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Think Again

Allison J. Smith and Rachael E. Wilson

A study was conducted to determine if people recall events as they actually exist or if schemas and prior expectations profoundly distort memories. The purpose was to establish if typical items present and not present in a particular scene would be recalled most frequently due to false memory, and if people are skeptical of their own mental abilities. Participants (n=45) briefly viewed 3 photos with typical and atypical items present and not present, then selected items they believed were in the picture. Analysis of the data partially supported our hypothesis because it indicated that typical and atypical items present were recalled the most (atypical was not included in the hypothesis), and typical items not present were recalled second most often.

An interactive experiment was conducted to assess how memory formation, memory reconstruction, and false recall affect mental processing abilities, particularly retrieval capabilities. In conjunction with utilizing a series of memory recall tests, a brief questionnaire was administered to establish participants' beliefs regarding their personal memory, their perception of their recall, and their demographic background information (i.e. age, gender, student grade level, grade point average, and program of study). The primary purpose of this experiment was to use a within-subjects design to determine if people actually recall situations as they exist or if they perceive the scenarios and then unintentionally employ their schemas and/or prior expectations to fill in the parts they think should be there. A secondary aim of this experiment was to determine the degree to which people are skeptical of how they recall items and events; however, since this was

not the main focus of the study, this aspect was found by analyzing the answers provided on the individual questionnaires.

An elementary understanding of certain variables utilized in this experiment should be acquired in order to gain heightened awareness and familiarity with the overall objective of this research. One basically needs to understand the foundation from which this idea was derived, and that entails grasping the notion of how the researchers believe information progresses within the human mind. First, according to Purdy, Markham, Schwartz, and Gordon (2001), memory can be defined as, “an internal record or representation of some prior event or experience” (p. 9). In addition, they state that an information-processing approach is used by the brain to convert sensory input into memory, whether it may be short or long-term memory, and that structure consists of three separate stages. Those levels are encoding, which involves changing received stimuli into a form recognized by the organism; storage, which is placing the encoded data in the mind for future use; and retrieval, which requires certain steps within the brain itself to extract the information that was stored (Purdy et al.).

A second paradigm that requires explanation is called the network model of memory, which is explained by Cook and Cook (2005) as the way associations between items encountered in life are stored. They state that memory works by having a central idea or node as a hub, which has corresponding items or beliefs connected and associated with it at varying strengths. This entire concept relates directly to schemas, which are frameworks that people use to organize and interpret information (Myers, 2004). A final element of this project that should be understood is memory reconstruction and false recall. Memory reconstruction involves recalling information that has been retained,

while unconsciously inferring the rest. According to Cook and Cook, memory reconstruction happens because memories are not mental copies of reality; therefore, when they are recalled by the individual, only some parts of the scenario are stored and the rest must be automatically inferred (i.e. using prior, similar experiences) in order to produce a complete, whole memory. Whereas, false recall (also referred to as false memory) is having memories for events or items that never actually took place or were there in the original condition, but instead only seem to fit with the given situation or prompt (Purdy et al.).

Along with acquiring the knowledge of the aforementioned elements comes understanding previous research performed in this field of interest. There have been extensive prior studies conducted concerning how memory configuration in general occurs, and how memory reconstruction and false recall affects the entire process. One such study was performed by Peters, Jelicic, Haas, and Merckelbach (2006) where they used 72 participants to evaluate how presenting a list of related words would lead those individuals to create a common word that links them all; however, that basic node was never stated to the participants. Consequently, they believed that hub word would be recalled frequently by the participants in various tests and that would suggest that false memory does affect retrieval ability. This particular study intertwined directly with our research because we both believe that memories placed into storage will change according to the preexisting schemas in a human's mind, which will then formulate the output people are capable of evoking. These experimenters found that reconstructive activity does occur significantly in tests of memory recall, and mentally healthy

individuals falsely recalled the hub word 65-80% of the time depending on the retrieval task that was given to them (i.e. a test of free recall or a test of basic recognition).

Another study that expands upon our preconceived belief that memory is not completely accurate and is subject to extreme distortions was carried out by Loftus and Manning (2001). These researchers utilized 276 participants and had them complete 40-item life event inventories. They then had these people entertain various imagined, hypothetical situations that could have happened to them when they were children based off their personal history. Finally, they had different participants take the same life event inventory again at diverse stages in time (i.e. one day, one week, or two weeks after the initial meeting) via the internet to determine if those imagined scenarios creep into their memories in any form. After statistical analyses were conducted, they discovered memories change with time and the more passage that happened, the more alteration and distortion tended to occur.

Along the same lines of working to pin-point how and where exactly the information-processing system fails, Goodwin, Meissner, and Ericsson (2001) did research that centered around trying to gain insight about assorted encoding strategies affect on recall aptitude. They used 80 participants and a procedure that had two various experimental conditions, which each had the two same basic levels. These researchers were testing to appraise how verbalizing words or remaining silent at the time of encoding changed the percentage of words recalled correctly on subsequent examinations. Their findings indicated that when the scenario trying to be encoded is elaborative or complex (i.e. story-like), it benefits the person to verbally discuss it while processing it in order to reduce the chances of false memories being formed. Whereas, if

the task is simple or repetitive in nature (i.e. remembering a list of words or numbers) the person should not articulate the items because it will substantially increase the likelihood of creating misconstrued information at the time of encoding. This discovery aided us in understanding how every level of the information-processing approach are all subject to undergoing system failures.

A notorious and prominent researcher in the field of false memory, Elizabeth Loftus, provides explanation about how this entire failure phenomenon may possibly occur in the first place. In an article authored by Loftus (2003), she described the numerous studies done by her and her associations, which ultimately lead her to conclude that the power of suggestion and the inability to simultaneously process incoming details is primarily how problems develop. She basically found that when questions are stated in a certain manner or if photographs and stories are doctored in subsequent viewings or recitations, it primes the individual to pullout related details from storage to facilitate a memory that seems most plausible with the given external cues. In addition, she established that human's memory is filled with an infinite number of similarly experienced events and the majority of them tend to eventually leak over into each other in order to provide maximum storage capacity in the mind. Loftus finally expressed that people tend to assume their personal memory is not prone to tremendous amounts of error; therefore, they typical convey memories, or false memories, with much confidence, which in turn makes people even more reassured in their recall ability.

Stemming from the idea that the lack of skepticism within people towards their own memory capabilities is very problematic, comes the implications of how it translates into societal functioning. Schacter (2001) stated in his research that in the late 1990s in

the United States more than 75,000 criminal trials were ultimately determined on the basis of eyewitness testimony alone. He went on to further describe how in an analysis he conducted on 40 wrongfully accused individuals (DNA evidence eventually exonerated them) that 36 of them were incarcerated based off mistaken eyewitness testimony. Schacter also explained how source misattributions, which is correctly recognizing information but not properly recognizing where it came from, and unconscious transference, which is unknowingly confusing memories of two similar events or objects, can both account for how the majority of false memory are created.

In a final experiment that contradicted our core beliefs, but ultimately assisted in our understanding of memory formation was conducted by Marsh, McDermott, and Roediger (2004). They recruited 36 participants in order to determine how the placement of the hub word on a list of related items influenced which words are eventually recalled. They performed systematic recognition and recall tests on the participants and finally found that false memories do occur frequently, but are not necessarily guaranteed when by priming people with certain information. They also decided that the emotional state of the individual is exceptionally important when encoding items into memory. These findings provided further proof that not only is memory incredibly malleable, but the idea of how memory precisely functions requires extensive future research since its capabilities are largely unknown.

Our research is primarily designed to add to the body of existing experiments, and thus it predicts certain aspects pertaining to the faintly understood topics of memory retrieval and formation as a whole. Our hypothesis states that if a participant is given a series of three photos with typical and atypical items present the person will recall the

typical items present most often (determined by the selected items on a given list including typical and atypical items present *and* typical and atypical items not present). Next, the person will recall the typical items not present the second most frequently due to false memory. In addition, we subsequently believe that participants do not generally realize how faulty their memory actually is, and lastly we predict all this knowledge could ultimately transpire into providing insight about the accuracy, or lack there of, pertaining to eye-witness testimony.

Method

Participants

The participants utilized in this research project consisted of Lindenwood University students recruited from the Human Subject Pool (HSP), as well as other university students not part of HSP, but interested in the study. Twenty-two men and 23 women from the ages of 17 to 27 ($M = 20.53$) comprised the final population, with all subjects, but one, being current undergraduate students (see Figure 1 for a compilation of class statuses). Among the participants, there was a very diverse set of student majors, where Psychology appeared most frequently with a total of nine students majoring in this area. The grade point averages of subjects ranged from 2.1 to 4.0 ($M = 3.23$). The students recruited from the HSP received extra credit for their introductory social science courses as compensation for their participation in this study; other students received Starburst© candy in return for their participation. The data collected from subjects with visual impairments was to be discarded; however, the subjects who participated in this study were not visually impaired in any such way. Data from one subject was discarded

because the subject's age was more than three standard deviations from the mean, making the subject an outlier.

Materials

A computer and printer were used to structure and print the informed consent forms, the non-standardized memory questionnaires, feedback letters, participant receipts, participant lists, experiment description form, data recording sheets, respondents answer sheets, and final experimental finding documents. The informed consent form allowed the experimenters to get documented consent from all participants via signature, which verified that the participants understood the activities entailed, any risks involved, the option to refuse participation and withdraw at any time and without any consequences, information will be unidentifiable and kept confidential, and questions may be presented to either experimenter at any time (see Appendix A). The memory questionnaire consisted of 12 items covering demographics, personal memory rankings, recently forgotten information or items, names of experimenters and experiment, and visual impairments (see Appendix B). The feedback letter simply thanked subjects for their participation, informed them of the purpose of the study, and listed experimenters' contact information for questions and follow-up information (see Appendix C). A respondent answer sheet was utilized after each scene was individually viewed for 20 seconds. The answer sheet was in a forced choice format that contained the five typical items present, five atypical items present, five typical items not present, and five atypical items not present. The participants were instructed to circle all the items they believed were present in the picture they previously viewed (see Appendix D).

A digital camera was utilized to capture the office, kitchen, and park scenes that were created by the experimenters, which contained the items listed in Table 1 (see Appendix E for sample picture). Photo paper in the dimensions of 5 X 7 (inches) was used to display the scenes with color detail. A pen was supplied to each participant so that they could fill out the required forms and select their responses on the questionnaire and answer sheet. A stopwatch was also used by the experimenters to designate time passage. The experiment was conducted in rooms that contained two desks, three chairs, and average wattage florescent lighting.

Procedure

All participants were tested individually in a private room and presented with two informed consent forms upon arrival. Participants read and signed both forms, and were verbally instructed to keep one of the forms for their personal records. The subjects then signed in on the experimenters' record sheet. A questionnaire regarding demographic information, their beliefs about their memory, and visual impairments they may have was given after they completed signing in. An anonymous subject identification number was assigned to each participant on the questionnaire and then used on subsequent answer sheets to ensure confidentiality. Next, participants were verbally informed that they would have 20 seconds to view one prearranged scene and then be asked fill out a data sheet corresponding to that scenario. They were also told that they would repeat this exact procedure two more times, for a total of three scenes.

After the instructions were understood by the subjects, one experimenter handed the participants a photograph while the other experimenter started the stopwatch. Once 20 seconds had elapsed, the participants were instructed to submit the picture back to the

experimenter, who in turn presented a single 20-item list answer sheet to the subjects with the verbal instructions to circle every item they believe they saw in the picture they just viewed. When the participants finished their selections, they were given a ten second break and then presented with the next prearranged scene. After the subjects completed all three viewing sessions and related respondent answer sheets, they were handed participant receipts and a feedback letters. The experimenters aided the subjects in properly filling out the participant receipts, and then debriefed the participants about the objective of the research project and how their information will be kept confidential. Lastly, the order of the three pictures was counterbalanced among the 45 participants using a Latin square design. This was done to reduce practice effect and minimize the influence of the order presentation.

Results

A one-way repeated measures analysis of variance (ANOVA) showed a significant difference between types of items recalled in each scene, $F(3, 42) = 5.017$, $p < .05$. Post hoc tests were then conducted to determine where the significant differences existed, and they revealed significance between five of the six pairs: typical-correct items and typical-added items, $t(44) = 18.005$, $p < .05$, typical-correct items and atypical-added items, $t(44) = 37.866$, $p < .05$, atypical-correct items and typical-added items, $t(44) = 10.595$, $p < .05$, atypical-correct items and atypical-added items, $t(44) = 20.437$, $p < .05$, and typical-added items and atypical-added items, $t(44) = 6.310$, $p < .05$. The paired items that revealed no significance were the typical-correct and atypical-correct items, $t(44) = .000$, $p > .05$ (see Table 2 for all means and standard deviations).

The results of the questionnaire indicated that the average number of tracking devices used was 2.24 on a scale ranging from one to seven. The average number of forgotten items or information within the past week was 2.68, with a range of 0 to 10. On a nominal scale rating memory, the majority of subjects rated their own memory as *average*, as opposed to the other categories: *poor*, *below average*, *above average*, and *superb*. The average agreeability rating of the statement, *I always recall all information and events I experience fully, completely, and accurately*, was 6.38, based on a scale from 0 to 10, with 10 being complete agreeability.

Discussion

The central findings of the analysis partially supported the hypotheses that typical items present and not present would be recalled in the greatest proportion out of the four categories of items. In congruent with the first hypothesis, typical items present were recalled the most; however, so were atypical items present, which occurred at the exact same averaged frequency. The latter part of the findings was a surprising discovery given that atypical items present and not present were hypothesized to be in the last two tiers in the sequence of most often recalled items. The results showed that anything present in the picture, regardless of typically, would be recalled more than items not even present, which does moderately agree with our first proposition because we stated that typical items present would be recalled the most.

The next hypothesis for our study specified that typical items not present would be recalled second most often, and this concept was fully supported due to this cluster falling into the second most commonly recalled group of items. After post-hoc tests were performed, the outcomes did demonstrate that the typical items not present were recalled

significantly more than atypical items not present and significantly less than the first two categories of present items (which were recalled at an equal amount). These results further reiterated the fact that typical items not present were remembered at the second most frequency, and this may be attributed to false memory given that these items were absent from each photo.

Secondary findings showed that people are generally skeptical of their mental capabilities. This was determined by the results of the individually administered questionnaire, which was a self-report measure. People typically used approximately two devices when trying to remember things they must do, they rated themselves moderately (an average of six out of ten) on a scale of having a perfect memory, and the majority of participants stated their memory as average (average was the most frequent response out of a five-item scale ranging from poor to superb). This concept of having skepticism towards one's own retrieval ability is a profound discovery because we were unsure how people generally regard their individual memory. We initially believed that people are not doubtful when it comes to things they believe they saw; however, the self-report answers revealed that people do in fact realize their personal recall might contain flaws and distortions.

All of these compiled data results can be further compared to previous research literature for the purpose of trying to establish general trends, consensus, and/or contrasts between findings. Our results did follow the preexisting notion that false memory does significantly intertwine with recall ability, and that memory reconstruction does occur considerably within the majority of people's mental retrieval process. However, even though our data matched the trend of false memory being influential in recall, it diverged

when it pertained to the level of skepticism towards personal memory. The participants in our study did rate their memory as less than perfect and stated they do typically forget details, which showed people do believe their memory does contain errors. Previous references literature found the opposite belief because it stated that people in their research do not believe their memory is prone to misrepresentations. Consequently, there is some disagreement on whether or not people believe their memory is faulty when it comes to recalling events they observed.

Our study did find some significant results; however, it is not without limitations and error. First, because our population was limited to 45 Lindenwood University students, we were unable to get a representative sample of the general population. Also, many of our subjects were only interested in the extra credit compensation and, therefore, completed the experiment as fast as possible and inefficiently. This included mainly underclass (freshmen and sophomore) subjects recruited from the HSP. While conducting the study, several participants interrupted their 20-second viewing period by asking questions, or even announcing they were done viewing the scene.

In the future, we would be sure to gather a representative sample including more subjects across different demographics. Also, extraneous variables, such as noise and others entering and leaving, would be controlled for. Subjects would need to be adequately informed that they will have only 20 seconds to view the scenes, without interruption, including questions.

This experiment adds to the existing body of false memory knowledge and helps people further understand the extent to which their memory is prone to distortions. Furthermore, other researchers could build off of this study by integrating more pictures

and/or items into each scene. This would provide even more data to the faintly understood area of brain capabilities and neurology. Ultimately, the field of memory is not fully explored and any reliable information will only help people uncover the mysteries surrounding the human brain.

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Author Note

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Table 1*Items in Scenes*

	TYPICAL ITEMS PRESENT	ATYPICAL ITEMS PRESENT	TYPICAL ITEMS NOT PRESENT	ATYPICAL ITEMS NOT PRESENT
Office	Computer Pencils Opened Book Briefcase Desk Lamp	Coca-Cola© Bottle Iron Baseball Trix© Cereal Box Fork	Printer Calendar Book Ends Pens Stapler	Snake Birdhouse Spoon Mittens Blue Flowers
Kitchen	Teapot Coffee Maker Liquid Dish Soap Dishwasher Toaster	Dumbbells Pink Rubber Ducky Toilet Plunger Toolbox DVD Case	Wall Clock Oranges Dinner Plates Tea Cup Refrigerator	Yellow Rubber Ducky Luggage Laundry Basket Credit Card Ruler
Park	Tree Shadows Bench Dog Lamp Post Yellow Flowers	Stop Sign Television Set Treasure Chest Milk Gallon Apple	Bird Clouds Squirrel Child Purple Flowers	Do Not Enter Sign Dog Leash Scissors Water Jug License Plate

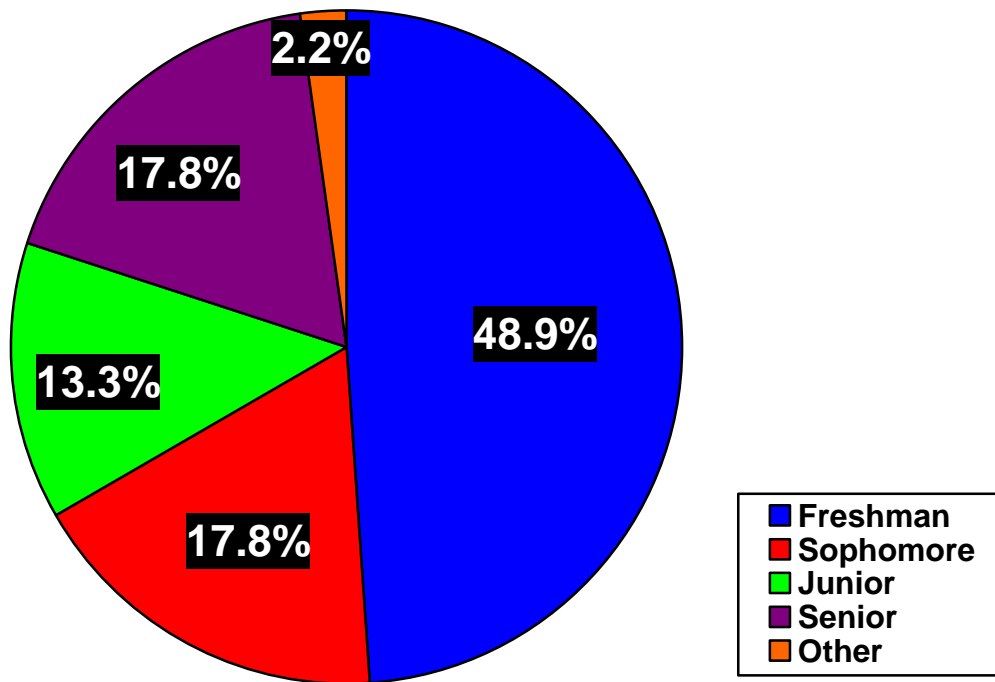
Table 2*Means and Standard Deviations of Items*

	MEAN	STANDARD DEVIATION
Typical Items Correctly Recalled	10.71	1.79
Atypical Items Correctly Recalled	10.71	2.82
Typical Items falsely recalled (Added)	3.11	2.69
Atypical Items Falsely Recalled (Added)	0.80	0.89

Figure Captions

Figure 1. Percentage of subjects recruited from each grade level.

Figure 1



Appendix A

Informed Consent Form

I, _____ (print name), understand that I will be taking part in a research project that requires me to complete a short questionnaire regarding my perceptions about my individual memory and participating in an experiment, which involves looking at three particular scenes and then recalling items I believed were present in the scene. I understand that I should be able to complete this project within 15 minutes. I am aware that my participation in this study is strictly voluntary and that I may choose to withdraw from the study at any time without any penalty or prejudice. I should not incur any penalty or prejudice because I cannot complete the study. I understand that the information obtained from my responses will be analyzed only as part of aggregate data and that all identifying information will be absent from the data in order to ensure anonymity. I am also aware that my responses will be kept confidential and that data obtained from this study will only be available for research and educational purposes. I understand that any questions I may have regarding this study shall be answered by the researcher(s) involved to my satisfaction. Finally, I verify that I am at least 18 years of age and am legally able to give consent or that I am under the age of 18 but have on file with the HSP office, a completed parental consent form that allows me to give consent as a minor.

 (Signature of participant) Date: _____

 (Signature of researcher obtaining consent) Date: _____

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Appendix B

Memory Questionnaire

SUBJECT ID NUMBER: _____ (Assigned by Researcher)

1) Are you: MALE FEMALE

2) Age: _____

3) Grade level: Freshman Sophomore Junior Senior Other:

4) Major: _____

5) Grade Point Average: _____

6) How do you keep track of things to do? (CIRCLE ALL THAT APPLY).

day planner your memory wall calendar other people post-its

electrical device (i.e. computer, personal digital assistant, cell phone)

other: _____

7) How would you rank your memory?

POOR BELOW AVERAGE AVERAGE ABOVE AVERAGE
SUPERB

8) **CIRCLE** on the scale of 0 to 10, how much do you agree with this statement **about yourself:** **I always recall all information and events I experience fully, completely, and accurately.**

0 1 2 3 4 5 6 7 8 9
10

Never True

Partially True

Always True

9) How many times in the last **7 DAYS** have you forgotten to do something? _____ times

10) What is the **name of this experiment**?

11) What is the name of the experimenters?

12) Do you have any visual impairments that are not corrected which would obstruct you from clearly viewing a **color photograph** and then circling answers on a data sheet? YES NO

Appendix C

Feedback Letter

Think Again

Thank you for participating in this study. The experiment will be used to determine whether prior knowledge and schemas influence a person's recall ability and how false memory manipulates that capability. The photographs used in the study contained typical items that were present, atypical items that were present, typical items that were not present, and atypical items that were not present. We predict that students will remember the typical items present in the scene the most, and then recall the typical items not present in the scene the second most often. For instance, in the office scene, we hypothesized that the computer, opened book, desk lamp, pencils, and briefcase would be recalled most often, followed by pens, book ends, stapler, calendar, and printer.

Please know that we are not interested in individual results, but the results of the group of participants as a whole. All identifying information about you will remain anonymous.

If you have any questions, please contact any of the following experimenters: Allison Smith or Rachael Wilson, contact information is found at the bottom of this letter. If you are interested in obtaining a summary of the findings, please contact us after May 18, 2008 and we will make it available to you.

Thank you again for your participation.

Sincerely,

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Appendix D

Experimenters cut between each scene selection and presented them one at a time so the participants did not have prior knowledge of what to look for in each picture.

Respondent Answer Sheet

Circle every item you believe you saw in the picture just presented to you.

computer	pencils	calendar	fork
Coca-Cola© bottle	baseball	briefcase	mittens
iron	opened book	desk lamp	pens
snake	birdhouse	book ends	blue flowers
printer	Trix© cereal box	spoon	stapler

Circle every item you believe you saw in the picture just presented to you.

teapot	toilet plunger	oranges	dishwasher
dumbbells	luggage	credit card	DVD case
yellow rubber ducky	toolbox	liquid dish soap	toaster
wall clock	laundry basket	ruler	tea cup
pink rubber ducky	coffee maker	dinner plates	refrigerator

Circle every item you believe you saw in the picture just presented to you.

bird	bench	stop sign	lamp post
do not enter sign	dog	child	gallon of milk
shadows from the trees	squirrel	purple flowers	apple
dog leash	scissors	television set	license plate
clouds	jug of water	treasure chest	yellow flowers

Appendix E

Materials Description

This study will require the use of three pictures of various commonplace scenes for the purpose of testing the participant about their recall ability. The three scenes will be: an office, a park, and a kitchen. This experiment will also have questionnaires that are administered to each participant, and will require the use of a data sheet to collect the data.

Sample Pictures

(Office)

