Effectiveness of Echoic and Iconic Memory in Short-term and Long-term Recall

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Abstract

Objective: To see whether iconic memory or echoic memory is more effective at being stored and recalled as short-term and long-term memory in healthy adults.

Method: Eight healthy adults between the ages of 18 and 45 were tested in the study. Participants were shown a video containing ten pictures and ten sounds of easily recognizable objects. Participants were asked to recall as many items as they could immediately after the video and were then asked again after a series of questions.

Results: In younger adults more visual objects are able to be recalled both short and long term, but with older adults, in short term recall, the same number of sound and visual items where remembered, and with long term recall, sound items were remembered slightly better. Results also showed that iconic memory fades faster than echoic memory.

Conclusion*:* The ability to store and recall iconic and echoic information both short and long term varies with age. The study has several faults including relying on self-reporting on health for participants, and testing environments not being quiet in all tests.

Introduction

There are three main different types of memory: Sensory memory, short-term memory, and long-term memory. Sensory memory deals with the brief storage of information immediately after stimulation. Sensory memory is then converted to short-term memory if deemed necessary by the brain where it is held. After that, some information will then be stored as long-term memory for later recall.

Echoic memory and iconic memory are sub-categories of sensory memory. Echoic memory deals with auditory information, holding that information for 1 to 2 seconds. Iconic memory deals with visual information, holding that information for 1 second. All information that is kept from these two types of sensory memory must be stored as short-term memory before being stored as long-term memory.

Many studies have been done on echoic and iconic memory storage. One study by Elizabeth Irvine looked at the common theory of visual richness. According to this theory, our working memories are not capable of storing, processing, and accessing enough information to make up the rich qualities of our memories. The detail we see in our memories, according to the theory, is not consciously there, but is instead provided by a lower phenomenal level of conscious. The overflow of information from our visual sensory memory that our working memories just cannot process due to their smaller capacity becomes this phenomenal level of consciousness that is responsible for the rich qualities of our memories. This study questions and disproves the visual richness theory.

The study looked at first the process in which the theory was proved. A process called partial reporting is what is used to prove the visual richness theory. In the test participants are presented with an array of letters in a 4 by 4 square for a short set amount of time. Then letters disappear and after a period of wait time the participants are asked to report as many letters as they can remember. Scores for this part of the test are extremely low, averaging only 4 letters out of 12. The test is then done again but this time with a delayed cue to a line of letters they should remember. Participants do much better with 3 out of 4 letters remembered. Participants also report that they remember seeing all the letters but cannot report them. The conclusion was drawn that the participants' sensory memory with its large capacity was able to absorb a large amount of the letters that were shown, but their working memories with such a small capacity could not report them all. The fact that participants reported experiencing all the letters but not being able to report them lead the proposers of the theory to claim that this experience is the underlying phenomenal memory reported to cause this visual richness. (Irvine, 2011)

There is a major flaw with these findings and the conclusions drawn from it. First off the conclusions rely on outdated models of visual sensory memory. The visual richness theory relies on the view that sensory memory is made up of a highly detailed image that decays within a short period. With this view, the working memory processes, identifies, and stores as much as it can but much of the sensory memory is never processed and becomes that underlying phenomenal level that accounts for visual richness. The more accurate model of sensory memory is composed of two parts: a visual portion that stores things like shape and location and decays quickly and an information portion that stores information like identity for much longer than the visual portion. The partial report test is really testing the information aspect of visual sensory memory and not the actual visual portion of things, which would be where the visual richness would lie. Both the partial report test is inaccurate and the conclusions drawn from it as they both rely on a very outdated model of visual sensory memory. (Irvine, 2011)

This study points out several things in relation to mine, that visual sensory memory does not save a particular image to memory but rather the identifiable information for that image. The visual image shown for this tests will fade rather rapidly after being shown, it is the information on the items identification that will be what is stored in the memory for recall later in the test, not the location or any other part of the image. Our memories are more or less in this test storing similar information when using both echoic and iconic memory, identifying information on the presented object. (Irvine, 2011)

The objective of this test is to see whether iconic memory or echoic memory is more effective at being stored as short-term and long-term memory in healthy adults. Through this test it was hypothesized that short-term, people will store more of visual items using iconic memory. This hypothesis is contributed to the fact that our brains are constantly being exposed to visual

information that needs to be stored and used. We, as people, rely on our sense of sight more than any other of our sense in an everyday setting, so it is plausible to conclude that our brain will store more visual (iconic) information than information from any of the other sense like echoic.

It was also hypothesized that over a period of time iconic memory will fade faster than echoic, allowing echoic memory to be more effective and remembering information long term. I contribute this to the fact that we are constantly receiving visual stimulus from the world around us and because our bodies rely more on sense of sight than any other sense. It is plausible to conclude from that information that because of the constant stimulus of visual information, that much is passed over in short-term to long-term storage.

Method

The study and test was designed to be performed by healthy adults between the ages of 18 and 45 with no known memory conditions. All eight participants fit into this category. The sample of participants in the test was a convenience sample. Participants were gathered through random selection among several family members and friends who were avaliable.

In the test participants were shown into a quieter room and the test was explained to them. A video was shown to each participant with a total of 20 items on it, 10 of those items being sound and 10 items being visuals. All items were easily recognizable pictures or sounds. Participants were instructed to watch the video and told that immediately afterwards they were to try and write down as many as the items as they could remember. Participants were allowed as much time as needed to write down their remembered items.

Participants were also informed they were to answer simple questions after this part of the test. The questions were used as a distraction to the next part of the test and the answers to the

questions were not recorded for each participant as they were deemed irrelevant to the results. Questions were all of a simple nature, easily answerable by most people with a high school education level and everyday life experience and all questions were the same for all participants. Questions were asked for 5 minutes then stopped and the next part of the test was taken.

Uninformed before, participants were asked to again list as many of the items or sounds that they could remember from the previous video. The video was not played again and participants were still allowed all the time they needed to complete their lists.

Data collection was handled orally and by paper. Name, age, and gender were self-reported by the participant. The number of items remembered were written and collected on paper and counted and added to the data after the participant was done with their test.

The main focus of the test was whether more visual or sound objects would be better remembered and stored into memory for recall, although other factors were looked at in the study. A comparison between ages on the number of sound objects vs. visual objects remembered, the total number of objects remembered, and the number of items lost between each test.

Results

Data from this study can be found in Appendix A.

Out of the 8 participants the average number of remembered items for sound was 6.1 for the first trial and 5.4 for the second trial. There were a total of 10 sounds in the test. The average number of sound items lost between the first and second trial for sound was 0.7 objects per participant. A majority of participants though did not lose any of their remembered sound items

between trials and the average is greatly affected by participants D and F as they are outliers compared to the other participants in the sound items remembered category.

Out of the 8 participants the average number of the remembered visual items was 6.9 for the first trial and 6.0 for the second trial. There were also a total of 10 visual items in the test. The average number of items lost between the first and second trial for sound was 0.9 objects per participants. Almost all participants forgot at least one visual item. Out of the 8 participants the average number of the total items remembered category was 13.0 for the first trial and 11.5 for the second trial. There were a total of 20 sound and visual items in the test. The average number of total items lost between the first and second trial was 1.5 objects per participants. All but two outlying participants forgot at least one item between the trials.

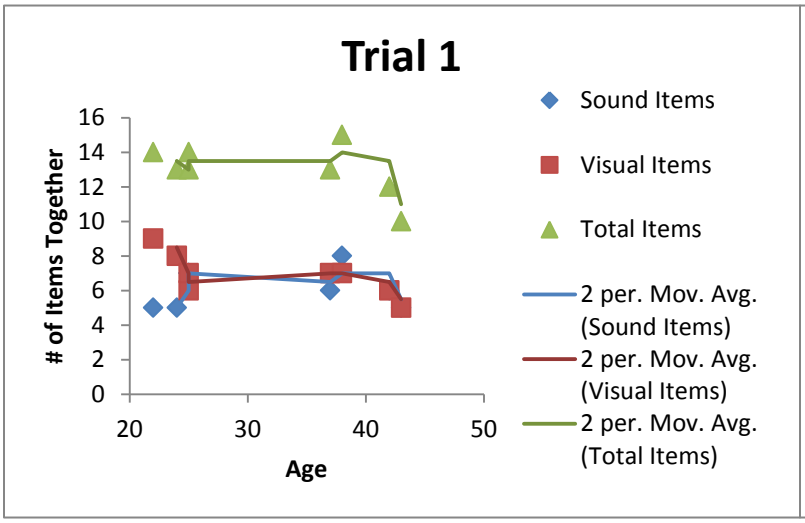

Figure A

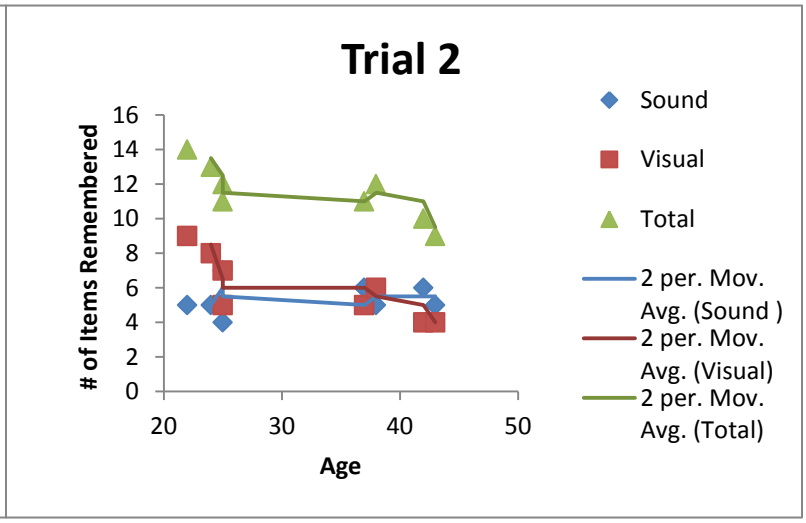

Figure B

Discussion

The hypothesis that iconic memory would be better remembered and stored short-term was not supported by this study. Although averages show that more visual items were remembered than sound items in the first trial dealing with immediate short-term recall, looking more closely at the data and at other factors, it appears that this is not the case. Figure A shows that for the first trial that visual information was better recalled the younger the person is and as the participants age increased the number of visual items and sound items recalled equaled out with neither being recalled more than the other. Although visual information is recalled better in younger people, in older generations there is no clear lead as to which type of items were recalled better, thus disproving the hypothesis that visual items are better remembered in short-term recall for all participants.

The hypothesis that echoic memory would fade slower than iconic memory and thus be better for long-term recall was partially supported by the experiment. On averages alone less sound objects are lost between the two trials, meaning that sound items were better stored in long-term memory than visual items. Although there is not a significant difference between the loss of sound and loss of visual items between the trials when looking at just the averages, individual participant data shows that the majority of participants lost visual items only, and only two participants lost sound items between the trials. This supports the part of the hypothesis that states that echoic memory will fade slower than iconic memory.

Part of the hypothesis that is not supported by the data is the part that states that echoic memory will become better for long-term recall. Figure B shows that the number of visual items recalled is still more or equal to the number of sound items recalled for trial 2 for most participants. Again results show that this is not true for all ages. Although visual is still better

recalled by the younger participants, older participants shifted again towards the same number of sound and visual items being recalled. The second trial does show that elderly participants recall sound items better long term, but this does not support the hypothesis that sound items are recalled more in the second trial as this is not true for younger aged participants.

The goal of the study was to find whether echoic or iconic memory was better stored and recalled in both long-term and short-term memory. The data implies that iconic memory is more effective in younger people in both short and long term storage and recall. As people age though, the ability to store and retrieve information short-term and long-term becomes less effective and iconic and echoic memory storage equals out. The study's biggest implications are the connections between age, sensory memory, and short and long term recall. Age appears to affect whether iconic amd/or echoic is the dominant sensory memory for storage and recall. The younger the participant the more visual items are recalled and thus iconic memory is the dominant type of sensory memory used for storage and recall. The other big implication of the study is that iconic memory fades faster than echoic memory. This is supported by the individual participant data as well as the calculated averages showing that more visual items were lost between trial 1 and 2 than sound items.

The study also shows another finding, that as adults age they are able to recall lesser items in total. In Figure A and Figure B, as well as individual participant data, show that the older the age of the participant, the less items the participant were able to remember in total. All the participants followed this trend with an exception of participant F who scored above those around his or her age on both trials. It is unclear as to why participant F scored higher than the other participants on the test.

The study by Elizabeth Irvine discussed earlier points out that more sensory information is collected that can be stored and processed by the working memory. This study done on iconic vs. echoic memory storage and recall shows that as in younger participants working memory favors storage and recall of visual information while in older participants the working memory equally processes and stores iconic and echoic information. The study by Irvine also pointed out that sensory memory quickly fades. This study on iconic vs. echoic also shows that visual information in a majority of participants faded slower just after stimulation of a visual image allowing more time for storage by the working memory for visual information but after that information is stored into the long term memory it fades or is replaced quicker compared to echoic memory. In other words, iconic memory may last longer in the beginning; after storage, it begins to fade quicker than its echoic counterpart. This conclusion is supported by the averages and participant data showing that more or the same number of visual items are stored as echoic, but after initial storage visual memory shows a larger loss between the two trials than rather than sound memory. (Irvine, 2011)

There are many faults in this study that may lead to inaccuracies in the data. First, not all locations where the testing was done were quiet environments. The many of the participants in these situation commented on the distracting effect that was created in the test that in turn affected how well they felt they had done. Another fault is with the questions asked after the first trial. Although the questions were meant to be equally answerable by all participants, gaps in education were apparent. The questions for some participants were vexing and required much contemplation and thought, while for other participants the questions required little to no thought to answer. The loss of items between trial 1 and 2 could have been easily affected by this fact. The experiment had all participants self-report any health issues that may impair their ability to

perform the test. This can be considered a fault in the test as participants could lie or be inaccurate about their own health information.

The significance of this test is not major. Although this study may change the way we look at iconic and echoic memory, the conclusions drawn from this study are not widely applicable to real life. One way the data can be applied is in teaching. The aid of sound in learning should help younger students store and recall information better due to the fact that echoic memory fades slower than visual memory, but because younger people better store and recall visual information according to this study, teaching students should include many visuals to aid in learning.

Conclusion

The study found that that overall neither iconic nor echoic is better for short-term and long-term recall in all people. The data shows that in younger people both short-term and long-term recall is better for their iconic memory rather than their echoic memory. Older people on the other hand are able to recall echoic and iconic memories equally short-term, but long-term they are able to recall slightly more echoic items or the same number of echoic and iconic items from the test. The study also shows that iconic memory fades quicker when stored long-term than stored echoic memories.

This data has not much major significance in the world today. It does though show that visual information is better stored and recalled in younger people. If this information was used in the classroom to making learning more visual, students may better remember and recall information for later.

Future studies need to be done with a larger data pool in order to further examine or clarify the results of this study. The results of this study lack a large data pool that is needed to make

more certain the results. Future studies should focus on age and could also look at other factors like gender that were not examined in this study. It appears in this study that iconic vs. echoic memory and age have a correlation.

References

Irvine, E. (2011). Rich experience and sensory memory. *Philosophical Psychology, 24*(2), 159-176.

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Appendix A

Participant	Age	Trial 1			Trial 2			Change Between Trials		
		# of Sound Items Remembered	# of Visual Items Remembered	Total # Remembered	# of Sound Items Remembered	# of Visual Items Remembered	Total # Remembered	# of Sound Items Lost	# of Visual Items Lost	Total # of Items Lost
A	22	5	9	14	5	9	14	0	0	0
B	24	5	8	13	5	8	13	0	0	0
C	25	7	6	13	7	5	12	0	1	1
D	25	7	7	14	4	7	11	3	0	3
E	37	6	7	13	6	5	11	0	2	2
F	38	8	7	15	5	6	12	3	1	3
G	42	6	6	12	6	4	10	0	2	2
H	43	5	5	10	5	4	9	0	1	1
# of Items		10	10	20	10	10	20	10	10	20
Average		6.1	6.9	13.0	5.4	6.0	11.5	0.7	0.9	1.5