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The Scope of Phonological Encoding Plans for Stutterers

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Abstract

The picture-word interference paradigm was used to examine the scope of phonological encoding plans of stutterers using two indicators: naming latency and error rate. The experiment requires participants to generate sentences containing three image names in their spoken language, while visually presenting interfering words and manipulating their phonetic correlations. The results showed that stutterers only had a phonological facilitation effect on the first noun, and there was no phonological facilitation effect or lexical interference effect on the second and third nouns, indicating that the scope of the stutterer's phonological encoding plan was the first noun.

Keywords: stuttering, scope of speech planning, phonological encoding

1. Introduction

Stuttering is a common speech fluency disorder. Stutterers are unable to communicate verbally and emotionally with others. Stuttering can damage a person's overall vitality, emotional, social, and mental health, and lead to a decrease in their quality of life (Craig et al., 2009; Yaruss, 2010). Although there have been many studies on stuttering, the causes of stuttering have not yet been fully determined. Among many stuttering theories, the EXPLAN theory model is more classic. This model was proposed by Howell and Au Yeung in 2002, who believed that the speech production process includes two independent and parallel processes: the speech planning (PLAN) process and the motion execution (EX) process. Stuttering is caused by a mismatch between planning and execution. The scope of speech plan refers to the amount of information extracted by a speaker at a certain processing stage before starting to pronounce, and the scope of speech plan can affect the fluency of speech. The picture-word interference paradigm is a classic paradigm for studying speech production, often used in the study of speech organization stages. The presentation of images is accompanied by interfering words, requiring participants to try to ignore the influence of interfering words and name the presented images quickly and accurately (Roelofs, 1992). When interfering words are phonologically related to image names, they promote image naming, resulting in a phonological facilitation effect (Meyer & amp, Schriefers, 1991). Therefore, this study uses the paradigm to examine the scope of phonological encoding plans of stutterers. The purpose is to

examine the issue of the planned scope of stutterers in speech production, in order to enrich and improve stuttering theory.

2. Experiments

2.1 Subject

Eighteen college students, including 7 stutterers (5 girls), with an average age of 18.86 years and an average length of education of 13.00 years; 11 non-stutterers (11 girls), with an average age of 20.27 years and an average education period of 13.91 years.

2.2 Materials

Forty-five pairs of double word images. The image is matched into three groups in terms of word frequency, number of strokes, and naming latency, with word frequency, $F(2,42)=0.02$, $p=0.98$; Stroke count, $F(2,42)=0.16$, $p=0.85$; Naming latency, $F(2,42)=0.19$, $p=0.82$, 15 images per group, with one group as the target image and the other two groups as paired images. There are a total of 15 projects, each consisting of three images, one target image, and two paired images.

2.3 Experimental Design

A three-factor mixed experimental design, 2 (Subject type: stuttering, non-stuttering) × 3 (Interference word positions: N1, N2, N3) × 4 (types of interfering words: syllable identical, syllable+tone identical, phonetics independent, baseline). The dependent variables are reaction time and error rate. 3 projects are used for practice, and 12 projects are used as formal experiments. The experiment includes one practice group and three experimental groups. Each experimental project was presented 4 times in a single experimental group, ensuring that each of the 4 interference types appeared once, resulting in a total of 48 experimental stimuli. The 48 experimental stimuli in each experimental group were evenly distributed at the position of interfering words, namely 16 for N1, N2, and N3 each. The order of the three experimental groups was balanced between the subjects using Latin squares.

2.4 Instruments

Using a laptop with a 13 inch Apple monitor and a resolution of 2560 × 1600 pixels, with a refresh rate of 60Hz. The experimental program uses DMDX.

2.5 Procedure

The experiment includes three stages: learning, practice, and formal experimentation. During the learning stage, participants need to learn 45 images. During the practice stage, participants are required to name the stimuli presented in the picture according to the prescribed sentence structure. In the formal experimental stage, the fixation point "+" is first displayed on the screen for 800ms, and then the interfering words and images are simultaneously displayed for 4000ms. Participants need to respond as soon as possible while ensuring accuracy.

3. Results

3.1 Non-Stutterers

In N1, a significant speech promoting effect was found in the naming latency, that is, the naming latency under the same syllable condition was significantly smaller than the speech independent condition, $t(10)=-2.37$, $p<0.05$, $d=0.71$; The condition of syllable+tone similarity is significantly smaller than the condition of phonetics independence, $t(10)=-3.41$, $p<0.01$, $d=1.03$. In addition, the naming latency under the same syllable and tone conditions was significantly shorter than the baseline condition, $t(10)=-2.24$, $p<0.05$, $d=0.67$. A significant speech promoting effect was found in the error rate, where the error rate of syllable+tone conditions was significantly lower than that of speech independent conditions, $t(10)=-2.09$, $p=0.05$, $d=0.72$.

In N2, the latent period of naming under the same syllable condition is significantly smaller than the baseline condition, $t(10)=-2.20$, $p=0.05$, $d=0.66$. A significant speech promoting effect was found in the error rate, where the error rate under the same syllable condition was significantly lower than that under the speech independent condition, $t(10)=-2.68$, $p<0.05$, $d=1.05$.

In N3, there was no significant difference in naming latency, only a significant speech promoting effect was found in error rate, that is, the error rate of the same syllable condition was significantly lower than that of the unrelated syllable condition, $t(10)=-1.96$, $p=0.07$, $d=0.79$; The error rate of the same syllable and tone condition is significantly lower than that of the phonetically unrelated condition, $t(10)=-1.84$, $p=0.08$, $d=0.60$.

3.2 Stutterers

In N1, a significant speech promoting effect was found in the naming latency, that is, the latency

under the same syllable condition was significantly smaller than the speech independent condition, $t(6)=-3.63$, $p<0.05$, $d=1.37$; The latent period of naming under the same syllable and tone conditions was significantly shorter than that under phonetically independent conditions, $t(6)=-2.49$, $p<0.05$, $d=0.94$. A significant word interference effect was also found, where the latent period of phonetically unrelated conditional naming was significantly greater than the baseline condition, $t(6)=3.30$, $p<0.05$, $d=1.25$. There is no difference in error rate.

4. Discussion

The results of naming latency showed that both stutterers and non-stutterers had a phonological promoting effect on the first noun, indicating that both selected and processed the phonological information of the first noun. However, the non-stuttering group also had a lexical interference effect on the second noun. In terms of error rate, the non-stuttering group had a phonetic promoting effect on all three nouns, while the non-stuttering group did not. That is to say, the stuttering group only selected the phonetic information of the first noun before speaking, while non-stutterers not only chose the phonetic information of the first noun, but also processed the second noun to some extent. Some studies have found defects in the phonological encoding of stutterers (Maheshetal, 2018), while Bosshardt et al. (2002) believe that stutterers do not have phonological encoding defects. Weber Fox et al. (2004) used ERP technology to require stutterers to perform rhyming judgment tasks on visually presented word pairs. The results showed that there was no difference in phonological encoding between the stuttering group and the control group, which may be due to multiple factors such as speech pressure or cognitive load leading to stuttering. The stuttering participants in this study were all mild stutterers, and a mild degree of stuttering may result in no difference in results (Byrd et al., 2012; Pelczarski et al., 2019). Korzeczek et al. (2022) found differences in brain nerves between severe and mild stutterers. In this study, both interference words with the same syllable and interference words with the same syllable and tone can stimulate the participants' speech promotion effect, promoting their speech production, and there is no significant difference between the two conditions. The appropriate unit for phonological encoding is syllable or syllable+tone. In summary, the results indicate that the phonological encoding plan scope of stutterers is the first noun, while non-stutterers are greater than the first name, indicating that the phonological encoding plan scope of stutterers is smaller than that of non-stutterers.

5. Conclusion

The phonological encoding plan scope of stutterers is the first noun, which is smaller than that of normal subjects.

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