Weapon Focus Effect on Auditory Memory

An Honors Thesis (Honors 499)

by

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Abstract

In the present study the possibility of weapon focus influencing auditory memory was explored. Weapon focus refers to the finding that the presence of a weapon impairs memory for other visual information, such as the perpetrator's physical characteristics. In the present study the target character in a video either carried a handgun or a popular soft drink and held a conversation with a control person that varied in difficulty of comprehension. Witnesses tried to remember visual and auditory information about the target. Accuracy of memory for the content of the target's speech was impaired by the presence of a weapon, but only if comprehension was difficult. The evidence suggests that the weapon focus effect crosses sensory modalities. Practical implications of the results are discussed.
Weapon Focus Effect on Auditory Memory

On several occasions, innocent people have been charged with crimes they have not committed because of the testimony of eyewitnesses. Take for instance the case of Robert Dillen (Hall, Loftus, & Tousignant, 1984), in which an innocent man was identified by 13 different victims of various crimes after his mug shot was made available to several police departments. It turned out that the original charge was eventually dropped and his photo taken out of police lineups. What would have caused several witnesses to identify this man as the perpetrator of various crimes? Why did their memory "fail" them and lead them to falsely accuse this man? These and other questions need to be addressed and researched in order to prevent innocent people (like Dillen) from being prosecuted for crimes they did not commit. Studies have shown that participants asked to view mug shots of "innocent people" after viewing a perpetrator in a video recording made several more identification errors than did the participants who did not view the mug shots after the video (Hall et al., 1984).

The United States Supreme Court has believed that witnesses' confidence of an identification (via photo lineup or police lineup) is directly related to their accuracy of their choice (Neil v. Biggers, 1972). However, studies by Deffenbacher (1980) and Wells and Murray (1984) have suggested that the relationship between confidence and accuracy of eyewitness identifications is lacking sufficient evidence to be considered significant. This finding is of considerable importance when taking into consideration the impact
and implications that eyewitness testimony can have in a courtroom (especially when a witness identifies someone as the perpetrator of a crime in the courtroom).

It has been suggested that memory for peripheral details (details not directly associated with the crime, e.g. color of the victim's pants, etc.) is linked to the number of people (distractors) around the scene of the crime while it is in progress or shortly before. In a study conducted by Cutler, Penrod, and Martens (1987), witnesses had a better memory for details that were considered peripheral in nature when there were two distractors in the crime scene than the witnesses who viewed a crime scene with five distractors. In the same study, witnesses who observed crimes committed in an outside setting reported more accurate peripheral details than those who witnessed the crime in an inside setting (in this particular study, a liquor store).

Perception of time was also suggested to be overestimated by witnesses in the Cutler et al. study. In the condition in which the robber was seen for 30 seconds, the witnesses overestimated the viewing time by 174%. In the condition in which the robber was observed for a longer amount of time (75 seconds), the witnesses overestimated the viewing time by 41%. These results help researchers to understand the importance of studying the different aspects of eyewitness memory and how accurately witnesses can remember details when they are influenced by other information.

Witnesses' memories can also be affected by details that are directly related to the crime. If the perpetrator is carrying a weapon, witnesses remember less peripheral information (Loftus,
Loftus, & Messo, 1987), which can be crucial information. Loftus et al. reported that witnesses who viewed a scene in which a weapon was involved were correct only 15% of the time when identifying the perpetrator via a photo lineup, compared with an accuracy rate of 35% for those witnesses who viewed a scene in which a neutral object was present (chance performance on the 12-person lineup test was 8.5%).

For further support of these findings, one can look to Steblay’s (1992) meta-analysis of the weapon focus effect. In her findings, she concludes that of all the experimental tests that were included in the analysis, there was a consistent result of greater accuracy for correct lineup identification in conditions where weapons were not present. Furthermore, accurate descriptions of the target’s physical features (clothing, facial features, etc.), were greatly reduced when a weapon was present in the condition. It also appears that the weapon focus effect is accentuated by longer time periods between the witnessed scenario and the lineup identification task. O’Rourke, Penrod, Cutler, and Stuve (1989) included in their experiment witnesses who ranged in age from 18 to 74. They concluded that their results do support the notion that eyewitness memory can be affected by the weapon focus effect and it can also be generalized to people of all ages.

Loftus et al. (1987) found that witnesses gazed more frequently and for longer periods of time at a weapon than at a neutral object. They attributed the weapon focus effect to weapons attracting visual attention for some reason, possibly because weapons are usually considered threatening, that they produce anxiety, or because they are unusual objects. In order to test the
hypothesis that the unusualness of a weapon, rather than the threat associated with it causes the weapon focus effect, Pickel (1998) conducted experiments manipulating both the perceived threat of the object carried by a target in a video as well as its unusualness within the situation. The results were that unusualness, but not threat, decreased witnesses' ability to describe the target accurately. A follow-up study (Pickel, in press) has provided additional support for the hypothesis that weapons attract attention because they are unusual in most contexts.

How do individuals allocate attention during an event? This is important in further understanding eyewitness testimony in courts of law or when identifying an individual to a police department. Wickens (1984) suggests that attention in humans comes from separate resource pools in the brain. In one particular stage which he labels "modalities of input" (p. 79), Wickens recognizes the modalities of visual and auditory input. He argues that auditory and visual modalities draw upon separate resource pools and therefore it is possible for individuals to effectively time-share two activities that use different pools (e.g., typing a paper while listening to music). However, in some instances, two tasks might collectively be so demanding that they compete for resources from the general pool, which contains both of the smaller pools.

In other words, as long as both the visual and auditory tasks are relatively easy, then sufficient attention can be given to both, and performance would be good. However, when either the auditory or visual task exceeds the limit of its particular resource pool, it must
then draw upon the general resource pool, taking away from the amount of resources available for the competing task.

If two tasks draw attention from the same pool (because both tasks are visual or both are auditory), performance is likely to suffer. Pezdek and Hartman (1983) supported this hypothesis by testing children's abilities to remember both auditory and visual information when given the information simultaneously. They manipulated the children's television observation by either presenting a visual distractor (a toy they could play with) or an auditory distractor (a record playing in the background). They found that the toy (visual distractor) interfered with the children's later visual memory of the television program, but not with their auditory memory. Furthermore, the children's auditory memory for the television program suffered when there was music playing in the background, but not when they played with a toy.

This leads to the following question in relation to eyewitness memory: Does the weapon focus effect cut across sensory modalities? In other words, could a weapon (which is a visual stimulus) affect auditory memory when witnesses are asked to remember details from both modalities? It is possible that the attention given to the weapon would exceed the limited resources in the visual resource pool, taking more resources from the general pool and therefore decreasing a witness's capacity to remember auditory information. Auditory memory should be especially harmed if the auditory task is especially demanding (e.g. if the witness is trying to monitor and remember the semantic content of a hard-to-comprehend conversation).
The purpose of the present study was to manipulate both whether or not a weapon was present and the difficulty of comprehension of auditory information to see if there would be any effects on witnesses' later memory for auditory details. Participants watched one version of a videotape depicting an interaction between a man (the target) and woman at a business establishment. The man carried either a weapon or a neutral object, and the content of his speech was either easy or difficult to comprehend. After watching the video, the witnesses tried to remember information that included both auditory and visual details. It was predicted that the two independent variables would interact so that witnesses would remember less auditory information when the target carried a weapon rather than a neutral object, but only if the level of comprehension was more difficult.

Method

Participants

The participants were 217 psychology students enrolled at Ball State University (Indiana). The mean age of the students was 20.21 with a standard deviation of 3.80. Sixty-five of the participants (30%) were male and 152 (70%) were female. The students received course credit for participating. They were tested in groups of 1 to 8 students.

Materials

A videotape was created which was set in a bar and grille. The opening scene shows the exterior of the building, including a window whose lettering identifies the business as a bar and grille.
scene includes an interior shot which depicts a female worker answering a phone while in the process of cleaning up the bar after business hours. The video then shows a man, who is the target, entering the building through a back door. The woman is unaware the man has entered the building at this time. She continues to converse with her friend over the phone until she hears a noise (the man knocking something over in the background). She then tells her friend she thinks she has heard something and asks if she can call her back at a later time. After hanging up the phone, the woman walks towards the door which leads to the kitchen area of the business. The video then returns focus to the man and through the man's "eye-view" the participants see that he is walking through different areas of the building, including a stairway which leads to the kitchen.

In different conditions, the man is next seen either holding a 20 oz. bottle of a popular soft drink or a handgun in his right hand. The man and woman meet in the kitchen and converse. In different conditions, their conversation is either "easy" or "difficult" to comprehend. To manipulate difficulty of comprehension, the researchers considered a Bransford and Johnson (1972) study in which participants showed poorer recall for stories they did not understand. In the Easy condition, the man asks the woman, "Are you here alone? I found out what time this place closes, so I knew you would be. I hope you're not planning on calling the police" (he laughs at the end of his statement). The conversation is deemed "easy" to comprehend because it can be readily understood in both contexts: In the condition in which the man holds a soda, it is
implied that he is a boyfriend or secret admirer who showed up at her workplace to surprise her, and, before she realized the noise she heard was made by him, she temporarily thought an intruder had entered the building. The woman reacts towards the man in a friendly manner, smiling when he asks her whether or not she is going to call the police, as if he is joking with her. She asks him, "How did you get in here?" in a relaxed state and also seems relieved when realizing it was the man who had caused the noise and not someone or something else. When the man asks her the same questions while holding the handgun, it is implied that he is an intruder who has been watching the business so that he could plan the best time to break in. It is also implied that he might harm the woman. Her reaction shows fear and uncertainty of who the man is and what he wants. When she asks him, "How did you get in here?" in this condition, she portrays more anxiety and apprehension, knowing that he intends to prevent her from using the phone to seek help.

The Difficult comprehension condition includes the man quoting lines from a poem immediately after he meets the woman in the kitchen. He says, "Did you open it? I arise from dreams of thee in the first sleep of night; the winds are breathing low and the stars are burning bright" (he then laughs). The woman then asks, "You sent that letter to me?" This conversation can be interpreted in two different ways; in the soft drink condition, the man seems to be a boyfriend or an acquaintance of the woman who has been secretly admiring her from afar. The woman seems surprised and a little delighted to realize that this may be her admirer when she asks if he
sent her the letter. In the handgun condition, the man seems to be someone who is stalking the woman. The woman reveals her surprise when asking if he sent the letter and seems to be frightened of the probability that this is the man who has been stalking her. The man's statement was intended to be difficult to understand regardless of whether he has a soft drink or a handgun. The woman's question (You sent that letter to me?) helps give the man's statement a context and helps the listeners to interpret the situation. However, the woman's question comes after the man's statement, and therefore it is hard for the participants to understand the meaning of his words as they hear them (see Bransford & Johnson, 1972). In both conditions of difficult comprehension, the script remains the same, and it is up to the observers to decide what they think is the relationship between the man and the woman. The running time for each version of the video is three minutes and fifteen seconds.

Design and Procedure

There were three independent variables that were manipulated in the experiment: whether the target was holding a soft drink or a handgun, whether or not the conversation between the man and woman was "easy" or "difficult" to comprehend, and whether the target was present in photo and audio line-ups that were used in questioning the participants after they viewed the video. The design of the experiment was 2 x 2 x 2 factorial with all independent variables manipulated between participants.

When arriving at the testing session, participants were told that they would watch a brief videotape and complete several
questionnaires afterwards. Each group was randomly assigned to one of the eight conditions. After viewing the videotape, the witnesses spent approximately 10 minutes completing a filler questionnaire involving student housing options.

Next the witnesses filled out a questionnaire requiring them to remember information from the video. The first section focused on the woman, who served as the control person. The questions included both multiple choice and cued-recall questions that asked about weight, height, hair length and color, approximate age, ethnicity and clothing. Witnesses were also asked about other physical features of the woman, including jewelry, eyeglasses, tattoos, scars, birthmarks, etc. Witnesses then answered questions concerning what the woman had said in the video while talking on the phone (actual content) and also about various vocal qualities the woman possessed, including volume, rate, level of pitch, amount or variation in pitch, and emotional tone. Witnesses were also asked whether or not they had noticed any speech impediment or accent the woman may have had.

The second section of the questionnaire requested identical information concerning physical and vocal qualities of the man. Witnesses then answered whether or not the man had been carrying an object in the video, and if so, to identify it and to rate the degree in which they found it unusual (using a 7-point scale). Next, they rated the degree to which they thought the man and woman knew each other and the degree to which they felt the man acted threatening towards the woman. The concluding questions asked
witnesses to summarize briefly what had happened in the videotaped story and to report their age and gender.

After completing the questionnaires, the witnesses were individually asked to identify the target in a 7-person photo line-up as well as identifying the voice of the target in a 6-person audio line-up. There were two different conditions of the line-ups: target-present and target-absent. If a witness was randomly assigned to the target-present condition, both visual and audio line-ups contained the target. Similarly, witnesses in the target-absent condition did not see the target in either line-up. In both conditions of the photo line-ups, the photos were randomly arranged in two rows on a desktop. Witnesses were told the man seen earlier in the video might not be present in the photos, and witnesses were allowed to point to an index card labeled "not pictured" if they wished. The males shown in the photos were dressed similarly (casual attire) and were similar in terms of height, weight, and physical appearance. After witnesses made their decision, they were asked to rate their confidence their decision was accurate on a 7-point scale.

Following the photo line-up, witnesses attempted to identify the target's voice while listening to six male voices via audiocassette. The voices were similar in tone, volume, and rate, and each voice read the same sentence: "The tide was out and the sun shone on the white sand of the beach" (see Yarmey, 1991). This sentence never appeared in the video. Two different orders of the voices were designed for both target-present and target-absent conditions to help avoid order effects. The witnesses were randomly assigned to one of
the orders. After making their choice, witnesses were again asked to rate their confidence in the accuracy of their decision on a 7-point scale. Finally, the witnesses were thanked and debriefed.

Results

The memory questionnaires were evaluated by two judges working independently of one another. The judges used an answer key that specified what would be considered correct responses. For each witness, separate scores were calculated that reflected the number of items accurately remembered about the appearance of the female worker (the control person) and the target. Furthermore, they computed separate scores reflecting the accuracy of the witnesses' memory for the content of each character's statements and their memory for the character's vocal qualities. The judges determined whether the witnesses had correctly answered the questions about the object carried by the target, and they categorized witnesses' answers regarding the story depicted in the video: witnesses' responses suggested that the worker and target were either friendly, threatening, or the relationship was described in some other way or was not specified.

It was expected that memory for the female worker's characteristics would not be affected by either the object manipulation or the comprehension manipulation. Those expectations were supported. A two-way analysis of variance found no significant effects for the following dependent variables: Memory for visual details ($M = 7.20; SD = 3.47$), memory for the content of her
speech ($M = 4.49; SD = 2.17$), and memory for vocal characteristics ($M = 2.81; SD = 1.26$).

**Memory for Visual Details of Target Person** A two-way analysis of variance showed a significant main effect of Object, $F(1, 213) = 7.30, p = .007$. Witnesses remembered less accurate information about the target if they saw the handgun ($M = 5.37; SD = 3.47$) rather than the soft drink ($M = 6.60; SD = 3.28$).

**Photo Line-Up** After conducting a two-way analysis of variance for dependent variables associated with the photo line-up, the following results were found: There were no significant main effects or interactions for the proportion of hits (correct identification in the target-present conditions), proportion of correct rejections (target-absent conditions), or proportion of accurate responses (using both conditions; an accurate response is a hit or correct rejection). There were also no effects found concerning the witnesses' confidence ratings of their choices.

A one-way analysis was used to test for order effects because witnesses were given line-up tests individually. There were six order conditions (orders 6, 7, and 8 were combined due to small sample sizes for those three orders). There were no differences in hits, correct rejections, accuracy, or confidence due to testing order.

**Memory for Auditory Details of Target** There were no significant effects related to the witnesses' memory for the target's vocal characteristics. However, a two-way analysis of variance revealed a
difference in memory for content of speech involving the independent variables of object and comprehension difficulty (see Figure 1). There was a main effect of difficulty of comprehension, $F(1,213) = 43.71$, $p = .001$, with witnesses remembering more in the Easy condition ($M = 1.82; SD = 1.29$) than in the Difficult condition ($M = 0.87; SD = 0.81$). Furthermore, an interaction was found, $F(1,213) = 7.44$, $p < .007$. A post hoc Newman-Keuls test revealed that when comprehension was easy, the same amount of content information was remembered by witnesses who saw the target carrying the soft drink ($M = 1.74; SD = 1.43$) and those who saw him carrying the handgun ($M = 1.91; SD = 1.14$). However, when comprehension was difficult, witnesses in the soft drink condition remembered more accurate information ($M = 1.19; SD = 0.81$) than did witnesses in the handgun condition ($M = 0.58; SD = 0.71$).

**Audio Line-Up** Results of the audio line-up revealed the same results as in the visual line-up. There were no significant main effects or interactions found for proportion of hits, proportion of correct rejections, or proportion of accurate responses. There was also no effect on hits, correct rejections, accuracy, or confidence when looking for order effects (orders 6, 7, and 8 were combined due to small sample sizes for those three orders as they were for the photo line-up).

**Identification and Unusualness of Object Carried by Target** In the soft drink condition, 97 witnesses (92%) answered correctly in identifying the object, while two (2%) answered incorrectly and
seven (7%) did not answer. In the handgun condition, all witnesses correctly identified the object.

Witnesses who named an object held by the target were asked to rate how unusual they thought it was the target was carrying that particular object. A two-way analysis of variance revealed a significant main effect of object, $F(1,204) = 13.98$, $p < .001$. The gun was rated as more unusual ($M = 4.18; SD = 2.08$) than the soft drink ($M = 3.13; SD = 1.91$).

**Interpretation of the Relationship Between Target and Control**

Witnesses were asked to speculate about what the target was doing in the bar and grille and about the nature of the relationship between the man and woman. Responses were coded as either reflecting the opinion that the target was at the bar and grille to commit a crime (robbery, murder, rape, etc.) or that he was a friend/admirer of the woman, or the witnesses' answers fell into the category of "other/neither."

Witnesses' interpretations of the relationship varied by object condition, $x^2(2, N = 217) = 73.48$, $p < .001$. In the soft drink condition ($N = 106$), 42% of the witnesses thought the man was a friend coming to see the woman, 1% thought the man had come to commit a crime, and 57% had a different idea or did not specify the relationship. In the handgun condition ($N = 111$), 32% thought the man had come to commit a crime, 1% though the man was the woman's friend coming to visit, while 70% interpreted the relationship otherwise or failed to specify the relationship between the two people.
Witnesses found the man more threatening towards the woman if he was holding the gun ($M = 4.08; SD = 1.73$) rather than the soft drink ($M = 2.46; SD = 1.40$), $F(1,213) = 58.47, p < .001$. The witnesses also thought it less likely the man and woman knew each other when the handgun was present ($M = 4.05; SD = 1.90$) as opposed to when he had the soft drink ($M = 5.37; SD = 1.55$), $F(1,213) = 31.01, p < .001$.

**Discussion**

The results suggest that witnesses' memory for visual details is affected negatively by the presence of a weapon. Witnesses who observed the target with the handgun remembered fewer visual details about him than did witnesses who observed him with a soft drink. This supports the theory of multiple resource pools (Wickens, 1984), in that when the witnesses' visual resource pool was "overloaded" by the presence of the handgun, memory for other visual information suffered as a result. However, the comprehension of the conversation (whether difficult or easy to understand) had no effect on visual memory, even if the auditory resource pool was "overloaded" because the conversation was difficult to understand, hence using more auditory resources from that pool. A similar separation of auditory and visual memory was found by Pezdek and Hartman (1983).

When witnesses were tested for a description of the target's vocal qualities, no significant effect was found in any of the conditions. The witnesses were able to retain this information even if the handgun was present (which because of its unusualness would
take more resources from the visual pool than the soft drink would) because monitoring and remembering the target's vocal qualities would theoretically draw very little resources from the auditory pool, thus not hindering memory for auditory details. However, witnesses' memory for the content of the target's speech did suffer when his speech was considered difficult to comprehend, especially when a weapon was visible. This again is consistent with the theory of multiple resource pools. The presence of a handgun did not affect the witnesses' memory for auditory information, except when the witnesses' auditory pool had to deal with an overload of information (a difficult conversation to comprehend), in which case auditory memory suffered.

The results from both the photo line-ups and the voice line-ups support the notion that sensitivity of information is a concern when questioning witnesses. Memory for descriptive information (e.g., a questionnaire involving recall and cued recall) is a more sensitive measure of a witness's memory than a photo or voice line-up. In studies that support the weapon focus effect, it has been found that this effect is more noticeable on questionnaires that ask cued-recall questions, rather than in the line-up identifications (e.g., Pickel, 1998).

It is interesting to note that in the present study, witnesses found the handgun to be both more unusual and more threatening than the soft drink. Two prior studies (Pickel, 1998; Pickel, in press) have found that the weapon focus effect may rely on unusualness of an object alone and that threat of the object is not a strong predictor of this phenomenon.
It should be understood that there may be limitations of the present results. The notion of realism should be considered. It is often difficult to present an experimental situation in which a participant would truly feel threatened (a target carrying a gun, for instance), and therefore one might question the external validity of the results. While studying the weapon focus effect, however, it would be unethical for researchers to place participants in situations where they would fear for their life (e.g., using actors to portray a real life situation in which they may threaten the participant with a gun, without the participant's knowledge that the gun is not real and can not hurt him or her). A "real" environment would probably have more of a realistic atmosphere than a videotaped scenario, but on the other hand several researchers have been successful in achieving the weapon focus effect while using slides or video (Loftus et al., 1987; Pickel, 1998; Steblay, 1992). Therefore, this method an effective means of producing the effect.

There may be several practical implications from the results of the present study. Eyewitness testimony is given considerable weight in our legal system. A false identification or accusation could incriminate an innocent person (Hall et al., 1984). Hopefully, investigators and the legal system are considering the results of prior research which shows a weapon focus effect on memory for visual information reported by witnesses. An eyewitness's memory can be affected if a weapon was present because both the weapon and the perpetrator's physical characteristics demand attention from the same visual resource pool. This is a situation that must be considered by investigators when accepting eyewitness testimony.
Likewise, if investigators are relying on "earwitness" memory, the present study suggests that it may be also important to take into consideration whether a weapon was present. For instance, if a person is having a casual conversation while sitting at a bar with another person and he or she sees a perpetrator approaching the bartender with a visible weapon, the witness's resource pools may be torn between fixating visually on the weapon and concentrating on the conversation. The focus on the weapon might harm the witness's auditory memory, especially if the perpetrator's statements are complex in nature or hard to follow.
Fig. 1 Witnesses' memory for the content of the target's speech.
References


