

The Attention Study: A Study on the Presence of Selective Attention in Firearms Officers

William Lewinski, PhD, Force Science Institute

Introduction

Perception, or the acquisition of information through the senses, has been a focus of philosophy and psychology for millennia. Phenomenological philosophers recognized that we were not simply passive absorbers of information but actively interact with our environment to perceive, process, and interpret this information. The philosophers' perspective simply expressed is that there is no such thing as an objective reality. The very act of perceiving is dependent upon the direction and quality of the senses of the perceiver, and this varies on an individual level based on the nutrition, fatigue, experience, interest, etc., of the observer. Further, they questioned whether the very act of observing changed in some fashion the elements of what was being observed. If that were true, it would further distort the reality of that which is being observed. For instance, a cell under a microscope is neither seen nor functions as it would among other cells in a body. The very act of observing changes the dynamics of that which is observed. Subsequently, there was and is no such thing as a pure, objective reality. Similarly, there is no such thing as a pure, objective viewer.

Not all philosophers held this phenomenological view. Even Augustine and Descartes argued for the "rational man" model of human behavior (Damasio, 1994). They saw human beings as objective and rational and as essentially bringing an unbiased perspective to their perception of the world. This "rational man" worldview was extremely appealing at that time in the evolution of the understanding of human behavior. Unfortunately, although humankind has significantly advanced, primarily through research, in its understanding of human beings and their subjective interpretation of the *real*, residue of the "objective, rational man" continues to pervade Western culture.

For example, Descartes' ideas about human information and decisionmaking had and still have a powerful influence over many areas of study on human behavior. His dichotomization of the soul (mind) and the body (emotions) into two separate parts and his powerful but chilling notion that issues of truth (including perception and memory) could be decided in light of reason alone became historically prominent in philosophy and then psychology and was very appealing to both the fields of theology and the law for centuries. In many countries, the field of law still has components that consider the human being as only a factual information-processing machine and a rational decisionmaker. Appeals to the heart or the influence of emotions had no place in Cartesian science. The thought that emotions could influence perception even at a subconscious level would have been ludicrous for them to consider. Yet, research done in the 1950s on "the smiling face in the crowd" (Hansen & Hansen, 1988) proved this very point. This research demonstrated that emotions even influence perception before that

perception occurs! Even research in the 1940s indicated that hungry rats saw less and subsequently learned less in a maze than non-hungry rats. The hungrier the rat, the more the rat was “tunneled in” on getting to the food, and the more they missed important clues about how to get there—the next time. The Cartesian view of human beings just didn’t stand up to the research conducted by today’s scientists, whether that research is in the perceptual, cognitive, or biological areas.

But Cartesian philosophy had an impact on at least some areas of psychological research and, as stated, remained influential up to the 1950s. Even in the 2000s, courts have been noted to report that there is little research on *perceptual distortions* and have subsequently questioned the validity of the effect of human emotions and perceptual limitations on perception, information processing, and memory.

However, this dualistic (mind/body or passions versus reason separation) approach has been swept aside in psychology, in fact in all branches of science, since the 1950s. Leading theorists and researchers in psychology, such as the noted Jerome Bruner, have argued for over half a century that the deeper question is not whether emotions influence our perception, judgment, and memory but how they do so (Niedenthal & Kitayama, 1994). Well-known psychological researchers in memory, such as James McGaugh (2003), have understood the impact of emotional reactions on attention and memory and literally have spent their entire careers examining this influence. McGaugh’s work even examined the impact of emotions on perception and memory formation when the emotionally arousing event occurs before, during, or even after the incident was recorded in our memory. Current neuropsychological giants such as LeDoux (2002) and Damasio (1994) argue that our brains actually are constructed in such a fashion that we are not thinking beings that happen to feel as Descartes proposed but actually the reverse. We are hard wired as feeling beings that think. The impact of this information on understanding the value of *memory recall* in the criminal justice system is and should be profound.

Further, an important question in psychology since the 1950s has been “What is the extent to which what humans see in the external world is driven by their need to seek out factual information that is simply registered in the storage device of our memory or whether there is something more?” The question simply put is, “How does our attention get focused on something?” Recently, considerable research has focused on our capacity to direct our attention to something of interest to us or, phrased another way, how our own cognitive and affective interests leads us to seek out information in the environment. This is a logical way of understanding the direction of attention and our ability to perceive and then process information in our environment. But it is only a limited explanation for understanding how attention is directed. Cartesian Science and this approach to research cannot explain the seductive nature of modern advertising and its capacity to draw our attention toward such things as an advertisement. The overt, attention-seizing aspect of an external stimulus apart from anything we might be thinking about at the time has been an interesting problem for cognitive and neuroscientists. The research indicates that certain elements in our environment have an amazing capacity to draw our attention and do so in an automatic or unconscious manner. An everyday example would be an advertisement whose color, topic, action, or some other feature seizes our attention, almost unwillingly, yet it does so precisely because of the soundly researched principles of visual cognition and attention.

We, therefore, can see that attention is both internally directed or driven to something, or externally attracted to it, and the process is both a conscious and an automatically unconscious one. A law enforcement example of this is an officer's attention in a conflictual situation such as when a subject draws or points a gun, knife, or club at an officer. That motion instantly attracts the officer's attention even if the officer was not even thinking about the incident having any potential for becoming violent. This illustration now provides us with two ways that an officer's attention can be drawn to something. Their training, experience, and/or information leads them to conclude that they need to visually search for something in their environment or something in the environment grabs their focus of attention.

Regardless of the reason for the officer's focus of attention in a rapidly evolving, dynamic, and high-stress encounter, research and logic both inform us that the officer's attentional focus is going to significantly influence what the officer is able to then perceive and remember. Generally speaking, if something is not perceived, it cannot be remembered. To reiterate, it is the focus of attention and not the operation of the senses that determines what information is perceived and then acted upon or remembered (Weltman, Smith, & Edstrom, 1971).

Attention has been extensively studied in a variety of areas in psychology. One area of study has been the singular, limited nature of a specific focus of attention and the information that is both acquired and discarded because of this. Another related area of study has been our ability to split our attention and multitask so we can accomplish a variety of tasks at the same time such as drinking coffee, talking on a cell phone, listening to the radio, and driving. Other areas of study have been on the effect of stress or threat and time compression on attention, as well as the catastrophic failure of attention when subjects panic.

Regardless of the data from research, even from our own experience, we are aware that it is possible for us to multitask and have a soft focus of attention over a number of items at the same time. Most of us multitask many times over the course of the day. However, we have also experienced that once our attention is driven or drawn toward an object, we have a limited capacity to attend to any other task. This usually has not been a controversial topic, except when law enforcement officers are apparently incapable of reporting on everything that occurs at a scene of what for them would have been an emotionally intense incident. This process of attentional tunneling or a narrowing of attention and its opposite *attentional blindness* have been well-researched for decades. Derryberry and Tucker in *The Heart's Eye* (Niedenthal & Kitayama, 1994) note that

attentional narrowing is an adaptive adjustment that serves to limit the processing of less important sources of information and to promote focused, effective responding in emergency situations; it is essential that the individual avoids distraction by irrelevant input, quickly narrows down the potential avenues of escape, and establishes a tight coupling between threat signals, relief signals and related response. . . . The general description suggests that the combined effects on orienting and focusing help to guide worrisome thought toward an effective solution or plan. (p. 189)

For example, it is not unusual for a driver of an automobile to listen to the radio, drink a cup of coffee, and drive at the same time—multitasking. We should note, though, that if the driver were to spill the hot coffee on their lap, for some brief period of time the driver's attention to the management of the vehicle and to the songs being played on the radio might be very limited and perhaps these would not be attended to at all.

Dr. Marcel Just, a psychology professor and co-director of the Center for Cognitive Brain Imaging at Carnegie Mellon University in Pittsburgh, conducted a study seven years ago that provides illumination into the limitations of the attentional processes (Just et al., 2001). Just et al. had participants in this study focus on language tasks and then on spatial tasks. By using brain imaging with an fMRI, Just was able to roughly compute the total amount of attentional resources used to intently focus on one task at a time. When he had the subjects attempt to work on two tasks at the same time, he found that the brain then allocated a certain amount of its total resources to each task. Interestingly, the total amount of attention given to both tasks roughly approximated the total amount of attention given to one task when the person focused entirely on that one task. Further, the relative amount of attention given to each task varied with the importance allocated to or difficulty involved with that task. For instance, in his study, if the spatial organization was more difficult than the linguistic task, the percentage of attentional resources dedicated to spatial organization were higher than the amount dedicated to linguistic tasks. However, regardless of how the attentional resources were divided up, the total amount of attentional resources did not exceed the total amount of attentional resources available, regardless of their distribution.

From this study and others, it seems that we have a limited amount of attentional resources, and these can then either be divided up in some limited way among many tasks or directed solely to one task with little or nothing left over for anything else. It should be noted that a significantly large and growing body of research in the area of visual cognition informs us that our attentional focus is what both permits us to acquire and then remember information. The opposite also has also been confirmed. That is, when we intently attentionally focus on something, we can literally be attentionally blind to something else, even if it is directly in front of us. Further, because we were incapable of noticing it at that point in time, we will not be able to report on it later, simply because something else has occupied our attention. This is true for information processed in both high- and low-stress conditions. To become inattentionally blind, one only has to intently focus on something else. The reader might be aware of times when they are commuting, and while doing so, they were focused intently on a conversation or were deep in thought and subsequently became inattentionally blind to some very prominent background noise or music.

Police officers refer to this narrowing of attention as *tunneling* and, subsequently, use the terms *tunnel vision* or *tunnel hearing*. Although these terms are understood in the academic world and have been used in research articles since the 1950s a more accurate term for this process is *selective attention*. Selective attention refers to something that the person is attentionally focused on and includes the use of all of the senses and attentional processes and not just vision and hearing. The research, particularly in visual cognition and selective attention notes that once someone selectively focuses on something, the person is then said to be *inattentionally blind*

to anything else. This means that regardless of whether the attentional process is internally directed toward something or externally drawn toward it, once we intently focus on something, we have, according to Just et al.'s (2001) research, a very limited capacity to notice anything else.

In the 1970s, Dr. Robert Nideffer theorized that selective attention could be further subdivided (Nideffer & Sharpe, 1978). He hypothesized that normally we direct our attentional resources to one of four types of attentional focus. He asserts that we have an external focus of attention, which is drawn or driven toward something outside of ourselves, and an internal focus that is directed toward something inside of us, either our body and the movement of our body or our thoughts. He further divided external attention into broad or narrow. A broad external focus of attention would be seeing a forest, while a narrow, or specific, focus of attention would be seeing or focusing on only a specific tree or leaf in the forest. He also has divided the internal component into both broad and narrow as well. An internal narrow focus of attention would be a specific focus on something experienced inside of yourself such as the tactile feel of a bat or pen in your hand. An internal broad focus might a whole body movement toward something, a limb movement such as swinging a bat or golf club, or a general awareness of feeling happy. Nideffer's division is so commonly experienced and so easy to notice that anyone working in a garden can easily experience all four of the attentional components. The gardener could shift their focus of attention to an external specific target such as a particular bug on a plant. They could have an external broad focus such as the overall aesthetic appearance of the garden. They could have an internal narrow focus by having their attention drawn to a painful knee when squatting down, or they could have an internal broad focus by experiencing a sense of satisfaction with a job well done in the garden. It is possible of course for the gardener to have a soft focus over all four attentional foci at the same time, but once the gardener's attention is strongly drawn to one of the foci, it becomes difficult for them to attend to other foci. For instance, attempting to identify a potentially damaging insect on a plant's leaf is going to significantly narrow the gardener's attentional focus and reduce their capacity to notice and then report on other elements in their potential attentional foci.

If we summarize the research it means that once our attention is driven or drawn toward an internal or external focus of attention, either broadly or narrowly, we then have a limited capacity to note and, subsequently, remember anything else that may be going on to which we are not attending.

Research on the impact of perception and attention on performance has been conducted for well over half a century, but so has research on the impact of emotions on the effectiveness of this perception and attention on performance. The research focusing on the impact of attention and emotion on performance also supports the research on attention and memory. Easterbrook (1959) noted that the pressure to perform well distracted performers from paying the appropriate attention to the main elements of their success on their task. Further research in the 1970s and 1980s confirmed an ancient belief—that is, that choking in a high-stress performance is the result of the performer becoming self-conscious and/or too concerned with the step-by-step execution of the task (Baumeister, 1984, 1985). This means that not only is an external narrow focus of attention important for success, but it has to be the correct external narrow focus. Even the famous

Asian philosopher Bruce Lee noted this concept in many of his movies prior to and including *Enter the Dragon* (Heller, 1973). Lee often noted the effect of the right “mind” or focus on performance. Self-focused attention (either internal narrow or broad) disrupted the automatic process that is so necessary for the skilled performance of a task just as much as the incorrect external focus of attention.

Gray (2004) used an innovative way of measuring the impact of an athlete’s focus of attention on his or her performance. Gray observed that expert batters had periods of both high and low levels of success at batting and predicted that expert batters would make more judgment errors about the angle their bat was held in when they were in a good phase of batting performance and fewer errors in judgment on their bat angle when they were in a batting slump. His logic was that the batters who were externally and narrowly focused on the game and responding automatically would not be paying attention to the angle of the bat and so would not remember it. Expert batters who were in a slump would have an increase in their self-focused attention, would be paying more attention to their own behavior, would be responding less automatically, and would remember the angle of their bat more often. Wulf (2007) also noted that, regardless of the causal factor, it is interesting to see that good athletic performance is associated with less attention directed to the details of the performance and most of the attention directed externally to the outcome of the performance. The author would like to add that the process Gray used of using recall memory to note the athlete’s attentional focus is a simple and effective tool for demonstrating the memory benefits of both selective attention and the memory impairment associated with inattentional blindness. Simply stated, besides noting the benefit of an external focus of attention and automaticity on great performance, Gray’s study also indicated that the more an athlete was focused on something, the less they were able to remember about anything else that occurred during this focused phase. This research study will use a like process of post-event reporting to assess a constable’s focus of attention.

In summary, some generally accurate statements from all of the research on attention are as follows:

- Attention, particularly under high stress, has a single, undifferentiated, limited capacity and reduces our ability to process information. This is termed *selective attention*.
- We can multitask or scan as long as anything we are doing is not too complicated or requires a rapid shift in attentional focus.
- Once we focus our attention, the perceptual narrowing involved leads to an increase in information from that on which we are focused and a reduction in information that is processed in the peripheral areas of our attention (e.g., visual, auditory, kinesthetic, spatial, etc.).
- Perceptual narrowing that occurs under these conditions results in more information being processed about that which we are attending to (selective attention), but it significantly restricts or blinds us to information that we are not paying attention to. This is called *attentional blindness*.

- Attentional narrowing, while being necessary for great performance, can also impair performance (depending upon its direction). It can also significantly enhance or impair memory as well.
- Attentional processes can be enhanced or impaired by our emotional responses.

Rationale for the Study

In the movie *The Last Samurai* (Cruise, 2003), the actor Tom Cruise was held captive in the camp of the samurai leader Katsumoto. As he was recovering from his wounds, Cruise's character began to train with the bokan, a Japanese wooden sword. As the movie evolves and Cruise develops his skill with the bokan, he was still being soundly beaten by a rival. At a significant point in the movie, when his rival is once again beating Cruise's character, one of the samurai comes up to him and says "too many minds." Cruise's character understands this to mean that his attentional focus (i.e., self-consciousness, focus on the use of the skill and not the conflict, etc.) is impairing his automaticity and causing him to not do well. He then loses his "too many minds" and fights his rival to a draw. The effect of attentional focus on performance has been the topic of philosophical musings and "practical" research for thousands of years among warrior cultures. Some of the most productive thinking has been from studies conducted by the practitioners of Yoga, Zen, and the martial arts (Ratti & Westbrook, 1973). This fertile work came to the attention of the Russian space industry at the end of the Second World War (Garfield, 1984).

Based on the philosophy of combat and human performance, in the 1940s, the Russians began to research the benefit of attentional processes on emotional control and performance. In the 1960s, the Western world began to learn of this research and by the 1970s, as noted earlier, Nideffer and others were speculating about and researching the benefit of specific types of foci of attention on performance (Nideffer & Sharpe, 1978).

The early research on memory, including that conducted by one of the pioneer researchers (Ebbinghaus 1885), noted that memory is connected to attention. Without some focus of attention, little environmental and personal information moves into permanent storage. It is important to note that memory is a product of information processing. That information processing may occur at all stages, or at any one stage of a behavior. For instance, first, the awareness might be at the beginning of the thought of initiating the behavior or being aware that the behavior started. Interestingly, even if the behavior is not completed, the memory of starting the behavior or even thinking of starting the behavior could lead the person to believe the behavior was completed—if they do not have any other memory of that behavior as it was occurring. Secondly, the behavior or act could be noted as it is happening and then it would be remembered as happening. Finally, even if the person had no knowledge of doing the behavior, if the outcome was observed, then it could be noted as having happened and would be remembered as such. Without an awareness of the behavior or act being initiated, observed while it is occurring, or noted as having happened, the behavior or act will not be remembered.

More subtle components of the behavior can also only be remembered if the person's attention is directed to that component of the behavior as it is occurring. As Gray (2004) noted, behavior that is processed automatically is not remembered, only that it is occurring or did occur. Subsequently, the information about how it is specifically occurring is not processed. Miller, Galanter, and Pribram (1960) observed that a rich store of unconscious motor memory is available for the performance of acts of neuromotor skill. In this sense, a complete neuromotor program, including significant amounts of stored memory, such as pointing and shooting a gun or automatically moving while in the middle of a high-stress encounter, can occur without any conscious effort at all, except for the shooter's decision to engage the correct motor program or the memory that the automatic motor program was engaged after it was over. The exact process by which it occurred as it was occurring will likely not be stored in the shooter's memory. The reader may recall that when they are typing on a computer, knowledge about their striking any specific key during the automatic act of typing a sentence is impossible to remember. That it occurred and the specific letter connected to that key is in the word displayed on the computer screen informs the typist that they did strike that specific key; however, knowledge about striking that specific key at that point in the sentence is unavailable to the typist and never will be. Therefore, *automatic* behavior that we do every day is noted as having occurred, but we cannot accurately and with honesty report that we remember having done it. A similar process occurs with police constables as they engage in any type of automatic behavior, including well-trained behavior, in a wide variety of both low- and high-stress encounters.

The purpose of this current study was to assess the validity and application of these observations to the behavior of police constables. The critic's conclusion would be that well-trained armed response officers from the Metropolitan Police Service do not experience *perceptual distortions*. The scientist would say that perceptual distortions and, in particular, selective attention and inattention blindness have been the topic of discussion among philosophers and warriors for thousands of years. Their presence in all humans, including expert athletes, has been researched for over half a century. Therefore, they will also be present in well-trained, armed officers from the Metropolitan Police Service. The question is not will they be present but, rather, to what extent.

The research presented here will focus on using the constables' perceived memories to assess their focus of attention at the moment of conflict in a scenario involving a simulated armed encounter. Nideffer's Quadrants of Attention (internal and external, narrow and broad) will serve as a way of categorizing the direction of attention and informing us about the presence of selective attention and inattention blindness among the constables during the simulated encounter (Nideffer & Sharpe, 1978).

The research secondarily will examine different means of acquiring post-incident information from the involved constables. These methods involved either having the constables interviewed or having them write reports. Further, the constables were divided up into groups that conferred or did not confer prior to their writing the reports or being interviewed.

Method

The goal of this study was to research the attentional allocation of firearms officers (constables) who were thrust into a simulated incident. The incident had to occur suddenly and be dynamic, rapidly evolving, complex, and symbolically life-threatening. To do this, the researchers had to create and then engage the constables in a realistic type of encounter.

Scenario

The scenario the constables encountered had to be realistic enough to create a stressful event for them. It also had to involve decisionmaking and action on their part such as would be required of them in a real life-and-death encounter. Further, it had to involve at least one other constable and several subjects so the researchers would be able to assess the constable's ability to note the behavior of others in the same scenario. It also had to be open-ended in that the constable's response changed the nature of the encounter in a fashion that would be unique and noticeable by that constable. The scenario also had to be novel and unique enough that the constables involved would need to read the situation. This meant their attentional resources and scanning behavior would be notable.

Location

The scenario occurred at the reception area of the gymnasium at the recruit-training center at Hendon. At this location, the entrance to the gymnasium building was altered to represent a reception area of a hospital ward. The benches at the site accommodated "waiting patients," and the large front desk facilitated the appearance of a reception area. A side door to the left of the reception area contained a small room that hid the hostage and hostage taker until their "surprise" entrance into the scenario. A hallway further to the left of the main desk led to an area where the constables could be equipped with simunition handguns loaded with simunition blanks before they engaged in the scenario. Heart monitors and numbered vests were also placed on their chests, and they were also briefed on the upcoming incident. When they had been briefed about the scenario and were ready, they then entered the hallway that led to the "waiting room" and into the scenario.

Incident

The constables were grouped into teams of two or three. They were then instructed that the scenario they were about to enter involved their being posted as guards for a subject who had been wounded in an armed robbery and who was now being held in a locked ward in a medical facility. The ward was located upstairs from their briefing room and they had to walk through the lobby to get to the stairs and then to the assigned area. As they walked through the lobby with "waiting patients" sitting in the reception area, unbeknownst to them a staged conflict was developing at the reception desk between a brother of the wounded subject and the receptionist. As the constables passed the reception desk on their way to the stairs, they would intentionally be drawn into the conflict by having the arguing parties escalate their voices, use profanity, or by having the brother threaten physical harm to the receptionist who was preventing him from seeing his wounded brother. In post-incident interviews or reports, not a single constable was able to note anything about the relationship of the complainant

at the desk to the wounded patient or of the communication content overall except that the complainant wanted to visit his brother.

After a brief period of time when the constables were sufficiently engaged in the conflict at the reception desk, the hostage taker, with his arm around the hostage and a double-barreled shotgun in his right hand, burst through the door to the left of the reception desk. The hostage taker fired the double-barreled shotgun twice into the floor, disengaged from the hostage, and pointed the shotgun at the constables. The constables immediately reacted and attempted to control or shoot the hostage taker.

Once the hostage taker was disabled, the scenario was halted and the constables were then ushered off to the staging room where they either conferred or did not confer and then were sent off to be interviewed or to write a report.

Figure 1. A Simulation Scenario



Volunteers

The study was possible due to the kind contributions of time, energy, and skill from a number of very gracious individuals. These included Dave Blocksidge, Paul Monk, Mark Williams, Dave Jeffries, Patricia Thiem, Dr. Alexis Artwohl, and several staff from the training facility who were kind enough to fill in as “waiting patients” on the benches. Members from the Department of Professional Standards served as interviewers and, of course, armed officers from the Uniformed Occupational Command Units were the volunteer constables who were involved in the study.

Subjects

The 46 subjects/participants were all armed officers from one of the four armed units within the department: (1) CO6 – The Diplomat Protection Group, (2) CO19 – The Armed Response Unit and Tactical Support Team, (3) CO18 – The Aviation Security Unit, and (4) the Territorial Support Group. Although they varied in age and experience, for the most part they were male and young. Three of the participants were women.

Interviews

The constables were divided into two reporting groups. One of the groups handwrote reports detailing the incident and their participation in it. The other group was interviewed about the incident using a cognitive interview format.

All of the interviewers were volunteers from the Department of Professional Standards with the Metropolitan Police Service and had training in cognitive interviewing. They were skilled interviewers. Dr. Amina Memon from The University of Aberdeen in Scotland conducted a refresher training session in cognitive interviewing for the interviewers just prior to the start of the research. The interviewers met and individually interviewed each participant. All of the interviews were recorded on audiotape, and these were later transcribed into a typed format.

Written Reports

The other main fashion in which the constables recorded their memory was in a written format. The constables were given incident report booklets, and they recorded their memories of the incident. These were also transcribed into a typed format.

Confer or Nonconfer

Each of the groups—the report group or the interviewed group—were further broken into two groups: (1) confer and (2) nonconfer. The confer groups met immediately after the incident and discussed their roles and perceptions in the scenario. The time for the confer session varied as each group was allowed up to 20 minutes to process the scenario. This method of conferring was not identical to the conferring method currently employed by the Metropolitan Police Service that occurs when their officers are writing their reports. Subsequently, only limited comparisons of the results of this study can be made to the conferring process currently employed.

Cardiac Measurement

Mr. Justin Dixon, the Physical Training Manager for the Metropolitan Police Service, arranged to monitor the heart rate of each of the constables by having them wear a Polar chest belt and recorder throughout the scenario and during their reporting of the event in either written reports or interviews. After the event, the constables who were still wearing their heart monitors were given the Metropolitan Police Fitness “Bleep” Test that provided information on their maximum level of physical exertion.

Video Recording

Three cameras stationed at three different locations in the reception area filmed each scenario and each constable. The film from each camera and for each scenario was loaded into a *Final Cut Pro Video Editing* program that permitted the precise syncing of all three cameras to specific frames. In this fashion, all three videos from each scenario could be viewed simultaneously in a precise frame-by-frame mode.

Transcribed Interviews and Reports

All of the interviews and reports of the constables were transcribed either from the audiotape or from the written report, and each constable's transcriptions were printed and placed into binders. Each grader was provided with their own binder of the constables' transcriptions.

Graders

The graders were graduates of or graduate students at Minnesota State University, Mankato.

Grading Process

Once the interviews and reports were transcribed, the graders then read the transcriptions of the interviews or reports of the constables and categorized every reported detail into one of the quadrants of attention. This included every item of clothing noted, every person, thought, action, and so on.

After this was completed, the graders individually viewed the synchronized videotapes of each scenario. During this viewing, they evaluated whether the constable was actually capable of reporting each item or behavior on which he or she had reported, and they noted the accuracy of the constable's report on that item or action. They then recorded the results. The prime area of interest for this project was the focus of each constable's attention during the high-stress component of this incident. Therefore, all of the analysis on the constables' attention was taken from the data provided by the constable from the point of the entrance of the hostage taker into the room and the unexpected discharge of the shotgun. The analysis ended when the constables noted that they exited the scenario.

Results

The results from the transcriptions of the constables' interviews or reports were then coded by the graders and entered into the appropriate categories in Nideffer's Quadrants of Attention (Nideffer & Sharpe, 1978). The results were grouped by the graders and also by whether the constables were interviewed or wrote a report and whether they conferred or did not confer.

This remembered information then allowed the researchers to extrapolate about the constable's focus of attention during the incident. If the constable was able to report on something that was present or occurred during the encounter, then it likely was something the constable had observed or focused on during the incident.

Inversely phrased, if the constable could not report on something or erroneously reported on it, then it was likely not a focus of the constable's attention.

The information on which the constables reported was then grouped into one of Nideffer's Quadrants of Attention, which allowed the researchers, among other things, to determine if there was any applicability of this concept to assist in understanding the constables' perceptions and memories in a high-stress encounter of limited duration.

Only one constable reported that he had acquired information during the confer stage of the experiment. The reports of all the other constables included details on which they were appropriately focused and on which they were thus capable of reporting. Of significant note here is that constables who conferred, whether they wrote reports or not, even if they did not report learning anything during the conferring, made significantly fewer errors on the material about which they were reporting.

Analysis

Results from the Cardiac Monitors

The constables' pulse rates during the incident were monitored by means of Polar cardiac monitors. Mr. Justin Dixon of the Metropolitan Police Physical Education Branch placed the monitors on the constables before they entered the staging room. After the constables completed the scenario, including being interviewed or writing a report, they were tested on the Metropolitan Police Fitness "Bleep" Test to assess their heart rate at maximum effort. Mr. Dixon then collected and analyzed the data. His report on 43 of the constables from this study is included in here as Addendum 1.

The scenario was constructed to be rapidly unfolding, highly dynamic, complex, and very stressful. The cardiac measurements revealed that the researchers had accomplished this goal. The constables' pulse rates spiked to an average of 75% of their maximum during the conflict situation in the scenario. Very significantly, it also spiked at 65 to 70% of their maximum when they were reporting on the conflict moment during their interviews. For illustration, a constable coded 001 in Group 1 had a maximum pulse rate of 198 beats per minute on the fitness test. During the shotgun blast, his pulse spiked at 159 beats per minute.

Nideffer's Quadrants of Attention

The research project was primarily designed to assess whether constables in the middle of a violent, rapidly unfolding conflict would develop a perceptual distortion known as tunnel vision. Also investigated was the relevance of applying Nideffer's Quadrants of Attention philosophy (Nideffer & Sharpe, 1978) to reports from the constables involved in this study, with the goal of assisting researchers in understanding and quantifying a constable's perception and attention in a stressful, use-of-force encounter in law enforcement. Further, a pilot study was conducted on various means to obtain the memory of a constable after an incident.

The information about the incident provided by each constable, whether the constable was interviewed or wrote reports, was transcribed and then three independent graders graded every word in the transcription. Every item of clothing, thought,

behavior, movement, etc., in the scenario, as noted by each constable, was graded for its appropriate fit into one of Nideffer’s Quadrants of Attention. For example, if the constable noted the double barrels of the shotgun, it was graded as being an item that was entered into the External Narrow focus of attention. If the constable thought they were in danger, it was an Internal Broad focus. If the constable thought he had to move to the pillar, it was an Internal Narrow focus. If the constable noted the assailant fell to the floor, it was an External Broad focus. The data was then entered into the appropriate attentional quadrant. This then gave the researchers a numerical indicator of the number of items the constables accurately remembered when they were engaged in the simulated critical incident and the placement of those items in Nideffer’s Quadrants of Attention. It is obvious that the constables could not see everything occurring at any instant in this encounter, but the items that the constables remembered at the end of the incident are a good indicator of their focus of attention during the incident.

A variety of statistical analyses were then applied to the data. However, in the author’s very first undergraduate class in research, the students were encouraged to “eyeball” the data first to see if any trends in the data “popped out” at them. The following tables are presented in that spirit.

Table 1. Average Score per Constable per Quadrant of Attention for All Experimental Categories

The Average Total Score for Each Constable When the Data Is Combined Across all of the Experimental Conditions (Conferred/Nonconferred and Interviews/Reports)		
	Narrow	Broad
Internal	9.40	4.07
External	35.37	19.94

The purpose of presenting the data in this format is to illustrate the blatantly obvious nature of this data. The above table illustrates the average score in each quadrant for the average constable when the data is combined across all of the research conditions. For example, the reader will note that the External Narrow quadrant of attention generally has nine times more data recorded in it than the Internal Broad quadrant. The Internal Narrow quadrant is generally over twice as large as the Internal Broad quadrant. The External Narrow quadrant is roughly about twice as large as the External Broad quadrant. Therefore, the researchers can state unequivocally that during the most stressful component of this simulation, the constables experienced a narrow focus of attention and were externally tunneled specifically on items or behavior that were crucial for their performance in this situation. This tunnel vision or selective attention is characteristic of all humans who engage in this type of encounter, whether they have received law enforcement training or not. This study illustrates that this phenomenon also occurs in well-trained peace officers.

The following is presented for a more detailed analysis of the data. Tables and figures reflecting a higher level of analysis are included in the Addenda and are available for review.

Condition I: Nonconferred and Wrote Reports (11 Constables)

A total of 11 constables were in this group. Immediately after participating in the scenario, each of the teams of constables in this experimental condition returned to the briefing room, where they returned their equipment. They were immediately separated after this. They were instructed to not discuss the incident with anyone. They were then told to go to an area where they could write their reports and that they should turn them in when they were completed. At some point after writing their reports and during the same shift, they took their fitness test.

The following table includes the average scores for the constables, recorded in each of the four quadrants of attention for this group. The numbers listed in each quadrant of the chart are averages in that quadrant for all of the scores of the 11 constables across all three graders.

Table 2. Average Score per Constable – Nonconferred and Wrote Reports

	Nonconferred and Reports Totals	
	Narrow	Broad
Internal	4.54	1.97
External	18.70	12.00

The constables who wrote reports in this category provided the least amount of information despite being requested to write full and complete reports about everything in the incident. They reported on the essence of the incident, providing little extra information. Their descriptions of the incident and the subjects, even when they were mentioned, were the barest, with little or no elaboration on such things as behavior or clothing. The constables' reports on their thought processes during the incident were also extremely sparse. Note that the average score per constable was fewer than two thoughts per constable per incident for an Internal Broad focus.

The reader should keep in mind that the pattern of the constables' scores regardless of the number of items listed is overwhelmingly large in the External category and exceptionally larger by far in the External Narrow category as compared to the External Broad category.

Simply stated, the constables who wrote reports primarily reported on items that they were externally and narrowly focused on while they were engaged in attempting to respond and control the events in the scenario.

Condition II: Conferred and Wrote Reports (14 Constables)

Fourteen constables were in this group. The teams of constables in this experimental condition also immediately returned to the briefing room where they returned their equipment. They were then allowed to discuss the incident for a brief period of time (no more than 20 minutes) and then were instructed to go to an area where they could write their reports and turn their reports in when they were completed. They were also instructed that after the initial conferring, they were not to discuss

the incident further with anyone. At some point after writing their report and during the same shift, they took their fitness test.

Table 3. Average Score per Constable – Conferred and Wrote Reports

	Conferred and Report Totals	
	Narrow	Broad
Internal	3.36	1.90
External	22.43	12.45

Constables in this experimental condition, on average, reported the same amount of data in all categories as the constables who wrote reports and did not confer.

Comparison Between Conferring and Nonconferring in the Report Category

Generally, the researchers would not have expected to have a difference in the Internal category between these two groups as this category relates to the constables' internal reflections and awareness of their own behavior. Considering that most of the constables did not mention their thoughts or make comments about their own behavior during the conferring and that other constables did not elicit their thoughts, there should be no difference in this category between Condition I and Condition II. If there was any expected increase, it should have occurred in the External category because of the conferring. However, during the conferring process, the researchers observed that the constables did not appear to learn anything "new" during the conferring. Therefore, it is not surprising that there was not a difference between conferring and nonconferring in any of the quadrants in the Report category. This is particularly true when what the constables reported was so sparse.

The most significant difference between the conferring and nonconferring report groups occurred in the number of errors that each group made. This is explained more completely in the "Error Rates" section. It is important to note here that in the External Narrow quadrant (which is the quadrant that the constables would be noting the behavior of the subject, the threat presented, etc.), the group that did not confer had four times more errors in their written reports than the group that conferred. This may mean that even though the constables did not comment that they learned anything new during the conferring, some accurate information processing was occurring.

Condition III: Nonconferred and Interviewed (6 Constables)

Six constables were in this group. The constables in this group returned to the briefing room right after the scenario and turned in their equipment. They were immediately separated after this and asked to not discuss the incident with anyone. They were then instructed to go to an area where they could be individually interviewed using a cognitive interview format. At some point after being interviewed and during the same shift, they took their fitness test.

Constables in both of the interviewing conditions provided much more information overall than did constables who wrote reports. This was particularly true in the Internal quadrant. The added information was generally two to four times the amount of information provided by the report group, dependent upon the

quadrant. In the External quadrant, the interviewed constables generally provided about twice the information as the constables who wrote reports. The reader will note, however, that particularly in the External Narrow quadrant, which was the primary focus area of all of the constables in the scenario, the error rates of those constables who were interviewed was exceptionally high in comparison to those who wrote reports (see the section on “Error Rates” for more information).

Table 4. Average Score per Constable – Nonconferred and Interviewed

	Nonconferred and Interviewed Totals	
	Narrow	Broad
Internal	17.20	9.11
External	56.83	28.50

Note that the pattern of the constables’ scores regardless of the number of items listed in each quadrant is overwhelmingly large in the External category versus the Internal category and exceptionally higher by far in the External Narrow as compared to the External Broad quadrant. This means that regardless of how the constables reported their information, all the constables had experienced the same type of perceptual process.

Condition IV: Conferred and Interviewed (15 Constables)

Fifteen constables were in this group. The constables in this experimental condition also returned to the briefing room where they returned their equipment. They then conferred with each other immediately after the incident, discussing the elements of the incident for a brief period of time. Sometimes the discussions lasted up to 15 or 20 minutes. They did not write a report. After conferring, they were individually interviewed using a cognitive interview format. At some point after being interviewed, and during the same shift, they took their fitness test.

Table 5. Average Score per Constable – Conferred and Interviewed

	Conferred and Interviewed Totals	
	Narrow	Broad
Internal	15.64	5.62
External	51.00	29.33

Again, note that the pattern of the constables’ scores regardless of the number of items listed is overwhelmingly large in the External category versus the Internal category and exceptionally higher by far in the External Narrow as compared to the External Broad.

Comparison Between Conferring and Nonconferring in the Interview Category

As with the report groups, generally the researchers would not have expected to have a difference in the Internal category between these two groups in the Interview categories. This is because this Internal quadrant relates to the constables’ internal thoughts, reflections, and awareness of their own behavior.

Considering that most of the constables in this condition also did not mention their thoughts or make comments about their own behavior during the conferring and that other constables did not elicit their thoughts, there should not be a difference in the Internal category between Conditions III and IV. If there was any expected increase, it should have occurred in the External category because of the conferring. However, during the conferring process, the researchers observed here as well that the constables did not appear to learn anything “new” during the conferring. Therefore, it is not surprising that there was not a difference between the information reported by the constables in any of the quadrants in the Interview condition from those constables who conferred and those who did not confer.

The most significant difference between the conferring and nonconferring interviewed groups occurred in the number of errors that each group made. This is explained more completely in the “Error Rates” section. It is important to note here that in the External Narrow quadrant (which is the quadrant in which the constables would be noting the behavior of the subject, the threat presented, etc.), the group that did not confer had 25% more errors than the group that conferred.

Narrow Versus Broad Focus of Attention

When the averages were combined across both the narrow and broad focus of attentions, the average across all of the experimental groups (conferred, nonconferred, interviews, reports) was four times larger in the External than in the Internal categories. The average for the External focus was 55.31 items noted versus 13.47 items noted for an Internal focus.

Table 6. Average Score per Constable for Internal and External Focus—Narrow and Broad Groups Combined

	Average Score per Constable Conferred/Nonconferred Interviews/Reports Narrow/Broad Combined
Internal	13.47
External	55.31

The data is overwhelmingly clear that the constables had an External focus of attention.

Table 7. Average Score per Constable for Narrow and Broad Focus—Internal and External Groups Combined

	Average Score per Constable Conferred/Nonconferred Interviews/Reports Internal/External Combined
Narrow	44.77
Broad	24.01

When the scores are combined across all of the conditions and compared to a Narrow versus Broad focus of attention, the Narrow focus of attention had an average of

44.77 items recorded for the average constable. The Broad focus of attention had 24.01 items recorded. This was true even though the graders were very liberal in putting External items in the Broad category. Therefore, as supported by the data, it is overwhelmingly clear that the constables had a Narrow focus of attention.

This means that when the constables were engaged in the performance of assessing and reacting to the scenario and in engaging the hostage taker with their firearm, they had an External and a Narrow focus of attention. For the most part, because of the close proximity of the encounter, the constables were not using their sights but were using a kinesthetic alignment (point shooting). Although this method of shooting did not require sight alignment, it still occupied some portion of the constables' attentional processes.

The important element about an External focus of attention, particularly an External and a Narrow focus of attention as most frequently occurred in our study, is that the process allows the constables to focus on what is important to them at the time. Unfortunately, they then can miss other items that later may turn out to be important. For example, if the constable's attentional processes at the moment of the shooting were on the alignment of their gun on the hostage taker's center mass, they then did not note anything about or paid minimal attention to anything else about the subject at that moment. This includes the specific movement of the subject, the subject's clothing, the subject's actions toward the hostage, etc. Under this condition, they would note that the subject had moved, for example, but be unable to explain the precise frame-by-frame movement of the hostage taker as they were simultaneously engaged in shooting.

This matches the research results found in the attentional process of successful athletes. Wulf (2007) notes that an External focus of attention is a primary prerequisite for successful performance in an athletic competition. Vickers (2007) adds that an External and Narrow focus is vital for successful performance of a psychomotor skill in athletics, from golf to basketball to football. It is reasonable that trained firearms officers will function in a similar psychomotor fashion to successful athletes when the officers are performing a psychomotor skill.

Therefore, the data is overwhelmingly clear that the constables had an External Narrow focus of attention during the most stressful component of the scenario, and this appeared to facilitate their performance and effectiveness but simultaneously impaired their ability to provide full and complete reports about the incident.

The use of Nideffer's Quadrants of Attention (Nideffer & Sharpe, 1978) was overwhelmingly supported as being an appropriate tool for categorizing and understanding a constable's focus of attention during a high-stress force encounter. To use law enforcement terminology, the research overwhelmingly supported the constables' experience of tunnel vision and tunnel hearing or perceptual distortions during this type of encounter.

The results of the research also clearly illustrate that the constables' focus of attention in this type of encounter was primarily external in both the External Narrow and External Broad modes. The constables who were interviewed had four times more observations in the External than in the Internal quadrant. The

constables who wrote reports had over six times more information in the External quadrants than the Internal quadrants.

Even though the constables were more focused on the External quadrants, they were more narrowly focused than broadly focused. Even when they were broadly focused, they still were narrowly focused on a particular person or event in the environment. This was in spite of the graders being very generous in grading the External Broad category. For example, if the constable noted the shotgun assailant was wearing a shirt, the constable would get a score in the External Broad category. If they noted the shirt had any particular features, such as short sleeves, then the constable would get a score in the External Narrow category.

As noted, an External and in particular an External Narrow focus of attention significantly facilitates a focus of attention on a threat and, in turn, facilitates great performance by the constable; however, it also renders the constable attentionally blind to anything that they are not focused upon. To paraphrase one constable, "I knew what I saw, but I don't know what I didn't see."

Also, the constables' accuracy of their reported memory waned the further they were away from the details on which they were specifically focused. For example, every constable who could see the shotgun usually reported a quite detailed and accurate description of the shotgun. They were accurate about the shooter's action while they were focused on it. They were less accurate about the clothing the shooter was wearing. They were often quite unobservant or inaccurate about the hostage, and they almost never noted the behavior or action of anyone other than the shooter. Further, they almost never noted the presence or action of the shooter's brother and even other constables—unless, of course, that constable or brother was somehow directly involved with them such as being directly between them and the assailant with the shotgun. Subsequently, we can state that the constables' focus of attention was very narrowly driven and externally specific. However, depending upon the constable, the constable's location, what the constable was attempting to do, and so on, the constable's specific focus varied and evolved during the incident and was often unique to that constable and the behavior on which that constable was focused and/or on what he or she was attempting to accomplish.

Thus, we can definitely state that the constables in this study had a very selective attention that was driven by the evolving incidents in the scenario and the constables' own attempts to respond to those events. They were attentionally blind to anything on which they were not focused.

This means that the constables made errors in reporting items, particularly items or behavior that occurred on the periphery of their attentional focus. We also recorded their errors.

Error Rates

As shown, the constables were both accurate and inaccurate in regards to their recollections about their incident from the moment of the assault by the hostage taker up to the constables' control of the incident. These error rates during that portion of their incident will be discussed in this section. However, before the data in this portion is discussed, it is important to note that the constables were also

both accurate and inaccurate in their reports on the scenario before the assault by the hostage taker. For instance, the constables did not note or report on the relationship between the individual engaged in the confrontation at the front desk and the wounded bank robber. In the scenario created for this research, this relationship was not important; however, it was also not noted by the constables during the initial conflict at the desk.

The results of the analysis of the error rates—that is, the number of items the constables incorrectly reported on—is truly astounding and definitely needs to be investigated further.

The following error rates were observed across the only quadrants that error rates could objectively be assessed in: External Narrow and External Broad. Under these conditions, the constables noted some particular behavior or items in their reports or interviews, and the graders could then assess whether or not that behavior actually occurred and was documented by video from one or more of the three video cameras recording the constable’s scenario.

The following tables present the error rate data grouped by the two viable foci of attention and the four treatment groups. Table 8 simply depicts the average number of errors for each constable in each category. Table 9 combines both the averages for the error rates for each constable in each category and the average number of items the constables reported in each of the categories. By combining them in this way, it is possible to assess the volume of items reported and the error rate in relation to that volume.

Table 8. Average Number of Errors per Constable in the External Broad and External Narrow Quadrants

	External Broad	External Narrow
Nonconferred/Report	0.45	0.60
Conferred/Report	0.50	0.14
Nonconferred/Interviewed	1.60	6.60
Conferred/Interviewed	1.40	4.50

Table 9. Average Number of Errors per Constable in the External Broad and External Narrow Quadrants Compared to the Average Number of Items Reported in Those Quadrants

	External Broad	External Narrow
Nonconferred/Report	0.45/12.00 items	0.60/18.70 items
Conferred/Report	0.50/12.45 items	0.14/22.43 items
Nonconferred/Interviewed	1.60/28.50 items	6.60/56.50 items
Conferred/Interviewed	1.40/29.33	4.50/51.00 items

The reader will note that the lowest error rates were recorded in the Report categories by the constables who wrote reports. The average number of errors for each constable in this category was somewhat less than half of one error per incident per constable. The errors were 0.45 per constable in the External Broad

for the nonconferred/report condition, 0.50 per constable in the External Broad conferred/report category, 0.60 per constable in the External Narrow for the nonconferred/report condition, and an astounding 0.14 per constable for the External Narrow category for those constables who conferred and wrote reports.

This may be a product of the small amount of information provided in the constables' written reports. The smaller amount of information provided by the constables in this category meant the constables had less chance of being mistaken.

The notable exception in the Report category was the exceptionally small number of errors in the conferred/report category for the External Narrow quadrant of attention. Fourteen constables were included in this group, and each constable reported 22.43 items or behaviors in this quadrant. The average error rate for every 22.43 items was 0.14. It is an amazing statistic. Framed another way, 14 constables provided a total of 314 correct details (14 constables \times 22.43 items) in this category and only recorded two factual errors in all of that data.

The smaller number of items reported in this category cannot be the only reason for this incredible statistic. The constables in the nonconferred/report group had about as many items noted but had four times the error rate in this category (0.60). This is still a small number, but it is about four times greater than the error rate of the constables who conferred and wrote reports.

Also, those constables who were interviewed, although they provided, on average, more than twice the amount of information in the External quadrants, they had an error rate for that information that was very high. Although the difference under the interview conditions between those constables who conferred and those who did not confer is not as dramatic as the difference in the report writing conditions, the constables who conferred and then were interviewed made 25% fewer errors in the External Narrow quadrant than the constables who did not confer and then were interviewed. This means the constables who conferred and then were interviewed were considerably more accurate in reporting those behaviors that they were narrowly focused or tunneled in on than the constables who did not confer and were interviewed.

The noticeable comparison is on the error rate in the "External Narrow" quadrant between those constables who conferred and wrote a report and those who did not confer and were interviewed. Those who conferred and wrote reports provided about a third of the information about that which they were "Externally" and "Narrowly" focused on as compared to the information provided by those who did not confer and were interviewed. However, those who conferred and wrote reports had fewer errors by volumes in this quadrant than did the constables who did not confer and were interviewed. The constables who conferred and wrote a report had an error rate of 0.14 per constable. This means when all the errors are combined across all of the constables in this category, only two errors were made by all of the 14 constables in all of the information they provided about that which they were externally and narrowly focused on.

In comparison, the constables who did not confer and were interviewed had an average of 6.6 errors per constable in this category in the External Narrow quadrant. The constables in this category reported a total of 339 items (56.5 items per constable \times 6 constables) and had 40 errors in total. There were only six constables in this

category, and although statistical analysis not provided in this report indicates the data is still reliable, due to the small sample size, the author of this paper is still suspicious. The error rate for those six constables who did not confer and were interviewed is 47 times that of those who conferred and wrote reports.

Another interesting result was found when comparing the error rate of those who conferred and wrote reports with those who conferred and were interviewed. Fifteen constables were in the confer and interview group. This is a significant size difference from the six constables in the nonconfer and interview group and should result in a good comparison. Each constable in the confer and interview group reported an average of 51 items in the External Narrow quadrant. This is a total of 765 items (51 items \times 15 constables), and they had a total of 66 errors compared to the two errors for those 14 constables who conferred and wrote reports.

Regardless of whether the constables conferred or not, the interviews led to a significant number of inaccuracies in the information that the constables reported. It is the observation of the graders and the author of this paper that the primary source of the errors dealt with information on the edge of the constables' focus of attention. The constables worked hard to provide accurate information, but the interviews apparently led them to expand on items that they were less knowledgeable about.

Discussion

A very credible conclusion from the results of this research might be that interviews produced significantly more data particularly in regard to the items and behavior that the constables were focused on during the incident, but those who were interviewed also had a significantly higher error rate on that increased quantity of information. The written reports produced less information but produced fewer errors and, therefore, were much more accurate in their totality. Conferring, as was done in our study, produced fewer errors around that information on which the constables conferred, which was primarily items and behavior in an External Narrow focus of activity and attention. Therefore, a recommendation from the results of this study would be that when constables are going to have to report on an incident, the most accurate reporting of the details is going to be provided by those constables who have had a chance to confer and write a report. A further conclusion might be that the fewer details the constables provide about the incident, the fewer errors they will make especially if they report only on the behavior that they were most specifically focused on.

This study and others, such as Just et al.'s (2001), inform us of the value of a single, undivided attentional focus. They also inform us of the liability of this same process, which results in, among other things, inattentive blindness to anything the constable is not focused on.

LeDoux (2002) and Damasio (1994) inform us as well that when human beings are performing under a high level of threat, they lose higher cognitive functioning which includes their *executive functions* such as the ability to critically think and perform logical analysis.

The scenario created in this study caused a high level of stress in the constables, as measured by their self-reports and the scores from heart monitors. This resulted in a significant narrowing of their attention to the hostage taker/assailant and his shotgun and their response to that threat. This narrow focus of attention toward the rapidly evolving and very threatening situation occupied all of the constables' attentional processes. This narrow focus of attention facilitated the constables' perception of and response to the threat, but it also created a significant cognitive impairment.

It is extremely difficult, if not impossible, for the constables or any human to be so intently and emotionally engaged in a scenario such as this one for such a brief period of time and also to simultaneously be critically assessing all of the related elements in the scenario as well as their own behavior. For instance, most of the constables noted that they heard the shotgun being fired, and many noted that it had been fired twice before it had been pointed at them. They also noted as it was being pointed at them that it was a double-barreled shotgun.

Only one team of three constables out of a total of 46 constables was able to note that the hostage taker had fired both barrels from the double-barreled shotgun and, subsequently, it was no longer loaded with viable rounds. That group noted this after they had attempted to verbally control the hostage taker who was pointing the shotgun directly at them. When the hostage taker, now with enough time, attempted to reload his gun, these constables saw that it was empty and rushed to control him.

This was not a behavior that the researchers were looking for, but it is consistent with the focus and the finding of this study. That is, that human beings attempting to perform in a high-stress incident of short duration lack the attentional processes and cognitive functioning to engage in life-saving behavior while simultaneously critically analyzing that behavior. Given the opportunity and time of the course, this process could occur as it did in a small number of participants in our study.

Conclusion

The scenario, although only symbolically threatening, produced a high level of stress for all but one constable in the study. The research results were indisputable. Selective attention and inattention blindness or tunnel vision/hearing were apparent in every constable except one. That constable stood away from his group and the incident and was not involved at all as a participant in the scenario. Other than that, every constable's attentional focus during the shooting portion of the scenario was narrowly directed at some element or subject in the encounter. The constables' External focus of attention was significantly greater than their Internal focus of attention, and their External Narrow focus of attention was significantly greater than their External Broad focus of attention.

The results of this study are, thus, incontrovertible. The constables all experienced the erroneously termed perceptual distortion of tunnel vision. They were able to report primarily on those elements of the incident that they were attentionally focused on, and their focus was primarily external and narrow. They were unable to report on or reported with varying degrees of error about those elements that they were not directly focused on. The constables who conferred reported more items correctly about the information they conferred about. These constables also had fewer errors

in their reported information than did those constables who did not confer. Those constables who wrote reports provided less information by about two thirds than those who were interviewed, but the constables who wrote reports had significantly fewer errors than those constables who were interviewed.

Unfortunately, the researchers were not able to schedule the number of constables needed at the time of the testing and so the population of participants in all of the subgroups was not large enough to ensure reliable results across all of the experimental conditions.

Therefore, the author of this article, based on this study, cannot recommend a particular practice for interviewing constables after an emotionally intense incident. This study was not set up to specifically address this issue, and although the data is amazing, the sample in the subgroups, because they were not large enough, could not provide the degree of reliability the author would prefer. Therefore, the author is recommending another study that focuses primarily on the most effective means to accurately and fully record a constable's statement. This additional study is needed to more appropriately and empirically address this issue.

Acknowledgments

This study was funded by a grant from the Constables' Branch Board of the London Metropolitan Police Federation. The Force Science Institute and the Force Science Research Center at Minnesota State University, Mankato are very grateful for this funding and support.

Two individuals from the Constables' Branch Board need to be recognized for their special efforts in ensuring this project was funded and conducted. The first is Constable Dave Bennett, whose foresight and leadership were foundational in the conduct of this study. The second individual is Constable Dave Blocksidge. His initiative was responsible for the first contact between the Force Science Research Center and the Constables' Branch Board. He has continued to be an avid supporter of the research goals of FSRC and is responsible for a considerable portion of the project coordination that was required to conduct this study.

The study participants came from the firearms department of the London Metropolitan Police. Without their participation, the project could not have happened. The interviewers came from the Department of Professional Standards. Both of these groups gave generously of their time and professional talents, and we are grateful for their contributions. Recognition also needs to be expressed to Dr. Amina Memon from the University of Aberdeen, Aberdeen, Scotland. She provided a review of the cognitive interviewing process for all of the interviewers just prior to the interviews.

Patricia Thiem, the Chief Operating Officer from Force Science Institute deserves special mention for the coordination of the project, the sacrifices she made during the project, and the critical recommendations that she has provided to make this study as successful as it was. Dr. Alexis Artwhol also lent her considerable talent and acting ability to the study as well and deserves special mention for her dedication to this project and to the welfare of the line officer.

The work of Mr. Justin Dixon of the Metropolitan Police Physical Training Branch was invaluable in providing insight into the level of cardiac response and the implied "emotional arousal" experienced by the constables at the time of the incident and how that compared to the constables' overall fitness level.

Bibliography

- Baumeister, R. F. (1984). Choking under pressure: Self-consciousness and paradoxical performance effects of incentives on skillful performance. *Journal of Personality and Social Psychology*, 46, 610-620.
- Baumeister, R. F. (1985). The championship choke. *Psychology Today*, 4, 48-53.
- Cruise, T. (Producer), & Zwick, E. (Director). (2003). *The last samurai* [Motion Picture]. Burbank, CA: Warner Bros. Pictures.
- Damasio, A. R. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York: HarperCollins.
- Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review*, 66, 183-201.
- Ebbinghaus, H. (1885). *Memory: A contribution to experimental psychology*. New York: Columbia University Press.
- Garfield, C. A. (1984). *Peak performance: Mental training techniques of the world's greatest athletes*. Los Angeles: Warner Books.
- Gold, P. E., & Greenbough, W. T. (2001). *Memory consolidation: Essays in honor of James L. McGaugh*. Washington, DC: American Psychological Association.
- Gray, R. (2004). Attending to the execution of a complex sensorimotor skill: Expertise differences, choking and slumps. *Journal of Experimental Psychology: Applied*, 10(1), 42-54.
- Haber, R. N., & Haber, L. (2002). Why witnesses to accidents make mistakes: The cognitive psychology of human memory. In R. E. Dewar & P. L. Olson (Eds.), *Human factors in automobile accident reconstruction* (pp. 663-695). Tuscon, AZ: Lawyers and Judges Publishing Co.
- Hansen, C. H., & Hansen, R. D. (1988). Finding the face in the crowd: An anger superiority effect. *Journal of Personality and Social Psychology*, 54(6), 917-924.
- Heller, P. M. (Producer), & Clause, R. (Director). (1973). *Enter the dragon* [Motion Picture]. Burbank, CA: Warner Bros. Pictures.
- Just, M. A., Carpenter, P. A., Keller, T. A., Emery, L., Zajac, H., & Thulborn, K. R. (2001). Interdependence of non-overlapping cortical systems in dual cognitive tasks. *NeuroImage*, 14, 417-426.

- Kent, M. (1998). *The Oxford dictionary of sports science and medicine*. Oxford, UK: Oxford University Press.
- LeDoux, J. (2002). *Synaptic self: How our brains become who we are*. New York: Viking Penguin.
- McGaugh, J. L. (2003). *Memory and emotion*. New York: Columbia University Press.
- Meyerhoff, J. L., Norris, W., Saviolakis, G. A., Wollert, T., Burge, T., Atkins, T., et al. (2004). Evaluating performance of law enforcement personnel during a stressful training scenario. *Annals of the New York Academy of Sciences*, 1032, 250-253.
- Miller, G. A., Galanter, E., & Pribram, K. H. (1960). *Plans and the structure of behavior*. New York: Holt, Rinehart and Winston.
- Nideffer, R. M., & Sharpe, R. C. (1978). *Attention control training: How to get control of your mind through total concentration*. New York: Simon & Schuster.
- Niedenthal, P. M., & Kitayama, S. (1994). *The heart's eye*. San Diego: Academic Press.
- Ratti, O., & Westbrook, A. (1973). *Secrets of the samurai: A survey of the martial arts of feudal Japan*. London: Prentice Hall International.
- Weltman, G., Smith, J. E., & Edstrom G. H. (1971) Perceptual narrowing during simulated pressure-chamber exposure. *Human Factors*, 13(2), 99-107.
- Wulf, G. (2007). *Attention and motor skill learning*. Champaign, IL: Human Kinetics.

Addendum 1

A Study of Heart Rates in Metropolitan Police Firearms Officers in Relation to Scenario Training.

J. E. Dixon

1.0 Introduction

As part of an ongoing research remit directed by and generated by the Metropolitan Police Service (MPS) branch of the Police Federation, the Metropolitan Police Physical Education Branch (PEB) became involved in a defined study commissioned by the MPS Police Federation and undertaken by the appointed research director, Professor William Lewinski. The area of interest in the main study was the analysis of movement during a contrived dynamic scenario involving firearms—specifically, the discharge of a shotgun at the officers and the subsequent return of fire. This data would then be scrutinised and compared to the ability to recall the events by the officers involved (all officers were MPS-trained firearms officers) in a taped interview conducted after the scenario. The nature of the interview and the time at which it occurred post the scenario were changeable parameters. The PEB's role in the study was primarily to monitor and record heart rate telemetry from the officers as they progressed through the various dynamic and interview scenarios.

2.0 Methodology

The data collection phase of the study took place in late October and early November 2006 spread over several days. Several different MPS firearms Operational Command Units (OCUs) were involved, namely CO6 (Diplomatic Protection), CO18 (Aviation Security), and CO19 (Specialist Firearms). In addition to the three full-time firearms OCUs, officers from the TSG (Territorial Support Group) who were trained at a basic firearms level were also involved. These four OCUs yielded a total of 43 officers with useable heart rate traces (out of the 46 tested). Prior to the scenario taking place, officers signed a consent form and had their height and weight taken. They were then fitted with a specific heart rate belt (Polar team system, Polar, OI, Finland), which was able to log and record their heart rate response up to 12 hours. They then went through the scenario, underwent an interview, and then undertook the Metropolitan Police Fitness "Bleep" Test to determine their VO₂ maximal oxygen uptake utilising a portable pulmonary gas analyser (Metamax, Cortex, Leipzig, Germany). Once all heart rate related data was collected, it was collated and analysed specifically to look for a correlation between the maximum heart rate attained during the firearms scenario and the maximum heart rate attained during the interview process.

3.0 Results

All the results shown have been determined from the applied methodology as previously outlined.

Results show the descriptive measurements of all subjects, the differences in peak heart rates elicited between the variables of firing a shotgun and sitting in a memory retrieval interview, and the relation between heart rate responses during firing the shotgun and sitting the interview.

All the results shown are given as minimum, maximum, and mean (SD), following a test for normality of distribution. Statistical analysis was carried out using an F-test for variance followed by a *t*-test for two sample means. Pearson's correlation coefficient was used to ascertain correlation between heart rate for variables of firing the shotgun and the interview. The statistical results from the data analysis were used for discussion points and for drawing final conclusions. Statistical significance was given at $p < 0.05$.

3.1 Descriptive Statistics

The baseline descriptive statistics of all subjects are presented in Table 1.

Table 1. Showing the Baseline Descriptive Statistics of All Subjects

N	Age in Years			
	Minimum	Maximum	Mean	SD
43 Males and Females	26	51	38.3	6.6

Note: Forty-six constables were tested, but only 43 had usable heart rates.

3.2 Heart Rate Responses

The minimum, maximum, and mean (SD) and differences between means of the peak heart rate responses of all subjects during the firing of the shotgun and the interview are presented in Table 2.

Table 2. Showing the Minimum, Maximum, and Mean (SD) and Differences Between Means of the Peak Heart Rate Responses of All Subjects During the Firing of the Shotgun and the Interview

Variable	N	Min – bpm	Max – bpm	Mean – bpm	SD	F-test sig.	t-test sig. (2 tail)
Shotgun	43	96.0	182.0	141.7	16.5	0.076	0.000*
Interview	43	85.0	137.0	115.2	11.1		

Note: bpm = beat per minute

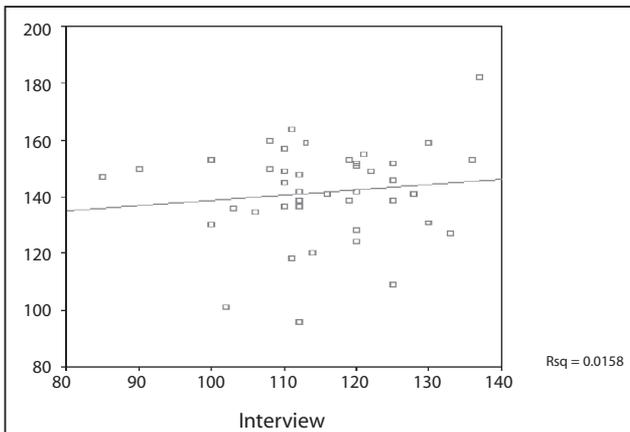
*Significant at the $p < 0.001$ level

The minimum, maximum, and mean of the peak heart rates elicited for the firing of the shotgun and during the interview were 96.0 versus 85.0 bpm; 182.0 versus 137.0 bpm; 141.7 (SD 16.5) versus 115.2 (SD 11.1), respectively. Heart rates elicited for the firing of the shotgun were higher than those recorded for the interview. An F-test for variance was 3.233 ($p = 0.076$), indicating equal variances between variables. A t-test on the means of the peak heart rate responses for the firing of the shotgun and the interview showed a highly significant difference ($p < 0.001$) between the two variables.

3.3 Relation Between Heart Rates

The relation between the mean peak heart rate responses for all subjects for the firing of the shotgun and for the interview are presented in Figure 1.

Figure 1. Mean Peak Heart Rate Responses



A Pearson's correlation coefficient between mean peak heart rates for the firing of the shotgun and during the interview was $r = 0.126$, which is significant at $p > 0.05$ ($p = 0.422$), indicating a poor relation between the two variables.

4.0 Discussion

During the scenario event, heart rate, by observation, was induced due to a psychological trigger(s) as there were no factors present or experienced that would have physiologically induced a higher heart rate. This may have had implications on officer action(s) and decisionmaking during the scenario. Research in firearms scenario training clearly shows a link between stress and performance (Meyerhoff et al., 2004). This would account for the elevated heart rate during the discharge of the shotgun within the scenario. Heart rate response during the interview process was also elevated but not as much as the heart rate response experienced during the training scenario. This response was due to a psychological reaction as no physical activity prior to the interview taking place was observed or recorded. The relationship between stress, anxiety, and physical performance is well-documented (Kent, 1998), and the poor relation between the two variables as seen in Figure 1 of this document is inconclusive.

5.0 Conclusion

Both the firearms training scenario and the interview were stress-inducing events in all participants. The higher heart rate during the discharge of the shotgun coupled with the analysis shows this to be the more demanding and stress inducing of the two events. The poor correlation between the two variables within this study is not conclusive proof of the lack of a link, and it is suggested that more research needs to be done in this area.

Addendum 2

The following tables are a more detailed analysis and representation of the average scores of all of the officers averaged across the three graders.

Combined Data

	Interview and Confered Totals	
	Narrow	Broad
Internal	704	253
External	2,298	1,320

Area 1: Internal Specific		Area 2: Internal Broad		Area 3: External Specific		Area 4: External Broad	
Mean	15.644	Mean	5.622	Mean	51.066	Mean	29.333
Standard Error	1.342	Standard Error	0.792	Standard Error	3.6	Standard Error	2.798
Median	15	Median	4	Median	51	Median	26
Mode	19	Mode	2	Mode	31	Mode	34
Standard Deviation	9.002	Standard Deviation	5.314	Standard Deviation	24.151	Standard Deviation	18.770
Sample Variance	81.052	Sample Variance	28.240	Sample Variance	583.290	Sample Variance	352.318
Kurtosis	0.236	Kurtosis	0.320	Kurtosis	0.003	Kurtosis	1.943
Skewness	0.789	Skewness	1.207	Skewness	0.062	Skewness	1.095
Range	37	Range	18	Range	110	Range	93
Minimum	1	Minimum	0	Minimum	2	Minimum	2
Maximum	38	Maximum	18	Maximum	112	Maximum	95
Sum	704	Sum	253	Sum	2,298	Sum	1,320
Count	45	Count	45	Count	45	Count	45
Confidence Level (95.0%)	2.704	Confidence Level (95.0%)	1.596	Confidence Level (95.0%)	7.255	Confidence Level (95.0%)	5.639

	Report and Confered Totals	
	Narrow	Broad
Internal	141	80
External	942	523

Area 1: Internal Specific		Area 2: Internal Broad		Area 3: External Specific		Area 4: External Broad	
Mean	3.357	Mean	1.904	Mean	22.428	Mean	12.452
Standard Error	0.434	Standard Error	0.198	Standard Error	1.640	Standard Error	0.688
Median	3	Median	1	Median	22.50	Median	11
Mode	1	Mode	1	Mode	14	Mode	11
Standard Deviation	2.818	Standard Deviation	1.284	Standard Deviation	10.629	Standard Deviation	4.462
Sample Variance	7.942	Sample Variance	1.649	Sample Variance	112.982	Sample Variance	19.912
Kurtosis	-0.150	Kurtosis	-0.125	Kurtosis	-0.284	Kurtosis	-0.057
Skewness	0.796	Skewness	0.983	Skewness	0.518	Skewness	0.660
Range	10	Range	5	Range	45	Range	19
Minimum	0	Minimum	0	Minimum	3	Minimum	4
Maximum	10	Maximum	5	Maximum	48	Maximum	23
Sum	141	Sum	80	Sum	942	Sum	523
Count	42	Count	42	Count	42	Count	42
Confidence Level (95.0%)	0.878	Confidence Level (95.0%)	0.400	Confidence Level (95.0%)	3.312	Confidence Level (95.0%)	1.390

Interview and Nonconferred Totals		
	Narrow	Broad
Internal	310	164
External	1,023	513

Area 1: Internal Specific		Area 2: Internal Broad		Area 3: External Specific		Area 4: External Broad	
Mean	17.222	Mean	9.111	Mean	56.833	Mean	28.500
Standard Error	2.225	Standard Error	1.791	Standard Error	6.060	Standard Error	3.907
Median	17.5	Median	7	Median	52.5	Median	23.5
Mode	19	Mode	1	Mode	58	Mode	10
Standard Deviation	9.440	Standard Deviation	7.599	Standard Deviation	25.711	Standard Deviation	16.578
Sample Variance	89.124	Sample Variance	57.751	Sample Variance	661.088	Sample Variance	274.852
Kurtosis	-0.416	Kurtosis	-0.546	Kurtosis	1.178	Kurtosis	-1.087
Skewness	0.202	Skewness	0.782	Skewness	1.041	Skewness	0.579
Range	34	Range	23	Range	99	Range	49
Minimum	2	Minimum	1	Minimum	22	Minimum	9
Maximum	36	Maximum	24	Maximum	121	Maximum	58
Sum	310	Sum	164	Sum	1,023	Sum	513
Count	18	Count	18	Count	18	Count	18
Confidence Level (95.0%)	4.694	Confidence Level (95.0%)	3.779	Confidence Level (95.0%)	12.786	Confidence Level (95.0%)	8.244

Report and Nonconferred Totals		
	Narrow	Broad
Internal	150	65
External	618	396

Area 1: Internal Specific		Area 2: Internal Broad		Area 3: External Specific		Area 4: External Broad	
Mean	4.545	Mean	1.970	Mean	18.727	Mean	12.000
Standard Error	0.620	Standard Error	0.215	Standard Error	1.516	Standard Error	1.173
Median	4	Median	2	Median	16	Median	12
Mode	4	Mode	1	Mode	16	Mode	12
Standard Deviation	3.562	Standard Deviation	1.237	Standard Deviation	8.712	Standard Deviation	6.741
Sample Variance	12.693	Sample Variance	1.530	Sample Variance	75.892	Sample Variance	45.438
Kurtosis	7.488	Kurtosis	-0.123	Kurtosis	0.672	Kurtosis	-0.112
Skewness	2.115	Skewness	0.693	Skewness	0.801	Skewness	0.555
Range	19	Range	5	Range	39	Range	26
Minimum	0	Minimum	0	Minimum	5	Minimum	1
Maximum	19	Maximum	5	Maximum	44	Maximum	27
Sum	150	Sum	65	Sum	618	Sum	396
Count	33	Count	33	Count	33	Count	33
Confidence Level (95.0%)	1.263	Confidence Level (95.0%)	0.438	Confidence Level (95.0%)	3.089	Confidence Level (95.0%)	2.390

Dr. William Lewinski is a professor in the Law Enforcement Program at Minnesota State University, Mankato. He is also the founder and director of the Force Science Research Center at MSUM. He has over 30 years of experience studying officer involved deadly force encounters.

Contact Information

William Lewinski
Force Science Institute
124 East Walnut Street, Suite 120
Mankato, Minnesota 56001
(507) 387-1290
E-mail: william.lewinski@forcescience.org