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Research Article

Effect of Stimulus related factors on performance of lexical decision task in Aphasia

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Abstract

Persons with aphasia flaunt word finding difficulty and this word finding difficulty is attributed to defective lexical access. Lexical access can be tested through naming and priming tasks. Naming tasks tests for the 'performance' based aspects of lexical access, while priming tasks tests for the 'competence factor'.

Kew Words: lexical access; word length; imageability

Introduction

Persons with aphasia flaunt word finding difficulty and this word finding difficulty is attributed to defective lexical access. Lexical access can be tested through naming and priming tasks. Naming tasks tests for the 'performance' based aspects of lexical access, while priming tasks tests for the 'competence factor'. Priming principle can be incorporated in a lexical decision task (where participants have to say if the given target is a word or non-word) or semantic judgment task. The performance on priming tasks is said to be influenced by stimulus related factors like syllable length & imageability, duration between prime and target (also called as stimulus onset a synchrony). The present study aims at determining the effect of two stimuli related factors i.e syllable length & imageability on the performance of lexical decision task in persons with Broca's aphasia and neuro-typical individuals. The results revealed that the performance of neuro-typical individuals did not vary with these two stimuli related factors while persons with aphasia performed better on stimulus with short syllable length and high imageability compared to stimulus with longer syllable length and low imageability showing that the stimuli related factors influence the performance of persons with aphasia on lexical decision task Lexical access is a process where the most appropriate word is retrieved from the lexicon. The naming task is used as a referent to explain the chain of events during lexical access [1]. The lexicon access is initiated with conceptual activation, following the conceptual activation, a set of related lemma nodes are activated, eventually phonemic segments related to the lexical node is retrieved. Following this, the phonemic segments is translated through the process of articulation, for which the articulators are programmed and positioned.

Word finding difficulties are the common linguistic deficits seen in persons with aphasia. The word finding difficulties in persons with aphasia is often attributed to defects in these three stages of lexical access [2]. The locus of lexical semantic breakdown in persons with aphasia is dependent on the type of aphasia. Persons with global aphasia would have difficulties at the level of conceptual representation, persons with non-fluent aphasia will certainly have expression related deficits alongside difficulties in retrieving phonemes from the phonological output lexicon and persons with anomic aphasia would have mild deficits in lexical semantic activation [3].

Different tasks can be employed to tap lexical access. The tasks can be roughly divided into categories; tasks that assess the performance related aspects related to lexical access (naming tasks, sentence completion task, rhyme production task etc) and tasks that assess for competence related aspects of lexical access (primed lexical decision, semantic judgment, phoneme judgement task etc). Priming based tasks are commonly used to assess the competence-based factors related to lexical access [4]. Priming operates when a given target word is preceded by semantically related word or phonemically related word, this facilitates the activation of the target word in a quick and accurate way. The duration between the prime (preceding word) and target is called as Stimulus Onset Asynchrony (SOA).

The occurrence of the semantically related word provokes words within the same semantic field as a result of which the activation of the target word takes place more easily. This priming principle can be employed with various tasks such as lexical decision and semantic judgment. Lexical decision refers to the process of deciding whether the given target is a word or non-word (non meaningful word). The performance on lexical decision task is dependent on factors like attention (as it is time bound task), conceptual knowledge, lemma node retrieval and phoneme retrieval abilities [5].

Several stimulus related factors influence the performance on lexical decision, the factors include the length of the target (short v/s long), imageability (low v/s high), duration between prime and target (Stimulus onset asynchrony) and the nature of the target word (concrete v/s abstract). A study reported that it was difficult for persons with aphasia to recognise short words compared to long words as they are not redundant. Words with high imageability can be activated easily compared to words with low image ability (Hardin, 2005). Short Stimulus Onset Asynchrony (SOA) is known to activate the automatic mechanism of lexical retrieval while long SOA is

known to activate the volitional mechanism of lexical retrieval. The duration of SOA is known to influence the performance; this in turn is dependent on the type of aphasia also [6,7].

Need for the study

Through studies it is clear that stimulus related factors influence performance of lexical decision task. The effect of stimulus related factors on the performance of lexical decision task has not been explored in persons with aphasia much. Owing to this reason, there arises a need to carry a study exploring these facts

Aim of the study

to study the effect of stimulus related factors (word length and imageability) on the performance of lexical decision task in persons with aphasia.

Method

Total of 6 males' participants in the age range of 45-65 years were recruited for the study. The six participants with cerebro vascular accident were diagnosed by a neurologist, Western Aphasia Battery (Shymala, Vijaya Shree & Ravi Kumar, 2001) was administered on the participants and these participants were diagnosed to have Broca's type of aphasia on WAB (see table 1). In order to compare the performance 5 neuro- typical individuals were also recruited.

Sl No	Age/Gender	Post stroke duration	Duration of therapy
1	52/M	3 months	2 months
2	42/M	6 months	1 month
3	45/M	6 months	6 months
4	52/M	8 months	6 months
5	61/M	6 months	5 months
6	64/M	9 months	3 months

Table 1. Details of participants

The stimulus for the lexical decision task was derived from a priming based study (Prema, 2010). The stimulus comprised of 90 prime-target word pairs. The length of prime and target was uniform. The stimulus further was divided into two DMDZ programs. The first program had 18 short syllable length prime target pairs (2 and 3 syllables) 18 words with long syllable prime and target (5 and 6 syllables) and 14 non words. These word pairs were randomized and presented on DMDX software Similarly to study the effect of imageability 40 separate prime target pairs were considered (13 with low imageability, 13 with high imageability and 14 non words) The duration of the prime was 500 milliseconds, Duration between prime and target was 500 milliseconds and the target display duration was 1000 milliseconds and the maximum response duration was 4000 milliseconds. The prime was aligned at the top of screen and the target was aligned at the centre of the screen. The participant had to decide if the target word was a true word (word which has meaning) or not by pressing button "1" on key board for word and button "0" for non word press 1. If the participants failed to respond within the stipulated duration of 4000 milliseconds, it was recorded as error. A trial block of 10 words was used to acclimatize the participants with the DMDX program and thus it was ensured that they understood the instructions. The output file saved separately for the two programs (syllable length and Imageability) saved in MS Excel format was analyzed.

Results and Discussion

As persons with Broca's aphasia had motor deficits, the reaction time was ignored and only the accuracy scores were taken into consideration. The accuracy scores for persons with Broca's aphasia- pwBA on short syllable and long syllable prime-target programs were 56% and 48% respectively. For the neuro-typical individuals, the accuracy scores were 87% and 85% respectively (see Figure 1)

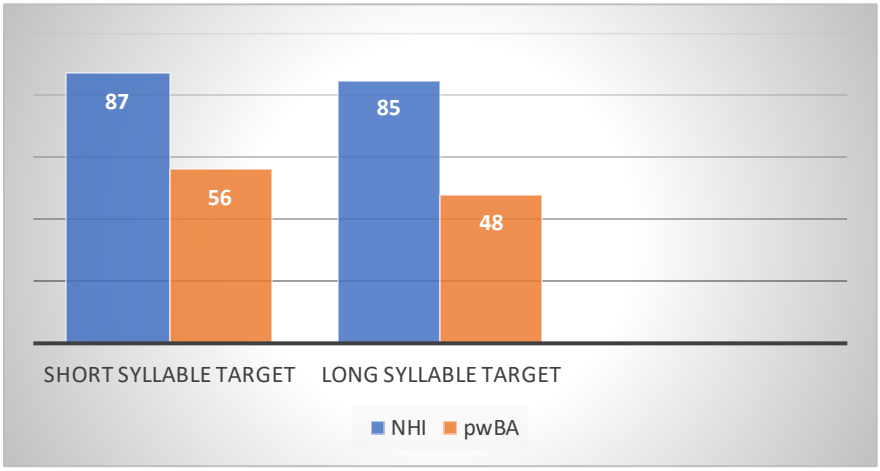

Figure 1. Accuracy scores of neurologically and persons with Broca's aphasia on short and long syllable target

Further in order to verify if there was any significant difference for persons with Broca's aphasia and neurologically healthy individuals on short syllable and long syllable target statistical analyses was carried out through non parametric statistics as the data did not abide by the properties of normal distribution. (Since the objective of study was to study the effect of stimulus related factors on performance, only within group comparisons were carried out by using Wilcoxon's sign rank test) The Z scores of persons with aphasia for short v/s long prime target pairs was 4.14 and the corresponding p values ($p<0.05$) showed significant difference. For neuro-typical adults, the Z scores for the same program was 3.14 and the p values showed no significant difference. Persons with aphasia found it difficult to identify long words compared to short words contradicting the findings of the previous study (Ex Misiurski, 1998). For normals, the performance did not vary as a function of the syllable length of the target word The accuracy scores for pwBA on low and high imageability prime-target pairs were 51% and 62%. For neuro typical individual's the accuracy scores were 88% and 74%. (see figure 2)

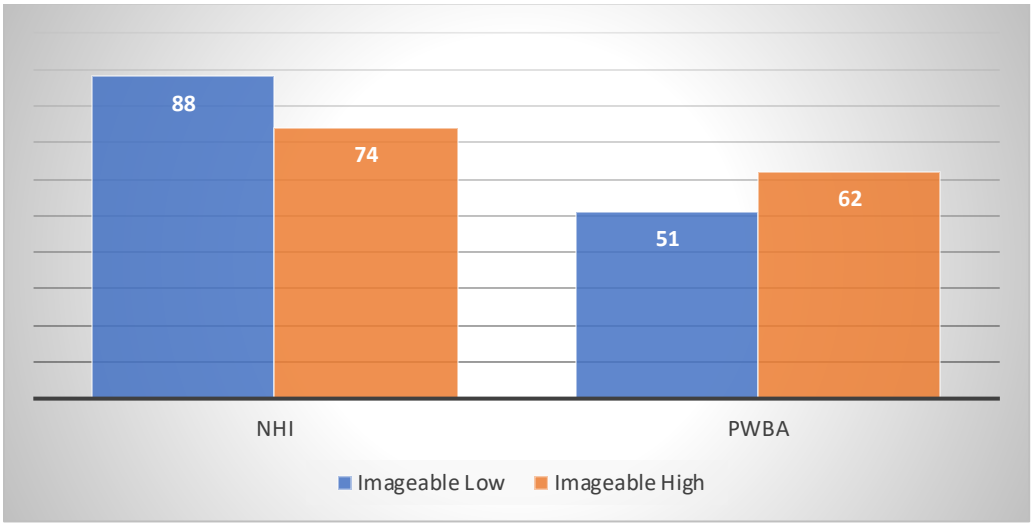

Figure 2: Accuracy scores of neurologically and persons with Broca's aphasia on low imageable and high imageable target

The Z scores for persons with Broca's aphasia and neurologically healthy individuals on low imageable and high imageable target words was 4.34 and 2.64, the corresponding p value ($p<0.05$) showed significant difference only for persons with aphasia. The mean scores were better for items with high imageability compared to low imageability items for both persons with aphasia as well as neurologically healthy individuals, this finding is in consonance with the previous studies. From the results of the present study, it can be inferred that the performance of persons with aphasia varied as a function of stimulus factors (word length & imageability), for neuro-typical adults, the performance did not vary much with these factors.

Conclusions

The stimulus related factors (syllable length & imageability) influenced the persons with Broca's aphasia only and did not influence the performance of neuro typical individuals. Persons with aphasia performed better on stimulus with short syllable length and high imageability compared to stimulus with longer syllable length and low imageability).

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