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Syntactic Representations and Phonological Shapes

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BOTH SYNTACTICIANS AND PHONOLOGISTS tend to see themselves as engaged in framing restrictive theories about these domains. There is much to be said for this attitude Occam's razor has often been wielded to good effect in linguistics but it is not an unmixed blessing. The danger is early theoretical closure, in which the theorist fixes on a few fundamental notions, assumptions, or formalisms (because these make plausible candidates for a minimal theory) and then refuses to entertain richer, or simply alternative, possibilities.

Now my purpose here is not to advance any new theory of grammar, or even any new framework within which such a theory might be couched. Instead, my intention is to try to stave off early theoretical closure in both syntax and phonology, and to step back some for a certain amount of pretheoretical stock-taking in both domains, in the hope that this will help to guide future theorizing and so eventually illuminate the nature of the connection between the two domains.

Consider syntactic representations (hereafter, synreps). I assume that each such representation is an assemblage of (at least) all the syntactically relevant information about (one reading of) a sentence. But what makes some particular bit of information, some particular property of an expression, syntactically relevant? The fact that some syntactic rule (hereafter, synrule) distributes this property or is sensitive to it. Synrules, in turn, I view as embodying constructions: they are matchings of semantic content with suites of formal properties properties that are formal in the sense that they ultimately manifest themselves in phonological substance.

I will not be assuming, then, that synreps encode either constituency or dependency relations but not both. Both, I believe, are relevant in syntax (and in phonology), so that the possibility that one set of properties might be definable on the basis of the other set is beside the point here; both should appear in synreps. Nor will I be assuming that the only properties distributed by synrules are ones that would ordinarily be recognized as 'syntactic' in a narrow sense. In particular, certain properties realized as inflectional forms of individual words serve as marks of specific syntactic constructions and so are distributed by synrules; the same is true of certain properties realized as intonational contours and accent patterns on constituents.

On the other hand, not all observations one might make about the syntax of an expression necessarily find a place in its synrep. Take a Subject-to-Object Raising (SOR) example like

(1) believe Robin to be a spy

It is true that the NP *Robin* must be the sort of constituent that could be the subject of the VP *be a spy*, and the rule describing the SOR construction must incorporate a restriction to this effect. But there is no reason to say that this rule assigns the subject property to *Robin* vis-a-vis *be a spy*; in particular, no other synrule — and, so far as I am aware of, no phonological rule either — treats *Robin* as a subject. As far as the synrep of *believe Robin to be a spy* goes, *Robin* bears the direct object relation to *believe*, period.

1   Organization of This Paper

Section 2 sketches some properties of expressions that (at least sometimes) belong in synreps; I make no claim that this list is exhaustive rather than merely illustrative. In principle, all these properties are available as conditioning factors in phonology.

Section 3 reviews the syntactic properties that are known to have influences on the application of phonological rules. Following Hayes's contribution to this volume, these influences are divided into two gross types—conditions on the distribution of alternative phonological shapes for lexemes and conditions on prosodic domain formation.

Section 4 then begins an exploration of what synreps would be like if they had to serve the purposes only of phonology (rather than also being motivated by syntactic, semantic, morphological, and pragmatic considerations). The suggested scheme of representation involves properties (of several types) belonging to individual words, and relations (also of several types) holding between pairs of words.

This paper is intended to be both integrative and exploratory, incorporating observations from the literature rather than contributing new data to the discussion of the phonology-syntax connection.

2   Syntactic Background

What properties of expressions can synrules distribute and/or be sensitive to?

2.1   Chunking (= Constituency)

The most impressive syntactic evidence for indicating chunking in syn-reps is that some synrules are sensitive to whether an expression forms a single constituent or not. The rule for WH question clauses in English, for instance, requires that such clauses begin with a single constituent preceding their head verbs. Compare

(2)   a.   Which people from California did you introduce to Tracy?

    b.   To how many of your friends did you introduce people from California?

with

(3)   a.*Which people from California to Tracy did you introduce?

    b.*People from California to how many of your friends did you introduce?

2.2   Unit Type

Synrules can be sensitive to various properties of the units they refer to.

Category membership

Little comment is required here, except to point out that the character of particular synrules seems to require a moderately complex organization of syntactic categories (hereafter, syncats), involving cross-cutting taxonomies. Vs, for instance, belong both to one larger syncat comprising Ps as well and to another larger syncat comprising As as well; this is the sort of observation that motivates the familiar decomposition of N, A, V, and P into two cross-cutting category features. But there are still larger syncats, and still smaller ones. As for larger syncats: NP, PP, and AP (vs. VP) group together in English, as the syncats that can be fronted in WH questions, and V, A, and N (vs. P) group together in English, as the syncats that can have PP and clausal complements as well as NP complements. As for smaller syncats: Count nouns constitute a syntactically relevant subclass of N in many languages, and transitive verbs (including ditransitives and also transitives with PP complements) constitute a syntactically relevant subclass of V in many languages.

Rank

I use the term in the Hallidayan sense, with reference to the distinction between W[ord], P[hrase], and C[lause] rank; this is the 'bar level' property of many current syntactic frameworks, but without the attendant arithmetic. Individual synrules can require that a particular constituent be of rank W, as in the WH clefts in English in (4); or of rank P rather than C, as in the objects of prepostions of English in (5); or of rank C rather than P, as in the *that*-complements of English in (6).

(4) What you saw from Antarctica was a penguin

   *What creature you saw was a penguin

   *What from Antarctica you saw was a penguin

   compare the WH questions

   What (creature) from Antarctica did you see?

(5) from the fact you left

   *from you left

(6) I know that they will be at home.

   *I know that they.

   *I know that (will be) at home.

Depth

NPs can be nested within NPs, and VPs within VPs, in many languages, and the depth of a unit within such a nesting can be relevant for synrules. Maximality has been made much of in the recent syntactic literature, thanks to the involvement of maximal projections in the GB notions of 'command' and 'government' (though Pullum 1986:204 maintains that "the relation ... MAX-command has very little support, if any, despite its popularity"). I will assume that both maximality and minimality are syntactically relevant properties of units - the latter, in my dialect at least, serving as a condition on the VP fronting construction:

(7) Watching television they might have been

   *Been watching television they might have

   *Have been watching television they might.

2.3   (Grammaticized) Functions

Under this heading I refer both to grammatical relations (hereafter, grels). which I view as grammaticizations of participant roles in events, and to pragmatic roles (hereafter. proles). insofar as these latter are grammaticized.

Grels

I take it as amply demonstrated that grels like subject, direct object, and so on are syntactically relevant. The English subject-auxiliary inversion rule, for instance, picks out rank-P constituents that are subjects, and so allows inversion both of NPs and PPs

(8) a. Have you finished?

b. Is under the rug a safe place to hide your money?

but not when these serve in a non-subject grel:

(9) a.*Have home I gone?

b.*Did under the rug go your money?

What has perhaps not been appreciated, despite the work of (several varieties of) dependency grammarians and relational grammarians, is the number of distinct grels that can be justified and the complexity of their organization. In both respects the world of grels seems to be entirely comparable to the world of syncats. In particular, the organization of grels involves cross-cutting taxonomies: The intransitive subject grel groups with transitive subject (in the larger subject grel) for some purposes, but with direct object (in the larger absolutive grel) for other purposes; all three together make a nuclear term grel, while direct object also groups with indirect object and oblique object, in an object grel; all these together with various others form a complementing (as opposed to complemented, modifier, and modified) grel; and the complementing and modified grels together make an argument (vs. functor) 'grel, the complemented and modified grels a head (vs. adjunct) grel.

Proles

Much the same is true, I believe, in the world of proles. There are two very large divisions in this universe, separating topic expressions from others and focus expressions from others, and each has a complex internal organization, which is only beginning to be mapped out by syntacticians. It seems clear, for instance, that contrastive focus, emphatic focus, and question focus must be distinguished in the syntax of at least some languages, but many other details are quite unclear.

2.4 Order

I scarcely need to point out that synrules can determine the linear sequence of constituents.

2.5 Conditions on Contained Unit(s)

Synrules describing expressions of type X routinely place conditions on some unit(s) contained within these expressions.

Head unit

A synrule can require that the head W within an expression must have some property, as when the English rule for passive VPs requires that the head W appear in its past participle form:

(10) (My chickens are) often attacked by wolves.

Edge unit

A synrule can require that the first (or last) W (or P) within an expression must have some property, as when the English rule for possessor NPs requires that the last W appear in its possessive form:

(11) my friend from Chicago's (crazy ideas).

Some unit(s)

A synrule can require that within an expression there must be one or more occurrences of a unit with some property, as when the English WH question rule requires that the clause-initial expression contain one or more WH-question Ws:

(12) Which people from which cities (did you meet?).

Exactly one unit

A synrule can require that within an expression there must be exactly one occurrence of a unit with some property, as when the rule for an English comparative AP requires that exactly one of its constituents be itself comparative:

(13) more handsome, handsomer, *more handsomer.

2.6 Stipulated Properties of Contained Unit

Beyond the obviously 'syntactic' properties listed above in 2.2, several other types of properties of a contained unit can be relevant for synrules. Some of these have already been illustrated.

Lexeme subcategories

In principle, whenever a synrule licenses a unit of rank W and category x in some slot, there is a special class of lexemes (a subclass of x) available for occurrence in that slot; this is the 'subcategory' (or, as I shall say, lexcat) associated with the rule. The unit in question is often the head in English, the V in the prepositional indirect object construction

(14) *donate* money to the campaign.

for instance, or the V in the subject-auxiliary inversion construction ('auxiliaries' in English being simply the verbs available for occurrence in this slot), or the V that occurs with a passive VP complement, as in

(15) *be/get* attacked by wolves.

But it does not have to be the head. The English WH question rule requires one or more units of rank W within the clause-initial constituent; the 'WH question words' are simply those that can occur in this slot. The rules for WH exclamations, WH clefts, restrictive relatives, appositive relatives, and free relatives all make reference to rank-W units, and the lexcat of WH words is somewhat different for each of these rules.

Grammatical categories

Synrules of several different types distribute properties that are realized in some instances via (inflectional) morphology and in other instances via lexemes specialized as grammatical markers, which I shall refer to as particlexemes. Some such rules involve 'vertical' distribution of properties, in which a construction relevant to some constituent is marked by an inflection or a particlexeme within that constituent (as when clausal negation in English is marked either by negative inflection on an auxiliary— *don't, won't,* and so on—or by the particlexeme *not* following the auxiliary). Other such rules involve 'horizontal' distribution of properties— government and agreement, essentially   in which one unit determines properties of, or imposes properties on, some adjacent unit, and these properties are themselves marked via inflections or particlexemes.

Particlexemes   To say that such a lexeme   the preposition *to* marking indirect objects in English, the auxiliary verb *to* marking infinitival VPs, the definite article *the,* the negative adverb *not.* the degree adverbs *more* and *most,* and so on—is specialized as a grammatical marker is to say, first, that it is available. so to speak. as a counter in the game of syntax, that it can be distributed by several different synrules (with different corresponding semantics). so that it will not necessarily be possible to assign a single meaning to it in all of its occurrences; and, second, that its default meaning—the meaning contributed by the lexeme so long as this is not contradicted by the semantics for a particular synrule—is not like the meaning of an ordinary lexeme. but instead involves two steps, each involving a default association rather than a simple translation: a default association of the lexeme with an assemblage of 'grammatical categories' (hereafter, **gramcats**), plus a default association of each gramcat with meaning. The second point here   that gramcats of case, gender, number, definiteness, tense, aspect, finiteness, polarity, degree, and so on are not themselves meanings, though they are not unconnected to meanings—I take to be a familiar one. The first point is in fact conceded (though perhaps inadvertently) whenever syntacticians write rules that introduce

particlexemes as acategorial words picked out by their phonological shape (see Pullum 1982) or by some arbitrary index.

Note that the 'same' item can serve sometimes as a particlexeme and sometimes as an ordinary lexeme, as when *to* serves both 'grammatically,' as a marker of indirect objects, and 'locally,' as a directional preposition:

(16) We sailed to China.

Some lexemes, including many particlexemes, function as ('bound word') clitics; they serve as independent words from the point of view of syntax but combine with adjacent (inflected) words to form units that are word-like from the point of view of morphology (Zwicky 1987b); but not all particlexemes work this way, and not all bound word clitics are particlexemes. It is also true that many particlexemes are phonologically dependent (and form prosodic units with adjacent expressions); but not all are, and not all phonologically dependent words are particlexemes.

Inflectional categories   Inflectional morphology is, in most respects, parallel to particlexemes. An inflectional category is available as a counter in the game of syntax (dative case forms might mark indirect objects in one synrule, direct objects in another, possessors in another, subjects in still another, for instance) and its default meaning is a matter of gramcats, these serving in fact to name the category. The 'same' category can serve sometimes grammatically, as when the German dative case marks indirect objects, and sometimes locally, as when the German dative case conveys location (rather than direction) with a set of prepositions (dative *hinter dem Hause* '(at) behind the house,' versus accusative *hinter das Haus* '(to) behind the house'). And some inflections function as ('phrasal affix') clitics, located in a layer of morphological structure outside ordinary inflections, as is the English possessive in *children's*.

Note that gramcats like syncats, grels, and proles are organized into cross-cutting taxonomies for the purposes of syntax and morphology. The accusative case category of a language, for instance, might group with a nominative category (as a 'direct case') for one generalization but with a dative category (as a 'spatial case') for another.

Shape properties

Gramcats provide one route by which synrules determine phonological shape, but according to the usual story for ordinary lexemes it is not a direct path: Synrules distribute gramcats, ultimately to individual words, and morphological rules describe how gramcats are realized as 'the (inflectional) forms of' those lexemes, where each such form has phonological content. It seems clear, however, that direct determination of aspects of phonological representation ('shape properties,' or shaprops), with no mediation by gramcats, must also be allowed for in synrules.

Emptiness To describe constructions like gapping, pseudogapping, and VP ellipsis in English, synrules must be able to stipulate that certain anaphoric constituents are phonologically empty. Gap-filler constructions like the WH question and topicalization constructions in English call for the same sort of direct determination of phonological shape. In neither case is there any reason to say that there is some gramcat of the constituents in question that is itself realized as a phonological zero.

Prosodies (in the strict sense) Accent patterns and intonation patterns not infrequently serve as marks of syntactic constructions, though this fact tends to be obscured by other grammatical and extragrammatical uses of such patterns. I would maintain, for instance, that there is a default accent pattern for N+N combinations in English, with accent on the first member, a pattern that is overridden by a second-member accent pattern that is one of the marks of a construction in which the first member denotes the material of which the object denoted by the second is composed; compare the default

(17) PAPER box 'box having to do with paper(s)'

with

(18) paper BOX 'box made of paper.'

And I would also maintain that the rising terminal intonation of the English yes-no question is one of the conventional marks of this particular construction. In neither instance is there any reason to say that there is some gramcat of any of the constituents involved that is itself realized as an accent or tone. Instead, the accents or tones are distributed by synrules without the mediation of gramcats.

Prosodies (in the wide sense) The phonological features distributed in this fashion do not have to be suprasegmental (or 'prosodic' in the narrow sense), but can in fact be segmental. The Welsh mutations of word-initial consonants, for instance, serve in a number of instances as marks of particular syntactic constructions (see Zwicky 1986a:310-12 for a compact review); there is no reason to say that the lenition of the first word of a feminine singular nominal under the triggering of a preceding definite article involves some mediating gramcat of the affected word, rather than being directly determined. Similar remarks hold for a number of the other phenomena treated by Lieber 1987 (who is, however, interested in the phonological description of mutation and harmony rather than in the syntactic distribution of these phonological effects).

3   Syntactic Influences on Phonology

I now summarize the types of contributions that syntax appears to make to phonology.

I assume here a division between two types of phonology, essentially the fundamental distinction of natural phonology (Donegan and Stampe 1979) between automatic phonology—involving rules applying within 'prosodic' (that is, phonological) domains and subject only to phonological conditions—and nonautomatic phonology; this division corresponds roughly to that between the P1 and P2 rules of Kaisse 1985. That is, I assume that there are rules of automatic phonology, P2 rules, which associate 'prosodophonological' (P2) representations (phonological representations organized entirely within prosodic domains, of the sort treated by Nespor and Vogel 1986) with phonetic representations; rules of nonautomatic phonology, P1 rules, which associate syntactic and morphological representations with 'tacticophonological' (P1) representations (phonological representations organized in part within morphosyntactic domains); and 'prosodic domain formation' (PDF) rules, which match P2 with P1 representations.

3.1   PDF and P1 Rules

Within this framework of assumptions, there are two ways in which syntax could influence phonology: via conditions on individual PDF rules, conditions referring to the syntactic properties of P1 representations; or via conditions on individual P1 rules.

Syntactic conditions on PDF rules are familiar from the literature on 'phonological readjustment.' A typical instance is the set of syntactic conditions on the English infinitive particlexeme *to* when it lacks its complement VP (Zwicky and Levin 1980, Zwicky 1982), conditions that for many speakers prohibit accented *to* in

(19) You don't have TO (*vs.* You don't HAVE to)

and for some speakers prohibit even unaccented *to* in

(20) I don't want PAUL to (*vs.* I don't WANT to).

Syntactic conditions on PDF rules also stand at the center of 'end-based' approaches to phonological domain formation (Selkirk 1986, Chen 1987c, Hale and Selkirk 1987, Cowper and Rice 1987), in which one end of a phonological domain is constrained to occur at the edge of a syntactic constituent of a specified sort.

The garden-variety P1 rule is exemplified by the alternation between *a* versus *an* as shapes for the English indefinite article. Almost anyone who considers such a phrase-phonological alternation is inclined to label it as a 'lexical' (item-specific) dependency on adjacent words. There is something right in this impulse, but there are at least three reasons for not dismissing the matter once a label has been assigned.

The first is that the epithet 'lexical' has been applied so widely and variously in the recent theoretical literature of linguistics that it is not clear that it conveys any real content anymore; I list here a small sample

of these uses, without attribution: lexical (= basic = underlying) phonological representation, lexical redundancy rule, the Lexicalist Hypothesis (whether 'strong' or 'weak'), the Lexical Integrity Hypothesis, Lexical-Functional Grammar, lexical (vs. syntactic) rules, Lexicase, Autolexical Syntax, lexical (vs. phonetic vs. underlying) phonological representation, lexical (vs. postlexical) rules, morpholexical rules, Lexical Phonology and Morphology, Radical Lexicalism, lexical (= derivational) versus phonological (= inflectional) rules, lexical insertion, lexical exceptions, nonlexical versus lexical items.

A second reason for pausing over the label 'lexical' for the *a/an* alternation is that the English indefinite article is one of the items to which the (apparently oxymoronic) term 'nonlexical item' has been applied.

A third is that the label alone is worthless without some account of the phonologically relevant information about lexemes and of the character of the P1 rules involved. At the very least, we need a distinction between four levels of paradigmatic organization: the lexeme (for instance, the verb *hit*); the (inflectional) form (for instance, the base form /hɪt/, the first-singular present /hɪt/, the first-singular past /hɪt/, the present participle /hɪtɪŋ/), a phonological representation paired with an assemblage of gramcats; the form set (for instance, base/present *hit*, past *hit*, present participle *hitting*), a class of systematically identical forms; and the shape (for instance, the present participle shapes /hɪtɪŋ/ and /hɪtɪn/), a P1 representation matched with a form. Rules of inflectional morphology, or 'realization rules,' are responsible for the description of the forms and form sets for lexemes (as in Zwicky 1985c), while P1 rules assign shapes to forms. Hayes's contribution to this volume suggests a scheme for P1 rules; the framework of Zwicky 1986a divides these rules into two types— 'shape' rules that override, or preclude, the effects of realization rules and 'morphonological' rules that alter, or are superimposed upon, the representations provided by realization rules—but this potential refinement should not obscure the general claim that phonologically relevant information about a lexeme must be organized in a fairly complex way: one or more stem representations for the lexeme, forms organized into form sets, and shapes for each form.

3.2   Syntactic Influences

What aspects of syntactic organization are relevant for the applicability of P1 and PDF rules?

Adjacency

Obviously, adjacent material is relevant for the applicability of P1 rules, and the literature on such rules routinely assumes that their triggers are adjacent to their targets. Lieber's 1987 approach is, in fact, designed to

maintain this position for all P1 rules, via the positing of floating autosegments, which on occasion must (apparently) be distributed syntactically.

I have been glossing over some complications here. To begin with, the targets of P1 rules are syntagmatic 'words' in either (or both) of two distinguishable senses, as we have been taught by works like Sadock 1985 and Di Sciullo and Williams 1987: expressions of rank W in the syntax, which is to say 'syntactic words' (synwords); or the word-like units of morphology, which is to say 'morphological words' (morwords). *Kim's going*, for instance, is three synwords, but only two morwords. The second complication is that synwords can contain synwords and morwords can contain morwords; compounds like *abstracts committee* are in fact complex in both ways. I will continue to gloss over both complications in this paper, though a careful discussion of the phonology-syntax connection cannot refer simply to 'words,' without differentiating synwords from morwords, and complex words of either type from elementary ones.

Distinguished words within constituents: edges, heads/bases

P1 rules have a demarcative and/or culminative function, just as many P2 rules do, but P1 rules serve to tick off the units and mark the boundaries of morphosyntactic, rather than prosodic, organization. Following the lead of Selkirk 1980a, we could say that rules of these two sorts apply within domains (morphosyntactic or prosodic, respectively) of certain types, at the edge of a domain of a certain type, or between domains of certain types. At any rate, both P1 rules and (insofar as prosodic domains depend upon syntactic constituency) PDF rules must be capable of being sensitive to whether some word is within a syntactic constituent (of some type) or at one of its edges.

I leave open the possibility that edge location for phonological purposes might be like edge location for clitic placement (see Zwicky 1987b and the references cited there), in that there might be four possibilities rather than only two: last word (word at right edge), penultimate word (word before right edge), first word (word at left edge), second word (word after left edge).

The culminative function of some P1 rules is evidenced by their picking out a single (not necessarily edge) word within a syntactic constituent — a word that counts as the 'head' for some phonological purpose as well as for syntactic or morphological purposes. For instance, "Shortening applies to the head [word] of the phrase" in Kimatuumbi (Odden 1987:20).

Now what is to count morphosyntactically as a head is not always clear (see Hudson 1987 for the latest in a series of discussions on this point). My current inclination is to say that there is not just one grammatically relevant notion here, that at the very least we must distinguish between, on the one hand, the word that is the *head* for the purposes of feature sharing (as in the Head Feature Convention of GPSG) and for the determination of government and agreement within its constituent and, on the

other hand, the word that is the syntactic *base* within ... in the sense that it is the obligatory element and the one whose lexcats determine the external syntax of the constituent. Usually the head and base coincide, but in certain types of constructions—most notably, those involving 'specifiers,' like VPs composed of a (specifier) auxiliary V and its complement VP the two sets of properties are allocated to different words; in the VP *am to go*, it is the auxiliary V that exhibits the (person, number, and tense) features belonging to the VP as a whole, and it is the auxiliary V that governs, or determines, gramcats on its sister (infinitival) VP rather than vice versa, but it is the V slot instantiated here by the lexeme *go* that is the obligatory element (a VP without an auxiliary is just a VP, but a VP composed only of an auxiliary is elliptical) and that is involved in subcategorization with an external subject argument:

(21) I am to go.

  *There is to go.

  There is to be trouble.

It is not entirely clear to me whether references to 'head of a phrase,' as in Odden's formulation for Kimatuumbi Shortening, are in fact to heads in the narrow sense, to bases, to words that are both, or sometimes to one and sometimes to the other. Our current data base seems too scanty for the matter to be decided now, so that I will leave open the possibility that both heads and bases (as well as edges) might be distinguished words for the purposes of phrase phonology.

Distinguished constituents containing a word: homes

The rather confusing literature concerning command relations and their relevance to phrase phonology (see especially Kaisse 1985 (chapter 7) and the formal discussion in Pullum 1986) has searched among the configurational properties of expressions for the factors that are crucial to whether two adjacent words count as part of the same unit, or instead as being at the edges of adjacent units, for the purposes of specific P1/PDF rules. Many of the crucial examples in this literature involve contrasts like those between *happy bear*, in which the A *happy* will count as being part of the same unit as the N *bear*, and *very happy bear*, in which the same A will count as ending an AP unit separate from N; or between *fierce bears*, in which the A *fierce* will count as being part of the same unit as the N *bears*, and *fierce bears and lions*, in which the same A will count as ending a unit separate from the coordinate NP *bears and lions*.

I believe there is some virtue in taking the contrast here to be primitive, rather than trying to define it from syntactic configurations. The intuitive notion is that for any word there is a rank-P constituent that is 'its phrase,' in much the same way that for any word there is a rank-C constituent that is 'its clause.' I will call such a distinguished constituent

the *home* (of rank P or C) for the word in question. A P1/PDF rule might then require that one word be an edge or head/base of an adjacent word's rank-P home constituent, or that one word stand in a specified grel to the rank-P home constituent of an adjacent word. Conditions of this sort require only a function that assigns to each word in an expression its rank-P home, rather than making large-scale reference to configurational properties.

Gramcats of individual words

One effect of synrules is to locate gramcats on individual words (the heads or edges of some units), and P1/PDF rules are routinely sensitive to these gramcats. In particular, the targets of P1 rules are often specific particlexemes (the indefinite article in English, for instance) or inflectional affixes (the realization of the nominative singular masculine in Sanskrit, for example), and these are often implicated in PDF rules as well.

Syncats and lexcats

As Hayes observes in section 2 of his contribution to this volume (notably, with reference to Ewe and Hausa), the syncats of both target and trigger words can be crucial to the applicability of P1 rules. There is some question as to whether the syncats of the constituent that a given word is at the edge of, is the head of, or is adjacent to is ever relevant—"cross-categorial behavior being the rule," as Kaisse and Zwicky 1987:7 have it—but I will not deny the possibility.

The lexcat of a word can also be relevant, as when the constraint that bars certain occurrences of accented *to* in English (Zwicky and Levin 1980) is only part of a more general constraint applicable to non-finite forms of auxiliary verbs.

Rank

Reference to (being at the edge of) a rank-P constituent is commonplace in P1/PDF rules; Chen's 1987c PDF rule for Xiamen, for instance, constructs a tone group from the right end of XP. Indeed, references to 'non-branching' constituents (as in Cowper and Rice 1987 on Mende) and to 'unmodified' constituents (as in Zwicky 1984 on Yiddish) can be treated as references to rank P, for a non-branching or unmodified constituent is one that comprises a single word—that is, a word that is both the left edge of some constituent i of rank P and also the right edge of i.

Depth

Reference to maximality, at least, is also commonplace. Hale and Selkirk's 1987 PDF rule for Papago, for instance, constructs a tone group from the right end of X^{max}.

Grels and proles

Both are obviously relevant for P1/PDF rules, but the extent to which they are relevant has been, I believe, grossly underappreciated. My discussion here is programmatic and tentative, but I hope at least to draw attention to the potential importance of grels and proles in phrase phonology.

Given my discussion in section 2.3 above, not only do references in P1/PDF rules to subjects ("A personal pronoun subject can form a prosodic phrase with the VP following it" in English (Zwicky 1986b:107)) and objects ("A verb-final long vowel is shortened immediately before an object NP" in Hausa (Hayes, this volume)) count as references to grels, but so do certain references to heads (for the appearance of *mon, ton, son* instead of *ma, ta, sa* in French, "the trigger must be the head noun in the NP" (Zwicky 1985d:435)) and to the distinction between arguments and modifiers (as in Chen's treatment of a Xiamen PDF rule, which marks off tone groups for rank-P arguments but not modifiers (Chen 1987c:118)). In other work, not yet published, Chen has suggested that reference to specific constructions might be necessary in describing tone sandhi in Chongming Chinese, but his summary statement of the rules—one sandhi effect in subject+predicate combinations, another in numeral+classifier combinations, a third elsewhere—suggests reformulation in terms of specific grels rather than specific constructions.

Other languages might have P1/PDF rules referring to specific proles, rather than specific grels. In fact, since proles are grammaticizations of discourse and context-dependent properties (such as aboutness, givenness, identifiability, foregrounding, and contrast), mediation by specific proles in phrase phonology could provide one way in which the effect of reference to semantics/pragmatics might be achieved in P1/PDF rules.

Shaprops

As pointed out in section 2.6 above, synrules can distribute shaprops directly: these will ultimately be associated with individual words. This scheme provides a direct way in which specific constructions could determine phrase phonology, and another way in which the effect of reference to semantics/pragmatics might be achieved in P1/PDF rules: Each synrule has an associated scheme of compositional semantics and an associated set of pragmatic values, so that if it also distributes shaprops, these are then indirectly tied to semantics and pragmatics.

4   Phonologically Based Syntactic Representation

My text for this final section is from Kaisse and Zwicky 1987:4:

"whether syntax conditions some phonological rules directly or whether its influence is entirely on principles of prosodic

domain formation, the phrase phonology of a language can tell us a good bit about what a syntactic description of a language should be like, and so about what syntactic theory should be like. Syntax, after all, must provide the information that is relevant for phrase phonology (be this constituent boundaries, category membership, c-command, headship, bar level, grammatical relations, or whatever), either by representing such information explicitly in syntactic structures or by representing syntactic properties from which it can be derived."

What, in fact, will a scheme for synreps be like if it is designed entirely for the purposes of phrase phonology? Various theoretical frameworks for syntax have posited representations motivated entirely by syntactic considerations; some syntactic theorizing has been guided in a fundamental way by the needs of semantic interpretation or of pragmatics, discourse organization, and stylistics; morphological considerations play an important role in other frameworks; but syntacticians are not accustomed to viewing phonology as a source of information about the nature of their domain. What happens if we adopt the strategy of taking such a scheme as the basis on which a fully adequate theory of synreps is to be constructed?

Notice that I am being careful here, as in section 1, to separate an account of synreps from an account of synrules. The latter concerns itself with the nature of language-particular generalizations about the objects that are the concern of the former. As a first approximation, I want to say that synrules are associated with semantic interpretation (and pragmatic values), while synreps are associated with phonological interpretation a position that is recognizably a descendant of the one in Chomsky 1965, where semantics interprets deep structure and phonology interprets surface structure.

Now, standard tree representations might be inadequate in various respects—see the inventory of possibilities in Zwicky 1985a, and note especially that grels do not appear in the standard two-dimensional trees but they are also (from the point of view of phonology) over-rich in a number of ways. In particular, syntacticians are accustomed to thinking of trees as global representations, in which constituents are apprehended as wholes, even though it is a hallmark of P1 and PDF rules that they involve local determination of phonological features. The usual mathematical treatment of tree representations, as in Wall 1972:144 52, builds on relations and properties immediate dominance, linear precedence of sisters, and category membership of constituents—which, as will be clear from the discussion of section 3, are for the most part not the ones that play roles in phrase phonology; alternatives such as those in Lasnik and Kupin 1977 and Chametzky 1985 are no improvement in this respect.

4.1 A Scheme for Syntactic Representation

In the scheme I sketch here, six types of information about an expression are to be encoded.

The word list

First, there is a list of the words in the expression, each assigned some arbitrary index.

Word properties

Second, for each word w there is an assemblage (which itself might be internally complex) of properties: syncats, lexcats, gramcats, and shaprops, whether these belong inherently to the lexeme instantiated in w or belong to w by virtue of the application of synrules.

Adjacency

Third, there is information about which words are adjacent to which others. All that is needed is a list of pairs (w_1, w_2) of immediately adjacent words.

Distinction lists

Fourth, for each word w there is information about which constituents w is a distinguished word of: which ones it lies on the left edge of, which it lies on the right edge of, and which it is the head/base of. This can be managed by providing 'distinction lists' for w, each such list consisting of a set of arbitrary indices, where each index c is paired with a set of properties (syncats, rank, depth, proles) for constituent c.

I have already pointed out, in section 3.2, that from the left edge and right edge lists for a word we can determine whether that word constitutes a phrase on its own, so that references to 'non-branching' or 'unmodified' constituents can be reconstructed in this system.

Homes

Fifth, there is information about the rank-P home for at least some words. I will assume that this is represented by further distinguishing one of the constituents on a distinction list.

Grels

What this scheme still lacks, for its sixth type of information, is a place for relations between words, other than the relation of linear ordering—a place for grels, in particular. The question then is: When should a grel

be listed as holding between two adjacent words? Do we list a grel, for instance, between *Antarctica* and *can't*, or between *fly* and *distresses*, in

(22) That penguins from Antarctica can't fly distresses me?

There are several ways in which such questions might be answered—I am about to suggest two—and I am not in a position now to commit myself.

It might be said that insofar as *Antarctica* bears any relation to *can't* (at least for phonological, if not also for syntactic, purposes), it does so by virtue of being at the right edge of a constituent that is the subject of the constituent that *can't* is at the left edge of, and that insofar as *fly* bears any relation to *distresses*, it does so by virtue of being at the right edge of a constituent that is the subject of the constituent that *distresses* is at the left edge of. Speaking this way would pick out what we might call the 'top grel' connecting two words—the grel of the sister constituents that lie, speaking in global tree terms, at the tops of the two chains of nodes dominating the words.

Another possibility would be to say that word w_1 is listed as bearing a grel g to adjacent word w_2 if and only if w_1 itself really bears g—that is, if and only if w_1 is the head of a constituent c that bears g to a constituent on one of w_2's distinction lists. On this interpretation, *Antarctica* bears no grel to *can't*, but *can't* bears to *Antarctica* the grel of expressions with subject complements, and similarly for *fly* in relation to *distresses*.

4.2 Nonstandard Synreps

I note here that without further conditions this scheme is compatible with various sorts of nonstandard synreps, including those with unattached interior constituents (as in Rotenberg 1978), with multiply attached constituents (as in Sampson 1975), and with discontinuous constituents (as in McCawley 1982). Ojeda 1987 discusses the latter two extensions in the standard tree representation framework.

However, it is not clear to me that there is motivation for these extensions in a reasonably rich scheme that incorporates grels. Consider, for instance, 'loosely adjoined' constituents, like the adverbial in

(23) You are, obviously, loony.

One possibility would be to represent it Rotenberg-fashion as an unattached constituent entirely surrounded by the clause

(24) You are loony.

Another possibility would be to represent it McCawley-fashion as a daughter of the top node in a tree, sister to a discontinuous clause. But another possibility would be to represent it as a sister of the constituents *are* and *loony*, but as forming a constituent with neither of them and as bearing a grel to neither of them.

4.3 The Relationship Between Synrules and Synreps

I have left unexplored here the question of how the six types of information in this scheme of synreps are determined from the application of synrules. Though the details are of considerable interest in themselves, it is enough to point out that there is reason to think that the information associated with individual words and with pairs of adjacent words can be derived by recursive definitions building on the (strictly local) information in synrules. The model for this sort of recursive definition is the way individual words are ordered with respect to one another in the standard framework of phrase structure grammar: Each rule orders a set of daughter constituents, and the recursive definition for precedence stipulates that if c_1 precedes c_2, then c_1 precedes all the daughters of c_2, and all the daughters of c_1 precede c_2.

I realize that this is only a promissory note, but it is impossible to be more concrete without making decisions about what I view as still-open questions, questions both about the nature of synrules and also about the nature of synreps as they are relevant to phonology. The exploration of the phonology-syntax connection is still in its infancy; as Kaisse and Zwicky 1987:4 have it,

"At the moment theories must be advanced on the basis of data that are, from the language-internal point of view, rich and complex, but are also, from the cross-linguistic point of view, sparse and diverse."