

Rate Enhancement and Usability of Conditional Letter Prediction Applied for Japanese Scanning Communication Aids

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1. Introduction

Japanese language basically consists of phonographic kana letters and ideographic kanji characters. Especially, kana letters are basics of Japanese and a kana table with five vowels and forty-one consonants as shown in Fig.1. is generally used as the original kana table. This table is also employed for Japanese scanning communication aids. The scanning is started from the column that has five vowels. As the original kana table has been taught at the elementary school in Japan, the most of users doesn't feel difficulty to use the original table for scanning. On the other hand, scanning is time consuming task, and rate enhancement for selecting letters has been a pending problem.

For rate enhancement, the authors have suggested to add a column at the side of the column with five vowels. The additional column has five kana letters with high frequency, from the original tables. These letters are predicted conditionally according to a kana letter selected just before. By selecting a next letter from the added column, selecting time becomes smaller than selecting it from the original table. Results of theoretical analysis on this method indicated the efficiency for rate enhancement³⁾. On the other hand, it is indicated that users have to find whether a next kana letter is included in additional column or not. For this problem the authors have also suggested highlighting of additional kana letters with different colors to make it easy to find location of next kana letter in table including the original kana table. A scanning program with this function is experimentally developed and evaluated. This paper reports the results.

Vowels Consonants

あ a	か ka	さ sa	た ta	な na	は ha	ま ma	や ya	ら ra	わ wa
い i	き ki	し si	ち chi	に ni	ひ hi	み mi	ゆ yu	り ri	を wo
う u	く ku	す su	つ tu	ぬ nu	ふ fu	む mu	よ yo	る ru	ん n
え e	け ke	せ se	て te	ね ne	へ he	め me		れ re	
お o	こ ko	そ so	と to	の no	ほ ho	も mo		ろ ro	

Fig.1 Basic Kana Table Used in Japanese Scanning Communication Aids

2. Method

2.1 System

An application program of Japanese scanning communication aid with conditional letter prediction (PWCLP) has been experimentally developed. Other program without conditional letter prediction (PWOCPLP) has been additionally developed to obtain reference data. Mouse button was used as a single switch to start and stop scanning.



Fig. 2 Screen of PWCLP

2.2 Subjects and sample document

The subjects were three university students (females, 20 years) without disability. As the style of sentences is familiar for the subjects, a novel written by Banana Yoshimoto (a famous novelist in Japan) has been used as a sample document. The subjects were asked to compose the same sentences in the sample document by using both PWCLP and PWOCPLP respectively. Experiment was carried out for six days (two days / week, totally three weeks). In each day, the subjects were asked to operate one program for twenty five minutes at first. After ten minutes' break, they were also asked to operate the other program for twenty five minutes.

2.3 Data

Both PWCLP and PWOCPLP have functions to record selecting time and searching time during operation. The selecting time is interval, by the second, to select a letter. The searching time is interval, by the second, between the end of a previous scanning and the start of next scanning. Location of a selected letter in the table and name of a selected letter were also recorded.

日時	時刻	操作	開始	終了	開始	終了	開始	終了	開始	終了	開始	終了
2006-12-08	13:07:55.015	start										
2006-12-08	13:07:57.328	select	?									
2006-12-08	13:07:58.437	start										
2006-12-08	13:08:03.073	select	7	1	み							
2006-12-08	13:08:03.453	start										
2006-12-08	13:08:08.171	select	4	4	と							
2006-12-08	13:08:08.573	start										
2006-12-08	13:08:12.500	select	6	0								
2006-12-08	13:08:13.856	start										
2006-12-08	13:08:15.437	select										
2006-12-08	13:08:18.887	start										
2006-12-08	13:08:20.343	select										
2006-12-08	13:08:20.703	start										
2006-12-08	13:08:22.082	select	0	1	も							
2006-12-08	13:08:22.468	start										
2006-12-08	13:08:25.825	select	1	4	お							

Fig. 3 Example of Recorded Data

3. Result and Discussion

3.1 Result

Tab.1 shows the results. "Letters" in Tab.1 is the number of letters selected correctly by both PWCLP and PWOCPLP during each operation. Ratio (PWCLP/PWOCPLP) under 1.00 indicates decrease of each time in PWCLP.

Tab.1 Result

Subject	Order of Operation	Letters	Ratio (PWCLP/PWOCPLP)				
			Selecting time			Searching time	
			Row	Column	Row+Column		
N	1st	PWOCPLP→PWCLP	220	0.95	0.96	0.95	1.51
	2nd	PWCLP→PWOCPLP	311	0.93	0.99	0.95	1.20
	3rd	PWOCPLP→PWCLP	321	1.00	0.97	0.99	1.49
	4th	PWCLP→PWOCPLP	340	0.99	0.96	0.98	1.27
	5th	PWOCPLP→PWCLP	310	0.99	0.98	0.99	1.08
	6th	PWCLP→PWOCPLP	327	0.95	0.97	0.96	1.13
C	1st	PWOCPLP→PWCLP	210	0.92	1.00	0.95	1.11
	2nd	PWCLP→PWOCPLP	278	0.90	1.01	0.94	1.20
	3rd	PWOCPLP→PWCLP	314	0.91	0.96	0.93	1.26
	4th	PWCLP→PWOCPLP	279	0.89	0.93	0.90	1.48
	5th	PWOCPLP→PWCLP	312	0.92	0.98	0.94	1.12
	6th	PWCLP→PWOCPLP	316	0.90	0.98	0.93	1.14
H	1st	PWOCPLP→PWCLP	222	0.89	1.01	0.93	1.00
	2nd	PWCLP→PWOCPLP	270	0.93	1.01	0.96	1.26
	3rd	PWOCPLP→PWCLP	296	0.93	0.99	0.95	1.14
	4th	PWCLP→PWOCPLP	305	0.86	0.97	0.90	1.47
	5th	PWOCPLP→PWCLP	293	0.94	0.98	0.95	1.00
	6th	PWCLP→PWOCPLP	319	0.92	0.96	0.94	1.23

3.2 Discussion

The selecting time in PWCLP is significantly less than it in PWOCPLP. This indicates the effectiveness of PWCLP. However, ratio of PWCLP/PWOCPLP couldn't exceed theoretical value (about 0.80) reported in previous research³⁾. It is considered that these results have been caused by number of selected letters. The number of selected letters by PWCLP is originally different from it by PWOCPLP. "Letters" in Tab.1 is, however, the sum of the number of letters that are included in both PWCLP and PWOCPLP. This means that some letters selected by PWCLP were not included in "Letters". It is supposed that the selecting time will be decreased by including these cancelled letters.

On the other hand, searching time by PWCLP is more than it by PWOCPLP. This means that users using PWCLP have to pay careful attention to see whether a next letter is included in added column or not. Further evaluation should be necessary to explain whether long use of PWCLP will decrease searching time or not.

4. Conclusion and Future work

From the result described in this paper, it is concluded that conditional letter prediction has potential for rate enhancement in Japanese scanning communication aids. Clinical testing and evaluation, including on mental workload of PWCLP for clients, should be necessary to put the results of the research to practical use.

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