

Investigating the irrelevant sound effect on free recall



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The effect of background noise upon free recall of visually presented words was investigated. A total of 60 participants were recruited for this psychological study. The experimental groups were the speech condition (N= 20) and the whale sound condition (N= 20) whereas the silent condition (N= 20) accounted for the control condition. Participants were randomly assigned to each group. The speech, whale sound and silence accounted for the three levels of independent variable whereas the subjective free recall accounted for the dependent variable. This study formed two hypotheses. Hypothesis one proposed that more words will be recalled in the control condition than in the experimental conditions and hypothesis 2 proposed that fewer words will be recalled in the speech condition than both the whale sound and silent condition. The present investigation employed a between groups design. One way ANOVA showed that participants in the control condition (M = 12.85 SD = 2.97) significantly recalled more words than the whale sound experimental (M= 9.05 SD = 2.13) and the speech conditions (M= 9.65 SD= 3.49) ($p < 0.05$) thus supporting the hypothesis 1. However, as the participants in the speech condition recalled significantly fewer words than the silent condition but the difference in recall compared to whale condition was none significant therefore only partially supporting hypothesis 2. The implications and further recommendations are discussed.

Background noise has been established to be among the most notable forms of interference in the in offices and educational settings causing stress and discomfort for workers and learners and affecting performance (Hugh & Jones 2001). Background noise from aircraft, road traffic, and trains have all

been shown to impair learning (Enmarker, Boman, & Hygge 2006; Hygge, 2003; Wible, Nicol, & Kraus, 2004 in McNeil).

The working memory model proposed by Salame and Baddeley (1990) constitutes of the visuo-spatial system and phonological system, however, the memory system that is concerned with verbal visual and auditory presentation is the phonological store. The phonological store, together with the process of articulatory rehearsal constitutes what is unknown as the phonological loop (Gisselgard, Petersson, Baddeley & Ingvar, 2003).

Prominent psychologists have investigated the phenomenon of background noise and its interference with the working memory processes and recall impairment. For example, Salame & Baddeley (1982 in Gisselgard, Petersson, Baddeley & Ingvar, 2003) argued of the irrelevant speech effect which refers to a reduction in the immediate recall of lists of presented items when irrelevant auditory material is presented together with the items to be memorized (Gisselgard et al, 2003). Salame and Baddeley argued that irrelevant sound effect interferes with the temporary storage of verbal material within a phonological input store of limited capacity (Gisselgard, 2003).

Jones (2004) also argues that auditory verbal stimuli have direct access to phonological system whereas visual - verbal has indirect access whereas the visual verbal stimuli endeavour a process of sub vocalization before passing through the articulatory suppression system. (Jones, Macken & Nicholls (2004: the phonological store of working memory). Other psychologists argue that the irrelevant speech will interfere with the representations of list

items if and only they are being held within the phonological store. However, during the rehearsal process (articulatory suppression), the irrelevant sound effect may be abolished (Gisselgard, Petersson, Baddeley & Ingvar, 2003), therefore not impairing word recall.

Beaman & Jones (1998) acknowledge that one of the earliest explanations produced for the irrelevant sound effect was the acoustic primary memory masking hypothesis (Colle & Welsh, 1976) which postulates that irrelevant auditory stimuli have the action of masking phonologically recoded visual stimuli in an acoustic primary memory store. According to this approach, the items lose their distinctiveness by being masked, making their retrieval difficult (Beaman & Jones, 1998).

Banbury, Macken, Trenblay & Jones (2001), on the contrary, argue that as the memory task and irrelevant speech are presented in different sensory modalities, the effect cannot be attributed to some kind of interference (or masking) at sensory level as suggested by Colle and Welsh(1976). Instead they argue that this disruption must be attributable to:

" A confluence of processing from the ear and the eye at some level beyond the sensory organs; this can be explained as a breakdown in attentional selectivity. Despite the intent of the person to concentrate on the memory task, the irrelevant sound intrudes therefore impairing recall." (Banbury, Macken, Trenblay & Jones, 2001)

Banbury, Macken, Trenblay & Jones (2001) suggest that interference results from the similarity of events represented in memory, a phenomenon known as phonological similarity. One subtype proposes that the disruption is based <https://assignbuster.com/investigating-the-irrelevant-sound-effect-on-free-recall/>

on a conflict of content between what is seen and what is heard. This may be through similarity (phonological similarity) in the identity of the irrelevant sound to the items being rehearsed (Salame & Baddely 1982 in Banbury, Macken, Trenblay & Jones 2001) through shared temporal cues or through degree of overlap of modality-independent features in the irrelevant speech with the items in the visually presented to-be-recalled list (Neath, 2000 in Banbury, Macken, Trenblay & Jones 2001). The phonological similarity is particularly relevant in this study as a back ground speech by Martin Luther King, in English will be employed and administered in the background.

It is worthy of acknowledgement that irrelevant sound hypothesis has been predominately investigated for serial recall (Lecompte, 1994 Beaman & Jones, 1998). The irrelevant speech effect has been found to effect and disrupt the learning of list of words in a sequential order and Salame and Baddeley (1990) did establish that background noise was disruptive.

However, free recall has also found to be affected by the irrelevant sound (Beaman & Jones 1998). In light of this, the present study will investigate the irrelevant sound hypothesis through assessing free recall of subjects.

Moreover, Studies (Beaman & Jones, 1998 have shown that the irrelevant sound effect does equally effect serial or free recall, without distinction. For example, in testing the free recall and the irrelevant speech effect, Lecompte (1994) study found that a) irrelevant speech inhibited free recall more than white noise. In addition Lecompte (1994) had found an effect on irrelevant sound on free recall in four conditions (Lecompte, 1994). This is also supported and acknowledged by Beaman & Jones (1998). The present study will be employing whale sound as one of the independent variables although

animal sound with relation to memory recall impairment have been investigated by Neath & Surprenant (2000) (the nature of remembering)

In other studies, the irrelevant speech effect was not found in free recall (Salame & Baddeley, 1990 in Lecompte, 1994). Although there is substantial research which has found that noise disrupts learning, there is however some other investigations which established that background noise had a facilitative effect on learning as oppose to a detrimental effect dependent upon the level and frequency of the noise and subjective ratings of levels for interference (Hughes & Jones, 2001).

It is noteworthy that although Salame and Baddeley (1989) used Japanese speech in the background which accounted for the irrelevant speech the present study will use English Martin Luther King speech. Use of English narrative as an independent variable has also been investigated. For example, Jones, Miles and Page (1990 in Jones, Madden & Miles, 1992) performed an investigation in which forward, reversed (English narrative) and Welsh (narrative) irrelevant speech were contrasted. Each produced a large and almost identical effect on the recall of consonant strings. In another study (in Jones, Madden & Miles, 1992) irrelevant Italian and English produced a similar degree of impairment (Morris, Jones & Quayle., 1989 in *ibid*) the psychologists argue that the phonological similarity effect isn't the cause of poorer recall as Salame and Baddeley (1989 in Jones, Madden & Miles, 1992) have argued.

The aforementioned mentioned study by Jones et al (1990) demonstrates that background speech which is similar to the language of the listener will

be equally disruptive when compared to other languages such as Welsh. Oswald et al (2000 in Hughes & Jones, 2001: the intrusiveness of sound) tested participants comprehension of sentences of meaningful speech, meaningless speech and in quiet. They found that performance was worse in both speech conditions relative to quiet, but most noticeably, meaningful speech was more disruptive than meaningless speech. This study therefore supports Salame and Baddeley (1990) similar phonological effect hypothesis with relation to interference and disruption, which will also form one of the hypothesis for the present study.

Amidst the scope of studies already performed in the domains of irrelevant sound effect and its effect upon the phonological working memory, this present study too, aims to investigate whether or not the background speech and whale sound will impair recall for words presented visually.

Method

Participants

A total of 60 participants were recruited for this psychological research. Each of the eight investigators for this study recruited eight participants. The control or silent condition comprised of 20 participants, the whale sound condition comprised on 20 participants and the Martin Luther King speech condition comprised of 20 participants. All these participants were randomly assigned to each of the eight investigators. All of the participants were over 18 and no other demographic variable such as specific age group or gender was considered in this present study. The participants were either related or associated with the investigators.

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Design & variables

A between subjects experiment design was employed. Participants were randomly allocated to each group. This study used one independent variable with three levels of background noise which were silent, speech, and whale sound. The silent condition was the control condition whereas the speech and whale sound were the experimental conditions. The dependent variable is the number of words correctly recalled by the groups. The noise level of the speech and whale sound was 66 -70 decibels. The present study employed the free recall methodology.

Hypotheses

Recall of words will be higher for the silent (control) condition than the whale sound and speech sound (experimental) conditions. This accounts for hypothesis 1. The recall of words will be lower in the speech sound condition compared to both the whale and silent conditions to investigate the phonological similarity effect and its effect of interference with information processing and recall. This therefore accounts for hypothesis 2.

Stimuli and materials

Martin Luther King speech (experimental condition 1); Whale sound (experimental condition2); Silence (Control condition); 20 words were selected from the Toronto Word Pool with neutral but similar levels of concreteness and imaginability. The lower level of imaginability and concreteness ranged from 1 to 3 and high ranged from 5 to 9 but the words

selected were at level 4. font was Ariel size 12. The format of the words was a visual presentation of in a list form.

Procedure

Participants were briefed and informed consent was obtained prior to commencement of experimentation. In the silent (control) condition the participants were presented with the words. Participants learned the words for 3 minutes. Participants were then given a further 3 minutes to recall the words followed by debrief. In experimental (1) whale sound and experimental (2) speech conditions participants were presented with words and were allowed 3 minutes to learn the words accompanied with either background whale sound or speech. A further 3 minutes were given for the written free recall of words followed by debrief. In the brief the participants were informed of the whale and speech background noise, neither any approach to learn the words was mentioned. Other background interferences and auditory disruptions, other than the intended noise were kept to a minimum.

Results

The effect of background sound (silent, speech, whale sound) on recall of words was examined using one-way subjects ANOVA. It was expected that participants in the silent condition would recall more words than the participants in the speech and whale sound condition. The mean scores revealed that more words were recalled in the silent condition ($M = 12.85$ $SD = 2.97$). There was almost equal number of words recalled in the whale sound ($M = 9.05$ $SD = 2.13$) and the speech condition ($M = 9.65$ $SD = 3.49$). There <https://assignbuster.com/investigating-the-irrelevant-sound-effect-on-free-recall/>

was significant difference between the recall scores of the control and experimental conditions $F(2, 57) = 9.748, p < 0.05$, $\eta^2 = 0.25$. Tukey's HSD revealed that participants in the silent condition significantly recalled more words than in the experimental whale condition (Mean difference = 3.8 $p < 0.05$) and in the experimental speech condition (mean difference = 3.2 $p < 0.05$). Participants in the whale condition significantly recalled less words in the silent (Mean difference = -3.8 $p < 0.05$), but the difference in the score with speech condition was not significant (Mean difference = -0.6 $p > 0.05$). Participants in the speech condition recalled significantly less than the silent condition (Mean difference = -3.2 $p < 0.05$) but difference of recalled words compared with the whale condition not significant (Mean difference = 0.6 $p > 0.05$). Therefore this experiment supports the hypothesis 1 and therefore the null hypothesis will be rejected. Lower recall in the speech condition compared to the silent but similar levels of recall compared to the whale sound condition partially supports hypothesis 2.

Condition Recall

N

Mean

Standard Deviation

Silent

20

12.85

2. 97

Whale

20

9. 05

2. 13

Speech

20

9. 65

3. 49

Total

60

10. 51

3. 33

Table 1 shows the mean score for each group together with their standard deviations. The silent condition recalled the most number of words and the whale and speech conditions scoring the similar number of words.

Sound

Sound

Mean Difference

Sig. Alpha 0. 05

Silent

Whale

3. 80

0. 00

speech

3. 20

0. 00

whale

Silent

-3. 8

0. 00

Speech

-. 60

0. 79

speech

Silent

-. 32

0. 03

whale

. 6

0. 79

Table 2

Multiple comparisons showing the scores of each group, inclusive of mean difference and their significance. There is a significantly larger difference between Silent compared to whale and speech conditions. There is a significant difference between whale and silent condition but not with speech condition. There is a significant difference between speech and silent but not with the whale condition. This test supports hypothesis 1 expected the recall for words in the control condition to be higher than the experimental thus supporting the experimental hypothesis and rejecting the null hypothesis. However, there is not a significant difference between the speech and whale noise condition therefore as fewer words were recalled in the speech condition compared to the silent condition and assessing that there is not a significance recall difference when compared to the whale noise condition only partially supports hypothesis 2.

Recall

Sum of Squares

Df

Mean Square

F

Sig.

$\hat{\rho}^2$

Between Groups

166.933

2

83.46

9.74

0.000

0.25

Within Groups

488.050

57

8.56

Total

654.983

59

Table 3 is showing the between and within groups mean scores and shows that the differences between the groups is significant ($p < 0.05$). Table 2 also shows that there is a small effect size that the independent variable did not significantly effect the recall.

Discussion

This present study attempted to investigate the effect of background sound on recall for words. The investigation manifested that overall the recall for the control (silent) condition was higher than the experimental (whale sound and speech) conditions. Therefore is supportive of the hypothesis 1 of this study and of the irrelevant sound hypothesis, and therefore rejecting the null hypothesis. The minor partial eta square effect is also noteworthy showing that the independent variables did not greatly affect the participant's recall of words.

In relation to the phonological similarity effect due to the administration of English words and English speech, it was found that articulatory suppression in the speech condition did not abolish the phonological similarity effect as well as the irrelevant speech effect which are known to impair the processing and retrieval of visually presented words. This is evident through lower production of words in the Speech condition. Therefore this study has

supported the phonological similarity effect and its impairing effects upon <https://assignbuster.com/investigating-the-irrelevant-sound-effect-on-free-recall/>

processing visually similar verbal information. This investigation has shown that the practice of rehearsal or articulatory suppression did not abolish the both the phonological similarity effect and the irrelevant sound effect. The abolishment the phonological similarity hypothesis through articulatory suppression is well documented by Gisselgard, Petersson, Baddeley & Ingvar (2003).

The findings of these results can therefore be extended to the wider world where people are reading verbal information and listening to verbal auditory concurrently, albeit individual differences can also be taken into consideration.

It was acknowledged that hypothesis 2 was partially supported because even though significantly fewer words were recalled in the speech condition than the silent condition but the difference is not statistically significant when compared to the whale sound condition. This finding is therefore also interesting as animal whale noise had equal level of disruption than human verbal speech.

Despite the interesting findings, this study however, does have some limitations. This present study didn't take into consideration other individual variables such as age, gender. Considering these variables could yield further complimentary or contradictory results which could be subjected to empirical analysis. In a study performed by Ellermeier & Zimmer (1997) individual difference was found with relation to susceptibility to the irrelevant speech effect. One study demonstrated that males and females perform differently in the presence of music when undertaking different tasks and

exercises (Miller & Schyb, 1989). In future studies, demographic variables and specific sample can be considered to ensure more reliable and valid results. Moreover, this present study did not take vocal or instrumental music as an independent measure and variable, although these variables may also be critical. Therefore, in future studies the inclusion of music condition and how background music facilitates and impairs learning can also be considered. Hillard and Tolin (1975), for example, showed that if the background music was well-known to the subject, they performed better on the given task than when unknown music was present. The domains of familiarity and unfamiliarity of music can therefore, also be explored. Moreover, in another study, the psychoacoustics found that music that contained speech had significant detrimental effects on the participants' ability to perform tasks (Martin, Wogalter & Forlano, 1988). Extensive studies can be performed in light of all of the aforementioned variables.