2 Lexical Access in Japanese

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ABSTRACT

The structural properties of the two Japanese scripts, kana and kanji, are described. Kanji characters are classified as either *single* or *compound*, with the single characters being subclassified as *simple* or *complex*. Some questions are raised with respect to the organization of the lexicon. The available evidence suggests that there is direct access to semantics from kanji stimuli but that kana characters have to be translated into a phonological code before lexical access is possible. More detailed analysis of lexical access in Japanese awaits the appropriate experiments.

AN INTRODUCTION TO JAPANESE SCRIPTS

There are two kinds of orthographic system used in Japanese—kana and kanji. Neither of these scripts is alphabetic. Kana characters each represent a syllable, while kanji is ideographic with the characters representing semantic units. In normal writing the two kinds of script are used together. Roughly speaking the kanji characters represent the base form of nouns, verbs, and adjectives, while kana characters are used for the grammatical morphemes and for imported words for which there is no kanji character.

Kana

There are two kinds of kana, each with 48 basic characters which are extended to 71 by the use of diacritics. The two forms are called hiragana

(cursive kana) and katakana (square kana). Each kana character represents a speech unit which may be either a consonant–vowel combination, a vowel alone, or a nasal sound. These units are of approximately equal duration in speech and are technically known as "mora." There are combinations such as /nyo/, written with two kana characters, /ni/ and /yo/, which are also one mora in length. We will refer to the speech units as "syllables," but it should be borne in mind that this terminology is not strictly correct.

The two sets of kana characters are shown in *Figs.* 2.1 and 2.2. Note that the characters for *wi*, *we*, *zi*, *v*, which occur in some available tables of kana, are not used any more. It should be apparent that, in general, the two scripts are only slightly related, although the characters for /he/ and /ri/ are virtually identical, and those for /u/, /ka/, and /ki/ are similar. Those similarities that exist are due to both forms having evolved by a process of simplification from kanji characters. It is not known why both forms have survived.

It should also be apparent that the basic characters in the two scripts are not decomposable phonetically. It is not possible to take a character and determine from its structure whether it represents a consonant–vowel (CV) or a vowel (V) syllable, let alone determine the precise phonetic elements. On the other hand, the diacritics do convey some phonetic information, one indicating a voiced consonant and the other an initial /p/.

Because of these features, Japanese children learn kana–sound correspondences by rote. Many children begin to do this before they reach school age without receiving any formal instruction, by being exposed to kana in their daily environment, for example books, toys, TV programs, etc. According to a nationwide survey on preschool children's reading abilities (National Language Research Institute, 1972), 14% of the 818 four-year-olds and 36% of the 13,995 five-year-olds studied could read all 71 hiragana. By the age of six, when they enter elementary school, the majority of children have learned to read hiragana. In formal education this process is completed and the children are taught katakana. Since the characters cover all the sounds of Japanese, the normal Japanese child or adult has no problem in transcribing any Japanese speech sequence into either form of kana. This would apply equally to sequences that would normally be written in kanji and to nonsense sequences.

The two versions of kana are used in different contexts. Hiragana is the form used for grammatical morphemes, while katakana is used for representing words borrowed from other languages and for transcribing non-Japanese proper names. It is also used to give emphasis, equivalent to the use of italics in English.

HIRAGANA

	A あ	I い	U う	E え	O お
K	ka か	ki き	ku く	ke け	ko こ
S	sa さ	si (shi) し	su す	se せ	so そ
T	ta た	ti (chi) ち	tu (tsu) つ	te て	ro と
N	na な	ni に	nu ぬ	ne ね	no の
H	ha は	hi ひ	hu (fu) ふ	he へ	ho ほ
M	ma ま	mi み	mu む	me め	mo も
Y	ya や		yu ゆ		yo よ
R	ra ら	ri り	ru る	re れ	ro ろ
W	wa わ				(w)o を
N ん					

G	ga が	gi ぎ	gu ぐ	ge げ	go ご
Z	za ざ	zi (ji) じ	zu ず	ze ぜ	zo ぞ
D	da だ	ぢ	zu づ	de で	do ど
B	ba ば	bi び	bu ぶ	be べ	bo ぼ
P	pa ぱ	pi ぴ	pu ぷ	pe ぺ	po ぽ

FIG. 2.1. The set of hiragana characters.

KATAKANA

	A	I	U	E	O
K	ka カ	ki キ	ku ク	ke ケ	ko コ
S	sa サ	si (shi) シ	su ス	se セ	so ソ
T	ta タ	ti (chi) チ	tu (tsu) ツ	te テ	to ト
N	na ナ	ni ニ	nu ヌ	ne ネ	no ノ
H	ha ハ	hi ヒ	hu (fu) フ	he ヘ	ho ホ
M	ma マ	mi ミ	mu ム	me メ	mo モ
Y	ya ヤ		yu ユ		yo ヨ
R	ra ラ	ri リ	ru ル	re レ	ro ロ
W	wa ワ				(w)o ヲ
N ン					
G	ga ガ	gi ギ	gu グ	ge ゲ	go ゴ
Z	za ザ	zi (ji) ジ	zu ズ	ze ゼ	zo ゾ
D	da ダ	bi ヂ	zu ヅ	de デ	do ド
B	ba バ	ヒ゛	bu ブ	be ベ	bo ボ
P	pa パ	pi ヒ゜	pu プ	pe ペ	po ポ

FIG. 2.2 The set of katakana characters.

Kanji

The structure of kanji is complex, and can be better understood by reference to the system's origins. Prior to the 18th century, contact between Japanese culture and other cultures was sparse. During some periods of contact with the Chinese, the Japanese adopted the Chinese writing system. Each character in Chinese corresponded to a concept which had a name in spoken Japanese. This name then became attached to the character. However, the Chinese characters corresponded to spoken forms in Chinese language and, in modified versions, these remained attached to the characters. The writing of the original characters became simplified but the two names remained attached. The original Chinese pronunciation is known as the *on*-reading, and the Japanese word is called the *kun*-reading. Thus, the character 土, which means "earth" or "soil," has an *on*-reading /to/, which is the present-day Japanese version of the original Chinese pronunciation, and a *kun*-reading /tuti/, which is the native Japanese word for the meaning of the character. For a variety of historical reasons, many characters have more than one *on*-reading or more than one *kun*-reading. With a few exceptions, when a character is used in isolation it is given the *kun*-reading; when it occurs in compounds, it is given the *on*-reading in the majority of cases.

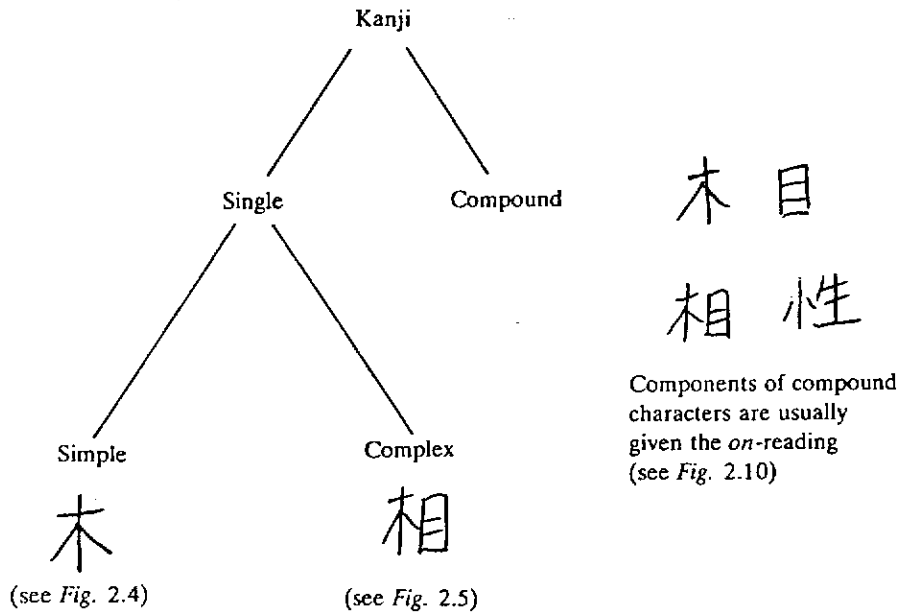


FIG. 2.3. A classification of kanji characters.

人 people /hito/

土 earth /tsuchi/

火 fire /hi/

山 mountain /yama/

石 stone /ishi/

虫 insect /mushi/

金 gold /kiN/

魚 fish /sakana/ FIG. 2.4. Examples of simple kanji characters.

We can divide words in kanji into two kinds, *single* and *compound* (*Fig.* 2.3). Compound characters are made up of a sequence of single characters and both the meaning and the pronunciation of the compounds are determined by the nature of the components. This will be illustrated shortly.

The single characters are of two kinds, *simple* and *complex*. Some of the simple characters, together with their meanings and pronunciation, are shown in *Fig.* 2.4. The complex characters are made up of two or three components, one of which is termed the "radical." There are 214 of these basic components, which include all of the single characters. Traditionally the meaning of the radical is reflected in the complex character. This is illustrated in *Fig.* 2.5 where two groups of complex characters are given, based on the single characters meaning "tree" and "speech/language" respectively. It will be seen that in these cases the complex characters are semantically related to the meaning of the radical. This relationship is extensively utilized to help children learn how to extract meanings out of complex kanji as well as how to write them. However, the relationship is not always as clear as in these examples. Thus the polysemous character 相 means "appearance," "minister of state," or "each other," none of which is transparently related to "tree." While the radical determines part of the meaning of a complex character, it has no effect at all upon its pronunciation. Thus, while the character for *tree* is pronounced "ki" in isolation, *timber* is "zai" and *village* is "mura."

It will be seen that the kanji characters are usually more visually complex than those of the kanas. However, there are regularities in the ways the

木 (tree)	言 (speech, language)
机 (desk)	話 (story)
杖 (cane)	詩 (poetry)
材 (timber)	語 (word)
村 (village)	評 (criticism)
枝 (twig)	訂 (correction)
板 (board)	証 (evidence)
松 (pine)	訳 (translation)
檜 (cypress)	誤 (error)

FIG. 2.5. Examples of complex kanji based on the radicals for *tree* and *speech, language*.

component units (or strokes) are combined (Fujimura & Kagaya, 1969). When the single characters are written they take up the same space whether they are single or complex. This means that the radical is sometimes modified compared with its form as a single character (see *Fig.* 2.5).

The single characters usually have mono- or disyllabic pronunciations. This means that there is a great deal of homophony in the language. According to Martin (1972) this is in part because in spoken Chinese any syllable can be spoken with one of four contrasting intonations or "tones" (e.g., rising, falling). These tones function like phonemes, such that a change in the tone creates a different word with a different meaning. When the Japanese borrowed the Chinese characters they ignored the tones in the pronunciation, thus greatly increasing the amount of homophony over the Chinese.

Figure 2.6 illustrates two examples of homophonous sets of words with their kanji. Note that some of these are simple and some complex. In one case there are as many as 18 different kanji characters with the same pronunciation. Moreover, there are numerous pairs whose members, unlike most homophonous pairs in English, are in the same semantic field and of the same form class. These are a real source of ambiguity. To give a couple of examples, the words for "national anthem" and "national flower" are homophones; so are the words for "integer" and "positive

/ka/	/shi/
花 (flower)	師 (teacher)
香 (scent)	市 (city)
課 (section)	史 (history)
科 (course)	詩 (poetry)
荷 (load)	死 (death)
蚊 (mosquito)	資 (resources)

FIG. 2.6. Sets of homophonous kanji. Note that some are simple characters and some are complex.

number." We have noted that many characters have multiple *kun-* and *on*-readings. In cases of polysemy, there is no systematic relation between the particular meaning intended and the pronunciation.

Some sets of homophonous words are signalled in the kanji character by means of a shared "phonetic" component. Complex Japanese characters are sometimes described as having two components, the radical and the phonetic, the former indicating a part of the meaning and the latter determining the pronunciation. By this account previously unknown kanji, representing known words, could be decoded. There are many characters for which this has some truth. *Figure* 2.7 gives some examples where the radical meaning "water" is combined with various phonetics in complex characters. Note that, in this case, the radical does not resemble the independent character meaning "water." 水. In *Fig.* 2.7 each of the complex

海	清	浅	浸
/kai/ (sea)	/sei/ (clear water)	/sen/ (shallow)	/shin/ (to soak)
悔	晴	銭	侵
/kai/ (to regret)	/sei/ (clear weather)	/sen/ (money)	/shin/ (to invade)

FIG. 2.7. Examples of the interaction of the radical and "phonetic" components.

characters is paired with another complex character which shares the same phonetic and has the same pronunciation. Altogether there are about 600 phonetics. These correspond to the *on*-reading of the characters.

According to some authorities, over 80% of the kanji are of the "radical + phonetic" form. Saito et al. (1979) stress this aspect of kanji: "If one needs to know the rough meaning, one can look at the semantic part (radical) first, and if one needs to find the sound, one can search out the phonetic part [p. 197]." However, very few Japanese use the phonetic in practice, or have even thought of doing so. The spatial relationship between the two elements is variable. The phonetic can be to the left, right, above, below, or inside the radical.

During the learning of kanji, particularly when the child has progressed to compound nouns, the kanji are paired with a kana transcription of the character. This is either written above or to the side of the kanji. This additional aid is called *furigana*. It is gradually removed from educational texts except for such kanji as placenames, names of people, and rare words. Thus it seems possible that in the course of learning kanji, some kind of phonological mediation process is set up. One issue might well be the extent to which this hypothesized mediation process drops out, or is bypassed, as the reader becomes more practiced. It is likely that there would be large individual differences in this respect and it is possible that the mediation, if it exists, is not connected functionally to output phonology or to normal kana reading. It could be an independent system or could tap into some stage of the speech-recognition processes.

The single kanji characters are classified by the number of strokes required to write them. This can be as many as 16 for relatively frequent characters, while more obscure words can have up to 30 strokes. The number of strokes is used as one dimension of classification of kanji in

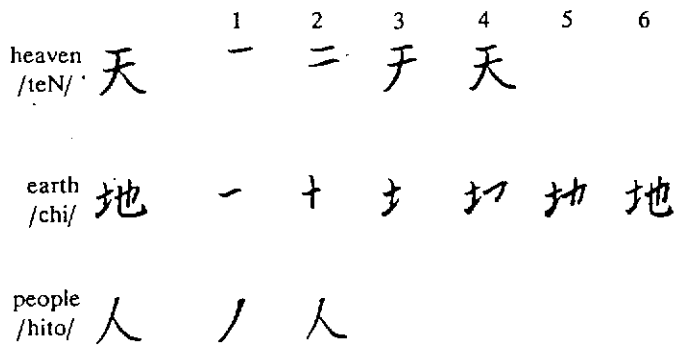


FIG. 2.8. The stroke order for kanji characters is invariable. For each of the three characters the sequence from left to right shows the successive stages in writing the character.

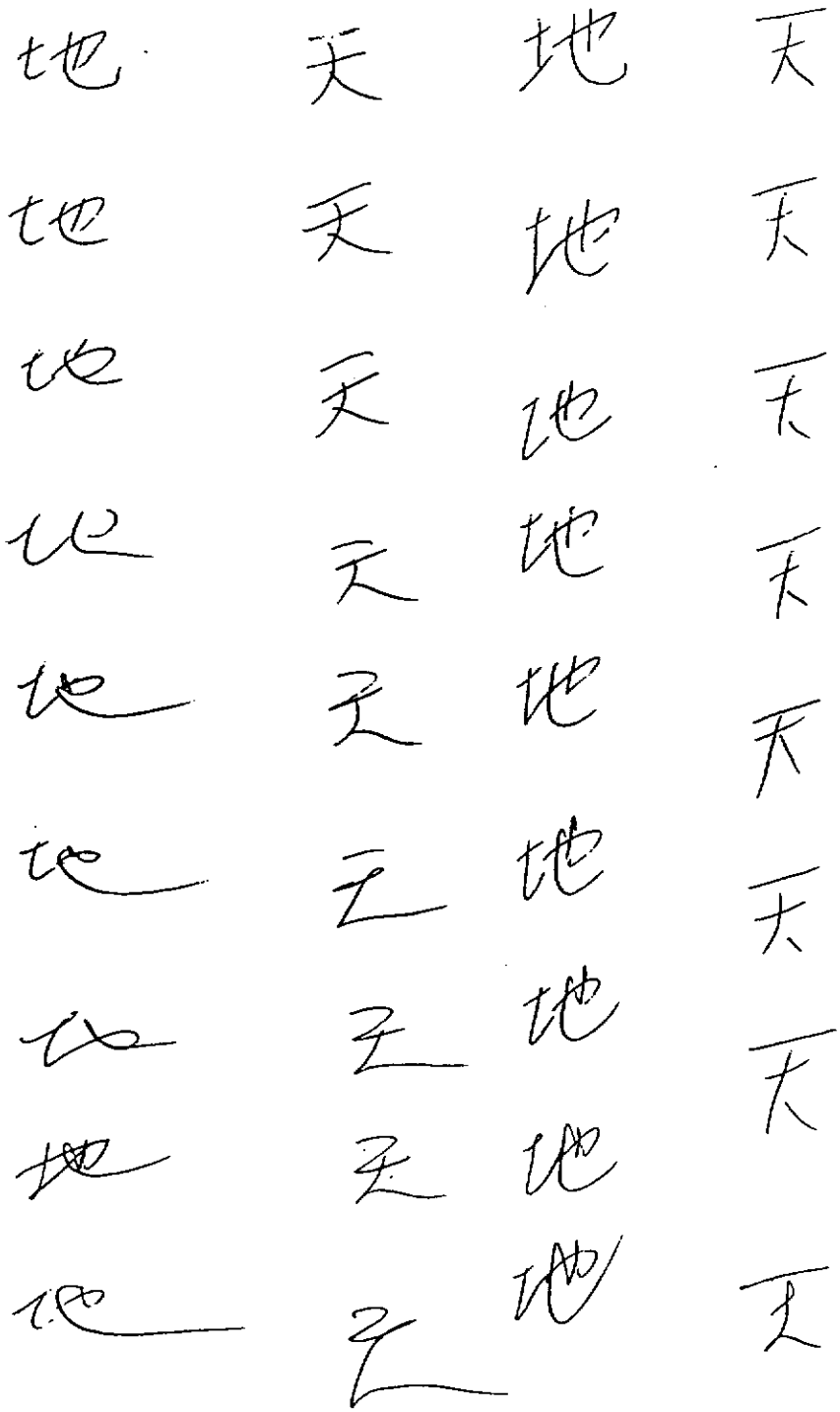


FIG. 2.9. Examples of rapid writing of two of the kanji characters whose structure is shown in *Fig.* 2.8. In these cursive versions some strokes are attenuated or even missing, but there is sufficient information to allow the perceptual system of the reader to "reconstruct" the missing strokes.

Japanese dictionaries. Thus it can be important to know what counts as a stroke. In addition, the order of writing the strokes is fixed. The rule is, roughly speaking, from top to bottom and left to right with horizontal strokes preceding vertical ones. However, there are subtle variations on these rules. In *Fig.* 2.8 we give examples of the order of writing two kanji characters. One reason for maintaining the correct order of strokes emerges with rapid writing, as illustrated in *Fig.* 2.9. In this figure the first two columns were written by one person and the last two columns by a second person. They represent successive attempts at two of the characters shown in *Fig.* 2.8, written increasingly informally down each column. All these versions would be acceptable in a letter from someone known to the reader. Here we see that some of the strokes are attenuated with respect to the canonical form, or even missing. However, there is information in the strokes, which gives clues as to the missing components.

There are many thousands of single kanji characters. Of these, about 1850 have been selected by the Japanese Ministry of Education as a basic minimum to be learned by all children by the end of their formal education. These are learned after kana has been mastered. Single kanji are introduced into easy sentences and the child has extensive practice in writing each one, in the proper manner, before being introduced to another set. The basic kanji are, however, inadequate even to read a newspaper or magazine. For this, at least 3000 kanji would have to be known. It is estimated that at least 90% of the Japanese population have this level of literacy, though there are no official data. Makita (1968) estimated the incidence of developmental dyslexia in Japanese children to be 0.98%.

The problem of learning kanji extensively is acute. Most Japanese adults observe that there are kanji which they once knew but have forgotten, and it is usual that the recognition vocabulary is much greater than the production (written) vocabulary. On the other hand, when asked for the Japanese equivalent of an English word, Japanese people will sometimes unconsciously write in kanji in the air with their fingers, before being able to produce the spoken form.

Compound Characters. The real complexity with the relation between print and sound with Japanese comes with the compound characters. As we have already observed, these are made up of a set of two or more single characters. The pronunciation of the compound is determined by its components. However, there appear to be no rules which determine whether it is the *on*- or the *kun*-reading of the component characters which is used in the compound. In *Fig.* 2.10 we give some examples of compounds in which both forms are used. Thus the character for *eye*, which is read /me/ in isolation, can occur either as /me/ or as /moku/—the *on*-reading—in compounds. The other two examples show that the reading which is used—the

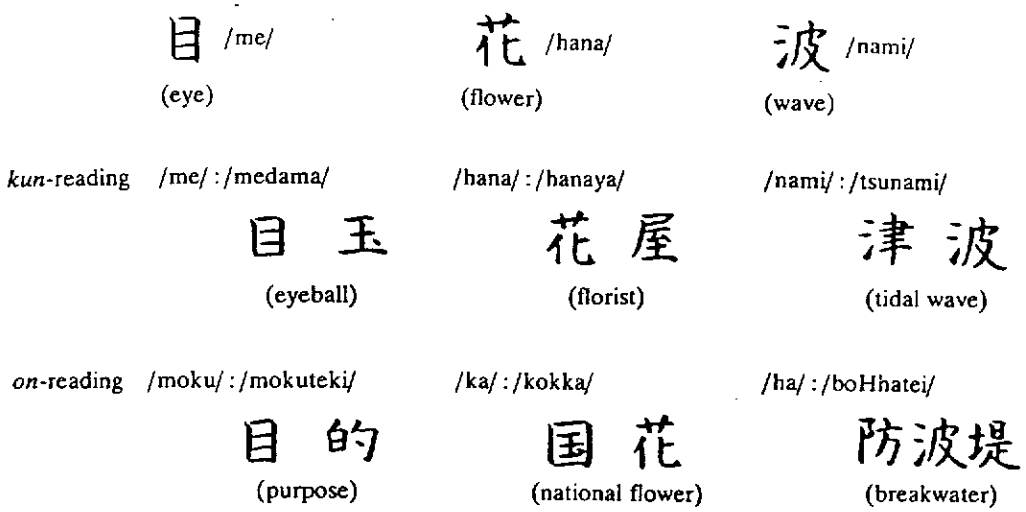


FIG. 2.10. Examples of the occurrence of both the *on*-reading and the *kun*-reading of single characters when they occur in compounds.

on- or *kun*-reading—is not determined by whether a character is at the beginning or end of the compound.

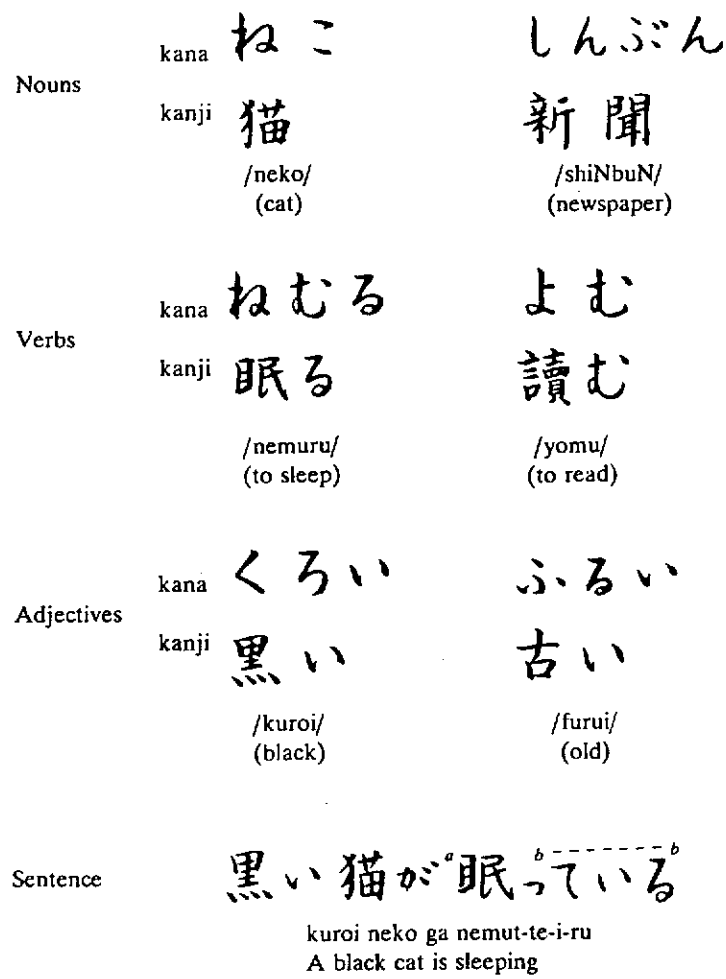
While both readings of single characters can occur in compound words, it should be noted that it is more usually the *on*-reading which appears. Note also that while it is usually the *kun*-reading which is used for single characters, this is not always the case.

The meaning of compounds is usually related to the meanings of the components. Thus *eyeball*—/medama/—is made up of /me/ (*eye*) and /dama/ (*round object*). The word /mokuteki/ is made up of /moku/, the *on*-reading of *eye* and /teki/ meaning "target." The result has the meaning "purpose," which is less directly related to the components. It should also be noted that a pair of simple characters can be combined to make up either a single, complex character, such as the polysemous 相, referred to above, which means "appearance," "minister of state," or "each other," or a compound character 木 目, which means "the grain of wood." The meanings of the two are unrelated, though the latter is related semantically to *tree*. Note that in cases where there is more than one *on*-reading to a single character, and where the character has more than one meaning, there is no systematic relation between the pronunciation and the meaning participating in a compound.

Writing in Japanese

Japanese was traditionally written vertically, with the columns going from right to left across the page. However, it is now often written horizontally,

as with English. In both cases the kana and kanji characters take up equal space and no space is left for word boundaries. The two scripts are used together in writing, but kanji can only occur by itself for nouns and, occasionally, adjectives; for all other parts of speech kana must be used as well. Such uses are illustrated in *Fig.* 2.11. This shows how nouns can be modified by the addition of a kana character, /i/, to form an adjective. Thus



[a]A case particle for subject.
[b]An auxiliary verb for present progressive.

FIG. 2.11. Examples of the combination of kanji and kana—the kana always follows the kanji with which it is associated. Although Japanese is written without spaces, the process of segmentation is made simple by the kanji–kana alternation.

blackness becomes *black*. The character retains the *kun*-reading in most but not all cases. Secondly, *Fig.* 2.11 shows verb forms with inflections. These are required for the infinitive as well as other forms. Note that the two verbs which are given take different inflections, written in kana, to indicate the infinitive. Finally we give a sentence written with the combination of forms.

Morphology in Japanese. With very few exceptions, nouns have no special plural form. There are no case variations, but "particles" (written in kana after the kanji root) are used to indicate certain relationships such as subject, object, and "of." Verbs have no inflections to indicate person or number. There are separate forms for present and past but no other forms equivalent to the English tenses. On the other hand, there is a variety of moods for the verb, including the "probable" mood, and different inflections for negative forms. Japanese adjectives are unmodified when they qualify a noun. In predicate position they sometimes agree with the verb in tense and mood.

Reading in Japanese

From what we have said about the structure of the two scripts and the way they are taught, we might have some a priori ideas about the way they are read. To start with, the strict relationship between sound and the kana characters, together with the early, extensive rote learning of the association, might lead us to expect that kana symbols are initially translated directly into some phonological equivalent. Any further processing would then be in terms of the phonology. Note, however, that this is not strictly entailed. For example, in principle the kana used as grammatical markers could, as visual symbols, directly trigger linguistic processes. In this way the kanji–kana combinations, such as an inflected verb, could be interpreted without any recourse to a phonological interpretation of the kana. Although such a process is possible it should be noted that it is counterintuitive to adult Japanese.

On the other hand, at first sight it seems clear that kanji characters are translated into meaning directly. It is widely reported that this process proceeds without any phonological activity at all, and such is the subjective impression of the Japanese reader. There are some obvious reasons for this. First, if we just take the reading of single characters, the degree of homophony in Japanese means that the phonological code would not be very helpful. Secondly, the existence of multiple readings of each character when they occur in compound nouns means that the citation form of a single character (usually the *kun*-reading) would often be misdirecting as a means of accessing the meaning. Given that most single characters actually

occur more often in print as part of compound nouns than they do as single nouns, this presents a major obstacle to the use of phonological codes as an intermediary. One theoretical option, which might rescue the phonological hypothesis, is that compound nouns are categorized as lexical units purely visually, and are translated, as units, into the full phonological interpretation. They are thus the equivalent of the direct input–output route in models of reading English (e.g., Morton & Patterson, 1980).

A related view is put forward by Saito et al. (1979), who argue strongly that kanji characters can be processed phonologically without recourse to the meaning of the characters. They quote experiments by Saito (1978) which used a same–different task with pairs of kanji characters. Four kinds of pairs were used: identical pairs; homonyms, which were graphically dissimilar; graphically very similar pairs with different names; and pairs which differed both graphically and in their names. The procedure used in the experiments was to present one of the pair and require the subject to read out the *on*-reading of the character. This was to guarantee that the homonym relationships were established, which they would not have been had the subjects (silently) produced the *kun*-reading. Then the second kanji was presented and the subject responded by saying "yes" or "no," being timed via a voice key.

In the first experiment the judgment was one of identity; the crucial data concerned the dissimilar pairs. Saito et al. report: "The results showed that RT (reaction time) increased when graphemically similar Kanji were presented. The results also showed that RT increased when homonym Kanji were presented, even though the experiment did not require the subject to use phonemic processing as the basis of his decision making [p. 201]."

In a second experiment the subjects were required to make a phonological judgment, responding "yes" if the two characters had the same pronunciation. Apparently, "yes" RTs were greater for the nonidentical homophonous pairs than for the identical pairs, and "no" times were greater for the graphemically similar, nonhomophonous pairs than for the completely dissimilar pairs.

Unfortunately we cannot tell whether the effects of phonological similarity would be found on identity judgments in an experiment where the subjects were not forced to read the stimuli out loud. Neither can we tell from this experiment whether the *on*-reading of the characters is produced directly from the visual code or after some semantic processing. Since the *on*-reading is, strictly speaking, a property of the character, in combination with other characters it might be simpler to imagine a direct connection between an input kanji lexicon and an *on*-phonological lexicon. (There are other ways of achieving the same end but this is the simplest.) The alternative would be to use the single kanji stimulus to access the representation of some compound noun (just one of many suitable compound nouns),

then to access the meaning of that compound and thence derive the pronunciation, producing only the appropriate part of it. Thus, faced with the need to produce the *on*-reading of the character for *eye* (see *Fig.* 2.10), one could access the compound noun with the meaning "purpose," derive the pronunciation /mokuteki/, and then just say "moku."

It seems from this analysis that maintaining the idea of semantic mediation in the pronunciation of kanji entails the postulation of rather elaborate processes. One thing to be said in favor of the idea is that, when asked to name single kanji characters without any instruction as to which reading is to be taken, some Japanese adults spontaneously use the *on*-reading for many of the characters, immediately glossing them by reference to a compound, thus "moku, as in mokuteki." The conditions under which this occurs have not been determined.

The dominance of the visual–semantic link for kanji is also illustrated by the fact that some Japanese, in listening to the spoken language, are aware of visualizing kanji, particularly with proper names and in cases of homonymy.

Models for Reading in Japanese

The best data available for helping us to decide on the organization of reading processes in Japanese appear to be neuropsychological. Some of this evidence is described by Sasanuma (see Chapter 3). The general conclusion is that kana is read phonetically and kanji is read visually. These conclusions, together with the impression of a strong dissociation between the processes involved in reading the two scripts, do not preclude the possibility that some visual–phonetic conversion is possible with kanji, or that some direct access to semantic or syntactic processes might occur with kana. But it seems likely that such possibilities are neither major nor necessary.

Beyond such issues we are faced with the task of determining the nature of the functional units in the recognition systems, the degree of interaction between the scripts and the speech recognition processes, and the degree of interaction between input and output processes. One way of investigating such issues is by means of various facilitation paradigms. The general technique is to present a priming stimulus and discover the effect on the later processing of a test stimulus. Using intervals between prime and test of 10–40 minutes, and using a perceptual recognition paradigm, it has been established for English that producing a word (e.g., naming a picture) does not affect subsequent visual recognition of that word (Clarke & Morton, 1983). As a result of these and other data, Morton (1979, 1982; Morton & Patterson, 1980) has proposed a separation of the systems responsible for input analysis of words on the two modalities and a separation of these

processes from output processes. The methodology is suggestive with respect to Japanese. There are a number of questions which could usefully be asked, and which presuppose certain factors. In particular they presuppose that there are early stages of analysis of kanji and kana, which are functionally separate from each other and from the speech recognition processes. Among other questions are the following:

1. Does kana recognition involve the speech system? This would be tested by examining the effects of reading words written in kana on the subsequent recognition of those words spoken in noise.
2. What is the organization of the kanji recognition system? Facilitation effects with a particular time course can be interpreted as identifying a particular processing level. In English the recognition task already described seems to tap a stage of processing where *sees* and *seen* are equivalent (Murrell & Morton, 1974) and where *stock market* is a unit but *street market* is not. Presentation of the latter but not of the former facilitates subsequent recognition of *market* (Osgood & Hoosain, 1974). With kanji we could examine whether facilitation effects found with single characters were also found from compound characters to the components (as with *street market*) or whether the compounds were integral at that level (e.g., with *stock market*). Equally, one could examine the pattern of interfacilitation between complex characters and the radicals which were a part of them.
3. Are input and output processes independent? This could be examined by looking at the effects of writing kanji characters to dictation on the subsequent ease of visual recognition of these characters. The priming would have to be done under conditions where the subjects could not see what they had written.

One experiment has been completed which casts some light on the second question (Sasanuma & Morton, in preparation). In this experiment subjects first made imageability judgments on a set of kanji. After this they were presented with a sequence of kanji in a tachistoscope. This sequence included some of the original set of kanji, characters related to some of the original set, and some controls. The most interesting relationship tested was that between single characters and compound nouns containing these characters. In the compounds selected the critical single characters are given the *on*-reading, that is, different from the pronunciation of the characters of their own. The data were clear: identity facilitation was found for both single and compound nouns. In addition, prior presentation of a compound led to facilitation in recognition of the components, which was equivalent to the identify facilitation. However, prior presentation of one of the components of a compound had no effect on the subsequent recogni-

tion of the compound. We conclude from this that the compound nouns have a representation in the input lexicon that is independent of the components, much as *stock market* is independent of *market*. However, unlike the English case, the units corresponding to the single characters are affected by presentation of the compounds.

It is relatively easy to design a research program for investigating Japanese. Only when some tens or even hundreds of empirical studies have been completed will we be able to piece together the nature of reading in Japanese.

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