The phonological similarity effect in working memory psychology essay

A considerable amount of cognitive, behavioural research has been conducted on the working memory model and the role of the phonological loop and similarity effects on the serial recall paradigm. The purpose of this study was to extend the existing research available in support of the evidence for Baddeley and Hitch (1974) working memory model and the role of the phonological loop. A group of 18 undergraduate university psychology students were each subjected to two individual visual phonological tests to provide data on recall scores for a set of six similar and dissimilar letters. The data obtained was analysed separately before performing a using a two tailed paired related sample t-test. The results indicated that there was a statistically significant difference in scores obtained on recall of dissimilar and similar letters with higher scores being recorded on recall of dissimilar letters.

Introduction

The concept of a well-defined form of memory that is able to store information on a temporary basis whilst being utilised in the service of cognitive process is not new idea, but theories regarding the components that make up the short-term storage memory have evolved considerably during the last century (Gross, 2010; Myers, 2005).

The proposal of the ‘ multi-store model’ (MSM) by Atkinson’s and Shiffrin (1968) introduced the concept that short-term memory (STM) and long-term memory (LTM) had differing and distinct modes of storing information. This led to a considerable amount of research being conducted on how STM operated (Baddeley & Hitch, 1974). Particular attention has been given to auditory and visuospatial input along with acoustically similar or dissimilar

associations in the information being stored and the affect this may have on information recalled (Conrad, 1964; Wickelgren, 1965; Schulman, 1971; Atkinson & Shiffrin, 1968).

In Atkinson and Shiffrin (1968) model, the function of STM is said to provide a means of controlling and enhancing information before it makes it into long-term memory. This is done through rehearsal and coding strategies (Atkinson & Shiffrin, 1968). In 1974 Baddeley and Hitch introduced their “ Working Memory” (WM) model, a more dynamic system, as opposed to the more passive Atkinson and Shiffrin MSM (Baddeley & Hitch, 1974).

A definition of working memory can be stated as the collection of cognitive processes that allows information to be held temporarily in an accessible state, whilst in the service of some cognitive task (Baddeley, 2001). One of the important characteristics that differentiate the WM model from the Atkinson-Shiffrin (1968) MS model is the use of two distinct short-term memory buffers, the phonological loop and the visuospatial sketch pad and the argument that the independence of these buffers allow for a greater flexibility in memory storage (Baddeley & Hitch, 1974; Baddeley, 1986)

These short term memory buffers are two of the four components that make up the WM model (Baddeley, 1986). At the core is the central executive hub, which processes data and cognitive tasks, followed by the two memory subsystems; the ‘ visuospatial sketch pad’, which processes information received in either visual or spatial form and the ‘ phonological loop’ the area within the WM that deals with language information in auditory or visual form. The final component is the episodic buffer, which was introduced 20

years after the model was first proposed, which links all the components of WM with long-term memory to enhance function (Baddeley & Hitch, 1974; Baddeley, 1986; Baddeley, 2000)

According Baddeley (1986) the phonological loop is comprised of two individual subcomponents; the phonological store, sometimes called the ‘ inner ear’ which holds auditorily presented verbal information and the articulatory control process (ACP), sometimes called the ‘ inner voice’. Although limits to working memory are easily observed, ever since George Miller (1956) suggested people can recall approximately seven independent, items or ‘ chunks’ of information at a time, it has been more difficult to determine what specific cognitive faculties underlie these observed limits.

It has been proposed in several studies (Conrad, 1964; Wickelgren, 1965) that observed limit recall depends upon details of the stimuli. For example, immediate memory retrieval for lists of serial presented verbal information is better when the lists that contain letters or words that are dissimilar as indicated in the experiments performed by Conrad (1959) and Wickelgren (1965). Consequently it is claimed there is a correlation between phonologically similar and dissimilar information input and memory span, specifically that the recall for dissimilar words or letters would be greater than that for the similar ones presented either auiditorable or viusally (Conrad, 1964; Wickelgren, 1965; Muller, Seymour, Kieras, & Meyer, 2003; Eysneck & Keane, 2010).

The aim of this study was to examine the evidence for Baddel and Shiffrin’s (1974) WM model with the hypothises that there is a greater ability to recall

letters that are dissimilar in nature to those that share common phonological similarities.

Method

Participants

A total of 18 participants were recruited from within a group of undergraduate students, enrolled on the Swansea Metropolitan University's Psychology Joint Hons degree course. The participants ages ranged between 18 and 51 years, (M = 26. 89, R= 33, SD= 10. 26). The participant group was comprised of six males who's ages ranged between 24 and 51 years, (M= 35. 5, R= 27, SD= 11. 47) and 12 females who's ages ranged between 18 and 38 years, (M= 22. 58, R= 20, SD= 6. 5).

Materials

The study materials consisted of two sets of six sequence cards one set for the similar letters and one for the dissimilar letters. The similar letter set comprised of the letters P, E, V, T, C and G with the dissimilar letter set comprising of the letters J, H, P, V, X and F. Each participant was given a blank recall sheet to record their answers with researcher using a score sheet to record their individual scores for each set of letters.

Design

This quantitative within-subject study sought to investigate the scores obtained between two variables using the paradigm of serial verbal recall. The independent variable (IV) being the similar and dissimilar letter sets

used and the dependent variable (DV), being that of the recall scores of each participant. Scores were recorded between 0 and 6 for each of the tests; with only letters recalled in their correct positions being positively scored. All the data obtained was analysed using a two tailed paired related sample t-test within a SPSS package.

Procedure

Both the participants and researchers were all part of the undergraduate psychology course and due to the study being performed as part of their studies, no consent for was required to be signed. Participants were informed of the requirements for the study before each researcher selected two individuals from the participant pool in order to carry out the experiment, with each participant being tested individually and in isolation of the other.

The experiment procedure was explained to each individual participant prior to testing, with a test run being conducted in order to assure full understanding was reached. Each set of six similar and dissimilar letters were presented to the participant separately, with each letter card being presented visually for 1 second, with a 2 second delay between the presentations of each new letter. After all of the six letters had been shown a 5 second delay was counted down by the researcher to allow for rehearsal, before the ‘ Recall Now’ card was shown. The participant then attempted to recall the letters shown in their correct sequence of display on the recall sheet. This was repeated for the next set of letters, with the same procedures being repeated. There was no preference of order for the similar or dissimilar letter sets to be shown first.

The recall sheets were returned to the researcher who calculated their scores on each of the tests with all scores for each pair of participants collected by the researchers and collated together to give an overall data set of 36 sets of scores.

Results

Table 1: Comparison of recall scores between similar and dissimilar word sets

Test Type

Total Score

Mean

Participants (n)

Std Deviation

t

df

Sig. (2-tailed)

Similar

130

3. 66

36

1. 66

2. 38

35

0. 23

Dissimilar

158

4. 39

1. 5

Table 1 shows the mean scores obtained for each of the conditions being tested; similar recall test (M= 3. 61, SD= 1. 66) and dissimilar recall test (M= 4. 39, SD= 1. 5). As the table indicates the participants scored higher on the dissimilar recall test by correctly recalling more letters in the right order of display than when tested on the similar letter set.

Analysis of these results show a significant difference in the recall scores, t (35) = 2. 38, p < . 025. These findings support the predicted hypothesis that there is a greater ability to recall letters that are dissimilar in nature compared to those that are similar by sharing common phonemes. A table showing the SPSS analysis of the data can be found in Appendix 1.

Discussion

The results obtained in this study has shown that there is a significant difference in the number of letters recalled in correct sequence between similar and dissimilar sets of letters, with dissimilar letters being recalled better than phonologically similar acoustic sounding letters. These results

support previous acoustic similarity recall effects in STM research (Conrad, 1964; Wickelgren, 1965; Muller, Seymour, Kieras, & Meyer, 2003; Jones, Macken, & Nicholls, 2004; Page, Cumming, Norris, Hitch, & McNeil, 2006) and in turn support the concept of the phonological loop as proposed by Baddeley and Hitch (1974) WM model.

The study also supports the findings of Smith, Wilson, and Reisberg (1995) in that the visual presentation of the letters sets were processed indirectly into the phonological store component of the phonological loop through the ACP allowing the participants to rehearse the letters observed acoustically using the inner voice.

However, there are some concerns on the effects of phonological complexity related to word length including the number of syllables or phonemic length of the letters within words, which suggests that the word length effect in the serial recall task may be better explained by differences in linguistic and lexical properties of words (Jalbert, Neath, Bireta, & Surprenant, 2011).

It can be argued that studies of this nature have a low ecological value, as they don’t represent the real world. Baddeley, Gathercole, & Papagno (1998), claim that the function of the phonological loop has evolved in order to facilitate the learning of unique phonological forms of new words. They propose that this is its primary purpose, to store unfamiliar acoustic patterns while more permanent memory records are being fabricated.

Despite this study supporting the hypothesis that there is a phonological effect that influences the ability to successfully recall more letters that are dissimilar in nature as opposed to those that share common phonological

similarities, the use of the phonological loop in retaining sequences of familiar letters/words is, it is argued secondary to its primary function of learning language (Baddeley, Gathercole, & Papagno, 1998).

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