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COMPOUND FORMATION BY JAPANESE APHASICS

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ABSTRACT

Some Japanese aphasics respond with kanji compounds when asked to read aloud single Japanese logographs. Two patients showing this tendency were tested to elucidate its causal basis. Revealed was the fact that the compound formation tendency does not result from an attempt on the part of a patient to decide among the phonological readings which may be attached to a single kanji. Other possible causal factors were discussed, but the most likely cause of the tendency revealed by the study was the degree to which individual kanji can be used in isolation--with single kanji not likely to be so used most likely to be read aloud as compounds. The question of the language-specific nature of this tendency was discussed, along with some implications for models of lexical access.

INTRODUCTION

Sasanuma (1980) has described a "compound formation" tendency among Japanese aphasics. This tendency is apparent with certain types of brain damaged Japanese when they are asked to read aloud single kanji (Sino-Japanese logographs). Instead of responding with a sound sequence appropriate to the target kanji, such patients often respond with a sound sequence corresponding to a kanji compound which incorporates the target kanji. Of course, such compound formations are also therefore usually semantically related to the target, single kanji. For example, a patient who exhibits this tendency might respond orally with [hiruma][1] (presumably[2] 昼間 --"afternoon") when asked to read aloud the single character 昼 (/hiru/--"noon").

The way in which single kanji are combined to form words in Japanese makes this tendency very apparent. Single kanji are, in fact, not completely like either bound or free morphemes in English. On the one hand, the majority of kanji can be used as free morphemes in at least one of their senses, and all kanji have semantic content--although this semantic content is not always transparent in compounds. On the other hand, the Japanese language makes use of single kanji (that is, the morphemes to which single kanji correspond) in their various senses to form words more than free morphemes are so used in English. Hereafter, it will be convenient to refer to single kanji as relatively "free" or "bound" according to whether their usage in isolation is relatively frequent or not. That is, a single kanji which appears only rarely in isolation (perhaps in a rare sense, but

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not necessarily so) will be referred to as relatively "bound" (and vice versa)--even though it may be technically a free morpheme thanks to this rare usage.

The exact lesion sites which give rise to a compound formation tendency are not known, and it is not known whether more than one site of brain damage may lead to this tendency. Sasanuma (1980:85) notes this tendency as a characteristic of "deep dyslexic" patients (see Marshall and Newcombe 1977).

Various possible causal bases for the compound formation tendency can also be imagined. Sasanuma (1980:85) has noted--along the lines of Saffran, Schwartz and Marin (1976)--that kanji compounds "may be effective in narrowing down the 'sphere of meaning'...so that the probability of the correct retrieval...is substantially increased" over single kanji.

An experiment was designed to reveal whether a brain damaged patient had a compound formation tendency. Its second, main purpose was to systematically control and test several factors of possible relevance to an explanation of the compound formation tendency.

The experiment was a reading aloud task which contained both single kanji and kanji compounds as stimuli. Thus, the experiment made it possible to tell whether the subjects had a tendency to form compounds with single kanji, and whether the subjects could read compounds more easily than single kanji. The former result would not necessarily have to entail the latter. In addition, the experiment systematically varied two factors of possible relevance to the compound formation tendency: the number of phonological readings associated with individual kanji and the degree to which individual kanji can occur in isolation--i. e., outside of compounds.

Some Japanese logographs are associated with only a single phonological sequence (which can be either a Chinese reading or a native Japanese reading); others have several readings. It might be thought that part of the difficulty some aphasics have with reading aloud single kanji has to do with deciding on which reading to produce for multiple reading kanji. This hypothesis would view the compound formation tendency as a way of deciding on which phonological reading to produce for a single kanji. Clearly, this theory would predict a difference in terms of the number of compound formations in response to single and multiple reading kanji.

The fact that kanji differ in terms of the degree to which they can occur in isolation was discussed above. To test the possible effects of this factor on the compound formation tendency, in this experiment kanji with different degrees of ability to occur in isolation were included as stimuli.

METHOD

Subjects

We found two patients with aphasia who showed a clear compound formation tendency. They were both right handed and had CVA etiologies. Neither had any apparent restriction in visual field. OH has been discussed in Bisazza (1980). NS is discussed in print for the first time in this paper.

NS--Male, age 49, office worker, 10 years of education. Onset of language problems 14 months prior to this study following surgical removal of an intercerebral hematoma due to aneurysm. Mild right hemiparesis and hypoesthesia. Fluent paraphasic speech. Auditory comprehension limited. Reading and writing severely impaired with kana (the Japanese syllabary) markedly more impaired than kanji. CT scan indicated large low density area in left posterior temporal lobe.

OH--Male, age 53, chauffeur, 10 years of education. CVA four months prior to this study. Moderately nonfluent speech, with impaired repetition and picture description. Auditory comprehension good, except where retention span was taxed. Reading and writing only mildly impaired for words in kanji but more markedly impaired for words in kana and for sentences. CT scan revealed large low density areas in left pre- and post-central sulcus regions--including supramarginal gyrus--and in left capsulo-putaminal area. In addition, there was an enlargement of the left anterior and posterior horns, with a frontal-parietal porencephaly--i. e., a hole connecting OH's cortical damage with the left anterior horn.

Materials

The stimuli consisted of single kanji and kanji compounds written vertically (to minimize effects of left-right visual scan problems, even though our subjects gave no evidence of such problems) in large characters with high contrast on separate white cards. There were four main lists of 20 stimuli each: single kanji with a single reading (e. g., 汽 /KI/--"steam"); a list of compounds incorporating each of the preceding (e. g., 汽船 /KISEN/--"steamboat"); single kanji with more than one possible reading each (e. g., 虫 /CHUU, mushi/--"insect"); and a list of compounds incorporating the preceding (e. g., 水虫 /mizumushi/--"athlete's foot"). Each of the single reading kanji had a Chinese reading rather than a Japanese reading.

In addition, a short list of six single kokuji (logographs invented in Japan; e. g., 峠 /tooge/--"mountain pass") and a corresponding list of these in compounds were also presented to the subjects. These stimuli were included because they each have only one reading, and that reading is, of course, a Japanese one. Such characters are relatively rare in terms of overall frequency and yet are somewhat more familiar than this fact might lead one to expect because of their association with Japanese place names

and Japanese culture and history.

The four main lists described above were designed with several possible interactions in mind. For example, following what was said above, multiple reading kanji might be more difficult for the subjects than single reading kanji in isolation but not in compounds. That is, in compounds multiple reading kanji might be no more difficult than single reading kanji in compounds since only one of their readings is usually possible in this case.

The two lists of single kanji (i. e., those with a single reading and those with multiple readings) were balanced in terms of the stimuli's possibility of being used in isolation according to the Japanese National Language Institute's (1964) word count of published material. In each of the two lists of single kanji the stimuli were allowed to vary according to this factor. However, no single kanji that could never be used in isolation (according to the above word count) were included, such kanji being in any case less frequent than kanji which can (at least rarely) be used in isolation.

The four lists of stimuli were balanced for frequency in print using the word count cited above. For this purpose, the frequency of the single kanji used in isolation was compared to the frequency of the compounds.

Procedure

The stimulus cards with either single kanji or kanji compounds were presented to the subjects one at a time for reading aloud. Subjects were not placed under any time pressure. If the subjects produced a nearly correct answer, or appeared close to providing a response, they were encouraged to continue with the same stimulus.

All 80 stimuli were completely randomized in the same order for each subject within the following requirement. Half of the single kanji were presented before their corresponding compounds, and half of the compounds were presented before their corresponding single kanji. Thus, the possible biasing effect of either type of stimulus (single kanji or compound) was balanced. This measure was felt to be necessary since--in contrast to the compound formation tendency--some Japanese aphasics show a tendency to read only one kanji (often the first) of kanji compounds which they are asked to read aloud.

Results

Table 1 (after the notes at the end of this paper) summarizes the results of the compound formation test.

Both NS and OH showed a clear compound formation tendency, with 20 and 6 compound formations, respectively, in response to the total of 40 single kanji (single and multiple reading kanji

combined). NS and OH both made a single compound formation on the list of six single kokuji. NS read 辻 (/tsuji/--"crossroads") as [tsujigiri] (辻斬り --"assassin"); OH read 栃 (/tochi/--"horse chestnut") as [tochigi] (栃木 --"Tochigi (place name)"). For ease of presentation, the discussion to follow will be concerned with the subjects' performance on the four main lists of kanji stimuli.

NS's errors which were not compound formations were most often phonological substitutions or distortions, and some of his responses which we counted as compound formations included such problems. That is, NS sometimes produced phonologically distorted (but still interpretable) compounds in response to single kanji stimuli. NS and OH produced 2 and 0 semantic paralexias, respectively, in response to single kanji other than compound formations.[3] OH's only errors in response to single kanji stimuli were compound formations; he made no other types of errors.

NS's greater number of error responses (including the purely phonological errors) compared to OH is consistent with the general picture of his language impairment as described above and its severity relative to OH's.

Seventeen of NS's 20 compound formations in response to single kanji were "originals"--i. e., either a compound produced in response to a single kanji before the same compound was presented as a stimulus (total = 2), or a compound not actually a stimulus item (total = 15). On the other hand, all but one of OH's 6 compound formations in response to single kanji were the corresponding compound stimuli which had been presented before the single kanji. That is, 5 of the compounds that OH produced in response to single kanji had been presented before these single kanji in keeping with the procedure outlined above.

All of NS's and OH's compound formations in response to single kanji are shown in Table 2 at the end of this paper.

For comparison purposes, we have tested other subjects, who did not have a compound formation tendency, with the stimuli discussed in this paper. In terms of the responses of these subjects to the single kanji stimuli, the differences with the error responses of NS and OH are apparent. These subjects have had a preponderance of monosyllabic responses. (Note that the Chinese readings of kanji are usually monosyllabic.) These responses have included phonemic paraphasias (e. g., 材 /ZAI/--"material (for building, etc.)" was read as [DAI]); semantic paralexias other than compound formations (e. g., 胃 /I/--"stomach" was read aloud as [CHOO]--"intestines" 腸 ?); and orthographic confusions, simplifications, etc. (e. g., 駅 /EKI/--"station" was read as [uma]--"horse" 馬).

Regarding the other comparisons which could be made for these results, the totals in Table 1 show that there was no trend for the single kanji with a single phonological reading (far left column in Table 1) to have either fewer errors or fewer compound

formations than the single kanji with multiple phonological readings. (The same is true for the subjects considered individually.) That is, kanji with a single phonological reading were not easier (or less likely to cause the patients to produce compound formations) than multiple reading kanji.

The compounds including the single reading kanji had only very slightly more correct responses than the single reading kanji.

The compounds incorporating the single kanji with multiple phonological readings were not easier than the single kanji with multiple readings--as might be expected from a hypothesis that the compound formation tendency represents a patient's attempt to decide on a phonological reading. (The kanji in both lists of compound stimuli shown in Table 1 which were not also used as single kanji stimuli usually had multiple phonological readings.)

Interestingly, NS and OH read only 5 and 3, respectively, of the total 40 compound kanji stimuli in abbreviated form--i. e., picking out only one of the characters in the compounds for reading. For example, both NS and OH read 水虫 (/mizumushi/--"athlete's foot") as simply [mushi] (虫 --"insect"). In this case the single kanji stimulus (虫) preceded the compound. (Of these abbreviations, 3 made by NS and 2 by OH were cases where the single kanji stimulus followed the compound.) Nonetheless, this example shows that in making such abbreviations the subjects did not only pick out the first character of the target compound. It should also be pointed out that the single kanji picked out of the target compound for reading in this case quite often occurs in isolation.

The above abbreviations need not be viewed as contradictions to the patients' compound formation tendency. Both NS and OH sometimes read the compound stimuli slowly, and one character at a time.

NS and OH also made error responses to the compound stimuli which appeared to be compound formations based on only one character (again, not always the first) of the compound stimulus. For example, NS produced [MONDAI] (問題 --"problem") in response to the compound stimulus 話題 (/WADAI/--"topic (of conversation)"). NS's response compound and the target compound have in common the character 題 (/DAI/--"topic").

Finally, the results were analyzed in terms of each stimulus's potential for use in isolation. For this analysis, the ratings of 26 Japanese undergraduates along a five point scale were obtained for the single kanji stimuli according to the criterion of whether each was almost always used in compounds or in isolation. The rating "3" was defined as appropriate for stimuli used equally often in and outside of compounds.

Five of OH's six compound formations in response to single kanji were for stimuli below the mean of the ratings (= 2.65)--

i. e., for kanji more often used in compounds than in isolation. More than two-thirds (number = 14; = 70%) of NS's 20 compound formations were for single kanji below this mean. The regression correlation coefficient for NS's and OH's number of compound formations for stimuli of different ratings confirmed this negative correlation ($r = -.38$, df 38, $p < .01$). NS's and OH'S compound formations below the mean of these ratings excluding those which were not original (see p. 183) totaled 11 and 1, respectively. The regression correlation coefficient for these totals in terms of the undergraduates' ratings just misses significance at the .05 level ($r = -.26$, df 34, $p < .1$), but this complete exclusion of non-original responses is probably not justified in any case since other patients to whom we have given the same test (p. 183) have not been led to produce compounds in response to single kanji merely by the prior occurrence of corresponding compound stimuli in a way comparable to NS and OH.

DISCUSSION

The fact that the great majority of the subjects' compound formations were made in response to single kanji relatively less able to occur in isolation suggests that a selectively impaired access to relatively "bound" kanji is a crucial causal factor in this tendency.

NS's response to the single character 塩 (/EN, shio/--"salt") on another occasion is highly revealing. On this occasion he again produced the same compound formation shown in Table 2--i. e., [ENBUN] (塩分 --"salt content, salinity"). But this time he self-corrected to [shio], and then--perhaps wanting to demonstrate his knowledge of both readings of this character--tried again to respond with the reading /EN/ but uncontrollably produced [ENBUN] once more. This sequence of events was repeated more than once! Of interest here is the fact that this character is frequently used in isolation with the reading /shio/ and rarely used in isolation with the reading /EN/ (except, for example, in chemistry); i. e., /EN/ is a relatively bound form. Now, /shio/ is also frequently used in compounds. However, NS did not seem to need to produce a compound for /shio/. (His response [shio] was of course correct under the instructions of the test.) On the other hand, he seemed unable to produce /EN/ alone.

NS's and OH's compound formations for kanji above the mean in terms of use in isolation can partly be explained by the influence of other stimuli. Such influences may not be sufficient to cause compound formations in patients lacking such a tendency to begin with, but might operate to lower thresholds toward compound formations for kanji more often used in isolation given the existence of such a tendency for kanji usually used in compounds. Compound formations in response to relatively free kanji were NS's numbers 2 and 7 in the list of compound formations for single kanji with a single reading in Table 2 and his 2, 3, 6 and 8 and OH's 2 in the list of kanji with multiple readings. NS's number 7 in the list of compound formations for

kanji with a single reading in Table 2 (胃袋 /Ibukuro/--"stomach" for 胃 /I/--"stomach") was probably the result of the fact that the character for "sack" (袋) was presented just a little before that for "stomach". Likewise for NS's number 2 in the list of compound formations for single kanji with multiple readings. The subjects were asked to read 糖分 (/TOOBUN/--"sugar content") just a few trials before 塩 (/EN, shio/--"salt"); the latter character plus the second character of the former target was NS's compound formation in this case. Finally OH's sole compound formation that was for a target relatively able to occur in isolation--number 2 in the list of compound formations for kanji with multiple readings--was not original.

Thus, there are only four compound formations (NS's number 2 in the list of single reading kanji and 3, 6, and 8 in the list of multiple reading kanji in Table 2) out of a total of 26 for both subjects which can not be accounted for by either inability to occur in isolation or precedence in the order of the stimulus presentation, and for which a factor like idiosyncratic familiarity has to be invoked. However, since OH produced no original compounds for single kanji above the mean in terms of use in isolation, these four original responses by NS might be due to an effect peculiar to him, perhaps operating in conjunction with the generally more severe nature of his symptoms, and not integral to the compound formation tendency.

The interpretation that the ability of single kanji to be used in isolation is crucial in the causal basis of the compound formation tendency gains support from the failure of another plausible causal factor, and the ambiguous status of a third, in accounting for the data.

First, the number of phonological readings associated with single kanji appears to have had zero effect on the number of compound formations made in response to the single kanji stimuli. This conclusion is obvious from a comparison of the respective number of compound formations made in response to the list of single kanji with a single phonological reading and to the list of those with multiple phonological readings by the subjects both individually and combined (see Table 1). The same conclusion could be drawn for the effect of number of phonological readings on the number of correct responses to the single kanji stimuli.

The factor whose role remains somewhat ambiguous in the compound formation tendency when the results of the experiment are considered in detail and contrasted with those reported in Saffran et al. (1976) is that of semantic specificity mentioned in the introduction. Many (but by no means all) of the compound formations shown in Table 2 seem to be in the direction of greater semantic specificity relative to their single kanji targets. (The same observation could be made with regard to the factor of concreteness.) However, this fact by itself can not be regarded as strong support of the role of semantic specificity in the causal basis of the compound formation tendency. Kanji compounds are by nature more specific than single kanji; kanji

compounds with the same degree of semantic specificity as single kanji would in any case be the exception rather than the rule.

Saffran et al. (1976) have shown that English-speaking patients who tend to make many semantic paralexias also perform better when asked to read aloud words in more semantically restricted contexts. For example, words (e. g., "king") presented in the restricting context of a proper name (e. g., "Bill King") were easier for such patients to read, along with the other word in the restricting context, than in isolation. The similarity of Saffran et al.'s proper name stimuli to compounds has occurred to us, and indeed Japanese data very similar to Saffran et al.'s is available. Sakamoto (1940) reports a patient who made many semantic paralexias when reading kanji aloud and who could read compounds like 乗馬隊 ("cavalry") better than individual kanji like 乗 ("to ride"), 馬 ("horse") and 隊 ("corps"). Sakamoto reports no compound formations by this patient.

However, recall that NS produced only 2 semantic paralexias and OH 0 in response to single kanji other than compound formations. Thus, the likelihood that our subjects produced compound formations only because of the compounds' greater semantic specificity over the target single kanji in a manner parallel to Saffran et al.'s subjects is reduced. And although NS is the type of patient who can be expected to produce some semantic paralexias in reading tests, OH is not this type of patient. Thus, overall, Saffran et al.'s subjects seem to resemble Sakamoto's patient more than our subjects, who seem qualitatively different.

Remark also that Saffran et al.'s subjects could read their semantically restricted, proper name stimuli better than single words. That is, the proper name sequences (first + family name) had both more correct responses and fewer semantic paralexias than single words in their study. The reading of kanji compounds by Sakamoto's subject was similar in this respect. However, NS and OH showed no such effect, further strengthening the conclusion that they are not of a type with the patients in these other two studies. And we can rule out unrelated, left-right and other visual scan problems as the reason for the failure of our subjects to match Saffran et al.'s and Sakamoto's in this regard since 1) our subjects showed no such deficit prior to the experiment; 2) our compound stimuli were presented vertically; 3) in the few cases where the subjects abbreviated a compound stimulus to the reading for one of its kanji members, the kanji read aloud was not always in the same position; and 4) likewise, when the subjects produced compound formations based on one character of a compound stimulus, the member of the compound chosen as the basis for such compound formations was not always in the same position.

This finding that compounds were not easier for the subjects to read than single kanji in our experiment does not constitute a contradiction to the subjects' compound formation tendency; it is a well known, quasi-paradox that the substitutive ease of an item

as a response does not entail the ease of the same item as a performance target in cases of aphasia.

Finally, the disconfirmation of number of phonological readings as a causal factor in compound formation also casts doubt on the role of semantic specificity in this regard. First, the reason for supposing number of phonological readings to have been implicated in the compound formation tendency (see the introduction) was an argument along the lines of specificity. Although semantic specificity and the specificity of phonological readings could logically be imagined to be dissociable in terms of impairment as a result of brain damage, the opposite case would seem to be rather more plausible. That is, if a brain damaged person is aided in lexical retrieval by specificity, such an effect would appear more likely to hold across the board. After all, these two dimensions are not completely independent. Kanji with multiple phonological readings often have different meanings more or less strongly associated with different readings.

All of the above reasons seem to point to a fundamental difference between the phenomena discussed by Saffran et al. and those presented in this paper. However, another result presented by Saffran et al. prevents a complete dismissal of their data's relevance to our own and thus of the role of semantic specificity in the compound formation tendency. In contrast to their first experiment involving proper names (and in contrast to our experiment in the case of kanji compounds), in their second experiment the subjects were asked to read aloud only the underscored words in a list of semantically restricting collocations. Sometimes their two subjects were unable to follow the instructions to read the collocations to themselves before reading the underscored word aloud. For example, one subject persisted in reading "the polar bear" as "polar bear". One of their two subjects made 6 such "phrase intrusion errors" (their terminology); the other made 9. The similarity of these errors to our patients' compound formations is striking.

Assuming Saffran et al.'s subjects had no problem with the instructions, should these "phrase intrusion errors" be taken as the English analog of the Japanese compound formation tendency? Apparently, their subjects produced no such errors in response to single words, but this fact could be attributed to the unbounded nature of the English single word stimuli. Then again, their subjects did not produce another type of error made by ours.

When attempting to read kanji compounds NS and OH sometimes picked up on one of the characters in a target compound and then read it aloud in a different compound, as mentioned in the results section. For example, NS read 話題 (/WADAI/--"topic (of conversation)") as [MONDAI] (問題 --"problem"). (Note that in this case there seems to be a net loss in semantic specificity.) The parallel in English would have been, for example, a response of "grizzly bear" to "the polar bear", but this type of response is not reported by Saffran et al. for their subjects.

An important question for future study is, thus, do the Japanese compound formation tendency and Saffran et al.'s phenomena share the same causal basis? If the answer to this question is affirmative, the differences in symptomatology pointed out above will remain to be explained. Perhaps such an explanation can be made on the basis of the peculiarities of kanji noted in the introduction; i. e., although they can usually be used in isolation in at least certain meanings these usages might not be common, and--in any case--even kanji which are commonly used alone are more often used as elements in compounds than free morphemes are so used in English. Clearly, the question of the language-specific character of the compound formation tendency is important here.

Of interest in this regard are recent data reported for Chinese (Huang 1983). Chinese dyslexics asked to read single characters like 銀 ("silver"; current Chinese character slightly different) sometimes produce an apparently unrelated oral reading which when combined with the target would form a semantically related compound. For example, in response to the target "silver" one of Huang's subjects produced an oral reading which could be interpreted as the character 行 ("go, send"), which with the target forms the common compound 銀行 ("bank"). In another case, a patient first read the compound target 文化 ("culture") as 化学 ("chemistry")--having one character in common with the target--and then self-corrected to the target. This patient's first response in this case was very similar to the compounds NS and OH made based on one kanji member of compound targets.

On an occasion separate from that of the experiment reported in this paper, NS read the character 期 (/KI, GO/--"period") as [SHUU] (probably 周 --"circumference"). (A little previously he had been asked to read the character 週 in isolation. This character for "week" shares the former's reading of /SHUU/ and, as can be seen, contains the character for "circumference".) When the character for "circumference" is combined with the target 期 , they produce the common compound "cycle, period" (read /SHUUKI/). (In fact, up until the early part of the twentieth century the character for "week" itself was used to form the compound "cycle, period" in specialized usages such as in astronomy, and it is just possible--given NS's age--that he may have learned this older usage.) In this case, which is very similar to some of Huang's data, we can surmise that NS may have first mentally accessed a compound (周期) based on the target (期) and then selected--incorrectly--part of this compound as his response. Of course, this and his many attempts at self-correction when producing compound formations also indicate that he was aware that a compound was not the correct response to the single kanji stimuli.

We can also imagine a similar process in the production of Huang's patient's responses cited above. In fact, Huang reports that his subjects sometimes made satements like "I know the [target, single] character is one of the characters in such-and-such a compound, but I do not know which one" or "It is the

character X in the compound XX". The former statement, especially, seems to indicate a process of first accessing a compound in order to produce an oral reading for a single target character, as just described for NS.

The points of difference between NS/OH and Huang's subjects are that our subjects made no such statements, and Huang's subjects did not produce compounds in response to single character targets! In a personal communication to the first author, Dr. Huang said that he thought his subjects did not orally produce compounds in response to single character targets because native speakers of Chinese have a one character-one syllable rule too firmly in mind. He also suggested that bilingual Chinese might make such compound formations.

Niki and Ueda (1977) report a Japanese patient who made many semantic paralexias in the oral reading of kanji and who could read kanji compounds better than single kanji, recalling Saffran et al.'s subjects' performance in English. However, this effect for Niki and Ueda's patient was most apparent when the target single kanji were abstract, the compound targets having a tendency to be less abtract. The same patient also made responses of the type "It is the character X in the compound XX" in a manner similar to Huang's Chinese patients. E. g., in Japanese: [denki ("electricity") no (GENITIVE) den ("electricity"; bound morpheme)]. However, our patients made no such responses, which in fact seem more consciously mediated than our patient's compound formations, which were most often spontaneous and sudden, with or without later attempts at self-correction. And Niki and Ueda report no simple compound formations on the part of their patient outside of such periphrastic expressions.

At this point we seem to have raised as many questions as we have answered! The language-specific and universal aspects of the cases described above remain the biggest question. To what extent do they all share the same causal basis? Of course, we can not rule out the possibility that one or more of the above cases mix different effects in different ways.

These questions will have to be answered before the more interesting questions raised by the compound formation tendency of our subjects can be addressed.

The tendency we have described suggests an impairment at a certain level of lexical access, a level at which compounds are accessed as a prior step in the retrieval of single kanji. That is, when trying to read single kanji our subjects appeared to adopt a strategy of first accessing a compound in which the target was an element and then picking out the target from this compound. Compound formations thus may be the result of a selective impairment in which lexical access mechanisms can not get beyond the compound stage. The response [SHUU] by NS to the character 朔 described above--where the response seemed to be incorrectly selected from a compound formation--supports this view. Of course, such a strategy could easily be imagined as

varying in effectiveness/necessity proportionally as single kanji decrease in ability to be used in isolation. That is, single kanji as commonly used as free morphemes as English words would probably not need to be accessed by such a strategy.

The question perhaps of greatest interest is whether the prior accessing of compounds when single kanji are the target for oral reading is used by normals--of course, without an impairment along the way--or whether patients like NS and OH resort to it as a result of other access routes being impaired.

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NOTES

1.) Square brackets will be used throughout this paper for the actual utterances of subjects; slashes (i. e., //) will be used for target phonological sequences. The Hepburn system of romanization for Japanese words will be used in both cases (except in that long vowels will be represented by double letters) for reasons of simplicity--narrower phonetic transcriptions not being necessary for the purposes of this paper. Upper case letters will be used for the Chinese readings (onyomi) and lower case letters will be used for the Japanese readings (kunyomi) of Japanese logographs whether in [] or //. See below for an explanation of the readings associated with Japanese logographs.

2.) Here we use "presumably" since, of course, the kanji corresponding to a subject's oral production is strictly a matter of surmise. However, the certainty of such conjectures is usually very high due to contextual factors and--in the case of compounds (but not single kanji)--the relatively small number of homonyms. Hereafter, where kanji are given for a subject's utterances we will provide no qualification unless there is some doubt to our interpretation.

3.) In this sentence--and in similar ones elsewhere--we do not mean to imply that compound formations are actually the result of a semantic search/matching impairment. We only intend that because of the relation of single kanji to the compounds in which they are used, as described above, compound formations in response to single kanji targets could be viewed as a kind of semantic paralexia. In the final section of this paper we will discuss the evidence regarding whether compound formations should actually be viewed as semantic paralexias.

Table 1

Results of the Reading Aloud Experiment

	STIMULUS CATEGORIES (number of stimuli in each column = 20)					
	SINGLE READING KANJI		COMPOUNDS WITH SINGLE READING KANJI	MULTIPLE READING KANJI		COMPOUNDS WITH MULTIPLE READING KANJI
	no. corr.	comp. forms.	number correct	no. corr.	comp. forms.	number correct
Ss:						
NS	6	12*	6	8	8	5
OH	16	4	19	18	2	15
TOTALS:	22	16	25	26	10	20

* NS's total of correct responses and compound formations here (and in the column for single kanji with multiple phonological readings) does not equal 20 since he made a very small number of phonological and other errors.

Table 2 (continued on next page)

Compound Formations Produced by NS and OH during the Experiment

		Compounds Produced in Response to SINGLE KANJI WITH A SINGLE PHONOLOGICAL READING		
		TARGET	RESPONSE (in [ ])	PRESUMED CORRESPONDING COMPOUND
NS	1	汽 /KI/ "steam"	KISEN	汽船 "steamship"
	2	駅 /EKI/ "station"	EKIBASHA*	駅馬車 "stagecoach"
	3	線 /SEN/ "line"	SENRO*	線路 "line, track"
	4	材 /ZAI/ "material"	ZAIMOKU*	材木 "timber"
	5	題 /DAI/ "topic"	MONDAI*	問題 "problem"
	6	区 /KU/ "ward"	CHIKU*	地区 "region"
	7	胃 /I/ "stomach"	Ibukuro*	胃袋 "stomach"
	8	制 /SEI/ "law"	SEIFUKU*	制服 "uniform"
	9	糖 /TOO/ "sugar"	KONPEETOO*	金米糖 "comfit"
	10	週 /SHUU/ "week"	HAISUU*	来週 "next week" (/RAISHUU/)**
			or	毎週 "every week" (/MAISHUU/)
	11	党 /TOO/ "political party"	NOOTOO*	郎党 "followers" (/ROOTOO/)
	12	症 /SHOO/ "symptom"	JUUSOO	重症 "severe illness" (/JUUSHOO/)
OH	1	汽 /KI/ "steam"	KISEN	汽船 "steamship"
	2	材 /ZAI/ "material"	ZAIMOKU*	材木 "timber"
	3	症 /shoo/ "symptom"	JUUSHOO	重症 "severe illness"
	4	題 /DAI/ "topic"	WATAI	話題 "topic (of conversation)" (/WADAI/)

Table 2 (continued from previous page)

Compound Formations Produced by NS and OH during the Experiment

		Compounds Produced in Response to SINGLE KANJI WITH MULTIPLE PHONOLOGICAL READINGS		
		TARGET	RESPONSE (in [ ])	PRESUMED CORRESPONDING COMPOUND
NS	1	期 /KI, GO/ "period"	SHUUKI*	周期 "cycle, period"
	2	塩 /shio, EN/ "salt"	ENBUN*	塩分 "salt content, salinity"
	3	境 /KYOO, KEI, sakai/ "border"	KYOOKAI*	境界 "border (of country)"
	4	牧 /BOKU, maki/ "pasture"	BOKUSHI*	牧師 "pastor"
	5	幹 /KAN, miki/ "trunk"	KANBU	幹部 "managing staff"
	6	袋 /TAI, fukuro/ "sack"	tebukuro*	手袋 "glove(s)"
	7	路 /RO, -ji/ "street, way"	HENRO*	遍路 "pilgrimmage"
			or	線路 "line, track" (/SENRO/)
	8	横 /yoko, OO/ "side"	okota*	横田 "Yokota (place)" (/yokota/)
OH	1	期 /KI, GO/ "period"	KIKAN	期間 "period"
	2	昼 /hiru, CHUU/ "noon"	hiruma	昼間 "afternoon"

* "Original" compound formations on the part of the subjects. (See results section for explanation.)

** Phonological readings are given in parentheses for those compound formations which involved some distortion in articulation (probably not due to other lexical factors).

REFERENCES

Bisazza, J. A. The Processing Complexity of Nouns and Verbs: Psycholinguistic and Neurolinguistic Issues. Ann Arbor, Michigan: University Microfilms International, 1980.

Huang, C. Y. Deep Dyslexia and Chinese Orthography, paper presented at the Fifth Neurolinguistics Seminar, International Christian University, Tokyo, Japan, November 19-20, 1983.

Japanese National Language Research Institute. Vocabulary and Chinese Characters in Ninety Magazines of Today (in Japanese). Tokyo: Shuei Shuppan, 1964.

Marshall, J. C. and F. Newcombe. Variability and Constraint in Acquired Dyslexia, in H. A. Whitaker and H. Whitaker (eds.), Studies in Neurolinguistics, Volume 3. New York: Academic Press, 1977.

Niki, R. and S. Ueda. A Case of 'Pure' Alexia Showing a Remarkable Recovery More than a Year after the Onset (in Japanese), Yoyogi Hospital Medical Report, 1977, 14:4-16.

Saffran, E. M., M. F. Schwartz and O. S. M. Marin. Semantic Mechanisms in Paralexia, Brain and Language, 1976, 3:255-65.

Sakamoto, S. A Contribution to Kanji and Kana Problems in Aphasia (in Japanese), Medical Journal of Osaka Nisseki, 1940, 4:185-212.

Sasanuma, S. Acquired Dyslexia in Japanese: Clinical Features and Underlying Mechanisms, in M. Coltheart, K. Patterson and J. C. Marshall (eds.), Deep Dyslexia. London: Routledge and Kegan Paul, 1980.