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Proceedings of the 37th Annual Meeting of the Berkeley Linguistics Society (2013), pp. 170-184
Editors: Chundra Cathcart, I-Hsuan Chen, Greg Finley, Shinae Kang, Clare S. Sandy, and Elise Stickles

Myth of the Wug Test: Japanese Speakers Can't Pass it and English-Speaking Children Can't Pass it Either

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Introduction

How do Japanese speakers learn and produce inflected verbs? With her classic *wug* test, Berko (1958) concluded that young English-speaking children were able to make productive use of linguistic rules. Since Berko's experimental findings are so widely cited as evidence that regular verbal inflection is accomplished by the use of combinatory rules (stem + affix), it is important to recognize that similar experimental findings have not been demonstrated for languages with different typologies.

Japanese, for example, has an agglutinative (*tabe-sase-rare-na-kat-ta* 'eat-causative-passive-negative-adjective-past') rather than a fusional (*walk + ed*) typology and lacks the binary contrast between regular (*walk/walk-ed*) and irregular (*run/ran, sing/sang, hit/hit*) that characterizes English verbal inflection. Rather, Japanese manifests several (allomorphic) patterns of predictable regularity: vowel-final root versus consonant-final root, with several sub-paradigms, but no bare stems (more precisely roots in Japanese) (Vance 1987). These typological characteristics are problematic for rule-based approaches (RBAs), which generally allow only one productive rule (the default) per inflectional suffix (Prasada and Pinker 1993, Pinker 1999, Pinker and Ullman 2002).

The fact that there are no bare roots in Japanese would require any RBA to provide an additional mechanism allowing Japanese speakers to identify and segment roots for use in combinatory rules. Although there are occasional references in the literature to 'affix stripping,' no detailed account of how this mechanism might apply to Japanese has appeared. In this paper I will make an important distinction between a rule (combination of root and suffix) and analogy (use of a novel item in an existing pattern based on stored exemplars) (Bybee 2010:57). I will suggest that Japanese speakers do not, and most likely cannot, segment Japanese verbs into the necessary roots required in an RBA. Moreover, it appears

that the productivity of the English-speaking children in Berko's experiment was limited in a very similar way. Taylor (2003), and Berko herself in the original 1958 paper, both concluded that the children analyzed the novel noun *tass* as a plural form because it ended with the final sibilant /s/. When asked to produce the plural form of *tass*, 62% of them confidently replied 'two **tass'* (Berko 1958:163).

Taylor refers to conclusions about productivity based on the *wug* test as "The Great *wug* Hoax". He points out that only 28% of the 4- and 5-year-olds that Berko tested and only 38% of the older children (5 1/2 to 7) could produce the appropriate plural form of the nonce noun *gutch*. Berko's data also show that, although the children knew the past form *melted*, they did not extend the rule to new forms such as *mott*. Only 31% produced *motted*. The widely held belief that combinatory rules are fully productive for young English-speaking children is not consistent with this gradient performance. An RBA offers no explanation for why some regular (but allomorphic) forms of the English plural and past are more productive than others. In the first section of this paper, I reexamine these original Berko findings and RBA assumptions about rule productivity.

In the second section, I consider Bybee's (2001, 2006, 2010) alternative Usage-Based Approach (UBA) to verbal inflection. This UBA is an exemplar model and assumes representation of fully inflected regular forms in memory. New forms are produced by analogical reference to previously experienced utterances (and hence the name Usage-Based). Productivity, the ability to produce novel forms, is determined by the interaction of schematicity (Clausner and Croft 1997, Bybee 2010:67), the degree of dissimilarity of forms in a category, and type-frequency.

In the third section, I outline the details of Japanese verbal allomorphy and examine the only two productive paradigms in modern Japanese. The first paradigm is the irregular verb *suru* 'do' with the extremely low type-frequency of one. *Suru* is highly schematic and imposes no semantic, categorical, or phonological restrictions on novel creations and is therefore highly productive. On the other hand, the only regular Japanese paradigm that shows any current productivity is the consonant-final /r/ root paradigm (*geror-u* 'vomit'). An RBA does not offer any principled explanation for why this one single regular paradigm should emerge as the privileged default (productive) paradigm. In the UBA presented in this paper I will suggest how this productivity can be explained by high type-frequency, and schematicity (openness of the pattern).

The fourth section describes an experimental study. Native speakers of Japanese (57 children and adults) were tested for the ability to produce novel inflected verb forms. Participants were first trained to respond to questions about video cartoons using actual Japanese verbs. In the following test task, they were asked to produce inflected nonce forms. The productivity predicted by a RBA was not observed. Only about 8% of responses from the 21 young children (ages 5 and

6) and about 30% of responses from the 36 older participants (ages 8 to 71) were correct.

The youngest participants avoided novel conjugation by combining the nonce verb provided and inflected forms of the two Japanese 'do' verbs, irregular *suru* and regular *yaru*. Given the nonce verb *muru*, they tended to produce **muru shita* 'did *muru*' or **muru yatta* 'did *muru*', rather than the predictable regular form *mut-ta*. Some older participants also followed this strategy, but others clearly made use of different strategies as well. As predicted by a UBA, production was gradient with best performance on high type-frequency verbs (root-final /r/).

This result is of particular interest because regular root-final /r/ verbs show a distinctive root allomorphy *kaer-u* 'return'/*kaet-ta* 'returned', and are sometimes referred to as Japanese 'strong verbs', suggesting that they are somehow 'irregular.' They are not irregular. On the other hand, root-final vowel verbs /i/ and /e/ show no root-allomorphy: *mi-ru* 'watch'/*mi-ta* 'watched' and *tabe-ru* 'eat'/*tabe-ta* 'ate.' Contrary to what one might expect from an RBA, the more 'irregular' verb types (root-final /r/) were actually much more productive than the 'more regular' (root-final /e/ and /i/) verb types. The older participants (ages 8-71) showed a consistent tendency to conjugate root-final vowel verbs (*me-ru* and *ri-ru*) as root-final consonant verbs (*mer-u* and *rir-u*).

Another important finding was participant use of already inflected nonce forms as roots. Participants were provided with, and asked to repeat illustrated sentence examples of the inflected non-past form *mur-u*, and the inflected desiderative form *mur-itai* 'want to *muru*', giving clear evidence that the root was *mur*. However, 18 of the 36 older participants (ages 8 to 71) produced some incorrect doubly inflected forms such as **mur-u-tta* 'past.' Just as Berko's English-speaking children appear to have analyzed the word *tass* as a plural form, these Japanese speakers appear to have analyzed *muru* as a root. Furthermore, it is clear from other productions that many Japanese speakers tend to analyze the word-final sequence *-tta* as a marker of the past. This speaker analysis contrasts with both descriptivist and generativist analyses of Japanese. Both groups of linguists identify the first /t/ in the /tta/ sequence (more precisely /Qta/) as an allomorphic part of the root, for example *kaer-u* 'return' and *kaet-ta* 'returned.' These experimental results are not unexpected if one accepts the UBA position that the analyzability of linguistic forms (Langacker 1987:292, Bybee 2010:45) is gradient.

These findings, along with a critical reexamination of the original English *wug* test results suggest that a UBA, which includes consideration of schematicity and type-frequency, more adequately accounts for how speakers from two very different language typologies actually represent and produce verbal inflection.

1 Myth of the Wug Test

Pinker (1991:191) citing results from Berko (1958) writes: "When children are old enough to sit still in an experiment, they pass the *wug*-test: After hearing that a man knows how to *rick* or *bing*, they say that yesterday he *ricked* or *binged*." However, *rick* and *bing* were not the only verbs tested. Berko's children were also tested on the nonce verbs *gling*, *spow*, *mott* and *bod*. Table 1 gives the complete results on all verbs tested in Berko's experiment and shows that none of the allomorphic forms of the past were nearly as productive as Pinker suggests.

Table 1. Children's Performance on the Creation of Novel Past Forms

Present	'Correct' Past	Pre-School (n=19)	First-Grade (n=61)
bing [bɪŋ]	binged/bang [bɪŋd]/[bæŋ]*	60	85
gling [gliŋ]	glinged/glang [gliŋd]/[glæŋ]*	63	80
rick [rɪk]	ricked [rɪkt]	73	73
melt	melted	72	74
spow [spow]	spowed [spowd]	36	59
mot [mat]	motted [matəd]	32	33
bod [bod]	bodded [bodəd]	28	39
ring	rang	0	25

*Both [bɪŋd]/[bæŋ] and [gliŋd]/[glæŋ] were accepted.

Figures in the columns show the percentages of correct forms produced.

Source: Data derived from Berko (1958:159, 161).

While most of the first-graders did produce *binged*/*bang* (85%) and *ricked*, (73%), pre-schooler performance on *binged*/*bang* (only 60%) was much less impressive. Production of *spowed* was only 36% and 59%. And, even though both groups produced the past form *melted* at around 70%, production of this allomorphic pattern with [əd] was generally not extended to *mott*/*motted* and *bod*/*bodded*. Even the first-graders scored less than 40% on these two items.

Ingram (1989:440) has proposed that children may need to acquire three different rules, one for each plural allomorph, [s], [z], and [əz]. A similar proposal might be made for the three English past allomorphs [t], [d], and [əd]. However, if there are three separate rules for both the English plural and the English past, it would be disingenuous to claim that English speaking children pass a *wug* test for the past when only two of the three rules for the past, namely [t] and [d], are clearly only partially productive.

Consistent with his RBA claim for the productivity of rules, which apply only to regular verb forms, Pinker (1991:16) is quick to make the following observation: "And the freewheeling children in Berko Gleason's study were downright

stodgy when it came to irregular forms: Only one of eighty-six turned *bing* into *bang* and only one other turned *gling* into *glang*."

Inspection of Table 1 shows why the children did not extend the irregular *ring/rang* pattern to the novel verb *bing*. Only 25% of the first-graders and none of the preschoolers produced the irregular past form *rang*. These children could not extend an irregular pattern that they did not have.

There are a number of other details that Pinker and other RBA proponents seem to have missed. Taylor refers to the *wug* myth.

> The wug test continues to be cited as evidence that even young children are fully able to apply 'source oriented' rules to input forms that they have never before encountered. A careful reading of Berko's 1958 article shows that this conclusion in not warranted. Even Berko herself, it seems, fell prey to this wug myth. Writing forty years later, she could state that a pre-school child 'can produce the plural nonsense word *gutch*, which she has never heard before' (Gleason and Ratner 1998:380) even though her own research had shown that over 70 per cent of the four- and five-year-olds that she studied could not produce the plural form, and those aged five and a half to seven did not perform much better. (Taylor 2003:315)

Berko tested for productivity of two of the English plural allomorphs, [z] and [əz]. As with the allomorphs of the past, the results show a distinct difference in productivity.

Again, it would be disingenuous to claim that children 'pass' a *wug* test if they only produce one of the two allomorphic plural forms tested. The conclusion in the present paper is that both the English past and plural 'rules' are not fully productive. Even when children are old enough to sit still in an experiment, they do not "pass" a *wug* test. There is an alternative explanation that does not require combinatory rules of the type proposed in an RBA.

2 Usage-Based Approach to Verbal Inflection

The Bybee UBA model assumed here treats inflected verbs as constructions (Fillmore et al. 1988, Croft 2001, Goldberg 1995, 2006). Constructions result from generalizations over stored exemplars at various levels of abstraction. Constructions do not require segmentation of inflected verbs into roots and suffixes and do not attribute any symbolic status to structural units. Furthermore, unlike the RBA proposed by Pinker, no distinction is made between regular and irregular forms.

Important concepts in this UBA are schema and schematicity. I have bolded the terms in the Bybee references that follow.

> Organizational patterns, **schemas** or categories arise in the lexicon or what has been called the 'constructicon' (a lexicon with an inventory of constructions and have no existence independent of the lexical units from which they emerge. (Bybee 2010:73)

> **Schematicity** refers to the degree of dissimilarity of the members of a class. Highly schematic classes cover a wide range of instantiations. A good example is the regular English Past Tense schema that can apply to a verb of any phonological shape. When high schematicity is combined with high type frequency, a maximally productive construction results. A morphological class with a high degree of phonological similarity will be more constrained. Low schematicity will limit productivity, since it limits the candidate items that extension could apply to. (Bybee 2010:67)

Therefore, while the regular English plural and past schemas are much more productive than the irregular schemas for the past and plural, there are also regular sub-schemas that account for the higher observed productivity of some regular categories.

For example, the past allomorph [t] has higher schematicity. It is a more open pattern and can follow [p k tʃ f ʃ]. It also exhibits high type-frequency (many verbs in this category) and results in higher *wug* test productivity (*ricked* 73%).

On the other hand, the past allomorph [əd] has a much lower schematicity. It follows only [t d], has a lower type-frequency (fewer verbs in this category), and results in lower *wug* test productivity (*bodded* less than 40% for both preschoolers and first-graders).

3 Japanese Verbal Inflection

Standard linguistic analyses of Japanese verbs (Bloch 1946, Martin 1952, MaCawley 1968, Vance 1987) recognize both regular and irregular verb classes. Due to unpredictable root vowel alternations, only two verbs, *kuru* 'come' and *suru* 'do' are considered to be irregular. Table 3 contrasts irregular *suru* and *kuru* with the regular verb *taberu* 'eat.'

Table 2. Irregular *kuru* and *suru* and Regular *taberu*

	Nonpast	Past	Negative
'come'	ku-ru	ki-ta	ko-nai
'do'	su-ru	si-ta	si-nai
'eat'	tabe-ru	tabe-ta	tabe-nai

Note: Verbs right-aligned to highlight root alternation.

However, the irregular 'do' verb *suru* is highly productive in so-called light verb constructions (Kageyama 1976, 1977) where a noun and *suru* are combined. In these constructions *suru* is used mainly to contribute its inflectional meaning. For example, the sudden and unanticipated resignation of Prime Minister Abe in

2007 led to the coining of the term *Abe-suru* with the meaning 'to abandon one's responsibility.'

Regular root-final vowel paradigms like *tabe-ru* (with neither root nor suffix allomorphy) would best fit the *root + suffix* model of an RBA. However, there are no *new* verbs in modern Japanese that exhibit this pattern. This pattern has no productivity.

The only regular verbal paradigm that shows any productivity is the root-final /r/ paradigm. Well attested examples are *sabor-u* 'cut class,' *dabur-u* 'double,' and *gugur-u* 'do a Google search,' While it has been suggested that these root-final /r/ paradigms are limited to loan words, the very recent *geror-u* 'vomit, hurl' appears to be a native creation. Another recent native example, attributed to the Asahi newspaper, is the verb *Asahir-u* 'to fabricate or invent something, or to bully.'

The question of why this one regular paradigm should be the only productive paradigm in modern Japanese is addressed in the next section.

3.1 Japanese Verb Type-Frequency

In addition to regular and irregular, the linguistic analyses previously cited agree that there are two types (sub-schemas) of Japanese regular verbs: root-final vowel and root-final consonant verbs. Table 3 and Table 4 give type-frequency counts from the 1995 edition (233,000 entries) of the *Daijirin* dictionary as it appeared at the *Asahi Shinbun* website until around 2006. Note again that there are no bare roots. Japanese dictionary entries appear under the inflected nonpast form. The four inflected forms provided in the tables illustrate root and suffix allomorphy.

Table 3. Summary of Root-Final Vowel Verbs Counted in *Daijirin* Dictionary

Final	Example	Nonpast	Negative	Volitional	Past	Number	%
/e/	'eat'	tabe-ru	tabe-nai	tabe-yoo	tabe-ta	2,054	31.1
/i/	'watch'	mi-ru	mi-nai	mi-yoo	mi-ta	260	3.9
irregular	'do'	su-ru	si-nai	si-yoo	si-ta	1	0.015
irregular	'come'	ku-ru	ko-nai	ko-yoo	ki-ta	1	0.015
					Total	2,316	35

While there were 453 actual entries for *suru*, each *suru* entry can be considered to be a compound consisting of another member and the same *suru* inflection. Therefore *suru* is counted only once in the summary above.

There were also 4 actual entries for root-final /n/ verbs. However, the only /n/ verb in modern Tokyo Japanese is *sin-u* 'die,' and it is counted only once in the summary in Table 4.

There are about twice as many root-final consonant verbs (65%) as root-final vowel (35%) verbs. If productivity can be predicted on the basis of (dictionary) verb type-frequency, we would expect the general consonant-final root paradigm with suffixes /u/ 'nonpast,' /anai/ 'negative,' /ta/ 'past,' and /oo/ 'volitional' to be

more productive.

Table 4. Summary of Root-Final Consonant Verbs Counted in *Daijirin* Dictionary

Final	Example	Nonpast	Negative	Volitional	Past	Number	%
/r/	'cut'	kir-u	kir-anai	kir-oo	kit-ta	1,368	20.7
/s/	'lend'	kas-u	kas-anai	kas-oo	kasi-ta	1,230	18.6
/k/	'draw'	yom-u	kak-anai	kak-oo	kai-ta	552	8.4
/m/	'read'	yom-u	yom-anai	yom-oo	yon-da	447	6.8
/w/	'meet'	a-u	aw-anai	a-oo	at-ta	401	6.1
/t/	'win'	kat-u	kat-anai	kat-oo	kat-ta	143	2.2
/g/	'sniff'	kag-u	kag-anai	kag-oo	kai-da	90	1.4
/b/	'call'	yob-u	yob-anai	yob-oo	yon-da	53	0.8
/n/	'die'	sin-u	sin-anai	sin-oo	sin-da	1	0.015
					Total	4,285	65

There is also a type-frequency explanation for why the root-final /r/ paradigm is the single paradigm that shows any productivity. About 56% of all verbs (root-final vowel 35% and root-final /r/ 21%) appear in the nonpast with the final sequence /ru/. Regardless of whether /r/ is part of the root, as in *kir-u* 'cut,' or part of the suffix as in *tabe-ru* 'eat,' the final sequence is /ru/. The next highest root-final consonant verb type is root-final /s/ with only about 19% of all verbs.

Another reason why the root-final /r/ paradigm appears to be the prototypical verbal paradigm is explained by the schematicity of the past form. A generativist analysis of Japanese (MacCawley 1968) finds one underlying past form //ta//. A structuralist analysis (Bloch 1970, Martin 1952) finds two allomorphs, /ta/ and /da/. However, both native speakers and learners appear to find three 'endings' for the past, /ta/, /da/, and /Qta/.

For example, in a verb like *kir-u* 'cut' with the past form *kit-ta*, the segmentation performed by speakers results in the past 'ending' *-tta*. For native speakers this segmentation (analysis) is consistent with Hale's constraint (Hale 1973), which claims that speakers do not segment words into forms that they cannot pronounce. With the exception of the mora nasal and the second part of a geminate consonant, Japanese does not allow syllable final consonants. Consonant-final roots are unpronounceable. Moreover, the /Qta/ 'ending' for the 'past' has much greater schematicity. A review of the inflected forms shown in Table 3 and Table 4 shows that the past marker /da/ follows only /n/. The past marker /ta/ follows only vowels /i/ and /e/. But, the 'ending' /Qta/ may follow all five Japanese vowels /i e u o a/.

4 Japanese Experimental Study

Monolingual speakers of Japanese were individually tested for the ability to produce inflected forms of novel Japanese verbs (a Japanese *wug* test). The 21 five- and six-year-olds were all attending the same day care center in Daitoku, Tokyo. A native Japanese speaker with linguistic training and previous experience with small children tested them. A second research assistant recruited 34 older children and adults from her neighborhood in Shinurayasu, outside Tokyo. Two additional undergraduate university students were recruited at the Komaba campus of Tokyo University.

4.1 The Training Task

The investigator read an incomplete sentence that appeared under an animated or stationary cartoon figure that appeared on a computer screen. The participant was asked to provide the verb form that would appropriately complete the sentence. The training task was used to confirm that participants knew the correct forms of the exemplar verbs and understood instructions. The investigator supplied a form when a prompt response was not given. At first, the youngest children sometimes supplied possible alternative verbs or noun forms. For example, a few offered the nominal form *gohonyomi* 'reading of a book' instead of *yonde iru* 'reading.' When prompted, they responded with the appropriate *yonde iru*. Table 5 gives the complete list of exemplar (actual) Japanese verbs used in the training task.

Table 5. Exemplar Verb Forms Elicited in Training Task

Animated Cue	Continuative	Past	Negative	Volitional
girl 'reading' book	yon-de iru	yon-da	yom-anai	yom-oo
children 'watching' TV	mi-te iru	mi-ta	mi-nai	mi-yoo
girl 'cutting' paper	kit-te iru	kit-ta	kir-anai	kir-oo
dog 'sleeping'	ne-te iru	ne-ta	ne-nai	ne-yoo
boy karate 'kicking'	ket-te iru	ket-ta	ker-anai	ker-oo
girl 'wearing' raincoat	ki-te iru	ki-ta	ki-nai	ki-yoo
girl 'drawing' picture	kai-te iru	kai-ta	kak-anai	kak-oo

These exemplar verbs were chosen because they provide a representative sampling of root-final vowel and root-final consonant verbs that appeared in the test task. The youngest children clearly knew all the inflected forms of the exemplar verbs and did not produce any error forms.

4.2 The Test Task

In the test task, a series of additional sentences and repetitions introduced each nonce verb. A translation of the series for the first nonce verb *muru* and the test frame for the continuative form *mutte iru* follows in example (1).

(1) This woman is good at *muru*.
Please say "*muru*."
The woman says 'I want to *muru*.'
Please say "want to *muru*."
Now this woman is going to *muru*.
What is the woman doing now?
Oh! She stopped.
Now, this woman will *muru* again.
Please say "*muru*" again.
Now this woman is...

Table 6 gives the nonce verb forms tested in the test task.

Table 6. Nonce Verb Forms Tested in Test Task

Animated Cue	Continuative	Past	Negative	Volitional
woman bouncing on ball	hon-de iru	hon-da	hom-anai	hom-oo
girl spinning hula hoop	ri-te iru	ri-ta	ri-nai	ri-yoo
woman crab walking	mut-te iru	mut-ta	mur-anai	mur-oo
girl doing walkover	me-te iru	me-ta	me-nai	me-yoo
girl doing walkover	met-te iru	met-ta	mer-anai	mer-oo
girl spinning hula hoop	rit-te iru	rit-ta	rir-anai	rir-oo
boy spinning on scooter	hoi-te iru*	hoi-ta**	hok-anai	hok-oo

* *hoite iru* is analogically consistent with both *kaku* 'draw'/*kaite iru* 'drawing' and *iku* 'go'/*itte iru* 'is gone.' Both *hoite iru* and *hotte iru* were accepted.
***hoi-ta* is analogically consistent with *kaita* 'drew' and with *itta* 'went.' Both *hoita* and *hotta were accepted*.

4.3 Results

Table 7 gives test task results. Best performance was on root-final /r/ verbs *mur-u*, *mer-u*, and *rir-u*. All participants were tested on the verb *muru*. Five- and six-year olds were tested on *muru* and one other verb (8 productions). Older participants were tested on *muru* and four other verbs (20 productions).

Table 7. Correct Nonce Forms Produced by All Participants

Verb	Age 5-6 (n = 21)	Age 8-11 (n = 11)	Age 15-71 (n = 25)
mur-u	7/84 = .08	21/44 = .48	51/100 = .51
mer-u	0/16 = .00	10/20 = .50	20/40 = .50
rir-u	0/8 = .00	6/24 = .25	21/60 = .35
hok-u	4/12 = .33	9/44 = .20	29/100 = .29
hom-u	1/16 = .06	12/44 = .27	27/100 = .27
me-ru	1/24 = .04	0/24 = .00	12/60 = .20
ri-ru	0/8 = .00	0/20 = .00	0/40 = .00
Total	13/168 = 8%	58/220 = 26%	160/500 = 32%

Table 8 gives the mean number of correct responses for all age groups. All 21

of the youngest children produced only 13 correct forms.

Table 8. Mean Number of Correct Nonce Responses

	Age 5-6 (n = 21)	Age 8-11 (n = 11)	Age 15-71 (n = 25)
Mean	13/21 = .62	58/11 = 5.27	160/25 = 6.40

Children (ages 5 and 6) were tested on production of 8 different forms.
Older children and adults were tested on production of 20 different forms.

Table 9 gives all responses by the 7 youngest children, who produced the 13 correct responses. Note that production is not consistent across the paradigm. Children who correctly produced negative *muranai* did not produce the correct past *mutta*. The children were very conservative, often preferring to use known vocabulary rather than novel verbs. For example, rather than inflect the verb *muru*, they described the action they saw with *asi o ugokasite iru* '(She) is moving (her) legs.'

Table 9. 13 Correct Responses by Children Ages 5 and 6 (n = 21)
Only These 7 Children Produced Any Correct Forms

Verb	Continuative	Past	Negative	Volitional
Child 01 Age 6				
mur-u	*asi o ugokasite iru	*muru o site ita	**muranai**	*yaru
hom-u	*homu o site iru	*yatte ita	**homanai**	*yaru
Child 03 Age 5				
mur-u	*muru	*muru	**muranai**	*muru
me-ru	*meru	*meru	*yaranai	*meru
Child 09 Age 6				
mur-u	*aruite iru	*muru	**muranai**	*yaru
hok-u	*mawatte iru	*mawatte iru	**hokanai**	no response
Child 14 Age 5				
mur-u	**mutte iru**	*mutte iru	*muru sinai	**muroo**
hok-u	**hoite iru**	*hoku	**hokanai**	**hokoo**
Child 17 Age 5				
mur-u	*asi o ugokasite iru	*muru	**muranai**	*muru
ri-ru	*wakka o mawasite iru	*mawasita	*riranai	*mawasu
Child 20 Age 5				
mur-u	*hasitte iru	*hasitte iru	*sinai	no response
me-ru	**mete iru**	*yatta	*yaranai	*yaroo
Child 21 Age 5				
mur-u	*muru	*muru	**muranai**	*muru
me-ru	*meru	*meru	*yaranai	*meru

Correct responses appear in **bold**. Incorrect responses are marked with *.

Table 10 shows that over half of all the responses by the youngest children avoided inflection of the nonce verb by using some form of one of the two Japanese 'do' verbs, irregular *suru*, or regular *yaru*. Examples are **muru sinai* or **sinai* in place of *muranai*. Even many older participants responded this way and several produced only or mostly responses with *suru* or *yaru*.

Table 10. Responses Using 'do' Verbs *suru* or *yaru*.

Age 5-6 (n = 21)	Age 8-11 (n = 11)	Age 15-71 (n = 25)
81/163 = 52%	85/217 = 39%	128/497 = 26%
5 'no response'	3 'no response'	3 'no response'

Table 11 and Table 12 give all responses from two older children and two adults. The older children begin to make use of another pattern that also used by the adults. Some of these children and adults use already inflected nonpast forms as roots. For example, they produce **hom-u-tte iru* rather than *hon-de iru*. In Table 11 and 12 these forms appear in bold.

Table 11. Sample Responses Showing Use of Inflected Nonce Form as a Root by Children Ages 8 to 11

Verb	Continuative	Past	Negative	Volitional
Child 08 Age 9				
mur-u	*notte iru	*notte ita	muranai	*noroo
hom-u	***homutte iru**	***homutte ita**	homanai	homoo
hok-u	***hokutte iru**	***hokutte ita**	*hoku sinai	*hoku siyoo
me-ru	*meru o site iru	*meru o site ita	*meru o sinai	*meroo
rir-u	*riru o yatte iru	*riru o yatte ita	*riru o sinai	riroo
Child 10 Age 10				
mur-u	mutte iru	mutta	muranai	muroo
hom-u	***homutte iru**	***homutta**	***homuranai**	***homuroo**
hok-u	hotte iru	hotta	***hokuranai**	***hokuroo**
mer-u	mette iru	metta	mette inai	meroo
ri-ru	*ritte iru	*ritta	*ritte inai	*riroo

These tables also illustrate the very strong tendency for older participants to inflect vowel-final *ri-ru* and *me-ru* as the consonant-final verbs *rir-u* and *mer-u*.

Table 12. Sample Responses Showing Use of Inflected Nonce Form as a Root by Adults (Age 14 to 71)

Verb	Continuative	Past	Negative	Volitional
Adult 01 Age 46				
mur-u	***murutte iru**	***murutta**	muranai	muroo
hom-u	***homutte iru**	***homuttta**	***homuranai**	***homuroo**
hok-u	***hokutte iru**	***hokutta**	***hokuranai**	***hokuroo**
me-ru	*mette iru	*metta	*meranai	*meroo
rir-u	*riritte iru	*ririta	riranai	riroo
Adult 02 Age 42				
mur-u	mutte iru	mutte ita	muranai	muroo
hom-u	***homutte iru**	***homutte ita**	***homuranai**	***homuroo**
hok-u	***hokutte iru**	***hokutte ita**	***hokuranai**	***hokuroo**
mer-u	mette ire	mette ita	meranai	meroo
ri-ru	*ritte iru	*ritte ita	*riranai	*riroo

Table 13 shows the tendency of older participants to use the nonpast form as a root. For example, 4 of the older children produced 24 forms of this type.

Table 13. Responses Using Inflected Nonce Form as Root

Age 5-6 (n = 21)	Age 8-11 (n = 11)	Age 15-71 (n = 25)
0/163 = 0%	24/217 = 11%	76/497 = 15%
0 participants	4 participants	14 participants

5 Conclusions

This paper presents experimental evidence demonstrating that native speakers of Japanese do not produce the inflected forms of novel verbs in a way that is consistent with a rule-based approach to verbal inflection. When presented with one form of a novel verb, they did not produce other inflected forms consistent with the existing paradigms of actual Japanese verbs. Assuming that the meaning of the word 'pass' is a 60% or better score, the Japanese speakers did not pass the verbal *wug* test. The 5- and 6-year-olds tested clearly understood the task, but produced correct forms only about 8% of the time. Over 50% of their responses made use of the 'prefab' 'do' verbs *yaru* and *suru*, suggesting that young children are much more conservative in their productions than previously believed. The older children and adults (ages 8 to 71) performed somewhat better but produced 'correct' forms only about 30% of the time. If the inflection of verbs already known to Japanese speakers is accomplished by the use of combinatory rules that combine roots and suffixes, there is no reason that those same rules could not be easily extended to novel verbs. This was the basic assumption of the original English *wug* test.

However, a review of the original verb responses from Berko (1958) showed that English-speaking children produced the appropriate [əd] past allomorph less than 40% of the time and produced the appropriate [d] past allomorph, with the test item *spow*, less than 60% of the time. In the analysis of the present paper, the English-speaking children did not pass the test either. And, the notion of fully productive rules is a myth, as suggested by Taylor (2003).

Performance by speakers of both languages was gradient and consistent with the predictions of a usage-based approach. Both English and Japanese productions showed evidence that speaker analysis of word forms differs from formal linguistic analysis. English-speaking children appear to have analyzed *bod* as a past form because it ended with the [d] past allomorph. Japanese speakers appear to have analyzed /Qta/ (rather than /ta/) as a marker of 'past.'

Rather than rules, this type of speaker analysis is consistent with the use of analogy, the use of a novel item in an existing pattern based on stored exemplars (Bybee 2010:57).

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