

SELECTIVE IMPAIRMENT OF PROCESSING PHONETIC AND  
NON-PHONETIC TRANSCRIPTIONS OF WORDS IN APHASIC PATIENTS

- Kana and Kanji in Visual Recognition and Writing -\*

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In our previous preliminary report on the study of impairments of kanji and kana processings in aphasic patients (Sasanuma, et al. , 1969), we dealt with the performances of the aphasic patients in the visual recognition of common nouns represented in kanji and in kana. Since then we have made some modifications in our experimental design, and some of the recent findings will be reported on here.

The present experiment has been designed to answer the following questions:

1. How does the performance in the visual recognition of common nouns vary depending on (a) the kind of transcriptions used for representing the stimulus word (kanji or kana), (b) the subject group (two aphasic subgroups and two non-aphasic groups, see infra) and (c) the exposure duration of the stimulus word (1/10 second, 1/2 second, or 1.0 second)?

2. How does the performance in writing of the same nouns as above vary depending on (a) the kind of transcriptions used (kanji or kana), (b) the subject groups, and (c) the mode of stimulus presentation, i. e. , speech or picture presentation?

3. On the basis of the findings of the study, what mechanisms can be hypothesized to underlie the impairments of kanji and/or kana processings?

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\*A paper with more detailed descriptions of the experiments reported here is being submitted for publication.

## PROCEDURE

Two aphasic subgroups of ten patients each, with and without apraxia of speech,\* and two non-aphasic right - and left-hemiplegic groups of six patients each, were administered two sets of tasks, i. e. , visual recognition and production in writing of 20 high frequency nouns. These 20 nouns consisted of a set of 10 words for which the most common transcription was that in kanji, and another set of 10 words of foreign origins (imported words) which as a rule in the Japanese orthography are represented in katakana. For the former ten words, hiragana transcriptions were also prepared as test items.

The subjects in each of the four groups were approximately comparable in age, educational level, post-onset duration, and premorbid reading and writing habits. All subjects were screened for the auditory recognition of the test words in two preliminary tasks: (a) speech-picture matching, and (b) speech-transcription matching, and those whose error rate exceeded 10% were excluded from the study.

### Visual recognition tasks

Each subject was presented tachistoscopically with three types of transcriptional stimuli (i. e. , both kanji and hiragana transcriptions for each of the 10 non-imported words, and katakana transcriptions for the 10 imported words), arranged in random order, for a duration of 1/10 second (Task 1, 30 responses), 1/2 second (Task 2, 30 responses), and 1 second (Task 3, 30 responses), and was instructed to locate the corresponding picture in a display of four, calling for a total of 90 responses. All three tasks were administered in one session for each subject in the order of Task 1, Task 2, and Task 3.

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\* Cf. our previous report, note (2).

### Writing tasks

In the picture-to-transcription conversion (Task 4, 30 responses), the subject was presented with each of the 20 pictures of the test words, and was instructed to write the word for it. For each of the 10 pictures representing non-imported words which had both kanji and kana transcriptions, the subject was instructed to write in both, the order being left to his choice.

In the speech-to-transcription conversion (Task 5, 30 responses), the subject was instructed to write each of the 20 test words upon the auditory stimulation given by the experimenter. For the non-imported words, the subject wrote in both kanji and kana. The two tasks were administered in two separate sessions to the aphasic, and in one session to the non-aphasic subjects, the ordering of the two tasks being randomized for different subjects.

## R E S U L T S

We may summarize the experimental findings as follows:

1. The overall performance levels of the aphasic subjects in all tasks were significantly lower than those of the non-aphasic subjects, and the overall performance levels of the Group B aphasics (with apraxia of speech) were lower than those of the Group A aphasics (without apraxia of speech). Figure 1 illustrates part of the data.

2. The Group B aphasics made a significantly greater number of errors in kana than in kanji processings in the visual recognition tasks as well as in the writing tasks, while the Group A aphasics showed no such tendency. (See Figure 1)

3. In the visual recognition tasks, the exposure duration of stimuli was positively correlated to the performance levels of the aphasic subgroups.

4. There was no marked difference in the performance levels of either group between the picture-to-transcription conversion and the speech-to-transcription conversion, indicating that the mode of stimulus presentation in these cases had little effect on the performance.

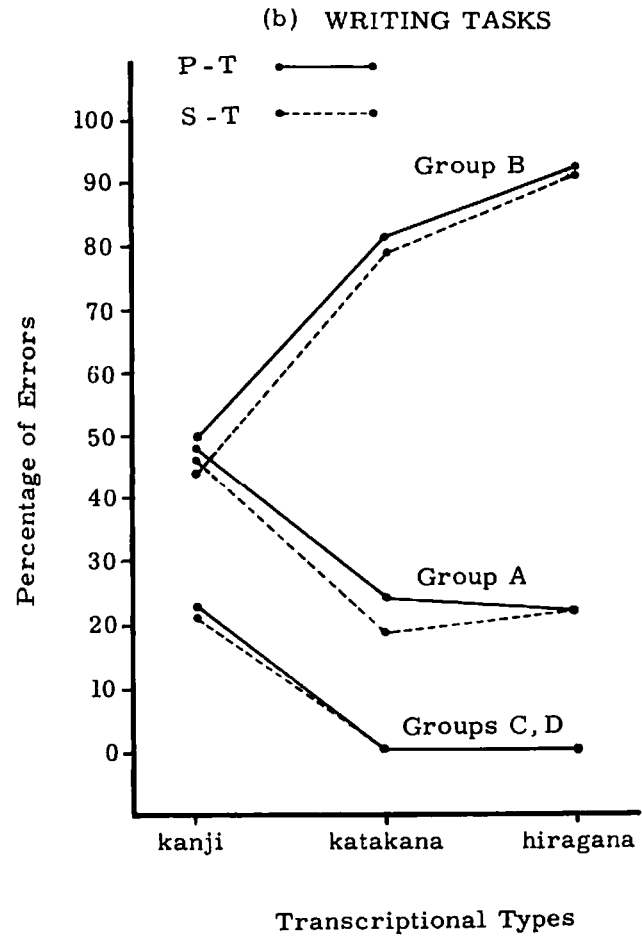
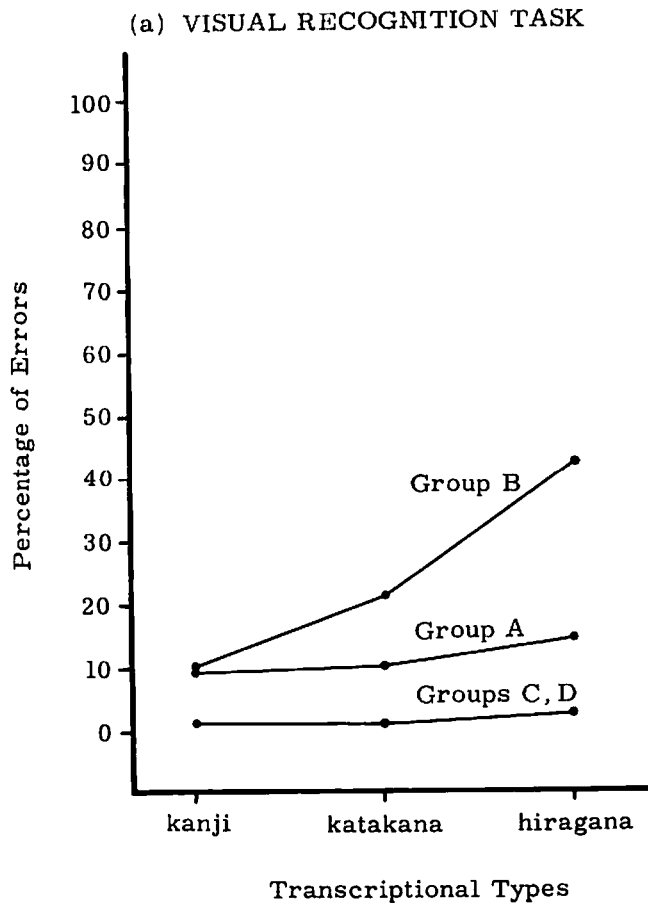


Figure 1.

Of special interest are the findings pertaining to the performance of each group in writing tasks with the different types of transcription. As was expected, none of the non-aphasic subjects made any errors on kana transcriptions, either for imported or for non-imported words, while they made sporadic errors on kanji transcriptions. The aphasic groups, both A and B, on the other hand, did make errors on kana as well as on kanji transcriptions. Furthermore, the distribution of kanji versus kana errors was markedly different between the two groups. This point is clear in Figure 1b. In spite of the fact that both groups made about an equal number of errors on kanji transcriptions, the Group B patients made far more (almost twice as many) errors on imported kana words than on kanji words, and even more errors on hiragana transcribed kanji words than on imported katakana words, on both picture-to-transcription and speech-to-transcription conversions. The Group A patients, on the other hand, made far less (less than half) errors on kana transcriptions of both imported and non-imported words than on kanji words. Hence we can conclude that the deteriorated efficiency in processing kana symbols as observed in the Group B aphasics is associated with a specific type, rather than the overall severity, of aphasic impairment.

## DISCUSSION

### Model on the cerebral mechanism for phonological processings

In the light of the above findings, some considerations have led us to the following hypotheses:

1. The storage in the brain of a lexical entry contains representations not only of its phonological form, semantic value and syntactic characteristics, but also representations of the graphic features of kanjis or to some extent in a similar manner katakanas, their sequences forming "gestalts".

2. There exists a phonological processor as a linguistic subsystem in the cerebral level, more or less independent from other systems with different functions, such as the motor execution or the auditory sensation.

3. In the case of the word transcribed in kana, in particular hiragana, the transcription has to be processed by the phonological processor before the word as a lexical form is identified. This follows from the fact that the transcribed form in kana as a graphic pattern has to be derived from the phonological representation of the form, the former being independent from the familiar kanji forms.

4. The kanji transcription, on the other hand, can be directly identified with a word, by-passing the phonological interpretation, because each word in the lexicon is independently associated with a kanji pattern as well as a phonological pattern.

5. The katakana word represents an intermediate case between the kanji and hiragana words, because the imported words are always transcribed in this way, and the user is familiar with the kana transcription as a graphic pattern.

6. In the case of the Group B patients, the phonological processor is selectively impaired in addition to some other more general kind of difficulty in executing the tasks which are common to both Group A and Group B aphasics.

In view of these hypotheses, the concept of "apraxia of speech" as it is used by Darley (as well as in this study) may be re-examined, and it may be pointed out that a true apraxia of the speech organs may not necessarily be associated with malfunctions of the phonological processor.