The kind of understanding we can hope to achieve from phonological research, then, is arguably possible only if we abandon the ultimately unreachable goal of complete predictability. Attempts to achieve predictability by imposing arbitrary limits on the form of phonological descriptions, such as by the decision a priori that 'extrinsic' or language particular orderings are one kind of complexity that languages absolutely cannot tolerate, seem unmotivated and misguided. In the absence of an understanding of general cognitive processes underlying language that could explain them, such 'constraints' cannot be taken seriously as the motivation for particular decisions about the appropriateness of descriptions. As Basbøll notes, such extralinguistic explanation seldom plays a real (rather than rhetorical) role in phonological theorizing.

To me, however, this suggests that much of the actual research Basbøll characterizes as 'substance based' is ultimately unproductive, since it is based on the arbitrary imposition of restrictive principles which rule out otherwise well-motivated descriptions. We have no way of knowing a priori what sorts of complexity, abstractness, etc. are tolerated by natural languages, and the only way of discovering this is through the unbiased examination of the facts they present. This is not to deny that such programs can lead to significant insights, as in the case of their emphasis on a distinction between morphological and purely phonological rules, which has evidently led to major improvements in our understanding of sound systems. Nonetheless, far from suggesting that the study of formal problems in phonology, of the sort arising in the framework of SPE, should be abandoned, the lesson of this research seems to be that it is only by taking these formal matters seriously that their ultimate role in a comprehensive view of sound structure can be appreciated.

References

Anderson, Stephen R. (1979): "On the subsequent development of the 'standard theory' in phonology", in Current approaches to phonological theory, D. Dinnsen (ed.), Bloomington, Indiana: Indiana University Press.

deChene, Brent, and Stephen Anderson (1979): "On compensatory lengthening", Lg. 55.

Dudas, Karen (1974): "A case of functional phonological opacity: Javanese elative formation", in Studies in the linguistic sciences 4:2, 91-111.

Gussmann, Edmund (1978): Explorations in abstract phonology, Lublin: Uniwersytet Marii Curie-Sklodowskiej.

FORMAL AND SUBSTANTIVE APPROACHES TO PHONOLOGY

Joan B. Hooper, State University of New York at Buffalo, USA

The main report on phonological theory by Hans Basbøll gives a rather thorough treatment of current phonological research. This response will mention a few additional works and issues, but it is intended primarily to supplement Basbøll's report by presenting in somewhat greater depth an examination of the theoretical diversity underlying current phonological research. Our point of departure is the distinction Basbøll discusses between a "substance based" versus a "formal" approach to phonological research. This distinction characterizes quite broadly two major research trends in generative phonology, but leaves out some important differences. In order to highlight several theoretical positions, the "substance" versus "formal" distinction will be divided into two separate distinctions which cross-classify fully. This brief report will discuss the resulting categories and the type of research emanating from each of them. Basbøll noted that his classification of two types of phonology was only rough and ignored some individual differences. Similarly, the distinctions I will make are also rough, and are meant only as a useful organization of a diversity of research perspectives.

1. Two major issues

1.1. The most direct interpretation of the substance-formal distinction divides phonological research into that which investigates formal or structural properties of grammars and that which investigates substantive properties. The former research is concerned with levels of representation, and how they relate to one another, and with the formal properties of rules, and the formal relations among them. Substantive properties can be thought of roughly as content properties -- phonological features are the content of representations, and changes in phonological features in the presence of other related phonological features are the content of rules. For most investigators, the substance of phonology is phonetic (but see section 3.2.).

This aspect of the substance/formal distinction is not so much a theoretical issue as a distinction between two types of interests, which are not mutually exclusive. Most researchers would agree that phonology has both a formal and substantive side, and that the two need to be studied together at least to some extent.

1.2. The second distinction that divides current work in phonology is a distinction in terms of theory, and thus has more serious consequences. Following common practice, this can be labelled the concreteness versus abstractness issue, although it is not abstractness per se that I will focus on here. There are many different degrees of abstractness. We can find a discrete division on this scale, however, if we consider one issue -- the use of data in analysis, in particular the importance of surface facts. In the transformational tradition, one working hypothesis seems to be that if x and y share some characteristics, then they must have the same underlying form. This produces an emphasis on the similarities between elements, and leads to a dismissal of their surface differences. Similarly, the goal of uncovering all the "linguistically significant generalizations" the data can yield makes it desirable to ignore counter-indications on the surface. The contrary position is that the rules of the grammar must be fully compatible with the surface data, and exceptions must be taken as giving evidence of rule productivity or the lack of it. Either of these approaches to the evidence can be combined with an interest in the formal or the substantive aspects of phonology.

2. The "abstract" positions

2.1. The tradition of the Sound Pattern of English (Chomsky and Halle 1968) combines the abstract approach to data with largely formal interests. Some new issues have arisen in this framework, such as recoverability, a relative of opacity (Leben 1977, Kaye 1978, as well as the references Basbøll cites), and some of the older issues, such as extrinsic rule order and rule types continue to be discussed (see Basbøll's report). It seems unlikely that these issues will ever be resolved, because of the approach to data customary in this framework. Since there is no requirement that a rule correspond in any predetermined way to the surface data, it is impossible to tell if the rules whose relationships are being studied are indeed rules of the grammar. It must be emphasized that the lack of importance of surface data is not an oversight, but rather is a deliberate component of this point of view, as is clear from the following statement by Keyser 1975. He has just argued for internal structural reasons that there is a rule of metathesis in Old English. He then says: "It is a rule whose output never appears unmodified on the surface. This fact may lead one to suppose that the rule is, therefore, not a possible rule of phonology. However, such a supposition seems to be based upon an excessive reliance on surface data" (pp. 410-411, emphasis mine, JBH).

Of course, Keyser's position is an extreme one. There are many more concrete works in the same general framework (e.g. Kiparsky and O'Neil's 1976 response to Keyser), and many explicit attempts especially by Kiparsky to make the theory more concrete. Despite Kiparsky's various conditions on grammars (e.g. Kiparsky 1976), his work remains in the same framework because he conceives of the grammar as something only indirectly related to surface data. This is evident in Kiparsky 1974 where apparent surface simplifications that must be represented as grammatical complications are lamented, and where the disparity between surface notions of opacity and paradigm uniformity and the formal notion of simplicity are discussed.

There are some works which explicitly disown the SPE model, while maintaining a similar view of surface data, and an interest in the formal aspects of phonology. One example is Leben and Robinson's "Upside-down phonology" which incorporates a very concrete level of lexical representation, while still allowing the formulation of abstract rules, such as the English vowel-shift rules, which are not disconfirmable by surface facts. It is claimed that this framework eliminates ad hoc exception features, but this strikes me as being of dubious value, since this is accomplished by saying nothing about exceptions at all.

2.2. The abstract approach to data can also be combined with an interest in substance, as illustrated in Chapter 9 of SPE. This particular proposal is probably the least satisfying of substantive proposals, because it was appended to a pre-existing formal machinery, and assumes the correctness of certain features and rules. Further, because of the view of surface data mentioned above, the theory does not generate testable hypotheses. Foley's 1977 approach seems closest to the SPE approach in its abstractness, but his proposals are more sophisticated because of a wider data base, a unified theory and the ability to incorporate more than two values for a given feature.

Neither natural phonology (Stampe 1973, Donegan and Stampe 1977) nor polylectal analysis (Bailey 1973 and 1978, and other

articles, too numerous to cite) imposes strict empirical criteria on what may be a rule. Exceptions to rules can arise through extrinsic ordering without affecting the validity of the rule. In natural phonology the reason is that all processes are universal, and occur in all languages unless they are explicitly suppressed. Thus a language does not have to directly evidence a process in order to have it. A polylectal grammar must be quite abstract if a large number of surface variants are to derive from a common underlying form. Both theories claim a close relation between phonetics and phonology, which gives their proposals an empirical aspect, since hypotheses about phonetic motivation can often be tested. (This is in contrast to Foley's theory, in which it is quite explicit that phonology has nothing to do with phonetics.) Moreover, natural phonology makes the important distinction between natural processes and acquired rules, which delimits the input to a theory of rule naturalness. Bailey's work (e.g. Bailey 1978) deals primarily with the very concrete details of phonetic realizations. Both of these approaches differ from the more formal abstract approaches by recognizing variation, and considering many types of independent evidence.

Donegan and Stampe 1977 have entered the race to invent universal principles of extrinsic rule order, with an interesting twist -- a substantive determination of ordering, by which fortition processes apply before lenition processes. The difficulty here is in dividing all processes up into the two types without seriously distorting some of them.

3. The "concrete" positions

The theories treated here as concrete have in common the requirement, either implicit or explicit, that the rules of the grammar represent true generalizations about the surface data. The rules are therefore disconfirmable and serve as solid input to theory development in both formal and substantive concerns.

The formal issues do not include rule order, but do include rule type. The distinction between phonetically-conditioned and morphologically-conditioned rules seems firmly established (Andersen 1969, Vennemann 1971 and Hooper 1976). Klausenberger 1978 compares this distinction to Kruszewski's categories of sound alternations, arguing for a third type of rule corresponding to Kruszewski's third category, which are rules with a general morpho-

logical function. There is some debate concerning Vennemann's 1972 via-rules, with Tiersma 1978 arguing for bidirectional rules, and Leben 1977 arguing for a parsing model.

The issues concerning underlying representations involve the unit of representation, morpheme or word, and the presence or absence of redundant feature specifications. These questions are often argued on purely formal grounds, since substantive evidence about underlying forms is difficult to obtain. However, substantive evidence is presented by Vennemann 1978, who argues from historical data that full paradigms must be listed lexically, and Vincent 1978, who finds historical evidence that at least some paradigms must be listed. With regard to redundant feature specifications only Davidsen-Nielsen 1977 has been able to present firm substantive evidence on this issue, and his evidence argues for archi-phonemic representations. Evidence about rules does not bear directly on underlying forms (as Basbøll implies, footnote 12), but rather these issues must be explored separately (see section 3.2.). Thus, for the moment, we must be content with formal arguments concerning underlying representation, such as those found in Hudson 1978, who argues that rules governing automatic alternations only add feature values, never change them, and Skousen 1977, who argues that constraints on underlying forms must be approached from the point of view of language acquisition.

3.2. There are quite a variety of approaches to substance from a concrete perspective, which I take to be a good sign, since this seems to be one of the most fruitful research perspectives. I begin with three proposals presented at the Bloomington Conference on the Differentiation of Phonological Theories.

Dinnsen 1977, Houlihan and Iverson 1977, and Sanders 1977 all propose theories that attempt to define "possible phonological rule". For the most part, they limit the input to their investigations to surface-true phonologically-conditioned rules, but none state that they would impose this limitation on individual grammars. Rather, it seems this limitation is imposed to make their hypotheses testable. Sanders' proposal concerning possible rules is embedded in the larger (formal) framework he calls Equational Grammar. His claim concerning phonological rules is that the directionality of rules is universal, so that if one language has a rule A→B, no language will contain the converse rule B→A in the

same environment. The directionality is functionally determined.
It follows from his Simplex Feature notation that allophonic rules
will only add features, producing more marked segments. Neutrali-
zation rules, on the other hand, produce phonetic structures that
are relatively unmarked and communicatively more valuable (than
the structures they apply to). Markedness is determined by uni-
versal distribution and communicative value "on the basis of physi-
cal, social and psychological efficiency" (p. 27). The specific
claims are, e.g. that if one language has prothesis (as for example
Spanish does), then no language has apheresis. The case is not
convincing in view of the large number of converse processes dis-
cussed in Andersen 1972, and the small number of examples given
by Sanders.

Houlihan and Iverson 1977 make a similar claim; however, their
definition of neutralization contains a built-in "blocking" device.
They adopt Kiparsky's 1976 definition which says that a rule is
neutralizing only if it produces strings or segments that are
identical to some strings or segments that are input to the rule.
Since the level of input to the rule is an abstract level of the
linguist's own devising, potential counter-examples are easily
dismissed. Thus it is claimed that English vowel reduction, which
produces schwa in unstressed syllables is not a neutralization,
since one can analyze English as having no underlying schwa.

These proposals refer to the structure of contrasts in the
system to determine what is a possible rule for the language.
This is a formal criterion. The substance involved is markedness.
The "naturalist" point of view would oppose this "structuralist"
point of view and claim that the processes have their own phonetic
teleology, and care little about whether they are neutralizing
contrasts in a language or not. It should be further noted that
these proposals refer only to the structural change of the rule
and say nothing of the environment. It seems to me that the en-
vironments are just as important and should be subject to cross-
linguistic comparison as in Ferguson 1978, and other articles in
Greenberg et al. 1978.

Atomic phonology (Dinnsen and Eckman 1977, Dinnsen 1977) in-
corporates certain testable claims such as, if fricatives devoice
word-finally, stops will also devoice word-finally (the latter is
the independent or atomic rule, the former its complement). In

Dinnsen 1978 it is argued that these atomic rules are linguistic
primes which are not further analyzable nor explicable. Dinnsen
argues explicitly against the position that phonological rules are
"phonetically explainable" (as claimed in Hooper 1976). His argu-
ment is that different languages have different ways of resolving
phonological problems. When tautosyllabic consonants differing in
voicing arise by morpheme combination in English, they are subject
to a progressive devoicing, while in Catalan, they are subject to
regressive voicing.

Of course it is true that it is not possible at present to
predict which language will have a certain process, especially on
the basis of the kinds of information phonological grammars tradi-
tionally include. But it is certainly possible that the processes
of a language are dependent upon one another, or on typological
properties of the language. It is probably no accident that English
and Catalan have different processes, since they also have differ-
ent syllable structure, different stress and different rhythm.
What is called for now are typological studies such as Andersen
1978, and studies that combine typological and phonetic substance.
Alan Bell and I had this need in mind when we organized the sym-
posium whose proceedings are contained in Bell and Hooper 1978.
The emphasis here is on phonetic, psychological and typological
facts that may help us understand the diversity of phenomena as-
sociated with the combination of segments into larger units.

Finally, a very exciting new perspective is opening up. This
is the possibility of approaching traditionally formal or struc-
tural problems from a substantive point of view. Hyman 1977 and
Hooper 1977 quite independently come to the conclusion that formal
distributional criteria cannot always determine the underlying re-
presentations of a language. Hyman gives the historical argument
that if what is predictable gradually becomes contrastive, there
must be a stage in which a feature is both represented lexically,
and predicted by rule. Hooper 1977 presents language acquisition
data that shows children treating a "predictable" feature (vowel
nasality in English) as contrastive. Implicit in these studies
is the notion that there may be some concept of "phonetic distance"
that partially or fully determines the speaker's analysis into
elements represented lexically and elements predictable by rule
(cf. Stampe's notion of "minimal structural change"). This opens

up the possibility of substantive phonetic criteria for phonemic analysis. Along similar lines, Comrie 1976 points out that in several cases the development of exceptions to subparts of rules can be correlated with a greater phonetic change produced by that subpart of the rule. If it is possible that even exceptions are not totally arbitrary, it is all the more important to pay attention to them, and to other surface facts of phonology.

References

Andersen, H. (1969): "A study in diachronic morphophonemics: The Ukrainian prefixes", Language 45, 807-830.

Andersen, H. (1972): "Diphthongization", Language 48, 11-50.

Andersen, H. (1978): "Vocalic and consonantal languages", in Studia Linguistica, A.V. Issatchenko a collegis et amicis oblata, L.Durevic and D.S. Worth (eds.), Lisse: P. de Ridder Press.

Bailey, C.J.N. (1973): Variation and linguistic theory, Arlington, Virginia: Center for Applied Linguistics.

Bailey, C.J.N. (1978): "Gradience in English syllabization and a revised concept of unmarked syllabization", Indiana University Linguistics Club Publication.

Bell, A. and J.B. Hooper (eds.) (1978): Syllables and segments, Amsterdam: North Holland.

Chomsky, N. and M. Halle (1968): The sound pattern of English, New York: Harper and Row.

Comrie, B. (1976): "Morphophonemic exceptions and phonetic distance", to appear in Linguistics, presented at the LSA Summer Meeting, Oswego, N.Y.

Davidsen-Nielsen, N. (1977): "A phonological analysis of English sp, st and sk with special reference to speech error evidence", Journal of the International Phonetic Association 5, 3-25.

Dinnsen, D. (1977): "Atomic phonology", to appear in Current approaches to phonological theory, D. Dinnsen (ed.), Bloomington: Indiana University Press.

Dinnsen, D. (1978): "Phonological rules and phonetic explanation", Indiana University Linguistics Club.

Dinnsen, D. and F. Eckman (1977): "Some substantive universals in atomic phonology", Lingua 45, 1-14.

Donegan, P. and D. Stampe (1977): "The study of natural phonology", to appear in Current approaches to phonological theory, D. Dinnsen (ed.), Bloomington: Indiana University Press.

Ferguson, C.A. (1978): "Phonological processes", in Universals of human language, Volume 2, Phonology, J:A. Greenberg, C.A. Ferguson and E.A. Moravcsik (eds.), 403-442, Stanford: Stanford University Press.

Foley, J. (1977): Foundations of theoretical phonology, Cambridge: Cambridge University Press.

Greenberg, J.H., C.A. Ferguson and E.A. Moravcsik (1978): Universals of human language, Volume 2, Phonology, Stanford: Stanford University Press.

Hooper, J.B. (1976): Introduction to natural generative phonology, New York: Academic Press.

Hooper, J.B. (1977): "Substantive evidence for linearity: vowel length and nasality in English", in Woodford Beach et al. (eds.), Papers from the Thirteenth Regional Meeting, Chicago: Chicago Linguistic Society, 152-164.

Houlihan, K. and G. Iverson (1977): "Functionally constrained phonology", to appear in Current approaches to phonological theory, D. Dinnsen (ed.), Bloomington: Indiana University Press.

Hudson, G. (1978): "Automatic alternations in non-transformational phonology", to appear in Language.

Hyman, L.M. (1977): "Phonologization", in Linguistic Studies Offered to Joseph Greenberg, A. Juilland (ed.), 407-418, Saratoga, California: Anma Libri.

Kaye, J. (1978): "Recoverability, abstractness and phonotactic constraints", to appear in Phonology in the 1970's, D. Goyvaerts (ed.), Ghent: Story Scientia.

Keyser, S.J. (1975): "Metathesis and Old English Phonology", Linguistic Inquiry 4, 377-412.

Kiparsky, P. (1974): "On the evaluation measure", Natural Phonology Parasession, 328-337, Chicago: Chicago Linguistic Society.

Kiparsky, P. (1976): "Abstractness, opacity and global rules", in The application and ordering of grammatical rules, A. Koutsoudas, 160-186, The Hague: Mouton.

Kiparsky, P. and W. O'Neil (1976): "The phonology of Old English inflections", Linguistic Inquiry 7, 527-558.

Klausenberger, J. (1978): "Nikolaj Kruszewski's theory of morphophonology", Historiographia Linguistica 5, 109-120.

Kruszewski, N. (1881): Über die Lautabwechslung, Kazań.

Leben, W.R. (1977): "The phonological component as a parsing device", in Current approaches to phonological theory, D. Dinnsen (ed.), Bloomington: Indiana University Press.

Leben, W.R. and O.W. Robinson (1977): "'Upside-down' phonology", Language 53, 1-20.

Sanders, G. (1977): "Equational phonology", to appear in Current approaches to phonological theory, D. Dinnsen (ed.), Bloomington: Indiana University Press.

Skousen, R. (1977): "Analogical sources of abstractness", to appear in Phonology in the 1970's, D.L. Goyvaerts (ed.), Ghent: Story Scientia.

Stampe, D. (1973): A dissertation on natural phonology, University of Chicago Doctoral Dissertation.

Tiersma, P. (1978): "Bidirectional leveling as evidence for relational rules", Lingua 45, 65-77.

Vennemann, T. (1971): "Natural generative phonology", paper read
    at annual meeting of the LSA, St. Louis, Missouri.

Vennemann, T. (1972): "Rule inversion", Lingua 29, 209-242.

Vennemann, T. (1978): "Rule inversion and lexical storage: the
    case of Sanskrit visarga", in Recent developments in his-
    torical phonology, J. Fisiak (ed.), 391-408, The Hague:
    Mouton.

Vincent, N. (1978): "Words versus morphemes in morphological
    change: the case of Italian -iamo", to appear in Historical
    Morphology, J. Fisiak (ed.), The Hague: Mouton.