Who Is the Better Witness: A Closer Look into Memory Recall Abilities Between Men and Women

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Abstract: In everyday court proceedings, eyewitness testimony has been considered an extremely important piece of evidence. However, despite its common usage in the court of law, it has been known to be unreliable and has led to wrongful convictions in the past. Understanding the significance of differences in the memory abilities from person to person is important when attempting to use testimony in court in hopes of reaching a guilty verdict. To better understand the accuracy of one's memory, specifically, the differences between a biological male and female's memory, recall abilities between 15 male and 15 female participants were analyzed. While memory recall was the main focus of the study, the effects of a difference in estrogen levels was also considered in order to determine whether or not there was a correlation between memory recall and estrogen levels in different witnesses. It was assumed that the females had a higher estrogen level than the males; therefore, the females were hypothesized to perform better on the questionnaire. A week after the initial questionnaire, the participants were asked to recall specific details from a scene and the correct number of answers from each group of respondents was recorded. No significant difference between the memory recall abilities of males and the memory recall abilities of females were found. With this, no definite conclusions about the effects of the presence of estrogen in different witnesses can be made, but larger work can be done in order to determine whether or not causation is present between the two variables.

Keywords: Testimony, memory, estrogen, male, female

Eyewitness testimonies play a crucial role in our present-day legal system. When other evidence is lacking, the prosecution will depend on an eyewitness testimony in order to procure the guilty verdict that they need. With the importance of eyewitness testimonies in mind, it is important to note the little research that has been done to fully understand how inaccurate memory recall can differ from memories that are accurate (Gustafsson et al. 2019). However, there has been an increasing amount of evidence that calls into question the reliability of said eyewitness testimonies (Shermer et al. 2011). Despite this, there has been no significant decrease in the usage of eyewitness testimonies due to DNA not always being available in cases in which it is needed in order to exonerate the defendant (Wells and Olson 2003). The effects of inadequate testimonies have predominantly been seen in the Innocence Project, where wrongful convictions were able to be looked at more closely in order to determine the reason for the injustices that occur on a day-to-day basis (West and Meterko 2015). Between the years

1989 and 2014, 72% of the wrongful convictions that the Innocence Project was able to identify occurred because of eyewitness misidentification (West and Meterko 2015). This further exemplifies the importance of understanding just how reliable testimony can be from a witness, especially if a long period of time has gone by. One's short-term memory duration is entirely dependent on the individual; however, it is evident that one's short-term memory is limited by decay over time (Cowan 2009). Unfortunately, because of this, one's short-term memory is not the end-all-be-all in a trial, yet time and time again, it is considered as such. As eyewitness testimonies continue to be used in the court of law, it is important to understand whether or not there is a difference between the capabilities of a man compared to a woman when it comes to memory recall. While as a whole eyewitness testimony is deemed unreliable, it can be considered to be reliable when it is not contaminated (Wixted et al. 2018). With this notion in mind, focusing specifically on presumed estrogen levels and how they correlate to memory recall can provide insight into how to properly analyze eyewitness testimonies. Furthermore, it has been found that estrogen treatment has protective effects on aspects of memory for postmenopausal women, which continues to support the idea that memory is an abstract concept that has a variety of factors affecting it (Sherwin 2005). A likely explanation that has been found in support of this claim is the increase in the concentration of an acetylcholine synthesis enzyme that has proved to be critical for memory in the presence of estrogen (Carpenter 2001). However, these findings have not been consistent despite the data that supports the idea that estrogen influences cognitive functioning (Sherwin 1994). While numerical estrogen values were not able to be collected from the participants, it was an assumed notion that women innately produced more estrogen than men. Knowing this, recall abilities were assessed in order to determine whether or not there was a significant difference between biological males and females. To do this, males and females were tasked with recalling a scene after a week and the differences between their baseline answers and their recall answers were recorded.

Materials and Methods

Sampling Procedure

30 college students between the ages of 17 and 21 were used as subjects. These 30 students were chosen at random across the span of two weeks, but a relatively equal number of males and females were sought out. Students living in a dorm on campus were asked to participate as well as students in a chemistry course. This allowed for a relatively random sample collected overall. Of the 30 that were initially questioned, only 21 responded to the follow-up questionnaire.

Questioning Procedure

Each participant was asked to analyze a photo of a scene for 45 seconds. They were then asked to answer 8 questions about the scene directly after looking at the photo. The responses that were collected directly after looking at the photo were considered the baseline for comparison a week later. After 7

days had gone by, the participants were sent the questionnaire containing the same 8 questions in the same order, but they were not given access to the photo. The difference in the number of questions that were answered correctly after a week were then compared to the number of questions that were answered correctly during the baseline questioning.

Questionnaire and Photograph

The following 8 questions were asked to the participants:

1. How many people are in the foreground?
2. How many people are riding a bike?
3. How many people are wearing a green shirt, if any?
4. How many people are sitting on the park bench?
5. What color shoes is the woman closest to the camera wearing?
6. What object was in the background on the grass?
7. What colored shirt is the man with facial hair wearing?
8. Was the woman with the backpack wearing any accessories? If yes, what were they?

These questions were asked in order to evaluate both quantitative and qualitative aspects of the scene in order to assess whether there were any differences between the two categories. The scene that was used in this experiment can be seen in Figure 1.

Figure 1: Photo of park scene that was shown to each participant upon first round of questioning

Statistical Methods

A Fisher exact test was done to compare the number of correct and incorrect answers between the male and female respondents. A Fisher Exact Test of Independence is used to determine whether or not the proportions of one nominal variable are different compared to another nominal variable (Raymond and Rousset 1995).

Results

After the 21 participants responded a week following their baseline, the difference between the number of questions they got correct initially and the number of questions they got correct after a week was analyzed. Of the 120 total questions that were asked to the initial 15 females, 60 questions were answered correctly. This initial baseline for the females was similar to that of the males who had 67 correct answers out of 120 total questions. However, after a week had gone by, the females that responded were more likely to either answer the same number of questions correctly or get one more question correct. This differs from the males that were more likely to either get more than 1 question correct or get fewer questions correct than their baseline. With this being said, the 11 female respondents answered 7 more questions correctly after one week while the 10 males only answered 3 more correctly after the same amount of time. However, it should be noted that the differences in correct answers seen after a week were only compared to the people that responded, therefore the ratio between the total amount of questions answered and the total amount of correct answers is slightly different than what is seen in the baseline. These totals can be seen in Table 1. The number of total correct and incorrect answers for each question can also be seen in Figure 2. The Fisher exact test yielded a Fisher exact test statistic value of 0.5353. This value is not significant at $p < 0.05$, therefore there is no significant difference between the number of incorrect and correct answers between the male and female respondents.

Table 1: *Contingency table used for Fisher exact test comparing the number of correct and incorrect answers between male and female respondents a week after baseline*

	Correct Answers	**Incorrect Answers**	**Marginal Row Totals**
Males	42	38	80
Females	51	37	88
Marginal Column Totals	93	75	168 (Grand Total)

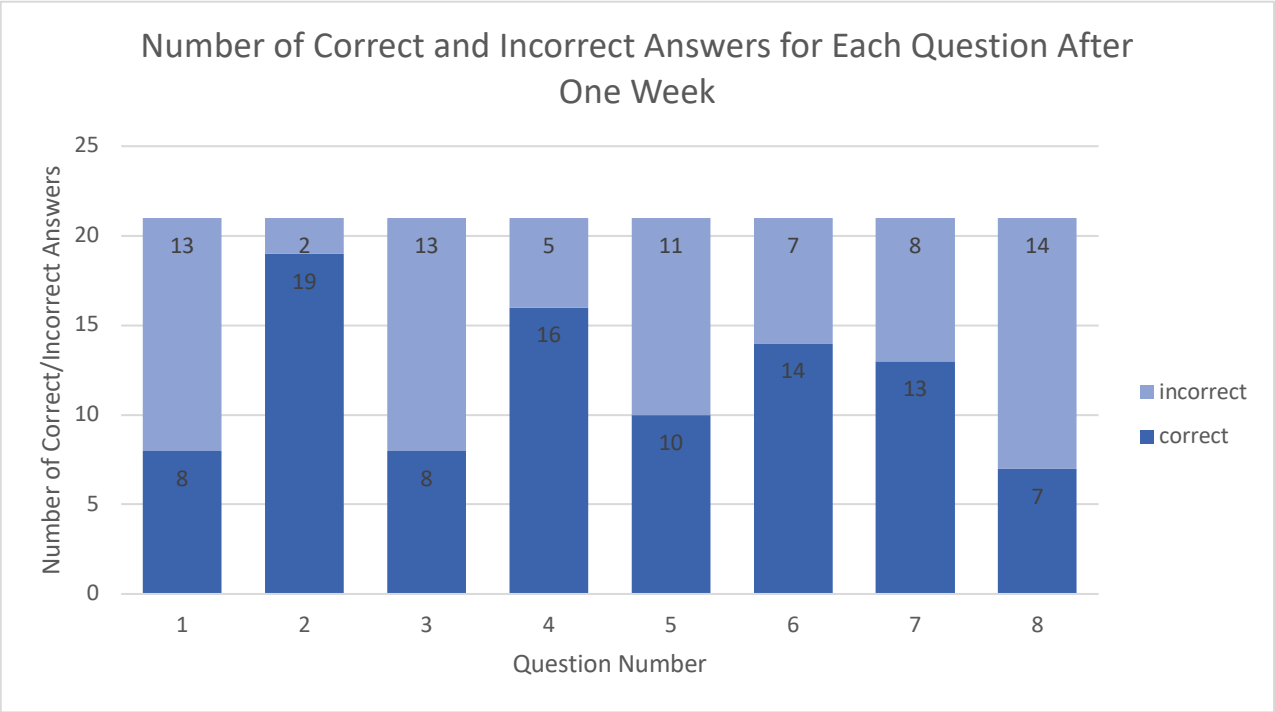

Figure 2: Bar graph comparing the number of incorrect and correct answers for each question in the questionnaire after a week

Discussion

While the data collected in this study was not considered significant, it is important to note the trends that were seen between the males and the females. After a week, the females answered approximately 58% of the questions correctly while only 52% of the questions were answered correctly by the males. Despite this being a slight difference and not necessarily statistically significant, it highlights the important fact that over time, the female respondents were able to recall more information than the males. Without significant results, it is unable to be determined at this time whether or not the assumed estrogen level in the female participants is a key factor in memory recall and whether or not there is any correlation between estrogen levels and accurate testimony. The limited number of responses that were received, a week after the baseline questionnaire was taken, is also a notable error in the design. Without a sufficient number of participants, it is hard to conclude the true effects of the study in order to draw any relevant conclusions. It can be said that after a week, both males and females answered more questions incorrectly than after only a few minutes. This supports the idea that as more time goes by, the reliability of the information that the witness has to offer grows more and more unreliable. This is true for both men and women, but with the underlying idea of estrogen levels in mind, it would be useful to expand this experiment and have a numerical estrogen value in order to use it in analysis. Furthermore, future studies can be done on a larger scale with more participants over a longer period in order to determine true causation and whether or not a person with more estrogen

in their system is intended to produce more accurate results when their memory is tested. To expand on this idea, the memory recall abilities of women that are experiencing a decline in estrogen levels could also be evaluated to see if females with higher levels of estrogen perform better than those with lower levels of estrogen. This could provide insight into if and how estrogen affects memory capacity in females and this information could then be applied to analyzing eyewitness testimonies in a new light. At the end of the day, the real question turns into who is the better witness? If a woman proved to be a more accurate witness over a certain amount of time, it would be interesting to see how this information would be used in court. It raises the question of whether or not an eyewitness that was female was looked at in a more positive light than their male counterparts in the same position. With the fragility associated with eyewitness testimony, and the weight it holds in court, having a better understanding of how memory works between the different genders would be a beneficial tool to consider while practicing law.

References Cited

Carpenter, S. 2001. *Does estrogen protect memory?* Monitor on Psychology. Retrieved December 2, 2021, from https://www.apa.org/monitor/jan01/estrogen.

Cowan, N. 2008. What are the differences between long-term, short-term, and working memory? *Progress in Brain Research*, 323–338. https://doi.org/10.1016/s0079-6123(07)00020-9

Gustafsson, P. U., Lindholm, T., and Jönsson, F. U. 2019. Predicting accuracy in eyewitness testimonies with memory retrieval effort and confidence. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.00703

Raymond, M., and Rousset, F. (1995). An Exact Test for Population Differentiation. *Evolution*, *49*(6), 1280–1283. https://doi.org/10.2307/2410454

Shermer O'Neill, L., Rose, K. C., and Hoffman, A. 2011. Perceptions and credibility: Understanding the nuances of eyewitness testimony. *Journal of Contemporary Criminal Justice*, *27*(2), 183–203. https://doi.org/10.1177/1043986211405886

Sherwin, B.B. 1994. Estrogenic Effects on Memory in Women. Annals of the New York Academy of Sciences, 743: 213-230. https://doi-org.srv-proxy1.library.tamu.edu/10.1111/j.1749-6632.1994.tb55794.x

Sherwin, B. B. 2005. Estrogen and memory in women: How can we reconcile the findings? *Hormones and Behavior*, *47*(3), 371–375. https://doi.org/10.1016/j.yhbeh.2004.12.002

Wells, G. L., and Olson, E. A. 2003. Eyewitness testimony. *Annual Review of Psychology*, *54*(1), 277–295. https://doi.org/10.1146/annurev.psych.54.101601.145028

West, E., and Meterko, V. 2015. Innocence project: DNA exonerations, 1989-2014: Review of data and findings from the first 25 years. *Albany Law Review, 79(3),* 717-796.

Wixted, J. T., Mickes, L., and Fisher, R. P. 2018. Rethinking the reliability of eyewitness memory. *Perspectives on Psychological Science*, *13*(3), 324–335. https://doi.org/10.1177/174569161773