EMPIRICAL INTERPRETATIONS OF PSYCHOLOGICAL REALITY

Royal Skousen, University of Texas, Austin, Texas, USA

In this paper I will discuss three requirements for a theory of language. These requirements are (1) inducibility, (2) generality, and (3) testability.

The first requirement, that of inducibility, is that linguistic descriptions must be directly derivable from the data that speakers are actually confronted with in learning the language. A linguistic description thus implies (1) a description of the relevant data and (2) a set of rules by which the linguistic description is derivable from the data. We refer to this set of rules as the rules of induction.

In order to understand this requirement of inducibility, let us consider some common violations of this requirement. For example, the order and frequency with which the data is presented to the speaker may be significant in determining the proper description of the data or in explaining how the language may change over time, so that if such information is ignored, the subsequent description may be untestable. Consider, for instance, Chomsky and Halle's statement in The Sound Pattern of English (p. 332) that "it is no doubt the case that the linguistic forms that justify our postulation of the Vowel Shift Rule in contemporary English are, in general, available to the child [?] only at a fairly late stage in his language acquisition, since in large measure these belong to a more learned stratum of vocabulary." Of course, there is no way that Chomsky and Halle's description itself can be empirically tested, since their description is based on data that, as they themselves admit, is unrepresentative of the data that children are confronted with in learning English. Children learn to speak long before they learn words as infrequent as profanity, comparative, gratitude, serenity, appellative, plenitude, divinity, derivative, conciliate, and so forth (SPE, p. 50).

Another common violation of inducibility occurs when a nonexistent ordering is imposed on the data. A common method of explicating linguistic data is to first offer that data which provides direct evidence for some rule and then treat the exceptions to the rule afterwards - by adding additional rules perhaps, but without changing the original rule. Consider, for instance, Chomsky and Halle's treatment of Kasem singular and plural forms in SPE (pp. 358-364). They first give us "regular" forms like bakada and bakadi

(singular and plural for 'boy') as evidence that the singular ending is a and the plural ending is i. Then they give us the surface exceptions to this "regularity" (e.g. kambia/kambi 'cooking pot', pia/pi 'yam', buga/bwi 'river', diga/di 'room', laŋa/læ 'song', naga/næ 'leg', pia/pæ 'sheep', and so on). Chomsky and Halle try to explain these forms without abandoning their original "regularity", but their explanation depends crucially upon the order of presentation of these "irregular" forms. For instance, they first argue that a plural form like kambi can be considered "regular" (that is, as /kambi+i/) if there is a phonological rule of truncation that will reduce ii to i. Having thus established that the "regular" endings are a and i and that there is a rule of vowel truncation, then a singular form like pia 'sheep' can be interpreted as /pia+a/: "Since the grammar already [!] contains the Vowel Truncation Rule, [pia] can also be derived from an underlying [piaa]." From an acquisitional point of view, Chomsky and Halle are assuming that the speaker takes care of the "regular" cases first and then the "irregular" case kambi before tackling the "irregular" case pia 'sheep (sg.)' (which, incidentally, is "regular" on the surface). Finally, Chomsky and Halle posit a rule of metathesis for Kasem, again assuming that all rules previously posited will be maintained. The rules which Chomsky and Halle present depend upon their artificial ordering of the data. But the data is not ordered in this way for the child learning Kasem, nor does the child know in advance which of these forms are "regular" and which ones are "irregular" or "exceptional". If such a characterization of these forms is correct, then the child must discover it from random data.

Another violation is to ignore some of the data, especially those forms which the linguist knows are "incorrect": slips of the tongue, false starts, analogical creation, stuttering, dialectal variants, and so on. Yet the child does not know in advance which of the forms in the data are errors. If a child hears another child using the form goed for the past tense of go, we do not delete this from the child's data. We keep it in the data, but try to explain why the child will eventually identify goed as an incorrect past tense form. Nor should we even delete examples of stuttering from the data, since speakers can learn to imitate stuttering. Speakers also learn how to show that they have made a false start. For instance, speakers of English may use uh (but not /i/) to indicate a false start. Nor do speakers ignore dialectal variants - they learn them, even though they may not use them.

Finally, linguistic descriptions cannot be based on non-existent data. Although speakers can learn that certain items do not occur in the data, this knowledge cannot be derived from knowing in advance that these items do not occur. The determination, for example, of syntactic descriptions cannot depend upon knowing which non-occurring sentences are ungrammatical and which ones are grammatical.

The second requirement is that of generality: The rules of induction are independent of any given set of linguistic data and independent of any given regularity found in linguistic behavior. In other words, the rules of induction are universal and not taxonomic or ad-hoc. Only in this way can the explanatory goal of linguistic theory be achieved.

An excellent example of a universal rule of induction is found in Jakobson's Child Language, Aphasia, and Phonological Universals in which Jakobson proposes that "the sequence of stages of phonemic systems" found in such diverse areas as aphasia and the acquisition of languages "obeys the principle of maximal contrast and proceeds from the simple and undifferentiated to the stratified and differentiated" (p. 68). Of course, there are problems with some of Jakobson's specific claims about language acquisition, aphasia, and the phonemic systems of the languages of the world. Nonetheless, the significant contribution that Jakobson makes is that he proposes a conceptually simple and universal principle in order to explain a diversity of linguistic behavior.

In accordance with Jakobson's general principle, let us consider a principle of maximizing acoustic differences and see how it might explain the instability of certain sounds in the languages of the world. Take, for example, the case of the phoneme ü. In comparison to the phonemes i and u, ü is unstable and relatively infrequent. Children trying to learn a language that has the phoneme ü generally replace it with i or u. Historically, languages with ü frequently lose it in favor of either i or u. In the languages of the world we find phonemic systems with i-u and i-ü-u, but i-ü is relatively rare, and ü-u, as far as I am aware, is non-existent. And when i-ü does occur, it is unstable and is usually replaced historically by the more stable phonemic systems i-u and i-ü-u. Finally, when an adult speaker of an ü-less language attempts to pronounce ü, it will be pronounced as i, u, or perhaps the diphthongal iu. Now Chomsky and Halle "account for" this linguistic behavior by means of a taxonomic marking convention which simply

recapitulates the linguistic behavior formalistically (SPE, p. 405):

$$[\,u\ \text{round}] \rightarrow [\alpha\ \text{round}] \Big/ \left[\begin{array}{c}\overline{\qquad}\\ \begin{array}{l}\alpha\text{back}\\ -\text{low}\end{array}\end{array}\right]$$

But a principle of maximizing acoustic differences could be used to explain this behavior. The motivation for this principle is that small acoustic differences are difficult to perceive and produce, thus shifts will occur in the direction of increasing acoustic differences. If we consider the first three formants of the vowels i, ü, and u, the maximal distinction occurs between i and u and thus the intermediate ü may be replaced by the phonetically similar i or u.

The important point in using a general principle such as this one is that it can account for the linguistic behavior of other sounds besides ü. For instance, the interdental fricatives θ and ð are also unstable and infrequent and tend to be replaced by phonetically similar sounds such as the dental fricatives s and z, the labiodental fricatives f and v, or the dental stops t and d. On the other hand, Chomsky and Halle's approach leads them to postulate a completely different marking convention in order to handle the instability of the interdental fricatives (SPE, p. 407):

$$[u\ \text{strid}] \rightarrow [\alpha\text{strid}] \Big/ \left[\begin{array}{c}\overline{\qquad}\\ \begin{array}{l}\alpha\text{del rel}\\ \left\{\begin{array}{l}[+\text{ant}]\\ [+\text{cor}]\end{array}\right\}\end{array}\end{array}\right]$$

Such taxonomic rules do not explain anything; they merely formalize observed regularties. The observation of regularities is, of course, critical to the construction of a theory, but observed regularities do not make theories. Instead, regularities demand explanation in terms of general principles.

The third requirement for a theory of language is that it must be testable: A theory must have an empirical interpretation. Let us assume that we have some linguistic data for a particular language and that we apply certain rules of induction to the data and derive a description of the data. The question of utmost importance is: How can we discover if the proposed rules of induction are correct? In other words, how can we determine if the linguistic description really represents what the speaker has learned? It is not enough to simply declare that the description is psychologically real. The linguistic data is available for observation, but we cannot observe

the rules of induction that speakers are using to learn the language nor can we observe the derived linguistic descriptions. But we can observe subsequent linguistic behavior. So in order to test the rules of induction and the derived linguistic description, we need a mapping between the linguistic description and linguistic behavior. This mapping is the empirical interpretation. A theory is tested by its ability to predict the nature of linguistic behavior. Thus a theory is composed of two parts: (1) the rules of induction and (2) the empirical interpretation of descriptions. A theory without an empirical interpretation is not really a theory because it is not testable. Most so-called "theories" of language are actually rules of induction - that is, systematical methods for describing linguistic data (or deriving linguistic descriptions). Theory construction must also include the interpretation of descriptions. The empirical interpretation will predict how speakers would use the linguistic description. By comparing the predicted behavior with actual behavior we can test our theory. If a theory has an empirical interpretation (that is, if the theory is falsifiable), then we may ask if there is any evidence in favor of this theory over alternative theories and if there is any evidence against this theory. If the theory fails in some respect to correctly predict actual linguistic behavior, then the fault may lie in the rules of induction or the empirical interpretation, presuming that the linguistic data is accurately represented.

A good example of an empirical interpretation of a linguistic construct is found within those phonological theories that treat the phoneme as a psychological unit. Consider, for instance, the following possible empirical interpretations of the phoneme:

(1) Naive spellings (especially the spellings of children learning how to read and write) are based on phonemic representations. On the basis of this empirical interpretation, Read (1975, 29-78) argues that invented spellings like CHRIE for try, JRAGIN for dragon, NUBRS for numbers, LITL for little, and LADR for letter give evidence that the children's phonemic representations for these words are /čraj/, /ǰrægən/, /nʌ̃brz/, /lɪtl/, and /lɛdr/, rather than the more common phonemic representations /traj/, /drægən/, /nʌmbərz/, /lɪtəl/, and /lɛtər/. (These latter forms have undoubtedly been influenced by the standard orthography.) Similarly, Sapir argued (1968, 54-58) that his informants' naive spellings were also representative of their phonemic representa-

tions.

(2) Slips of the tongue are based on phonemic representations. For instance, Fromkin (1971, 33) argues that since slips of the tongue never split apart the affricates [tš] and [dž] in English, these affricates should be interpreted as single phonemes, /č/ and /ǰ/, rather than as a sequence of phonemes, /tš/ and /dž/. In contrast, actual phonemic sequences like [spr], [pl], [kr], [bl], and [fr] are frequently split apart. This difference in linguistic behavior is explained if we assume that this empirical interpretation is correct. Similarly, Stampe (1973, 35) argues that there are no archiphonemes in English because of the occurrence of [hwɪpsr̩] rather than [hwɪbsr̩] as a slip of the tongue for the word whisper. The psychological (or phonemic) representation of whisper is, say, /hwɪspr/ rather than /hwɪsbr/ or /hwɪsBr/, where B stands for a labial stop unspecified for voicing (that is, an archiphoneme). The reason then that the slip of the tongue is [hwɪpsr̩] is that slips of the tongue switch the order of phonemes, and the metathesis in this example shows that the real phonemic representation contains a voiceless, bilabial stop.

(3) Linguistic games are based on phonemic representations. This empirical interpretation serves as the basis of Sherzer's (1970) analysis of the Cuna language. The games that speakers play are characterized as simple operations on strings of phonemes, although one speaker's phonemes may be more "abstract" than another's. The problem of the English affricates can also be studied by means of linguistic games. Those "speakers" of Pig Latin who move only the first consonant of an initial consonant cluster (e.g. spin is [pʰɪnsej]) always move the complete affricate (e.g. chin is [ɪn͡čej] and never [sɪn͡tej]), thus indicating once more that [tš] is to be interpreted as a single phoneme, /č/, rather than as /tš/.

Now let us suppose we have some rules of induction for the determination of phonemic representations and that these rules lead to the interpretation that the English affricates should be sequences of phonemes, as /tš/ and /dž/. Without any empirical interpretation of phonemic representations, there would be no way to test this description of English or the rules of induction which are used to derive this description. In order to test our theory, we must determine some empirical interpretation for our phonemic representations. If we accept these three interpretations (namely, that naive spellings, slips of the tongue, and linguistic games

are based on phonemic representations), then we can test this description of the English affricates and any set of inductive rules that would lead to such a description. We have already seen that the evidence from linguistic games and slips of the tongue imply that the affricates are unitary. In fact, children's spellings also support this conclusion, since there is no evidence for invented spellings of the form TSH for the affricate /č/ (e.g. chin is not spelled as TSHIN). In this case, all three empirical interpretations argue against the phonemic representations /tš/ and /dž/. These interpretations support each other, which is what we should expect if all three of these interpretations are correct. Now it may be that these empirical interpretations are, in fact, incorrect, but we should not reject them simply because we desire, above all else, to maintain our description of the English affricates (as /tš/ and /dž/) and the rules of induction that derive them. And even if these empirical interpretations are not correct, this does not relieve the phonologist of the responsibility to provide some empirical interpretation for his phonemic representations. In order for his theory to be testable, the linguist must determine what will count as evidence for his description and what will count against it. If the linguist can think of nothing that will disprove his theory, then he does not have a theory.

One important empirical interpretation that should hold for any theory is the principle of homogeneity: If the rules of induction do not distinguish between A and B in the linguistic description, then the behavior of A and B should be the same. Thus the rules of induction can be shown to be wrong if, in fact, A and B behave differently. The principle of homogeneity requires linguistic theory to predict linguistic behavior accurately. If a theory fails to predict an observed difference in linguistic behavior, then the theory must be revised.

A well-known case where this general principle of empirical interpretation has been used is in Kiparsky's paper "How Abstract is Phonology?". Kiparsky argued (pp. 24-25) that "contextual neutralizations are reversible, stable, and productive, whereas the alleged absolute neutralizations are irreversible, unstable, and unproductive." Now the standard generative phonology of that time did not distinguish between contextual and absolute neutralization; both were equally possible. Since linguistic behavior does distinguish between these two categories, the theory must be wrong.

Kiparsky therefore argued that the theory must include an alternation condition, which would either forbid absolute neutralization or at least make it highly improbable. In this way the linguistic theory could predict the non-homogeneous linguistic behavior.

This example suggests that the principle of homogeneity can be used to discover what sorts of information a linguistic description should have in order to predict differences in linguistic behavior. In fact, without the goal of predicting linguistic behavior, there would be no motivation for discovering the psychologically real linguistic descriptions.

References

Berko, Jean (1958): "The child's learning of English morphology", Word 14, 150-177.

Chomsky, Noam and Morris Halle (1968): The Sound Pattern of English, New York: Harper and Row.

Fromkin, Victoria (1971): "The non-anomalous nature of anomalous utterances", Language 47, 27-52.

Jakobson, Roman (1972): Child Language, Aphasia, and Phonological Universals, The Hague: Mouton.

Kiparsky, Paul (1973): "How abstract is phonology?", Three dimensions of linguistic theory, Osamu Fujimura (ed.), 5-56. Tokyo Institute for Advanced Studies of Language, Tokyo.

Read, Charles (1975): Children's *categorization of speech sounds in English, National Council of Teachers of English, Urbana.

Sapir, Edward (1968): "The psychological reality of phonemes", Selected Writings of Edward Sapir, David G. Mandelbaum (ed.), 46-60, Berkeley: University of California Press.

Sherzer, Joel (1970): "Talking backwards in Cuna: The sociological reality of phonological descriptions", Southwestern Journal of Anthropology 26, 343-353.

Stampe, David (1973): A dissertation on natural phonology, PhD dissertation, University of Chicago.