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# Surface-oriented Morphological Network

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## 1 Introduction

The approaches to inflectional morphology have mainly been divided into two types: morpheme-based approaches and paradigm-based approaches. The former regard word forms as concatenations of minimal meaningful units called ‘morphemes’. The latter, on the other hand, assume that a ‘word’ is the basic unit in morphology and each word exists in relation to other words, namely various word forms constitute an inflectional ‘paradigm’. To formalise morpheme-based approaches, two well-known models, an Item and Arrangement (IA) model and an Item and Process (IP) model, have been developed in the literature (Bloomfield 1933, Hockett 1954). The IA model posits isomorphic relationships between morphemes and functions, so that word forms are analysed as or constructed by agglutination of morphemes and their functions are calculated by addition of the morphosyntactic properties of each morpheme. Beyond mere composition of morphemes, the IP model develops morphophonological rules which are operated over underlying forms of morphemes and derive surface strings, so that stem alternations and allomorphy can be captured by

rule applications. Paradigm-based approaches have been developed as a Word and Paradigm (WP) model (Matthews 1972, 1991, Anderson 1992, Aronoff 1994, Beard 1995, Stump 2001). The WP model assumes that inflected forms are all derived from a base form (root or stem) of a lexeme by a stem change or addition of affixes. Such morphological operations are carried out according to the morphological class and various morphosyntactic properties. The outputs are an exhaustive list of inflected forms of a given lexeme, and they constitute a paradigmatic structure in which entries are related to each other in terms of their morphosyntactic properties.

Languages vary in terms of their degree of transparency of components within a word. Some are fusional, which makes it difficult to identify units smaller than a word, while others are agglutinative, where a word can easily be decomposed into pieces. Japanese is one of the languages often referred to as an agglutinative language. Therefore, on the surface, it seems to favour morpheme-based approaches to analysing its morphological structure. Rickmeyer (1995) and Narrog (2009), for instance, present IA and IP model analyses of Japanese conjugation system. Despite the seemingly plausible analyses of those previous works, this paper argues against a morpheme-based approach to Japanese verb morphology, and instead proposes a WP analysis. Unlike many of recent rule-based WP models, the present study re-evaluates a traditional surface-oriented model by utilizing cognitive concept of ‘analogy’ (Blevins and Blevins 2009). Based on the empirical study of the language, this work further develops psychologically valid network model of morphology, primarily focusing on Bybee’s (1985, 1995, 2001) pioneering proposal.

This paper is organised as follows. In section 2, I will overview a morpheme-based approach to the Japanese conjugation system presented by Rickmeyer (1995) and Narrog (2009) and point out empirical and conceptual problems in their analyses. I then propose an alternative analysis in section 3. The analysis consists of two parts. In the first part, an outline of the concept of analogy and its application to the verb inflection in Japanese will be presented. The second part focuses on modeling Bybee's network model in relation to the WP analysis presented in the first part. The discussion will be concluded in section 4.

## 2 Morpheme-based analysis

### 2.1 IA and IP models

Japanese is a highly agglutinating language, in which it is relatively easy to isolate grammatical morphemes from roots and stems and assign a unique feature to each of them. Since the fusion between stems and affixes or the cumulation of features is rare, morpheme boundaries are highly transparent. Those properties motivate researchers to take IA or IP approaches to the Japanese conjugation system, which generalise the relationships between word forms only in terms of presence or absence of morphemes and associated features. For instance, following Rickmeyer (1995), Narrog (2009:68) presents a template analysis of Japanese inflectional system as shown in (1). In this formula,  $q$  stands for a prefix,  $L$  for a lexeme,  $s$  for a derivational suffix,  $f$  for an inflectional suffix, and the possibility of recursive applications and the optionality of affixes are signalled by  $r$  and  $\pm$  respectively.

$$(1) \quad q_r \pm (L \pm s)_r \pm f$$

Lexemes ( $L$ ) are divided into categories of verbs (V), adjectives (A), nouns (N), adverbs (ADV), adnominals (ADN) and interjections (I). Derivational suffixes ( $s$ ) also belong to any of these classes represented as -v, -a, -n, -na, -adv and -adn (interjections do not have derived forms). According to this template word-internal structure, agglutination of lexeme stems and derivational and inflectional suffixes can be analysed as follows.<sup>(1)</sup>

$$(2) \quad \text{a. } yom\text{-}eba$$

read (V) -COND

$$\text{b. } yom\text{-}are\text{-}ta$$

read (V) -PASS (v) -PST

$$\text{c. } yom\text{-}ana\text{-}kute$$

read (V) -NEG (a) -COND

$$(3) \quad \text{a. } taka\text{-}i$$

high (A) -NPST

$$\text{b. } taka\text{-}kat\text{-}ta$$

high-VRB (v) -PST

$$(4) \quad o\text{-}hiki\text{-}uke\text{-}si\text{-}na\text{-}i$$

HON-pull (V) -receive (V) -do (V) -NEG (a) -PST

(cf. Narrog 2009:70)

In (2 a), the verb stem (V) is immediately followed by an inflectional suffix ( $f$ ) signalling conditional mood. In (2 b), a verbal passive derivational suffix, *are*, is inserted between the stem and the inflec-

tional suffix encoding past tense. (2c) illustrates that the verb stem is followed by an adjectival negative suffix, *ana*, so that it is subject to the adjective inflectional pattern. (3) shows the cases where an adjective lexeme stem is followed by an inflectional suffix with or without an derivational suffix. Finally, in (4), the cluster of three verb stems is preceded by the honorific prefix and followed by the adjective negative suffix and the inflectional suffix.

In addition to word formation by the combination of stems and affixes, the Japanese conjugation system utilises particle cliticisation to extend its inflectional pattern. Narrog (2009:69) cites Rickmeyer's 'one-word-phrase' template incorporating particle attachment as in (5).

$$(5) \quad W \pm (=p \pm s \pm f)_r$$

*W* signifies an output of (1), namely a word consisting of lexeme stems and affixes, and *p* stands for particle. = mark preceding *p* signals clitic status of particles. Hence, (5) states that *W* can be followed by a complex of a particle, a derivational suffix (*s*) and an inflectional suffix (*f*). Again, *r* allows a cluster of *p*, *s* and *f* to appear recursively after *W*. With respect to the categories, *p* is divided into word classes in nearly the same way as suffixes, i.e. =v (verbs), =a (adjectives), =n (nouns) and =na (nominal adjectives), except some of the particles, such as case particles *ga* (nominative), *o* (accusative) and *ni* (dative), which are treated as an unspecified category =p. Rickmeyer calls the whole unit of (5) 'one-word-phrase'. Narrog (2009:70) provides an example of one-word-phrase as in (6).

- (6) [*o-hiki-uke-si-na-i*] = *rasi-kat-ta*  
 [HON-pull (V) -receive (V) -do (V) -NEG (a) -PST]  
 =EVID (a) -VRB (v) -PST  
 'It was said that (s/he) wouldn't accept'.

The square brackets enclose *W* in the one-word-phrase, which is already given in (4). The following cluster consists of an adjectival particle encoding evidential mood, a verbalizer and a past tense suffix.

## 2.2 Morphomic alternation and periphrasis

Although the morpheme-based analysis summarised so far captures agglutinative nature of Japanese verbal inflectional morphology neatly and presents very powerful analytic architecture, it is not immune from classic problems in morpheme-based approaches that have long been pointed out in the literature. First of all, some of the inflectional forms are built on other inflectional forms. For example, the negative imperative *yom-u-na* and the negative hortative *yom-u-mai* are both constructed by suffixation to the non-past form *yom-u*. Any morpheme-based approach would incorrectly predict that those forms include the non-past feature in their grammatical meaning as shown in (7).

- (7) a. *yom-u*  
       read-NPST  
       b. *yom-u-na*  
           read-NPST-NEG.IMP  
       c. *yom-u-mai*  
           read-NPST-NEG.HORT

Another problematic aspect is observed in the forms founded on the gerundive stem like *yom-i*. This stem can be part of various other complex forms such as polite forms (*yom-i-masu* 'read-POLITE'), verb-verb compounds (*yom-i-hazimeru* 'read-begin'), verb-noun compounds (*yom-i-kata* 'read-way') and verb-adjective compounds (*yom-i-yasui* 'read-easy'). Since a stem ending in a vowel is directly followed by a suffix or another word as exemplified in *tabe-masu* 'eat-POLITE' and *tabe-hazimeru* 'eat-start', the morpheme *-i* seems to function merely as an epenthesis that enables the stem with a consonant ending to be connected to another formative. However, the *-i* suffixation has some more complication. This stem can also precede suffixes beginning in a voiceless alveolar stop such as *ta*, *te*, *tara*, *tatte* and *tari*. In those cases, the stem alternation and the epenthesis insertion are regulated by complex rules summarised in (8).

- (8) When a suffix *ta*, *te*, *tara*, *tatte* or *tari* follows a stem,
- a. a voiced consonant ending of the stem makes the initial voiceless consonant of the suffix voiced.
    - i. *sin* + *ta* → *sin-da* 'die-PST'
  - b. a stem ending *r* or *w* is changed to *t*:
    - i. *kar* + *ta* → *kat-ta* 'cut-PST'
    - ii. *kaw* + *ta* → *kat-ta* 'buy-PST'
  - c. a stem ending *b* or *m* is changed to *n*:
    - i. *tob* + *ta* → *ton-da* 'fly-PST' (cf. (8 a))
    - ii. *yom* + *ta* → *yon-da* 'read-PST' (cf. (8 a))
  - d. a stem ending *k* or *g* is deleted after *i* is inserted between

the stem and the suffix:

- i. *kak* + *ta* → *ka-i-ta* 'write-EP-PST'
- ii. *kag* + *ta* → *ka-i-da* 'sniff-EP-PST' (cf. (8 a))

Some of those rules may be given straightforward phonological accounts such as voice harmony as often postulated in an IP model analysis. Tsujimura and Davis (1988), for example, present an autosegmental phonology account of the *-i* epenthesis. However, one of the questions those complex rules raise is the morpheme status of such an epenthesis. (8) shows that they are not part of extension of the stem. They do not contribute any grammatical meaning to the form. In fact, Japanese has various other epentheses, which do not seem to be phonologically motivated. They are inserted in morphologically or lexically idiosyncratic ways according to the element that follows the stem. (9) shows insertion of epentheses before the negative suffixes with an initial nasal consonant and *zu*. Further, the choice of imperative suffixes and epentheses for a stem with a vowel ending and a consonant ending are arbitrarily determined as in (10).

- (9) a. If a stem ending in a consonant is followed by either *nu* ~ *n*, *naide*, *neba* or *zu*, *a* is inserted between the stem and the suffix:
  - i. *kas* + *nu* → *kas-a-nu* 'lend-EP-NEG'
  - ii. *kak* + *neba* → *kak-a-neba* 'write-EP-COND'
- b. If a stem ending in *mas* is followed by *nu* ~ *n*, *e* is inserted between the stem and the suffix:
  - i. *kak-i-mas* + *n*



→ *kak-i-mas-e-n* 'write-EP-POLITE-EP-NEG'

- (10) To realise an imperative form,
- a. add *e* to a stem with a vowel ending:
    - i. *kak* + *e* → *kak-e* 'write-IMP'
  - b. add *o* to a stem with a consonant ending and insert either *r* or *y*:
    - i. *tabe* + *y/r* + *o* → *tabe-y/r-o* 'eat-EP-IMP'

The idiosyncratic insertion of the epentheses *a* and *e* and the arbitrary choice of formatives for imperative are clear indication of 'morphomic' status of those operations in Aronoff's (1994) sense. The morphology proper status of epentheses cannot naturally be captured by any morpheme-based approach. There is no substantial reason for assigning a certain grammatical function to morphomic epentheses.

Another serious problem in a morpheme-based approach is found in the intra-paradigm relationships between word forms. As argued in Otoguro (2007), the Japanese conjugation system has some gaps in its paradigm. Table 1 illustrates that there are gaps in the verbal negative forms and those gaps are complemented by the inflected forms of the derived adjectival stem. The cells of negative past, conditional, disjunctive and representative are expressed entirely by inflection of the derived stem, i.e. *kakanakatta*, *kakanakattara*, *kakanakutatte* and *kakanakattari* respectively. The negative tentative, conjunctive and conditional I are expressed by multiple competing forms. The degree of frequency of use of those forms varies. For instance, the derived conditional I *kakanakereba* is more frequently used than *kakaneba*, presumably because the latter is syncretic to the obligative mood. Similarly,

the negative non-past is dominantly expressed by the derived adjectival form *kakanai*, rather than the verbal counterpart *kakanu*. The forms for the conjunctive *kakanaide* and *kakanakute*, on the other hand, are interchangeable with a slight stylistic difference. The two forms for the tentative are rarely used and being replaced by a circumlocutive expression *kakanai daroo*, in which the non-past form is followed by the tentative form of a copula. A rule-based morpheme analysis fails to capture such complementary relations across paradigms or varying degree of frequency of use found in competing forms.

	Aff	Neg	Neg
Non-past	<i>kaku</i>	<i>kakanu</i>	<i>kakanai</i>
Indicative			
Past	<i>kaita</i>	—	<i>kakanakatta</i>
Tentative	<i>kakoo</i>	<i>kakumai</i>	<i>kakanakaroo</i>
Conjunctive	<i>kaite</i>	<i>kakanaide</i>	<i>kakanakute</i>
Conditional I	<i>akeba</i>	<i>kakaneba</i>	<i>kakanakereba</i>
Conditional II	<i>kaitara</i>	—	<i>kakanakattara</i>
Disjunctive	<i>kaitatte</i>	—	<i>kakanakutatte</i>
Representative	<i>kaitari</i>	—	<i>kakanakattari</i>

Table 1: The forms of *kak* ‘write’ and *kakanai* ‘not write’

A similar argument is applicable to the negative polite forms. Table 2 shows the gap in the negative polite past form in the synthetic paradigm. This missing cell is complemented by a periphrastic negative. One of the interesting aspects of the periphrasis is the fact that politeness feature is doubly marked on the main verb *kakimasen* and the copula *desita*. Moreover, this form is not mere circumlocution in that no formative can intervene between the main verb and the copula. For in-

stance, a normaliser *no* can often appear inside a similar verb-copula construction as in (11a, b). Such intervention, however, is not allowed for the negative polite past periphrasis as shown in (11c, d). This fact suggests that the components of the periphrasis are being tied more closely due to its role of complementing the missing cell in the synthetic paradigm. A morpheme-based approach is unable to account for the fundamental reason why a special periphrasis is utilised in the language's morphological system, since it ignores mutual relationships among inflected forms.

	Aff	Neg	Periphrastic Neg
Non-past	<i>kakimasu</i>	<i>kakimasen</i>	—
Past	<i>kakimasita</i>	—	<i>kakimasen desita</i>

Table 2: The forms of synthetic and periphrastic negative polite

- (11) a. *kakanai daroo*  
 write.NEG COPULA.TENT
- b. *kakanai no daroo*
- c. *kakimasen desita*  
 write.NEG.POLITE COPULA.POLITE.PST
- d. \**kakimasen no desita*

### 3 Network model

In this section, I shall present ‘word-based’ analysis of the Japanese verb inflectional morphology. Although a word-based approach follows the fundamental assumption of WP models, it is distinct from recent rule-based WP frameworks such as Anderson (1992), Beard

(1995) and Stump (2001). In those frameworks, inflected forms are derived from a base form via realisation rules. In other words, a unidirectional relation between inputs and outputs is assumed. As summarised in the previous section, Japanese morphomic stem alternations and epentheses as well as periphrastic inflection make it difficult to set up realisation rules. Instead, I will pursue an alternative approach, analogical proportion. Another notable property of the Japanese conjugation system is the fact that there are competitions among synthetic, periphrastic and circumlocutive forms. I will illustrate that the strength of the competing forms in the lexicon can be captured by Bybee's network model.

### 3. 1 Analogical proportion

Anderson (1992:365–372) raises the issue of 'analogy' in the discussion of morphological change. He highlights the Old English (OE) noun *bōk* 'book' and its transition of the sub-regular umlaut plural form *bēc* in OE to the more productive regularised *bōkes* in Middle English. In traditional historical linguistics, this sort of diachronic change is often attributed to the analogy of a regular singular and plural pair such as *stōn* 'stone' and *stōnes* 'stones' to other inflectional patterns. As Anderson presents, the analogical relations can formally be stated as an equation like (12), in which a pair of singular and plural forms associated with each other by the regular pattern is equated to the singular *bōk* and a variable *X*. The proportional analogy allows us to solve this equation as in the second line where *X* is equal to *bōkes*.

$$(12) \quad st\acute{o}n : st\acute{o}nes = b\acute{o}k : X \\ X = b\acute{o}kes$$

The key to establish the analogical proportion is the grammatical and lexical relatedness between the forms (cf. Kuryłowicz 1964). When the pair  $a : b = c : d$  conforms to analogical proportion, one side of the proportion, e.g.  $a : b$ , must be an instantiation of some rule or principle of grammar. If derived or inflected form  $b$  is 'founded' on the base form  $a$ , then the formula  $a : b = c : d$  is an admissible proportion. To illustrate this point more clearly, Anderson (1992:369) shows the following contrast between two kinds of proportional relations. (13a) is a valid proportional analogy, since the relation between *write* and *writer* can be established by the morphological system of English that derives an agentive noun of an action from the base verb. In (13b), on the other hand, the relation between *write* and *receive* cannot be deduced from the morphology in English. Therefore, (13b) does not constitute a legal analogical proportion.

$$(13) \quad \text{a. } write : writer = receive : receiver \\ \text{b. } write : receive = writer : receiver$$

Although Anderson's discussion mainly focuses on diachronic 'change' of inflectional patterns, particularly the regularisation of irregular or sub-regular forms, analogical relationship is applicable, or even desirable, to synchronic morphological relations between inflectional forms.<sup>(2)</sup> I outline what kind of analogical proportion can be presented in order to work out the details of Japanese verb inflec-

tional morphology. First of all, following the standard WP model assumption, I assume that inflected forms are paired with morphosyntactic features. The features are represented as [+...] (cf. Karttunen and Beesley 2003).<sup>(3)</sup> Accordingly, the lexeme *yom* ‘read’ has pairs of fully inflected forms and features as in (14). Those entries allow other forms to be deduced by analogical proportion as in (15).

- (14) a. *yomu* [+npst]  
 b. *yome* [+imp]  
 c. *yomeba* [+cond]  
 d. *yomoo* [+hort]  
 e. *yomanu* [+neg]
- (15) a.  $\langle yomu, [+npst] \rangle : \langle yome, [+imp] \rangle$   
       =  $\langle nomu, [+npst] \rangle : \langle X, [+imp] \rangle$   
        $X = nome$
- b.  $\langle yomoo, [+hort] \rangle : \langle yomeba, [+cond] \rangle$   
       =  $\langle nomoo, [+hort] \rangle : \langle X, [+cond] \rangle$   
        $X = nomeba$

Note that in (15), the analogical pattern is more explicitly stated by four-part analogy, i.e. using a pair of ‘form’ and ‘feature’. Of course, the analogy can be defined purely in terms of form, i.e. checking the phonological similarity between the proportions, as in (16), but even in that formalism, feature matching is implicitly operated to check whether the analogical proportion is admissible or not (cf. (13)).

- (16) a. *yomu* : *yome* = *nomu* : *X*  
       *X* = *nome*  
       b. *yomoo* : *yomeba* = *nomoo* : *X*  
       *X* = *nomeba*

As alluded to in (7), some of the forms are built on the non-past form of the lexeme without including the non-past property in their grammatical meaning. This can be captured by two-part analogies as follows (cf. Blevins 2005:16).

- (17) a.  $\langle X, [+npst] \rangle = \langle Xto, [+trns] \rangle$   
       b.  $\langle X, [+npst] \rangle = \langle Xna, [+neg, +imp] \rangle$   
       c.  $\langle X, [+npst] \rangle = \langle Xmai, [+neg, +hort] \rangle$

(17) is a formula abstracted from concrete forms and applicable globally to the whole conjugation system. That is, the transitional, the negative imperative and the negative hortative are always based on the non-past form, as Matthews (1972, 1991) calls such forms ‘parasitic’ inflection. Therefore, the three patterns of inflectional forms can be obtained regardless of the types of stems as shown in (18).

- (18) a. *yomuto* [+trns] (‘read.TRNS’)  
       b. *kuruna* [+neg, +imp] (‘come.NEG.IMP’)  
       c. *tabemai* [+neg, +hort] (‘eat.NEG.HORT’)

In a similar fashion, we can define the two-part analogy over a root and a gerund as in (19) where *Xc* and *Xv* signify a root ending in a con-

sonant and one ending in a vowel respectively. As mentioned above, since some other inflectional forms and variety of compounds are parasitic on a gerund, we further develop the analogy into (20).

- (19) a.  $\langle Xc, [ ] \rangle = \langle Xci, [+gerd] \rangle$   
 b.  $\langle Xv, [ ] \rangle = \langle Xv, [+gerd] \rangle$
- (20) a.  $\langle X, [+gerd] \rangle = \langle Xmasu, [+pol, +npst] \rangle$   
 b.  $\langle X, [+gerd] \rangle = \langle Xtai, [+desid, +npst] \rangle$

Those generalisations allow us to put various inflectional forms together in the network. The lexical entries deduced from (20) can be given as in (21) and (22).

- (21) a. *yomi* [+gerd]  
 b. *yomimasu* [+pol, +npst]  
 c. *yomitai* [+desid, +npst]
- (22) a. *tabe* [+gerd]  
 b. *tabemasu* [+pol, +npst]  
 c. *tabetai* [+desid, +npst]

The periphrastic inflection found in Table 2 can also be deduced from the two-part analogical proportion with other polite forms. Firstly, we can obtain the negative polite non-past form from the affirmative, polite, non-past form as generalised in (23a). Then, since the negative polite past is parasitic on the non-past counterpart, (23b) can be posited. The resultant lexical entries are given in (24).



- (23) a.  $\langle Xu, [+pol, +npst] \rangle = \langle Xen, [+neg, +pol, +npst] \rangle$   
 b.  $\langle X, [+neg, +pol, +npst] \rangle = \langle X \textit{ desita}, [+neg, +pol, +pst] \rangle$
- (24) a. *yomimasu* [+pol, +npst]  
 b. *yomimasen* [+neg, +pol, +npst]  
 c. *yomimasen desita* [+neg, +pol, +pst]

Note that realisations by analogical proportions are not unidirectional rules. As long as the proportions are admissible, the forms can be deduced in any direction. Moreover, since the analogy is defined purely in terms of surface forms and deductive implication, it is unnecessary to posit indices of morphological classes for the sake of constraining rule applications as found in rule-based WP models.

### 3. 2 Lexical connections

One of the remaining questions is how analogically related entries are structured in the lexicon. Bybee (1985, 1995, 2001) proposes that lexical items are stored in the procedural memory and constitute a network in the lexicon where each form has a different degree of relatedness to other forms. The strength or closeness of relation varies depending on semantic similarity, phonological similarity and the token frequency of the forms. For instance, inflected forms of the same lexeme are semantically very similar, so that they are closely related to each other. Among them, some members share the same stem which makes them phonologically closer to each other than others that have different stems. In addition, token frequency of use affects the strength of a given item.

Based on those assumptions, Bybee (2001:118) depicts a partial net-

work of the Spanish verb *cantar* ‘sing’ like Figure 1. The distance between forms corresponds to the degree of relatedness, and the size of the form represents its lexical strength. In Figure 1, the third person singular forms are the strongest in the network, which are often regarded as default forms in the language. Among other forms, the first person singular is stronger than the second person or the plural forms. The forms that share the same tense are semantically closer, so that the distance between them are closer than ones that encode different tense.

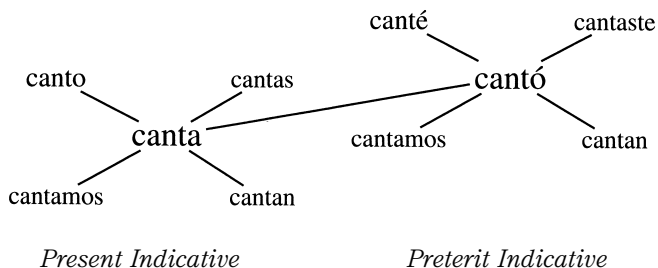


Figure 1 : Relations among some forms of the Spanish verb *cantar* ‘to sing’

If we apply this type of network model to the representation of the lexical relatedness of entries in the Japanese conjugation system, something like figure 2 can be given (cf. Table 1 and 2). Although this is a conventional schematic way of describing the relationships among forms, the fundamental idea is to place four core entries in the centre of the network, i.e. the non-past *kaku*, the polite non-past *kakimasu*, the negative non-past *kakanai* and the negative polite non-past *kakimasen*, and all the forms inflected for tense, politeness and polarity surround those four core entries. At the same time, those surrounding forms are also in relation to other forms in terms of their semantic

and phonological closeness.

The lexical strength of the entries is also reflected in the figure. Clearly, the core four items are strong since they are the most frequently used. The crucial point in this respect is the relative strength between two competing forms such as *kakanu* vs *kakanai*, *kakaneba* vs *kakanakereba*, and *kakanaide* vs *kakanakute*. In the first two pairs, the latter are stronger than the former, whereas in the last pair the two forms are more or less equal in terms of strength. Those differences in lexical strength reflect the token frequency of the forms.

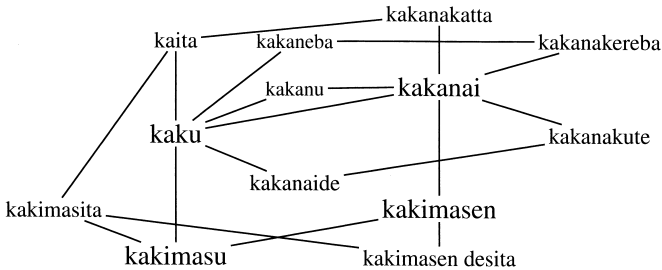


Figure 2 : Relations among some forms of the Japanese verb *kak* 'write'

## 4 Conclusion

Languages vary in terms of its complexity and transparency of morphological structures. The classic IA and IP models seem to work nicely when the target language is highly agglutinating, and fusion or cumulation of features rarely occurs. However, careful observation reveals that it is not always the case that we can expect isomorphic relations between formatives and functions. Furthermore, in many languages intra-paradigm relation plays a crucial role to structure the lexi-

cal organisation of inflectional forms.

This paper has primarily focused on the Japanese conjugation system and provided a critical overview of a morpheme-based approach. The existence of morphomic stem alternations and epenthesis sheds doubt on the IA and IP analyses. Furthermore, the periphrastic negative polite past form clearly suggests that the lexical relatedness between the members of a paradigm must be incorporated in the theory of inflectional morphology. To this end, the present study offers an analogy-based WP analysis of the Japanese verb inflection. It has elegantly revealed that all the forms across the paradigm can be deduced from each other, and parasitic relations among forms are also generalised based on analogical proportions.

Finally, we have investigated the lexical organisation of surface forms. Following Bybee's pioneer work on network model, surface-oriented morphological network has been proposed for the Japanese conjugation system. Although more detailed empirical support is needed to develop a fully representative network, the current proposal successfully puts inflectional forms in relation to other forms in the network reflecting the analogical connections between them and describes the lexical strength of the entries, which are largely ignored both in the IA and IP models and WP models.

#### Notes

- (1) The following abbreviations are used in the gloss: COND (conditional), CONJ (conjunctive), EP (epenthesis), EVI (evidential), HON (honorific), NEG (negative), NPST (non-past), PASS (passive), PST (past), SUBJUNCT (subjunctive), TENT (tentative), VRB (verbalizer).
- (2) Blevins (2005, 2006), for instance, argues for the advantages of a word-

based approach to Estonian and Saami declension and Georgian conjugation patterns.

- (3) The following abbreviations are used for the morphosyntactic features in the lexical entries: +cond (conditional), +conj (conjunctive), +desid (desiderative), +exmp (exemplificative), +gerd (gerandive), +hort (hortative), +imp (imperative), +neg (negative), +npst (non-past), +pst (past), +subj (subjunctive), trns (transitional).

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