The Influence of Phonetic and Shape Information on Mongolian Students' Recognition of Mongolian Words

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Abstract. In the process of vocabulary recognition, the role of shape information and phonetic information has been a hot topic in recent years. There are three more influential theories: straight through theory, phonological mediation, and dual--route theory. The theory of phonological mediation believes that the order of activation of phonological, graphic and semantic in vocabulary recognition is different. The accessibility of semantic is through the voice route, and phonological plays an important intermediary role. The straight-through theory believes that the accessibility of semantic is activated by the graphic. Phonological activation is at the end, which is an additional process. The dual--route theory holds that both phonological mediation and the straight-through theory exist. However, there is still controversy about the role of phonetic and shape information in vocabulary recognition. Some of the reasons for this debate are the differences in experimental tasks and research methods designed by researchers. The results of most researchers using Chinese and English as experimental materials show that in the reading of alphabetic writing, the main route of semantic activation is through the intermediary of phonological, which plays a vital role in the process of acquiring semantics. The semantics of accessibility in the process of Chinese vocabulary recognition is obtained through glyphs. However, there are few studies on minority students' recognition of their mother tongue and recognition of second-language vocabulary. Then, as one of the alphabetic writing in Mongolian, does Mongolian semantic activation in vocabulary recognition pass through the voice route? Does college students of Mongolian support the theory of phonological mediation or straight through theory in the recognition of second language vocabulary?

1. Research method

Thirty Mongolian college students were selected as subjects, and their mother tongue was Mongolian. This experiment uses a single-word recognition task, which is designed with two factors. One is the start-up mode, including start-up mode of listening and start-up mode of watching. Another is the type of competition words, which are divided into four types: homophonic, orthographically similar, Synonyms and totally dissimilar to the original character. (see Figure 1). In the formal experiment, the borders in the matrix grid did not appear. The experiment was divided into two groups. The first group was based on listening to Mongolian words as start-up mode. The instruction is: After the experiment starts, first a “+” will be displayed on the display, then you will hear a Mongolian word from the headset, and there will be four competition words matching the target word on the display screen. You can swipe freely on the screen and end the browsing with the space bar. At this point, you can go directly to the next sequence, a total of 15 sequences. The second was based on watching to Mongolian words as start-up mode. The instruction is: After a while, a “+” sign will appear on the
display. First, a Mongolian word will appear on the display screen, and then four competing words matching the target word will appear on the display screen. You can swipe freely on the screen and end the glance with the space bar. At this time, you can go directly to the next sequence, a total of 15 sequences. Before the formal experiment, the participants had enough practice and understanding of the experiment.

![Figure 1 Single word recognition task map](image)

2. Conclusion and analysis

The iView X software and the Experiment Center software that comes with the eye tracker are used to record the eye movement data of the experiment and extract and analyze the data.

(1) The division of the interest area, the four competition words corresponding to the stimulus words are divided into an equal area of interest, that is, that is, place the four competitive words in the 7th, 9th, 17th and 19th grids of the 5*5 grid respectively.

(2) The selection of eye movement analysis indicators, the selected eye movement indicators are: First Fixation Duration, Total time in zone, and Fixation Count. First Fixation Duration is the duration of the first gaze point in the current region of interest. Total time in zone refers to the sum of the durations of all gaze points in the current interest. Fixation Count is the number of all gaze points entering the current interest.

(3) Processing of the original data, the data processing standard is: deleting the original data of the gaze time less than 80ms and greater than 1000ms, which accounts for 2.2% of the total data. Then delete the data outside the three standard deviations in the data, accounting for 2% of the data after the first step is deleted. The rest of the data goes into the final statistical analysis.

(4) Results of statistical analysis of eye movement data

| start-up mode | First Fixation Duration (ms) | Total time in zone (ms) | Fixation Count (times) |
|---------------|------------------------------|-------------------------|------------------------|
| Homophonic    | 396.020                      | 520.255                 | 1.904                  |
| Orthographically similar | 458.025  | 592.020                 | 2.311                  |
| Synonyms      | 423.293                      | 546.622                 | 2.198                  |
| Irrelevant words | 489.650  | 766.930                 | 3.344                  |

Table 1  Average and standard deviation of First Fixation Duration, Total time in zone and Fixation Count

Spss19.0 was used to conduct statistical analysis on eye movement data of Mongolian college students in experiment 1 (experiment with listening to Mongolian words as the starting mode), when they recognize four competitive words related to the target word. (see table 3-1 for the analysis results). The analysis of First Fixation Duration found that when Mongolian students recognized the corresponding homophonic, orthographically similar, Synonyms and totally dissimilar to the original
words of Mongolian, First Fixation Duration effect of the homophonic was extremely significant, $F=8.481, p=0.000<0.001$. The First Fixation Duration effect of synonyms also reached extremely significant level, $F=9.167, p=0.001$. The First Fixation Duration effect edge of orthographically similar reached a significant level $F=9.535, P=0.039<0.05$. The First Fixation Duration effect of totally dissimilar to the original words was not significant, $F<1, p=0.425>0.05$. Analysis of Total time in zone found that the Total time in zone effect of homophonic was extremely significant, $F=12.127, p=0.000<0.001$. The Total time in zone effect of Synonyms was extremely significant, $F=14.787, p=0.000<0.001$. The Total time in zone effect of orthographically similar also reached a significant level $F=11.740, p=0.000<0.001$. The Total time in zone effect of totally dissimilar to the original words was not significant, $F<1,p=0.529>0.005$. Analysis of the Fixation Count found that the effect of Fixation Count of homophonic was significant, $F=9.568, p=0.000<0.001$. The Fixation Count of Synonyms was significant, $F=10.027, p=0.000<0.001$. The Fixation Count of orthographically similar also reached a significant level, $F=9.746, p=0.025<0.05$. The Fixation Count of totally dissimilar to the original words was not significant, $F<1, p=0.328>0.05$.

Table 2 Average and standard deviation of First Fixation Duration, Total time in zone and Fixation Count

| start-up mode | First Fixation Duration (ms) | Total time in zone (ms) | Fixation Count (times) |
|---------------|-------------------------------|-------------------------|------------------------|
| Homophonic    | 399.293                       | 465.232                 | 1.987                  |
| Orthographically similar | 380.520                     | 436.023                 | 1.720                  |
| Synonyms      | 442.230                       | 514.023                 | 2.291                  |
| Irrelevant words | 501.002                     | 631.080                 | 2.914                  |

Spss19.0 was used to conduct statistical analysis on eye movement data of Mongolian college students in experiment 2(experiment with watching to Mongolian words as the starting mode), when they recognize four competitive words related to the target word. (see table 3-1 for the analysis results). The analysis of First Fixation Duration found that when Mongolian students recognized the corresponding homophonic, orthographically similar, synonyms and totally dissimilar to the original words of Mongolian, First Fixation Duration effect of the orthographically similar was significant, $F=5.219, p=0.000<0.001$. The First Fixation Duration effect of homophonic also reached a significant level, $F=7.856, P=0.021<0.05$. The First Fixation Duration effect edge of Synonyms was significantly $F=7.987, p=0.05$. The First Fixation Duration effect of totally dissimilar to the original words was not significant, $F<1, p=0.314>0.05$. Analysis of Total time in zone found that the Total time in zone effect of homophonic and orthographically similar was extremely significant, $F1=9.158, p=0.001; F2=8.797, p=0.001$. The Total time in zone effect of Synonyms also reached a significant level, $F=10.588, p=0.031<0.05$. The Total time in zone effect of totally dissimilar to the original words was not significant, $F < 1, p = 0.427 > 0.005$. Analysis of the Fixation Count found that the effect of Fixation Count of orthographically similar was significant, $F = 8.245, p = 0.001$. The Fixation Count of homophonic reached a significant level, $F = 9.516, p = 0.0175 < 0.05$. The Fixation Count of Synonyms was significant, $F=8.918, p=0.028<0.05$. The Fixation Count of totally dissimilar to the original words was not significant, $F=5.193, p=0.349>0.05$.  

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Figure 2 Comparison of First Fixation Duration, Total time in zone and Fixation Count

In the figure, P, G, S, and U respectively represent phonological, graphic, semantic, and unrelated word. FFD, TTZ and FC respectively represent First Fixation Duration, Total time in zone and Fixation Count. L refers to listening, and W refers to watching.

Figure 2 is a comparison of the three indicators of First Fixation Duration, Total time in zone and Fixation Count of Mongolian college students under different start-up modes of listening and watching Mongolian words. As can be seen from Figure 3-2, when listening is the starting mode, First Fixation Duration and Total time in zone of the homophonic are the shortest, and Fixation Count is the least. Therefore, when the listening mode is used as the starting mode, the target word plays a significant role in promoting the activation of the homophonic, which shows that when Mongolian students recognize the Mongolian (native) word in the way of listening, the homophonic is processed first, followed by the semantics, and then the glyph, and the last irrelevant word is activated.

When watched as the start-up mode, First Fixation Duration and Total time in zone of the orthographically similar are the shortest, and Fixation Count is the least. For Mongolian students, when they watch a Mongolian word, they first use the glyphs to scan the shape, then activate the Phonetic by the glyph, encode the Phonetic, and finally get the meaning by the Phonetic. When Mongolian students use it as a starting method to identify Mongolian (native) words, first orthographically similar is activated, then homophonic is activated, and finally Synonyms is activated by homophonic. The irrelevant word is activated last time. Total time in zone used is the longest, and Fixation Count is the most, that is, the load is large. Therefore, under two different start-up modes, Mongolian college students are affected by the startup mode when they recognize Mongolian words.

3. Discussion
This experiment mainly discusses that the speech information plays a facilitating role in the early and late processing of vocabulary recognition and the order of activation of the four competing words, when Mongolian college students in different start-up modes (watch Mongolian (native) and listen Mongolian words) to identify Mongolian homophonic, orthographically similar, synonyms and totally dissimilar to the original words.

When watch the Mongolian word as the starting mode, First Fixation Duration and Total time in zone and Fixation Count of homophonic and orthographically similar are significant, and First Fixation Duration and Total time in zone and Fixation Count of Synonyms reached a edge of significant, while First Fixation Duration and Total time in zone and Fixation Count effects of irrelevant words are not significant. On the indicator of Fixation Count, Fixation Count Of orthographically similar is the least, followed by homophonic, and finally Synonyms. Of course, Fixation Count of the irrelevant word is the most, and the cognitive load is large.
When listen the Mongolian word as the starting mode, the order of activation of the four competing words is that homophonic is activated first, followed by Synonyms, orthographically similar, and finally the irrelevant word. When see the Mongolian word as the starting mode, the order of activation of the four competing words on the screen is the first orthographically similar, followed by homophonic, Synonyms, and finally the irrelevant word. This indicates that phonetic plays an important intermediary role in the process of vocabulary recognition. The meaning of words is obtained by phonetic information.

When listen the Mongolian word as the starting mode, the order of Phonological, Graphic and Semantic activation in vocabulary recognition is (1) phonological, (2) Semantic, (3) Graphic, (4) unrelated word. When watch the Mongolian word as the starting mode, the order of Phonological, Graphic and Semantic activation in vocabulary recognition is (1) Graphic, (2) Phonological, (3) Semantic, (4) unrelated word. The theory of speech mediation is a theoretical model of vocabulary recognition. The theory emphasizes the mediation of speech. The experimental results support the theory of speech mediation.

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