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Attention and Criminal Charge, Profile and Description: The Effect on Prospective Person Memory

Lindsey Nicole Sweeney
University of Arkansas, Fayetteville

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ATTENTION AND CRIMINAL CHARGE, PROFILE, AND DESCRIPTION: THE EFFECT ON PROSPECTIVE PERSON MEMORY
ATTENTION AND CRIMINAL CHARGE, PROFILE, AND DESCRIPTION: THE EFFECT ON PROSPECTIVE PERSON MEMORY

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Psychology

By

Lindsey Nicole Sweeney
University of South Carolina
Bachelor of Arts in Psychology, 2008
University of Arkansas
Master of Arts in Psychology, 2011

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University of Arkansas
ABSTRACT

Prospective person memory is the ability to recognize and react to a missing or wanted individual that one has been asked to be on the lookout for in the future. Prospective person memory relies on several processes including face recognition, event-based prospective memory, and attention. Only recently has research on the role of visual attention on prospective person memory been examined. In this dissertation, the gap between prospective person memory and attention is addressed. Although research on prospective person memory is steadily increasing, the research in this area is still in its infancy and the exact memory mechanisms that affect prospective person memory have yet to be uncovered. Two experiments examined how stereotypes affect automatic versus strategic processing by examining the effect of Attention (Experiment 1 & 2), crime stereotype (Experiments 1 & 2), criminal charge (Experiments 1 & 2) and criminal profile (Experiment 2) on prospective person memory. A significant amount of evidence was found for the idea that the more match there is between criminal elements the better prospective person memory is. Implications for these findings as well as future research are discussed.

Keywords: attention, crime, prospective person memory, wanted persons
This dissertation is approved for recommendation to the Graduate Council.

Dissertation Director:

Dr. James Lampinen

Dissertation Committee:

Dr. Ana Bridges

Dr. David Schroeder
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DEDICATION

I would like to dedicate this dissertation to my mother, Julie Choate, and my son, Dylan Sweeney. My mother has been as much of a friend to me as a mother and I love her more than anything. She has supported me throughout the dissertation process and encouraged me to be the best person I could be. I would not have been able to finish my dissertation without all the babysitting my mother did. I would also like to dedicate this dissertation to the most amazing person I know, my baby boy, Dylan. He has taught me what is truly important in life and I would not be where I am today without his love.
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Attention and Criminal Charge, Profile and Description:

The Effect on Prospective Person Memory

Prospective person memory refers to the ability to recognize and react to a missing or wanted individual that one has been asked to be on the lookout for (Lampinen, Arnal & Hicks, 2009). Prospective person memory relies on a number of component processes including face recognition, event-based prospective memory, and attention. Because prospective person memory involves visual recognition of a face in an unexpected location, visual attention is bound to be important. But only recently has research on the role of visual attention on prospective person memory been examined (Gier, Kreinger & Hudnell, 2011; Sweeney & Lampinen, 2012).

In this dissertation, I plan to bridge this gap by examining research on the role of visual attention in prospective person memory. To do this, I will start by addressing the practical reasons why these literatures should be looked at together. This will focus on the issues of missing and wanted individuals. Next, I will introduce the phenomenon of prospective person memory and describe in detail how it relates to the more general concept of prospective memory. I will then turn to some of the major factors known to influence visual attention, specifically those factors most likely to impact prospective person memory. I will also suggest some implications to build programs to find missing and wanted individuals based on my literature review. Finally, I have conducted two experiments further examining perspective person memory. More specifically, I will look at how stereotypes impact prospective person memory and the memory mechanisms that impact recognition. To investigate these memory mechanisms I will use the theories discussed in event-based prospective memory (e.g., Einstein & McDaniel, 1990; Smith, 2003) to talk about how stereotypes push around automatic vs. strategic processing.

Big Picture- Why it Matters
There are several reasons one might be on the lookout for an individual in the future. If a child goes missing it is important to be able to be on the lookout for that child. Likewise, adults go missing just as children do and it is important to be able to recognize missing adults if they are encountered. Additionally, when authorities are on the hunt for wanted fugitives they often rely on the general public to help recognize and locate those individuals. Furthermore, increasingly over the years it has become important to be on the lookout for terrorists and to be able to recognize wanted terrorists. All of these examples are cases in which one might need to remember an individual in the hopes of later recognizing them if encountered.

**Missing Persons**

**Missing Children.** Currently there are thousands of missing children world-wide (National Center for Missing and Exploited Children, 2011; Lampinen, Arnal, Culbertson-Faegre & Sweeney, 2010). Many missing child cases are resolved quickly; however, some cases go unsolved for an extended period of time (Finkelhor, Hammer & Sedlak, 2002; Hammer, Finkelhor & Sedlak, 2002; Lampinen et al., 2010; Sedlak, Finkelhor & Hammer, 2005). The U.S. Department of Justice funded a series of large scale studies that randomly sampled U.S. households and asked parents about cases where a child may have gone missing, even if they were only missing for a short amount of time (Finkelhor, Hotaling & Sedlak, 1990; Flores, 2002). The studies, known collectively as the National Incidence Studies of Missing, Abducted, Runaway, and Throwaway Children (NISMART), were conducted in two waves about 10 years apart. NISMART classified missing child cases into five distinct categories: (1) Runaways/throwaways, (2) Family Abductions, (3) Non-Family Abductions, (4) Missing: Involuntary, Lost, or Injured, (5) Missing for Benign Explanations (Flores, 2002).
Due to the fact that children go missing for several different reasons, it is important to understand the type of cases in which children go missing. The most common reason why children go missing is because they run away from home or are forced to leave their home (NISMA-2: Sedlak, Finkelhor, Hammer & Schultz, 2002). About 1.68 million U.S. youth are classified as runaways or throwaways each year (Hammer, Finkelhor & Sedlak, 2002a).

Although runaway incidents are sometimes marginalized, by treating them as cases of the ‘voluntarily missing’, studies suggest that runaway youths can be subject to a number of dangers including crime victimization, increased risk of drug and alcohol abuse, sexual predation, and human trafficking (Flores, 2002; Sadler, 1986). NISMA RT found that 71% of runaways could be classified as ‘endangered’ on the basis of these risk factors and others (Flores, 2002).

Another large category of missing child cases involve family abductions (Sedlak et al., 2002). Family abductions are most commonly abductions by parents in the context of custody disputes, although other family members may also, at times, abduct children. In 1999 there were 203,100 family abductions (Hammer et al., 2002b). Most family abductions are resolved rather quickly with the child’s safe return; however, about one in five cases take more than a month to be resolved. Physical violence and sexual predation are rare in family abductions, however, studies indicate that children who are abducted by family members can experience a range of harmful psychological consequences including emotional trauma, grief, and rage (Sadler, 1986) as well as bedwetting, difficulty sleeping, and clinging behavior (Schetky & Haller, 1983).

Abductions by non-family members can also occur (Finkelhor et al., 2002). Our archival study of the website of the National Center for Missing and Exploited Children (NCMEC) found that about 10% of all of the cases listed involved non-family abductions (Lampinen, Arnal, Culbertson-Faegre & Sweeney, 2010). It is important to note that non-family abductions are
commonly committed by acquaintances of the child or the family, with stranger abductions making up 1% of missing child cases reported to the police (Hammer et al., 2004). Approximately 58,200 non-family abductions were reported in 1999 according to the NISMART survey. Most non-family abductions last less than a day and occur in a context where abduction is not the main goal. Rather, non-family abductions typically occur in the furtherance of another crime such as rape, robbery, car theft, or various types of revenge plots. Only a small number of non-family abductions per year match the media portrayal of the stereotypical kidnapping. Stereotypical kidnappings are defined as abductions committed by a stranger who has taken the victim at least 50 miles away, where the perpetrator uses force or the threat of force, and where the perpetrator intends to kill the child, hold the child for ransom, or keep the child (Finkelhor, Hammer & Sedlak, 2002). Only about 100 of these cases occur in the United States each year (Asdigian, Finkelhor & Hotaling, 1995). Although rare, stereotypical kidnappings are extremely dangerous crimes that often result in the murder and/or long-term disappearance of the child (Brown & Keppel, 2007; Finkelhor et al., 2002).

The fourth type of missing child case involves children that go missing because they get lost or hurt. This group accounts for about 198,300 missing children (Sedlak et al., 2002). These disappearances are more likely to happen for boys (about 70% of cases), and often happen to children playing in wooded or isolated areas (Sedlak et al., 2005). About 65% of these cases involve children that are over the age of 12. Most of these cases are resolved rather quickly, with about 85% of the cases being resolved in less than six hours and 93% of cases being resolved in less than one day (Lampinen et al., 2010).

The last type of missing child case that accounts for 28% of all missing children are those that are missing for benign reasons, meaning they were reported missing but were in no real
danger (Sedlak et al., 2005). Of the 374,700 cases categorized as missing for benign reasons in 1999, 340,500 cases were reported to the authorities. Around 60% of these cases involve males. Most of these cases are resolved very quickly, with 85% being resolved within six hours and 95% being resolved in less than one day. Although these cases can be scary to parents, they typically represent misunderstandings or miscommunications in which the child is in no substantial danger.

When one considers the problem of missing children it is important to maintain a degree of perspective on the issue. It is widely reported that 800,000 children go missing every year, and that a child is reported missing every 42 seconds. This is true, but without considering the full context can be misleading (Lampinen et al., 2010). Most of these 800,000 missing child cases are resolved quickly, a substantial proportion involve simple misunderstandings between parents and children (i.e., missing for benign reasons), and very few involve the stereotypical abduction that pre-occupies the public’s perception of this issue. With that being said, it is important to recognize that there are thousands of active missing child cases in the United States at any given time. Figures suggest around 40,000 children are reported as currently missing in the NCIC database at anytime (NCIC, 2011), and several thousand cases are currently listed with the National Center for Missing and Exploited Children (NCMEC). Many of these cases involve long term and unresolved cases. Below I discuss some of the efforts that have been undertaken to help recover children who go missing.

Most programs designed to help find missing children rely, at least in part, on involving the public by releasing the child’s photograph and other information in the hopes that someone will see the child and contact the police (Pashley, Enhus & Leys, 2010). The success of this approach depends on the number of people that are exposed to the information, the probability
that those people will notice and attend to the picture of the missing child, the probability those individuals will actually encounter the child, the probability that after encountering the child they will recognize the child, and the probability that after recognizing the child they will contact the authorities (Lampinen et al., 2010; Lampinen, Peters & Gier, 2012). Such programs are quintessential examples of prospective person memory in action, as they require individuals to form the intention of reporting a sighting to authorities and then remembering that intention upon encountering the child.

Information about a missing child can be released to the public in several ways. For instance, images of missing children used to be commonly placed on milk cartons (Sadler, 1986). The Wal-Mart Corporation has been placing posters of missing children at the exits of their stores since 1996 (Wal-Mart, 2011). There are also searchable databases maintained by NCMEC in the United States and Child Focus in Europe that show pictures and give information about missing children (NCMEC, 2010; Missing Children Europe, 2011). NCMEC also conducts direct mail campaigns (Child Focus, 2011; Girouard, 1990; Office of Juvenile Justice and Delinquency Prevention, 2004). Another approach to finding missing children is that when a child goes missing in the United States and is considered to be in imminent danger, the U.S. authorities can issue an AMBER (America’s Missing: Broadcast Emergency Response) Alert to the local media (Gier, Kreiner & Hundell, 2011; NCMEC, 2010). AMBER Alerts allow information to be broadcasted to the public such as demographic information, when and where the child was last seen, and any other information that may be pertinent to the case. With the variety of efforts made to recover missing children, an important question to consider is how effective are these techniques and how can we make them more effective.
Some of the first research on prospective person memory was conducted in order to examine the effectiveness of missing children posters and was conducted in a supermarket where eight posters of missing children were displayed at exits (Lampinen et al., 2009b). The posters were displayed for a week before a survey about the posters was conducted.Exiting customers filled out a questionnaire about themselves and their children, if they had any. Participants were also asked how important they believed the issue of missing children was and how often they looked at posters of missing children. Although most participants indicating that they believed the issue of missing children was important, only 30% reported looking at posters of missing children.

Following the questionnaire, participants were shown eight pictures of children that were on the displayed posters and eight children that were not displayed, and asked to indicate whether the children were shown on the posters in the supermarket (Lampinen et al., 2009b). Despite the fact that participants were surveyed just after they had passed the missing child posters, recognition of the displayed children was at chance levels. Participants reported that although they believed the issue of missing children was important, they often did not look at the posters because they were in a hurry or thinking about other things (Lampinen, Arnal & Hicks, 2009b).

One study investigated whether changing the location of the missing children posters would affect recognition (Lampinen, Peters, Hicks & Arnal, unpublished manuscript). It was hypothesized that displaying the posters in the checkout lines at supermarkets, the point of purchase, would increase recognition, as people are more likely to pay attention to the posters when waiting to be checked out. As most people can attest to, when waiting to check out at a grocery store there is nothing better to do than look at the products and advertisements around
them. Accordingly, placing missing children poster at the point of purchase would likely result in more attention being paid to the posters. In fact, it was found that 65% of participants looked that the missing children posters when the posters were at the point of purchase, compared to 30% in the previous study.

**Missing Adults.** When members of the general public think about missing persons cases, they invariably think about missing children. Indeed, very few people seem to be aware of the equally large number of missing adult cases that occur every year. Although missing child cases are very important, family members of missing adults sometimes express outrage at the short shrift they feel their cases get from members of law enforcement and the news media (National Center for Missing Adults, 2012). The NCMEC, which was created by an act of Congress, has an annual budget of approximately $90 million. By comparison, the National Center for Missing Adults, which was also created by an act of Congress, has been unfunded for years (National Center for Missing Adults, 2012). Yet, the National Crime Information Center (NCIC, 2011) reports that at any given time there are about 85,000 active missing person cases and about 55% of those cases involve missing adults. It is important to understand the recovery efforts made to bring back missing children, but it is also important to devote some attention, and resources, to efforts geared towards bringing home missing adults and to bringing closure to families of individuals that have remained unidentified or unclaimed.

Much less is known about cases of missing adults than is known about cases of missing children. Many missing adult cases involve presumed foul play. Over a 20-year period the number of these cases has been estimated to be in the hundreds of thousands (Rittner, 2007). The suspicion of foul play in these cases is well founded. There are more than 40,000 unidentified remains in Coroner’s Offices around the United States that have gone through the
standard victim identification protocols (e.g., fingerprints, dental records, DNA, personal property) but have not yet been identified, leading Rittner (2007) to call the problem of unidentified remains the “nation’s silent mass disaster.” Part of the problem in these cases is developing unified national approaches to link up missing person’s reports with recovered bodies. Because a number of independent local, state and federal agencies are involved, coordinating information becomes problematic. A recent approach has been the development of the National Missing and Unidentified Persons System (NamUs). NamUs is a national center for missing persons and unidentified decedent records (National Institute of Justice, 2012). NamUs is an online, publically available system, which is made up of two portals. One portal allows law enforcement and members of missing person’s families to enter information about the person who is missing including case details, detail records, DNA profiles, fingerprints, information about distinguishing marks like tattoos, and so on into the database. The other portal allows Medical Examiners to enter information about the recovered body into the system. A number of search features allow the two sets of information to be linked up providing potential matches that can be followed up on. A majority of the records in the system can be viewed by anyone who registers, however, the information can only be updated by individuals given appropriate permission by a case manager. NamUs has already been used to solve a number of cold cases that had remained unsolved for years (National Institute of Justice, 2012).

In addition to going missing pursuant to a crime, adults sometimes go missing due to cognitive impairments. The best known example of this are cases where an elderly adult gets lost as a consequence of dementia. Dementia is a loss of brain function that happens with certain diseases and affects memory, thinking, language, judgment, and behavior (PubMed Heath, 2011). The most common form of dementia is Alzheimer’s disease. Alzheimer’s disease is an
illness where symptoms usually develop slowly and get worse over time, eventually becoming severe enough to interfere with daily tasks (Alzheimer’s Association, 2012a). Thousands of patients that are suffering from dementia wander away from safe environments each year, and in doing so risk serious injury or death (Koester & Stooksbury, 1995). This is a syndrome known as ‘wandering’ (Algase, Moore, Vandeweerd & Gavin-Dreschnack, 2007). The Alzheimer’s Association estimates that 60% of the 5.4 million people suffering from Alzheimer’s disease will become lost at some point during their illness (Alzheimer’s Association, 2012b). It is because of facts like these that it is crucial to understand the factors that affect recognition of missing persons and the effectiveness of campaigns designed to locate missing persons, such as those that have wandered off.

**Wanted Individuals**

**Wanted Fugitives.** Prospective person memory plays a role in recovering missing persons, but the concept was first discussed in the context of public efforts to find wanted fugitives (Lampinen et al., 2009a). In these cases, like in missing persons cases, a person’s picture may be released to the general public in the hopes that someone will observe the individual and contact authorities. With wanted individuals, however, the goal is to help capture the individual rather than recover the individual. In the 2010 fiscal year, the U.S. Marshals Service apprehended more than 36,100 federal fugitives, which resolved about 39,100 felony warrants (U.S. Marshals Service, 2012). In the same year the U.S. Marshals-led district task forces arrested 81,900 state and local fugitives, clearing about 108,200 state and local felony warrants (U.S. Marshals Service, 2012). Since 1950 there have been 496 fugitives on the Federal Bureau of Investigation’s “Top Ten Most Wanted Fugitives” list; 466 have been apprehended or located (Federal Bureau of Investigation, 2012a). This program relies heavily on
the assistance of the public, as demonstrated by the fact that 154 fugitives have been captured or located as a result of citizen cooperation (Federal Bureau of Investigation, 2012a).

There are other campaigns that bring wanted fugitives to justice and missing children home. The television show “America’s Most Wanted” is a reality television program that brings awareness to the issues of wanted fugitives and missing children. This program has helped law enforcement members to capture more than 1,100 wanted fugitives and bring home more than 50 missing children since the show started in 1988 (America’s Most Wanted, 2012). In all of these cases, pictures of wanted individuals are publicized with the hope either that someone already knows the person’s whereabouts (retrospective person memory) or that someone sees the individual and contacts law enforcement (prospective person memory).

**Terrorists.** Law enforcement agencies may also seek the help of the public in identifying high value terrorist targets. The Federal Bureau of Investigation has released a list of alleged terrorists that have been indicted by Federal Grand Juries for crimes of terror (Federal Bureau of Investigation, 2012b). Due to the serious nature of these crimes, it is important to be able to locate and recognize suspected terrorists as quickly and as accurately as possible.

Many people believe that the issues of missing persons, wanted fugitives, and terrorists are important issues. Many campaigns have been created and used to find missing persons and apprehend wanted fugitives and terrorists; however, these campaigns are not informed by empirical research. These campaigns have largely been designed based on intuition. Developing a scientific understanding of the factors that influence the effectiveness of these programs has only recently started.

**Prospective Person Memory**
Most of the campaigns used to try and locate missing persons, wanted fugitives, and terrorists involve the public by releasing the individual’s photograph to the public in the hopes that someone will see the individual and report it to the authorities (Pashley, Enhus & Leys, 2010). These campaigns rely on two forms of memory known as prospective person memory and retrospective person memory (Lampinen et al., 2009a; Lampinen, Miller & Dehon, 2011). Prospective person memory is when one sees an alert for a missing or wanted person (e.g., missing child poster, AMBER Alert, wanted poster) and later encounters that individual. These situations rely on facial processes, attentional resources, as well as event based prospective memory (see Lampinen et al., 2009a, 2009b; Lampinen et al., 2010, Lampinen, Arnal, Adams, Courtney & Hicks, 2011; Lampinen et al., 2011). On the other hand, retrospective person memory is when one encounters a person during their day-to-day activities and only later sees an alert stating that the individual is missing or wanted (Lampinen, Miller & Dehon, 2011).

Both avenues to identification are important (Lampinen, Peters & Gier, 2012). When law enforcement releases the picture of a to-be-identified individual, there is no way of knowing whether the individual who sees that photograph has already seen the individual or will later see the individual. Thus, maximizing the effectiveness of these programs requires maximizing both prospective and retrospective person memory. Arguably, recognizing people retrospectively has already received a great deal of scientific attention. There is, after all, a large scientific research literature on the topic of eyewitness identification (Lampinen, Neuschatz & Cling, 2012). Thus, the focus of the present review is on prospective person memory in particular.

The research on prospective and retrospective person memory is still in its infancy; however, this body of research is steadily growing. The earliest research on prospective person memory was meant to mimic searches for wanted fugitives (Lampinen et al., 2009). In one
study, five general psychology classes were shown pictures of two “wanted” men, where one of the males was the critical suspect that students would later have the opportunity to identify. Participants were informed that these men were not really wanted by the authorities but if they later encountered them and contacted their instructor they could win a portion of a cash prize. Half of the participants viewed pictures of the men when they were unshaven, and half of the participants viewed the men when they were clean-shaven. Participants were given four minutes to study the pictures. Two days later the critical suspect came to the students classrooms clean-shaven to deliver some papers to the instructor. The suspect faced the class, said “Good morning,” paused for a few seconds, then left. Only 5% of students that were present during both class periods contacted their instructor and correctly identified the suspect. Of the students that identified the suspect, 75% had seen a picture of him when he was clean-shaven. However, due to the fact that the identification rate was so low, a reliable comparison between the unshaven and clean-shaven conditions could not be made.

In the second study, participants from four general psychology courses viewed mock news broadcasts depicting two individuals wanted for bank robbery. Participants were informed that the individuals were not actually wanted by the police, but if they were to encounter the individuals at any time in the future and were to contact their instructor they could win a portion of a cash prize. Two days after viewing the mock news broadcast, the two wanted individuals held a cookie sale for the psychology club on the second floor of the psychology building. The classrooms for all of the general psychology classes were on the third floor of the building, so the students had to pass the cookie sale on their way out of the building. Of the students that were present in class on the day the mock news broadcast was viewed and the day the cookie sale occurred, only 4% of the students make a correct identification. To examine how attention
affected prospective person memory, half of the students were sent an e-mail about the cookie sale with a coupon to get two cookies for the price of one prior to the cookie sale. Students that received the e-mail about the cookie sale correctly identified the “fugitives” 6.67% of the time compared to 2.47% of the time for the control condition.

Field studies like these have also been conducted to examine prospective person memory for missing persons. As previously mentioned, it has been argued that the overuse of AMBER Alerts tends to dilute the system’s effectiveness because people start to tune out the alerts (i.e., the car alarm effect). One recent field study used the prospective person memory paradigm to provide some support for this idea. Lampinen, Erickson, Peters, Sweeney & Culbertson-Faegre (2012) showed mock missing person alerts to several different sections of a general psychology course during one semester. Each alert showed a college aged male and female and indicated that the individuals had recently gone missing. Students were told that the individuals were not actually missing but that they might be on campus at some point in the future and if the students were to contact their instructor they could win a portion of a cash prize. In about half of the classes students were shown one mock missing person alert each week for six weeks (six video condition). In this condition, each mock missing person alert contained a different individual, and there was no chance that the individuals from the first five weeks would be seen on campus. The other classes were shown one mock missing person alert during the sixth week of the study (one video condition). On the sixth week of the study, the two target individuals were positioned outside the students’ classrooms immediately after each class period to guarantee that the students would have to walk past one of them when leaving class. Students were more than seven times more likely to make an identification in the one video condition compared to the six video condition. These results suggest that issuing too many missing person alerts can result in
people paying less attention to the alerts. Even though it is not exactly clear how many alerts is too many, it is clear that AMBER Alerts and other types of missing person alerts should be limited to cases where the child or individual is in imminent danger and there is good reason to believe issuing an alert will be effective.

Another field experiment of prospective person memory was designed to simulate a Silver Alert (Lampinen, Sweeney, Erickson & Starr, in prep). Participants first engaged in an online survey that was purportedly about ‘attitudes towards the news media.’ Students watched three brief news segments that they were led to believe were actual local news stories being reported by a student run news station. In fact, the first two stories were actual local news stories, but the third story was a professional quality mock Silver Alert. After watching each news story, participants rated the stories on a number of dimensions including the quality of the news story, the importance of the story, and the emotional reaction to the story. After providing ratings for the mock Silver Alert, participants were told that the alert was not real, but was part of a contest where students could win up to $200. To win the money, participants were to email the experimenter if they spotted the ‘missing woman.’ Between one and six days later, the woman from the video was stationed outside the dining hall where the students indicated that they typically ate lunch. We later confirmed that 175 students had both seen the video and been at the dining hall at the same time as the target woman. Out of those 175 students, only three made a correct identification. Two other students made mistaken identifications. In a follow up survey, 23 students indicated that they saw someone who they thought might be the woman, but they decided not to report it because they were concerned they might be mistaken. In seven of these cases, the person seen, but not reported, by the students, really was the ‘missing woman.’ Thus, a major reason for low reporting rates in field prospective person memory experiments might be...
failure to report sightings because of a lack of confidence in the identification. However, even if all of these students had reported their sightings, the overall rate of identification would only have been 5.7%.

Field experiments of prospective person memory suggest that performance in naturalistic settings is often quite poor. However, these studies are difficult to conduct. They rely on dichotomous data, have very low baseline success rates, and require establishing both that the participant viewed the wanted or missing person alert and that they had an opportunity to view the target. Because of this, a number of laboratory paradigms have been designed to study prospective person memory as well.

As with the field experiments, the earliest of these studies were designed to examine the ability to recognize wanted individuals. In one laboratory study, participants were shown pictures of four individuals and asked to imagine that the individuals were wanted by the police. In one condition, participants were asked to imagine that the individuals were wanted for a serious felony (armed robbery). In the other condition, participants were asked to imagine the individuals were wanted for a relatively minor crime (unpaid parking tickets). A control group was also utilized where participants were not asked to be on the lookout for anyone. Across conditions participants were instructed to press the space bar right away if they saw the wanted individual.

Participants also engaged in two ongoing tasks, where the prospective memory targets were embedded in the second ongoing task. The first ongoing task consisted of participants viewing a slide show on a computer screen of a trip through the grocery store. Participants were given a list of items on a grocery list and asked to indicate whether the item was on the right or left side of the screen. For the second ongoing task, participants viewed a slide show of a person
walking around campus. As the participants continued though the campus walk they were to accomplish as series of goals (e.g., mail a letter, recycle a soda bottle). The ongoing task was to press a response key any time there was the opportunity to complete one of their tasks. Participants pressed the ‘z’ key if the opportunity to accomplish the task occurred on the left side of the computer screen, and they pressed the ‘/’ key if the opportunity occurred on the right side of the computer screen. Multiple people, including the four target missing fugitives, appeared on the slides throughout the second ongoing task.

It was found that those in the felony condition correctly identified only 26.61% of the “fugitives.” Those in the misdemeanor condition correctly identified 36.76% of the “fugitives.” There were no significant differences between conditions, and the results were in the opposite direction as predicted. Those in the control condition responded about 200 msec faster on the ongoing task than those in either of the prospective person memory conditions, which is consistent with the idea that prospective memory engages strategic processing.

Laboratory studies of prospective person memory have also examined recognition of missing persons. In one study, Lampinen, Miller and Dehon (2011) investigated the impact of age progressed images on prospective and retrospective person memory for missing children. In Experiment 1, prospective person memory was examined by taking photographs of volunteers and their biological relatives at ages 7 and 12 years old and having age progressions created based on these images. Participants viewed mock “missing child” posters including images of the targets at age 7 (outdated photograph condition), age 12 (current photograph condition), or an age progressed image created where the child looks to be 12 years old next to a picture of the target at age 7 (age progressed condition). Participants viewed one of the three poster types and were told they were taking part in a study meant to simulate a search for missing children.
Photographs of children who were about age 12 were viewed and participants sorted them into one of two teams to simulate encountering children during the course of day-to-day tasks. Participants were told that their task was to sort the children into teams of two, the ‘P’ team and the ‘Q’ team, by pressing the corresponding key on their keyboard. They were to create teams that had an equal number of boys and girls on each team. Participants were instructed that if they saw any of the “missing children” that they should press the ‘H’ key for help. Prospective person memory was best in the current photograph condition. Memory for the outdated and age progressed images did not differ significantly but in both cases was significantly better than chance. Similar results were obtained by Lampinen, Arnal, Adams, Courtney and Hicks (2011).

In order to investigate the retrospective component of the task, Lampinen, Miller and Dehon (2011) conducted a second experiment in which the order of the tasks was reversed. Participants first completed the team-sorting task, and then unexpectedly viewed the mock missing child posters. Six of the posters contained images of children shown during the team-sorting task and six were of gender-matched foils. Participants were asked whether they had encountered the child during the team-sorting task. Retrospective person memory was best in the current photograph condition. The age progressed condition did not significantly differ from the outdated photograph condition. Similar results were obtained when age progressions from an actual missing person case were used (Lampinen et al., 2011, Experiments 3 and 4).

Another study examined some factors that affect both prospective and retrospective person memory. Lampinen, Peters and Gier (2012) examined the effect of presenting a relatively small number of posters (i.e., four posters) with a relatively large number of posters (i.e., 12 posters) on prospective person memory. In the first experiment, mock missing child posters were patterned off of posters found on the NCMEC website using photographs from adult
volunteers from when they were between 11 and 12 years old. Four of the posters were target posters. Participants were randomly assigned to either the "four poster condition" where they viewed posters of the four target children, or the "12 poster condition" where they viewed the four target posters plus 8 non-target posters to expand the array size. Participants then engaged in a team-sorting task similar to Lampinen et al. (2011). Although total time per poster was about equal, no differences were found between conditions for prospective person memory accuracy.

Due to the fact that study time per poster was equated in Experiment 1, Lampinen, Peters and Gier (2012) conducted a second study to examine whether people were willing to devote a set amount of time to looking at missing child posters, regardless of how many children appear on the posters. In Experiment 2, total time for all posters across the two conditions were equated such that participants viewed each poster for three times longer in the four poster condition than in the 12 poster condition. The procedure was identical to Experiment 1 except participants were given a total of 60 seconds to learn the posters. The results suggested a decrease in prospective person memory accuracy in the 12-poster condition.

In order to examine the effect of array size in a free study condition, meant to be more analogous to an actual missing child campaign, Lampinen, Peters and Gier (2012) conducted a third study. Participants individually viewed a display board (similar to the boards often used to display actual missing child posters) containing either the four target posters used in the first two studies or the four target posters plus eight non-target posters. Participants were instructed to look at the posters like they would look at actual missing child posters and to tell the experimenter when they were done. The experimenter candidly timed how long each participant looked at each poster using a stopwatch and recorded the time to the nearest second. Participants were then led to a separate room where they completed the team sorting task as in Experiment 1.
and 2. Across conditions total looking time was almost identical. However, when total looking time was divided by the number of posters viewed it was found that the average study time was significantly greater in the four poster condition than in the 12 poster condition. Results showed a decrease in prospective person memory in the 12 poster condition compared to the 4 poster condition.

**Prospective Memory**

Prospective person memory is a special case of event based prospective memory. As such, an understanding of the factors that can affect these cases requires a more in depth understanding of prospective memory. *Prospective memory*, which refers to memory for an intention, has two components: a prospective and a retrospective component (Einstein & McDaniel, 1990; Einstein & McDaniel, 1996). The prospective component refers to remembering to do something in the future, whereas the retrospective component refers to remembering what has been done (Einstein & McDaniel, 1990; Einstein & McDaniel, 1996). There has been a lot of research on retrospective memory over the past few decades, but relatively less research on prospective memory. Recently, the body of literature on prospective memory has been gradually increasing with the intent to understand how exactly prospective memory occurs, how it affects day-to-day life, and how it can be improved.

**Types of Prospective Memory.** There are two main types of prospective memory: time based prospective memory and event based prospective memory. *Time based prospective memory* involves remembering to do something at a specific time or after a particular amount of time has passed (Aberle & Kliegel, 2010; Einstein, McDaniel, Richardson, Guynn & Cunfer, 1995). For example, you may need to remember to call your insurance company after 2:00 pm or check on the lasagna in the oven in 15 minutes. The other type of prospective memory is
In event based prospective memory, remembering to engage in a delayed intention is indicated by an event (Aberle & Kliegel, 2010). For example, you may need to remember to e-mail your co-worker the next time you have internet access or you may need to remember to deposit a check the next time you pass your bank. Most researchers believe that time based prospective memory is more taxing, because it requires an entirely self-initiated response. In event based prospective memory, on the other hand, cues in the environment potentially serve to remind one of the delayed intention.

**Event Based Prospective Memory.** The focus of this dissertation will be on event based prospective memory because prospective person memory is a form of event based prospective memory. Successful event based prospective memory depends on the retrieval of the memory and the execution of a delayed intention when a relevant cue is encountered (Dobbs & Reeves, 1996; Einstein & McDaniel, 1990). Research on event based prospective memory has typically been conducted using a series of laboratory based paradigms (e.g., Einstein & McDaniel, 1990; McDaniel & Einstein, 1993; McDaniel, Robinson-Riegler & Einstein, 1998). In a standard event based prospective memory study, participants are given at least one prospective memory cue (i.e., PM cue) that they are told to be on the lookout for during the study. For example, participants may be told to be on the lookout for the words *hat, elephant,* and *fork.* Participants are told that if they see these words they should make a certain response, such as hitting the ‘alt’ key or the ‘/’ key on their computer keyboard (i.e., PM response). Due to the fact that prospective memory takes place during everyday activities, laboratory based paradigms require participants to engage in an ongoing activity that requires attention. For example, participants may be asked to rate the pleasantness of several hundred words. During this rating period participants encounter PM cues. The main dependent variable is whether or not the participants
make the appropriate PM response (e.g., press the ‘alt’ or ‘/’ key). Doing so successfully requires that participants inhibit the ongoing task (e.g., rating pleasantness) and engage in the delayed intention. Throughout the course of a standard event based prospective memory study, participants often engage in filler tasks where the PM cues are never presented in order to decrease item-by-item monitoring. In fact, it is typically argued that without such intervening filler tasks, the task becomes a vigilance task, not a prospective memory task at all.

Some experimental examples of event based prospective memory include tasks like pressing a certain key on a computer keyboard every time the participant is presented with an animal word (Marsh, Hicks, Hancock & Munsayac, 2002). For example, in Experiment 1, Marsh et al. (2002) sought to obtain an objective measure of how often people remember having responded to something earlier and how often they forget. In the control condition (simple condition), participants were instructed to press the first key (the “/” key) when they saw an animal word during the cover task. However, if participants remembered responding to the exact word with the first keypress, they were told to press the repeat key (the “=” key). In a second condition, intended to make the prospective response more memorable (elaborated condition), participants said the animal aloud to the experimenter. To determine whether lag time between the first occurrence and its repetition might affect performance, two repeated targets occurred at a lag of 100 trials and two occurred at a lag of 200 trials. Participants were told they were taking place in a study investigating how people judge the pleasantness of certain concepts, and that they were to indicate the pleasantness of words using the number keys that corresponded with a 5-point Likert scale. Participants were also told that the experimenters were interested in people’s ability to remember to perform an action later. In general, the results suggested that when people make an event based prospective response they remember doing so, even though
some forgetting does occur. On the other hand, when participants missed a response they often believed that they had responded earlier to it when they actually had not. Thus, it appears that participants behaved as if they had performed an action earlier whether or not they had actually done so.

Several other techniques have also been used to investigate event based prospective memory. Another study looking at event based prospective memory required participants to tell the experimenter each time a specific task needed to be completed (e.g., picking up dry cleaning) in association with a current event (Rendell & Craik, 2000). Participants have also been given the task of circling target words that appear throughout the course of the experiment (Guynn, McDaniel & Einstein, 1998).

The parallels between the standard prospective memory task and the prospective person memory tasks described earlier should be pretty clear. First, in both prospective memory and prospective person memory tasks participants are given the task of remembering to engage in a behavior in the future. In traditional prospective memory tasks this could be something like remembering to mail a letter or to call a friend back. In prospective memory tasks this is remembering to be on the look out for an individual in the future. Second, in both types of tasks participants engage in at least one ongoing task, to make sure that some of their attention is being devoted to other areas besides simply remembering to engage in the future target behavior. Finally, in both types of tasks when participants encounter the item (e.g., an object or an individual) they must ignore the other things going on around them, recognize that they are supposed to act, and then remember to respond appropriately.

The body of research on event based prospective memory is steadily growing. Some research on event based prospective memory has investigated the effect of certain characteristics
of prospective memory cues, specifically prospective memory cue distinctiveness and level of association between the prospective memory cue and the intended action. Due to the fact that target cues might be especially distinct or have especially high salience in the real world, researchers have begun to investigate whether or not these factors have an impact on prospective memory. These factors have been investigated using meaningless target words (Einstein & McDaniel, 1990; McDaniel & Einstein, 1993), upper case presentation of target words and lower case other words (Brandimonte & Passolunghi, 1994; Einstein, McDaniel, Manzi, Cochran & Baker, 2000), and by increasing the prospective memory cue picture size (Uttl, 2005). Results from all of these studies demonstrated that greater salience of the prospective memory cue lead to greater prospective memory.

Role of Attention in Prospective Memory. As previously mentioned, various factors that affect prospective memory have been investigated recently, all of which extend our knowledge of how prospective memory works. The main debate in prospective memory literature is the role of attention, specifically: to what extent does one need ongoing attention to be successful at event based prospective memory? Some researchers argue that successful prospective memory always requires monitoring (e.g., Smith, 2003, Experiment 3; Smith & Bayen, 2004; Reese & Cherry, 2002; West & Craik, 2001). Some researchers have found that completing prospective memory tasks interferes with ongoing tasks, suggesting that some parts of working memory are being engaged in an ongoing monitoring task (Marsh, Hicks, Cook, Hansen & Pallos, 2003). Other researchers argue that there are some situations in which recognition of prospective memory targets occurs automatically (Einstein & McDaniel, 2005; McDaniel & Einstein, 2000). Researchers that argue that prospective memory is sometimes automatic, those that hold a multi-process view, believe that whether the prospective memory
task is completely automatically or strategically depends on how important the task is, how distinctive the prospective memory cue is, how stereotypical the prospective memory cue is, as well as the planning strategies and the characteristics of the participant (Lampinen, Arnal & Hicks, 2009a).

**Monitoring View of Prospective Memory.** Those researchers that believe prospective memories are retrieved due to continuous monitoring hold that individuals can be aware of their delayed intention until a prospective memory cue is presented. Once the prospective memory cue is presented then action will be taken. Smith (2003) proposed the preparatory attentional processes and memory processes (PAM) theoretical model, which suggests that individuals are constantly monitoring their environment for prospective memory cues. By monitoring in this model, Smith is talking about non-automatic monitoring of the environment for the occurrence of prospective memory target events. The PAM model assumes that continuous monitoring will use up some cognitive resources, leading to poorer performance on an ongoing task. The PAM model also assumes that continuous monitoring will use this capacity on non-prospective memory target trials. If continuous monitoring is to be effective it must occur both before and during the presentation of prospective memory targets. Smith (2003) found that working memory was highly positively related to prospective memory performance and that non-target trials were negatively affected by the prospective memory task. Since the original proposal of the PAM model, similar findings have supported the original findings by Smith (2003) (e.g., Marsh et al., 2003; Smith & Bayen, 2004, 2006).

Smith and Bayen (2004) proposed the first multinomial model of event-based prospective memory. The main task of this multinomial process tree (MPT) model was to separate prospective and retrospective memory used in the same task. This model is based on Smith’s
PAM theory. This model was designed to evaluate situations with an ongoing task that had two trial types and two possible responses. Thus, there were four types of trials presented to participants that they could either make a ‘Yes’ response or a ‘No’ response to, or they could make a PM response by pressing the ‘Z’ key on their keyboard. Therefore, there are 12 empirical probabilities that could be fit to their model. Therefore, joint probabilities can be used to derive formulas for the probability of making each of the three responses in each of the types of trials. The model has six free parameters that can then be estimated using multinomial modeling techniques. More simply put, monitoring is either happening or not happening. If monitoring is not occurring there is never prospective monitoring. If monitoring is occurring, we will sometimes notice the prospective memory target.

One source of evidence for the claim that prospective memory requires ongoing monitoring is the finding that a prospective memory search often imposes a cost on ongoing task activities (e.g., Marsh et al., 2003; Smith, 2003; Smith & Bayen, 2004). One well known study that has supported this monitoring process was conducted by Marsh et al. (2003). In the first experiment, half of the participants were given the task of being on the lookout for the word dog, and half the participants were told to be on the lookout for any animal word. Participants that were on the lookout for the word dog had significantly better prospective memory than those that were on the lookout for any animal word. Additionally, those that were just on the lookout for the word dog did not show an increase in reaction time to the ongoing task compared to the control group, whereas those looking for any animal word did show an increase in reaction time. The authors argue that this is due to the monitoring process that occurs when individuals are asked to be on the lookout for words in a category, but not for those on the lookout for specific words.
In a second experiment Marsh et al. (2003) had participants learn either four or eight prospective memory targets that were either semantically related or were unrelated targets. This created four study lists. Accuracy was greater for participants that studied related items than for those that studied unrelated items. Additionally, reaction times for the ongoing tasks were slower for those that studied unrelated items, especially when participants studied eight unrelated items compared to participants that studied four unrelated items. Furthermore, participants in the unrelated condition showed more interference in reaction times on the prospective memory trials.

In a third experiment, Marsh et al. (2003) presented participants with cue-target pairs. Participants were told to say the target word out loud when the cue word was presented. One group learned related cue-target pairs, a second group learned unrelated pairs, and a third group learned just the cue word and was instructed to reply with those cue words at test. A significant difference in accuracy was found overall, but pairwise comparisons showed no significant differences amongst groups. However, reaction times significantly slowed down for the ongoing trials for all three experimental conditions compared to the control condition, with no differences found again between the three prospective memory conditions. Furthermore, significant interference was found in all three prospective memory conditions with lower interference being found in the cue only condition compared to the cue target conditions.

In a fourth and final experiment, Marsh et al. (2003) again had participants say words out loud in response to prospective cues. Just like in Experiment 3, some participants were given common phrases for their cue-target pairs (e.g., dog-food, photo-album) and other participants were given the same words in different pairs (e.g., dog-album). A third group was told to respond by saying “now” whenever they saw a cue. A fourth group was told to respond with the first associate that they thought of for the presented cue. Participants that responded with the
first associate word they thought of showed significantly more interference than participants in the “now” condition. Additionally, participants that were given the common phrase word pairs showed significantly less interference than those that were given the different cue-target pairs. These four experiments support the findings of Smith (2003) and suggest that prospective memory is heavily dependent on a monitoring task.

Further support for the idea that prospective memory requires ongoing attention can be found in research that speaks to how expectations guide attention (Cohen-Servi, Meiran & Kessler, 2006). Participants were presented with word triplets (e.g., shoe-drum-love) and asked to rate the concreteness of the middle word. This was repeated for 15 blocks with each block being made up of 18 trials. In addition to the rating task, participants were instructed to hit a yellow key if they saw the word cup (which appeared at some point in every block). Twelve times the word cup appeared in the middle position and three times it appeared on either the right or left side. Prospective memory was found to be much better when cup appeared in the middle position. This finding is likely due to two things. First, given the ongoing task, only the middle word is really relevant because you rate the concreteness of the middle word not the other words. Second, because the prospective memory task usually occurred in the middle position, across trials one is likely to develop an expectation that the prospective memory target will occur in the middle. Therefore, it appears that people’s expectations guide their attention and thus have an impact on prospective memory.

**Multiprocess View of Prospective Memory.** In opposition to the monitoring process viewpoint, some researchers claim that some prospective memories are retrieved reflexively, without the need for focal attention (e.g., Einstein & McDaniel, 1990; Guynn et al., 1998). It has been argued that cues will interact with prospective memory traces, and if this interaction
reaches a threshold then prospective remembering will automatically occur, which will lead to completion of the delayed intention (Guynn et al., 1998).

Combining parts of both the automatic and monitoring processes, McDaniel and Einstein (2000) proposed a multiprocess view of prospective memory. These authors argue that both characteristics of the task and of the individual will determine how automatic the process of prospective memory is. McDaniel and Einstein’s (2000) multiprocess view assumes that both monitoring and automatic processes can result in prospective remembering. This view also assumes that characteristics of the prospective task, the ongoing task, and the individuals determine which process will be used and how efficient that process will be. Finally, the multiprocess view assumes that there is a bias toward the automatic retrieval processes.

Spontaneous retrieval may be supported by a variety of processes. For example, how strongly a cue is associated with an intended action during planning may affect whether processing the cue will reflexively trigger the retrieval of the associated intention (i.e., the reflexive-association hypothesis; McDaniel, Guynn, Einstein & Breneiser, 2004). There is evidence of non-significant cost (e.g., Cohen et al., 2008; Einstein et al., 2005), and other research demonstrating lower cost being accompanied by higher prospective memory performance (McNerney & West, 2007), which suggests that monitoring may not always be required for prospective memory to be successful. McDaniel and Einstein (2000) argue that prospective remembering is sometimes spontaneously drawn out by features of the target cue even though no resources are being devoted to the prospective memory intention at the exact time the target occurs. This is in addition to the fact that monitoring is taking place, which is a resource-demanding process.
Other research has investigated the discrepancy processes in prospective memory retrieval (Breneriser & McDaniel, 2006). Participants studied prospective memory targets one time and studied non-targets five times, so that during the prospective memory test the non-targets resulted in more familiarity than the targets. It was found that having participants study the non-targets multiple times actually made it easier for them to notice the targets in the prospective memory task. The basic idea is that one notices prospective memory targets because they produce feelings of discrepancy with the non-target items, they stand out as different from the non-target items (Whittlesea & Williams, 2001a, 2001b). This typically occurs because the target has been studied, which produces a feeling of familiarity that the non-targets do not produce. However, it is not the familiarity per se that is relevant, it is the discrepancy between the targets and the non-targets.

West, Krompinger and Bowry (2005) used an n-back ongoing task to examine reaction times on three trials that preceded focal and non-focal prospective memory hits and prospective memory misses. It was found that ongoing task reaction times were slower on the trials that came before focal (Experiment 1) and non-focal (Experiment 2) prospective memory hits than on trials that came before prospective memory misses. This suggests that monitoring processes support prospective remembering. However, another study that examined focal prospective memory was conducted by Loft and Yeo (2007). These authors manipulated how strongly associated focal prospective memory cues and the intended action were. Lexical decision reactions times on three trials that preceded prospective memory hits and misses were then examined. A significant difference was found in Experiment 2 and Experiment 3 between the ongoing response time on trials that came before focal prospective memory hits versus trials that came before focal prospective memory misses when prospective memory target cue and action
were minimally associated. However, when the prospective memory target cue and action were highly associated, no significant differences in reaction time were found between prospective memory hits and prospective memory misses. These findings suggest that monitoring may not always be necessary for prospective memory to be successful.

Focal versus Non-Focal Tasks in Prospective Memory. Researchers have found that when the ongoing task emphasizes the same level of processing as the prospective memory task, prospective memory is more successful and costs to the ongoing task are more limited (Einstein & McDaniel, 2008). Such tasks are called focal tasks. For instance, imagine that participants are told to press the ‘q’ key any time they see a word referring to an animal. They then complete a lexical decision task as the ongoing task where they have to indicate for every item whether it is a word or a non-word. Every 25 words or so they see a word referring to an animal (e.g., tiger). In this example the prospective memory task (look for animal words) and the lexical decision task (is this a word) both require processing the semantic content of the word. The multi-store model predicts that these tasks should be easy because both tasks focus on the same aspect of the word. However, if the ongoing task is a structural task (indicate how many vowels are in the word) the two tasks are not focused on the same aspect of the word. Such tasks are called non-focal prospective memory tasks, and produce lower performance and more interference (see Einstein & McDaniel, 2005, for additional examples of focal and non-focal tasks).

According to the multiprocess view of prospective memory (McDaniel & Einstein, 2000) monitoring should be a requirement for prospective remembering with non-focal cues but not with focal cues. Scullin, McDaniel and Einstein (2010) investigated this hypothesis by varying monitoring. In Experiment 1, participants completed two blocks of trials: one that contained a prospective memory task and one that did not contain a prospective memory task. A lexical
decision task was then completed along with a digit-monitoring task to divide attention. Participants were instructed to press the ‘Q’ key on their keyboard if they saw a target word (i.e., *water* in one condition and *animal* in the counterbalanced condition). Four semantic associates were presented either very close to the prospective memory target or very far from the prospective memory target. No significant differences were found in lexical decision reaction times between blocks (i.e., between completing the prospective memory task or not). Presenting semantic lures temporarily increased monitoring. Increased evidence of monitoring was found on the target trial in the proximal lure condition; however, an increase in prospective memory was not found.

In a second experiment, Scullin et al. (2010) examined the effect of focal and non-focal cues on prospective memory. Again, a lexical decision task was used where the focal cue was *tortoise* and the non-focal cue was *tor*. In order to use some attentional resources, participants engaged in a concurrent digit-monitoring task. To cue monitoring, participants were presented with a different color background (e.g., red) and were told that that prospective memory targets would sometimes follow this screen. Participants that were not to be cued were still shown the screen but were told nothing about what the screen meant. The idea behind cuing the participants or not cuing them was that cuing should help participants in the non-focal prospective memory task but not participants in the focal prospective memory task. It was found that the lexical decision reaction times were slower in the non-focal prospective memory tasks compared to the control. No differences were found in lexical decision reaction times between the focal prospective memory task and the control. Based on only the five trials right before the prospective memory targets, a cost for the cued non-focal task was found but no cost was found in the other conditions. These findings support the multiprocess view of prospective memory.
Focal versus Non-Focal Tasks in Prospective Person Memory. In prospective person memory, the delayed intention involves contacting the authorities if one encounters a missing or wanted individual during the course of their day. Prospective person memory tasks may also be either focal or non-focal tasks like Einstein et al. (2005). For example, the prospective person memory paradigms that use the team-sorting task would be considered focal tasks (e.g., Lampinen, Arnal, Adams, Courtney & Hicks, 2001; Lampinen, Miller & Dehon, 2011; Lampinen, Peters & Gier, 2012; Sweeney & Lampinen, 2012). Peters, Lampinen, Sweeney & Erickson (in prep) investigated prospective person memory using a non-focal task where participants were shown mock wanted posters of two individuals. They were told that if they saw those individuals at any point during the experiment they should press the ‘H’ key. Participants were then shown slides of a person walking through a grocery store. The two wanted individuals appeared in different locations in the grocery store. One third of the participants were told that their only task was to find the wanted individuals. Two thirds were told that in addition to finding the wanted individuals, they should also press a particular key if they saw any items from their shopping list. For half of these individuals some of the shopping list items were in the same aisle as the wanted individuals, for the other half, none of the shopping list items were in the same aisle as the wanted individual. Initial findings showed that the same aisle condition produced dramatic impairments in prospective person memory, but that the different aisle and control task did not significantly differ from each other.

Status of the Debate on the Role of Attention in Prospective Memory. Both the monitoring and the multi-process views claim that attentional resources can sometimes impact the successful completion of a delayed intention. Thus, it is not surprising that researchers have found evidence for ongoing monitoring in some prospective memory tasks (Cohen-Servi et al.,
2006; Marsh et al., 2003; Smith, 2003; Smith & Bayen, 2004, 2006). However, there is also good evidence supporting the multiprocess view of prospective memory suggesting that monitoring is not always a requirement for successful prospective memory (Breneiser & McDaniel, 2006; Cohen et al., 2008; Einstein et al., 2005; Einstein & McDaniel, 1990; Einstein & McDaniel, 2008; Guynn et al., 1998; Loft & Yeo, 2007; McDaniel & Einstein, 2000; McDaniel et al., 2004; McNerney & West, 2007; Scullin et al., 2010). Both the monitoring and multiprocess view of prospective memory state that attention is necessary for successful prospective memory at least some of the time. Due to the fact that there are several solid examples of spontaneous retrieval in prospective memory, it seems most appropriate to adhere to the multiprocess view of prospective memory. Regardless of which view is correct, it is clear that attention is important in prospective memory as well as in prospective person memory.

**Role of Attention in Prospective Person Memory**

Prospective person memory is a special case of event based prospective memory (Lampinen et al., 2009; Lampinen, Peters & Gier, 2012; Sweeney & Lampinen, 2012). As can be seen from a description of the paradigms used to study prospective person memory, this statement is certainly true. But there are both interesting and less interesting interpretations of it. According to one interpretation, the less interesting interpretation, prospective person memory is just like all other event based prospective memory paradigms, and thus the general principles that guide prospective person memory are exactly those that guide prospective memory in general. According to the other interpretation, the more interesting interpretation, prospective person memory is a *special* case of event based prospective memory, with properties that are unique to it, and different from the prototypical prospective memory experiment.
There are at least three major characteristics that make prospective person memory unique among prospective memory paradigms in general. The first is that prospective person memory deals with faces, and indeed, face perception is special (McGugin & Gauthier, 2010). This is true in a number of ways. We know for instance, that the perception of faces is guided by configural processes much more than the recognition of other kinds of stimuli (Maurer, Le Grand & Mondloch, 2002). Faces have a great deal of social significance making them stimuli that are differentially processed compared to other stimuli (Ruckmick, 1936). There is etiquette about faces (i.e., “It is not polite to stare”). And faces are never the same from one viewing to the next. That is people’s faces are dynamic, requiring us to acquire and use viewpoint independent representations in order to recognize them (Biederman & Gerhardstein, 1993, 1995; Johnston & Hayes, 2000; Marr & Nishihara, 1978). This is quite different from the usual prospective memory experiment in which the stimuli are words, the words are lacking in social significance, looking at the words is expected by the nature of the task, and the words either clearly are, or clearly are not the words you were asked to look for. Thus, by virtue of being about faces, prospective person memory raises a number of issues that are not raised by the prototypical prospective memory experiment.

A second way in which prospective person memory is unique is the specific demands it puts on the attentional resources of the person doing the looking. As noted earlier, it is widely agreed that event based prospective memory requires attentional resources, at least some of the time. However, the type of attention required in the standard laboratory based prospective memory task is very constrained. Typically, participants view individual words, presented serially, and are making judgments about those words. On rare occasion, a target is presented, and participants are required to notice that it is a target and take the appropriate actions. These
paradigms, thus involve a task-switching component, which is known to be a major function of the central executive component of working memory (e.g., Vandierendonck, 2000). Prospective person memory requires the noticing and task switching components of traditional event based prospective memory tasks, but also requires that the allocation of attention be spatially and temporally distributed, with potentially many stimuli of the same class (i.e., faces) competing for attention. Thus, prospective person memory is likely to be especially taxing on the visual attention system. This challenge is magnified in field experiments, where the time span in which the target may be seen is unbounded, which is perhaps why performance is typically so poor.

Because visual attention plays such an important role in prospective person memory, an understanding of the mechanisms involved in visual attention is especially important. Visual attention has been divided into four main subprocesses: Orienting, Filtering, Searching and Preparing (Coren, Ward & Enns, 2004). Orienting involves having your attention drawn to a particular stimulus, like when you hear a loud noise or someone says your name. Filtering involves ignoring stimuli that are not relevant to your currently active goals, such as when the television is on when one is trying to write their dissertation. Searching involves looking for a particular stimulus in a group of stimuli, such as looking for Waldo in the Where’s Waldo game. Finally, preparing involves maintaining attention in anticipation of a stimulus that is not currently in the environment, but which you expect to be in the environment shortly.

Each of these subprocesses is likely to play a role in prospective person memory. For example, imagine a 10-year-old girl named Janie is kidnapped. If you were to be walking down a busy street filled with kids and their parents during the time of the kidnapping and heard little Janie scream, “help, you’re not my daddy,” you would be experiencing the orienting component of attention. Hearing little Janie’s scream has drawn your attention to her kidnapping. Because
there are so many families on the street you would have to engage in filtering whereby you ignore the irrelevant screams and conversations of the other families because they are not relevant to your new goal of helping Janie. You would then need to begin the process of searching by looking for the distraught Janie amongst all of the children screaming and talking back to their parents. Finally, you would need to begin preparing by maintaining your attention in anticipating of seeing Janie.

**Orienting.** Orienting is important because it deals with how something in the environment captures your attention, which is what we hope happens in cases of prospective person memory. There are several factors that cause attention to be captured by a stimulus.

**Attentional Capture.** Attentional capture is the involuntary tendency of something unusual in our visual field to attract our attention (Egeth & Yantis, 1997). In one study on attentional capture Egeth and Yantis had participants determine which of two target shapes was in a display as quickly as possible. The target shape was a rectangle that was a little bit taller or a little bit wider than the other shapes (squares) in the display. It should be noted that there was one other feature of the display that was hard to ignore. One of the squares was black instead of gray like all the other squares. An obvious color difference like this is likely to pull one’s attention toward it. The test was set up in a way that the black color coincided with the target rectangle only by chance, something participants knew, so they tried hard to ignore the black color patch (something that is not very easily done). It was found that search times were much faster when the target rectangle was also black than when it is gray. When a non-target square was black, making the target rectangle gray, search for the target was much slower than when there was no black square in the display. Therefore, the influence of the task-irrelevant black color patch was obviously an indicator of its ability to capture attention. Attentional capture is
important for prospective person memory because people’s attention may be drawn to the individual they are to be on the lookout for or to objects in their everyday environments (e.g., products at a grocery store).

**Covert and Overt Orienting.** Research on orienting makes a differentiation between shifts in attention that involve eye movements (overt orienting) and those that do not involve eye movement (covert orienting) (Hunt & Kingstone, 2003b). Some research suggests that reflexive shifts in overt and covert attention can be dissociated, as can voluntary shifts in overt and covert attention (Hunt & Kingstone, 2003b). Although shifts in attention do not necessarily need an overt shift of the eyes, spatial attention and the eyes often move through the environment together (Posner, 1980). For example, a quick movement in the visual periphery can reflexively “capture” both attention (Yantis & Jonides, 1984) and the eyes (Theeuwes, Kramer, Hahn & Irwin, 1998). Some research has suggested that both the eyes and attention are drawn toward a salient external stimulus because the two forms of orienting (covert and overt) are linked by a common neural architecture (Grosbach & Paus, 2002; Hoffman, 1995; Moore & Fallah, 2001; Perry & Zeki, 2000; Rizzolatti, Riggio, Dascola & Umilta, 1987). Other researchers suggest that the eyes and attention are drawn to an external stimulus because they are independent and each is activated by an abrupt onset (Hunt & Kingstone, 2003a). For example, one study demonstrated a double dissociation between eye movements and covert attention in regards to the reflexive effects of abrupt onsets, which supports the idea that the two forms of orienting are independent (Hunt & Kingstone, 2003a).

More recently, Hunt and Kingstone (2003b) investigated whether a similar separation occurs when covert and overt orienting are activated voluntarily, meaning in response to the internal goals and expectations of an individual. It is important to investigate how the effects of
volitional attention and reflexive attention differ because in contrast with reflexive attention, volitional orienting happens more slowly (Müller & Rabbitt, 1989), is more vulnerable to inhibition (Cheal & Lyon, 1991), may involve differences in the representation of space (Reuter-Lorenz & Fendrich, 1992), and is sensitive to dual task demands (Jonides, 1981).

Hunt and Kingstone (2003b) tested two groups of participants. The primary task for the first group (Eye Movement Group) was to prepare an eye movement to one of two peripheral locations. The eye movement response was signaled on most trials, although sometimes the eye movement to the other location was signaled or a visual probe appeared briefly at one of the two locations. Participants indicated on a keyboard whether the probe was a vertical or horizontal line. The primary task for the second group (Keypress Group) was to attend covertly to one of two peripheral locations and respond on the keyboard to whether the target was vertical or horizontal. Most of the time the target appeared at the attended location, although sometimes it appears at the other location or a speeded eye movement to one of the two locations was signaled. Results suggest that volitional attention and eye movements are independent. The eye movement group showed that preparing to move one’s eyes to a certain location does in fact lead to covert attention being sent to that location. Similarly, the keypress group demonstrated that allocation of covert attention to a certain location does not result in the eyes preparing to move to that location. These results are similar to previous findings on the matter (Jonides, 1981, Klein, 1980).

When looked at together, the results from Hunt and Kingstone (2003a) and (2003b) suggest that attention and eye movements are independent whether they are activated reflexively or volitionally. These findings support the theories of attention that are based on the assumption that bottom-up (reflexive) or top-down (volitional) processes have the same cognitive and neural
architectures that underlie attention and eye movements (Hopfinger & Mangun, 1998; Hopfinger, Buonocore & Mangun, 2000). What this really means is that even though bottom-up and top-down control differ, they use and control the same independent covert and overt attentional systems.

**Filtering.** Normally the ability to filter out irrelevant stimuli is adaptive. However, we sometimes have more than one goal at a time. In that situation, activation of one goal may cause you to filter out stimuli that are relevant to another goal that is not currently the focus of attention. In the case of prospective person memory, you may have a goal of finding a wanted person, but that goal is assigned low priority because you do not think it is likely you will encounter the person. While out shopping, you may have in the focus of attention items on your shopping list: carrots, apples, Cheetos, chocolate pudding, and dog biscuits. In order to attend to the task of finding the items on your shopping list, you may filter out faces of other shoppers, since those faces are not relevant to your currently active goal. If one of the people in the store is the wanted person you were looking for, you are likely to miss that person. A number of different paradigms have been developed to examine the filtering aspect of attention.

**The Cocktail Party Phenomenon.** A great example of a situation that requires filtering is a loud party. Imagine being at a crowded and loud party talking to a neighbor about their garden. You then notice that a colleague walks in and you covertly orient toward their conversation about a new project you are up for. Meanwhile you are still nodding and saying things like “uh huh” to your neighbor about their garden. Suddenly your neighbor rolls their eyes at you and walks away, clearly annoyed that you have not been paying attention to them. You have no idea what your neighbor was saying but you can list word for word what your colleague was saying in the conversation you were covertly listening to. What has happened is that you have
demonstrated the cocktail party phenomenon (Coren et al., 2004), you have effectively filtered out everything but the conversation you were listening to with the colleague, including the apparent conversation you were actually having with your neighbor.

Colin Cherry (1953) investigated some of the problems exemplified in the type of behavior described with the cocktail party phenomenon. Cherry introduced an experimental technique known as shadowing in order to control how participants oriented their auditory attention. Using the shadowing technique, participants are presented with two different channels of information. For example, participants may receive information one message to each ear (known as dichotic listening, Cherry, 1953). The participant must then repeat aloud, that is “shadow,” one of the messages as it is presented. It was found that participants could orient to one message and filter out the other. The difficulty in shadowing depends on what exactly the message is. For example, shadowing prose, like the selection of a story, is fairly easy, whereas, shadowing random word lists is more difficult (Coren et al., 2004). Shadowing is also easier if the messages come from two different places in space, are in a different pitch, or are presented at different speeds (Coren et al., 2004).

So what happens to the information that we do not attend to, the information that we “filter out”? Cherry (1953) found that participants could not remember much of the information that was filtered out in a shadowing task. Even if participants know that they will be asked about both messages, in a difficult shadowing task participants were unable to remember words that had be repeatedly presented (Moray, 1959). This result could be due to listeners not hearing the unshadowed message or due to the shadowed message somehow interfering with the memory of the unshadowed message. Cherry (1953) and Moray (1959) both waited a while after the shadowing task to ask about the unshadowed message. It could be that the unshadowed message
was heard but did not get transferred to long-term memory. It may be that we need to pay attention to a message for a certain amount of time for it to get transferred to long-term memory.

The idea that we may need to pay attention to a message for a certain amount of time in order to transfer it to long term memory was tested by interrupting the listener’s shadowing and asking them what had just been presented to the unshadowed ear (Norman, 1969). Participants recalled between five and seven words, numbers, or whatever piece of information was being shadowed. This finding suggests that information in the unshadowed channel did not reach short-term memory.

Other research on this phenomenon has added a method to detect momentary shifts of attention to the unshadowed ear. Wood and Cowan (1995a) found that people could remember information from the unshadowed channel only if they shifted attention to that channel during the presentation of the message. Even a stimulus as personally relevant as their own name only made 34% of participants detect that information in the unshadowed ear (Wood and Cowan, 1995b). The only people that actually recalled hearing their own name made attentional shifts to the unshadowed channel right after their name was spoken (and they recalled an average of two words after their name). Therefore, it appears that information in the unshadowed channel is available, at least for a little while, but unless the information is attended to it will not be sent to long-term memory.

**The Video Overlap Phenomenon.** The auditory shadowing task described above has also been demonstrated using visual filtering. Neisser and Becklan (1975) overlapped video programs, one where actors were engaging in a hand game and the other where actors were engaging in a ball game. The resulting video looked similar to a poorly tuned television where one program bleeds into the other. In the hand game, actors tried to slap each other’s hands, and
participants that “shadowed” this game were instructed to count the number of slaps but ignore the feints. In the ball game, actors passed a basketball to each other while moving around, and participants that “shadowed” this game were instructed to count the basketball passes but ignore the fakes and dribbles. Additionally, “odd” events sometimes occurred during the video (e.g., in the hand game players shook hands then continued, or in the ball game the ball was thrown out of the picture and the actors played with a fake ball for a while before resuming with the real ball).

Just like in the auditory shadowing experiments, participants could easily follow one program and they even had little difficulty following one program when it was superimposed on the other (although there were more errors in this condition) (Neisser & Becklin, 1975). Additionally, the odd events in the shadowed programs were almost always recognized, whereas odd events in the unshadowed programs were almost never recognized. For example, no participants noticed the ball disappear in the ball game when they were shadowing the hand game. Some participants reported that something was “off” about the videos, but their answers were often vague or uncertain. These results suggest that just like auditory filtering, visual filtering does not allow much of the filtered information to remain in memory. These results have been replicated in a variety of different situations (e.g., Rock & Guttman, 1981). More recent research has gone on to demonstrate the importance of attention in noticing events in a visual scene.

*Inattentional Blindness.* Inattentional blindness is an error in perception that results from lack of attention to an object (Chabris & Simons, 2010). Inattentional blindness is really more than just lack of attention to an object, but rather a failure to perceive a specific target object while one’s attention is focused on a more salient primary task. This is extremely important with
prospective person memory because you are going about your normal business, which requires your attention, and are expected to notice the target person.

In a typical inattentioanal blindness task, participants view a cross that appears on a computer screen for 200 milliseconds and then is replaced by a patterned mask. Participants are asked whether the horizontal or vertical arm of the cross was longer. On the critical trial an unexpected object appears in addition to the cross. The dependent measure is whether or not participants retrospectively report having seen the unexpected object. Depending on the exact study, between 25% (when the cross was presented at fixation and the unexpected object was presented parafoveally) and 75% (when the cross was presented parafoveally and the unexpected object was presented at fixation) of participants fail to notice the unexpected object (Mack & Rock, 1998). In these studies the unexpected object typically occurs quickly and leaves the screen quickly. However, research has demonstrated the occurrence of inattentioanal blindness in more complex situations as well.

Simons & Chabris (1999) conducted a series of studies where participants watched two basketball teams (one wearing white and one wearing black) pass a basketball back and forth. Participants were told to count the number of passes either the black or the white team made. In the middle of the task either a women with an umbrella or a person in a gorilla suit walked through the middle of the basketball scene and remained visible for five seconds before exiting the scene. Participants were then asked if they saw the women with the umbrella or the person in the gorilla suit. Despite the fact that women with the umbrella was very obvious to anyone not engaged in the counting task, 35% of participants failed to notice her. Even more surprising, 56% of participants failed to notice when the person in the gorilla suit walked though the basketball scene. Interestingly, more participants saw the person in the gorilla suit when they
were counting the passes made by the black team than those counting passes made by the white team. It is possible that because participants watching the passes made by the black team were attending to black objects they were more likely to notice the unexpected black gorilla. Across studies it appears as though people are poor at noticing unexpected objects in their environment (e.g., Chabris & Simons, 2010; Mack & Rock, 1998; Simons & Chabris, 1999).

Several different factors influence inattentional blindness. Explanations for the inattentional blindness phenomenon typically put an emphasis on stimulus or task properties or put an emphasis on the properties of the individual (e.g., expectations). For the task properties explanations, reporting the critical stimulus is dependent on salience. That is, the more salient the critical stimulus, the more likely it is to capture attention (Mack & Rock, 1998; Most et al., 2001). Additionally, with this explanation, reporting the critical stimulus is dependent on perceptual load. That is, the higher the level of perceptual load in the primary attentional task, the less likely the critical stimulus is to be reported (Cartwright-Finch & Lavie, 2007; Gu, Stocker & Badler, 2005). Lavie’s perceptual load model (Lavie, 1995; Lavie, Hirst, de Fockert & Viding, 2004) predicts that irrelevant visual stimuli will not be detected under conditions of high perceptual load. However, spare attentional capacity should spill involuntarily to the perception of task-irrelevant stimuli when there is low perceptual load (Lavie, 2006; Rees & Lavie, 2001). The assumptions of this model were tested in three experiments by Cartwright-Finch and Lavie (2007), and it was found that more participants failed to notice an unexpected stimulus in the high-load condition. Due to the fact that the stimulus was just as irrelevant and unexpected across the two load conditions, the authors argued that the modulation of inattentional blindness cannot be explained in terms of differences in intentions and expectations, but suggest that it depends on the level of task-relevant perceptual load.
Other researchers suggest explanations for inattentional blindness that emphasize the properties of the individual, such as expectation. Mack and Rock (1998) conducted a series of inattentional blindness experiments with the goal of isolating the role of expectation. The authors acknowledged that failing to perceive the critical stimulus in inattentional blindness studies may be due to attentional demands of the primary task, lack of expectation, or both factors. In the first experiment conducted to investigate expectation, the primary task was to identify a geometric shape. An auditory tone was used to signal to the participants that the stimulus was about to appear. On the critical trial where the unexpected event occurred, the timing was manipulated so that the stimulus shape appeared even though the auditory tone did not occur. Inattentational blindness did not occur in this experiment, participants correctly identified the shape even though it was presented “early.” This becomes an issue in prospective person memory because if we expect to see an individual looking a certain way, in a certain place, doing a certain thing, we may fall prey to inattentional blindness.

One study recently conducted on prospective person memory may be explained by inattentional blindness (Lampinen, unpublished raw data). It was hypothesized that prospective person memory for a wanted fugitive would be influenced by how serious the crime they were accused of committing was. Students at a community college were given a link to a survey dealing with “attitudes about the media.” Students viewed videos of three student produced news stories and rated the videos. Two of the news stories were real and one was about a fake “wanted person” alert, where the wanted individual either forged a money order (lower seriousness) or committed a robbery and double homicide (higher seriousness). After rating each news story students were informed that the video about the wanted individual was not real, however, if they spotted the individual and contacted the experimenters they could win a prize of
up to $200. The wanted individual later showed up on campus near the students’ classrooms. It was found that of those that viewed the less serious crime, 0% correctly reported seeing the “wanted individual.” Of those that viewed the more serious crime, 10% of the students correctly reported seeing the “wanted individual.” These results indicate that people only have a limited amount of attention. Even though the “wanted individuals” were located right outside participants’ classrooms, most participants failed to notice the individuals. This is likely because when one is attending to one thing (e.g., getting to the next class) other stimuli are missed. Additionally, the more serious crime was likely to be more salient, making participants more likely to notice those individuals wanted for the more serious crime,

**Searching.** Searching concerns finding a target in a field of non-targets. That is, it is an exploration of visual space within a constrained period of time.

**Location and Attention.** One big issue in the study of visual attention is the question of whether attention is solely location-based or whether attention can be affected by non-spatial-factors (Most, Simons, Scholl & Chabris, 2000). For example, location-based models of attention include the “Spotlight” model (Posner, 1980; Cave & Bichot, 1999). A spotlight illuminates everything that is located within the area the beam of light covers. Therefore, the spotlight metaphor suggests a mechanism that selects all the information from a specific area of the visual field and excludes information from all other areas (Cave & Bichot, 1999). In this model attention acts to “illuminate” whatever falls within a region one is attending to. Selecting by location allows raw input to be organized spatially. In addition to performing visual selection, a spotlight mechanism may also achieve position constancy. In some models (e.g. Kosslyn & Koenig, 1992; Olshausen, Anderson & Van Essen, 1993), the region of visual input that falls within an attentional space is copied to a higher-level buffer, where it becomes
available for high-level processing (Cave & Bichot, 1999). This is beneficial because it allows information from the selected region to be recorded in a location-independent reference frame, which makes it easier to recognize an object no matter where it appears in a visual field.

Location clearly plays some role in selection. For example, some studies have used single-letter displays where a pre-cue signaled the exact location in the visual field that a target letter would appear (Ericksen & Hoffman, 1973, 1974; Hoffman, 1975). One of two possible target letters appeared in one of eight possible locations on a circular display that was centered on a fixation point. Only the single target letter appeared without any distractors. If the location that the target letter would appear was pre-cued by a bar marker 50 to 100 msec before the letter appeared, reaction time increased by 30-40 msec. Similar results have been found using a detection task as well (Posner, Snyder & Davidson, 1980).

Although the spotlight model is probably the most common way cognitive psychologists talk about attention, there are other ways attention can be described. Another location-based model of attention, the “zoom lens” model (Eriksen & St. James, 1986), states that attention can be directed across broad areas in coarse detail or can be directed at small areas in fine detail. One version of the zoom lens model states that attention expands from fixation to fill the whole region from the fixation point to the cued location, and then shrinks back to include just the cued location (Eriksen & Yeh, 1985). Other models based on visual attributes include those suggesting that discrete objects or features within a scene can be directly attended, unmediated by a spatial spotlight (Baylis & Driver, 1993; Duncan, 1984). One cannot say which metaphor of attention is most accurate. However, it appears that the best evidence suggests that attention does not move from point to point in the brain like a physical spotlight would move across a visual scene (Cave & Bichot, 1999). Additionally, it is not always certain that there is simply
one spotlight (McMains & Somers, 2004), although most of the time visual selective attention is focused on one thing in one location.

**Distractors.** Visual selection is incredibly important in situations in which distractors are present because one must maintain enough attention to suppress competing information from distractors. Neurophysiological studies have shown that attentional modulation of neural responses is greatest when both the target and the distractor are in the same receptive field of a neuron (Luck, Chelazzi, Hillyard & Desimone, 1997; Moran & Desimone, 1985). Therefore, it seems like the most important results are those that occur when targets have to be selected and distractors have to be ignored. The differences in results in cuing studies that use landmarks and do not use landmarks demonstrate how performance can change depending on whether distractors are present in the display.

**Feature versus Conjunction Searches.** A common task used in laboratory studies consists of participants being asked to scan a display of letters (or other forms) in order to find a specific target letter (or other target form). In an earlier study, Neisser (1967) had participants search for targets in a list of letters arranged in 50 six-letter lines. With practice, participants were able to perform a top-to-bottom search at speeds as fast as 60 letters per second. However, several factors affected their search speed. For example, when the target was an angular letter (W, Z, X) and the distractor letters were more round (O, Q, C), participants searched much faster than when the targets were similar to the distractors (e.g., G). A *feature search* is conducted when a search target differs from all of the distractors by having a feature they do not have (e.g., an angled line). A *conjunction search* is conducted when the only way to detect a target is to detect a conjunction (or certain combination) of features (for example, the specific angles and their orientations that differentiate a M from a W).
In general, feature searches are easier than conjunction searches (Coren et al., 2004). Participants reported that when they were searching the list the non-target letters were just a blur, and they did not see the individual letters. This was especially the case when the target was very different from the distractors (Neisser, 1967). It seemed as if the target just “popped out” of the display, this is a characteristic phenomenon of feature search often called the “pop-out” search (Coren et al., 2004).

Neisser (1967) suggested that there is a “preattentive” level of processing that separates a visual scene into figure and ground. When there are obvious differences between the target and the distractors, the target becomes readily visible because the distractors are combined together as the ground and the target stands out as the figure by the action of this preattentive process by itself. The basic idea is that similar items are grouped together automatically and the ones that do not fit in stand out, capturing attention. This is not possible when the targets and distractors are similar (Duncan & Humphreys, 1989). If the targets and distractors are similar, closer attention is needed to detect specific elements (e.g., Julesz, 1980).

The differences between feature and conjunction searches have been widely investigated (e.g., Treisman, 1986). One of the largest findings is that when a feature search is possible, the number of distractors does not have an effect on the search speed. The target simply pops out of the display and the search is accomplished in parallel, meaning all of the items are processed at the same time. On the other hand, when a conjunction search is required the number of distractors does affect search speed. It appears that when we conduct a conjunction search we are comparing each of the distractors one at a time with the image of the target and are only responding when there is a match. This sequential set of comparisons is often called a serial...
search (Coren et al., 2004). To explain these kinds of findings Treisman and colleagues proposed a feature integration theory.

*Feature Integration Theory.* Some of the theoretical literature on attention speaks to the importance of attention in tasks like prospective person memory. For example, over the past few decades the visual search paradigm has been extensively used to study visual attention. In these types of tasks, participants are given instructions about the defining features of a target that they are to be on the lookout for. The target may or may not be shown amongst several distractors and participants are asked to indicate whether the target is present or absent. Original studies of this task by Treisman and colleagues (Treisman & Gelade, 1980; Treisman, Sykes & Gelade, 1977) showed a dichotomy in efficiency with which attentional processes could detect the target. When a target was defined based on only one perceptual dimension (e.g., color, orientation, size, ect; see Garner, 1970), the search was very efficient regardless of set size. However, when the target was defined by multiple perceptual dimensions (e.g., a blue X among red Xs and blue Os), the search was usually inefficient. Due to this dichotomy Treisman proposed a two-stage model of visual attention called the *feature integration theory*.

In the first stage of the feature integration theory, the preattentive stage, primitive features are analyzed (e.g., color, orientation, size, ect.). Stimuli defined by each of these perceptual dimensions are handled by distinct analyzers (Garner, 1974; Treisman et al., 1977), often called dimensional modules. Registering these features by these modules has been assumed to be spatially parallel (Treisman & Gormican, 1988) and responses could be produced by obtaining this information. Thus, if a target is identified in terms of only one dimension, then responses should be independent of set size. On the other hand, if one has to use multiple dimensions to identify a target, focal attention is required to integrate features from each
dimension. If this were the case, searches would be considered inefficient and search speed would depend on set size. This would be the case because focal attention was operating on a single item at a time. This research is relevant to prospective person memory because to the extent a face needs to be integrated, it requires strategic attention.

*Illusory Conjunctions.* When we have multiple objects to pay attention to there are multiple features involved that exist at several different locations. The perceptual system must associate each of these features with the object they belong to. Feature integration theory suggests that for this to occur we have to focus our attention on each of the objects. Once we focus our attention on a particular location, the features at that location are bound together and associated with the object at that location.

One line of evidence that supports the idea that focused attention is necessary for binding can be found in *illusory conjunctions.* Illusory conjunctions are based in the finding that under some conditions, features associated with one object can sometimes become incorrectly associated with another object (Treisman & Schmidt, 1982). In the first demonstration of illusory conjunctions, Treisman & Schmidt created a display with four shapes (varying in color) that were flanked by two black numbers. The display was flashed quickly on the screen followed by a random-dot masking field. Participants were instructed to report the two black numbers first then what they saw at each of the four locations where the shapes had been. Participants reported seeing illusory conjunctions 18% of the time. For example, if participants saw a small red triangle and a small green circle they might report seeing a small red circle. The reason illusory conjunctions happened in this experiment was because the stimuli were flashed very quickly and participants were asked to pay attention to the black numbers. When Treisman
and Schmidt told observers to focus on the shapes however, illusory conjunctions were eliminated.

**Schemas.** Schemas are generalized knowledge or expectations that are gained from past experiences with an event, object, or person (Matlin, 2009). For example, you likely have schema for the sequence of events during a visit to the doctor. Researchers have argued that schemas play a role in how people search for objects in real-world scenes (Biederman, Glass & Webb, 1973). Biderman et al. (1973) found that searching for an object in a coherent scene takes less time than searching for the same object in a version of the scene that had been jumbled. The evidence that jumbling the scene reduced participants’ ability to derive a topic or overall conceptualization of the scene came from results from the trials when the object was not in the scene. Participants were much faster (by about 750 msec) for both the jumbled and coherent versions of a scene when the target object was unlikely to appear in the scene (e.g., when a cup was the target in a street scene) compared to when the target was likely to appear in the scene (e.g., a cup in the kitchen). Biederman et al. (1973) argued that when viewing both types of scenes participants were able to derive an overall conceptualization of the scene and use it to quickly terminate their searches when the object was unlikely, given the conceptualization. The relatively large 225 msec effect of jumbling on these “impossible-no” reaction times is good evidence that jumbling affected participants’ ability to achieve that conceptualization.

**Preparing.** Preparing involves anticipating a future event and allocating resources to look for it. Preparing is extremely important in the case of prospective person memory. If one is asked to be on the lookout for a missing or wanted individual, a large portion of what is taking place is preparing. One must anticipate seeing the missing or wanted individual in the future and must allocate resources to look for them.
Symbolic Cues and Expectancies. Research by Posner and colleagues (Posner, Nissen & Ogden, 1978; Posner, Snyder & Davidson, 1980) has examined participants’ ability to detect stimuli that appears at expected and unexpected locations. At the start of each trial, a cue indicated whether a stimulus was likely to appear in two possible locations. Response times were faster for stimuli at the cued location. Downing and Pinker (1985) conducted another cuing experiment where they had ten different locations along a horizontal midline. It was found that reaction time increased with distance between the expected location and where the actual target was located. The authors suggested that the size of the cuing effect depended on “corticial distance” between two points, not on the physical distance between the cue and the stimulus. Due to the fact that more of our visual cortex is devoted to processing the center visual field, distance effects were larger when the two points were near the center compared to the periphery. The largest effects were found when the two points were on the opposite sides of the vertical midline.

Similarly, Rizzolatti, Riggio, Dascola and Umiltá (1987) found slower responses with longer distances within a quadrant. These authors also found additional cost when the cue and the target were on opposite sides of a horizontal or a vertical midline. Due to the fact that their stimuli were located in the periphery, the authors suggested this effect was not due to cortical magnification, but rather the delays produced by cuing were due to the time associated with programming eye movements. However, these distance effects have not been unanimous. For example, Hughes and Zimba (1985, 1987) found that responses were uniformly fast when the cue and the target were in the same hemifield and were uniformly slow when in different hemifields. This was found regardless of whether they tested the top versus the bottom or the right versus the left.
Experimental differences are likely the cause the discrepancies between findings. Downing and Pinker (1985) and Rizzolatti et al. (1987) marked their target locations with a square, whereas Hughes and Zimba (1985, 1987) had stimuli that appeared on basically blank screens. In 1987 Zimba and Hughes replicated Downing and Pinker’s experiment using ten squares to mark ten locations and found distance effects as well. Taken together these experiments indicate that reaction time increased with distance between the cue and the target only when displays include some type of landmark.

It is possible that the landmark squares act as distractors, which cause these distance effects (Cave & Bichot, 1999). When the squares appear on the screen participants have to pay attention to whether the stimulus is part of the target or part of the square. Participants may then have to focus their attention to the small areas within the cued square, whereas without the squares they can spread their attention across the entire display.

**Prospective Person Memory and Attention**

Prospective person memory involves noticing a missing or wanted person in a visual environment, thus it involves attention. It is possible that when we see an image of a missing person we pay attention to specific details of that image. If we encounter the individual at a later date and they do not fit the specific details we had remembered about them it is possible that recognition suffers. Therefore, it may be beneficial to display multiple images of missing children in order to allow viewers an opportunity to see the child in a variety of contexts. Sweeney and Lampinen (2012) examined the effect presenting multiple images of missing children on prospective and retrospective person memory for missing children. In the first experiment prospective person memory was examined. Mock missing child posters were created, similar to those found on the National Center for Missing and Exploited Children’s
(NCMEC) website, using four pictures of four adult volunteers when they were 14-years-old. There were two types of posters; *multiple image posters* contained three images of the target next to demographic information of the child, whereas *single image posters* contained a single image of the target next to demographic information. Participants were randomly assigned to view either the single or the multiple image posters. Participants then engaged in a team-sorting task (similar to Lampinen et al. (2010) and Lampinen, Peters and Gier (2012)) where 50 photographs were viewed (including the four targets). Participants in the multiple image condition were significantly more likely to correctly identify the targets than those in the single image condition. Additionally, mistaken identifications of non-targets occurred infrequently across the board and did not significantly differ for the two conditions. Furthermore, the corrected identification scores showed a significant advantage for using multiple images over using single images. Therefore, it appeared that presenting multiple images on missing child posters increased prospective person memory.

In order to examine the retrospective components of the task, Sweeney and Lampinen (2012) conducted a second experiment in which the order of the tasks was reversed. The team-sorting task occurred prior to seeing the posters and without any mention of the experiment having to do with missing children. Participants saw posters of two targets and were then randomly assigned to the single or the multiple image poster condition. Participants saw four mock missing child posters (two of targets). It was found that participants were significantly more likely to correctly recognize posters of children they had previously seen in the multiple image condition compared to the single image condition. Additionally, mistaken identification of non-target posters was not significantly different between conditions; however, these errors were more common in the multiple image condition. Furthermore, corrected identification
scores did not significantly differ between conditions, although there were non-significant
differences in the direction of the multiple image condition. Therefore, it appears that presenting
multiple images of missing children improved retrospective person memory as well.

There appears to be several advantages for presenting multiple images of a missing child.
Some evidence has been found suggesting that when a study picture is more similar to a test
picture, recognition is higher (Gier et al., 2011). Participants viewed the television show
*Criminal Minds* where a mock AMBER alert was inserted (Gier et al., 2011). Participants were
told that the show was recorded from their professor’s television and therefore included
advertisement and commercials. One of the commercials was a professional quality mock
AMBER alert of four “missing children.” Two of the children were made to look dirty by
messing up their hair, putting dirt on their faces and using make-up to create bruises. The other
two children appeared clean. After viewing the television show (including the inserted mock
AMBER alert) participants took a recognition test where they viewed photographs of children
that were either physically similar to those shown in the mock AMBER alert or physically
different from those shown. When physical appearance was similar recognition was
significantly higher than when physical appearance was different. However, it is not always the
case that we know what the child will look like when later encountered. Therefore, it may be
beneficial to include multiple images of the child. Presenting multiple images of a child
increases the likelihood that the appearance of the child when later encountered will match one
of the images on the missing child poster. Taken together, these studies suggest that the role of
attention in prospective person memory is vital to successful prospective person memory. The
literature reviewed thus far in this paper suggests that attention is important in the role of
prospective person memory.
Implications to Build Programs for Missing and Wanted Individuals

The goal of this literature review was to examine the evidence on prospective memory and visual attention and use it to build better programs to find missing and wanted individuals. The studies of prospective memory and visual attention are several decades old. The research reviewed on prospective person memory is a relatively new and important application of prospective memory in the real world, that is, finding missing and wanted individuals.

Prospective person memory relies on a number of component processes including face recognition, event-based prospective memory, and attention. Due to the fact that prospective person memory involves visual recognition of a face in an unexpected environment, visual attention is clearly important. However, only recently has research begun to investigate the role of visual attention on prospective person memory. The research reviewed thus far in this paper suggests that attention is important for successful prospective memory, at least some of the time. Research also suggests that attention is then important for successful prospective person memory as well because prospective person memory is a special case of event-based prospective memory.

When one is considering building programs to find missing or wanted individuals it is important to consider the role of attention in these programs. Small factors may determine whether or not a person notices, recognizes, and reports a missing or wanted individual. In order to improve prospective person memory, attention must be paid to the missing or wanted individual. For example, research has suggested matching the image of the missing child on the poster to how the child might appear when encountered could improve prospective person memory (Gier et al., 2011). Other research has suggested that displaying multiple images of missing children improved both prospective and retrospective person memory (Sweeney & Lampinen, 2012). Although the research on prospective person memory is still growing, it is
important to appreciate the apparently large role that attention plays in successful prospective person memory. Additional factors that affect prospective person memory must be examined to have a full understanding of the memory mechanisms that affect prospective person memory. Two experiments were conducted that examined the memory mechanisms that affect prospective person memory.

**The Current Research**

As can be seen from the review above, some research has been conducted investigating factors that affect prospective person memory. However, the research on prospective person memory is still in its infancy, and the exact memory mechanisms that affect prospective person memory have yet to be uncovered. The goal of the current research was to empirically examine the memory mechanisms that affect prospective person memory. To do this, two experiments examined how stereotypes affect automatic versus strategic processing by examining the effect of attention (Experiment 1 & 2) crime stereotype (Experiments 1 & 2), criminal charge (Experiments 1 & 2) and criminal profile (Experiment 2) on prospective person memory. In order to do this, two crimes were chosen: aggravated assault and computer fraud. These two crimes were chosen because they vary in degree of violence and they tend to elicit different stereotypes about the criminal. Because of these differences, I was able to physically depict the stereotypes associated with each crime in photographs that participants viewed. From this point forward the criminal stereotypes I manipulated will be referred to as Criminal Description because it is a less biased and a more accurate way of describing the manipulated variable.

**Experiment 1**

**Method**
**Participants.** Experiment 1 consisted of 160 undergraduate psychology students (97 females, 60 males, and three participants who chose not to identify their gender) from the University of Arkansas with an average age of 20.75 ($SD = 9.77$). Ten participants were not included in the calculation of the average age due to their response on the age question being indistinguishable. The majority of the participants (131) self-identified as Caucasian, four participants self-identified as African American, ten as Asian, one as Native Hawaiian or other Pacific Islander, one as Native American, six as Hispanic, one as biracial, three as other, and three participants chose not to identify their race or ethnicity. All students participated in order to partially fulfill a departmental research requirement for their General Psychology course. Power analysis using G-Power indicated 20 participants were needed in each of my eight groups to have 88% power for detecting a medium sized effect when employing the traditional .05 criterion of statistical significance.

**Design.** A 2 (Criminal Charge: Aggravated Assault, Computer Fraud) x 2 (Criminal Description: Aggravated Assault Description, Computer Fraud Description) x 2 (Cognitive Load: Present, Absent) between-subjects design was used. The Criminal Charge variable was designed to examine how different crimes impact prospective person memory. The Crime Description variable was designed to examine differences in recognition based on the crime stereotypes one holds for people that commit aggravated assault versus those that commit computer fraud. The cognitive load portion is important because that allowed me to manipulate the degree of automaticity. Specifically, automatic processes have been defined as those that occur even when the attention that can be allocated to the task is minimal (Posner & Snyder, 1974). Strategic processes, on the other hand require ongoing attention. Thus, if attentional load substantially impairs prospective person memory, it implies that prospective person memory depends heavily
on strategic processing. On the other hand, if attentional load has limited impact on prospective person memory, it implies that prospective person memory can occur automatically. To manipulate this variable, half of the participants engaged in a digit-monitoring task where they heard letters read out loud at a rate of about one letter per second. Participants pressed the ‘3’ key when they heard three odd digits in a row.

It was predicted that participants would be better at recognizing the target individuals when the criminal charge matched the criminal description (i.e., Criminal Description X Criminal Charge interaction). I hypothesized that this would occur because when participants read a criminal charge they likely formed a mental picture of what that criminal would look like. When they later encountered the criminal in a manner consistent with their stereotype automatic processing should have occurred (Einstein & McDaniel, 2005; McDaniel & Einstein, 2000). When participants encountered the criminal in a manner that was inconsistent with their stereotype of the criminal it is likely that strategic processing took place (Smith, 2003).

My second hypothesis regarded the automaticity of recognition when stereotypes are involved. The basic idea is that stereotypes should make prospective person memory more automatic than strategic. If this is the case then people should recognize description consistent targets even when they are under cognitive load (i.e., engaging in the digit monitoring task). Therefore, there should be little cost imposed by adding cognitive load in the description consistent condition (i.e., Cognitive Load X Criminal Description X Criminal Charge interaction). In other words, my second hypothesis was that cognitive load would have a significantly greater impact in the description inconsistent condition.

Materials and Procedure.
**Norming.** A norming study was conducted in order to generate the descriptions that would be used in Experiment 1. Nineteen undergraduate students (84.21% female), with an average age of 23.50 ($SD = 9.75$), in the Law and Psychology Laboratory at the University of Arkansas responded to ten questions about their stereotypes about people that commit aggravated assault and computer fraud. The majority (84.21%) of participants self-reported being Caucasian, 5.26% reported being Hispanic, 5.26% reported being Asian, and 5.26% reported being African American. Participants wrote their answers in free-response form. Participants were asked to take out a blank sheet of paper and answer the following questions: “1) What would someone that committed *aggravated assault* LOOK LIKE?, 2) What would someone that committed *aggravated assault* DRESS LIKE?, 3) Where in a natural foods grocery store would you EXPECT TO SEE someone that committed *aggravated assault*?, 4) What would a person that committed *aggravated assault* be SHOPPING FOR in a natural foods grocery store?, 5) What FACIAL EXPRESSIONS might a person that committed *aggravated assault* display if they were grocery shopping?” Participants were then asked the exact same questions but the words “aggravated assault” were substituted with “computer fraud.”

A Qualtrics survey (an online survey response system) was created based on the information collected from the Law and Psychology Laboratory members. Any response that was given by more than two participants was put into a Qualtrics survey to be taken by a new set of participants. Forty-one undergraduate students (73.17% female), with an average age of 21.78 ($SD = 1.19$) years, in a Perception class at the University of Arkansas took the survey for extra credit in the course. The majority of participants (80.49%) self-reported being Caucasian, 9.76% reported being Asian, 4.88% reported being African American, and 4.88% reported being Native American.
Participants gave demographic information, then half were asked to, “Please close your eyes and imagine a person that committed AGGRAVATED ASSAULT. Please answer the following questions about how CONSISTENT the items are with a person that committed aggravated assault. Please rate your decision on a scale from ABSOLUTELY INCONSISTENT to ABSOLUTELY CONSISTENT.” The other half of the participants were asked to do the same thing but to imagine a person that had committed computer fraud. Participants then answered the same five questions that the Law and Psychology Laboratory answered but rated several items on a scale of 1 (Absolutely Inconsistent) to 6 (Absolutely Consistent). See Table 1 for a complete list of items rated and which items were significantly different between the crimes.

**Experiment 1.** For Experiment 1 participants were tested in the laboratory in groups of up to five people. Participants were seated at a computer and asked to read and sign an informed consent. Experiment 1 was presented via stimulus presentation software called SuperLab. First, demographic data was collected, including participants’ age, race/ethnicity, and gender. Next, instructions were given informing participants that they were about to see wanted posters of four men wanted for either aggravated assault or computer fraud (See Appendix A for examples). Participants were told to be on the look out for the men throughout the course of the experiment and to press the “h” key for help if they saw one of the men. Four mock wanted posters were then presented to participants for 15 seconds each. A presentation time of fifteen seconds was chosen because Lampinen, Peters and Gier (2012) found that when participants were shown missing child posters to freely study, they spent an average of 13 seconds studying each poster.

In order to ensure that participants paid attention to what crime the men were wanted for, participants were asked to chose what crime the men were wanted for from a multiple choice list
of Aggravated Assault, Computer Fraud, and Car Theft. Just to make sure that it was clear to participants the crime that the men were wanted for, they were once again reminded what the crime was.

Next, participants engaged in a prospective memory task where they saw photographs of individuals taken in a bar scene. Participants were told to pay attention to the customers ordering drinks in order to determine if they were the legal drinking age (21 years old). Participants were told that if they believed either person was under age they should press the ‘c’ key to card the individual. The main goal of the bar task was to allow the participant to get a feel for prospective memory tasks, as well as let them engage in a task in which they never saw any of the targets so that they did not come to expect to see them during each task.

Following the bar task, participants engaged in the main prospective memory task, a grocery shopping task. Participants received instructions about the shopping task informing them that they were about to see photographs from a grocery store. Participants were told that they would be given a shopping list that they should use to locate items in the photographs. Participants were informed that if they saw a product they were looking for in the photographs that they should press the “p” key to purchase the item. On the same screen, to the right of the instructions, participants were given their shopping list, which contained ten items. Directly below the list they were reminded of what key to press in order to indicate that they saw an item on their list. To ensure familiarity with the shopping list, participants were asked to write out the shopping list four times on a sheet of paper before proceeding. Next, participants saw slides where a photograph of the grocery store appeared on the left and the shopping list appeared on the right. The slides automatically advanced every three seconds.
Half of the participants engaged in a digit-monitoring task where they heard numbers read through headphones as they went through the shopping task. These participants were informed that as they completed the shopping task they would also be asked to monitor the numbers being read and to press the ‘3’ key if they heard three odd numbers in a row. Participants were given an example of three odd digits being consecutively read and what they should do in that situation (i.e., press the ‘3’ key). It should be noted that three odd numbers never appeared on a target-present slide in order to reduce response competition.

Throughout the experiment participants saw slides of individuals shopping at the grocery store. Most slides contained both people and products, although a few contained products only (See Appendix B for examples). All of the products from the grocery list appeared at some point in the slides. None of the products from the grocery list appeared on the same slide as a target individual. Four of the individuals in the slides were the target individuals that participants saw mock wanted posters of at the beginning of the experiment (See Appendix C). After completing the shopping task participants were asked if they had been previously familiar with one of the people in the study and if they had taken part in a similar study in the recent past. Finally participants were thanked, debriefed, and credit was assigned.

**Results and Discussion.** The purpose of this experiment was to examine the effect of criminal charge, criminal description, and attention on prospective person memory. My first hypothesis was that participants would be better at recognizing the target individuals when the criminal charge matched the criminal description (i.e., Criminal Description X Criminal Charge interaction). My second hypothesis was that cognitive load would have a significantly greater impact on prospective person memory in the description inconsistent condition. To examine this, I calculated the proportion of target criminals correctly identified (hit rate) in the grocery
shopping task (out of four possible), as well as the proportion of non-target criminals mistakenly identified (false alarm rate) during the grocery shopping task (out of 37 possible). I also calculated a difference score (a measure of corrected recognition) for each participant by taking the hit rate for the prospective person memory task and subtracting the false alarm rate for the prospective person memory task, as it is a more sensitive measure of accuracy because it corrects for guessing.

The data was then analyzed using a 2 (Criminal Charge: Aggravated Assault, Computer Fraud) x 2 (Criminal Description: Aggravated Assault Description, Computer Fraud Description) x 2 (Cognitive Load: Present, Absent) between-subjects analysis of variance (ANOVA) on participants’ hit rate, false alarm rate, and difference scores for the prospective person memory task.

With regard to the prospective person memory task, a marginally significant two-way interaction was found for the prospective person memory hit rate between criminal description and cognitive load (i.e., attention), $F(1, 152) = 2.97, p = .087$. Those that saw the individuals wanted for aggravated assault demonstrated better prospective person memory when under cognitive load (i.e., their attention was divided) ($M = 1.37, SD = .22$) than when they were not under cognitive load (i.e., full attention was given) ($M = .31, SD = .26$). However, those that saw individuals wanted for computer fraud had better prospective person memory when full attention was given ($M = .34, SD = .27$) rather than divided attention ($M = .26, SD = .20$). However, two independent samples t-tests revealed that these differences were not significant.

A significant main effect of attention was found when examining the false alarms rates for the prospective person memory task, $F(1, 152) = 6.00, p = .015$. There were more false alarms for prospective person memory when attention was divided ($M = .05, SD = .04$) than
when full attention was given ($M = .04, SD = .03$). This makes sense because more mistakes are likely to happen when attention is divided between the shopping task and the prospective person memory task. Additionally, a significant three-way interaction was found between criminal charge, criminal description, and cognitive load, $F(1, 152) = 7.20, p = .008$. Those that saw individuals wanted for aggravated assault and viewed the target individuals as matching a description of aggravated assault had more false alarms for prospective person memory when full attention was given rather than when attention was divided (See Table 2). However, the reverse was found when participants saw individuals wanted for aggravated assault and viewed the target individuals as matching the description of someone wanted for computer fraud. The reverse was also found when participants viewed individuals wanted for computer fraud.

The prospective person memory difference score tells us the most about prospective person memory because it is a measure that corrects for guessing (i.e., hit rate – false alarm rate). A marginally significant two-way interaction was found between criminal description and cognitive load, $F(1, 152) = 2.88, p = .092$. When participants saw individuals that were depicted to match the aggravated assault description recognition was better when attention was divided ($M = .32, SD = .21$) than when full attention was given ($M = .28, SD = .26$). However, an independent samples t-test revealed this difference was not significant. When participants saw individuals that were depicted as matching the description of someone that committed computer fraud recognition was better when full attention was given ($M = .30, SD = .27$) than when attention was divided ($M = .21, SD = .19$). An independent samples t-test revealed a marginally significant difference here, $t(78) = 1.70, p = .094$.

These results make sense because those individuals that were depicted to fit the aggravated assault description stand out against the background of a natural foods store.
Therefore, recognition does not suffer when attention is divided because the aggravated assault description stands out enough on its own to draw attention. On the other hand, for those individuals that were depicted to fit the stereotype of someone that committed computer fraud, participants needed to devote more attention to locating them in a natural foods store because they would not simply stand out. Therefore, in this case having divided attention hurt recognition. There are some situations where attention to wanted individuals will be automatic. I originally thought this would be the case because of a match to criminal description, but there was no evidence of that.

Finally, correlations between all the dependent variables were run and it was found that prospective person memory was uncorrelated with the shopping task ($r = -.007, n = 160, p = .933$) and the digit monitoring task ($r = .103, n = 80, p = .364$). If one assumes that prospective person memory is correlated then participants should do worse on the prospective person memory task, but there is no evidence of this.

**Experiment 2**

In order to further investigate how stereotypes affect automatic versus strategic processing I investigated the effect of criminal profile on prospective person memory. By adding the criminal profile element I hoped to better understand the effects of stereotypes on prospective person memory by being able to depict the criminal stereotype with a more detailed description of the criminal based on stereotypes about criminals. The inclusion of the profile in Experiment 2 was designed to see if one can override the automatic processes that likely come along with stereotypes. Thus, I hoped to gain some insight about strategic processing in prospective person memory. Furthermore, investigating whether or not including a profile on a
wanted person poster increased prospective person memory would tell us whether this practice would be beneficial for real life wanted person posters.

It was hypothesized that participants would perform best when the criminal profile matched the criminal charge and criminal description. This would likely be due to the automaticity of processing. The more match there is between the criminal profile, criminal charge, and criminal description, the better recognition should be for the targets. As those elements start to mismatch (e.g., criminal profile and criminal charge match but not criminal description) recognition should get worse. This would likely be because participants would need to engage in more strategic processing.

**Method**

**Participants.** This experiment consisted of 162 undergraduate psychology students (111 female) from the University of Arkansas with an average age of 20.53 ($SD = 8.79$). All students participated in order to partially fulfill a departmental research requirement. The majority (122) of the participants self-reported their race or ethnicity as Caucasian, ten as African American, seven as Asian, five as Native Hawaiian or other Pacific Islander, eight as Hispanic, six as Biracial, three as Other, and one participant chose not to respond.

**Design.** A 2 (Criminal Charge: Aggravated Assault, Computer Fraud) x 2 (Criminal Description: Aggravated Assault Description, Computer Fraud Description) x 2 (Cognitive Load: Present, Absent) x 2 (Profile: Matched, Mismatched) mixed-factor design was used. Criminal description served as a within-subjects factor.

**Materials and Procedure.** Just as in Experiment 1, participants completed Experiment 2 via SuperLab. The set up was mostly identical to Experiment 1 with the addition of investigating the effect of criminal profile on prospective person memory. Criminal description served as a
within-subject factor where each participant saw two targets that matched the description of someone charged with aggravated assault and two targets that that matched the description of someone charged with computer fraud. The reasoning behind this change from Experiment 1 was simply that this factor was basically a replication of Experiment 1 and making criminal description a within-subjects factor reduced the number of participants needed. With regard to the criminal profile element, participants viewed wanted posters as they did in Experiment 1, however, in Experiment 2 the wanted posters contained a criminal profile (See Appendix D). The criminal profiles were developed based on profiles one might find on the Federal Bureau of Investigation webpage. The profiles included statements about the wanted criminals (i.e., the targets) that either matched the criminal description or mismatched the criminal description. The information about the criminal description was based on the norming data used in Experiment 1. In order to ensure that participants paid attention to the criminal profile, participants re-wrote the profile in their own words on a sheet of paper. As in Experiment 1, half of the participants engaged in a digit monitoring task.

**Results and Discussion.** The purpose of Experiment 2 was to further investigate how stereotypes affect automatic versus strategic processing by examining the role of criminal profile on prospective person memory. More specifically, I wanted to examine the strategic processing that was likely to occur when participants read a criminal profile. It was hypothesized that participants would have the best prospective person memory when the criminal elements matched. In other words, prospective person memory would be best when criminal profile, criminal charge, and criminal description all matched. The more match between the criminal elements the better prospective person memory should be.
In order to investigate this hypothesis I calculated each participant’s hits and false alarm scores for the prospective person memory task. I calculated the proportion of target criminals correctly identified (hit rate) in the grocery shopping task (out of four possible), as well as the proportion of non-target criminals mistakenly identified (false alarm rate) during the grocery shopping task (out of 37 possible). Additionally, I ran a correlation to see if there was a relationship between the shopping task and the digit monitoring task with overall prospective person memory performance.

The data was analyzed using a 2 (Criminal Charge: Aggravated Assault, Computer Fraud) x 2 (Criminal Description: Aggravated Assault Description, Computer Fraud Description) x 2 (Cognitive Load: Present, Absent) x 2 (Profile: Matched, Mismatched) mixed-factors analysis of variance (ANOVA) on participants’ hit rate and false alarm rate. Criminal description served as a within subjects factor.

With regard to the prospective person memory task, a significant main effect of criminal description was found, $F (1, 154) = 6.22, p = .014$. Participants were better at recognizing wanted individuals when the description of someone that committed computer fraud was given ($M = .36, SD = .37$) than when the description of someone that committed aggravated assault was given ($M = .27, SD = .33$).

A two-way interaction was found between criminal profile and criminal description, $F (1, 154) = 7.23, p = .008$. An independent samples t-test revealed that participants were better at recognizing wanted individuals when the profile given was consistent with someone that committed aggravated assault and the individuals matched the description of someone that committed aggravated assault, $t (160) = 3.1, p = .002$ (See Figure 1). Similarly, participants were better at recognizing wanted individuals when the profile given was consistent with
someone that committed computer fraud and the individuals matched the description of someone that committed computer fraud. However, an independent samples t-test revealed this difference was not significant. These findings were consistent with the hypothesis that prospective person memory should be better when the criminal elements match, in this case the criminal profile and criminal description.

A second two-way interaction was found between criminal description and criminal charge, $F (1, 154) = 7.41, p = .007$. A paired samples t-test revealed that prospective person memory was better when the description given matched someone wanted for computer fraud and the wanted individuals were charged with computer fraud than when the description given matched someone wanted for aggravated assault but the individuals were charged with computer fraud, $t (79) = -2.36, p = .021$ (See Figure 2). Likewise, when the description given matched someone wanted for aggravated assault and the wanted individuals were charged with aggravated assault prospective person memory was better than when the description given matched someone wanted for computer fraud but the individuals were charged with committing aggravated assault. However, a paired samples t-test revealed this difference was not significant. Again, these results are consistent with the hypothesis that prospective person memory should be better when there is a greater match between criminal elements, in this case criminal description and criminal charge.

A third two-way interaction was found between criminal profile and criminal charge, $F (1, 154) = 3.98, p = .048$. Prospective person memory was better in cases where the criminal profile was consistent with someone that committed aggravated assault and the individuals were charged with committing aggravated assault than when the profile was consistent with someone that committed computer fraud but was charged with aggravated assault (See Figure 3). The
same pattern was found where prospective person memory was better when the profile given was consistent with someone that committed computer fraud and was charged with committing computer fraud than when the profile was consistent with someone that committed aggravated assault but was charged with committing computer fraud. However, independent samples t-test revealed that neither of these differences were significant. That being said, the pattern here suggests that people have better prospective person memory when criminal profile and criminal charge match.

A final fourth two-way interaction was found between cognitive load and criminal charge, $F(1, 154) = 4.87, p = .029$. As can be seen in Figure 4, participants had better prospective person memory when they were not under cognitive load and the wanted individuals were charged with computer fraud than when they were under cognitive load and the wanted individuals were charged with computer fraud. This is to be expected as cognitive load has been shown to impose a cost to the ongoing task (e.g., Marsh et al., 2003; Smith, 2003; Smith & Bayen, 2004). However, prospective person memory was better when participants were under cognitive load and the wanted individuals were charged with aggravated assault than when they were not under cognitive load and the wanted individuals were charged with aggravated assault. This finding is not consistent with previous research that being under cognitive load imposes a cost to the ongoing task. That being said, independent samples t-tests revealed that neither of these differences were significant, but the effect of cognitive load was larger when wanted individuals were charged with computer fraud than when they were charged with aggravated assault.
A Univariate ANOVA was run on participants’ false alarm scores. No significant difference was found in foil recognition where all $p > .072$. Because no significant differences were found in false alarm rate, difference scores were not calculated.

Finally, correlations between all the dependent variables were run and it was found that prospective person memory was uncorrelated with the shopping task ($r = .034, n = 162, p = .665$) and the digit monitoring task ($r = -.182, n = 81, p = .104$). If one assumes that prospective person memory relies heavily on attentional resources then there should be a trade-off between performance on the prospective person memory task and the ongoing task of shopping for items, and the resource consuming task of monitoring digits. The fact that this was not the case suggests that prospective person memory can occur relatively automatically.

**General Discussion**

The goal of the current research was to empirically examine the memory mechanisms that affect prospective person memory. Prospective person memory is the ability to recognize and respond to a missing or wanted individual that one has been asked to be on the lookout for at some point in the future. This type of memory is made up of several important processes, three of which are face recognition, event-based prospective memory, and attention. It has only been recently that research on the role of visual attention on prospective person memory has been examined. This dissertation focused on closing the gap between prospective person memory and attention.

The purpose of Experiment 1 was to examine the effect of criminal description, criminal charge, and attention on prospective person memory. Participants engaged in a computer shopping task where they viewed slides of a natural foods grocery store and were asked to locate items on their shopping list at the same time as being on the lookout for four “wanted” men. The
first hypothesis was that participants would be better at recognizing targets when the stereotype people associate with the criminal charge matched the criminal’s actual appearance. I originally thought that when people saw the wanted men were charged with a particular crime they would form a mental image of what the wanted person would look and act like. Later when they saw the wanted men in the shopping task I expected participants to engage in automatic processing when the criminal description matched the criminal charge, thus demonstrating greater prospective person memory. I thought that if participants saw the wanted men in the shopping task and the criminal description did not match the criminal charge strategic processing would occur. No evidence was found to support this hypothesis. It is possible that because the wanted men were seen in the shopping task in static images something was lost in translation with regard to the stereotype. Perhaps participants did form a mental image of what the wanted men would look like but the images used in the shopping task could not perfectly portray those mental images.

The second hypothesis in Experiment 1 was that cognitive load would have a significantly greater impact in the description inconsistent condition. Again, no real evidence was found to support this hypothesis. This is not a surprise because no interaction between criminal charge and criminal description was found.

Despite the fact that neither hypothesis from Experiment 1 was confirmed, this experiment did reveal some interesting findings. Most interesting was the fact that there was an interaction between criminal description and cognitive load. It was found that when participants viewed individuals that matched the description of someone that committed aggravated assault recognition was better under cognitive load than when they were not under cognitive load. Despite this difference not being significant, there was a significant difference showing that
when participants saw individuals depicted as matching someone that committed computer fraud recognition was better when participants were not under cognitive load than when they were under cognitive load.

The above result is interesting because it speaks to why I may not have been able to confirm my two hypotheses for Experiment 1. It is possible that this difference was due to the fact that the individuals depicted to match a description of someone that committed aggravated assault simply stood out too much in my shopping task that was photographed in a natural foods store. It makes sense that recognition would not suffer when attention was divided because the aggravated assault description stood out enough on its own to draw attention. When individuals matched the description of someone that committed computer fraud more attention was required from participants to pick the individuals out of the natural foods store. Thus, in this case having divided attention hurt prospective person memory. In summary, despite the fact that my hypotheses were not confirmed in Experiment 1, some interesting results did surface that suggest possible avenues for future research. One potential avenue to study this explanation would be to embed wanted individuals in locations where their appearance would not stand out (e.g., a biker bar).

Experiment 2 was designed to examine the effect of attention, criminal description, criminal charge, and criminal profile on prospective person memory. Participants engaged in a similar computer shopping task as in Experiment 1 where participants were asked to locate items on their shopping list at the same time they were to be on the lookout for four “wanted” men. The addition of a criminal profile element was added in Experiment 2 where participants read a profile of the wanted individuals on the wanted posters. It was hypothesized that prospective person memory would be the best when criminal elements matched. In other words, the more
match between criminal charge, profile, and description the better prospective person memory should be.

Much evidence was found in Experiment 2 to support the hypothesis that the more match there is between criminal elements the better prospective person memory would be. It was found that participants were better at recognizing wanted individuals when the criminal profile matched the criminal description. This likely occurred because participants were given a detailed profile that included the same elements used to make up the criminal description. Both the criminal profile and the criminal description were based off the norming information people gave about criminal stereotypes for people that commit aggravated assault and people that commit computer fraud. When there was a match between these two criminal elements automatic processing occurred making prospective person memory better.

Additional support of this hypothesis comes from the significant interaction found between criminal description and criminal charge. Once again, when there was a match between criminal elements prospective person memory was better. When participants read the criminal charge that the wanted individuals were charged with and they saw those individuals in the shopping task in a manner that was consistent with the stereotype they held for someone that committed that crime, automatic processing occurred and they were able to accurately identify the wanted individual.

Further support for the hypothesis that the more match there is between criminal elements the better prospective person memory will be comes from the significant interaction found between criminal profile and criminal charge. When participants read a detailed profile that matched the criminal charge the wanted individuals were charged with prospective person memory was better. When participants read a criminal charge and it matched the profile
automatic processing occurred making it easier to later recognize the wanted individuals in the shopping task.

Results from Experiment 2 suggest that individuals are unable to override the automatic processing that occurs when one encounters a criminal stereotype. Because prospective person memory was best when criminal elements matched it is safe to assume that automatic processing occurs during prospective person memory. When one considers the practical application of these results it is interesting to note that the addition of a criminal profile does seem to help prospective person memory when the wanted individual matches the profile. Therefore, it would be beneficial for law enforcement to include criminal profiles on wanted persons posters when possible.

It is also important to consider the implications for the preparatory attentional processes and memory processes model (PAM; Smith, 2003), as well as the multiprocess view (Einstein & McDaniel, 1990) of prospective memory. The PAM model suggests that people are constantly monitoring their environment for prospective memory cues. This view also assumes that continuous monitoring will use up some cognitive resources, which in turn will lead to poorer performance on an ongoing task. The results from the current research do not support the idea of continuous monitoring. Prospective person memory search did not impose a cost to the ongoing task. That is, participants still paid attention to the shopping task.

The multiprocess view of prospective person memory suggests that prospective memories are retrieved reflexively, without the need for focal attention (e.g., Einstein & McDaniel; Guynn et al., 1998). The current research supports this idea because across studies prospective person memory was not largely affected by the shopping or digit-monitoring task and a match between criminal elements improved prospective person memory.
Limitations

Although the results from both experiments are interesting there are some limitations that need to be considered when interpreting the results. The first limitation to consider in this type of research is the ecological validity of the paradigm used. In both experiments I used a computer based prospective person memory paradigm where participants imagined they were customers shopping in a grocery store at the same time they were to be on the look out for wanted criminals. As described above, this paradigm has been used in many prospective person memory studies. This paradigm is useful because it allows me to examine prospective person memory in a controlled setting at the same time as manipulating variables I would be unable to manipulate in a field study. Field studies in prospective person memory are very difficult to conduct because prospective person memory is so low to begin with. When you take a prospective person memory study out of the laboratory you risk recognition levels reaching floor. Additionally, these types of studies rely on dichotomous data and require establishing that that participant viewed the wanted person alert and had the chance to see the wanted person.

Although a laboratory computer based paradigm may not be ideal to represent the conditions of prospective person memory in the real world, I believe the paradigm used in both experiments is a good representation of what takes place in real world prospective person memory.

A second limitation to consider is the fact that the images of the men wanted for aggravated assault likely stood out on their own compared to the images of men wanted for computer fraud. The stereotype that most people had for individuals that commit aggravated assault stood out more against the backdrop of a natural foods store. When one enters a natural food store they probably do not expect to see men with neck tattoos staring wide-eyed at a bottle of alcohol. Most people, however, would probably not be surprised to see “geeky” looking men
concentrating on the coffee they are buying at a natural foods store. Therefore, it is possible that the images depicted individuals as matching someone that committed aggravated assault simply stood out too much in the shopping task.

A final limitation to consider when interpreting these results is the fact that photographs were used to depict the criminal description. Despite the fact that these images were created based on norming data about people stereotypes of individuals that committed aggravated assault and computer fraud, it is inherently difficult to perfectly replicate a stereotype in a still image. Because the stereotype most people had about men that committed aggravated assault was easier to depict in still images, recognition may have been affected. The stereotypes gathered in the norming process for Experiment 1 included more physical attributes for those that committed aggravated assault and more character attributes for those that committed computer fraud. Therefore, it is possible that using still images in the shopping task affected prospective person memory. Because of these limitations, it is important to conduct further experiments on prospective person memory to examine the memory mechanisms involved and correct for the limitations of the current studies.

**Future Directions**

The results from Experiment 1 that people were better at recognizing individuals depicted as having committed aggravated assault compared to those that committed computer fraud could be due to the fact that the individuals depicted to match the aggravated assault stereotype stood out too much against the backdrop of a natural foods store. In order to eliminate this possibility, future research could be conducted where foil individuals were depicted to match the aggravated assault description. For example, eight new foils could be photographed where four would be depicted as matching the aggravated assault description and four would be depicted as matching
the description of someone that committed computer fraud. By switching out these foils I would be better able to tell whether participants are recognizing the target individuals because they are remembering their faces or because the aggravated assault description simply stands out too much.

Another way to expand this research and account for some of the limitations from the current research would be to conduct these experiments using video footage instead of still images for the shopping task. It would be possible to use the same paradigm used in the current experiments with video footage going down the shopping aisles. By using video footage I would be able to better depict the stereotypes of someone that committed aggravated assault and computer fraud because one would be able to see the kinetic movement of the individuals. I would also be able to include more information about the individuals dress, as the camera would likely capture a full body image.

There really is no limit to the number of ways prospective person memory could be researched. Due to the fact that this type of research is still in its infancy, the number of variations that could be instituted is limitless. As research in this area develops, so will our understanding of prospective person memory as well as basic memory mechanisms in general.

Conclusion

Prospective person memory and attention are crucial to understand when trying to locate wanted or missing individuals. Although the research in this area is still in its infancy, great steps are being made towards understanding in these areas. In the current research several criminal elements were examined to understand their effect on prospective person memory. A substantial amount of evidence was found to support the general idea that the more match between criminal elements the better prospective person memory is going to be. That being said,
more research in the area is necessary to fully understand the memory mechanisms associated with prospective person memory. Practically speaking, it appears that the inclusion of a criminal profile on wanted persons posters might be beneficial to law enforcement.
References


Cognitive Psychology, 7, 480-494.


Table 1

Means and Standard Deviations for Experiment 1 Norming Items

<table>
<thead>
<tr>
<th>Item</th>
<th>Aggravated Assault</th>
<th>Computer Hacking</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Looks Like</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dirty</td>
<td>4.68 (1.04)</td>
<td>3.89 (1.59)</td>
<td>t(39) = 1.90, p = .07</td>
</tr>
<tr>
<td>Tattooed</td>
<td>4.64 (.85)</td>
<td>&gt; 2.84 (1.12)</td>
<td>t(39) = 5.83, p &lt; .001*</td>
</tr>
<tr>
<td>Unkempt</td>
<td>4.82 (.85)</td>
<td>4.21 (1.32)</td>
<td>t(39) = 1.78, p = .08</td>
</tr>
<tr>
<td>Wild looking eyes</td>
<td>4.32 (1.36)</td>
<td>&gt; 3.37 (1.42)</td>
<td>t(39) = 2.18, p = .04*</td>
</tr>
<tr>
<td>Has facial hair</td>
<td>4.45 (1.34)</td>
<td>4.16 (1.07)</td>
<td>t(39) = .78, p = .44</td>
</tr>
<tr>
<td>Clean</td>
<td>2.36 (.95)</td>
<td>2.84 (1.17)</td>
<td>t(39) = -1.44, p = .16</td>
</tr>
<tr>
<td>“Geeky”</td>
<td>1.91 (.97)</td>
<td>&lt; 5.21 (.98)</td>
<td>t(39) = -10.83, p &lt; .001*</td>
</tr>
<tr>
<td>Wears glasses</td>
<td>2.09 (.97)</td>
<td>&lt; 4.89 (1.45)</td>
<td>t(39) = -7.37, p &lt; .001*</td>
</tr>
<tr>
<td>Average</td>
<td>4.00 (1.23)</td>
<td>4.53 (.77)</td>
<td>t(39) = -1.61, p = .12</td>
</tr>
<tr>
<td><strong>Dresses Like</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheap clothing</td>
<td>4.50 (.80)</td>
<td>&gt; 3.68 (1.60)</td>
<td>t(39) = 2.11, p = .04*</td>
</tr>
<tr>
<td>Dark clothing</td>
<td>4.77 (1.19)</td>
<td>4.68 (1.38)</td>
<td>t(39) = .22, p = .83</td>
</tr>
<tr>
<td>Torn clothing</td>
<td>4.18 (1.30)</td>
<td>&gt; 3.00 (1.76)</td>
<td>t(39) = 2.47, p = .02*</td>
</tr>
<tr>
<td>Old work boots</td>
<td>4.32 (.89)</td>
<td>&gt; 2.68 (1.92)</td>
<td>t(39) = 3.58, p &lt; .001*</td>
</tr>
<tr>
<td>Hoodie/sweatshirt</td>
<td>4.50 (1.10)</td>
<td>4.95 (1.22)</td>
<td>t(39) = -1.23, p = .23</td>
</tr>
<tr>
<td>Sloppy</td>
<td>4.77 (.81)</td>
<td>4.42 (1.30)</td>
<td>t(39) = 1.05, p = .30</td>
</tr>
<tr>
<td>Nice clothing</td>
<td>2.14 (.99)</td>
<td>2.42 (1.26)</td>
<td>t(39) = -.81, p = .42</td>
</tr>
<tr>
<td>Button-down shirt</td>
<td>1.95 (.72)</td>
<td>2.53 (1.39)</td>
<td>t(39) = -1.69, p = .10</td>
</tr>
<tr>
<td>Sci-fi/videogame</td>
<td>2.32 (1.17)</td>
<td>&lt; 4.11 (1.82)</td>
<td>t(39) = -3.79, p &lt; .001*</td>
</tr>
<tr>
<td>Cargo pants</td>
<td>3.36 (1.36)</td>
<td>3.74 (1.48)</td>
<td>t(39) = -.84, p = .41</td>
</tr>
<tr>
<td>Nice slacks</td>
<td>1.86 (.99)</td>
<td>2.00 (1.25)</td>
<td>t(39) = -3.39, p = .70</td>
</tr>
<tr>
<td>Dress shoes</td>
<td>1.86 (1.04)</td>
<td>1.89 (1.05)</td>
<td>t(39) = -.10, p = .92</td>
</tr>
<tr>
<td><strong>Expect to see</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash register</td>
<td>4.77 (1.02)</td>
<td>4.53 (1.39)</td>
<td>t(39) = .65, p = .52</td>
</tr>
<tr>
<td>Alcohol aisle</td>
<td>5.36 (1.05)</td>
<td>&gt; 3.05 (1.35)</td>
<td>t(39) = 6.16, p &lt; .001*</td>
</tr>
<tr>
<td>Meat Section</td>
<td>3.86 (1.52)</td>
<td>3.26 (1.24)</td>
<td>t(39) = 1.37, p = .18</td>
</tr>
<tr>
<td>Frozen food</td>
<td>3.23 (1.48)</td>
<td>&lt; 4.21 (1.08)</td>
<td>t(39) = -2.39, p = .02*</td>
</tr>
<tr>
<td>Snack aisle</td>
<td>3.55 (1.34)</td>
<td>&lt; 4.68 (1.42)</td>
<td>t(39) = -2.65, p = .01*</td>
</tr>
<tr>
<td>Fruit section</td>
<td>1.95 (.95)</td>
<td>2.21 (.92)</td>
<td>t(39) = -.87, p = .39</td>
</tr>
<tr>
<td>Vegetable section</td>
<td>1.86 (1.04)</td>
<td>2.21 (1.03)</td>
<td>t(39) = -1.07, p = .29</td>
</tr>
<tr>
<td>Electronics</td>
<td>3.77 (1.63)</td>
<td>&lt; 5.37 (1.07)</td>
<td>t(39) = 3.64, p &lt; .001*</td>
</tr>
<tr>
<td>Health &amp; fitness</td>
<td>2.50 (1.34)</td>
<td>1.84 (1.07)</td>
<td>t(39) = 1.72, p = .09</td>
</tr>
<tr>
<td><strong>Shopping for</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>5.27 (.88)</td>
<td>&gt; 3.26 (1.66)</td>
<td>t(39) = 4.93, p &lt; .001*</td>
</tr>
<tr>
<td>Meat</td>
<td>4.41 (1.37)</td>
<td>&gt; 3.37 (1.54)</td>
<td>t(39) = 2.30, p = .03*</td>
</tr>
<tr>
<td>Pizza</td>
<td>3.64 (1.43)</td>
<td>&lt; 4.84 (1.21)</td>
<td>t(39) = -2.88, p = .01*</td>
</tr>
<tr>
<td>Coffee</td>
<td>3.05 (1.59)</td>
<td>&lt; 4.42 (1.71)</td>
<td>t(39) = -2.67, p = .01*</td>
</tr>
<tr>
<td>Chips</td>
<td>3.64 (1.43)</td>
<td>4.53 (1.47)</td>
<td>t(39) = -1.96, p = .06</td>
</tr>
<tr>
<td>Fruit</td>
<td>2.27 (1.16)</td>
<td>2.58 (.96)</td>
<td>t(39) = -.91, p = .37</td>
</tr>
<tr>
<td>Item</td>
<td>Aggravated Assault</td>
<td>Computer Hacking</td>
<td>t</td>
</tr>
<tr>
<td>--------------------</td>
<td>--------------------</td>
<td>------------------</td>
<td>-------</td>
</tr>
<tr>
<td>T.V. Dinners</td>
<td>3.86 (1.55)</td>
<td>4.47 (1.35)</td>
<td>t(39) = -1.33, p = .19</td>
</tr>
<tr>
<td>Energy drinks</td>
<td>4.50 (1.41) &lt;</td>
<td>5.26 (.81)</td>
<td>t(39) = -2.09, p = .04*</td>
</tr>
<tr>
<td>Office supplies</td>
<td>1.36 (.58) &lt;</td>
<td>3.68 (1.80)</td>
<td>t(39) = -5.73, p &lt; .001*</td>
</tr>
<tr>
<td>Facial Expressions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td>5.18 (.91) &gt;</td>
<td>3.47 (1.39)</td>
<td>t(39) = 4.72, p &lt; .001*</td>
</tr>
<tr>
<td>Seriousness</td>
<td>4.41 (.96)</td>
<td>4.67 (1.28)</td>
<td>t(39) = -.73, p = .47</td>
</tr>
<tr>
<td>Blank Stare</td>
<td>3.95 (1.43)</td>
<td>3.95 (1.47)</td>
<td>t(39) = .02, p = .99</td>
</tr>
<tr>
<td>Distrust</td>
<td>4.41 (1.05)</td>
<td>3.74 (1.48)</td>
<td>t(39) = 1.69, p = .10</td>
</tr>
<tr>
<td>Sad</td>
<td>2.55 (1.10)</td>
<td>2.11 (.81)</td>
<td>t(39) = 1.44, p = .16</td>
</tr>
<tr>
<td>Smug</td>
<td>4.00 (1.02)</td>
<td>4.58 (1.07)</td>
<td>t(39) = -1.77, p = .08</td>
</tr>
<tr>
<td>Neutral</td>
<td>2.86 (1.39) &lt;</td>
<td>4.05 (1.08)</td>
<td>t(39) = -3.02, p &lt; .001*</td>
</tr>
<tr>
<td>Anxious</td>
<td>4.41 (1.14)</td>
<td>3.84 (1.57)</td>
<td>t(39) = 1.33, p = .19</td>
</tr>
<tr>
<td>Smiling</td>
<td>2.27 (1.28)</td>
<td>2.63 (1.26)</td>
<td>t(39) = -.90, p = .37</td>
</tr>
<tr>
<td>Concentrating</td>
<td>3.95 (1.29) &lt;</td>
<td>5.42 (.61)</td>
<td>t(39) = -4.53, p &lt; .001*</td>
</tr>
</tbody>
</table>

* Indicate significant differences at p < .05
Table 2

*Means and Standard Deviations for Experiment 1 False Alarm Rates.*

<table>
<thead>
<tr>
<th></th>
<th>Aggravated Assault Charge</th>
<th>Computer Fraud Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AA Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Load</td>
<td>.03 (.03)</td>
<td>.07 (.05)</td>
</tr>
<tr>
<td>No Cognitive Load</td>
<td>.04 (.04)</td>
<td>.03 (.03)</td>
</tr>
<tr>
<td><strong>CF Description</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Load</td>
<td>.06 (.03)</td>
<td>.04 (.05)</td>
</tr>
<tr>
<td>No Cognitive Load</td>
<td>.03 (.03)</td>
<td>.04 (.04)</td>
</tr>
</tbody>
</table>

*Note: AA stands for aggravated assault and CF stands for Computer fraud.*
Figure 1. Mean hit rates as a function of criminal profile and criminal description. AA stands for aggravated assault and CF stands for Computer fraud.
Figure 2. Mean hit rates as a function of criminal description and criminal charge. AA stands for aggravated assault and CF stands for Computer fraud.
Figure 3. Mean hit rates as a function of criminal profile and criminal charge. AA stands for aggravated assault and CF stands for Computer fraud.
Figure 4. Mean hit rates as a function of cognitive load and criminal charge.
Appendix A
Example Wanted Posters for Experiment 1

WANTED FOR AGGRAVATED ASSAULT
THIS PERSON IS NOT A WANTED FUGITIVE. HOWEVER, IF YOU RECOGNIZE THIS PERSON DURING THIS STUDY PLEASE INDICATE SO HITTING THE 'Y' KEY ON YOUR KEYBOARD

Name: PETERSON, Jason John
DOB: 11/19/1991
Race: CAUCASIAN
Sex: Male
Height: 5'00
Age: 22
Hair: BLOND
Eyes: GREEN
Weight: 155

WANTED FOR COMPUTER FRAUD
THIS PERSON IS NOT A WANTED FUGITIVE. HOWEVER, IF YOU RECOGNIZE THIS PERSON DURING THIS STUDY PLEASE INDICATE SO HITTING THE 'W' KEY ON YOUR KEYBOARD

Name: PETERSON, Jason John
DOB: 11/19/1991
Race: CAUCASIAN
Sex: Male
Height: 6'00
Age: 22
Hair: BROWN
Eyes: BROWN
Weight: 155
Appendix B
Example Shopping Slides

Example of slides with product and people.

Example of slides with only product.
Appendix C  
Example Shopping Slides of Target Individuals

Slides of target individuals wanted for aggravated assault.

Slides of target individuals wanted for computer fraud.
Appendix D
Example Wanted Posters for Experiment 2

Example of Aggravated Assault charge and Aggravated Assault Profile

**WANTED FOR AGGRAVATED ASSAULT**

*THIS PERSON IS NOT A WANTED FUGITIVE. HOWEVER, IF YOU RECOGNIZE THIS PERSON DURING THIS STUDY PLEASE INDICATE SO HITTING THE ‘H’ KEY ON YOUR KEYBOARD*

These men are Caucasian and between the ages of 20 and 25 years old. They are known to have multiple tattoos. They are likely dressed in cheap torn clothing and are wearing old work boots. These men have been described as having wild looking large eyes. They have been known to drink alcohol regularly and frequent bars. These men have been described as appearing angry.

All of the crimes committed by these offenders were in and around northeast Arkansas, suggesting they have strong ties to northwest Arkansas and Washington County. This is likely where they live, work, and/or shop. You may be standing next to them in line at the grocery store, sitting next to them at a baseball game, or working beside them. If you know someone who fits the characteristics described above please do not hesitate to report this information.

- White/male;
- Current age ~20 to 25
- Tattooed;
- Wearing cheap/torn clothing & work boots;
- Wild looking/large eyes;
- Drinks alcohol;
- Appears angry

Example of Computer Fraud charge and Computer Fraud Profile

**WANTED FOR COMPUTER FRAUD**

*THIS PERSON IS NOT A WANTED FUGITIVE. HOWEVER, IF YOU RECOGNIZE THIS PERSON DURING THIS STUDY PLEASE INDICATE SO HITTING THE ‘H’ KEY ON YOUR KEYBOARD*

These men are Caucasian and between the ages of 20 and 25 years old. These men would likely be described as “geeky.” They probably dress in t-shirts with sci-fi or videogame designs on them. They have been known to consume a lot of energy drinks and coffee to stay awake. These men would mostly likely be described as having neutral expressions or looking as though they are concentrating very hard.

All of the crimes committed by these offenders were in and around northeast Arkansas, suggesting they have strong ties to northwest Arkansas and Washington County. This is likely where they live, work, and/or shop. You may be standing next to them in line at the grocery store, sitting next to them at a baseball game, or working beside them. If you know someone who fits the characteristics described above please do not hesitate to report this information.

- White/male;
- Current age ~20 to 25
- “Geeky”;
- Sci-fi/videogame t-shirts;
- Drinks energy drinks and coffee;
- Neutral expressions/concentrated expression