressed decision making: Recognizing, critiquing and correcting. *Human Factors, 38*, 206-219.

Cooke, N.J. (1994). Varieties of knowledge elicitation techniques. *International Journal of Human-Computer Studies, 41*, 801-849.

Coram, R. (2004). *Boyd: The fighter pilot who changed the art of war.* New York, NY: Little, Brown, & Company.

Crandall, B.W. (1989). A comparative study of think-aloud and critical decision knowledge elicitation methods. *SIGART Newsletter, 108*, 144-146

De Keyser, V. & Nyssen A-S. (2001). The management of temporal constraints in naturalistic decision making: The case of anesthesia. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 171-188). Mahwah, NJ: Lawrence Erlbaum Associates.

Doane, S.M., Sohn, Y.W., & Jodlowski, M.T. (2004). Pilot ability to anticipate the consequences of flight actions as a function of expertise. *Human Factors, 46*, 92-103.

Dominguez, C.O. (2001) Expertise in laparoscopic surgery: Anticipation and affordances. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp.287-301). Mahwah, NJ: Lawrence Erlbaum Associates.

Dominguez, C.O., Flach, J.M., McDermott, P.L., McKellar, D.M., & Dunn, M. (2004). The conversion decision in laparoscopic surgery: Knowing your limits and limiting your risks. In K. Smith, J. Shanteau, & P. Johnson (Eds.), *Psychological investigations of competence in decision making* (pp. 7-39). Cambridge, UK: Cambridge University Press.

Dreyfus, H. L. & Dreyfus, S. E. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer.* New York, NY: The Free Press.

Ericsson, K.A. & Charness, N. (1994). Expert Performance. *American Psychologist, 49*, 725-747.

Ericsson, K.A., Krampe, R.T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review, 100*, 363-406.

Ericsson, K.A. & Simon, H.A. (1993). *Protocol analysis: Verbal reports as data (Rev. Ed.).* Cambridge, MA: MIT Press.

Ericsson, K.A. & Smith, J. (Eds.). (1991). *Toward a general theory of expertise.* Cambridge, MA: Cambridge University Press.

Fallesen, J.J. & Pounds, J. (2001). Identifying and testing a naturalistic approach for cognitive skill training. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 55-70). Mahwah, NJ: Lawrence Erlbaum Associates.

Feldman, J.M. (2004). *Training for situation awareness: What? How?* [on line]. Available: http://www.teddytactical.com/archive/Feature/2004/12_Feature.htm.

Fisher, R.P. & Geiselman, R.E. (1992). *Memory-enhancing techniques for investigative interviewing: The cognitive interview.* Springfield, Illinois: Charles C. Thomas.

Flanagan, J.C. (1954). The critical incident technique. *Psychological Bulletin, 51*, 327-358.

Flin, R. (1996). *Sitting in the hot seat.* West Sussex, England: John Wiley and Sons, Ltd.

Forsythe, C. (2004, January). The future of simulation technology for law enforcement. *F.B.I. Law Enforcement Bulletin 73* (1), 19-23.

Fowlkes, J.E., Salas, E., Baker, D.P, Cannon-Bowers, J.A., & Stout, R.J. (2000). The utility of event-based knowledge elicitation. *Human Factors, 42*, 24-35.

Geiselman, R.E., Fisher, R.P., MacKinnon, D.P., & Holland, H.L. (1986). Eyewitness memory enhancement with the cognitive interview. *American Journal of Psychology, 99*, 385-401.

Gigerenzer, G. & Todd, P.M. (Eds.). (1999). *Simple heuristics that make us smart.* New York: Oxford University Press.

Goodrich, M.A., Sterling, W.C., & Boer, E.R. (2000). Satisficing revisited. *Minds and Machines, 10*, 79-110.

Hoffman, R.R., Crandall, B., & Shadbolt, N. (1998). Use of the critical decision method to elicit expert knowledge: A case study in methodology of cognitive task analysis. *Human Factors, 40*, 254-276.

Hoffman, R.R., Shadbolt, N.R., Burton, A.M., & Klein, G. (1995). Eliciting knowledge from experts: A methodological analysis. *Organizational behavior and human decision processes, 62*, 129-158.

Hunter, K.O., Hart, W.E., & Forsythe, C. (2000, May). *A naturalistic decision making model for simulated human combatants* (Report No. SAND2000-0974). Albuquerque, NM: Sandia National Laboratories.

Jones, D.G. & Endsley, M.R. (2000) Overcoming representational errors in complex environments. *Human Factors, 42*, 367-378.

Kaempf, G.L., Klein, G., Thordsen, M.L., & Wolf, S. (1996). Decision making in complex naval command-and-control environments. *Human Factors, 38*, 220-231.

Kirschenbaum, S.S. (2001). Analyzing submarine decision making: A question of levels. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 189-207). Mahwah, NJ: Lawrence Erlbaum Associates.

Klein, G. (1998). *Sources of Power.* Cambridge, MA: MIT Press.

Klein, G.A., Calderwood, R., & Clinton-Cirocco, A. (1986). Rapid decision making on the fire ground. *Proceedings of the Human Factors Society, 30th Annual Meeting* (Vol. 1, pp. 576-580). Dayton OH: Human Factors Society.

Klein, G.A., Calderwood, R., & MacGregor, D. (1989). Critical decision method for eliciting knowledge. *IEEE Transactions on Systems, Man, and Cybernetics, 19*, 462-472.

Klein, H.A., Vincent, E.J., & Isaacson, J.J. (2001). Driving proficiency: The development of decision skills. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 303-320). Mahwah, NJ: Lawrence Erlbaum Associates.

Krafka, C. & Penrod, S. (1985). Reinstatement of context in a field experiment on eyewitness identification. *Journal of Personality and Social Psychology, 49*, 58-69.

Lipshitz, R., Klein, G., Orasanu, J., & Salas, E. (2001). Focus article: Taking stock of naturalistic decision making. *Journal of Behavioral Decision Making, 14*, 331-352.

Lipshitz, R. & Strauss, O. (1997). Coping with uncertainty: A naturalistic decision-making analysis. *Organizational Behavior and Human Decision Processes, 69*, 149-163.

Maxwell, J.A. (2005). *Qualitative research design: An interactive approach (2nd Ed.).* Thousand Oaks, CA: SAGE Publications, Inc.

Militello, L.G. (2001). Representing expertise. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 245-262). Mahwah, NJ: Lawrence Erlbaum Associates.

Miller, T.E. (2001). A cognitive approach to developing tools to support planning. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 95-111). Mahwah, NJ: Lawrence Erlbaum Associates.

Murray, K. R. (2004). *Training at the speed of life (Vol. 1): The definitive textbook for military and law enforcement reality based training.* Gotha, FL: Armiger Publications.

The 9/11 Commission report: Final report of the National Commission on Terrorist Attacks Upon the United States (2004). New York, NY: Norton & Company, Inc.

Nisbett, R.E. & Wilson, T.D. (1977). Telling more that we can know: Verbal reports on mental processes. *Psychological Review, 84*, 231-259.

Orasanu, J., Martin, L., & Davison, J. (2001). Cognitive and contextual factors in aviation accidents: Decision errors. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 209-225). Mahwah, NJ: Lawrence Erlbaum Associates.

Patel, V.L. & Groen, G.J. (1991). The general and specific nature of medical expertise: A critical look. In K.A. Ericsson & J. Smith (Eds.), *Toward a general theory of expertise* (pp. 93-125). Cambridge, MA: Cambridge University Press.

Pennington, N. & Hastie, R. (1986). Evidence evaluation in complex decision making. *Journal of Personality and Social Psychology, 51*, 242-258.

Pennington, N. & Hastie, R. (1988). Explanation-based decision making: Effects of memory structure on judgment. *Journal of Experimental Psychology, 14*, 521-533.

Phillips, J.K., Klein, G., & Sieck, W.R. (2004). Expertise in judgment and decision making: A case for training intuitive decision skills. In D.J. Koehler & N. Harvey (Eds.), *Blackwell handbook of judgment and decision making* (pp. 297-315). Victoria, Australia: Blackwell Publishing.

Phillips, J.K., McCloskey, M.J., McDermott, P.L., Wiggins, S.L., Battaglia, D.A., Thordsen, M.L., & Klein, G. (2001). *Decision-centered MOUT training for small unit leaders.* (Technical Report Contract DASW01-99-C-0002, U.S. ARI/Infantry Forces Research Unit). Fairborn, OH: Klein Associates, Inc.

Pliske, R.M., Crandall, B., & Klein, G. (2004). Competence in weather forecasting. In K. Smith, J. Shanteau, & P. Johnson (Eds.), *Psychological investigations of competence in decision making* (pp. 40-68). Cambridge, UK: Cambridge University Press.

Pliske, R., & Klein, G. (2003). The naturalistic decision-making perspective. In S.L. Schneider & J. Shanteau (Eds.), *Emerging perspectives on judgment and decision research* (pp. 559-585). New York: Cambridge University Press.

Pliske, R.M., McCloskey, M.J., & Klein, G. (2001). Decision skills training: Facilitating learning from experience. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 37-53). Mahwah, NJ: Lawrence Erlbaum Associates.

Randel, J.M. & Pugh, H.L. (1996). Differences in expert and novice situation awareness in naturalistic decision making. *International Journal of Human-Computer Study, 45*, 579-597.

Ross, K. G., Phillips, J. K., Klein, G., & Cohn (2005). Creating expertise: A framework to guide technology-based training. (Technical Report Contract M67854-04-C-8035, Office of Naval Research).

Roth, E.M., Lin, L., Kerch, S., Kenney, S.J., & Sugibayashi, N. (2001). In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 113-135). Mahwah, NJ: Lawrence Erlbaum Associates.

Rouse, W.B. & Morris, N.M. (1986). On looking into the black box: Prospects and limits in the search for mental models. *Psychological Bulletin, 100*, 349-363.

Salas E. & Klein, G. (Eds.). (2001). *Linking expertise and naturalistic decision making*. Mahwah, NJ: Lawrence Erlbaum Associates.

Shanteau, J. (1992). Competence in experts: The role of task characteristics. *Organizational Behavior and Human Decision Processes, 53*, 252-266.

Shiver, J., Martin, L., & Flin, R. (2004). Emergency decision making. In K. Smith, J. Shanteau, & P. Johnson (Eds.), *Psychological investigations of competence in decision making* (pp. 125-148). Cambridge, UK: Cambridge University Press.

Simon, H.A. (1990). Invariants of human behavior. *Annual Review of Psychology, 41*, 1-19.

Smith, S.M. (1988) Environmental context-dependent memory. In G. Davies & D. Thomson (Eds.) *Memory in Context: Context in Memory* (pp. 13-34). London: John Wiley & Sons.

SNC Technologies, Inc. (2002). Product information cited from: www.simunition.com.

Sonnentag, S. (2001). Using and gaining experience in professional software development. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 275-286). Mahwah, NJ: Lawrence Erlbaum Associates.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research (2nd Ed.).* Thousand Oaks, CA: SAGE Publications, Inc.

Todd, P.M. & Gigerenzer, G. (2003). Bounding rationality to the world. *Journal of Economic Psychology, 24*, 143-165.

Vicente, K.J. & Wang, J.H. (1998). An ecological theory of expertise effects in memory recall. *Psychological Review, 105*, 33-57.

Weick, K.E. (2001). Tool retention and fatalities in wildland fire settings: Conceptualizing the naturalistic. In E. Salas & G., Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 321-336). Mahwah, NJ: Lawrence Erlbaum Associates.

Weiss, D.J. & Shanteau, J. (2004). The vice of consensus and the virtue of consistency. In K. Smith, J. Shanteau, & P. Johnson (Eds.), *Psychological investigations of competence in decision making* (pp. 226-240). Cambridge, UK: Cambridge University Press.

Williamson, J., Ranyard, R., & Cuthbert, L. (2000). A conversation-based process tracing method for use with naturalistic decisions: An evaluation study. *British Journal of Psychology, 91*, 203-221.

Wong, B.L. & Bandford, A. (2001, October). Naturalistic decision making in emergency ambulance command and control. The Information Science Discussion Paper Series, 2001/11. Dunedin, New Zealand: University of Otago.

Zimmerman, L.A. (2003). *The influence of guided memory and structured interview techniques on eyewitness verbal descriptions after short and long delays.* Unpublished master's thesis, University of Texas at El Paso.

APPENDIX A

*CDM Interview Training**

The Critical Decision Method (CDM) interview uses intensive interview techniques to gather information from decision makers about their cognitive processes when they assess situations, decide on a course of action, evaluate and adjust their decisions, and when they take action. CDM engages decision makers in multi-trial retrospection of a critical situation they previously experienced. This retrospection is semi-structured, with the interviewer guiding the decision maker with probe questions specifically designed to identify important cues, decision points, action plans, and experience-based processes of the decision maker. In order to obtain different types of information, a series of recall 'sweeps' are used to guide the decision maker as they recount the incident multiple times.

The purpose of the interview is to gain knowledge about police decision making processes. The interview process is non-evaluative, we are trying to understand the *process* not evaluate performance. The goal is to discover how police officers think about and evaluate the situations they encounter.

Purpose of CDM: (relevant information to obtain in interview)

- To obtain basic knowledge about specific policing domains
- To gather information about police decision processes
- To identify cues used to assess critical situations and determine courses of action
- To obtain understanding of decision choice options
- To reveal critical components of situations similar to the ones presented at test
- To provide detailed descriptions of critical requirements for officers in these situations
- To outline the parameters of action choices based on situational elements

The three information-gathering sweeps:

1) *Time line verification with decision point identification* - serves to structure the account into meaningful ordered segments
2) *Progressive deepening* - leads to a comprehensive, detailed, and contextually rich account of the incident
3) *"What-if" queries* - serve to identify potential errors, alternative decision-action plans, and expert/novice differences

Steps in CDM interview:

Step 1: Incident recall

Participant recounts the episode in its entirety. They should describe the event from beginning to end. The interviewer listens without asking questions, allowing the participant to structure the account. This allows the participant to describe the event from their perspective and activates the participant's memory. They do not know exactly what information you want, or at what level of detail. You should instruct them to provide as much detail as possible, taking into account information from all their senses (sight, sound, smell, touch). Listen for pauses and turning points in the story, such as when the action or scene changes. These points give you the frame of the story that later can be divided into meaningful parts.

During the interview, you should use encouraging body language (lead forward, maintain eye contact, open facial expression) and verbal indicators ("uh-huh", "OK", head nods) to

convey that you want them to tell their stories and that you are interested in what they report. This maintains cooperation and shows you as a good listener. If participants start instructing about standard operating procedures, you can help keep them on track. For example, say, "We're very interested in that, and I would like to talk more about procedural issues at the end. For now, can you give me a quick overview *of this particular incident*, so I have sense of what happened from beginning to end?"

Step2: Incident retelling

The interviewer tells the story back in as much detail as possible, using the participant's phrasing and terminology. The retelling should match the content and sequence of the original story. Instruct the participant to listen to the details and sequence and offer additional details, clarifications, and corrections. This step allows for a common understanding of the incident. Do not ask questions at this point. Instead, retell the event in the participant's language, intonation, and rhythm. Mismatching will interfere with their mental representation and hinder recall. Instead, mirror their account, which will assist in memory retrieval. Mirroring also indicates to the participant that you are an engaged and attentive listener, increasing their trust and building rapport.

Step3: Time line verification and decision point identification

The purpose of step three is to get a clear overview of the incident and identify key events and segments of the incident. At this point in the interview, the participant and interviewer should work to identify gaps and fill in missing details, and to clear up any inconsistencies in the story. Going over the event in detail helps the participant recall events in greater detail. The objective for the interviewer and participant is to obtain a shared view of the event. The goal is to specify and verify decision points - points when multiple ways to understand the situation or different action choices existed.

The time line illustrates the sequence of key events and identifies decision points. *Key events* in the time line could be objective (i.e., when another officer arrived at the scene), or subjective (i.e., when the officer saw a shift in the suspect's demeanor). *Decision points* are moments in the account where a major shift in assessment of the situation took place or where the participant took an action that influenced the outcome of events. Decision points occur when the participant describes making a decision. When describing the decision making process, the participant may also describe *action alternatives*. These are revealed when the participant deliberates among choice options, when they discard an action choice ("I was going to run to the back door, but decided to enter from the front"), or when they make a judgment that leads to an action ("I heard a noise and took off running in that direction").

In this time line, we are interested in the *sequence* of events, and, to a lesser extent, the duration of events. There may be key decisions made by the participant that were important to the outcome, but they were not "critical decisions" because the decision maker had no other choice of action. For instance, many decisions are part of standard operating procedure, and any officer, regardless of experience, would take that action (shoot at a perpetrator who is shooting at them). Even though these decision are important, the officer did not engage in an active decision making process, thus these events will not likely be a direct focus of questioning, even though the information may make valuable contribution to later decisions. Our focus here is on decisions made when participants had to evaluate an ambiguous situation and choose a course of action from among multiple options.

Step 4: Progressive deepening

The general strategy of step four is to reveal the cognitive underlay, the "story behind the story," and get at the *key cognitive events* from the situation. The interviewer asks probe questions that focus attention on particular aspects of each decision-making event. The questions should be about the information, or cues, used in situation assessment, and about the expectations, goals and actions those cues elicit. The information obtained about cues should be specific, contain many details, and be explicitly linked to specific actions and plans ("When you noticed X, what was the next thing you decided to do?", "When you saw Y, how did you interpret the situation?").

Use the probe questions provided (See 'Probe Questions' sheet) as a guide but do not be constrained by these probe questions. If something is unclear, not obvious, or amazes you, ask questions about it. Let natural questions that arise, and curiosity guide the questioning. If the participant makes comments such as "I just knew…" or "my gut told me that..." or that "it was obvious that…" probe further. It may be obvious to the participant, but not to the interviewer. Gut reactions or use of "intuition" implies a decision process that the participant has not yet verbalized. We are mainly interested in understanding these intuitive-type decision processes. The probes and interview guide are a place to start digging, but use them flexibly, to get at all aspects of the story. When the participant has already given the answer to a preplanned probe, you can skip that probe, or look for a way to expand on it.

The purpose of the CDM is to progressively deepen understanding of the event and build a comprehensive, detailed, and context-specific account of the event from the decision maker's perspective. The participants need support to say what they know. Probes help facilitate communication of their knowledge about the event, procedures (tactics), decision processes, and outcomes. The information obtained in this step should go beyond the time elements and basic facts of the event to the participant's perceptions, expectations, goals, assessments, concerns, confusions, and uncertainties about the event as it unfolded. During this step, you also want to know what other options the participant considered, what information was necessary to evaluate the situation, and how they obtained that information. By the end of step four, the interviewer should have a detailed, specific, and complete picture of each segment of the event and of the overall incident

This step is considered the *most challenging*, and most fun part of the interview. Based on the first two information sweeps, the interviewer knows what happened, who did what, and what the participant's role was during the event. During step four the interviewer wants to find out *what* they knew, *when* they knew it, *how* they knew it, and *what* they did with what they knew.

Step 5: "What-if?" queries

The final account of the incident shifts from the participant's actual experience to a more analytical strategy. This step allows the interviewer to gain complete insight into the participant's experience, skill, and knowledge. The interviewer poses various *hypothetical changes* to the incident account and asks the participant to speculate on what might have happened differently, how they may have responded differently, and how the outcome may have been altered (i.e., "At this point in the event, what if there had been a less experienced officer present? Would they have noticed Y? Would they have known to do X?", "What if a victim had been in the middle of the event?"). The purpose is to specify the dimensions on which key features of the account may vary. By highlighting and discussing the choices that were *not* made or that were rejected, this

account also provides further understanding into the reasons why decision makers take particular actions. You also want to identify potential errors at each decision point, and discuss how and why these errors might occur. Explain that you are discussing this to understand the vulnerabilities and critical junctures within the event, not to highlight things officers may do wrong.

CDM Interview Script

Start the interview by introducing yourself and giving some background. For example, explain that you are a UTEP graduate student in legal psychology, and very briefly describe your interests. State that the purpose of the interview is to understand police decision processes when they encounter critical, time-pressured, ambiguous situations. We want to understand how police, in general, assess situations, evaluate action choices, and reach decisions.

REMIND THEM: we are not evaluating their decisions or their actions, we are only trying to understand the decision process during critical incidents - how officers think about and process information and how they make the decision to engage in specific actions. We are not evaluating their performance or rating performances as better or worse. Instead, we are gathering information that we can use to develop training and offer systematic explanation of officer decision methods. Explain that information obtained in these interviews is confidential. We will not be reporting what the officer says to any other officers (including their bosses). These interviews and future training will enhance officers' ability to process and verbalize the reasons behind their decisions. Essentially, we are trying to assist in making explicit their "intuitive" decision processes.

General Interview tips:

During the entire interview, sit through pauses, let the interviewee think about your questions and come up with answers. If they say "I don't know" or "I can't think of anything," repeat the questions and add some description, rephrase the question, and/or explain what type of information we're after. Don't talk through silences. Bring paper and an extra pen to the interview and allow participant to use paper-and-pencil to sketch details and diagrams as they attempt to convey the incident from their perspective.

Prior to the interview, build rapport by making small talk. DO NOT ask about years on the force or rank. Instead, talk about recent news/sports items, share where you are from and make comparisons, talk about the weather, etc. As you are building rapport, get out your papers, give them a note pad and pen, and turn on the recorder. Explain that you are taping the interview so you can get all the information and that it will not played outside the researcher lab.

Use standard interview procedures, focusing on open-ended questions and encouraging free recall. Avoid interrupting the participant and save questions until they are done speaking. Repeat information back to the participant when you are phrasing your follow-up questions. For instance, "You mentioned the suspect was acting nervous, what did he do to lead you to think he was nervous?" or "You said you could tell he was up to something, tell me more about that?" With this second example, you would want to get at what the suspect did that made the participant think he was up to something and also what some of the "something's" may have been. It may take more than one follow-up question to gather all the information.

Step 1: Incident recall

Ask the participant to describe the event in as much detail as possible, starting from the moment they "got the call." Summarize their understanding of what the call was about and then proceed to describe the event including what they did, what they saw, heard, smelled, felt. Also they should describe the thoughts they had as the incident unfolded, cues and indicators they picked up from the suspect's behaviors or other sources, perceptions about suspect motives and intentions, their decisions and action choices, and rejected actions. Take note of pauses and turning points in the story, when the action or scene changes. Wait until the participant says they are done before continuing. Ask if there is anything else, and pause before continuing.

Step 2: Incident retelling

Tell the incident back to the participant using their phrasing and terminology. Try to match the sequence and content of the story. Explain what you are going to do, "we are going to go over the story multiple times. First, I will tell your story back to you, to make sure I got what you said. Please, fill in any missing details and correct anything that I say wrong."

Step 3: Time line verification and decision point identification

Go over the incident again and ask the participant to provide the sequence of key events. The time line is composed of the important events, decisions, and actions taken during the event. The main goal of step 3 is to divide the incident into segments and identify key events and points when decisions were made and actions were taken. You also want to determine when important information was received and when action choices were contemplated. Use the legal pad to write out a time line and diagram various events.

Once you and the participant have identified key events and decision points, you should apply segments of the incident to the decision points. The participant should fill in as much detail along the timeline as possible. As you are writing the timeline, elicit their help by asking where you should put various components on the time line and by verifying that you have the information correct. From the time line, the interviewer and participant identify, clarify, and verify key segments and decisions points.

Step 4: Progressive deepening

The purpose of step 4 is to dig progressively deeper into the participant's cognitive processing during the event. Using the time line and interviewer notes, take the participant back to the beginning and go through the event again. Take one segment at a time and probe for additional detail, while encouraging the participant to elaborate and deepen the event account. A good way to begin is with questions about the cues involved in the initial assessment of the event. Find out *what* they knew, *when* they knew it, *how* they knew, and *what* they did with what they knew. Discover everything about each part of the event in detail, including the cognitive elements of the participant's experience. Have the participant focus on the array of cues (using all five senses) and the information available within the situation. Refer to the probe questions (See 'Probe Questions' sheet) as a guide, but also probe based on the participant's comments.

Step 5: "What-if?" queries

Go back to the beginning of the incident again and this time pose various *hypothetical changes* to the incident account and asks the participant to speculate on what might have happened differently. Ask how they might have responded differently and how this response may have altered the outcome. Let them know that you are going to play devil's advocate and pose

"what-if" questions in order to get at all alternative options. Refer to the probe questions (See 'Probe Questions' sheet, pg. 2). Below are a few examples:

Present errors: things that produce less than optimal outcomes (i.e., "Suppose that when you did X, the victim was injured")

Question assumptions: things they assume will happen or assumptions about what they perceive (i.e., "What if the suspect's nervous behavior was not due to deception, as you said, but was instead due to physical illness?" "What if, instead of it being quiet when you got there, you heard screaming?")

Present expectancy violations: something they expect to happen does not happen or happens differently than expected (action X = outcome Y, what if outcome Z happens instead? i.e., "What if while you were handcuffing the suspect, the victim pulled out a weapon?")

Questionnaires

Once the interview is complete, have the participant fill out the Background questionnaire, the Scenario questionnaire, and the Interview questionnaire.

Debrief participants

Explain again what the purpose of the interview was to understand how police officers assess critical incidents and make decisions. We are trying to understand the cues officers use to assess situations, the types of responses they consider, and why they choose particular courses of action. We are going to use this information to develop decision making training that we hope will enhance cognitive processing during critical incidents. Instead of just learning how to respond tactically to situations, officers will also be able to understand and process their actions at a cognitive level, which will expand decision making options and increase ability to verbalize the reasons for their decisions. Remind them that the next step in this experiment is for them to attend the 8-hour "Critical Incident Decision Skills Training" course on (date to be announced) (this is part of their 20 hours TCLEOSE credit, so they MUST attend).

Allow officers to ask questions and discuss the scenario, interview, and training course. Pay particular attention to any comments about their emotional/stress level during the scenario. Be sensitive to any comments they make about needing feedback on their performance in the scenario or interview ("How did I do?" "Did I answer right?"). Remind them that we are not judging their performance, we are just gathering information about their knowledge. Compliment them on providing interesting and very useful information. Thank them for their time. Remember, they are very busy and they are doing us a huge favor by participating!

** The above procedure was obtained from Hoffman, Crandall, & Shadbolt (1998) who described and evaluated the CDM procedure in detail.*

APPENDIX B

CDM Interview Probe Questions

STEP 4	PROBE QUESTIONS
Cues	
What were you seeing, hearing, smelling?	
What did you think was going on at that point	
What specific factors (cues, indicators) lead to your interpretation?	
What was seen/heard that caused you to choose the course of action?	
Concerns	
What concerns did you have at this point, if any?	
What concerns might a less (or more) experienced officer have at this point?	
Did this cue/indicator lead you to be concerned? How so?	
What was your stress level at this point?	
Goals	
What were your specific goals and objectives at this time?	
What were your short term objectives at this time?	
What were you trying to achieve at this point?	
Basis of Choice	
Why was this option selected?	
Why were other options rejected?	
Options	
What other courses of action were considered?	
What other courses of action were available?	
Are there any alternative actions that might have worked?	
Mental Modeling	
Did you think of the events that would unfold?	
Did you imagine the possible consequences of this action?	
Knowledge	
What information did you use in making this decision?	
How was this information obtained?	
Confidence	
How confident were you in the decision you made?	
How confident were you as you performed this action? (faith factor)	
Standard operating procedures	
Does this case fit a standard or typical scenario?	
How is this case different from the standard scenario?	
Does this case fit a scenario you were trained to deal with?	
What do you do at each step in this procedure?	

Expectations
What outcome did you expect from that action? What did you think would happen next? From the suspect's behavior, what did you think he would do next?

Reasoning rules
Why/how/when would you do that? Is (the rule) always the case?

STEP 5	DEVIL'S ADVOCATE / "WHAT-IF'S"

Hypotheticals
If XXX had been different, how might that have influenced your decision? If action X lead had let to outcome Z (a different outcome from what happened): - what would you have done different? - would your assessment of the situation change?

Test assumptions
You said that X meant that Y happened but what if Z happened instead? What if it were not the case that (currently true condition)?

Experience
What specific training or experience was helpful in making this decision? Had you previously encountered a situation like this one? How might an inexperienced officer have behaved differently?

Errors
What mistakes are likely at this point? What errors would inexperienced officers be likely to make in this situation? Are there any cues an inexperienced officers might miss in this situation?

Aiding
What information could you have used at this time to make a different (better) decision? If the decision was not the best, what training, knowledge, information could have helped?

APPENDIX C

*Critical Incident Decision Skills (CIDS) Training Lesson Plan**

El Paso County Sheriff's Office
Region VIII Training Academy
Lesson Plan Cover Sheet

Course Title: Critical Incident Decision Skills Training
Instructor(s): Laura Zimmerman **Date Prepared: 11-14-2005**

Time Frame Total Hrs. 8 Min. Suggested Schedule From: 8:00 a/pm To: 4:00 a/pm Day: Thurs. November 17, 2005 Day: Fri. December 2, 2005 Day: Fri. December 16, 2005	Target Population: El Paso Sheriff's and Police Patrol Officers Number of Students: 40 each day Space Requirements: As Needed
Learning Objectives: By the end of the presentation, participants will be able to: 1. Identify at least four elements of critical incident environments 2. Discuss and evaluate decision choices and action alternatives 3. Identify differences between expert and novice decision making 4. Name the components of Boyd's OODA loop 5. Identify techniques to improve critical decision making 6. Communicate the reasons for deciding on specific courses of action	Evaluation Procedures: (How the completion of the objectives will be evaluated) 1. The student will complete a written exam. To successfully complete, the student will have to pass with a 70% or better.

Lesson Plan Cover Sheet
Lesson Title: Critical Incident Decision Skills Training

Methods and Strategies:
Lecture, handouts, examples, class discussion, class demonstrations

Training Materials:
PowerPoint Presentation
Video
White Board

References:
Cohen, Freeman, & Thompson (1998). Critical thinking skills in tactical decision making: A model and a training strategy. In Cannon-Bowers & Salas (Eds.), *Making decision under stress: Implications for individuals and team training* (pp.155-189)
IMPACT CD-Rom Training Disc, Klein Associates, 2001.
Murray, K.R. (2004). Training at the Speed of Life, Vol. 1, Gotha, FL: Armiger

Equipment & Supplies Needed:

__X__	Multi-Media Projector	Other: (list other item)
__X__	Lap-Top Computer	_____
__X__	VCR	_____
_____	Flip chart easel	_____
_____	Flip chart pad(s)/markers	_____
__X__	Overhead projector	_____
__X__	Video Monitor(TV)	_____
_____	Video Camera	_____
__X__	Dry-erase board/markers	_____

Student Materials and Handouts:
Student Handout
PowerPoint Slides
Test
Survey of Course Content
Decision Making Game

El Paso County Sheriff's Office
Region VIII Training Academy
Presentation Guide

Lesson Title: Critical Incident Decision Skills Training

Presentation Guide	**Notes to Instructor**
I. Introduction	
A. Instructor bio	
1. Laura Zimmerman, Doctoral Student at UTEP	
2. Internship at the Sheriff's Academy	Simunition classes
3. Interest in police decision making	Pilot Study SFPD ride-alongs
II. Presentation	Show MIB clip
A. Learning Objectives	
1. Identify at least 4 elements of critical incident environments	
2. Discuss and evaluate decision choices and action alternatives	
3. ID differences between expert and novice decision making	
4. Name the components of Boyd's OODA loop	
5. Identify techniques to improve critical decision making	
6. Communicate reasons for deciding on specific courses of action	
B. Purpose	
1. Increase experience base	
a. Build mental model (fill toolbox)	
b. Provide action alternatives	
2. Increase ability to identify the factors that play into decisions	written/verbal
a. Provide descriptive accounts of critical incidents	court testimony
b. Explain why certain decisions were made	read "illegal alien run"
C. Decision Environments	
1. Strategic decisions	
a. Identify the problem	
b. Generate a set of options for solving the problem	
c. Evaluate these options concurrently	
d. Choose and implement the preferred option	
2. Decision environments	Discuss differences
a. Strategic environments	
b. Critical environments	

Lesson Title: Critical Incident Decision Skills Training

Presentation Guide	**Notes to Instructor**
D. Critical Decisions 1. Still need to identify the problem 2. But no time to generate a set of options 3. Options are evaluated sequentially 4. As soon as the first acceptable option is found, it is implemented	
E. Intuitive Decision Making 1. Experience matters a. Expert decision making use of their existing knowledge to build mental models to react quickly and efficiently b. Mental models enable experts to make decisions automatically, without considering all possible options c. Experts quickly evaluate options and imagine implementing it d. Good intuition is often the only explanation for expert decisions 2. Intuition a. Intuitive decisions – just know what to do b. Intuition is really a complex and sophisticated mental activity	Read: Example 1 focus on situation assessment info processed instantly and outside conscious awareness
F. Decision Making Model 1. Decision Making Loop a. Boyd's OODA Loop b. Observe, Orient, Decide, Act 2. Decision components: Observe a. Assess the situation – behaviors, environment 3. Decision components: Orient a. Incoming data is worthless without our interpretation b. Recognize the situation – "clarity threshold c. Take novel information into account d. Accept uncertainty 4. Decision Components: Decide a. Decide on a course of action b. Visualize, evaluate and modify, critique and correct	VIDEO: Lundsford/ Lopez Handout: OODA loop VIDEO: Trooper Coats

Presentation Guide

Lesson Title: Critical Incident Decision Skills Training

Presentation Guide	**Notes to Instructor**
5. Decision Components: Act	
a. Decision outcomes – expectancies, feedback loops	
6. Inside the enemy's OODA Loop	
a. The bad guy chooses in there will be a fight – action faster than reaction	
b. Keep the enemy confused so they remain stuck in the observation phase	VIDEO: patrol car to stop suicide
c. From inside the enemy's OODA loop, you can control their decision making cycle	
d. Use speed, ambiguity, deception, novelty	
e. Time or opportunity neglected by one adversary can be exploited by the other	
7. Quick Test: To think or to act?	Handout: Quick Test
a. Do I have some time before I must commit to a decision?	
b. Are the stakes of an error high?	
c. Is the situation unfamiliar, atypical?	
d. If "no" to any, implement plan = ACT	
e. If "yes" to all, critique plan, make corrections = THINK	
G. Action Outcomes	
1. Evaluating decision outcomes	
a. Intuitive decisions = critical environments	outcome that satisfices
b. Analytic decisions = strategic environments	optimal outcome
2. The worst-case outcome	
a. Error continuum = worst case – satisfice – optimal	
b. Inadequate decisions are a result of poor situation assessment, rather than poor action-choice decisions	
3. Common errors	
a. Task fixation – hang on to inappropriate action choices	"get-there-itis" tool drop error
b. Expectancy bias – scenario fulfillment	Perception eg.
H. Decision Making and Stress	
1. Acute stress occurs when there is	
a. High physiological arousal	
b. Need to make multiple decision rapidly	
c. High uncertainty because of incomplete information	
d. Extreme consequences of failure (high-stakes)	VIDEO: Trooper XXX

Presentation Guide

Lesson Title: Critical Incident Decision Skills Training

Presentation Guide	**Notes to Instructor**
2. Anxiety leads to a narrowing of attention (tunnel vision) 3. Stress constrains the thinking process 4. Stress affects the way we process information, it does not cause poor decisions a. Stress does not necessarily increase poor decisions b. More experienced decision makers are less influenced by stress	
D. Making Better Decisions	Read: Example 2
1. Improving critical decisions a. Practice: Build experience base b. Build mental models - visualization c. Ask "what-if's" – imagine scenarios and possible actions d. Play devil's advocate – what if favorite action won't work e. Feedback: critical assessment of performance	
2. Communicate decision reasoning a. Highly likely that two officers in the exact same situation will see and process different information b. Goal of explaining decisions is to rule out alternative action choices as the best decisions and make all other explanations implausible – arm against Monday morning quarterbacks	
III. Summary	
A. Critical Environments B. Develop experience and intuition C. Boyd's OODA Loop D. Thinking vs. acting based on outcome goals E. Improving critical decisions 1. Practice, feedback, vocabulary	
IV. Decision Making Games (DMG's)	DMG 1-6 Discussion questions

* The above procedure was obtained from Cohen, Freeman, & Thompson, 1998, who developed, described and evaluated the CTT procedure. Additional information incorporated into this procedure was obtained from Cohen, Freeman, & Wolf, 1996.

APPENDIX D
Pilot Study Protocol

Stimulus/Materials

Video. Officers will view a videotape of an actual traffic stop. The video depicted a scene that begins as a routine traffic stop, with an officer pulling over a motorist, but escalates to the point where weapons are drawn and the officer shoots the motorist.

Participants

Thirty officers from the El Paso County Sheriff's Office and the El Paso Police Department will participate in this study. Officers will be classified into two groups. Group one will contain patrol officers certified as Basic (1 yr experience/400 hrs education) and Intermediate (2yrs experience/2400 hours education through 8 yrs experience/400 hours education). Group two will contain patrol officers certified as Advanced (6 yrs experience/2400 hours education) or Master (10 yrs experience/4000 hours education through 20 yrs experience/1200 hours education).

Design

This study is an exploratory analysis that will compare decision processes among two groups of police officers: Basic/Intermediate Patrol x Advanced/Master Patrol. The dependent variables will be the types of cues, action choice options, errors, predictions and overall assessments discussed in the interview.

Procedure

Classification procedure. In El Paso, officers increase their certification levels as they gain experience. The EPSO and EPPD award certification based on number of years on the force and the amount of academic and policing education received. Classification of officers into one of two groups will take place after the interview procedure is complete. The interviewer will not know officers' experience levels during the experiment.

Warm-Up. After signing informed consents, participants will listen to an overview of the experimental procedures. Participants will engage in two warm-up exercises prior to the main experimental task. The first is a think-aloud warm-up task. Participants will solve a simple math problem out-loud (i.e. 32 x 12). Second, participants will inspect a photo of a potential crime event for three seconds. After viewing the photo, they will recall as many details as possible about the photo and discuss their interpretation of the events depicted. Specifically, they will be asked to: 1) describe everything you can recall about the photo, 2) provide an interpretation of what you think is going on in this scene, and 3) what factors lead you to this interpretation.

Main Task: The main task will consist of a combination unstructured and structured interview. The unstructured portion will consist of participants "thinking aloud" as the scenes unfolds. Participants will verbalize their thoughts as they watch the scenes. The structured portion of the interview will consist of asking participants specific questions at various moments during the scene. At three pre-determined points, the researcher will stop the tape and participants will answer questions about the events witnessed thus far. The questions will focus on the participants' interpretations of the unfolding events, the cues they were attending to, their predictions about what may happen next, the types of errors that might occur, and what action-choice they would make at this point (see below for question). After the scene ends, participants will answer the same questions as in the previous segments and will then provide an overall

evaluation of the scene and answer follow-up questions based on their earlier responses. Participants will evaluate what went wrong, what they would have done differently, and why their actions would have resulted in a different outcome. This procedure was derived from the research presented by Dominguez (2001) and Dominguez, Flach, McDermott, McKellar, and Dunn (2004).

Background questionnaire

After the interview session is complete, participants will complete a background questionnaire. This questionnaire will indicate the participant's certification level, and thus their experimental condition. Their position, years on the force, hours of education, and certification level will be determined at this point. In addition, officers will provide standard demographic information.

Instructions to Participants

Introduction. Prior to entering the experiment session, officers will hide all badges, pins, and other markers that may distinguish their rank, position, and experience within the department. After introduction to the experimenter, participants will be told, "This purpose of this study is to gather information about police thinking processes as they view an officer engaging in a common policing activity. I am interested in your assessment of the situation and the actions that take place. By obtaining this information, we can begin to understand how law enforcement officers perceive and think about situations as they unfold. Gathering information about individuals' thought processes can be challenging, therefore we will begin by doing some practice warm-up tasks. After the practice tasks you will watch a short video and discuss what you see. Your individual performance on these tasks will not be evaluated and your responses are confidential. I am here to learn about police decision making in general and not to analyze or evaluate your individual performance. Do you have any questions so far?"

Warm-up. There are two ways to get at your thinking processes, and one is by having you think out loud. When you think out loud you say what you are thinking. This is not a narration of what is going on, instead it is your thoughts about what you see, as if I was not in the room. Experimenter do example (5 x 35 = 75). Now it's your turn, "What is the result of multiplying 24 x 36?" (864) (if it seems necessary to practice another problem, "how many windows are there in your house?" and/or "name 20 animals").

In order to illustrate the type of information I will be looking for, we're going to do another warm-up task. For this one you will view a photo for three seconds and then I will ask you a couple of questions. *(Show photo for three seconds*). OK, now 1) describe everything you can recall about the photo, 2) provide an interpretation of what you think is going on in this scene, and 3) what factors lead you to this interpretation (Ericsson & Simon, 1996).

Main task. Any questions so far? Now we will watch the video. As you watch the video, please think aloud (verbalize your internal thoughts) as if I was not in the room, so do not explain the scene to me, instead talk to yourself, but out loud. I will stop the tape at three points and ask you some questions about what you viewed. I will ask you the same questions at all three stopping points and when the scene is complete. After the final questioning, I will ask some follow-up questions based on your previous report. At a certain point, a backup officer arrives. Please focus on the lead officer and his actions. You can think about and comment on the interactions the lead officer has with the backup officer and the commands he gives to the backup officer, but do not focus solely on the backup officer's actions. There will be time at the

end of the session to discuss the backup officer's activities. Any questions? *(Show video segments and ask the following questions after each segment)*

Questions asked at each decision point

1. What do you think is going on here?
    a. What specific factors (or cues) are leading to this interpretation?
2. Do you have any concerns at this time? What are they?
    a. What information about the scene are you taking into consideration at this time?
3. What errors would inexperienced officers be likely to make in this situation?
    a. Are there any cues they might miss?
4. Can you give me a numerical rating, from 1 to 7, of your comfort level with continuing as this officer is continuing, using the anchored scale shown here?
5. If I told you that the officer decided to call for a roll-by at this time, would you think that was a reasonable course of action? Why or why not?
6. Given that your overall goal is to complete this call without incident, what are your short term objectives at this time?
7. Are there any alternative courses of action that might work?
    a. Would you do anything different than this officer?
8. Are there any other cues you see that are influencing your actions that you have not mentioned yet?
    a. Are there cues that you expect to see that are not present?
    b. As a supervising officer, would you be satisfied that all actions taken thus far are acceptable?

End of entire video: Now the video is complete, please provide an overall evaluation of the scene and contribute any comments you may have (*Ask questions based on previous comments*).

Debriefing. The purpose of this study is to access police officer decision making processes. When making decisions in high-stakes situations it is necessary for people to assess the situation, evaluate possible actions to take, and determine the likely outcome based on the action choice. Police officers of all ranks must make life-and-death decisions in everyday situations and they must be prepared to take action in extreme and unusual situations. Because if this, it is useful to understand how trained and experienced officers make decisions. With this knowledge, we can begin to tease apart the processes officers go through when making "intuitive decisions." By training officers how to specify and verbalize their decision processes, clearer assessment of their decisions can be made.

This study is a preliminary study. The information obtained from this study provides information about how officers of differing levels of experience assess and evaluate situations and determine the best course of action. This insight gained from this experiment will allow for development of in-depth interview techniques and training courses designed specifically to develop and enhance police officer decision processes during and after critical incidents. The goal of this type of training is to enhance basic peace officer ability to more advanced levels at quicker rates than what normally takes place with years of experience. This training will also enable officers to explain in detail the cues and reasons for their decisions. Finally, this training will tie closely in with tactical skills training and provide officers with the cognitive as well as the tactical skills necessary to correctly assess unusual situations and quickly choose the correct course of action.

APPENDIX E
Scenario 1 and 2

Role-Player Guidelines and Script*

General Overview
The purpose of these scenarios is to provide officers with opportunity to evaluate an ambiguous and potentially life-threatening situation. The goal is to present situations where officers have to figure out what is going on and if you are the person they are looking for. As a role-player, you want to present yourself first as someone who may be innocent and harmless, but then slowly become a threatening presence. These scenarios need to be structured, but the scripts should provide enough flexibility for you to play off the actions of the officers. The officers need indicators of your motivation and intent. Because we are using Simunition gear, you will not be able to convey many types of nonverbal behaviors. But, you can use big body movements that contradict what you are saying. Standing tense or swaying/moving with nervousness can be conveyed even with Sims gear on. Much of an officer's evaluation of the situation will come from what you say. Again, it is difficult to hear with Sims headgear on, but talking loudly and slower than normal will help. Slow down the action and take your time building up tension. Remember, it is important to provide the officer with opportunity to assess the situation and decide what the correct course of action should be. Thus, we don't want things to erupt into a gun battle before any assessment of the situation has taken place.

SCENARIO 1: KIDNAPPING

Scenario Overview

Synopsis: A female student was kidnapped from the UTEP campus. Patrol officers were on the look-out for the perpetrator and victim, although they have no photo of either person. An officer was dispatched to check out a motorist's tip that a woman was struggling with a man near Globe Mills. Upon arrival, the officer will hear a male voice yelling threatening remarks inside a building. After entering and searching the building, the officer will find Role-Player (RP) in a mildly agitated state. RP will keep his distance from the officer and state that he is a drifter. RP eventually becomes argumentative and confess that the victim hidden but won't say where. He will eventually produce a pistol and begin raising it toward the officer. He will force a lethal encounter if necessary by firing at the officer.

Role Player Character

Summary of character and reason for police contact: You are an ex-con who grabbed a young woman, who is your stepdaughter, off the street and brought her to an abandoned building with the intention of kidnapping her and taking her to Mexico. A patrol officer has found you during his search for the missing woman. The woman is currently hidden in another room. You recently came to town after being released from jail in New Mexico. You are in violation of your parole and do not want to go back to jail.

Detailed Scenario Outline

These sections present an idealized situation. The true course of the scenario will be dictated by the officer's actions. The RP should try to steer the scenario so it generally fits the script.

Section A: Based on a phone tip, the officer is called to check out a potential kidnapping situation at Globe Mills. After the officer arrives, he hears a male voice yelling threatening remarks inside an abandoned building.
RP instructions: You recently arrived in town after getting out of jail in New Mexico. While you were in jail, your family left town without telling you and you are upset. You tracked down your stepdaughter on the UTEP campus and kidnapped her on impulse. You drove her to an abandoned building and are not sure what to do next. You are agitated and angry, yelling threatening remarks to females in general (not specifically to or about your stepdaughter).

Section B: The officer searches the building and finds RP inside.
RP instructions: The officer enters the room and sees you. Tell the officer you are homeless and squatting in the building and you do not know anything about a kidnapping. Start out mildly agitated and increase your agitation as the encounter continues. Do not let the officer near you. State you were yelling because your wife left you and you were venting your frustration. Do not become physically aggressive and keep a distance between yourself and the officer to avoid physical contact. Do not follow any verbal directions or commands. Display nervous movements, such as pacing, arm movements.

(If the officer draws his weapon at any point, try to keep a distance and pull your weapon)

Section C: The officer talks to the RP.
RP instructions: Become increasingly agitated and talk about how you refuse to go back to jail. Reveal that the kidnapped girl is hidden nearby and imply that she is hurt. State that you regret hurting the girl and imply that you and the girl have a history. Make agitated movements and keep looking at and/or approaching the backpack and/or knife. Do not pick them up. Continue to keep a distance between yourself and the officer.

If conversation continues…..
Section D / RP instructions: Makes movements toward the knife but do not pick it up. Produce a firearm but do not point it at the officer.

Section E: Raise the firearm toward the officer. Whether or not the officer fires, you will shoot at the officer. Continue to fire until grounded by officer.

Section F: If the officer remains exposed, continue to try to shoot him. If the officer utilizes effective cover, remain on the ground and follow commands to drop the pistol, but do not follow any additional commands. Stay on the ground and groan in pain. If the officer retreats outside the building, do not follow. This should result in a barricade situation, and will end the scenario.

SCENARIO 2: SEXUAL ASSAULT

Scenario Overview

Synopsis: The officer is on patrol when a witness flags him down and states that a sexual assault is occurring in an abandoned building. The witness also states that the perpetrator may have been holding a gun. The officer will enter the building to investigate. He finds a man in a room alone, holding a cell phone but no weapon. The man is visibly upset and not responding to the officer. RP eventually starts to reply, but is evasive and angry. He will eventually produce a pistol and raise it toward himself. He finally lowers the weapon but does not drop it. Eventually he points the weapon toward the officer. He will force a lethal encounter if necessary by firing at the officer.

Role Player Character

Summary of character and reason for police contact: You are prominent businessman in El Paso who was at a bar after a bad day at the office. Your business partner figured out that you had embezzled hundreds of thousands of dollars and was going to report you to the authorities. You met a young woman who was very drunk and you drove her to Globe Mills and tried to get physical with her. Things got rough and you tried to force yourself on her. She fought you off and ran away. You were in the abandoned building trying to clear your head when the officer found you. You have a family and a reputation to uphold and feel you cannot live with the punishment you will likely receive. You feel you have two choices, end your life or escape from the officer by any means possible.

Detailed Scenario Outline

These sections present an idealized situation. The true course of the scenario will be dictated by the officer's actions. The RP should try to steer the scenario so it generally fits the script.

Section A: A witness flags down a passing officer on patrol. The witness tells the officer that a sexual assault is occurring in an abandoned building. The witness also states that the perpetrator may have been carrying a gun.

Section B: The officer enters the building to investigate a report of a sexual assault. The officer finds RP alone, with no victim around.
RP instructions: An officer finds you in an abandoned building. You are visibly upset and talking to yourself. Do not respond to the officer at first. You have a cell phone in your hand, which you keep fiddling with. Keep a distance between yourself and the officer to avoid physical contact. Pace back and forth, showing frustration and worry. Do not say that a woman was with you, and act like you do not know about a sexual assault.

(If the officer enters the scenario with his gun drawn, continue to pace and talk about your troubles. Do not follow commands. Pull out your firearm but do not point it. If situation escalating, progress to section D and take a suicidal position)

Section C: The officer talks to the RP.
RP instructions: Express regret about what happened and confusion about what to do, but do not be more specific. State that you would rather die than go to jail. Talk about your family and how everything goes wrong in your life. Eventually, produce a firearm but do not point it at the officer.

Section D / RP instructions: No matter what the officer does, slowly raise the firearm towards yourself in a suicidal manner ***(be mindful of safety)***. State that you have a family and a reputation to uphold. Finally lower the firearm, but do not drop it. State that you have to get out of this situation one way or the other.

Section E: Raise the firearm toward the officer. Whether or not the officer fires, you will shoot at the officer. Continue to fire until grounded by officer.

Section F: If the officer remains exposed, continue to try to shoot him. If the officer utilizes effective cover, remain on the ground and follow commands to drop the pistol, but do not follow any additional commands. Stay on the ground and groan in pain. If the officer retreats outside the building, do not follow. This should result in a barricade situation, and will end the scenario.

* The above scenarios were constructed using the scenario design materials and protocols provided in Murray, (2004)

APPENDIX F

*Interview Coding Categories**

Broad decision making concepts (how decisions were made)

Overriding goal: Resolve the situation without loss of life

Priorities and constraints:

a) Find victim and arrest perpetrator
b) Maintain safety of officer and other people present
c) Determine appropriate use-of-force considering situation and use-of-force policies

Decision processes

1. *Assess the situation:* a) assess the problem, b) assess subject, c) assess the environment
2. *Plan and select a course of action:* a) how to enter the building, b) how to approach subject, c) how to interact with subject, d) strategic moves

Structure of the decision process

1. *Activities:* what officer did during each process
2. *Cues, sources, and considerations:* what information was or needed to be attended to, where the information came from, and what considerations were made
3. *Knowledge and experience:* the knowledge and experience that were used in this part of the decision making
4. *Difficulties, likely mistakes, and consequences:* the problems the officers had with the situation and the things that made it harder for them to achieve their goals, things that did or may lead them to making mistakes, the consequences of those mistakes

Decision Tasks

I. Enter Building

A. Situation assessment
   1. Physical cues
   2. Subject cues
   3. Action cues
   4. Strategy cues
   5. Story building/Feature matching
   6. Info-seeking
   7. Expect/assume
   8. Unknown/uncertain
   9. Missing Information
   10. Rule-of-thumb

B. Course of action
   1. How to search/enter
   2. Weapon
   3. Announce self
   4. Call dispatch
   5. Mental simulation

II. Interact with Subject

A. Situation Assessment
1. Physical cues – subject positioning
2. Subject cues – subject actions
3. Verbal cues
4. Nonverbal cues
5. Situation evaluation
6. Strategy cues
7. Story building/Feature matching
8. Info-seeking
9. Expect/assume
8. Unknown/uncertain
9. Missing Information
10. Rule-of-thumb

B. Course of action
1. Approach/Interact with subject
2. Weapon
3. Positioning/cover
4. Verbal - conversation
5. Interaction strategy
6. Call dispatch
7. Mental simulation

III. Engagement, Final Interaction, Outcome

A. Situation assessment
1. Physical cues – subject positioning
2. Subject cues – subject actions
3. Verbal cues
4. Nonverbal cues
5. Situation evaluation
6. Strategy cues
7. Expect / assume
8. Rule-of-thumb

B. Course of action
1. Approach/Interact with subject
2. Weapon – fire, hit/miss
3. Positioning/cover
4. Verbal - conversation
5. Interaction strategy
6. Mental simulation

C. Course of action outcome
1. Who shot first
2. Who shot total
3. Who hit
4. Final outcome

* The above coding structure was derived from Wong and Blandford (2001)

CURRICULUM VITAE

Laura Zimmerman was born May 18, 1966 in Seattle, Washington. The first daughter of Robert and Barbara Zimmerman, she graduated from Lake Oswego High School, Lake Oswego, Oregon in 1984. She took many courses at San Francisco City College before entering San Francisco State University as a junior in 1999. While pursuing a bachelor's degree in Psychology with a minor in Criminal Justice she did internships at the San Francisco District Attorney's Victim Witness Assistance Program, and Milestones Human Services. In the fall of 2001, she entered the Graduate School at The University of Texas at El Paso. In the spring of 2003, she earned her Master's Degree. While pursuing her doctoral degree, she did an internship with the El Paso County Sheriff's Office Region VIII Training Academy and became a state certified law enforcement instructor. During her graduate career, she has presented research at many conferences, co-authored a chapter in *The Encyclopedia of Applied Psychology*, published research articles in *Behavior Research Methods* and *Law and Human Behavior*, and wrote book and article reviews for *The Canadian Journal of Police and Security Services* and *Applied Cognitive Psychology*. She currently has multiple research articles under review or under revision.

Permanent address: 5890 Bandolero Dr.
El Paso, Texas 79912

This dissertation was typed by the author.