Cross-linguistic Differences in Children's Syntax for Locative Verbs

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1. Learnability and Syntax-Semantics Correspondences

Learning a verb's meaning and its associated syntactic structures pose a number of difficult problems for a learner. However, it is widely assumed that there are consistent correspondences between verb meanings and verb syntax, and that knowledge of these correspondences may provide important help to the learner (Gleitman 1990; Grimshaw 1981; Landau & Gleitman 1985; Pinker 1989; Gropen et al. 1991a,b). To take a simple example, English mental verbs like "think", "know", and "believe" take sentential complements, as do many other mental verbs in English and other languages. Accordingly, if this connection is universal, and if the learner knows this, then it could be very useful. If the learner already knows that a verb is a mental verb, then she can infer that it allows a sentential complement. If the learner hears an unfamiliar verb that takes a sentential complement, then this can be used as a clue that the verb might be a mental verb.

In this paper we are primarily concerned with locative verbs, such as "pour", "fill", "load", and "stuff". Locative verbs encode the relationship between a moving object - the "Figure"- and a location - the "Ground". Although locative verbs all show this semantic similarity, they fall into at least four different syntactic subclasses based on their syntactic possibilities (Pinker 1989), as shown in (1-4). In addition to the Figure and Ground *Non*-alternating classes, Alternating verbs are divided into two subclasses, the Figure Alternating verbs in (3) and the Ground Alternating verbs in (4), based on which argument is obligatory in both syntactic frames (see Pinker 1989).

Non-Alternating Figure verbs in English ("dribble", "spill", "slop", or "ladle")
(1) a.   John poured water$_{Figure}$ into the glass$_{Ground}$.   Figure-frame
     b. *John poured the glass$_{Ground}$ with water$_{Figure}$.   *Ground-frame
          manner-of-motion   Non-Alternating Figure verbs

Non-Alternating Ground verbs in English ("cover", "decorate", or "soak")
(2) a. *John filled water$_{Figure}$ into the glass$_{Ground}$.   *Figure-frame
     b.   John filled the glass$_{Ground}$ with water$_{Figure}$.   Ground-frame
          change-of-state   Ground verbs

Figure-Alternating verbs in English ("spray", "load", or "sow")
(3) a.   John piled books (on the table_{optional}).   Figure-frame
     b.   John piled the table with books.   Ground-frame

Ground-Alternating verbs in English ("paint", "wrap", or "stuff")
(4) a.   John stuffed feathers into the pillow.   Figure-frame
     b.   John stuffed the pillow (with feathers_{optional}).   Ground-frame

For example, the verb "fill" allows the Ground to be the direct object, and the Figure to be the indirect object, as in a sentence like "John filled the glass with water". We will call this the "Ground frame". But the verb "fill" does not allow the so-called "Figure frame", as in a sentence like "*John filled the water into the glass". Interestingly, other locative verbs with similar syntax to "fill" have semantic properties in common with "fill". Verbs with the same syntax as "fill" - such as "cover", "decorate", and "soak"- all describe a change-of-state. Thus, we have another example of a reliable syntax-semantics correspondence. If a learner knows about correspondences like this, then it could be easier to learn the syntax and semantics of locative verbs.

However, there is a puzzle. Despite consistent syntax-semantics mappings in English, there is cross-linguistic variation in these mappings. For example, change-of-state verbs like "fill" are Ground verbs in English, but the Korean counterparts of this class are syntactic Alternators, which allow both Figure and Ground frames, as shown in (5). This suggests that the connection between change-of-state meanings and Non-alternating Ground frame syntax might not be universal. And if it is not universal, then it is much less clear how it could be useful to a learner.

(5) a.   Yumi-ka mul-ul   cep-ey   chaywu-ess-ta.
           Nom water-Acc   cup-Loc   fill-past-Decl
           '*Yumi filled water into the glass.'   Figure-frame
     b.   Yumi-ka cep-ul   mul-lo   chaywu-ess-ta.
           Nom cup-Acc   water-with   fill-past-Decl
           'Yumi filled the glass with water.'   Ground-frame

To take another example, one of the subclasses of Alternating locative verbs in English - the class that includes verbs like "pile" or "spray" - has Korean counterparts which are consistently *Non*-alternating Figure verbs, as in (6).

(6) a.   Yumi-ka chaek-ul   chaeksang-ey   ssa-ass-ta.
           Nom book-Acc   table-Loc   pile-past-Decl
           'Yumi piled the books on the table.'   Figure-frame
     b. *Yumi-ka   chaeksang-ul   chaek-elo   ssa-ass-ta.
           Nom   table-Acc   book-with   pile-past-Decl
           'Yumi piled the table with the books.'   *Ground-frame

The two remaining classes of locative verbs in English - the Non-alternating Figure verbs and the second subclass of Alternating verbs - are syntactically identical in English and Korean, as shown in (7) and (8).

(7) a. Yumi-ka   mul-ul   cup-ey   pwu-ess-ta.
          Nom   water-Acc   glass-Loc   pour-past-Decl
         'Yumi poured water into the glass.'   Figure-frame
     b. *Yumi-ka   cup-ul   mul-lo   pwu-ess-ta.
          Nom   glass-Acc   water-with   pour-past-Decl
         'Yumi poured the glass with water.'   *Ground-frame
(8) a. Yumi-ka   kirul-ul   pyek-ey   chilha-ess-ta.
          Nom   oil-Acc   wall-Loc   paint-past-Decl
         'Yumi painted the oil onto the wall.'   Figure-frame
     b. Yumi-ka   pyek-ul   kirul-elo   chilha-ess-ta.
          Nom   wall-Acc   oil-with   paint-past-Decl
         'Yumi painted the wall with the oil.'   Ground-frame

In sum, some Korean locative verbs show the same syntactic possibilities as their English counterparts, as in (7-8), some are syntactically more liberal, as in (5), and some are syntactically more restricted, as in (6). Therefore, our first problem will be how a learner can use syntax-semantics correspondences despite the problem of cross-linguistic diversity.

Our second puzzle involves the kinds of generalizations about verb syntax that native speakers of English need to make. We know that adult speakers make quite constrained, conservative generalizations about verb syntax. For example, native speakers of English can generalize the double-object syntax of the verb "send" to verbs like "e-mail", "fax", or "ftp". However, they do not generalize from "send" to verbs like "deliver" and "dispatch", which have related meanings but only allow the dative construction.

(9) a.   John sent/emailed/faxed Mary a letter.
     b.* John delivered/dispatched Mary a letter.

Therefore, a learner must make similarly constrained generalizations, if she is to become a native speaker. However, the work of Bowerman (1982), Gropen et al. (1991a,b) shows that English-speaking children overgeneralize Figure-frame syntax to Ground verbs like "fill", and produce ungrammatical sentences like "She filled the water into the glass", as shown in (10).

Figure-frame errors in spontaneous speech of English children (Bowerman 1982)
(10)   I didn't fill water up to drink it; I filled it up for the flowers to drink it.
        Can I fill some salt in the bear? [= a bear-shaped salt shaker]
        I'm going to cover a screen over me.
        (see also experimental data in Gropen et al. 1991a, b)

Why do children overgeneralize in these cases, and how do they recover? The first possibility, due to Bowerman (1982, 1990), is that the Figure-frame overgeneralizations are parallel to well-known overgeneralizations of past tense morphology, based on the idea that Figure frames might outnumber Ground frames in English (but cf. Gropen et al. 1991b). We will call this the Input Frequency Hypothesis.

The second possibility is that children's Figure frame errors result from the greater perceptual salience of moving objects compared to stationary ground objects (Gentner 1978; Gropen et al. 1991a,b). This could bias children to encode the figure object as the direct object, even when this is ungrammatical. A variant of this idea is the suggestion by Gropen et al. (1991a,b), that the salience of the figure object may cause learners to semantically misanalyze Ground verbs. For example, the verb "fill" might be taken to mean "fill-by-pouring", which has the manner of motion meaning required to license Figure frames.

The third possibility is that learners of English think that their language has the properties of Korean, in which verbs like "fill" allow Figure-frame syntax. This could be because the Korean pattern is the unmarked pattern, or we could think of it as a mis-set parameter.

To address these questions, we examined spontaneous descriptions of locative events produced by Korean and English speaking children and adults. Our experiment allows us to assess 3-4 year olds' knowledge of the syntax of locative verbs, while also testing to see if we can find independent support for any of these different accounts of syntactic errors with locative verbs.

2. Experiment

In our experiment, we elicited the production of 14 locative verbs from 60 participants, including 30 speakers each of English and Korean. Within each language group we tested three groups: 10 3-year olds; 10 adult native speakers; 10 mothers of 2-year olds who were asked to describe the scenes to their child. The data from the adults and mothers were virtually identical, hence we focus here only on the mothers in comparison to the 3 year-old children.

The 14 locative verbs that we used came from each of the 4 subclasses of locative verbs: Verbs in group 1 ("pour"-class) are Figure verbs both in English and Korean (*pour, spill, hang,* and *stick)*; Verbs in group 2 ("paint"-class) are Alternators both in English and Korean (*paint, wrap, stuff,* and *spread*); Verbs in group 3 ("pile"-class) are Alternators in English but Figure verbs in Korean (*spray, pile*, and *load*) ; Verbs in group 4 ("fill"-class) are Ground verbs in English but Alternators in Korean (*fill, cover*, and *decorate*)[1].

The subjects' task was to describe a videotaped event, using a specific verb that was provided to them in a neutral context. We found that this was enough to elicit complete sentences with Figure and Ground arguments from adult subjects, but in a pilot study we found that children often omitted one or more of the

arguments, which was compatible with the pragmatics of the situation. Therefore, with the children, before showing each video clip, we acted out a contrasting event using the same verb but different objects. For example, when the video-clip showed juice being poured into a glass, the experimenter first acted out an event in which water was poured into a bowl. The details of the procedure are shown in Table 1:

Table 1: Sample story for children

Locative verb "pour"	*Pragmatic Set-up* (children only) • I have water and a bowl • I'm going to **pour…** I **poured**. • Did you see what I did? Let's watch the movie
	Test Event on TV screen (all subjects) • She has different things. She has a glass and some sugar • She's going to **pour…** She **poured.** • Can you tell me what she did? • She **poured** _____ • Can you tell me what I did? I **poured** _____

We also included two different scenes for each of the verbs that we tested, one in which the ground object was completely filled or covered, and another in which it was only partially affected by the action. We included this manipulation because it has often been pointed out that the ground frame is associated with a "holistic interpretation" of how the ground object is affected (Anderson 1971). However, it turned out that this manipulation had no effect on any of the results. Finally, we included two versions of the "filling" event - one which could be interpreted as "filling" caused by "pouring", and another which involved still "filling", but not caused by "pouring".

Table 2 shows the results for the first group of verbs, which included "pour", "hang", "spill", and "stick". These are semantically manner of motion verbs, and syntactically Non-alternating Figure verbs in both languages. Mothers perform as expected, and children in both languages respond in a target-like manner, using only Figure frames.

Table 2
Proportion of Figure Frames Used by Subjects for Group 1 ("Pour"-class)

	English	Korean
Mother	1	1
Child	0.98	1

Age: $F_{(1,36)}=2.25$, ns; Language: $F_{(1,36)}=2.25$, ns
Interaction between Age and Language: $F_{(1,36)}=2.25$, ns
*Significant level at .05

The second group of verbs - which included "paint", "wrap", "stuff", and "spread" - is important because it consists of verbs which are Alternators in both

English and Korean. The fact that both languages allow a choice gives us an opportunity to look for independent evidence for a figure frame bias. Table 3 shows that children do indeed use more figure frames than mothers with this class of verbs. However, it is important to notice that this effect is relatively small, in the 10-20% range. This is an effect that we will see again. There is also an effect of language, with Korean speakers overall producing more Figure frames.

Table 4 shows the results for the third group of verbs - which included "pile", "load", and "spray". These are Alternators in English but only allow Figure frames in Korean. The Korean subjects use Figure frames 100% of the time, as Korean grammar requires. This matches the result shown in Table 2. The results for the English subjects parallel this results in Table 3 - mothers and children mostly use figure frames, but children use Figure frames about 20% more often than the mothers.

<table>
<tr><td colspan="3">Table 3
Proportion of Figure Frames Used by
Subjects for Group 2 ("Paint"-class)</td></tr>
<tr><td></td><td>English</td><td>Korean</td></tr>
<tr><td>Mother</td><td>0.59</td><td>0.71</td></tr>
<tr><td>Child</td><td>0.74</td><td>0.84</td></tr>
</table>

Age: F(1,36)=11.11, p<.01
Language: F(1,36)=7.44, p<.01
Age × Language: F(1,36)=.09, ns

<table>
<tr><td colspan="3">Table 4
Proportion of Figure Frames Used by
Subjects for Group 3 ("Pile"-class)</td></tr>
<tr><td></td><td>English</td><td>Korean</td></tr>
<tr><td>Mother</td><td>0.7</td><td>1</td></tr>
<tr><td>Child</td><td>0.9</td><td>1</td></tr>
</table>

Age: F(1,36)=7.35, p<.01
Language: F(1,36)=18.15, p<.01
Age × Language: F(1,36)=7.35, p<.01

The fourth group included the verbs "fill", "cover", and "decorate". These verbs only allow Ground-frames in English but are Alternators in Korean. The results for Korean shown in Table 5 are not surprising. Both the Korean mothers and the Korean children treat these verbs as Alternators, but the children produce Figure frames about 20% more often than the mothers. So again we see a small Figure frame bias in the children, within the bounds of what the target language allows. The English-speaking mothers used no Figure frames at all with these verbs, as we would expect from the grammar of English. In the light of this, the fact that English-speaking children produced Figure frames at a rate of over 50% is quite striking. Not only is this the first time in these results that we have seen anybody speaking ungrammatically; the difference between children and adults is much larger than in any of our other verb groups.

In fact, Table 5 is a little misleading, because it masks important differences among the verbs that we used. If we just look at the verbs "cover" and "decorate", as shown in Table 6, we find that the English- speaking children only produce ungrammatical Figure frames about 20% of the time. This is much more like the child-adult differences that we have seen a number of times already.

Table 5		
Proportion of Figure Frames Used by Subjects for Group 4 ("Fill"-class)		
	English	Korean
Mother	0	0.57
Child	0.56	0.78

Age: $F_{(1,36)}=38.43$, $p<.01$
Language: $F_{(1,36)}=41.89$, $p<.01$
Age $\times$ Language: $F_{(1,36)}=7.8$, $p<.01$

Table 6		
Proportion of Figure Frames Used by Subjects ("Cover" and "decorate" only)		
	English	Korean
Mother	0	0.53
Child	0.2	0.55

In contrast, the 10 English-speaking children in this study used "fill" with a figure frame almost 100% of the time. In fact, this effect was found in both types of scene involving "fill" - both the version involving pouring of juice, and the version involving loading of toys. This indicates that the use of a "pouring" manner is not necessary to elicit Figure-frame errors with "fill" in children. Therefore, it does not seem that English-speaking children's overgeneralization errors are due to the incorrect semantic representation for "fill" (e.g., "fill" means "fill-by-pouring").

Summary of Findings

The results of our experiment can be summarized as follows. First, we replicated the finding that English-speaking children make errors with Ground verbs like "fill", but they do not make errors with Figure verbs like "pour". To this we added the finding that Korean children also make no errors with their Non-alternating Figure verbs.

Second, in both English and Korean we found independent evidence that children use more Figure frames than adults. Although this confirms the suggestion of a Figure frame bias, our results also allow us to rule out this bias as the source of children's well-known syntactic errors with "fill". The 'figure-frame bias' is a consistent but small effect. What the English-speaking children did with "fill" was vastly different from this.

Third, we have the data needed to evaluate the suggestion that "fill" errors are an overgeneralization error, caused by the global frequency distribution of figure frames in the input. The proportions of figure frames used by mothers and children with the 7 Alternating verbs that we used in each language show that there is a rather good correlation between mothers and children, even on individual verbs ($r^2=0.47$; $F_{(1,12)}=10.52$, $p<.01$). If children are so similar to adults on a verb-by-verb basis, then it does not seem very likely that their high percentage of errors with "fill" can be explained in terms of how they match *global* input frequencies. Of course, an alternative might be that children are biased by more local input frequencies, e.g., based on individual semantic classes of verbs, but this would fail to account for "overgeneralizations" with verbs like "fill".

Fourth, it does not seem likely that English-speaking children have mistakenly adopted a Korean-style syntax for locative verbs. The children in both languages overwhelmingly conform to what the grammar of the target language allows, and in most cases they closely track the behavior of mothers speaking the same language.

Finally, the ungrammatical sentences produced by English-speaking children are overwhelmingly due to the single verb "fill", suggesting that their syntactic knowledge for ground verbs is not uniformly incorrect. Therefore, any account of children's "fill" errors is going to need to be one which does not automatically generalize to all other ground verbs in English, such as "cover" and "decorate".

3. Learnability and Cross-linguistic Diversity

Having seen what 3-4 year old speakers of English and Korean know about locative verb syntax, we now turn to our questions about learnability. How did the children in our study get where they are, and how can they proceed from there to the adult state?

At this point we can look beyond English and Korean to a wider range of languages, to see how broad the cross-linguistic diversity is. We have found that languages fall into two basic classes. One class of languages - which includes Korean, Japanese, Chinese, Thai, and Turkish - has a very simple pattern for locative verbs. *All* locative verbs allow figure frames. And then verbs which have change-of-state as a primary meaning component typically allow ground frames too. These languages never have Non-alternating ground verbs. The second class of languages - which includes English, French, Spanish, Singapore Malay and Classical Arabic - shows the more complicated English-style syntactic pattern, which includes both Figure and Ground Non-alternating verb-classes, plus one or more classes of Alternating verbs.

Across languages, some syntax-semantics correspondences appear to be universal, some correspondences appear to apply only within one of the two broad language groups, and some correspondences appear to be subject to idiosyncratic language-by-language variation.

First, the one generalization that seems to hold across *all* of the languages that we have looked at is that manner of motion verbs allow the figure frame.

- *Universal Syntax-semantics correspondence*
  manner-of-motion meaning → Figure frame

Second, two syntax-semantics correspondences depend on which broad language group the language belongs to. In English-style languages, basic change-of-state verbs always allow the ground frame. Not surprisingly, our 3-4 year olds seemed to know this quite well. In Korean-style languages, *all* locative verbs allow the figure frame, and there are no Non-alternating Ground verbs.

- *Group-specific syntax-semantics correspondences*
  English-type languages: change-of-state meaning → Ground frame
  Korean-type languages: *all* locative verbs→Figure frame
  no *Non*-alternating Ground verbs

Of course, these group-specific correspondences are not much use if the learner does not know which group her language belongs to. Fortunately, the two groups of language may be distinguishable based on an independent property. Table 7 shows that all of the Korean-type languages, and none of the English-type languages, allow complex predicates to be constructed by combining verbs, which is known as V-V compounding or verb serialization. Such verb forms are common in adult speech, and are also common in the speech of children below age 3 in Korean. Some examples of this construction are shown in (11). Table 7 also shows the distribution of a number of other properties of these languages which appear *not* to correlate with their syntax for locative verbs.

Table 7: Locative verb syntax and Serial verb constructions

	Syntax of Ground verbs	Serial verbs	Overt Causatives[2]	Lexical parameter	Word order	Pro-drop
English	Ground only	**no**	no	Satellite-framed	SVO	no
French	Ground only	**no**	no	Verb-framed	SVO	no
Spanish	Ground only	**no**	no	Verb-framed	SVO	yes
Singapore Malay	Ground only	**no**	yes[3]	Satellite-framed	SVO	?
Classical Arabic	Ground only	**no**	yes	?	VSO	yes
Korean	Alternator	**yes**	yes	Verb-framed	SOV	yes
Japanese	Alternator	**yes**	yes	Verb-framed	SOV	yes
Chinese	Alternator	**yes**	yes	Satellite-framed	SVO	yes
Thai	Alternator	**yes**	yes	?	SVO	yes
Turkish	Alternator	**yes**	yes	Verb-framed	SOV	yes

(11) a. John-i   ttangkhong-ul   sa-mek-ess-ta.
     Nom   peanuts-Acc   buy-eat-Past-Decl
    'John bought peanuts and ate them.'   (Korean)

  b. John-ga   niwatori-o   naguri-korosi-ta.
     Nom   chicken-Acc   beat-kill-Past
    'John beat and killed a chicken.'   (Japanese)

  c. Baoyu   song-gei   Daiyu   yiben   shu
     send-give   one   book
    'Baoyu sent Daiyu a book.'   (Chinese: Li 1990)

  d. Chan   pat kai   kin.
     I   fry chicken   ate
    'I fried chicken and ate it.'   (Thai)

      e.   John   tavugu   pisit-ip yedi.
                     chicken   cook-eat-past
         'John cooked chicken and ate it.'   (Turkish)

An important question, then, is why verb compounding/serialization should correlate with locative verb syntax. As a possible answer, we suggest that the semantic packaging of predicate meanings that is needed in order to use Ground verbs with Figure frames involves exactly the same kind of process seen overtly in serial verb constructions. The generalization to explain is that in serializing languages, all Ground verbs also allow Figure-frames. We suggest that creating a Figure frame based on a Ground verb depends on a property of verb serializing systems, such as (i) indirect causation, or (ii) argument sharing. One possibility is that the formation of Figure frame syntax with a Ground verb has the semantics of complex verb formation: the predicates (X affects Y) and (Y affects Z) are combined, and an argument is shared between the predicates, as is characteristic of verb serialization, as in (12a). Another possibility is that the Figure frame use of Ground verbs encodes indirect causation of change-of-state, as in (12b). Serializing languages typically allow indirect causation meanings to be expressed overtly, by overt causative marking on the second verb of the serializing pair.

(12)   * John decorated the lights on the tree.
             a. [John affects the lights] + [the lights decorated the tree]
             b. John caused the lights to cause the tree to be decorated.

In any case, if learners can determine at an early age whether or not their language allows verbal complex predicates - and at least for Korean we know that there's plenty of evidence in the input - then they might be able to use this information to determine which broad language group their target language is in. Based on our experiment, it appears that the 3-4 year olds already know enough to know whether they are speaking an English-style language or a Korean-style language. If the cue for this distinction is as simple as we have suggested, then this is not so surprising.

Finally, there are syntax-semantics correspondences that seem to vary on a language-by-language basis. The classes of verbs which are syntactic Alternators in English show much broader syntactic variation across languages than the classes which are Non-alternators in English. As Pinker (1989) and Levin (1993) have shown for English, this probably involves idiosyncratic semantic properties which can affect syntactic possibilities in some languages but not others. An example from English is that verbs of ballistic motion such as "spray" and "sprinkle" are Alternators, whereas related non-ballistic verbs such as "pour" and "dribble" only allow the Figure frame. This affects some languages but not others: For example, "spray" is an Alternator in Chinese and Thai, but is a Non-alternating Figure verb in Korean.

Interestingly, we have found that "fill" is one of the most syntactically variable verbs across languages. In English it is a Ground verb, in Korean it is an Alternator, in Thai it is a Figure verb, and in Singapore Malay it is an Alternator. In contrast, "cover" and "decorate" show much less variation across languages. Therefore, it is perhaps not so surprising that the English speaking children in our experiment are making errors in an area where there is greatest cross-linguistic diversity. "Fill" is a verb which is affected by an idiosyncratic rule in some languages but not others. What the children in our experiment have not yet learned is that "fill" is not affected by one of these idiosyncratic rules in English. The remaining question, then, is how children learn these language-specific idiosyncrasies. This is an important question which we unfortunately cannot answer in this paper.

4. Conclusion

In this paper we have shown that by age 3-4 children's errors with the syntax of locative verbs are extremely restricted, and that this is consistent with what they can and cannot learn by using consistent cross-linguistic syntax-semantics correspondences. Syntactic generalizations based on universal correspondences are mastered, as are syntactic generalizations based on correspondences which hold across broad classes of languages. Errors are confined to areas where syntax-semantics correspondences are most variable and idiosyncratic across languages.

Endnotes

* Authors are listed in alphabetical order. We would like to thank Andrea Zukowski and Nicole Kurz for their help in running the experiments.

1. The classes are based on the results of an earlier grammaticality study (Kim & Landau 1997). We examined grammaticality judgments by native speakers of English and Korean for 20 locative verbs selected from Levin's (1993) list of locative verbs. Although Levin reports that verbs like "hang" and "stick" are Alternators in English, we found that those verbs were judged to be Figure verbs in English in the contexts we used in our experiment.
2. Juffs (1996) suggests that there is a connection between the syntax of locative verbs and the presence of overt causative affixes across languages.
3. Note that in Singapore Malay, the causative morpheme "-kan" is often referred to as a transitive morpheme.

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