Subjective judgments of spelling-sound correspondences: Effects of word regularity and word frequency

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Subjects asked to judge which of two pronunciations of a letter sequence is typical of how that sequence is pronounced in English showed a strong tendency to nominate the linguistically "regular" word in preference to the "irregular" or "exceptional" word. Experiment 1 showed that this tendency was uninfluenced by the frequencies of the words being compared. The effect of regularity was replicated in Experiment 2, which also demonstrated the importance of the method of cuing the common letter sequence; when it was printed beside the words being judged, a stronger regularity effect was obtained than when the words were presented alone. Both experiments also showed a variation in the subjective strength of spelling-sound correspondences, and it was concluded that all-or-nothing conceptualizations of "rules" and "regularity" are oversimplifications. The implications of the findings for the concept of analogies in pronunciation were also considered.

Although there is hardly a letter or combination of letters in the English language that cannot be pronounced in two or more ways, the view has been put forward (Venezky, 1970a, 1970b; Wijk, 1966) that the majority of English words do follow certain rules of pronunciation. Wijk suggested that the impression of excessive irregularity is largely due to a high proportion of irregular patterns among the commonest words in the language and estimated that between 90% and 95% of the total vocabulary shows regular spelling-sound patterns.

This view fits in well with evidence suggesting the importance of phonological coding in learning to read aloud (Firth, 1972) and learning to read for meaning (Doctor & Coltheart, 1980). Although experimental studies with fluent adult readers are broadly counter to the possibility that in normal circumstances access to the internal lexicon occurs by a phonological route in preference to a faster visual coding (Coltheart, Besner, Jonasson, & Davelaar, 1979; Coltheart, Davelaar, Jonasson, & Besner, 1977), developmental research does suggest that visual coding is increasingly relied upon between 6 and 10 years of age in normal readers (Doctor & Coltheart, 1980). However, the capacity for phonological coding is evidently retained by skilled readers; thus it has been shown (Coltheart et al., 1977, 1979; Rubenstein, Lewis, & Rubenstein, 1971) that in a lexical classification task the nonword decision is slower for pseudohomophones than for nonpseudohomophones. Such findings suggest that phonological coding continues

to offer a speedy route into the lexicon despite lagging behind the faster visual coding system. The existence of a phonologically coded spelling-to-sound route independent of lexical access is also implied by the ability of normal readers to pronounce orthographically legal nonwords (e.g., "gak"), and it is demonstrated too by evidence that regular words can be read aloud more quickly than exception words (Baron & Strawson, 1976; Midgley-West, 1979; Stanovich & Bauer, 1978). The advantage of regular words over exception words can be satisfactorily explained by postulating the operation of a nonlexical spelling-to-sound pathway in addition to and in parallel with the lexical pathway. The phonologically coded nonlexical pathway would be available to regular words, which follow rules of pronunciation, but not to exception words, which do not.

Individual differences in phonological coding among skilled readers have been closely examined by Baron and colleagues (Baron & Strawson, 1976; Baron, Treiman, Wilf, & Kellman, 1980). Although initially hampered by methodological problems, Baron et al. (1980) devised a selection test involving the use of spelling-sound rules to produce and recognize phonetically correct respellings of words (e.g., "hamb" and "hamm" but not "haim" for "ham"). Performance on phonemic perception tasks, entailing the ability to perceive relations between words based on common phonemes, was superior for subjects who did very well (90% correct or higher) on the selection test than for subjects who did badly (less than 65% correct). The strength of this evidence has, however, to be judged in light of the fact that significant differences in phonemic perception were obtained only by selecting subjects at the extremes of this selection test distribution.

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The evidence in general seems to show that the interrelated concepts of word regularity and rules of pronunciation have a bearing not only on the processes involved in learning to read, but also on the performance of skilled readers in certain circumstances. It is upon the relationship between these concepts and performance by skilled readers that the present study focuses. Important questions remain concerning rules of pronunciation and how they may be used in reading. Readers may well not have introspective access to the fundamental processes of reading and the underlying knowledge base on which these processes draw (Coltheart, 1977). Indeed, it seems likely that little of what is referred to as rules of pronunciation is explicit knowledge for the general reader. These rules are themselves not immutable or beyond controversy; their psychological embodiment is hypothetical, and they may be explicitly known only to the experts who write and read about them. What is available to the general reader, and how it is used, is part of the thrust of this study.

More particularly, it is argued that some refinement of the concept of word regularity is needed if the relationship between pronunciation rules and the underlying processes thought to be involved in reading is to be clarified. Both Venezky (1970a, 1970b) and Wijk (1966) took as their criterion of regularity the total frequency of occurrence of spelling-sound correspondences in the English language. That is to say, the status of regular or divergent pronunciation was assigned to any particular spelling-sound correspondence on the sole basis of frequency weightings that give equal weight to every word in the language (i.e., an analysis in terms of types rather than tokens). It is not clear on present evidence, however, whether this criterion is psychologically adequate as an indicator of the tacit knowledge available to and perhaps made use of by the reader. In the present experiments, we invited the subjects to make judgments about the typicality of the pronunciations of a series of letter sets as encountered in English words. This is not to assert that typicality and regularity are equivalent, although it is possible that the former may serve as an everyday analogue of the latter. "Typicality" is used here as a device for externalizing the knowledge that readers possess that may reflect the linguistic distinction between regular and irregular pronunciations.

It is apparent that no ordinary reader would have access to the entire collection of English words that would contribute to this system, and in practice, the system would have to be assumed to be implemented with a degree of reliability that reflects the size of the sample available to the individual reader. More seriously, it may be objected that Wijk's (1966) criterion ignores the possible contribution of word frequency. Certainly, frequency is deemed a sufficient description of linguistic regularity in some accounts; thus Hockett (1958, p. 280) states that "an alternation is regular if it is what occurs most frequently under stated conditions." But, as

Venezky (1970b) notes, it is necessary to be clear about what constitutes legitimate stated conditions. With respect to the definition of "regularity," current practice is surprisingly vague. Sometimes it seems to be specified on the basis of a simple type count (e.g., Wijk, 1966), and on other occasions the concept is subjected to critical attack without receiving any definitional analysis (e.g., Glushko, 1979). We therefore take "regular" to indicate what may be termed as "dominant spelling-to-sound correspondences," and this seems broad enough to embrace the spectrum of contemporary usage. It leaves open the question, which is addressed by our study, of whether "dominant," and hence whether "regularity," should be specified in terms of stated conditions of word frequency, and Experiment 1 was therefore designed to investigate whether readers' judgments about the pronunciation of a word are independent of its frequency. If regularity is driven by word frequency, then skilled readers will be more likely to choose an exemplar exception word, in preference to an exemplar regular word, as typical of the pronunciation of a letter set when the frequency of the exception word is higher than that of the regular word than when it is lower.

EXPERIMENT 1

Method

Design. A rules of pronunciation test was devised using 12 rules of pronunciation from Wijk (1966). For each of 12 letter sets, each subject was asked to judge which member of a word pair (a regular word and an exception word) best illustrated a typical use of that set of letters in the pronunciation of English. All subjects were tested under three conditions of word frequency: regular word frequency higher than exception word frequency, regular word frequency the same as exception word frequency, and regular word frequency lower than exception word frequency.

The experimental design may be viewed from the standpoint of frequency condition as a repeated-measures factor. Each pronunciation rule contributed in one frequency condition, and which rule served under which condition was balanced through the use of six alternate forms of the test. A complete design, with each rule represented under each condition for each subject, would have exceeded the available vocabulary resources.

Subjects. There were 48 undergraduate or postgraduate psychology students who served as unpaid subjects (24 males and 24 females); they were aged between 21 and 35 years (mean = 29 years) and were native English speakers, using British pronunciation, selected on the basis of availability.

Materials. Rules of pronunciation. The rule-governed letter sets selected from Wijk (1966) were AI, AUGH, EAR, OE, OU, OUR, UI, OO, OA, IE, SS, ONE.

Stimulus pool. For each of the 12 letter sets, four exemplar words were selected, one each from the four categories high-frequency regular, low-frequency regular, high-frequency exception, and low-frequency exception. The high-frequency words had a word frequency in the general count of Thorndike and Lorge (1944) of AA or A; the low-frequency words were in the frequency range of 1 to 48 per million (20 of the 24 low-frequency words having a frequency count below 20). The full collection of words used is given in the appendix. The regular-exception distinction in this experiment was for British

speakers (following Wijk, 1966); hence, "shone" was counted as an exception word, although it would be regular in American English.

Stimulus sampling. Three lists of 12 word pairs (each pair consisting of a regular and an exception exemplar of 1 of the 12 letter sets) were drawn up corresponding to the three frequency conditions. (The list for the equal-frequency conditions was entirely constructed from high-frequency words.) Each of the three lists was divided into three blocks of four word pairs, making nine word blocks in all.

Rules of pronunciation test. Six forms of the test were compiled. Each form was constructed from three different word blocks, one from each frequency condition. Over the six test forms, each of the nine word blocks occurred equally often and each frequency condition occurred equally often in first, second, and third place. The resulting six test forms each consisted of 12 word pairs, typewritten to one side of the corresponding letter set, with restricted randomization used to assign and balance the positions occupied by words from the four stimulus categories. The letter set was printed separately in uppercase to the left of the word pair, which was also typed in uppercase. The particular letter set ONE was intended to be considered with regard to its occurrence at the end of words and was therefore presented as -ONE. No restrictions were implied for the other letter sets. Four male and four female subjects completed each of the six forms of the test.

Procedure. Each subject was given a copy of one form of the rules of pronunciation test and written instructions asking him to indicate one word in each pair as best illustrating a typical use of the adjacent set of letters in the pronunciation of English.

Results

In a preliminary analysis, subject sex was found not to contribute significantly as a main or interaction effect ($F < 1$). The reported analyses therefore ignored sex as a factor.

The number of regular words judged typical of English pronunciation, pooled over letter sets, was found not to vary significantly between frequency conditions [$F(2,92) = .12$]. Table 1 summarizes this outcome in terms of the percentages of regular words considered to typify the pronunciation of the related letter sets. There was a considerably higher proportion of regular words judged as more typical than exception words for all frequency conditions, and this held pooling over frequency conditions for 47 of the 48 subjects. The proportion of exception words chosen showed little variation between subjects [$F(47,94) = .95$].

In Table 2 are presented data on the 12 pronunciation rules. It can be seen that there were marked differences between rules, with regular instances for all but one (-ONE, final silent "e") judged as more typical than the exception instance. Analysis of variance, pooling over subjects, indicated a significant difference between rules [$F(11,22) = 9.180, p < .001$].

Table 1
Mean Percentages of Regular Words Judged Typical
for Each Frequency Condition, Pooled Over
Letter Sets and Subjects for Experiment 1

RWF > EWF	RWF = EWF	RWF < EWF
79.7	81.8	80.2

Note—RWF = regular word frequency; EWF = exception word frequency.

Table 2
Proportion of Subjects (N = 48) Judging the Regular Word as
Typical for Each Rule of Pronunciation in Experiment 1
(Pooled Over Frequency Conditions)

Rule of Pronunciation	Proportion
IE	.98
OUR	.98
EAR	.96
OU	.92
SS	.90
OE	.85
AI	.83
OO	.81
OA	.79
AUGH	.65
UI	.65
-ONE*	.35

*Final silent e.

Discussion

Counter to expectation, high-frequency exception words were not selected more often than low-frequency exception words as typical of a spelling-sound correspondence. Indeed, the effect of word frequency in this experiment was negligible. Averaging over the 12 rules of pronunciation used, subjects chose an exception word about 20% of the time for all frequency conditions. This strong tendency to nominate the regular pronunciation is paralleled by the finding of Coltheart et al. (1979) that nonwords containing vowel digraphs tended to be given the regular pronunciation of the digraph. The averaged percentage of regular pronunciations was 82%, which compares with an overall average of 81% in the present study.

In contrast, the strength of different pronunciation rules varied considerably, and in one notable case (-ONE), subjects' judgments of the typical pronunciation tended to oppose that of the authority used to distinguish between regular and divergent pronunciations for this study (i.e., Wijk, 1966). In the study by Coltheart et al. (1979), a similar wide range of rule strengths was obtained (24%-97%), but this was largely due to one aberrant case ("A," with 24% regular pronunciations); the remaining eight cases were more homogeneous (72%-97%).

The results provide strong evidence that certain regular patterns of pronunciation are discernible independently of the word frequency of particular words exhibiting those patterns. To that extent, the psychological robustness of word regularity is supported. It is at the same time true, however, that the wide variation in rule strength weighs against the likelihood that the criteria for regularity adopted by Wijk (1966) provide an adequate representation of those processes engaged as a reader makes judgments that bear upon regularity. Wijk's criterion, namely, that those pronunciations are regular that have the highest frequency in the English language, would not seem to provide an explanation for the variation in rule strength. While some margin of error could be accommodated by a model using this

criterion to allow for readers' incomplete knowledge of all words in the language, it seems unlikely that it could cope with an error rate that varies so considerably between rules.

The variation in rule strength could be a matter not so much of the frequency of the individual word being judged as of the collection of words sharing its pronunciation, be it "regular" or "divergent." Thus a rule would be more effective if the regular pronunciation operated for many words and the exceptional pronunciation for few words. Some support for this hypothesis is forthcoming from the present study. Taking Wijk's (1966) compilation as a data base, those divergent pronunciations tested for OUR ([ə], as in "journey" and "scourge"), EAR ([ɛ], in about 12 words, e.g., "learn," "rehearsal"), and OU ([ʌ], in about 15 words, e.g., "young," "couplet") have relatively few exemplars. This corresponds to the finding that the rules operated strongly in these cases (see Table 2). The divergent pronunciation tested in the present experiment for OO ([ʊ], as in "good," "book," "look," "foot") has many more exemplars, and correspondingly, the rule operated relatively weakly.

Nevertheless, this account seems to break down in the case of the rule "final silent e," for which the exception word was chosen more than 60% of the time. In this study, it was represented to the subjects as the pronunciation of -ONE, and subjects may have registered this as the digit "one" prior to making a typicality judgment. It would not be surprising if the preference for the exception words (one of which was DONE) reflected this temporary set. It is also consistent with the outcome for the two other letter sets OUR and EAR, which are words themselves and with whose pronunciations the subjects' judgments tended to agree. In the pilot study, the same rule was represented by -OVE, and this also gave a high bias in favor of exception words (42%), so this is not a complete explanation of the weakness of this rule.

Wijk (1966) estimates that the percentage of irregularity for "final silent e" is only 10% (i.e., in only 10% of words with a final silent e, the preceding vowel does not have its regular free pronunciation; e.g., "have," "give," "love" in contrast to "make," "life," "grove," etc.). But, as Wijk also points out, on an average page of prose, the percentage of irregularity is as high as 30%. This reflects the higher average frequency of words carrying the irregular form and is itself a partial vindication of the view that word frequency may be implicated in pronunciation rules.

One remaining possibility for a role for word frequency is for it to be effective via the entire repertoire of exemplars associated with a particular pronunciation, whether regular or divergent. Evaluation of this and related variations on the frequency hypothesis must await the computerization of data bases such as that of the Kučera and Francis (1967) word count with the phonetic transcriptions of its constituent words. Never-

theless, a particular case in Table 2 provides useful advance notice in this connection. The rule for AUGH is also a weak one, with 34% of the exception words taken by the subjects as typical of English pronunciation, even though its single divergent pronunciation, [a:f], occurs only in a very few words ("laugh," "draught," and derivative words) in contrast to its regular, and relatively common, pronunciation ([ɔ], as in "caught," "taught," "daughter"). It seems unlikely that a rule-based system, even when weighted with word-frequency information across the entire repertoire of related words, could generate the observed degree of diffuseness in this rule. Conceivably, it illustrates a more general problem, that readers are likely to be phonemically sensitive in different degrees to different letter combinations and that they may be least sensitive to cumbersome quadgraphs rather than shorter letter combinations. Such a variation in readers' sensitivity to different letter sets may be usefully related to the notion of phonemic perception (Baron et al., 1980), that is, the ability to perceive relations between words based on common phonemes.

EXPERIMENT 2

Glushko (1979) has argued that a psychologically more cogent distinction than that between linguistically regular and exception words is one in which words are contrasted in terms of whether or not they are consistent with the orthographic and phonological information they activate. This distinction is made on the basis of whether or not other words with the same spelling pattern have the same pronunciation (e.g., "late" is consistent with "fate," "gate," "hate," etc., whereas "cave" is inconsistent with "have"). This cuts across the regular-exception distinction, since regular words may or may not be consistent but exception words are always inconsistent. Glushko's account concentrated on the evidence on reading aloud, and he showed that regular consistent words were named faster by 29 msec than regular inconsistent words, whereas exception words were, in turn, only 4 msec slower to name than regular inconsistent words.

The present evidence suggests that in a more reflective context than that of a speeded naming task, the distinction between regular and exception words is psychologically effective. However, it is possible, particularly in light of the marked variation in rule strength reported above, that the effect of regularity on pronunciation judgments would not generalize beyond the 12 instances used in Experiment 1. Since the pool of words used here contained virtually no overlap with that of Glushko (1979), Experiment 2 was designed to determine whether the regularity effect could be replicated using words from Glushko's study.

The opportunity was also taken to examine a methodological question that arose in connection with Experiment 1. This has to do with the way in which the criti-

cal letter sequence is cued to the subject. In Experiment 1, this was done by prefacing the comparison words by the letter combination, written in capitals; in Experiment 2, this method of cuing was compared with that of supplying no cue, as an attempt to encourage subjects to treat the letter combination as an integral part of the words being judged.

Method

Design. The same pronunciation judgment task was used as in Experiment 1, but the corpus of words was taken from Glushko (1979). Word frequency was not manipulated in this study, and each pair of words for comparison comprised one regular and one exception word. Half of the subjects served in a condition in which the letter set whose pronunciation was being judged was presented separately, and half of the subjects were uncued as to the letter set. Subjects were otherwise assigned at random to these two conditions.

Subjects. There were 40 undergraduate students and school-children who served as unpaid subjects. There were 7 males and 33 females, and they were aged between 14 and 62 years (mean age = 28.4 years) and were selected on the basis of availability. All had English as their first language and used British pronunciation.

Materials. Stimulus pool. The "inconsistent" words from Glushko's (1979) Experiment 3 (his Appendix A3) were used. Not all of them were satisfactory for British subjects because of pronunciation or spelling differences, and a proofreading error reduced the available pool even further. In the event, 33 pairs of words were used, including several duplications of certain rules (e.g., eight instances of "final silent e"). There were 9 five-letter and 24 four-letter exception words and 10 five-letter and 23 four-letter regular words. Word length was not matched within word pairs. Median word frequency for the exception words was 100 or more per million and that for the regular words was 37 per million (Thorndike & Lorge, 1944).

Task. The task in Experiment 2 was somewhat different from that in Experiment 1 because of the basis on which Glushko (1979) assembled his material. The pairing of regular and exception words was more restrictive than by rule only, being based instead on a matching of as much of the words as possible. In practice, the words used were matched for their word endings (e.g., "both/moth," "break/peak," etc.), and accordingly, these are what served as the letter sequences whose pronunciation had to be judged.

Stimulus sampling. Two orderings of the word pairs were generated and were typed on four separate pages. Booklets based on one or another randomization were prepared, with the four pages in orders balanced by the use of Latin squares. The word pairs were typed side by side in lowercase, with the letter set in the cued condition printed, in uppercase, to their left. The positions assigned to regular and exception members of each word pair were decided on a random basis.

Procedure. Each subject was given a booklet with written instructions that included an example ("fruit" vs. "build"). The instructions asked the subject to indicate by underlining which of the two words in each case was more typical of how their common letter sequence is pronounced in English words. The spontaneity of the subject's impression was emphasized as was the need not to look back at earlier responses. One group of 16 subjects was tested together, and the remainder were tested in groups of 4.

Results

A simple index of the strength of the regularity effect in Experiment 2 is the number of regular words that were chosen as having the more typical pronunciation by a majority of the subjects ($N \geq 11$) in each of

the cue conditions. For the uncued condition, there were 29 pairs in which the majority nominated the regular word, whereas all 33 regular words were selected in the cued condition. The somewhat weaker regularity effect in the uncued condition is demonstrated more clearly by a comparison of the proportions of subjects choosing the regular member of each pair. There were 24 of the 33 pairs in which this proportion was higher in the cued condition (significant by a sign test, $p < .05$). The average proportions were .848 and .733 for the cued and uncued conditions, respectively.

Only two subjects (both in the uncued condition) selected more exception words than regular words. In contrast, six subjects (three in each cue condition) correctly nominated 31 or more of the 33 regular words.

Table 3 shows the proportion of subjects selecting the regular word in each pair. A rough classification is imposed to aid examination of these data.

Table 3
Proportion of Subjects ($N = 40$) Nominating the Regular Word for Each of 33 Word Pairs in Experiment 2

Word Pair	Proportion
Free Vowels (Final Silent e)	
baste-caste	.93
wave-have	.83
here-were	.80
bone-done	.75
dome-come	.70
five-give	.65
home-some	.63
cove-move	.48
Simple Checked Vowels	
sand-wand	.95
loss-gross	.93
stint-pint	.83
flush-bush	.75
moth-both	.73
plush-push	.65
dull-pull	.55
gull-full	.55
Vowel Digraphs	
leaf-deaf	.95
weak-steak	.95
fool-wool	.95
paid-said	.93
seat-great	.93
toad-broad	.90
boot-soot	.88
pouch-touch	.88
braid-plaid	.83
shoot-foot	.83
goes-shoes	.80
peak-break	.80
plays-says	.75
brood-flood	.75
Vowels Before r, ll	
wall-shall	.85
pork-work	.83
sear-pear	.75

Note—The regular word is on the left.

Discussion

Experiment 2 supplies strong confirmation that what is described as the linguistically regular spelling is also viewed by our subjects as having the more typical pronunciation. It also makes it clear that the cuing method of the previous study, far from mitigating the effect of regularity, instead served to focus attention on the regular pronunciation.

Although word frequency was not specifically manipulated in Experiment 2, the results are consistent with the earlier finding that word frequency has little moderating influence on the effect of regularity. Indeed, for most of the word pairs, frequency tended to oppose the effect of regularity. Despite this, an average of 85% of the choices in the cued condition, which is procedurally more directly comparable to Experiment 1 than the uncued condition, were of the regular examples, and this is even higher than that achieved previously (81%).

The strength of the regularity effect may be further gauged by the fact that at least 75% of the subjects chose the regular word for 23 of the 33 word pairs. Nevertheless, the data contain clear signs in confirmation of the impression from Experiment 1 that there is considerable variation in the strength of pronunciation rules. It is of interest that "final silent e" produced such a crop of highly variable outcomes that one could reasonably hesitate about characterizing this as a general rule. A similar equivocal position seems to be occupied by the simple checked vowel "u" (word ending: -ull, -ush). It is of particular interest that the four cases involving u should produce homogeneously weak regularity effects, since this tends to bear out the supposition that judgments in this task are relatively independent of the consonant endings.

GENERAL DISCUSSION

Word Frequency and Word Regularity

The immediate objective of this research was to determine whether the concept of word regularity might need to be amended to take account of word frequency. Plainly, frequency exerted a negligible influence on how the pronunciation judgment task of Experiments 1 and 2 was performed. However the subjects went about making their judgments, it seems that the knowledge base they drew on enabled word-frequency information to be ignored.

Variation in Rule Strength

Individual differences within conditions were understandably not very marked, with performance tending toward a ceiling in both experiments (shown as a strong bias to nominate regular words). The uncued condition in Experiment 2 produced greater variability than the cued condition, and this is straightforwardly attributable to the greater uncertainty in the former condition as to the nature of the task. This also bears out the conclusion that cuing is a helpful device in this task.

The strength and generality of the regularity effect are clear from both experiments. On the other hand, there is evidence from both experiments that some of the spelling-to-sound correspondences, on which the regular-exception distinction is based, are weak, inasmuch as subjects were unsure about which pronunciation to nominate as typical. According to the present evidence, it is an oversimplification (and one presumably not intended by linguists) to suppose that the psychological realization of the regular-exception distinction is a simple two-valued affair. However, in practice, word regularity tends to be treated as an all-or-nothing property, and opposition to (and, for that matter, support for) a conception of spelling-to-sound pronunciation rules embodying this binary characteristic may be misleading. Indeed, a more tenable position supported by the present findings, and those of Coltheart et al. (1979), is that rules vary in strength.

Analogies in Pronunciation

Explanations of how nonwords are pronounced include the notion that they are dealt with by the application of the grapheme-phoneme conversion (GPC) rules (e.g., Coltheart, 1978). Other accounts have argued that people pronounce nonsense strings, and, more important, new words, by seeking analogies between these strings and words they already know how to handle. Thus only whole-word pronunciations need to be known, along with "general strategies for forming analogies" (Baron, 1977). Readers are otherwise thought not to have very sophisticated knowledge about pronunciation rules (Calfee, Venezky, & Chapman, 1969, cited by Baron, 1977). The account of Glushko (1979) extends the notion of analogies to explain how words in general are pronounced, but it postulates the parallel use of orthographic and phonological knowledge, including information about component letter strings. Indeed, the pronunciation of words and nonwords entails only a quantitative difference, in terms of the mediating units that may be used in activating analogies for pronunciation (which tend to be larger for words than nonwords).

The tasks used by Baron (1977) explicitly instructed the subjects to make use of analogies, and their use may also have been invited by the present task, although we have no systematic introspective confirmation that this is how subjects tackled the task. Glushko (1979) distinguished between the explicit use of analogies as a conscious strategy and their implicit and automatic activation in speeded naming experiments. What force this distinction may have in relation to the present task is not clear, since judgments could be based on the relative ease of active search for analogies or the relative speed with which they are (passively) activated. A full explanation of our findings requires a consideration of this kind of issue, in which the focus of interest is the mechanism mediating pronunciation judgments of

the sort asked for in these experiments. However, it is more immediately significant that our subjects were able reliably to draw on a knowledge base embodying a statistical representation of the pronunciations of words, to make explicit what might otherwise be construed as tacit knowledge. It is, of course, a moot point whether this knowledge has a functional role in more substantive psychological contexts.

Glushko's (1979) formulation of the analogy concept also includes the nice distinction between words that are orthographically and phonologically consistent and those that are inconsistent with others evoked by their presentation. Although it seems to sidestep the neuropsychological findings (e.g., Saffran & Marin, 1977), which supply one of the main platforms for "rule-based" theorists, Glushko's account of the evidence on naming and reading aloud offers persuasive support for his analogies hypothesis.

The present study bears on the analogies hypothesis in two ways. First, our findings show that in at least a related circumstance a distinction is readily and reliably made between words on a dimension that has no psychological force according to Glushko's (1979) view of pronunciation. Importantly, the distinction is made between regular and exception words with no less ease with respect to the corpus of words used by Glushko and with regard to which he found only a trivial latency difference. We have yet to determine whether subjects remain sensitive to this distinction when a less direct method of probing their knowledge of pronunciation regularities is used, and more intriguingly still, whether people can discriminate between consistent and inconsistent words on the basis of a pronunciation judgment task.

The second point stems from the suggestion that rules vary in strength according to the numbers of associated exemplars and exceptions. An account has thus emerged that closely resembles the analogies hypothesis and, indeed, tends to blur the distinction between rules and analogies. This will come as no surprise, given Baron's (1977) observation that compilers of lists of spelling-sound correspondences are likely to have relied heavily on the use of analogies. It may be suggested on the basis of the present findings that to Glushko's (1979) distinction between consistency and inconsistency should be added the qualification that this distinction should be thought of as one of graduated influence due to varying numbers of helpful and unhelpful analogies, rather than an all-or-none contribution due to their existence or nonexistence. That a fuller account may need to emphasize the degree of consistency among "regular" words is supported by the marked variation in "rule" strength noted here.

A final point also bears on the distinction between rules and analogies. Regular pronunciations were nominated by our subjects as typical of how the critical letter sequences are pronounced in English. This quite marked preference relates to a comparison between regular

inconsistent and exception words whose pronunciation latencies were found by Glushko (1979) to differ by a bare 4 msec. This mismatch between the outcomes of his and our studies may reflect the subjects' use of a conscious strategy in the judgment task, and at first glance, it seems to indicate a reliance on rules. However, it is possible that exception words have fewer helpful analogies and that this is what influenced our subjects' judgments. It is symptomatic that nine of Glushko's exception words (his Appendix A3) have no analogies according to Walker's rhyming dictionary (Dawson, 1973), whereas all 41 of the matched regular inconsistent words have at least one (regular consistent words, of course, by definition have only helpful analogies). It seems important now to unconfound these several factors in order to assess their relative importance in naming and pronunciation judgment tasks. Whether a common knowledge base is tapped in these tasks is unclear, and the use of a wider variety of paradigms will perhaps help to settle this question and to elucidate the nature of the mechanisms underlying pronunciation.

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Appendix
Words Used in Experiment 1, Classified According to "Regularity" and Frequency Criteria

Letter Sequence	Regular Words		Exception Words	
	High Frequency	Low Frequency	High Frequency	Low Frequency
IE	believe	siege	friend	sieve
OUR	flour	scour	journey	scourge
EAR	clear	dreary	learn	rehearse
OU	cloud	oust	young	couplet
SS	lesson	ass	possess	dessert
OE	goes	toe	shoe	canoe
AI	maid	staid	said	aisle
OO	food	aloof	good	woollen
OA	coal	oath	broad	abroad
AUGH	caught	haughty	laugh	draught
UI	suit	nuisance	build	conduit
-ONE*	bone	cone	done	shone

*Final silent e.

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