

# Psycholinguistic Probes of Native Speakers' Phonological Knowledge\*

Manjari Ohala and John J. Ohala

## INTRODUCTION<sup>1</sup>

It has been one of the tasks of phonologists since the time of Panini or Plato to demonstrate relationships between words based on their sound. In the past 200 years this has meant establishing the *historical* connection between words, i.e., to show that due to sound change, the same morpheme could show divergent forms in different phonological, morphological, or dialectal environments. More recently, especially since generative phonology, a new goal has been adopted, namely, to show how native speakers represent the phonological relationship between words in their language, e.g., *music/musician*, *right/righteous*. Most of the problems that have occupied phonologists within the past few decades have arisen in the course of this task, e.g. the character of the underlying forms common to morphological variants and of the rules that convert them to surface forms. But what does it take for native speakers to even *conceive* that two (or more) words are related, such that they are motivated to try to deduce an underlying form and the phonological rules which will make the relationship a regular one? It is this question we address here.

First of all, for words to appear related they should presumably show some phonetic similarity, otherwise there would be little reason for speakers to try to work out *phonological* rules which relate the words. Second, they should be related semantically. Without this there would be as much reason to relate *lathe/lather* as there is *Kate/Katherine*, which is counterintuitive. Derwing and Baker (1977) conducted an interesting experiment which showed that similarity in meaning is a more important determinant than phonetic similarity of speakers' judgements that pairs of words are derivationally related. What else might influence these judgements? A very important factor should be the *number* of word pairs which show the same or similar phonological and semantic relationships. Thus, a pair which exemplifies a very common phonological pattern, e.g. that in *extreme/extremity*, should be a more likely candidate for being considered derivationally related than would *pope/papal*. Alongside the former, there are a host of examples showing the same vowel alternation, e.g. *serene/serenity*, *obscene/obscenity*, *compete/competitive*, *obsolete/obsolescence*, etc. The latter, however, has only (to our knowledge) one similar pair, *nose/nasal*. Thus the rules that would have to

<sup>1</sup> Space limitations do not permit a review of relevant literature.

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be worked out for *extreme/extremity* would constitute a "linguistically significant generalization"; the rules to relate *pope/papal* would not. It would be more costly for speakers to work out an underlying form common to *pope/papal* and the phonological rules which apply to it than to represent them simply as unanalyzed phonological wholes.

This, then, was the basis for our experiment.<sup>2</sup> We conducted the same type of experiment done by Derwing and Baker which found the correlations between subjects' judgements of derivational relationship of word pairs and their ratings of those words' semantic and phonetic similarity. However, we did it with two types of test words: one, exhibiting a well-attested pattern, like *extreme / extremity* and another which exhibited what are essentially isolated phonological patterns like *pope/papal*. If it is true that speakers are more inclined to conceive that words of the first type have a derivational relationship, then for sets of words having equal judgements of semantic and phonetic similarity, the first type should get higher judgements for derivational relationship than the second type. Of course, it is highly unlikely that any two pairs of words will get precisely the same judgements for semantic and phonetic similarity, so the hypothesis was revised as follows: it should be found that the regression lines that predict subjects' derivational ratings as a function of the semantic or phonetic ratings would be higher for words like *extreme/ extremity* than for words like *pope/papal*. The null hypothesis would be that the type of word made no difference and the regression lines would not be significantly different for the two types of words.

#### EXPERIMENTAL DESIGN

The subjects — who volunteered their services — were 20 young adult native speakers of English who had not studied linguistics and had had no more than 2 years study of another Indo-European language.

The word pairs used are given in Table 1 on the facing page. (In addition there were 10 "filler" words which were not of interest to this experiment.) To obtain meaningful regression lines it is necessary to get values for word pairs that span the full range of semantic and phonetic similarity. Thus type 1 words span the range of semantic distance from *abstain/abstention* to *marine/marinate* and phonetic distance from *substance/substantiate* to *vine/vinegar*. The words of type 2 also spanned a wide range, including pairs that were not, in fact, historically related, e.g. *linger/lingerie*

<sup>2</sup> This experiment was conducted as a class project by the students in the 2nd author's "Methods in Phonological Analysis" course. Credit goes to Mariscela Amador, John Cherry, Hazel Corcoran, Barbara DeMarco, Debbie Feder, Randy LaPolla, Kiki Nikiforadou, Jing Wang, and Barbara Weldon, who collected the data and contributed in many ways to the design of the experiment.

TABLE 1. Word pairs used in the experiment.

<i>Common Patterns</i>	<i>Isolates</i>
particle / particular	thumb / thimble
substance / substantial	strong / stringent
extreme / extremity	pope / papal
resume / resumption	applaud / plausible
abstain / abstention	peace / pacify
regal / regicide	nose / nuzzle
comprehend / comprehensive	slay / slaughter
erode / erosion	price / precious
permit / permission	mouse / muscle
proper / propriety	toad / tadpole
secret / secretary	confer / confession
Peter / petrify	live / liver
magnet / magnesia	linger / lingerie
vine / vinegar	page / pageant
fable / fabulous	promise / promiscuity
glass / glacier	tame / timid
vocal / vociferous	leap / leopard
marine / marinate	male / malicious
slipper / slippery	risk / rescue
sect / section	haste / hassle

and *risk/rescue*. This might seem questionable, but recall that we do not expect the subjects to have the same technical knowledge of the history and origin of English words that linguists do. We were interested in their intuitive judgements of relatedness. As it happens many of the word pairs that are not historically related received a higher rating for derivational connection than many of those which are in fact historically related. For example, *tame/timid*, *confer/confession* and *promise/promiscuity* got higher derivational ratings than *strong/stringent*, *applaud/plausible*, *toad/tadpole* and *mouse/muscle*.

Another feature of these pairs is that one member consists of a part that resembles the other plus some sort of ending. This was done to avoid the possible objection that speakers would not attempt to create phonological rules deriving one of these pairs from the other or both from a third unless there were some difference in the environment in which the putative common underlying form was found in the two cases, i.e., to account for the difference in surface forms. Thus word pairs of the sort *ten/tithe* were avoided.

These words were randomized and presented to the subjects to rate first for derivational, then the same 40 for semantic, and, finally, phonetic closeness on a 5-point scale. They were told that these judgements were being obtained in order to help in the selection of vocabulary items for a state aptitude test for high school children; that from this pre-test we would discover the relations between words as perceived by a cross-section of educated adults. That is, that there were no right or wrong answers; that we were

interested in their intuitions. For the derivational judgements they were asked to indicate how likely it was that the pair of words came from a common ancestor. Semantic judgements were obtained by asking how alike in meaning the words were; phonetic judgements, how alike in sound. Examples of clear extreme cases of each were given which were not from the test items, e.g. to illustrate the semantic judgements, "*parasol/umbrella*" and "*tooth/fang*" were given as sample pairs that should receive scores nearer to 5 on the scale, whereas "*lamp/lamb*" scores nearer to 1.

### RESULTS

The responses of two subjects who did not use the full 5-point scale in the phonetic section were normalized in order to be comparable to the other subjects' responses. We also eliminated the responses of any subject whose answers on any of the three sections did not show a .5 or better correlation with the average responses from all 20 subjects. This reduced the subject population to 16.

**TABLE 2.** Incidence of correlated responses, derivational vs. semantic, all 40 test words

Derivational Rating	5	15	26	37	60	96
	4	26	20	34	39	27
	3	30	32	23	11	8
	2	44	22	12	3	4
	1	50	8	7	5	1
		1	2	3	4	5
		Semantic Rating				

**TABLE 3.** Incidence of correlated responses, derivational vs. semantic, 20 words of type *extreme / extremity*

Derivational Rating	5	11	20	25	43	75
	4	15	12	17	20	8
	3	14	9	9	0	4
	2	16	8	3	0	0
	1	10	1	0	0	0
		1	2	3	4	5
		Semantic Rating				

**TABLE 4.** Incidence of correlated responses, derivational vs. semantic, 20 words of type *pope / papal*

Derivational Rating	5	4	6	12	17	21
	4	11	8	17	19	19
	3	16	23	14	11	4
	2	28	14	9	3	4
	1	40	7	7	6	1
		1	2	3	4	5
		Semantic Rating				

Tables 2, 3, and 4 give the frequency of occurrence of correlated responses to the derivational vs. semantic sections. For example, in Table 1, the entry 15 in the upper lefthand corner indicates that there were 15 instances in which subjects gave a rating of '5' to an item (not necessarily the same word, though) to which they had given a semantic rating of '1'. The relationship between these two parameters is obviously not linear. After trying various types of curves — concentrating on mathematically tractable ones — we found a logarithmic function to yield the highest correlation.

For all 40 words the correlation coefficients between the different parameters are given in Table 5.

TABLE 5. Correlation coefficients (Pearson's) for various parameters

Parameters Correlated	Correlation Coefficient	Amount of Variance Accounted for (%)
Semantic vs. Phonological	.07 (n.s.)	0.55%
Derivational vs. Phonological	.21 ( $p < .01$ )	4.4%
Derivational vs. Semantic	.57 ( $p < .01$ )	32.5%

Since the phonetic judgements contributed so little to the determination of the derivational judgements we simplified the remaining analysis by dealing only with the derivational vs. semantic relationship.

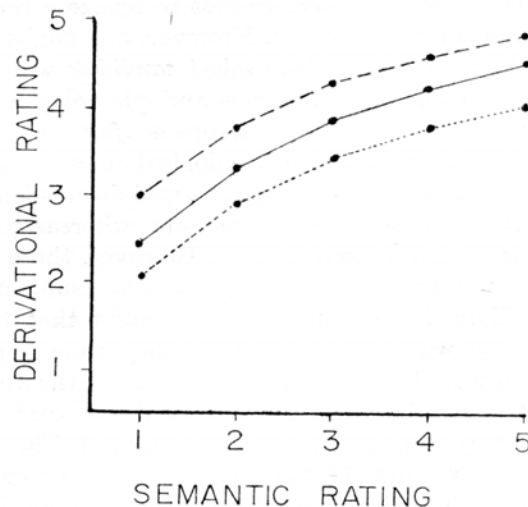


FIGURE 1. Regression lines found by least squares method showing the subjects' judgements of derivational relationship as a function of their judgements of semantic similarity of the word pairs in the experiment. Solid line: all 40 words; dashed line: 20 words of the type *extreme / extremity*; dotted line: 20 words of the type *pope / papal*.

The regression line, a logarithmic function determined by the least squares method, which best predicts the derivational score for all 40 word-pairs as a function of the semantic score, is given as the solid line in Figure 1. The regression lines for the 20 word-pairs of type 1 and the 20 of type 2 are given as the dashed and dotted lines, respectively, in Figure 1. It is true that the regression line for the pairs of the type *extreme/extremity* lies above that for pairs of the type *pope/papal*, but neither one is significantly different from the single regression line computed for all 40 pairs as a whole. That is, the regression lines computed for the two subsets of 20 do not account for significantly more variance than the regression line for all 40 pairs. We therefore accept the null hypothesis, i.e. that whether the word pair exhibits a phono-logically well-attested pattern or not plays no role in subjects' judgements that the words might be derivationally related.

## DISCUSSION

If one accepts that the behavior of subjects in this experiment tells us something about native speakers' conception of the relations between words, then the results suggest that they are about as likely to conceive of a derivational relationship between words exhibiting an isolated phonological connection as they are of those exhibiting a well-exemplified one. It would appear that native speakers, unlike linguists, cannot recognize a linguistically significant generalization when they see one. However, one might argue that these results only tell us how native speakers select *candidate* word pairs for which they will try to work out underlying forms and phonological rules; that this experiment tells us nothing about what happens *after* they actually attempt to deduce the underlying forms and phonological rules for these candidates. Perhaps they will find that forms like *pope/papal* do not lend themselves to the formation of common underlying forms, etc. whereas pairs like *extreme/extremity* do. This is a legitimate objection. However, there is another interpretation to give to this experiment. Given that the subjects were all adult native speakers of English one might have thought that they would have *already* pondered these word pairs — before they were approached by the experimenters — and would have attempted to deduce the appropriate underlying forms and so on, and, in doing so, have found that *extreme/extremity* yielded to such an analysis whereas *pope/papal* did not. The results, however, seem to show that this was not the case; subjects gave no evidence that they recognized one word pair as being more easily related by derivational rules than another, except, trivially, as a function of the degree of semantic and surface phonetic similarity they exhibit. We are left with one of two conclusions that are damaging to the assumptions underlying most modern phonological

work: either speakers fail to work out the systematic phonological relationships that exist between pairs like *extreme* / *extremity* or they do work out such rules but they also do the same for such "oddball" pairs as *pope/papal*.

#### REFERENCES

- DERWING, B. L., and BAKER, W. J. 1977. The psychological basis for morphological rules. Language learning and thought, ed. by J. Macnamara, 85-110. New York: Academic Press.