Rule vs. Analogy in Word Formation*

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1. Productivity of word formation rules

One of the salient properties of language is that it has two faces: dynamic and static. We often attribute the uniqueness of human language to the fact that it can generate infinite number of sentences to express infinite number of propositions, but at the same time it has a finite set of words that are combined to form a sentence. Roughly speaking, the former property can be relegated to syntax and the latter to the lexicon, so syntax represents the dynamic aspect of language, while in the lexicon we find a finite list of words memorized by the speaker of that language. Thus it is often pointed out that while it is possible to list the memorized words as a dictionary, it is utterly impossible to compile all the potential sentences of one language.

When we look closely into what constitutes the mental lexicon (our knowledge about the words of one language), however, we see that it is not merely static. There are word formation processes that create words out of existing ones: taking *happy* as an example, prefixation of *un-* derives *unhappy*, suffixation of –ness *happiness*, and compounding *trigger-happy* and *happy hour*. Given such word formation rules, can we say that the lexicon is as dynamic as syntax is? The answer is clearly no, since many of the outputs of word formation rules are themselves listed in the lexicon because many of such outputs are only potential words and not actual words (Aronoff (1973)): *unhappy vs. #unsad*.[1] In other words, even though word formation rules can combine words just as syntactic rules do, there is a question of productivity of the process. Some word formation processes are extremely productive and most of the outputs are actual words, while others are not productive (or idiosyncratic) and produce only a handful of existing words. Such varying degrees of productivity are never observed in syntactic rules; even though there may be some constraints to limit the application of syntactic rules, the grammaticality of the output sentence is always predictable by principle.

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[1] The symbol '#' is used to mark potential but non-existing words.

The various degrees of productivity that we find with word formation rules have raised the following question. Is the difference in productivity only a matter of degree or are some word formation rules fundamentally different from others? To this effect there recently have appeared a large number of works investigating the nature of word formation rules, especially inflectional morphology, from the psycholinguistic and neurolinguistic point of view. In the following I will first review the claims put forward concerning the mental mechanisms behind the regular and irregular inflection in English. Then I will discuss the possibility of extending such proposals to derivational morphology as well. In particular, various productivity found in Japanese derivational morphology will be taken up, followed by some experimental evidence suggesting that different degrees of productivity can be attributed to different mental mechanisms behind them. In the course of the discussion I hope to show that two different mechanisms, rule and analogy, are responsible for creation of new words, and that they should be distinguished from each other.

2. Regular vs. irregular inflection in English

2.1. Different approaches to English inflection

In languages that show dichotomy between regular and irregular inflection such as English, it has been assumed that the forms with regular inflection (*boys*--PL., *walked*--PAST) are generated by the rule which attaches *–s* and *–ed* to the stem, while those with irregular inflection (*teeth*--PL., *ran*--PAST) are memorized. In other words, the inflected forms are listed in the lexicon item by item, whereas the outputs of regular inflection (e.g. *boys, walked*) are not necessarily memorized.

This idea of regular/irregular dichotomy in inflection has been disputed from two completely different angles. On one hand, there is the connectionist group in psychology which claims that regular and irregular inflection are basically the same processes, so there is no clear dichotomy between the two. There is no suffixation rule which attaches plural or past ending to the stem; rather there exists a network of connections between the base word (*run, walk*) to the inflected word (*ran, walked*), which sustain such inflectional relations (Rumelhart & McClelland 1986). This idea is partially motivated by the fact that so-called ‘irregular’ inflection paradigm is not totally random but actually consists of some prominent patterns. For instance, the pattern *XinY --> XanY* accounts for a number of verbs; *sing/sang, ring/rang, drink/drank, sink/sank* (Bybee and Slobin 1982, Pinker and Prince 1991). Such patterns in inflectional paradigm have been shown to have some psychological reality

by an experiment involving novel words (Bybee and Moder 1983). For example, hen asked to form a past form from a novel word which belong to the given pattern '*XinY*', the subjects answered '*XanY*' (ex. *spling* --> *splang*). If we assume that each irregular inflection belongs to a certain pattern, the so-called 'regular' inflection can be considered just one such pattern, X --> X-ed, except that it is found with the majority of verbs. Then in this account there is no dichotomy in inflection. A single mechanism of network connection can handle all inflection; the distinction between regular and irregular inflection consists only in the number of verbs belonging to that pattern rather than in the mechanisms behind them.

On the other hand, it has been claimed by Pinker & Prince (1991) and others that inflection in English does not consist of a regular/irregular dichotomy, but there are three different mechanisms involved in the production and comprehension of a complex lexical item as listed below:

(1) Type of process:	Examples (English past forms):
a. computation / rule	V+ed --walk/walked, laugh/laughed
b. associative memory	sing/sang, ring/rang, drink/drank, sink/sank, . . .
	sleep/slept, keep/kept, feel/felt, mean/meant, . . .
c. rote memory / listed	go/went, be/was

Rule-governed processes such as the English past participle formation with -ed in (1a) are derived by pure concatenation of stem and affix, and are characterized by being productive, applied to nonce words, and compositional in meaning. On the other hand, the so-called irregular inflection forms are not simply listed in the lexicon, but can be divided into two groups, (1b) and (1c) above. Associative memory links patterns or types, and handles the irregular forms that show 'sub-regularities' or family resemblance, as exemplified in (1b). This process can be characterized as semi-productive, as it allows analogical extension such as *spling* --> *splang,* which we have seen above. Rote memory links item to item without any association of patterns, so the suppletion pairs shown in (1c) are simply listed in the lexicon. This process is completely unproductive.

Since there is little controversy over the claim that the suppletive pairs of (1c) are listed in the rote memory, the issue is whether (1a) and (1b) are different mechanisms or not. While the connectionist approach claims that they are, Pinker and his colleagues claim they are not; hence the latter is called the "dual-mechanism" approach. Now we will look at its motivation in more detail.

2.2. Rule and associative memory in inflection

According to the dual-mechanism view put forward by Pinker and Prince (1991),

rule and associative memory represent two distinct mechanisms behind production and comprehension of inflected forms; rule (suffixation of *–ed* for verb, *-s* for noun) is responsible for regular inflection, and associative memory for irregular inflection (XinY~XanY pattern for *sing/sang, sink/sank,* etc., and XooY~XeeY for *tooth/teeth, foot/feet,* etc.) Their major differences as noted by Pinker and Prince (1981), Prasada and Pinker(1983), and Pinker (1998) can be summarized as the following.

First, associative memory maintains the links between the existing forms in the lexicon, while rule applies 'on-line' to a given item. From this follows the fact that when a new form enters the lexicon, it almost always takes the regular inflection. For instance, the plural form of a loanword from French *chief* is *chiefs*, not *chieves* (cf. *thief~thieves*, *leaf~leaves*). Secondly, associative memory, but not rule, shows the frequency effect, that is, irregular inflection is found only with words of high frequency, since the association link is strengthened by frequency. It is well known that irregular forms (*give~gave, hide-hid*) are the ones frequently used, while less frequent words such as *cleave~clave*, *chide~chid* tend to be overgeneralized to *–ed* forms. Furthermore, some verbs are used less frequently in past tense (ex. *I can't <u>bear</u> it*., and such verbs sound awkward in past tense: *bore*. This contrast is not found with regular inflection verbs: *afford* is not frequently used in past tense, but *afforded* is just as fine.. Thirdly, associative memory is based on similarity (or recognized pattern) of the linked items; thus we find some patterns of resemblance among the family of irregularly inflected forms as shown in (1b) above. This point was demonstrated by the experiments using nonce words: *splung* was accepted as the past form of *spling* due to its similarity to the pattern observed with *spring~sprung, string~strung,* and so on. In contrast, *nust* was not accepted as the inflected form of *nist* because there is no similar existing verb with the same inflection pattern.

This last point is significant in that associative memory can be the basis for formation by analogy. In non-experimental situation, we find some speech errors that are based on analogy, when one utters *brang* as the past tense of *bring* by analogy to the registered pattern of sing/sang, ring/rang and so on, when the rote memory that links bring and brought fails. Thus, as we will discuss later, analogy based on associative memory provides a way of deriving new words, which is distinct from deriving new words by rule.

The regular-irregular dichotomy has also been attested by various observations about level-ordering in word formation as pointed out by Kiparsky (1982). In level-ordered morphology, word formation processes are classified into more idiosyncratic Level 1 processes and more regular Level 2 processes. Level 1 processes such as *go~went, sing~sang, and keep~kept* precede Level 2 processes such as *–ed* suffixation, so the former can block the application of the latter and we do not get *goed, singed,*

and keeped. In other words, regular inflection such as –ed suffixation functions as the default rule and attaches to the verb unless it has been already turned into the past form. For instance, the verb *fly*, in the sense "to hit a fly-ball " is a denominal verb and its [+irregular] verbal feature has been lost, so it undergoes regular inflection: *flied*. Similar explanation can be offered as to why irregular plural inflection is blocked in exocentric words and proper names: low-lifes, Mickey Mouses, Batmans. Furthermore, since compounding belongs to Level 2, it follows that only irregular inflection can occur inside the compound: *mice-infected* (vs. **rats-infected*), *teeth-marks* (vs. **claws-marks*), and *men-bashing* (vs. **guys-bashing*). This contrast has been attested to exist in the grammar of the 3 to 5 year-old children (Gordon 1985).

We have briefly reviewed the claims of the dual mechanism theory as opposed to the single-mechanism theory now. In short, the dual mechanism theory claims there are two distinct processes or rule and associative memory involved in inflection, while the single mechanism theory claims only the latter is involved.

3. Dual-mechanism theory and derivational morphology

The debate between the single and dual mechanism theories have been very intense over these few years, but it has only involved inflectional morphology as its domain. This naturally raises the question as to whether derivational morphology involves both rule and associative memory. If that turns out to be true, the dual mechanism theory can encompass all types of complex word formation, not just inflection.

There has been very little attempt to extend the debate in the current context to the processes of derivational morphology. One exception is the study in progress by Alegre and Gordon (1998). They have tested whether the 'neutral' affixes (e.g. –er, -ness, -able), which do not affect the internal phonology of the stem to which they attach, behave like regular inflection, as opposed to 'non-neutral' affixes (e.g. –ion, -al, -ity). They tested the acceptability ratings for nonce derived forms with different degrees of similarity to existing forms that take the affixes in question, and found that the acceptability ratings for the non-neutral affixes were affected by similarity to some extent and those for the neutral affixes were not, but the correlation was not perfect. Thus the question of whether the dual mechanism theory can apply also to derivational morphology has not sufficiently been explored.

In the following I will discuss the various degrees of productivity found in Japanese derivational morphology, and give some evidence which suggest the possibility that rule/associative memory dichotomy can be observed in derivational

morphology on a par with that found in regular/irregular inflection.

4. Productivity of affixation processes in Japanese

As an agglutinative language Japanese employs numerous affixation processes of various degrees of productivity. Among them we can find at least the following three categories which were also attested for English as discussed by Pinker and Prince (1991): not productive at all, semi-productive, and completely productive.

First, some affixation processes are so unproductive that the output clearly is listed in the lexicon as such; for example, derivation of an inchoative verb from a color term by the following various affixes.[2]

(2) Noun / Adjective stem + affix : 'to take on [color]'
N + (r)am-u: aka-ramu 'redden', shir-amu 'whiten'
N + bam-u: ki-bamu 'yellow', aka-bamu 'redden', shira-bamu 'whiten',
&ao-bamu 'become bluish', &murasaki-bamu 'become purple',
&kuro-bamu 'blacken' (cf. ase'sweat'-bamu 'become sweaty')
N + zum-u: kuro-zumu 'blacken', &ao-zumu 'become bluish'
N +zame-ru: ao-zameru 'become pale'
N + ker-u: shiratya 'lit. white-brown' –keru 'discolor, fade'
akatya 'lit. red-brown'-keru 'tan' (cf. susu 'soot'-keru: 'become dirty')
N + bi-ru: &ao-biru 'become bluish' (cf. huru 'old'-biru: 'look aged')

These affixes are very similar to one another in their meaning but they differ depending on the color term they attach to. Some color noun (e.g. ao 'blue') can take more than one affix, but some forms listed in the dictionary are obsolete. And there are color terms that cannot take any affix of this sort (e.g. midori 'green'). These affixes are all quite low in productivity and attach to only a handful of items including color terms. So even though it is clear that these words consist of stem + affix, we hardly get conscious about them being complex words.

The second group of affixes are the semi-productive ones, which attach to a fair number of stems. They show a certain degree of idiosyncrasy in selecting some stems over the others for no clear phonological or semantic reasons. In the following examples, the lexical gaps, the words that should be possible but do not exist, are marked with #.

First, *-maru / -meru* attaches to a large number of adjective stems to derive inchoative verbs, but as shown below it has certain lexical gaps for no apparent

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[2] The symbol '&' is used to mark words which are listed in the dictionary but are not frequently used.

reason. In this respect English deadjectival formation by *–en* or zero affix is more productive.

(3) Adjective + -maru / -meru ‘ become / cause to become (Adjective)’

taka-maru / -meru ‘heighten’ tuyo- maru / - meru ‘strengthen’
kata-maru / -meru ‘harden’ atata-maru / -meru ‘warm (up)’
maru-maru / -meru ‘curl (up)’ hiro-maru / -meru ‘widen’
sizu-maru / -meru ‘quiet (down)’ haya-maru / -meru ‘quicken’
usu-maru / -meru ‘thin (down)’ huka-maru / -meru ‘deepen’
yowa-maru / -meru ‘weaken’ seba (<sema)-maru / -meru ‘narrow’
chika-maru / -meru ‘near’
#naga-maru / -meru ‘lengthen’ #ko-maru / -meru ‘thicken’
#atu-maru / -meru ‘heat (up)’ #asa-maru / -meru ‘shallow’
#tumeta-maru / -meru ‘cool (down)’ #too-maru / -meru ‘get far’

Secondly, *-meku* attaches to a handful of adjective stem or noun to derive a verb meaning “showing the property of being (Adjective/Noun)”. It is much less productive than *-maru / -meru*, but as the question mark before some words with # suggests, the line between existing and non-existing forms is not so clear, probably due to analogy based on the existing form.

(4) Noun / Adjective + -meku ‘show the signs of x’

N: haru-meku ‘show the signs of spring’
aki-meku ‘show the signs of fall’
nazo-meku ‘appears to be a mystery’
ima-meku ‘show the signs of present, modern.
#asa-meku ‘show the signs of morning’
?#huyu-meku ‘show the signs of winter’
?#kotae-meku ‘appears to be an answer’

A: huru-meku ‘appears to be old, oldish’
?#atarasi-meku ‘appears to be new’

Third, the suffix *–asii* attaches to verbs of psychological attitude and derives adjectives with the meaning “(Verb)-able, causes one to (Verb),” but it also has lexical gaps.

(5) Verb + -asii ‘causes one to (Verb)’

konom-u ‘to like x’ – konom-asii ‘(x is) likable’
nozom-u ‘to hope for x’ – nozom-asii ‘(x is) desirable’
urayam-u, netam-u ‘to envy x’ – urayam-asii, netam-asii ‘(x is) enviable’
hohoem-u ‘to smile at x’ – hohoem-asii ‘(x is) heartwarming’
nayam-u ‘to worry about x’ – nayam-asii ‘(x is) worrisome, enchanting’
namida-gum-u ‘to shed tears for x’ – namida-gum-asii ‘(x is) touching, pathetic’

kiraw-u ‘to dislike x’ – #kiraw-asii ‘dislikeable’

higam-u ‘to be jealous of x’ -- #higam-asii ‘(x) causes jealousy’

Finally, the suffix *-mi* attaches to some adjective stems to derive nouns. (See Section 5 for more discussion.)

(6) Adjective + -mi ‘an entity with the property of being (Adjective)’

taka-mi ‘height’ maru-mi ‘round shape’ atataka-mi ‘warmth’

?#hiku-mi ‘low point’ #sikaku-mi ‘square shape’ #tumeta-mi ‘coolness’

These semi-productive suffixes attach only to a subset of what meets their selectional restrictions, and there also are a number of dictionary listings that sound arcane today. Some affixed forms show phonological alternation: e.g. sema-i ~ seba-maru, uram-asii ~uram-esii, konom-asii ~konom-osii. Such phonological alternation is characteristic of word formation processes that are less than fully productive, as has been pointed out for the Class 1 suffix *–ity* (velar softening in *electri<u>c</u>ity*) as opposed to Class 2 suffix such as *–ness*. We will later see the phonological alternation in certain types of compounding. The above are only a small part of many semi-productive affixes found in Japanese derivational morphology, but it shows that at least some morphological relations must be memorized.

The last type of affixes are productive and without any lexical gap. First, a nominalizing suffix *–kata* attaches to a very stem. It can attach to any verb, and furthermore, to lexical compound verbs (7b), syntactically derived compound verbs with aspectual verbs (7c), and causative and passive forms of verbs (7d).

(7) V + -kata ‘how to V, the way of V-ing’

a. tabe-kata ‘how to eat’, tukai-kata ‘how to use’, asobi-kata ‘how to play’

b. tori-hazusi-kata ‘how to remove’, naki-sakebi-kata ‘how to cry and shout’

c. hasiri-hazime-kata ‘how to start running’,
utai-owari-kata ‘how to finish singing’

d. hatarak-ase-kata ‘how to make (one) work’,
home-rare-kata ‘how to be praised’

These examples show that the outputs of *–kata* affixation cannot be listed in the lexicon, and this affixation process has the regularity and productivity of syntactic rules. Another affix, *-mi*, exhibits the same kind of productivity. This affix nominalizes adjectives and adjectival nouns (so called ‘*na* Adjectives’) as exemplified below.

(8) A / AN+ -sa ‘A / AN -ness, the fact of being A / AN’

a. taka-sa ‘height’, ama-sa ‘sweetness’, usu-sa ‘thinness’, ko-sa ‘thickness’,
tumeta-sa ‘coldness’, atarasi-sa ‘new-ness’

b. oroka-sa ‘foolishness’, sizuka-sa ‘quiet-ness’, hogaraka-sa ‘cheerful-ness’

genki-sa ‘healthy-ness’, titeki-sa ‘intelligent-ness’,
mazime-sa ‘square-ness’

The affix *–sa* contrasts nicely with *-mi* we saw in (6) in that they both nominalize adjectives but are quite different in productivity. In the next section we will take up this pair of affixes and discuss the nature of their productivity in the context of the dual mechanism model.

5. Rule vs. associative memory in nominal affixation

5.1. Level ordering of *–sa* vs. *-mi*

As we have seen above, both *–sa* and *–mi* attach to adjective stems and derive nouns.[3] While –sa can attach to virtually all adjectives, –mi is found with only a small subset of frequently-used adjectives (about 30 of them), so we find numerous lexical gaps. For example it is not uncommon to find only one of the antonym pairs to allow –mi affixation.

(9) a. akaru-mi ‘bright-ness’ / #kura-mi ‘dark-ness’ (cf. kura-gari ‘darkness’)
b. atataka-mi ‘warmth’ / #tumeta-mi ‘coldness’
c. atu-mi ‘thickness’ / #usu-mi ‘thinness’

It is thus plausible to differentiate these two suffixes according to the level-ordering as proposed by Kiparsky (1982) (see Section 2.2. above), taking *–mi* as a Level 1 affix *–sa* as a Level 1 affix. There is some evidence showing that they belong to different levels of derivation (Sugioka 1984, 1992, Kageyama 1993). First, -sa, but not *–mi*, can attach to adjectives derived by various affixes (10) as well as compound adjectives (11).

(10) a. urayam-asi-sa ‘envy-causing-ness, enviousness’ / *urayam-asi-mi
b. kodomo-rasi-sa ‘child-like-ness’ / *kodomo-rasi-mi
c. sirooto-ppo-sa ‘amateur-ish-ness’ / *sirooto-ppo-mi
d. kaki-yasu-sa ‘write-easy-ness, easy-to-write’ / *kaki-yasu-mi
e. asobi-ta-sa ‘play-want-ness, desire to play’ / *asobi-ta-mi

(11) a. oku-huka-sa ‘end-deep-ness, profound’
/ *oku-huka-mi (cf. huka-mi ‘depth’)
b. tyuui-buka-sa[4] ‘attention-deep-ness, carefulness’ / *tyuui-buka-mi

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[3] Although –sa can attach equally productively to adjectival nouns and –mi can also attach to a handful of Sino-Japanese AN bases (e.g. shinken-mi ‘seriousness’, shinsen-mi ‘fresh-ness), we will limit our discussion to nominalization of adjectives.

[4] Voicing of the initial consonant in the second element (huka --> buka) is called Rendaku and is

c. nebari-zuyo-sa ‘stick-strong-ness, tenacious’ /
*nebari-zuyo-mi (cf. tuyo-mi ‘strength)
d. sakana-kusa-sa ‘fish-smelly-ness, smelling like fish’ /
*sakana-kusa-mi (cf. kusa-mi ‘smelly-ness’)

The contrast found in (10) and (11) follows naturally from our assumption that *–mi* belongs to Level 1 and thus cannot follow other affixation or compounding, while *–sa* follows those processes at Level 2. Here we find the parallelism between these affixes and regular and irregular inflection in English as briefly discussed in Section 2 above.

It also follows that *-sa* affixation, like English regular inflection, functions as default rule and apply to foreign borrowing[5] or newly coined word as exemplified below.

(12) a. nau-na, nau-i ‘(lit. now) hip’ --> nau-sa / *nau-mi
b. hotto-na ‘hot, trendy’ --> hotto-sa / *hotto-mi
c. keba-i ‘flashy’ --> keba-sa / *keba-mi
d. dasa-i ‘tacky’ --> dasa-sa / *dasa-mi

Now we have seen that –sa affixation has much in common with English regular inflection in being the default rule placed later in derivation. There are, however, more differences between –sa affixation and –mi affixation, since derivational morphology, unlike inflection, involves both syntactic and semantic factors. We will look at them in turn.

5.2. Thematic constraints on nominals

It is well known that when inherited arguments appear with derived nominals, the preposition accompanying the argument NPs express the thematic relations those NPs hold to the base verb (Rappaport 1983). See the following examples.

(13) a. The soldiers invaded the city (Theme).
b. the soldiers’ invasion of the city

(14) a. The soldiers entered the city (Goal).
b. the soldiers’ entry to the city
c. * the soldiers’ entry of the city

Note that in (14b) *the city*, which is the direct argument NP in the corresponding

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very common in Japanese compounds.

[5] Here ‘foreign borrowing’ means borrowing from English or European languages, which is much more recent than Sino-Japanese borrowings. Foreign adjectives are mostly used as adjectival nouns and not adjectives because of the phonological restriction to the latter.

sentence (14a), cannot appear with *of*. Since it bears the Goal theta role, it must appear with *to*. It is the thematic relations rather than the syntactic positions of the argument NP that determines the choice of preposition.

Turning to nominalized adjectives in question, we find that –mi nominals appear only with Theme arguments, while –sa nominals can appear with arguments bearing Theme, Experiencer, and Locative roles.

(15) a. karada no atataka-mi 'the body's warmth' (Theme)
b. *heya no atataka-mi 'the room's warmth' (Locative)

(16) a. karada no atataka-sa 'the body's warmth' (Theme)
b. heya no atataka-sa 'the room's warmth' (Locative)
c. watasi no tura-sa 'my painfulness' (Experiencer)
d. wakare no tura-sa 'painfulness of parting' (Theme)

Note that *–sa* can attach to Theme or Locative NPs (16ab) and Theme or Experiencer (16cd) of the same adjective. It indicates that NPs corresponding to the argument NP (subject NP) of the base adjective can appear as argument to the *–sa* nominal, regardless of their thematic relations.

Furthermore, it is also well known that if the argument NP is a non-theta position, the derived nominals cannot allow it as an inherited argument (Baker 1985). See the following cases of ECM and raising.

(15) a. John believes Mary to be insane.
b. *John's belief of Mary to be insane.

(16) a. John is easy to please.
b. John's easiness to please.
(cf. John's eagerness to please.)

Again, –sa nominalization allows raised NP to appear, showing the contrast with *–ness* in English.

(17) a. [baka o damasi] –yasui.
fool ACC deceive easy 'It is easy to deceive a fool.'
b. baka ga [t damasi] –yasui.
fool NOM deceive easy 'A fool is easy to deceive.'
c. baka no damasi-yasu-sa
fool GEN deceive-easy-ness 'A fool's easiness to deceive.'

(18) a. [kono beddo de nemuri] –yasui
this bed LOC sleep easy 'It is easy to sleep in this bed.'
b. kono beddo ga [t nemuri] –yasui
this bed NOM sleep easy 'This bed is easy to sleep in.'
c. kono beddo no nemuri-yasu-sa
this bed GEN sleep easy 'This bed's easiness to sleep in.'

(17c) and (18c) demonstrate that –sa nominalization can take any argument NP that becomes the argument of the complex predicate headed by the tough adjective.

5.3. Semantic transparency of nominals

In inflectional morphology the semantic factor plays no role, since inflection does not change the meaning of the base except for marking it for a certain grammatical feature such as tense and number. In derivational word formation, however, the semantics is also important since the derived word often has a different meaning from the base. As pointed out in Sugioka (1984), less productive processes in derivational morphology tend to involve more lexical idiosyncrasy, and if the process is completely productive the semantics of the output is compositional. This holds true for *–mi* affixation as opposed to *–sa* affixation. Deadjectival nominals with –sa denote abstract state or property and means "the degree of (Adj.)-ness / the fact of being (Adj.)." Nominals with *–mi*, on the other hand, can signify various tangible objects bearing the property denoted by the base adjective; e.g. maru-mi 'round shape', huka-mi 'deep point (in water)', ama-mi 'sweet taste', ita-mi 'pain', tuyo-mi 'strong point'. Thus, while *–sa* nominals are transparent in meaning, *-mi* nominals are not predictable and so they must be listed in the lexicon with their meanings.

Because of this meaning difference the nominals with the two affixes appear in slightly different discourse contexts, as exemplified below.

(19) a. Kawa no huka-mi / *huka-sa ni hamatta.
river GEN depth LOC fell 'I fell in the deep section of the river.'
b. Kawa no huka-sa / *huka-mi o hakatta.
river GEN depth ACC measured 'I measured the depth of the river.'

Hence *-mi* nominals do not block *–sa* nominals, unlike in the case of inflection, where irregular forms always block the regular forms because they denote exactly the same thing.

5.4. Limited productivity of *-mi* affixation: analogy

As we have already seen above, -sa can attach to virtually all adjectives and adjectival nominals including new loan words or coinages (12). The fact that it can attach mechanically to any morphologically appropriate base can also be seen in the way it attaches to verbs. Negation affix in Japanese *-(a)nai* is morphologically an adjective, and so if the negated verb denotes not action but some property, it can be nominalized by *-sa*, as shown below.

(20) a. suugaku ga wakar-anai --> suugaku no wakar-ana-sa
math NOM understand-NEG math GEN understand-NEG-sa
'don't understand math' 'not understanding math'
b. okane ga tar-anai --> okane no tar-ana-sa
money NOM suffice-NEG money GEN suffice-NEG-sa
'there is no enough money' 'there being not enough money'
c. keikaku ga susum-anai --> keikaku no susum-ana-sa
plan NOM advance-NEG plan GEN advance-NEG-sa
'the plan does not advance' 'the plan's not making progress'

Similarly, *-sa* can attach to adjectives that have lost its literal meaning in idiom chunks.

(21) a. atama ga yawarakai --> atama no yawaraka-sa
head NOM soft 'flexible' head GEN soft-sa 'flexibility' '
b. kao ga hiroi --> kao no hiro-sa
face NOM wide face GEN wide-sa 'having many acquaintances'
c. ten ga karai --> ten no kara-sa
grade NOM salty grade GEN salty-sa 'marking hard'

In contrast, *-mi* cannot appear in any of the contexts above. Nevertheless, we find some limited cases where *-mi* is attached to form new words under some specific conditions. Studying those conditions reveals that the nature of the limited productivity that *-mi* affixation displays comes from analogical formation, in contrast to the default-type productivity of *-sa* affixation.

As briefly discussed in Section 2.2. the dual mechanism model proposed by Pinker and Prince (1991) and others for the regular/irregular dichotomy in English inflection maintains that irregular inflection is supported by associative memory, which is sensitive to frequency and similarity. The limited productivity exhibited by -mi affixation seems to display the same features.

First, among the limited number of -mi nominals a number of them have to do with taste, as exemplified below.

(22) ama-mi 'sweetness' kara-mi 'salty-ness, spicy-ness' niga-mi 'bitterness'
sibu-mi 'astringency' uma-mi 'tastiness' egu-mi 'bitterness'

In addition, the following nominals are acceptable if not totally so, although derived adjectives reject *-mi* as we have seen earlier (cf. 10).

(23) a. su-ppai --> suppa-mi
vinegar -ish 'sourness'
b. sho(<sio)-ppai --> shoppa-mi
salt -ish 'saltiness'

Furthermore, although *-mi* does not attach to native Japanese adjectival nouns (see

note 3), the following form has been attested in a TV commercial.

(24) karee ni koku to maroyaka-mi o ataeru tyoomiryoo
curry DAT flavor and mildness ACC give seasoning
'the seasoning that gives flavor and mellow taste to curry'

We can conjecture that these limited cases of -mi affixation is made possible by analogy to the existing -mi nominals denoting some taste, which are quite frequently used.

The example in (24) may also be affected by the phonological similarity to the existing forms. Although -mi does not attach to native Japanese adjectival nouns, the following -mi nominals are derived from adjectives also has adjectival noun forms.

(25) a. atataka-mi 'warmth' < atataka-i (cf. atataka-na) 'warm'
b. yawaraka-mi 'softness' < yawaraka-i (cf. yawaraka-na) 'soft'

It is possible to reanalyze these nominals as being formed by -mi affixation not to the adjective base but to the homomorphic adjectival noun base. It is then conceivable that *maroyaka-mi* in (24) is formed based on the phonological similarity as the following.

(26) atataka-mi / yawaraka-mi : -- (C)aka-mi --> maroyaka-mi

In fact, attaching -mi to adjectival nouns with the same ending as shown in (26) yield forms that are not completely unacceptable (27ab), in contrast to doing so to other adjectival nouns (27c).

(27) a.--yaka : Seikaku ga odayaka-mi o masita.
personality NOM calm-mi ACC increased
'(He) became more calm in personality.'
?sawayaka-mi 'freshness' ?hanayaka-mi 'flamboyance'
b. --raka: ?nameraka-mi 'smoothness' ?nadaraka-mi 'flatness',
c. others: #shizuka-mi 'quietness' #nodoka-mi 'peacefulness'
#tasika-mi 'sureness' #oroka-mi 'foolishness'

Although the forms in (27ab) are less than fully acceptable, it is expectedly so, since analogy is based on the existing form and is applied to fill the lexical gaps (i.e. possible but non-existent words) in the outputs of semi-productive word formation. As Thompson (1975: 347) points out, "the main features of these coinages [by analogy] is their awkwardness."[6]

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[6] Thompson (1975:347) gives the following example of coinage by analogy in deadjectival nominalization in English.

"... so, if we're talking about the ideal communicator, it would be concern, credibility, sincerity, and being seemingly involved for your involvement. Now, Nixon doesn't match warmth, does he?

Another instance of innovative -mi affixation is based on the nominals derived from psychological adjectives ending with *-sii* as exemplified in (28).

(28) a. tanosii 'enjoyable' --> tanosi-mi 'fun' [7]
b. kanasii 'sad' --> kanasi-mi 'sadness'
c. kurusii 'painful' --> kurusi-mi 'pain'

The following forms are not listed in the dictionary but have been attested, and are marginally acceptable.

(29) a. ?yasasi-mi 'tenderness' < yasasii 'tender'
b. ?okasi-mi 'funniness' < okasii 'funny'

It is quite possible that they are formed by analogy to the existing forms in (28), which are phonologically similar.

These observations on the limited productivity displayed by -mi affixation follows naturally, if we assume it is supported by associative memory, which is sensitive to frequency and phonological similarity.

5.5. Nominal affixation to novel adjectives [8]

Our contention that the innovative application of *-mi* affixation is by way of analogy based on the existing words has been confirmed by the experiments using novel adjectives.

Based on the subtle difference in meaning between-*sa* nominals and -mi nominals, three different discourse contexts were devised for the experiment: one in which the *-mi* form is preferred to the -sa form (30a: *-mi* discourse), one in which both forms are equally possible (30b: neutral discourse), and one in which the -sa form is more acceptable than the -mi form (30c: *-sa* discourse).

(30) a. Rebaa wa kusa-i node tabe-nikui.
liver TOP smelly because eat-difficult
Gyuunyuu ni tukete oku to sono ?kusa-sa /kusa-mi ga nukeru.

What do we get? Coolth." (*Esquire*, August, 1974:68)

[7]These -mi nominals can also be the outputs of the nominalizations of corresponding verbs: *tanosim-u* 'to enjoy', *kanasim-u* 'to grieve', *kurusim-u* 'to suffer'. Note, however, that the innovative forms in question *yasasi-mi* has no corresponding verb *yasasim-u*, and the verb *okasim-u* is obsolete.

[8] This section is based on the collaborative work with Hiroko Hagiwara and Takane Ito. For more discussion and details of the experiment mentioned here, see the Section 3 of Hagiwara et al., "Neurolinguistic evidence for rule-based nominal affixation" (*Language* 1999). The paper also discusses the results from the experiment on brain-damaged patients, and their inplication concerning the neurological bases of the different mental mechanisms of rule and associative memory.

milk LOC soak if that smelly-ness NOM be gone
'Liver is difficult to eat because it is smelly (has distinct smell).
If you soak it in milk, you can remove the smell.'

b. Kono yasai wa sukosi niga-i.
this vegetable TOP a little bitter
Sono niga-sa/niga-mi ga wahuu no azituke ni yoku au.
that bitter-ness NOM Japanese seasoning to well match
'This vegetable tastes a little bitter.
Its bitterness goes well with Japanese seasoning.'

c. Burokku-bei wa zisin ni yowai.
concrete block-wall TOP earthquake to weak
Sono yowa-sa /?yowa-mi ga konkai no sinsai de syoomei-sare-ta.
that weak-ness NOM recent earthquake in was proved
'Concrete block walls are weak against earthquakes.
Their weakness was proved by the recent earthquake.'

Thirty discourse sets were constructed, 10 for each of the three types, i.e. mi-, sa-, and neutral discourse, with existing adjectives and their nominalized counterparts. Another thirty discourse sets were constructed by replacing existing adjectives/nouns by novel forms. In order to examine the similarity effect, two types of novel adjectives were used: 'familiar' ones which phonologically resemble an existing adjective, and 'unfamiliar' ones which sound odd as Japanese adjectives (stem ending with /i/, /e/, /n/, etc.). The examples of familiar novel adjectives include *toka-i, simaka-i, maku-i, sano-i, meka-i, taso-i,* and *kunaro-i*; those of unfamiliar ones are *gome-i, yati-i, rahi-i, dotiki-i, pameri-i, mebene-i,* and *katon-i*.

115 university students were asked to give judgments about the naturalness of the nouns in the second sentence as the nominalized forms of the adjective in the first sentence in each discourse. They were reminded that there were no right or wrong answers and that we were asking for their personal judgments. The scale of 1-5 was used in the rating, where a rating of 1 indicates that the derived noun sounds unnatural and that of 5 perfectly natural.

First they judged the discourses containing existing adjectives to confirm the appropriateness of the examples used. Then they were asked to judge the familiar and unfamiliar novel adjectives.

In this experiment it was found that -sa nominals based on novel adjectives showed high acceptability, equal to the results from existing adjectives. In contrast, -mi nominals derived from novel adjectives were judged much lower in acceptability compared with those from existing adjectives even in the -mi discourse. This result indicates that the outputs of -mi affixation are listed in the lexicon so -mi

cannot attach freely to novel adjectives, while -sa affixation, being a default rule, applies freely to novel forms.

Next the effect of the phonological similarity to the existing adjectives was analyzed based on the results obtained on 'familiar' and 'unfamiliar' novel adjectives. It was observed that while -sa nominals showed high acceptability regardless of the familiarity of the base adjective, while the acceptability for -mi nominals depended on the familiarity of the novel stem: familiar novel adjectives yielded more acceptable nominals, while the -mi nominals based on unfamiliar novel adjectives were judged significantly lower. This result indicates that -sa affixation is not affected by the phonological similarity, while -mi affixation is. This is consistent with our assumption that innovative -mi affixation is done by way of analogical extension which is supported by associative memory.

5.6. Rule and analogy in affixation: summary

In this section we have seen various degrees of productivity in derivational word formation. As a case study of difference in productivity we focused on nominal affixation to adjectives in Japanese and found that the two affixes studied show contrastive features that suggest different mechanisms of rule and associative memory.

Nominalization by the suffix -sa is mechanically applied as default rule application, which explains its extremely high productivity and ability to be attached to new coinage. Furthermore, -sa nominals are semantically transparent so they need not be listed in the lexicon from the semantic point of view as well. In contrast to this, the suffix -mi has relatively low productivity and more semantic idiosyncrasy, and is very much limited in its extension to new coinage. Through examining the few cases of new coinage as well as by the experiment using novel adjective base, we found that -mi affixation exhibits sensitivity to frequency and phonological similarity in extending to new bases by way of analogy. These observation indicates that -mi affixation is supported by associative memory that links the base forms and the derived nominals in the lexicon.

Thus we have seen in this section that the different types of productivity found in affixation processes can be relegated to rule and analogy. This result shows that the dual mechanism model proposed by Pinker and Prince (1991) and others, which have been proposed for regular and irregular inflection in English,[9] can also account

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[9] The supporting evidence for the dual mechanism model for German inflection can be found in Clahsen et al. (1992).

for derivational word formation. Although both rule and analogy can be used to create new words, they are fundamentally different in their nature and mode of operation because they are supported by different mental mechanism of rule (i.e. computation) and (associative) memory.

6. Rule vs. analogy in compound formation

I would now like to address the question of whether the rule/associative memory distinction we have seen in affixation processes can be applied to the other major type of word formation, compounding. In this section I would like to show that the dichotomy is also valid in analyzing the deverbal compound formation of Japanese.

Compound formation is generally perceived as a rule of simple concatenation of two items (e.g. $[\text{computer}]_N$+ $[\text{desk}]_N$), just like the regular inflection or derivational affixation we saw above (base+ suffix: *walk* + *-ed*, *taka* + *-sa*).

Alternatively, it is also possible to say that in some cases a new compound is formed by analogy to the existing one, as schematized in (31):

(31) XZ --> YZ (X-->Y on the basis of XZ)

In this formation a new compound YZ is formed by analogy to the existing XZ by supplying a different non-head Y. The following examples are clearly formed this way rather than simple concatenation.

(32) a. firewoman < fireman
b. chairperson < chairman
c. air-sick < sea-sick (Becker 1993)
d. seascape, cloudscape, waterscape < landscape (Bauer 1983)

For another set of examples, take the English back formation compound verb. As is well known, English does not have a productive compound verb formation rule, and it has been claimed that what appears to be compound verbs in English are formed by back formation, which also is analogy, from the related compound nouns; for example, a verb *babysit* is derived from a compound noun *babysitter* by analogy to the productive rule of *-er* suffixation. Now a number of variants of this compound verb such as the following, and so on are found in use.

(33) phone-sit, dog-sit, house-sit, apartment-sit, plant-sit

Such compound verbs are not necessarily derived by back formation from the corresponding agent nominals but can be formed by analogy to the existing verb *babysit* by replacing the non-head element, especially since there is no productive compound verb formation rule $[\text{N-V}]_V$ in English. In other words, it is possible that a speaker derives and uses a compound verb *phone-sit* without there being a compound noun *phone-sitter* in her lexicon.

Now take a look at the following cases of Japanese novel compounds, which are also derived by analogy to the existing forms.

(34) a. kyabetu no hyaku-giri (< sen-giri '(lit.) thousand-cut, finely-cut')
cabbage GEN hundred-cut 'coarsely cutting of cabbage' (Sawaki 1989)

b. zassi no tati-yomi to suwari-yomi o kin-ziru
magazine GEN stand-read and sit-read ACC forbid
(<tati-yomi 'stand-read, browse')
'we forbid standing or sitting around reading magazines (in the bookshop)'
(Satake 1989)

It is clear that in order to understand the new compounds in (34), the existing compounds in the parentheses must be evoked either by memory or by actual juxtaposition.

On the other hand, there are new compounds which do not seem to be based on existing compounds, as exemplified below.

(35) a. Syanai ga atui node mado-ake ni gokyooryoku kudasai.
train NOM hot because window-open DAT cooperate please
'It is hot in the train, so please cooperate in opening the windows.
(announcement on the train)'

b. tyoonooryoku niyoru supuun-mage
supernatural power by spoon bend
'spoon-bending by the supernatural power'

c. Muri na kisyu-age ga hikooki-ziko no gen-in da.
reckless nose-lift NOM plane-accident GEN cause be
'Reckless nose lifting caused the plane crash.'

d. puroguramu no bagu-hiroi
program GEN bug hunt 'bug-hunting of a computer program'

These compounds are used to name a certain action (open window, bend spoon, lift the nose of an airplane) without making reference to any existing compounds. These example show how compound formation as a rule can be used spontaneously to create new words.

The compounds in (34) and (35) are all deverbal compounds, which consist of a verbal head preceded by the verb's argument or adjunct. As pointed out in Sugioka (1996), among the deverbal compounds those with the verb's direct object argument as the non-head, is very productive. The following are the examples of each type of deverbal compounds.

(36) Productive -- direct object+V:
(Act) tegami-kaki 'letter writing', takara-sagasi 'treasure hunting',
gohan-taki 'rice cooking', sakana turi 'fish-fishing',

tuna-hiki 'rope tugging' pan-yaki 'bread baking',
mizu-kumi 'water fetching', kihukin-atume'donation collecting',
yasai-zukuri 'vegetable growing'

(Agent) hana-uri 'flower vender', gekkyuu-tori 'salary earner'
sinario-kaki 'scenario writer', , hituzi-kai 'sheep herder'

(Instrument) tume-kiri 'nail-cutter', kawa-muki 'skin peeler',
hae-tataki 'fly swatter', nezi-mawasi 'screw driver'

Note that it is also very easy and common to coin a new word in this category as well, as the novel examples of (35) belong to this type. In contrast to this, compounds with unaccusative subjects and adjuncts are possible but not fully productive.

(37) Semi-productive -- unaccusative subject + V:
yuki-doke 'snow melting' / *koori-doke 'ice melting'
zi-nari 'ground rumbling' / *beru-nari 'bell ringing'
ne-agari 'price rising' / *kion-agari 'temperature rising'

(38) Semi-productive -- semantic argument/adjunct + V:
GOAL+V --Pari-iki 'Paris going(bound)', *Pari-tuki 'Paris-arriving'
INSTRUMENT --te-gaki 'hand writing(handwritten)', *te-nuki 'hand-pulled'
LOCATIVE --Amerika-umare 'American-born' *Amerika-zini 'America-died'
CAUSE --sigoto-zukare 'work tired' *sigoto-nayami 'work troubled'
MANNER/RESULT Adv --haya-gui 'fast-eating', *haya-nomi 'fast drinking'
usu-giri 'thin-cutting', *usu-nobashi 'thin-pounding'

These observations suggest that deverbal compound formation involving direct object arguments has a rule-like productivity, while that with adjuncts have lexical gaps. In fact, the somewhat odd-sounding new coinages *hyaku-giri* and *suwari-yomi* in (34) involve adjuncts. Such oddness is not present in the novel examples in (35) although they also are new coinages. In differentiating analogy and truly productive processes in derivational morphology, Thompson (1975) notes that “the main feature of these coinages[10] [by analogy] is their awkwardness. [...] I think this contrasts sharply with coinages created according to productive rules, which I claim are not generally noticed by the participants in a discourse.” The same type of contrast can be observed between the compounds in (34) and (35), which is consistent with our contention that they are formed by analogy and rule, respectively.

We have seen earlier that both irregular inflection and semi-productive affixation exhibit some characteristics of ‘lower-level’ in derivation, as opposed to regular inflection or productive affixation. Adjunct compounding in Japanese shows the following type of phonological alternation, which is not found in argument

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[10] See note 6 for one of Thompson’s (1975) examples.

compounding.

(39) Rendaku (voicing)

a. Adjunct: pen-gaki 'writing with a pen', hasiri-gaki 'hastily written',
Argument: tegami-kaki 'letter writing', syoosetu-kaki 'novel writer',

b. Adjunct: usu -giri 'thin-sliced', te-giri 'hand-cut', yotu-giri 'cut into four'
Argument: pan-kiri 'bread cutting', kan-kiri 'can opener'

c. Adjunct: umi-zuri 'ocean fishing', ippon-zuri 'single-hook fishing'
Argument: sakana-turi 'fishing', ika-turi ‘squid fishing’

d. Adjunct: maru-gari 'completely mowed'
Argument: kusa-kari 'weed mowing'

e. Adjunct: te-buki 'hand-wipe', zookin-buki 'mop-wipe', kara-buki 'dry-wipe'
Argument: ase-huki 'sweat wiper, towel', mado-huki 'window wiping'

Although the exact nature of the voicing process is unknown (see Sugioka 1997 for some discussion and an analysis), considering the fact that it is the lower-level affixation that induces some phonological change (cf. *-ity* vs. *-ness* in English), the contrast between the two types of compounds is consistent with the claim here that adjunct compounding is the lower-level process.

Another piece of evidence for the claim comes from the phenomenon known as ‘blocking’. It has been observed (Aronoff 1976) that the more lexical (or lower-level) word formation processes pre-empt the more productive ones if the outputs compete for the same slot. The following exemplified some cases of blocking.

(40) a. glory / glorious / #gloriousity
#cury / curious / curiosity (Aronoff 1976)

b. tonight / # this night (cf. this morning, this afternoon)

In (40a) *glory* blocks the *-ity* affixation to *glorious*, and in (40b) the word *tonight* blocks the phrase *this night*. It is crucial here that the blocking element is listed in the lexicon. Now look at the following examples of adjunct compounds.

(41) a. inaka-zumai / #inaka-zumi ‘living in the country’
country live country live

b. apaato-zumai / #appato-zumi ‘living in an apartment’
apartment live apartment live

The verb *sumau*, which appears in the well-formed compounds of (41) is an archaic expression seldom used now, and one would use *sumu* ‘live in’ instead, but the compounds containing this verb are not well-formed. Furthermore, the compound pattern ‘(place)-zumai’ itself is very productive in that any location or type of residential building can be the non-head.

(42) mansyon-zumai ‘living in a condo’,
syataku-zumai ‘living in a company housing’,

Amerika-zumai ‘living in US’, nyuuyooku-zumai ‘living in NY’

This kind of productivity is typical of analogical formation. Thus it is plausible to say that the compound pattern ‘(place)-zumi’ is not well-formed because it is blocked by the already existing form ‘(place)-zumai’ in the lexicon. If adjunct compounding is not a productive rule but is based on associative memory, it is natural that such blocking should occur.

On the other hand, we can find among argument compounds the following virtually synonymous verbs forming a compound without blocking each other.

(43) tug-u / sas-u ‘pour’
abura-sasi / abura-tugi ‘oil pitcher’
mizu-sasi / mizu-tugi ‘water pitcher’
syooyu-sasi / syooyu-tugi ‘soy sauce pitcher’

If these argument compounds are rule-based, then there should be no blocking between these pairs.[11]

Thus we have seen some evidence which indicates the rule-based nature of the deverbal compounds involving direct object argument and the memory-based nature of those involving adjuncts. If the argument compounds can be created ‘on-line’ by rule, it is not surprising that they can sometimes involve phrases as non-heads. In fact we find the following types of examples to be not uncommon.

(44) [senzo no haka] -mairi (Kageyama 1993) / cf. haka-mairi
ancestor GEN grave visit ‘visiting the ancestor’s grave’
[heiwa na kuni] -zukuri / cf. kuni-zukuri
peaceful country build ‘building a peaceful country’
[yuunoo na sinzin] -sagasi ‘searching for an able new employee’
able new employee search
[konpyuuta no yoosi] -ire / cf. yoosi-ire
computer GEN paper put ‘case for computer paper’

These examples can be seen as an expansion on the simple form, expressing more complex ideas with the modified non-head. In contrast, the adjuncts that can appear in deverbal compounds are usually limited not only to words but often mono-morphemic ones.

(45) *[osanai te] -zukuri / cf. te-zukuri
young hand make ‘made by a child’s hand’
*[akai pen] -gaki / cf. pen-gaki

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[11] This does not mean that argument compounds are not listed in the lexicon at all. It is conceivable that many deverbal compounds involving direct object arguments are listed in the lexicon if their meaning and use are fixed.

red pen write ‘written by a red pen’
*[hidari-te] -gaki / cf. te-gaki
left hand write ‘written by the left hand’

It then seems that the type of semi-productivity we find with adjunct compounds is restricted to replacing the non-head with another word of the same semantic category, and ‘expanding’ it by modification is not possible.

We have seen in this section that compound formation contains two different types of processes: rule-based and extremely productive argument compounding, and memory-based and only semi-productive adjunct compounding. In the latter the relatively limited productivity is based on analogy formation based on the existing forms. The dichotomy found here has much in common with what was found with affixation.

7. Concluding remarks on rule and analogy

Compound formation is often said to be closer to syntax than other types of word formation in that it combines words to form a more complex expression. Nevertheless, the different types of productivity observed in Japanese deverbal compounds suggest that even among compound formation there are more rule-like processes and less rule-like lexical ones. It is quite possible, then, that the rule-memory dichotomy we have seen in the earlier part of this paper does also exist in compound formation, so that the dichotomy cuts across all word formation processes.

Equally, the notion of productivity can be divided into the one based on rule and the other based on analogy for all types of word formation processes. In inflection analogy plays very little role because inflectional paradigm provides no ‘new slot’. In derivational morphology of affixation and compounding, however, the derived complex words can take on different meanings and be lexicalized, so there are ample ‘new slots’ to be filled. Here analogy plays a large role in creating new words. That factor may have made it difficult to confirm the existence of rule-based processes in derivational morphology. The observations made in this study, however, indicate the plausibility of assuming the rule-memory dichotomy in derivational morphology as well.

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