

Review on “Reliance on orthography and phonology in reading of Chinese: A developmental study”

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The question of the study

Although the title of this paper is “Reliance on orthography and phonology in reading of Chinese: A developmental study”, its main question is whether people are more dependent on the phonological pronunciation or orthographic spelling to get the meaning of words. At the same time, for beginners and skilled readers, whether their dependence on the first two in the reading process is different. In addition, to facilitate the observation and reduce the error, the researchers observed the pre-target words, target words and post-target word together.

The question was raised primarily based on the following known premises

1. It is generally assumed that, As people develop reading skills, voiced reading techniques precedes before silent reading, also, according to the previous study of Doctor and Coltheart (1980), In childhood (6-10 years old), children rely more on phonemes to identify the meaning of reading words; the acceptance of homophonic errors decreases as adults ages, but still this sort

of mistakes will be made, which means that alphabetical readers will still get access to the meaning of words through voice representations after having been skilled readers, Although the proportion of understanding semantics by orthography is higher.

2. Since Chinese is hieroglyphic, the basic units of writing are characters, most of the Chinese writing and its pronunciation are relatively independent, and the orthography itself can express its semantics and does not have to go through pronunciation. Previous studies on Chinese reading have shown that skilled Chinese readers can bypass the pronunciation of words and master the semantics directly based on writing. These studies show that alphabetical language is more related to phonological mediation than Chinese in obtaining word meaning.

3. However, the previous research on Chinese reading was limited to adults, and the skilled readers. They did not mention the role of the beginning readers using a phonological mediation in Chinese reading. Adult readers understand the semantics directly by orthography and rely less or not on the mediation of phonology to understand words’ meaning. However, this does not mean it is also the case of children, the beginning readers. So the researchers have raised the above questions.

Predictions: In the experiment, researchers interfere with readers by replacing the homophonic or orthographical substitution of the first character in two-character

words. By investigating the readers at different stages, adult readers should be more disturbed by homophonic words, and children readers should be more affected by orthography.

The original author's research raises meaningful and practical research problems to fill the blank on the basis of previous researchs. The research results are enlightening to some extent to explore the human Chinese reading understanding mechanism. However, at the same time, the research subjects were only adults and children, although it can reflect the data more intuitively, there is a lack of intermediate process from the perspective of development, and the object level span is large, so it is difficult to find the change trend. In addition, similar research on Chinese reading starts from pinyin, single-character, two-character words, and this article uses two-character words. Different perspectives lead to different conclusions, the processing of readers dealing with these two kind of words may not be the same, like the interference effect in the sound condition, in the single-word condition the difficulties may be the combination of the meaning of pretext and post-text in single character research, and in the two-character words condition it may encounter the difficulty of activating of the two-character words' meaning.

Methodology and measurement

Error disruption paradigm: In the Daneman and Reingold studies, the error disruption paradigm (error disruption paradigm) was used to investigate the role of phonological coding in reading comprehension. They set up target words in reading articles in three forms: These target words come in three forms: correct words, simultaneous words (that is, the same sound as the original word), and non-simultaneous words (that is, different sounds from the original word). They also controlled for how similar the substitution words were to the original words. In the process of reading, the eye movement of the subjects was recorded with an eye tracker. The results show that the gaze duration of both simultaneous and non-simultaneous words is longer than that of correct words, and there is no significant difference between them. The total repair time of both simultaneous and non-simultaneous words was longer than that of correct words, but there was a significant difference between the former two words, simultaneous words were shorter than that of non-simultaneous words. From this, Daneman and Reingold conclude that phonological coding plays a role in reading, but only at a later stage. Since the emergence of this research, many people have used this error disruption paradigm to further study the role of phonics in reading. However, the conclusions unfamiliar by different researchers are quite inconsistent. Rayner et al. found that phonetic coding plays a role in early reading. They argue that Daneman and Reingold did not discover the effect of speech coding early on because their metrics were not sophisticated and sensitive enough. In addition to gaze duration and total repair time, they also used first fixation as a new index. According to Rayner, first fixation reflects early processing, while gaze duration and Total repair time reflect later processing. In addition, Rayner found that only when

the target word was predictable and the similarity between the simultaneous word and the original word was high, the early phonological activation occurred. Jared controlled the predictability of the target word, the frequency of the target word and the reading level of the subjects. The results showed that phonology only activated in the meanings of unpredicted and low frequency target words when the reading level was not considered. The subjects with high reading level can activate meaning directly from form to meaning without using phonetics, while the subjects with low reading level can activate meaning through phonetics.

It can be said that the error disruption paradigm is a common method to investigate the role of phonetic coding in reading comprehension. In this study, the researchers replaced the primers of two-character words with homophones, orthographic words and unrelated words in the target sentences. The interference of these substitutions with the reader was observed with an eye movement tracker to determine their dependence on phonology and writing. Gaze duration and first fixation duration were introduced. At the same time, considering parafoveal-on-Foveal (POF) effects and the characteristics of Chinese text density, the measurement objects are divided into pre-target words, target words and post-target words.

In addition to the error disruption paradigm, the paradigm of articulatory suppression (that is, letting subjects do the task of suppressing pronunciation while reading comprehension) is the most frequently used method to explore the impact of pronunciation on reading. As the inhibition of pronunciation is considered to hinder the function of speech circuit, so if it affects reading comprehension, We can demonstrate that phonological circuitry plays a role in reading comprehension. Extraneous pronunciation paradigm and questionnaire measurement are also available for this kind of research. These methods measure the impact of pronunciation on reading by studying the target's understanding of sentence semantics. research design

Experiment design and data collection

Participant

The original text uses quantitative research methods and mainly obtains the data through experimental research methods. The author chose 36 undergraduates from Beijing Normal University and 36 pupils from a primary school in Beijing as the experimental subjects. Two groups were also recruited for the needs of norming study, one of 24 adults, college students, to test the familiarity proportion of orthography, the other group had 20 members, 10 pupils and 10 adults, to test the familiarity of the experimental materials. All subjects were native Chinese with normal vision and had not previously undergone similar linguistic or psychological tests or training. All participants were properly rewarded for their participation in the experiment.

In order to proceed norming study, two additional groups of subjects who did not participate in the experiment were introduced to exclude the influence of text familiarity and the familiarity of experimental data on the material. However, it did not explain how the experimental objects were selected, there is a possibility that the selection of objects is not random enough. At the same time, although there is no significant difference in the language level of the subjects, their educational background may still affect their response to the reading materials. College students of different majors, especially those majoring in liberal arts, have obvious advantages in reading. On the other hand, children's performance level and whether they have received extra-curricular education will also affect children's performance. If conditions permit, more realistic results can be obtained by selecting subjects with similar academic performance in the same major.

Material

Eighty-eight two-character words within the range of textbook of grade 1 to 3 are selected to form sentences. The type of words and the functions in the experiment are covered and distributed evenly, and the choice of the materials is reasonable and representative. To exclude disturbing variables, the subjects should identify the material and ensure that there were no unfamiliar words. Considering the particularity of Chinese, we try to avoid the acrophonic characters (the acrophonic characters in Chinese has the phonological symbol which determines the pronunciation of the character and the ideogram which determines the meaning of the character, so it is easy for acrophonic characters to interfere with reading comprehension). In the frame of the sentence, the two-character word was also used before and after the target word, and the words are always invariable in the experiment, ensuring that the change of the target words in the sentence is only variable in the experimental operation. In the selection of materials, disturbing variables such as new words, shapes and sounds, words before and after the target word and sentence length are excluded to ensure that the replacement of the target word is the only variable.

The experiment is divided into three steps. First, the subjects should test the measurement apparatus to calibrate the vision; then read the sentence on the screen, use the eye fixation to indicate they have finished sentence reading; and finally answer the judgment question about the sentence through the button to confirm whether they understand the meaning of the sentence or not. In total, subjects read 30 randomly selected sentences and the experiment lasted for 30 minutes.

The arrangement of the three-step experiment and the final understanding of the test are more reasonable, and can help the subjects to actively participate in the experiment. The experiment time is moderate, which can ensure that the subjects remain focused, and the subjects only need to operate manually throughout the whole process, reducing the impact of sound on the results. The researchers generally handled the experiment, and analyzed the collected data: former target word, target

word and post-target word. When demonstrating the experimental method, the author has an explanation for each method, the analysis of its advantages and disadvantages and reasons, and ensures the validity of the experimental results. The interference of subjective factors was excluded as possible during the experiment, and corresponding measures were taken to control this to improve the credibility of the experimental results. However, in order to ensure the objectivity of the experiment and avoid the subjective factors in the experimental process as far as possible, the experimenter can repeat the operation, compare the experimental results when the time permits, and observe whether the experimental data are quite different to ensure the accuracy of the experiment. In the experimental results analysis part, it is basically based on the data calculation results, and the reliability of the conclusion is relatively high. The experiment used a mixed linear model to show the data, considering both fixed and random effects.

Experimental results and conclusions

Pre-target words only children have less fixation time and unrelated words on phonetic substitution, which means that children can use parafoveal phonology at the beginning of reading; on target words we observed good adult recovery in orthographic similarity, and orthographic substitution has limited impact on children's gaze time, while adults are more dependent on orthography to understand reading; for post-target words, adults are stronger than children in both homophonic and orthographic recovery. We can conclude from the record of reading eye movement, for beginning Chinese readers, they still need phonological mediation to help understand semantics, while adult readers can understand the semantics directly from orthography. This result is basically the same as the prediction before the experiment. The results found that in Chinese reading, beginners readers mainly rely on the sound of characters. With the increase of reading level, the role of glyph gradually decreases, and the role of glyph began to rise. In adult skilled readers, they mainly rely on glyph.

In the study of the relationship between phonology and reading understanding, it has also been argued that at the beginning glyph and sound have the same influence on Chinese reading, while some believe that the phonology has no influence on early Chinese reading. The inconsistency may be related to the different experimental conditions and the different control variables used by different studies. However, these studies are enlightening to explore the relationship between phonology and reading comprehension. For example, eye movement technology can more reliable on reflecting the role of phonology coding in reading; some important variables (such as the reading level, the predictability of target words, the frequency of target words and the appearance of substitutions and original words) may affect the results.

References

- Zhou, W. , Shu, H. , Miller, K. , & Yan, M. 2018. Reliance on orthography and phonology in reading of Chinese: a developmental study. *Journal of Research in Reading*. Volume 41,370-391
- Baddeley A. 1986.*Working Memory*. Oxford:Clarendon
- Baddeley A., D, Lewis V., Vallar G. 1984.Exploring the articulatory loop. *Quarterly Journal of Experimental Psychology*,36A:233~252
- Salame P., Baddeley A. 1982.Disruption of short-term memory by unattended speech:Implications for the structure of working memory.*Journal of Verbal Learning and Verbal Behavior*, 21(2): 150~164
- Montgomery J W. 2002.Understanding the language differences of children with specific language impairment: does verbal working memory matter? *American Journal of Speech-Language Pathology*, 11(1): 77~92
- Daneman M., Reingold E. 1993.What eye fixation tell us about phonological recoding during reading. *Canadian Journal of Experimental Psychology*, 47(2): 153~178
- Rayner K, Pollatsek A., Binder K. 1998.Phonological codes and eye movements in reading. *Journal of Experimental Psychology:Learning, Memory, and Cognition*, 24(2): 476~487
- Jared D., Levy B A., Rayner K.1999.The role of phonology in the activation of word meanings during reading:evidence from proofreading and eye movements. *Journal of Experimental Psychology: General*,128(3): 219~264
- 宋华., 张厚粲., 舒华.1995. 在中文阅读中字音、字形的作用及其发展转换. *心理学报*,27(2): 139~143
- 武宁宁., 舒华., 周晓林.,石东方.1998. 移动窗口条件下语音、字形信息在汉语阅读中的作用. *心理学报*, 30(2): 154~160
- 黄健辉, 陈焯之. 2000.中文阅读中的字形与语音加工.*心理学报*, 32(1): 1~6
- 刘润清.1990.*外语教学中的科研方法*.北 京: 外语教学与研究出版社,208.
- 文秋芳.2004.*应用语言学研究方法与论文写作*.北 京: 外语教学与研究出版社,100 -118.
- Wong K F E., Chen H. 1994.Orthographic and phonological processing in reading Chinese text: evidence from eye fixations. *Language and Cognitive Processes*, 14(5/6): 461~480

Feng G., Miller K., Hua S., Houcan Z. 2001. Rowed to recovery: the use of phonological and orthographic information in reading Chinese and English. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 27(4): 1079~1100

Coltheart, V., Avons, S.E. & Trollope, J. 1990. Articulatory suppression and phonological codes in reading for meaning. *The Quarterly Journal of Experimental Psychology*, 42(2), 375–399. .

Coltheart, M., Rastle, K., Perry, C., Langdon, R. & Ziegler, J. 2001. DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review*, 108(1), 204–256.