Memory Span Experiment Lab Report

Seven Plus or Minus Two Final Group Project

Amanda Ernstberger

Hanover College

Memory Span

Many cognitive theories discuss the existence of short term memory or working memory stores. The evidence for these stores exist with the mind's capacity to hold information before it is processed into long term memory. The purpose of this research is to explore that capacity and how much the mind can remember or recognize after a short period of time. The Memory Span experiment included five different types of stimuli, which were numbers, letters that sound different, letters that sound the same, short words, and long words. Participants are presented with a series of stimuli and after a period of time are asked to recall what was just presented to them. From previous research such as the Memory Span experiment is has been suggested that the capacity to hold information reaches its limits at seven plus or minus two items.

In order to further the previous findings it has been suggested to modify the memory span experiment to explore the effects different types of items have on memory and the magic number of seven. The current study explores digits and words as if the mind processes these in the same or different ways. This research explores whether the capacity will be the same for numbers or words of different lengths. It is expected that participants will recognize more 2 digit numbers than 4 digit numbers, as well as, more short words than long words. As part of this hypothesis, it is also expected that participants will be able to recognize more long words than long numbers.

Method

Participants

The participants in this experiment include 22 students who attend a Midwestern liberal arts college. The participants were contacted by the three researchers through e-mail and asked to volunteer. Their participation was not a requirement of any class and they did not receive credit for their involvement in the study. There were 6 males and 16 females participating in the experiment. The participants range in age from 18-25 years old and represent each grade level in which 4 were freshmen, 7 sophomores, 9 juniors, and 2 were seniors. All of the participants reported having either normal or corrected vision and wear glasses or contacts, which allows them to use acuity to see and read the stimulus if necessary.

Equipment

The equipment that was used for this experiment included a computer and a monitor. The computer was an E4300 Gateway model with a Pentium4 processor. The monitor had an LCD screen, was 15 inches in size, and had a resolution of 1024 x 780 pixels. The monitor model number was an FPD1565. The experiment screen is 350mm x 190mm and the background was grey. The Free Recall Memory Experiment was run on the computer through a program called Cognition Laboratory Experiments (Krantz, 2007). These programs and experiments were written in Java. Paper and pencils were also used to collect experiment results and responses from demographic questions for each of the participants.

Stimuli

There were two independent variables of this experiment added to the original experiment which studied the accuracy of memory span of numbers and letters. These include type of stimulus and length of the stimulus. There were two levels of each of these independent

variables creating four conditions for the participants to experience. Type of stimulus included either a word, or a series of digits. Length of the stimulus included either long or short. Short digits were created out of a series of 2 digits and long digits were created out of a series of 4 digits, both in which used the digits from 0-9. Short words were made up of 3-4 letters and long words were made up of 7-8 letters.

In order to manipulate the independent variables there were four conditions in the experiment corresponding to the two levels of the two additional independent variables. Each condition contained one level of type of stimulus and one level of length of stimulus, as seen in Table 1. Each level of the independent variable was repeated twice, such as two conditions contained words and two conditions contained digits. Across each condition level the stimulus remained constant at a one second duration for fixation target before block, a five second duration for each item being presented, with 30 seconds for participant recognition, and distance of .5 for word relative to x and y positions. The stimulus was also constant at a font size of 24.

Table 1. Four conditions

Condition	Type	Length
1	Word	Short (3-4 letters)
2	Word	Long (7-8 letters)
3	Digit	Short (2 digits)
4	Digit	Long (4 digits)

Procedure

In order to develop this experiment a list of words was created. A large list of words was needed in order for there to be enough stimulus words and extra words to be used as

distractor words during participant recognition so that no words were repeated throughout the entire experiment. The final list was comprised of 100 short words made up of 3-4 letters and 100 long words made up of 7-8 letters that were familiar to participants. Before the experiment took place informed consent was gathered from each of the participants. The participants were given instructions to complete each of the four conditions of the experiment and record the results on a given piece of paper. The computer randomized the order of the four conditions for the participants in which to complete them. Each trial consisted of 10 words or digit series and there were 5 trials within each condition for each stimulus and response from the participant.

In the experiment the participants sat at the computer and were presented with a fixation mark to focus their attention. A series of digits or letters creating a word, according to condition level, was presented to the participant in the middle of the screen where the fixation mark had been. The series of stimuli differed in length, according to condition level and could either be short or long such that short included 2 digits, or 3-4 letter words, and long included 4 digits, or 7-8 letter words. After the series of ten stimuli were presented in a row the participant was asked to recognize the words or digits they had just seen from a list presented to them on the computer screen. The given list was made up of the actual ten stimuli and ten distractor words or digits. The participants were to use the computer mouse and click on up to ten words or digits in no particular order they could recognize from their memory. The computer records this data according to the accuracy of the participants' recognition of the ten words or digits. A new trial began after the participant pressed the spacebar on the keyboard. The computer records the accuracy and computes the average of these for each condition. The results were then recorded on paper for each participant's four conditions. After the participants had completed the experiment

they were asked demographic questions which included gender, age, ethnicity, and class year at school. Participants answered these questions with pencil and paper. After this was completed participants were debriefed and thanked for their involvement.

Results

After the data was recorded, the results were then compiled into an SPSS data program to organize each participant's accuracy of word or digit recognition for the four conditions. A two-way between subjects ANOVA test was conducted to analyze the data collected and determine the relationship between the means of the four conditions. There was a significant main effect of length on recognition such that participants recognized short stimuli with more accuracy than long stimuli, $F(1,21) = 11.14$, $p < 0.01$. There was also a significant main effect of type of stimuli on recognition such that words were recognized with more accuracy than digits, $F(1,21) = 671.01$, $p < 0.01$. These main effects were qualified by a significant interaction between length and stimulus type, $F(1,21) = 68.06$, $p < 0.01$. This interaction showed that the effect of length depended on whether the stimulus was words or digits. This suggests that there is a bigger difference between words and numbers when the stimulus was in long word type. From these significant results a t-test was conducted to find the means of the variables. A t-test showed that when participants were presented with words, accuracy improved as length increased, $t(21) = -4.39$, $p < 0.01$. When participants were presented with digits, accuracy decreased as length increased, $t(21) = 7.34$, $p < 0.01$.

A graph has been constructed to display the results for memory span. Figure 1 shows the effect of stimulus type and length on accuracy. The stimulus was presented to the participants in

two different lengths either short or long which are graphed on the X axis. The other independent variable, type of stimulus is also shown as a line in the graph. The dark purple line marked with a diamond is the word type stimulus and the bright pink line marked with a square is the digit type stimulus. The Y axis shows the range of accuracy the participants had in making their judgements when recognizing the stimuli. According to Figure 1, there was a higher accuracy rate for participants across the word condition compared to the digit condition. This suggests that participants were able to recognize more words than digits over both the short and long conditions. Figure 1 also shows the interaction previously discussed which displays the differences in accuracy across the two variables. Participants recognized long words with more accuracy, while they also recognized short digits with more accuracy. This suggests that as the words became longer the accuracy increased, but as the digits became longer the accuracy decreased.

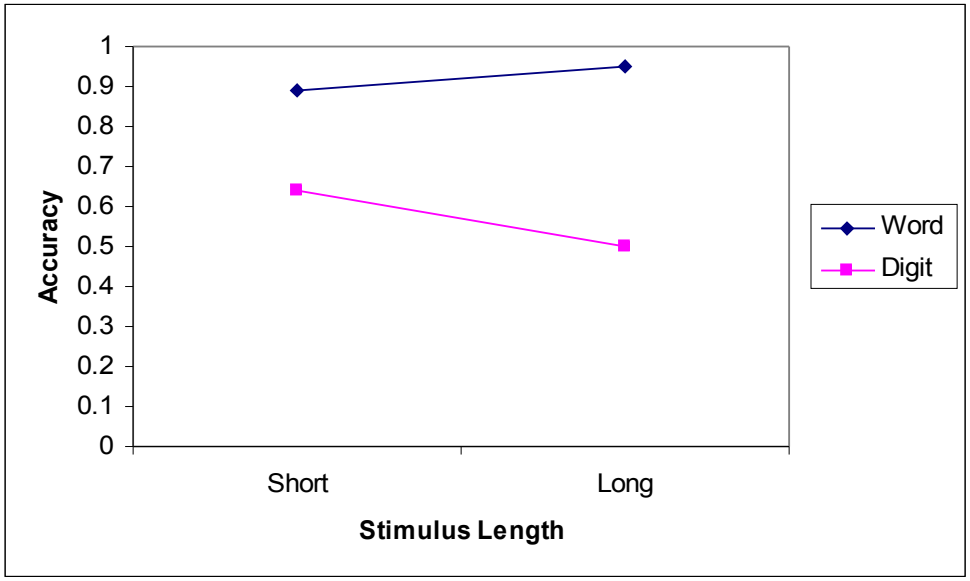
Conclusions

According to the significant results of this experiment, there was an effect of the independent variables found on the dependent variable. As expected, the current study found that participants did recognize more 2 digit numbers than 4 digit numbers and did recognize more long words than long numbers. These findings support the previous research in which short numbers are recognized with more accuracy than long numbers, because numbers are abstract in memory and harder to remember after a period of time. In this way, words can be recognized with more accuracy compared to digits, because words are read with automaticity.

Previous research by psychologist, Page, suggests that short words take less time to recite than long words, and if a person can recite the words more, they will remember more words.

Therefore, people remember short words more than long words (Page, 1998). The current study found results that would like to suggest something different. The hypothesis was however, only partially supported. Participants were expected to recognize more short words than long words, but instead had more accuracy recognizing more long words than short words. This may have occurred for a few reasons. The participants of this experiment were all college students who are required to do a lot of reading for their classes. Reading becomes an automatic process the more it is performed. As the participants were presented with the stimuli in the word conditions, both short and long, they may have found it easier to recognize the stimuli later, because it was automatic to read those words in the first place. Familiarity to the words may have also allowed the participants to chunk the information more easily. The words in both short and long conditions were created to be familiar to all participants. In this way, information about these words or associations with these words was possibly already existing in the long term memory of the participants. Solso suggests that chunking cannot occur until some information in LTM is activated. As the participants read the words presented to them, they were able to chunk more words based on familiarity. The more words participants can chunk the more capacity they have in short term memory and therefore can recognize more long words. Along with this, participants reported using stories or phrases to help remember the longer words. The participants reported that mnemonics were more easily used for the longer words than the shorter words which helped them have more accuracy. The results of this research, however, still do not specifically answer the questions about the capacity of short term memory and if seven really is the magic number.

Figure 1.



Page, M.P.A & Norris, D. (1998). The primacy model: a new model of immediate serial recall. *Psychological Review*, 105, 761-781.

Solso, R. L. (2005). *Cognitive Psychology*. Boston, Massachusetts: Pearson Education, Inc.