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Parameter setting in second language phonology and syntax

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This paper reports on studies of second language acquisition in two domains, phonology and syntax. The phenomena investigated were the acquisition by native speakers of Hindi, Japanese, and Korean of two areas of English: in phonology, the mastery of particular syllable onset clusters, and in syntax, the acquisition of the binding patterns of reflexive anaphors. Both these areas are ones for which multi-valued parameters have been posited to account for the range of variation across natural languages. The paper presents evidence that acquisition in these two areas is quite similar: at a certain stage of acquisition learners seem to arrive at a parameter setting that is midway between the native and the target language settings. This effect occurs both when the target language employs a less marked setting than the native language and when the target language setting is more marked than that of the native language.

I Introduction

This paper deals with two basic questions in second language acquisition. The first question concerns the relative importance of markedness, defined in terms of a set of parameters and parameter settings given by Universal Grammar (UG), and transfer, defined as the carrying over of the L1 parameter setting into the L2. The second issue is the question of whether the same principles drive the acquisition of both phonology and syntax – that is, whether transfer and markedness play similar or very different roles in the acquisition of different components of a second language grammar. We will present evidence that acquisition in these two areas is quite similar: at a certain stage of acquisition learners seem to arrive at a parameter setting that is midway between the native and the target language settings. This process involves transfer, in that the parameter setting of the L1 is apparently the starting point, and markedness, in that learners' errors reflect the markedness hierarchy implicit in the parameter

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settings: learners master less marked constructions earlier. The similarity between our results in the phonology and syntax contradicts the assumption that is implicit in much work – and explicitly argued for in some[1] – that transfer is a far more important factor in phonology than in syntax.

We report on studies in two domains: the acquisition of onset clusters in syllables, and the acquisition of principles of reflexive binding. Both are areas where multi-valued parameters have been posited to account for the range of variation across natural languages. The various settings associated with these parameters define a subset relation: the more marked settings include the constructions permitted by each less marked setting. We assume, following the work of Berwick (1985), Wexler and Manzini (1987), and others that in first language acquisition, the initial setting of a parameter is the most restrictive setting. Resetting of a parameter to a more marked setting is triggered by exposure to positive evidence (that is, by exposure to constructions outside the subset defined by the more restrictive setting). This assumption, Berwick's Subset Principle on Learnability, makes explicit the connection between markedness and learnability. In second language acquisition, our results reveal effects of both markedness (defined in terms of the subset relation among parameter settings) and transfer (defined in terms of the native language parameter settings). In both the phonological and the syntactic domains, the evidence suggests that learners have neither retreated to the unmarked setting for a given parameter nor transferred the setting of their native language wholesale; instead, responses tended to cluster around a parameter setting intermediate in markedness between those of the native and the target languages. This effect occurs both when the target language employs a less marked setting than the native language (as in the acquisition of the English setting for the Governing Category Parameter (GCP), which fixes the binding domain for reflexive anaphors), and when the target language setting is more marked than that of the native language (as in the acquisition of the English setting for the Minimal Sonority Distance (MSD) Parameter, which determines the relative sonority of consonants in syllable onset clusters).

II Phonology

1 Background

We begin with a discussion of the phonological data. The phonology experiment was designed to test the ability of learners to master L2

[1] Ioup (1984), for example.

consonant clusters differing in degrees of markedness. We assume a model in which segments are organized into syllables according to a universal set of rules of syllabification, essentially those proposed by Steriade (1982). These include a universal rule which joins a consonant to a following vowel, creating CV syllables, which occur in all languages. Languages with more complex onset types also have an additional syllabification rule, the Onset Rule, which incorporates a second consonant into a syllable already beginning with one consonant. In languages that allow more than two consonants in onset position, the Onset Rule applies iteratively. Since languages do not have complex onsets without also having simple ones, iteration is the marked option. Onsets containing a single consonant form a subset of those containing more than one consonant.

The co-occurrence of consonants within the onset (or coda) seems to be governed by principles of sonority; in general, syllables are arranged so that the most sonorous elements (vowels) appear in the centre of a syllable, while segments are arranged in order of decreasing sonority toward the syllable margins (Sievers 1881, Jespersen 1904, de Saussure 1916, and others; a recent statement of this principle is that of Selkirk 1984). Thus the hierarchy shown in (1) represents the optimal order of segments in the onset, with voiceless stops (such as *p*) being the least sonorous and glides the most sonorous consonants.[2]

1) Sonority Hierarchy

Obstruents - Nasals - Liquids - Glides - Vowels
(p-b-f-v)

least sonorous . . . . most sonorous

Sonority Sequencing Generalization (SSG): Segments within a syllable tend to be arranged in order of decreasing sonority approaching the syllable margins.

The SSG restricts the order of consonants in syllable onsets, while the number and type of consonants in an onset is restricted by requiring a certain distance in sonority between adjacent onset consonants. In English, for example, an obstruent may be followed by a liquid or glide - segments which are farther away from obstruents on the sonority hierarchy - but not by a nasal, which is closer in sonority. To account for cross-language variation in possible consonant combinations, Selkirk (1982) and Steriade (1982) propose that grammars contain a sonority scale ordering classes of segments in terms of

[2] Fricative-stop onset clusters (*st* in English, for example) contradict this generalization, but see for example Selkirk 1982, Ewen 1982, Broselow (in preparation) for arguments that these onsets have a structure different from that of true onset clusters.

sonority and assigning a value to each class. Languages may vary in the degree of difference they require between the values of adjacent tautosyllabic segments, this difference presumably reflecting different settings of a multi-valued MSD parameter. The MSD defines a subset relationship among the classes of possible onsets (for example) across languages. To see how this works, we can assume for simplicity's sake that each class of sounds in (1) is assigned a sonority value varying by one interval:

2) Sonority Scale

class	value
stops	1
fricatives	2
nasals	3
liquids	4
glides	5

Given these values, a language (L_5) that has one consonant of each class and a MSD setting of 5 could have only single-consonant onsets, since there are no two consonants in these language that differ by 5 in sonority; thus, language L_5 has 5 possible onsets. A language L_4 with an identical inventory of consonants but a MSD setting of 4, however, should have 6 possible onsets: the 5 single-consonant onsets plus the combination stop-glide, which is allowed because this combination satisfies the minimal distance of four. A language with a MSD setting of 3 would permit a still wider range of onset types, including all those permitted in L_4 plus the combinations stop-liquid and fricative-glide. Thus the most liberal setting of the MSD parameter is the one that requires the lowest MSD, since this setting permits all possible combinations of consonant classes within the onset, while progressively higher MSD settings are more restrictive, each setting providing for a subset of the onset types permitted by the next lowest setting. Therefore, by the assumption that the most restrictive parameter setting generates the least marked set of elements, clusters whose members are closer in sonority are more marked than clusters whose members are farther apart on the sonority hierarchy. The (universal) SSG and the (language-particular) setting of the MSD combine to limit the length and composition of clusters in a language.[3] Thus, a language like Japanese allows only obstruent-glide onset clusters (that is, clusters of a low sonority consonant followed by a high sonority consonant); English, with a more marked setting, allows both obstruent-glide and obstruent-liquid

[3] It is actually generally assumed that a certain degree of variation is permitted across languages with regard to which features are relevant with respect to relative sonority; see Selkirk 1984, Steriade 1982, Clements 1988, Zec 1988 for various proposals.

onsets; Greek, with a still more marked setting, allows the above types as well as obstruent-nasal sequences (as in *pneumonia*).

In this framework, then, UG makes available to the learner the rule forming CV syllables and additional rules creating more complex syllables. The learner must determine the requirements of relative sonority governing the elements within those constituents. This system embodies a hierarchy of relative markedness of onset types, with a single C the unmarked option and an increasingly wide range of onset types associated with more marked, less restrictive settings on the MSD parameter. The experiments we will discuss here were designed to investigate the relevance of the MSD parameter to second language acquisition: specifically, we were interested to see whether clusters closer in sonority (that is, the more marked clusters) are harder to learn than clusters containing consonants separated by a wider sonority difference (the less marked type). We were also interested in one area of controversy in the formulation of the MSD parameter: the status of the voiceless-voiced and stop-continuant distinctions in the sonority hierarchy. It has been argued both that these distinctions are irrelevant for sonority sequencing (most recently by Clements 1988) and (Steriade 1982) that the sonority status of the features [voice] and [continuant] may vary across languages. Thus we were interested in language learners' relative mastery both of clusters that uncontroversially differ in sonority (obstruent-liquid vs. obstruent-glide) as well those for which sonority differences are less clear (stop-sonorant vs. fricative-sonorant and voiceless obstruent-sonorant vs. voiced obstruent-sonorant).

2 Methodology

To investigate these questions, we had 32 subjects (24 native speakers of Korean and 8 native speakers of Japanese) produce words with initial clusters *pr, br, fr* and *py, by, fy*. Subject were students at the State University of Stony Brook or in the Intensive English Program there, or were friends or spouses of students. All had had formal instruction in English in their native countries, and some had taken EFL classes in the United States. In general, their level was high intermediate; all but six scored 80 or above (out of 100) on the ELSA (English Language Skills Assessment) test. The method was as follows: learners were told that they were going to learn a set of vocabulary items, many of which might be new to them. These were actually a mixture of real words and nonsense words, a distinction which we assumed was irrelevant since many of the actual words of English were also unfamiliar to most subjects. Subjects were presented with a tape consisting of a total of 34 sentences, each giving a definition of the new 'word', as exemplified in (3):

3) 'Puce' [pju:s] is a colour.

Subjects heard each defining sentence twice and were directed to repeat the sentence twice into a tape recorder in order to fix the definition in their minds. The actual purpose was, of course, to elicit their pronunciation of these clusters in phrase-initial position (where there could be no possibility of syllabification of one or more of the onset consonants with a preceding vowel). In addition to hearing the words on the presentation tape, subjects were provided with a sheet giving the word both in English spelling and in transcription (following the system of the dictionaries most commonly used by students of each language background), as illustrated in (3). This triple mode of presentation was designed to maximize the possibility that students really were attempting to produce the desired target phonemes rather than translating the English strings into the native language phoneme system; that is, to tease apart production and perception as sources of errors. All test words began with either a single consonant or two consonants; there were four words exemplifying each cluster (*py,by,fy,pr,br,fr*) and two words exemplifying each single consonant (*p,b,f,y,r*). The shapes of the carrier words were rigidly proscribed: for each cluster there were two monosyllabic words of the shape CCVC and two bisyllabic words of the shape CCVCVC, with stress on the initial syllable, and the vowel following the initial onset was always *u:*. Order of presentation was randomized.

After each set of 17 sentences, subjects were given what they were told was a vocabulary test, consisting of questions like the one in (4):

4) Which word means a color?
([pju:t], [pju:m], [pju:s])

Subjects simultaneously heard and read this question. They then heard three possible responses (*pju:t, pju:m, pju:s*), and were told to repeat the correct response. Since all three response began with the same onset sequence, the 'correctness' of the responses was irrelevant to the actual purpose of the experiment. This portion of the experiment was designed to serve as a more natural, speech-like task, in which subjects focused not on repetition but on recalling the word with the given meaning. The order of presentation of onset types was randomized, as was the position of the correct response in the three response choices. Since each of the four words exemplifying each onset cluster was pronounced three times (twice in the repetition, once as answer to a question), each subject produced 12 tokens of each cluster (except for a small number of cases in which subjects did not respond or their responses were erased), for a total of 384 tokens. Each tape was then transcribed by two native speakers of American English. In cases where transcriptions disagreed, the tape was transcribed by a third native speaker and the transcription agreed upon by two out of the three transcribers was chosen. There were no cases in which all three transcribers disagreed.

3 Results

Since *r* is less sonorous than *y*, the MSD predicts that clusters of the type obstruent-*r* should be more marked than obstruent-*y* clusters. Furthermore, some versions of the sonority hierarchy assign different sonority values to voiceless stops, voiced stops, and fricatives, with voiceless stops less sonorous than voiced ones and stops less sonorous than fricatives. If this is the correct version of the sonority hierarchy, these clusters should exhibit different degrees of markedness with respect to the MSD. Relative markedness relationships are depicted in (5):

5) less marked . . . . more marked
Cy . . . . Cr
pC . . . bC . . . fC

Thus, taking only markedness considerations into account, we would predict that *py* should be the least problematic cluster type for learners, since *p* is the least and *y* the most sonorous consonant type, while *fr* should be the most difficult, since *f*, and *r* are relatively closer in sonority. Since the sonority difference among the different obstruent types is smaller than the difference among obstruents, liquids, and glides, all obstruent-*y* clusters should be less difficult than all obstruent-*r* clusters. And in general, the results for the Japanese and Korean subjects, given in Table 1, bear this out:

Table 1 Error types, all subjects subjects = 32 (24K, 8J) × 12 tokens of each cluster

	py	pr	by	br	fy	fr
1 Total Errors/n	3/384	2/383	5/384	16/384	15/384	21/382
%	5	3	8	26	24	34
2 Errors → CV						
EM (CCV → CVCV)	0	1	1	12	0	0
DM (CCV → COV)	3	1	4	3	7	6
Total	3	2	5	15	7	6
3 Errors in Manner						
RI	0	0	0	0	8 (p)	13 (p) 1 (b)
RM	0	0	0	1 (y)	0	1 (y)
Total	0	0	0	1	8	15

Table 1 *Continued*

	Cy	Cr	pC	bC	fC
4 Total Errors/n	23/1152	39/1149	5/767	21/768	36/766
%	19	31	4	17	29
5 Errors → CV	15/23	23/39	5/5	20/21	13/36
%	65	59	100	95	36
6 Errors in Manner	8/23	16/39	0	1/21	23/36
%	35	41	0	5	64

Row 1 shows total errors for each onset type and row 4 shows total errors for groupings of clusters according to second and first consonant. While the total number of errors was small, the errors line up fairly nicely with the degree of markedness defined by the MSD parameter: there are 23 errors for *Cy* vs. 39 for *Cr* (p-value = 0.0386). The difference is even greater on the voiceless stop vs. voiced stop vs. fricative axis, with only five errors for *p*-sonorant clusters, but a jump to 21 errors for *b*-sonorant clusters and to 36 for *f*-sonorant clusters; the difference in error rates is highly significant (p-value = 0.000). However, this difference cannot be attributed to markedness until we have looked more closely at the native and target language restrictions on onset clusters and the types of errors attested.

All six clusters are of course entirely grammatical in English. The constraints of the two native language grammars in question, however, are more complex. First, we consider the phoneme inventories of the native languages. Both Korean and Japanese have *y* and *r*, though *r* in each language is phonetically different from English *r*, and in complementary distribution with a lateral. We therefore counted as correct pronunciations of *r* ranging from flap *r* to *l*, since these all presumably occupy fairly close positions on the sonority hierarchy. Adjusting for lateralization of *r*, learners made no errors in pronunciation of single *y* and *r*. For obstruents, Japanese has a voiceless-voiced distinction between labial stops (*p* and *b*), but in native vocabulary *p* is not pronounced in word-initial position, where it is replaced by *h*, or by a bilabial fricative before *u*. Thus there is no phonemic distinction between *p* and *f* in Japanese native vocabulary, though initial *p* may appear in loanwords (Lovins 1975). Korean also lacks a *p/f* distinction, having labial stops but no labial fricatives. But while Korean lacks a voiced-voiceless distinction, it does have a series of three stops: aspirated, unaspirated, and tensed. We assume (following Park 1989) that Korean learners (and English transcribers) identify the aspirated/unaspirated distinction with the English voiceless/voiced distinction. This is not an atypical situation, since the phonological distinction of voicing is realized in different languages by different patterns of voicing onset time (VOT).

Thus both Korean and Japanese have what is at least translatable into a phonemic distinction between *p* and *b*, though Japanese speakers have a fricative as the initial allophone of *p*. Neither L1 has *f* as a phoneme. Subjects' performance on single-consonant onsets, however, was nearly perfect. Japanese speakers made no errors on single *p*, *b*, or *f*. Of the 24 Korean subjects, 23 made no errors on single *p*, *b*, or *f*. One subject made one error, substituting *br* for initial *b* in one instance, and one subject made four errors, substituting the affricate *pf* for *f*, *f* for *p*, and *v* or *vy* for *b*. Thus we conclude that any difficulty with the clusters cannot be ascribed to an inability to produce any single consonant.

We now turn to constraints on the onset in both Japanese and Korean. Both languages are far more restrictive than English: the only onset clusters allowed in either language are obstruent-*y* clusters.[4] Thus, English is more marked in this respect: the clusters allowed in the native language are a subset of those permitted in the target language. Both transfer and markedness considerations predict, then, that the *Cy* clusters should be easier than the *Cr* clusters. While this is broadly true, based on a comparison of total errors for *Cy* and *Cr* clusters, a different picture emerges if we break these clusters down according to initial consonant.

Let us consider first just four cluster types: *py*, *pr*, *by*, and *br*. The relative markedness of these cluster types, given the assumptions outlined above, should be as follows:

6) least marked . . . most marked
py . . . . . by . . . . . pr . . . . . br

Table 1 gives the breakdown of errors by type. Rows 2 and 5 show syllable simplification errors. These fall into two categories: (a) medial epenthesis (marked EM), which transforms a sequence like *pruf* 'proof' into *peruf*, breaking the onset cluster into two separate syllables; and (b) medial deletion (marked DM), which deletes the second member of the cluster (transforming 'proof', for example, into *puf*). Rows 3 and 6 show errors in manner, which involve replacing one of the onset consonants by a consonant with a different manner

[4] One reviewer suggested that perhaps *y* is analysed as a vowel in these clusters in the learners' native languages. Given the nonsyllabicity of *y* in the native language pronunciation of *Cy*, we assume that the suggestion is that in the learners' grammars these are not clusters but rather single, multiply articulated consonants (complex segments) derived from coalescence of a consonant-vowel sequence, along the lines of Sagey's (1986) analysis of the Bantu language Kinyarwanda or Broselow and Niyondagara's (1990) analysis of the closely related language Kirundi. The choice between the cluster analysis and the complex segment analysis can be resolved only by evidence presented in favor of the cluster analysis for other languages. However, given either analysis, the subjects' correct pronunciations of the obstruent-*y* clusters is consistent with the occurrence of these clusters (or complex segments) in the native language grammars.

of articulation and hence different sonority value; RI indicates replacement of the initial consonant and RM replacement of the medial consonant. While several other error types are conceivable – for example, epenthesis before the initial consonant – these were in fact the only types attested in this experiment. In considering these error patterns, we should note that the total number of errors is small relative to the total number of tokens, consistent with the fairly high level of these subjects; in fact, 13 of the 32 subjects made no errors at all. Our concern, however, is with the relative difficulty of these clusters rather than their absolute difficulty.

Considering first *py* and *pr* clusters, we see that their error rates are both trivial and only trivially different – three errors (or 4.8% of total errors) for *py*, two errors (3.2%) for *pr* (p-value = 0.6542). Furthermore, *by* clusters fall into the same region, with only five errors (8% of the total errors). Thus, although *pr* clusters are prohibited in both Japanese and Korean, our subjects performed roughly as well with *pr* clusters as with *py* or *by* clusters. Given the very low percentage of errors for *py*, *by*, and *pr*, then, we feel safe in concluding that learners can be considered to have mastered these three cluster types. These effects, of course, contradict the hypothesis that the learners have simply transferred their native language parameter setting to English, which would predict significantly better performance on *Cy* clusters (or, for Japanese speakers, on *by* clusters) than on *Cr* clusters. Instead, *pr* clusters actually showed fewer errors than *by* clusters.[5]

However, note that not all *Cr* clusters exhibit the same good performance: *br* clusters have an error rate of 16, or 25.8% of the total errors. The greater difficulty with *br* cannot be attributed to difficulty with either *b* or *r*, since the error rate on single-consonant onsets was so low, and since *pr* and *by* clusters exhibit a low rate of errors. The relatively poor performance on *br* clusters must therefore be an effect of combining these two consonants – a combination which is of course more highly marked than the other three in terms of the MSD. Thus, although neither the L1 nor the L2 distinguishes *br* clusters and *pr* clusters in terms of grammaticality – neither is permitted in the L1 grammars, both are permitted in the L2 grammar – learners tend to make significantly more errors with *br* clusters than with *pr* clusters (p-value = 0.002), while the difference in error rate of *py* clusters, of the type permitted in the L1, and *pr* clusters, which are not permitted, is not significant (p-value = 0.6542). These results contradict a straight

[5] It is possible that some of the seven errors involving deletion of *y* in *Cy* clusters were an effect of English spelling conventions, in which *y* is normally not represented orthographically in *Cyu* sequences.

transfer hypothesis: that all structures not attested in the L1 should be equally difficult for learners. Note that these errors are all in the direction of making the syllable structure less marked; learners either create unmarked single C onsets (by splitting the onset consonants into two syllables or by deleting the second consonant), or, in one case, they widen the sonority difference between the two consonants by transforming the *r* into a *y*. We conclude, then, that learners are at an intermediate stage between the L1 and L2 grammars. While they have not reached the English setting, which allows both *pr* and *br* clusters, they have moved beyond the NL setting, which allows no *Cr* clusters at all. Their error rates are presented schematically in Figure 1, where the increase in errors rates in *br* onsets is apparent. These results are consistent with the assumption that *p* is less sonorous than *b*.

The results discussed above are particularly interesting in view of the fact that initial *b*, but not initial *p*, is permitted in native vocabulary for the Japanese speakers, which should make *br* easier than *pr*. Yet, as shown in Tables 2 and 3, the Japanese subjects still made more errors on *br* clusters than on *pr* clusters (though the difference was not significant: p-value = 0.213). These results suggest that markedness in terms of the MSD is enough to offset the effects of the native language allophonic constraints.

Still left to consider are the even more highly marked clusters involving *fy* and *fr*. These clusters also exhibit a high rate of errors,

Table 2 Error types, Koreans (24)

	py	pr	by	br	fy	fr
1 Total Errors/n	1/288	1/287	5/288	11/288	13/288	18/286
%	2	2	10	22	27	37
2 Errors → CV						
EM (CCV → CVCV)	0	0	1	8	0	0
DM (CCV → COV)	1	1	4	3	5	6
Total	1	1	5	11	5	6
3 Errors in manner						
RI	0	0	0	0	8 (p)	11 (p) 1 (b)
RM	0	0	0	0	0	0
Total	0	0	0	0	8	12

	Cy	Cr	pC	bC	fC
4 Total errors	19	30	2	16	31
5 Errors → CV	11	18	2	16	11
6 Errors in manner	8	12	0	0	20

Table 3 Error types, Japanese (8)

	py	pr	by	br	fy	fr
1 Total Errors/n	2/96	1/96	0/96	5/96	2/96	3/96
%	15	8	0	38	15	23
2 Errors → CV						
EM (CCV → CVCV)	0	1	0	4	0	0
DM (CCV → COV)	2	0	0	0	2	0
Total	2	1	0	4	2	0
3 Errors in Manner						
RI	0	0	0	0	0	2 (p)
RM	0	0	0	1 (y)	0	1 (y)
Total	0	0	0	1	0	3

	Cy	Cr	pC	bC	fC
4 Total Errors	4	9	3	5	5
5 Errors → CV	4	5	3	4	2
6 Errors in Manner	0	4	0	1	3

15 (or 24% of the total errors) for *fy* and 21 (or 33.8% of total errors) for *fr*. Interestingly enough, while most of the errors on the *p* and *b* clusters involve simplification of the syllable structure, the majority of errors in *fC* clusters involve replacement of the *f* by a *p*. In fact, if we consider only syllable simplification errors (row 2), performance on *f* clusters is actually better than performance on *br* clusters. As we have seen, Korean does not have an *f* phoneme, and it is characteristic of Korean learners to replace *f* by *p*, so this result is not surprising; it is a simple case of phoneme substitution. The effect of this substitution, however, is to transform the *fC* clusters into less marked cluster types – hence their lower error rate.

These results, then, are suggestive with respect to the question of how parameters are set (or reset) in second language acquisition. If we assume that the L2 learner simply carries over the setting of the L1, we would expect a learner whose L1 has a less complex syllable structure than the L2 to simplify all and only those syllables that are more complex than those allowed in the L1. These learners, however, simplified only the more marked of the new onset types, rather than simply transferring the onset constraints of the native language. If, on the other hand, the learner retreats to the unmarked setting regardless of L1 parameter setting, we would expect that even syllable types allowed in the L1 would be simplified. White (1985a, 1985b, and elsewhere) has argued explicitly against the latter position in terms of the acquisition of second language syntax, but one study of the acquisition of second language phonology (Tarone 1980) has pre-

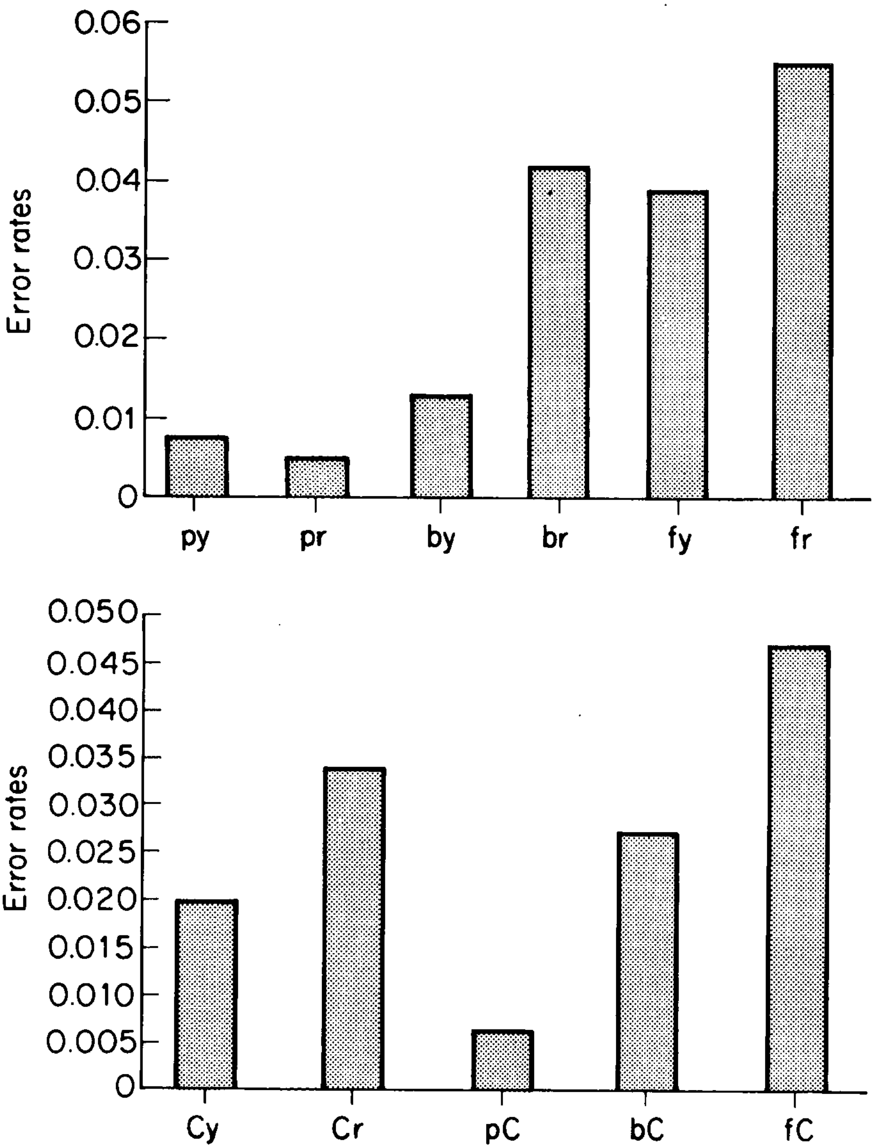


Figure 1 Error rates: Japanese and Korean

sented several cases of this sort. Tarone found, for example, that a Korean learner of English simplified *ho:l* to [ho:], although syllable rimes of the form [o:l] are permitted in Korean. Learners in the present study did not seem to retreat to the unmarked setting, however. This becomes even clearer when we consider a third group of subjects, 11 speakers of Hindi, whose native language contains both *Cy* and *Cr* clusters, putting these subjects, for the purposes of this experiment, at the same NL and TL parameter settings. The Hindi speakers' error rates are shown in Table 4:

Table 4 Error types, Hindi (11)

	py	pr	by	br	fy	fr
1 Total errors/n	1/132	1/132	2/132	0/132	1/132	0/132
2 Errors → CV						
EM (CCV → CVCV)	1	0	1	0	1	0
DM (CCV → COV)	0	1	1	0	0	0
Total	1	1	2	0	1	0
3 Errors in manner						
RI	0	0	0	0	0	0
RM	0	0	0	0	0	0
Total	0	0	0	0	0	0

	Cy	Cr	pC	bC	fC
4 Total errors	4	1	2	2	1

Of these 11 subjects, nine made no errors at all. One subject made a single error (*py-> piy*), and one made four errors, three involving epenthesis between *C* and *y* and one involving deletion of *y*. The insertion of a vowel between a consonant and *y* may simply represent overly careful pronunciation of the sort also employed by native speakers reading unfamiliar words.

Thus, the results of the phonology experiment support the hypothesis that learners seem to converge on a parameter setting somewhere between the native and target language settings. The Japanese and Korean learners appear to have moved to a position midway in markedness between the L1 and the L2 grammars. This can be explained by the assumption that learners of a second language start out with the parameter settings of the native language and then move in stages through the intermediate settings in the direction of the target language settings. The claim that learners begin with the L1 setting is not particularly surprising when the L1 setting is less marked than that of the L2, as in the case of Japanese and Korean onset restrictions. However, we will see very similar results in the acquisition of reflexive binding in syntax, where it appears that the more marked L2 setting serves as the starting point for learners acquiring the less marked English system.

III Syntax

We begin with a discussion of the relevant syntactic parameter, the GCP, which determines the possible structural relationships obtaining in a language between a reflexive pronoun and its antecedent.

Principle A of the Binding Theory as laid out in Chomsky 1981 requires that an anaphor (a reflexive in the present case) must have an antecedent within a certain range of syntactic structure, defined as the governing category. It has been fairly well-documented, however, that the domain of reflexive binding (and hence the definition of governing category) varies across languages. Manzini and Wexler (1987, see also Wexler and Manzini 1987) postulate five values for the governing category parameter (GCP) which reflect this variation, shown in (7).

7) Governing Category Parameter (M&W 87)
γ is a governing category for α iff γ is the minimal category which contains α, a governor for α and has
a a subject; or
b an Infl; or
c a Tns; or
d an 'indicative' Tns; or
e a 'root' Tns

The sentences in (8) provide illustrations. A version of English is used as a metalanguage here, displaying the range of variation claimed by Wexler and Manzini. *Self* is a reflexive anaphor in these examples, bound by the coindexed NP. This NP is at the outside limits of the governing category of the reflexive:

8) a Starsky considers Hutch_i fond of Self_i.
b Curly_i stole Moe's pictures of Self_i.
c Ralph_i expected Norton to invite Self_i to dinner.
d Ward_i requires that Wally be polite to Self_i.
e Alexis_i doesn't care that Krystle dislikes Self_i.

It is important to recognize that any NP which intervenes hierarchically between the reflexive and the indicated antecedent is also a potential antecedent in the above examples since the governing category includes these other NPs as well as the antecedent indicated in the example. *Moe, Norton, Wally*, or *Krystle* could therefore equally well serve as values for *Self* in (8b-e). Only on the (a) parameter setting is the illustrative sentence not ambiguous, since *Starsky* is not included in the same domain as *Hutch*. Languages that contain anaphors found along this hierarchy are English for type (a), Italian for type (b),[6]

[6] Here we follow Manzini and Wexler in the classification of Italian as having a type (6b) parameter setting. A reviewer reminds us that this classification is not universally accepted among Italian linguists, and suggests that German or Dutch would be better choices in this context.

Russian for type (c), Icelandic for type (d), and Korean and Japanese for type (e).

As Wexler and Manzini point out, this particular binding parameterization induces subsets: any NP that is a possible antecedent according to parameter setting (a) is possible with (b) is possible with (c) and so on out to setting (e). Wexler and Manzini argue that in first language acquisition, the initial, unmarked setting of the GCP is the most restrictive (the English setting, as it turns out). The parameter is reset only upon exposure to positive evidence that supports a more marked setting.

We investigated the acquisition of reflexive binding when the respective governing categories of the anaphors of the native language and the target language occupied different positions on the markedness hierarchy. If transfer is the dominant factor in second language acquisition, one might expect language learners to simply transfer their native language setting to the target language. Thus, speakers of Korean and Japanese, whose L1 employs the most marked setting, would therefore make mistakes such as taking any of the NPs in (8) as possible antecedents of the reflexive. Alternatively, however, one might assume that the acquisition of the binding principles of a second language proceeds as acquisition of the binding principles of the first language is claimed to: learners start with the unmarked value (that is, the English value, in which the reflexive and its antecedent must be clausemates[7]), and stay at that unmarked value until positive evidence forces them to change the parameter setting. Here, one would expect few mistakes from Korean and Japanese speakers learning English, since these learners would presumably ignore the parameter setting of their native language, and start afresh, as it were, with the least marked parameter setting. Our results suggest that instead, as in the phonology experiment, subjects had arrived at a parameter setting midway between that of the native language and the target language.

1 Methodology

To investigate these hypotheses, we administered a picture identification test to 97 subjects: 30 native speakers of Korean, 37 native speakers of Japanese, and 30 native speakers of Hindi. (The subjects in the phonology experiment formed a subset of those in the syntax experiment.)

Subjects simultaneously heard and read 24 sentences involving reflexives, 13 of the form of (9a) displaying either object control or

[7] Strictly speaking, the two elements must be in the domain of a subject, which, for the examples under discussion here, has the same effect as does the clausemate requirement.

exceptional case-marking, nine sentences with tensed complements, as in (9b), and two sentences with subject control verbs, as in (9c).[8]

9) a. Mr Fat { expects / tells } Mr Thin to paint himself.

b. Mr Fat { believes / thinks } that Mr Thin will paint himself.

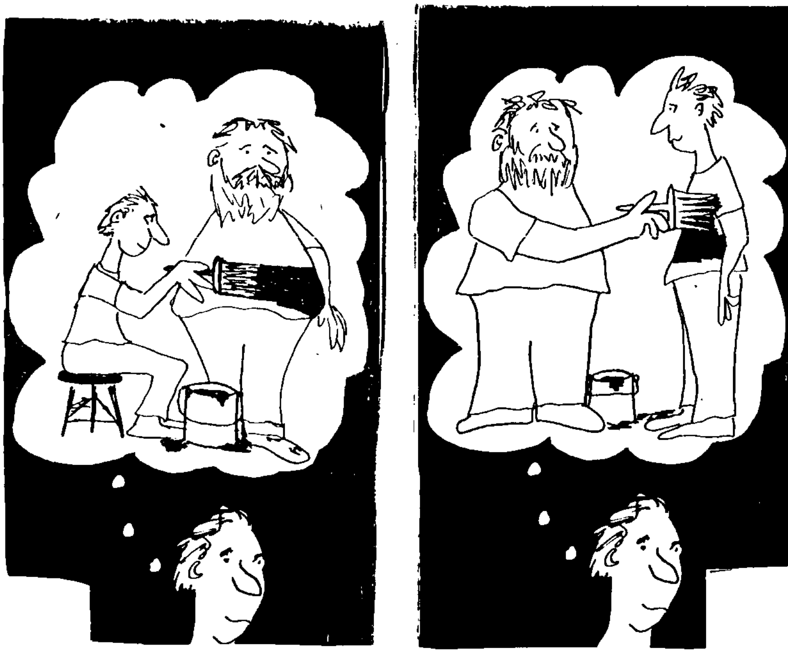
c. Mr Fat { threatens / promises } Mr Thin to paint himself.

The subjects were given four pictures to choose from for these sentence types. (See sample pictures.) A similar instrument was constructed in the native languages of the subjects, and it was administered one week after administration of the English version. The anaphors used in the native language instrument were *ẑibun, čaki,* and *apne* (for Japanese, Korean, and Hindi, respectively). The sentences were translations of the English examples. In both cases, the test sentences were presented aurally and orthographically simultaneously with the corresponding pictures, and the subjects were instructed to mark the picture(s) which corresponded to the meaning of the sentence. In the English sentences (9a-b) above, only *Mr Thin* can be the antecedent of *himself*. The Japanese and Korean counterparts of these sentences, however, are ambiguous; either *Mr Fat* or *Mr Thin* would be a potential antecedent of the Korean reflexive *čaki* or the Japanese reflexive *ẑibun*.

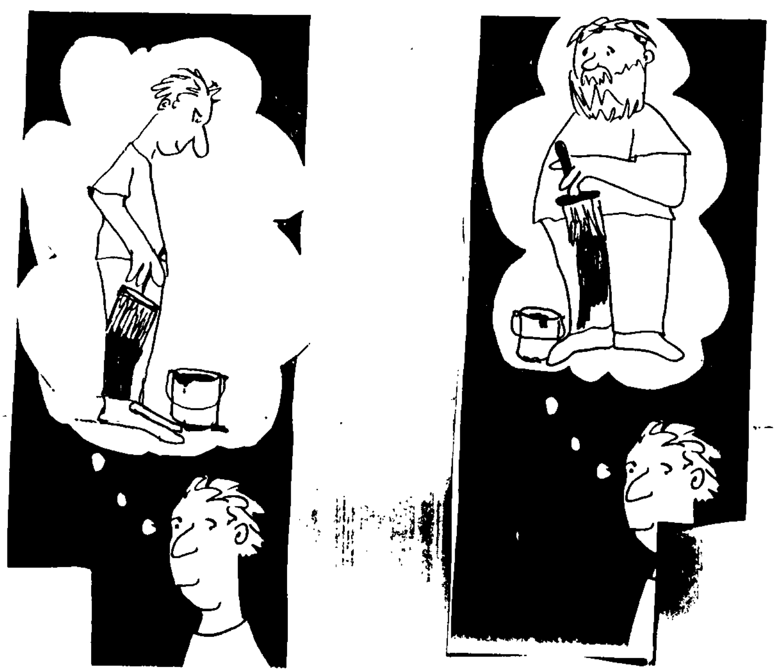
2 Results

We found that the Japanese and Korean subjects, with far greater than chance frequency, took *Mr Fat* as the antecedent in sentences like (8a) comparatively more frequently than *Mr Thin*, and they took *Mr Thin* as the antecedent in sentences like (9b). It was as though they followed English binding principles in sentences like (9b), but Korean or Japanese principles in sentences like (9a). Or, in terms of the governing category parameter, the subjects were treating the English reflexive as if it occupied position (c) or (d) on the hierarchy

[8] Another part of this experiment involved a second binding parameter, that which specifies which NPs within the governing category (subjects vs. nonsubjects) are possible antecedents of reflexives. Sentence forms probing this parameter exhibited double object constructions of the form *Mr Fat gave Mr Thin a picture of himself*. Finer (in press) discusses the results of this experiment and the implications for the GCP results discussed above.



MR. THIN EXPECTS MR. FAT TO PAINT HIMSELF.



in (6).[9] This is reflected in Table 5 below, and comparative error rates are shown in Figure 2. The hypothesis that the rows and columns vary independently can be rejected with a p-value of 0.0000 for both tensed and infinitival complements.[10]

Table 5

			Tensed					Inf		
	L	NL	L&NL	NL*	L*	L	NL	L&NL	NL*	L*
KK	47	164	45	2	4	50	258	33	6	5
KE	251	4	1	1	3	305	23	3	6	12
	97%	2%			1%	88%	7%	1%	2%	3%
JJ	63	169	90	3	2	71	206	105	19	7
JE	291	28	6	2	5	296	84	7	15	19
	88%	8%	2%		2%	70%	20%	2%	4%	5%
HH	260	1	0	0	0	239	23	2	5	54
HE	269	1	0	0	0	315	8	0	4	2
	100%					96%	2%		1%	

(n% wrt XE)

This outcome is interesting for a number of reasons. First, since Japanese and Korean appear not to have a grammatical distinction between tensed clauses and infinitives, the distinction that the subjects made in their interpretations of the sentences from the second language cannot have come from their native language. Second, since English has no distinction between the binding patterns of reflexives in infinitives and tensed clauses in examples like those in (9a–b), the distinction that emerged cannot be attributed to the target language either. And third, the distinction that emerges between these particular clause types is one that is attested in the anaphora patterns induced by the hierarchy in (7), rather than the logically possible but so far unattested pattern in which reflexives can be bound non-locally in tensed clauses but must be bound locally in infinitives. (To our

[9] A reviewer points out that Japanese also has another anaphor, *žibun-žišin*, which takes the same parameter value as English *himself*. The Korean anaphor *čaki-čašin* has this property as well. While it is certainly possible, as the reviewer suggests, that the subjects are assigning *himself* to their nonlocal equivalent in the infinitival examples and to the local equivalent in the tensed examples, this is unlikely. Since there is no principled reason for choosing one such assignment over the other, we would expect the nonlocal-local choices to be equally distributed across the tensed/infinitival distinction, and we would not expect the skewed interpretations that we do in fact get.

[10] The starred columns list interpretations with subject control properties (e.g., *promise* vs. *persuade*), and rows introduced by geminates show the native-language results, while rows KE, JE, HE show the respective interpretations of English sentences by Korean, Japanese, and Hindi subjects (the percentage figures reflect these rows). In addition, the columns headed by 'L' show the numbers of responses which reflected a local binder for the reflexive, and the columns headed by 'NL' show the number of non-local bindings. Not all sentences were responded to by all subjects and so totals may differ from expectations.

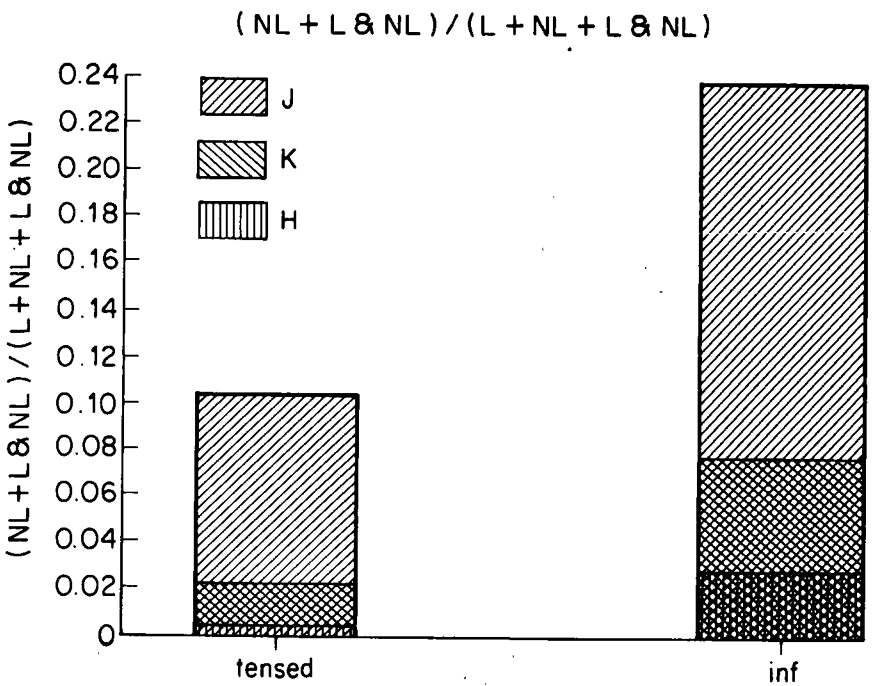


Figure 2 (NL + L&NL)/(L + NL + L&NL)

knowledge, no natural language includes an anaphor with this sort of binding pattern.)

However, the Hindi speakers, whose native language shows the binding patterns exemplified by the interlanguage of the subjects of the preceding paragraph, setting (7c) (Dunlap 1985), did *not* make a distinction between the clause types. Their English reflexives were bound locally in both types of examples, to an overwhelming degree. This may perhaps be attributed to the sociolinguistic context in India, where English is the language of higher education, and has in fact taken root as an indigenous variety. In other words, these subjects simply may have been native speakers of a form of English. Another interpretation of the data, of course, is along the lines of the L1-L2 compromise model discussed above, and following this approach, note that these subjects, as well as the Japanese and Korean subjects, would be showing movement along the hierarchy to a more restrictive setting. A compromise between settings (c) and (a), namely (b), is impossible to distinguish from simple adoption of (a) in this case since the types of sentences which would provide the crucial structures, fully saturated NPs or small clauses (such as in (8a) or (8b), respectively), were not present in the test instrument. In any case, the important feature of the interlanguages that we wish to emphasize at this point is their overall compatibility with UG-based principles of binding: if there is movement along the hierarchy, it is movement toward the target language to a pattern that is consistent with a possible parametric option.

IV Conclusions

Our conclusion, then, is that principles of Universal Grammar, including the markedness relationships of various parameter settings, do constrain the range of hypotheses that second language learners entertain about the target language. Therefore, it appears at this point that the 'learning module' in L2 acquisition accesses the same grammatical principles and markedness relationships that are available to the child learning a first language. However, rather than beginning with the least marked setting for a given parameter, as children are assumed to do, these results at least suggest that adult learners of a second language appear to transfer their NL parameter settings, in both phonology and syntax, regardless of whether the L1 setting is more or less marked than the L2 setting. One consequence of this is that while more marked features are harder to learn, less marked features are not necessarily correspondingly easier; both markedness and transfer must be considered in second language acquisition.

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V Appendix

Experiment one

Part I. Instructions
This is an experiment in vocabulary learning. You will hear each definition twice. After you hear the definition spoken twice, repeat the whole sentence twice into the tape recorder.

> Example: 'Goof' [gu:f] means to make a mistake.
> Now you repeat the sentence to fix it in your memory.

Now listen and repeat exactly what you hear:
'Frug' [fru:g] is a dance.
'Frumy' [fru:mi] is a woman's name.
'Future' [fju:tʃər] is the opposite of past.
'Butte' [bju:t] is a city in the western U.S.
'Use' [ju:z] is to employ something.
'Boot' [bu:t] is a shoe for the snow.
'Brewing' [bru:iŋ] is a way to make coffee.
'Fume' [fju:m] is a smell from gas.
'Prune' [pru:n] is a dried plum.
'Foolish' [fu:liʃ] means acting silly.
'Pure' [pju:r] means clear.
'Bruce' [bru:s] is a man's name.
'Broom' [bru:m] is something used to clean.
'Proof' [pru:f] means convincing evidence.
'Pool' [pu:l] is a body of water.
'Byume' [bju:m] is a type of flower.
'Poodle' [pu:dəl] is a kind of dog.

Part II. Instructions
Now you will hear a question asking you for the correct word. After you hear the question, choose the best answer from the three words that follow it, and say that word into the tape recorder. Be sure to answer every question.

> Example: Which word means 'to make a mistake'?
> goof
> goop
> goom
> Now you answer:

Now answer the following question:
1 Which word means 'acting silly'?
2 Which word means 'a body of water'?
3 Which is a city in the western U.S.
4 What is used to clean?
5 Which word means 'convincing evidence'?
6 Which word means a 'smell from gas'?
7 Which word means 'to employ something'?
8 Which word means a kind of dog?

9 Which word means a 'shoe for the snow'?
10 Which word means 'clear'?
11 Which word means 'a way to make coffee'?
12 What is the opposite of past?
13 What is a man's name?
14 Which word means a type of flower?
15 What is a 'dried plum'?
16 Which word means a dance?
17 Which word means a woman's name?

Part III. Instructions
This is an experiment in vocabulary learning. You will hear each definition twice. After you hear the definition spoken twice, repeat the whole sentence twice into the tape recorder.

Example: 'Goof' [gu:f] means to make a mistake.
Now you repeat the sentence to fix it in your memory.
Now listen and repeat exactly what you hear:

'Prudent' [pru:dənt] means cautious.
'Fruit' [fru:t] is something you eat.
'Room' [ru:m] means space.
'Unit' [ju:nit] is any fixed amount.
'Frugal' [fru:gəl] means not wasteful.
'Pewter' [pju:tər] is a kind of metal.
'Futile' [fju:təl] means worthless.
'Ruler' [ru:lər] is used to measure things.
'Food' [fu:d] is something you eat.
'Puce' [pju:s] is a color.
'Booming' [bu:miŋ] means growing rapidly.
'Beauty' [bju:ti] means prettiness.
'Fuse' [fju:z] means to join together.
'Pupil' [pju:pəl] is a student.
'Proving' [pru;viŋ] is showing something is true.
'Buick' [bju:ik] is a kind of car.
'Bruising' [bru:ziŋ] means damaging the skin.

Part IV. Instructions
Now you will hear a question asking you for the correct word. After you hear the question, choose the best answer from the three words that follow it, and say that word into the tape recorder. Be sure to answer every question.

Example: Which word means 'to make a mistake'?
goof
goop
goom

Now answer the following questions:

18 Which word means 'worthless'?
19 Which word means 'something you eat'?

20 Which word means a color?
21 What is a 'kind of metal'?
22 Which word means 'space'?
23 Which word means 'a fixed amount'?
24 What is a kind of car?
25 What is used to measure things?
26 What is a 'student'?
27 Which word means 'not wasteful'?
28 What means 'damaging the skin'?
29 Which word means 'growing rapidly'?
30 Which word means to 'join together'?
31 Which word means 'cautious'?
32 Which word means 'prettiness'?
33 Which word means 'showing something is true'?
34 Which word means 'something you eat'?

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