Comparative mental rotation study on recognizing Kana and Kanji between Chinese and Japanese

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Abstract

A mental rotation (MR) task was conducted to examine the differences of identity of syllabic letters (i.e., Kana) and morpho-syllabic characters (i.e., Kanji) between Chinese and Japanese. The results suggested that Chinese with Japanese language education responded to Kanji faster than Kana for their familiarity with Kanji. Kanji contains more graphical features that could be utilized in recognition, however, Japanese responded to Kana faster, implying that more than morphological recognition took places when the stimuli were deformed (i.e., mirrored and rotated). Additionally, the response time (RT) of mirrored Kana was found to be slower than front one within Chinese, causing by a weaker representation for Kana that varied with Japanese.

Keywords — Kana, Kanji, Bilingualism, Mental rotation, Letter recognition.

1．Introduction

Despite the researches on word recognition by second languages, there is a dearth of studies about “letter” recognition have been attended in the literatures of bilingualism. Literally, phoneme letters such as alphabet do not contain semantic components whereas Kanji which is usually adopted in Chinese and Japanese language provides phonological and semantic attributes within a single character. These kinds of language consist of numerous characters.

Written Japanese, for instance, can be generally divided into 2 forms: Kana and Kanji. The amount of common use Kanji was 1945 (i.e., JYOYO-Kanji), and Kana is only restricted to 49 letters, resembling English alphabet whose number is 26. Thus, we hypothesized that letter recognition of these could be considered to learn easily as a second language, compared to character recognition. In the present article, we focused on the letter/character recognition, by using MR task, which requires the subjects to judge the letter/character is in front or mirror image with various angles, because more loads are needed in a recognizing process along with angles. We compared Chinese and Japanese subjects for the common representation of Kanji knowledge, and Kana and Kanji represented letter and characters respectively.

2．Method

Subjects: A total of 40 (17 Japanese and 23 Chinese) subjects were recruited from Nagoya University. Among Chinese students, 18 are in possession of Japanese Language Proficiency Test (JLPT) Level 1 (Highest) and 5 are in possession of JLPT Level 2.

Stimulus Materials: Stimuli were classified by four categories which illustrated type and frequency (Table 1).

Procedure: All subjects were tested in a sealed booth with one screen and one response pad. A trial started by a fixation point (800ms) followed by a stimulus presentation either in front or mirror images with different angles (0^o, 60^o, 120^o, 180^o, 240^o, 300^o). Subjects were instructed to press the buttons on the pad accordingly with position as quickly and accurately as possible. Half of them pressed right button as a response to front image, left as a response to mirrored one, another half did oppositely as a counter-balance.

Table 1 Stimuli used

	Kana	Kanji
High-frequency	か, な, れ, に, の, う;	分, 見, 年, 上, 生, 子;
Low-frequency	む, ぬ, ろ, ゆ, や, ね;	頒, 錘, 繭, 匂, 謄, 銑.

3. Results

RT increased as a function of degrees as common MR task; Chinese subjects showed tardiness in response to factors: type (Kana vs Kanji), frequency and position than Japanese; slower response to Kana and faster to Kanji was a significant manifest among Chinese and an opposition occurred among Japanese (Fig.1); There was a significant difference for interaction between type and position, and the time difference of response to mirrored Kana and Kanji was getting closer for Japanese, which was opposite with Chinese condition (Fig. 2).

4. Discussion

Within Japanese subjects, response to Kana was significantly faster than Kanji. However in previous study, Kanji was found to be faster than Kana because semantic information was much more effective than phonemic information in achieving recognition, since more features were involved and distinctive (Umemura, 1981). This can be attributed to a substantial difference in the

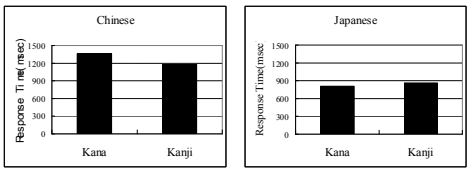

Fig 1. RTs for Kana and Kanji by Chinese and Japanese

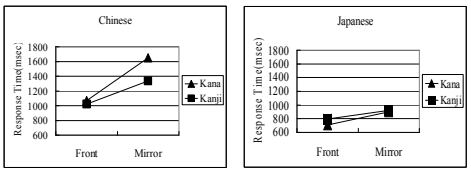

Fig 2. Interaction between type and position

tasks used by these two studies. Umemura (1981) assessed recognition directly after cued stimuli, and present study employed MR to distinguish the front and mirrored stimuli. It could be hypothesized that more loads for recognition may change the representations of Kanji and Kana within Japanese. On the other hand, the RT of Kanji was shorter than that of Kana within Chinese, which could be explained that Chinese are familiar with morpho-syllabic Kanji which could facilitate to distinguish the features of characters. Secondly, interaction between type and position indicated different representations of RT between Chinese and Japanese, the disparity of RT from front to mirror increased gradually which varied with the case of Japanese. Mirrored stimuli, especially Kana, were hard to recognize for Chinese for the deformed stimulus complicated the representation of characters and increased the difficulty of semantic processing and feature catching. In other words, Chinese with skilled Japanese ability may not have acquired concrete representations for Kana.

This research was supported in part by a Grant-aid for Scientific Research (B) from the JSPS (No. 19330159) to NK.

Reference

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