10.0. Introduction

It is not in dispute that syntax and phonology are interconnected to some extent. Though syntax and phonology are certainly distinct levels, nonetheless the grammar and pronunciation of a language cannot be fully described in disjoint vocabularies with neither description making any reference to the categories employed in the other. The issues discussed here are how far each domain is relevant to generalizations in the other, and in what specific ways. One \textit{a priori} possibility would be that there was unlimited scope for interconnections and cross-references. Another would be that there were certain specific types of information from each domain available to the other. We believe that neither of these positions is the actual one. We hold that there is an asymmetry: certain specific types of syntactic information are indeed available to phonology, but no phonological information is available to syntax. This chapter will be to some extent a brief for this position, as well as a sampler of the recent literature on the syntax–phonology interface.

10.1. Phonology, morphology, and syntax

We take it as established that it is common, perhaps even universal, in the languages of the world for the phonological form of certain linguistic units to depend on nonphonological properties, either of these units or of the constructions they occur in. Certainly the phonological form of a morpheme can depend on nonphonological properties of its own as well as of the morphemes it combines with; for examples and discussion, see Chapters 6 and 7 in this volume, on ‘Morphological theory’ and ‘Phonological theory’. It is also true that the phonological form of a word or phrase can depend on nonphonological properties of its own or of the sentences it occurs in.

In Welsh, for instance, an NP like \textit{cath} [kaɬ] ‘a cat’ or \textit{pob cath} [pobkaɬ] ‘every cat’ in combination with a preposition will have different phonemic forms, depending idiosyncratically on the preposition: \textit{wedi pob cath}
(A) What syntactic information is accessible to phonological rules?

Question A naturally suggests a converse question, about whether nonphonological properties of a syntactic unit can depend on the phonological form of its parts or of the units with which it combines:

(B) What phonological information is accessible to syntactic rules?

Questions like (A) and (B) cannot be usefully explored in a theoretical vacuum. They make sense only against a considerable background of assumptions about the architecture of grammar – about the components of grammar, about the types of representations available in a grammar, and about the nature of the rules within particular components.

We will assume from the outset that grammatical theory will distinguish (one or more components of) phonology from (one or more components of) morphology and from (one or more components of) syntax. It follows that (A) is a distinct question from (A') and (A'') below, and that (B) is distinct from (B') and (B'').

(A') What morphological information is accessible to phonological rules?

(A'') What syntactic information is accessible to morphological rules?

(B') What phonological information is accessible to morphological rules?

(B'') What morphological information is accessible to syntactic rules?

Only (A) and (B) fall within the scope of this chapter. However, the other four questions, which concern morphology rather than syntax or morphology rather than phonology, are easily confused with (A) and (B).
In speaking of 'syntactic information' in (A) and 'phonological information' in (B), we made no commitment as to the number of types of syntactic and phonological representations that might be relevant, nor as to the relationship between such representations and the 'information' referred to in (A) and (B). In part, such matters are simply what is at issue in questions like (A) and (B). But they are also determined to some extent by the choice of theoretical framework, so that (A) and (B) become somewhat different questions in different theoretical contexts.

Consider question (A) with respect to classical transformational grammar, that is, the kind of work that flourished in the period after Chomsky (1965) was published, in which deep structures representing function-argument relations and participant roles for NP referents in basic simple clause types are linked by transformations to surface structures representing linear order and phonologically relevant constituent structure. Classical TG distinguishes several types of syntactic representations. Deep structures are the structures defined prior to any transformational operations. Cyclic structures (Pullum 1979: 154) are the output of the set of cyclic transformations applying within a given cyclic domain. Shallow structures (ibid.) are the output of the entire set of cyclic transformations in all cyclic domains. Surface structures are the structures defined after all transformational operations. In addition, since the syntactic framework is derivational, with different levels of representation related to one another via a series of intermediate representations (corresponding to the application of individual transformations), a host of unnamed intermediate representations is also made available by the framework. In principle, any one of these types of representations might incorporate information relevant to the applicability of a phonological rule.

In fact, it has been suggested by a number of different linguists that information from any of these representations might condition or constrain phonological rules; viz. the espousal of 'global rules' by Lakoff (1970), the suggestion of Baker & Brame (1972: 54) that the classical theory might be 'incorrect in maintaining a strict separation between syntactic rules on the one hand vs. morphological and phonological rules on the other,' the claim by Hetzron (1972: 251–2) that 'there is no clearcut boundary between syntax and phonology,' the echoing of this by Tegey's assertion (1975: 571) that 'a strict separation of phonological from syntactic processes is not possible,' and many other statements quoted in Zwicky & Pullum (1986).

In contrast, in a monostratal syntactic framework, such as that of generalized phrase structure grammar (GPSG) (Gazdar et al. 1985, henceforth GKPS), only one type of syntactic representation, corresponding to the surface structure level of classical TG, is available. Since a tree is defined as well-formed if it meets all the clauses of a single, static definition of admissibility (GKPS: 104), the notion that syntactic and phonological rules might
be interspersed, as some have suggested, does not even make sense. It is a notion that only arises under the classical theory's assumption, shared by current variants of government-binding (GB) theory, of a sequential derivation through a series of transformations, after any of which some phonological rule might in principle apply.

With respect to the representations they posit, standard TG and GPSG share at least one important assumption, however: that syntactic representations are constituent structures; they indicate the way in which contiguous constituents, belonging to specified categories, are grouped into constructs of specified categories. Such representations indicate the boundaries and category membership of syntactic constituents, but do not indicate, directly at least, many types of information that could in principle be relevant for the operation of phonological rules and which are represented explicitly in some other grammatical frameworks. Among these types of information are: (1) which constituent in a construct is the head; (2) among non-head constituents, which are modifiers of the head and which are complements to the head; and (3) for a particular complement, which grammatical relation it bears to its head. We might add that many linguists assume that pure constituent structure frameworks have to be modified to allow not only for the representation of semantically needed constituents that are syntactically absent (examples might be the determiner in *Birds have wings*, the head noun in *the very rich*, or the implicit subject and object pronouns in languages such as Japanese), but also for at least two types of syntactically present but phonologically null constituents: empty anaphoric ones, as in *We tried to θ*, and traces, as in *Who did you see θ?*. Constituent structure-based frameworks are not obviously adequate for linguistic description, therefore. Clear evidence of the phonological relevance of the kinds of information they fail to represent, under conditions that did not allow for constituent structure surrogates to serve the purpose, would provide an interesting kind of evidence from phonology about the character of syntactic theory. We regard many questions in this area as still open.

10.2. Rule types in morphology and phonology

Question (A) potentially has a number of different answers, depending upon what is meant by 'phonological rules'. In virtually every extant theory about how phonological shapes are associated with linguistic units, the task of making this association is divided between the lexicon and the grammar proper, and within the grammar proper the task is parcelled out among several components.

Some aspects of pronunciation belong idiosyncratically to particular words, of course. No sort of generalization predicts that the base form of the
verb go is /gɔ/, that the past tense form of go is *went* rather than *goed*, or that the base form of the causative verb related to die is *kill* rather than die. Some aspects of the pronunciation of words, on the other hand, can be predicted from other of their properties. The dividing line between aspects of pronunciation that are predicted by rule and aspects that are stipulated in lexical entries is a matter on which phonological theories diverge dramatically.

Moreover, the very far-reaching changes in phonological theory that have emerged over the past ten years (since the publication of such works as, for example, Goldsmith 1976; Kahn 1976; Liberman & Prince 1977) have introduced a vast range of relevant new questions about different aspects of phonological structure. Morris Halle has presented in various public lectures the notion of a structural representation for a sentence as an object with the topology of a spiral-bound notebook, the string of phonetic segments being set out along the spine and the different pages providing structural descriptions of that string in different descriptive vocabularies (metrical structure, autosegmental tone representation, CV skeletal structure, morphological structure, syntactic structure, and so on). Ultimately we have to understand, for the entire n-dimensional cartesian product, which pages of the notebook can make reference to which information on which other pages.

Thinking on these questions within the TG investigative paradigm has traditionally been oriented toward thinking about derivations. Process-oriented derivational metaphors have been extremely potent and long-lived, but in our view they have obscured matters as often as they have illuminated them. We regard the limited (but still insufficient) move toward nonderivational thinking in generative linguistics as eminently desirable and long overdue. The issue of syntactic influence in phonological rules, for example, is not about whether a 'late' rule in the phonology may 'look back' at the syntactic description to 'see what was there,' but whether allocation of phonological properties may be contingent on facts about the syntactic environment. Likewise, the issue of phonological influence in syntactic rules is not about 'peeking ahead' at the phonology, notwithstanding the many places in the literature where this phraseology has been used; see Cornulier (1972) for one example of alleged 'peeking', and Sadock (1985: 436) for a hint of how the portmanteau morphs discussed by Cornulier might be analyzed.

In the next five subsections we will very briefly review our conception of the phonological and morphological parts of the grammar. The theory we sketch is not known from the literature; it draws distinctions that have not hitherto been drawn consistently, or at all. We present it here, however, because we have found the framework it provides to be very valuable in clarifying the ways in which syntax and phonology mesh together.
Regularities in the lexicon

The lexicon is the repository of unpredictable phonological information about words. But it does not, we suggest, contain only unpredictable information. Rather, a lexical entry contains a phonological base and also a list of word forms. Thus the entry for go will contain not only a phonological base /gə/ but also a list of word forms: goes (3rd sg. pres.), went (past), gone (past ptcpl.), going (pres. ptcpl.), go (default).

Some aspects of the shape of word forms are predictable via general principles, at least insofar as special idiosyncrasies do not interpose themselves. There will doubtless be principles of derivational morphology, i.e. word formation, though we will say nothing about them here. There may also be lexical implication principles (more usually known as lexical redundancy rules). Lexical implication principles state correlations between properties of lexical items, and we tentatively assume that they may mention phonological properties; for example, if there were a language where all verb stems had the shape CVC, a lexical implication principle could express the generalization that the morphosyntactic feature ‘verb’ implies the phonological form CVC. We suspect that clear cases of this sort are rare to the point of being nonexistent, but we do not entirely rule out the possibility of phonological reference in the special case of generalizations about the form of classes of words. Accidents of history could in principle have a language with generalizations of this sort holding of its lexicon (for example, as C. E. Bazell once pointed out, none of the monosyllabic verbs of English that are phonologically palindromic have irregular morphology; this looks like a coincidence to us, but it is exceptionlessly true). Conceivably, a descriptive linguist might want to incorporate such a generalization into the description of the lexicon. This would not, we submit, constitute a challenge to the claim that syntactic rules do not refer to phonology.

Inflectional allomorphy statements

It is uncontroversial, almost definitional, to say that inflectional allomorphy rules are rules of realization: they are statements about the phonological form that is associated with certain elements characterized in morphosyntactic terms. But we propose that two basic types of rule should be recognized: rules of exponence and rules of referral. Rules of exponence state correspondences between morphosyntactic categories and morphophonological operations; a typical example from English morphology would be (informally): ‘the category FUTURE VERB, PAST TENSE is realized by the operation of adding the suffix -ed.’ Rules of referral state correspondences between morphosyntactic categories and stipulate that they have the same rule of exponence; a typical
example would be: 'the category verb, past participle has the same realization as the category finite verb, past tense.'

As should be obvious (since the foregoing examples do not express exceptionless claims about English), all realization rules are defaults rather than absolute conditions. Rules imposing more specific conditions override them.

2.3. Conditions on shape

Quite distinct from the realization rules of inflectional allomorphy are shape conditions, which are sensitive to more than just the internal feature composition of words. Shape conditions override not only other phonological rules but even lexical entries. We distinguish three types of shape condition, involving (1) filtering, (2) realization, and (3) referral.

Filtering shape conditions are a proper subset of the well-known class of constraints referred to in the transformational literature as 'filters' (Chomsky & Lasnik 1977), 'surface structure constraints' (Perlmutter 1971), or 'output conditions' (Ross 1967: ch. 3). They state local constraints on permissible morphological and phonological realizations of word sequences in ways that have often been cited as illustrative of phonological conditions on syntactic structure (Perlmutter 1971: ch. 3; Hetzron 1972: section 4.2; Schachter 1974; Rivero & Walker 1976; and many others works). We assume that they may be sensitive to the superficial syntactic properties and the basic (underlying) phonological form of more than just one word, which is why they cannot be regarded as a part of the morphology, with which they otherwise have something in common. (Clear evidence that underlying phonology is the level referenced, rather than some more superficial 'phonemic' level, is not available, incidentally; we consider this to be a topic that needs further investigation.)

Our position is essentially identical to the one defended by Perlmutter (1971: esp. ch. 3), though we will ignore the question of whether linguistic theory countenances positive filters, negative filters, or both, to which Perlmutter devotes some attention. It seems very likely to us that this issue has no content: a positive filter requiring structures to meet condition C is equivalent to a negative filter blocking structures that meet \( \sim C \), and given only that C is a recursive predicate in the sense of recursive function theory, any filter could be phrased either way.

Filtering shape conditions appear to be needed to capture some generalizations, such as the ill-formedness of strings with sequence of articles in English (*a the Hague shipping company, *an 'A Chorus Line' performance, *the 'The Gables' on Main Street), the prohibition against sequences of adjacent identical clitic pronouns in many languages, the constraint against
sequences of adjacent infinitives in Italian (Longobardi 1980), and so on. For a particularly clear case, see the study of Tagalog clitic order by Schachter (1974).

Filters are strictly local (i.e. they do not make reference to variables over infinite classes of strings); in fact all the cases we are aware of refer to nothing more than two adjacent lexical items. Because of this, there is a very large part of the domain of syntax that filters (in our sense) cannot in principle express. Nonetheless, some have assigned a wider role to filters than we would. Thus some claimed examples of filters discussed in the literature certainly do not meet the definition of filtering shape conditions. The filter "*[V adjunct NP], NP lexical' in Chomsky & Lasnik (1977: 479) does not, for example (it is a constraint on constituent order intended to claim that a lexically filled direct object NP cannot be legally separated from the preceding verb by an adjunct such as an adverb or PP). We are concerned here solely with filters that state conditions on the morphological and phonological composition of word sequences.

Other alleged filters may not be rules of grammar at all. For example, the 'doubl-\-ing constraint' of Ross (1972), relevant because Ross argues that several distinct suffixes pronounced ing cause ungrammaticality if they appear on adjacent words, has been argued by Bolinger (1979) to be an illusion. The phonetically ugly effect of two adjacent words with similar endings can, if the rhythmic structure enhances the ugliness, sound strikingly unacceptable, but no grammatical condition need be postulated, he suggested. It is continuing raining is no more ungrammatical that It's rotten to have gotten forgotten, though both are phonesthetically inept.

It may turn out that no filters are genuinely needed in syntax, in which case the relative autonomy and non-uniformity of the components of grammar would be even clearer; but at present we assume at least a small amount of evidence supports them.

Realizational shape conditions can be illustrated by reference to the familiar fact of English that the indefinite article is a when followed by a consonant but an when followed by a vowel. This is not part of the lexical entry for the word, because it refers to the following syntactic context. It is not a phonological rule of English, for it applies only to the indefinite article and has no general applicability to phonological domains. It is a condition on shape that overrides the lexical entry for the indefinite article and stipulates that another shape is called for.

Referral shape conditions can also be illustrated with a fact about the phonological form of articles. In Spanish, when the definite article is adjacent to a feminine singular noun that begins with a vowel, its normal shape, la, is discarded, and the shape assigned instead is that of the masculine
article, *el*. Clearly syntactic factors are at work here; for example, a prenominal adjective beginning with a vowel does not trigger the referral even though a homonymous noun does (cf. *la alta torre*, 'the high tower,' but *dar el alta* '(re)assign to military service' not *dar la alta*, even though the noun *alta* is feminine). Thus although it is conceivable that a phonological account could be given of these facts, it seems to us that an account in terms of a referral shape condition is more plausible.

Summarizing, we observe that there is some support for directly stated conditions governing the allowable shapes of particular sequences of adjacent words, and we regard these as evidence of conditions stated on the interface of syntactic structure and phonological realization, not as evidence of intermingling or interaction across the boundary.

10.2.4. Morphonology

The allomorphy rules and shape conditions mentioned so far can all be thought of as stating constraints on the phonological form an item can take. Clearly, morphological and morphosyntactic rules make reference to, and determine, phonological facts. However, Dressler (1985) has clarified at length a very important distinction between phonological aspects of morphological statements on the one hand, and rules of what he calls *morphophonology* on the other.

Morphonology embraces those aspects of phonology that are concerned solely with the phonological realization of morphemes in phonological contexts but are nonetheless conditioned in part by morphological or syntactic factors. Vowel harmony alternations seem in general to be governed by morphonological rules, as are the Finnish consonant gradations. Dressler's extended examples (1985: chs. 6, 7) are certain palatalizations of velars in Italian and Polish. One difference between morphonology and morphology/morphosyntax is that we assume that rules of morphonology may well be formalized as processes converting one phonologically defined shape into another, whereas in our view morphological rules should not be.

A defining characteristic of morphonological rules is that although they operate on phonological inputs they are not blindly applicable to items of the appropriate shape in the appropriate contexts; lexical properties conferring exceptional status may cause some apparently eligible items to be ineligible, so there may be items whose phonetic form appears to contradict a morphonological rule. Morphonological rules are, in a word, nonautomatic (see Kiparsky 1973: 68, for an explicit definition of this term).

The morphonological rules that apply in phrasal domains are the *rules of connected speech* or *rules of external sandhi* of Kaisse (1985): they are nonautomatic, morphosyntactically sensitive rules of phrase phonology. Kaisse's
own examples (ch. 7) are French liaison, Ewe tone sandhi, Italian syntactic doubling (raddoppiamento sintattico), Mandarin tone sandhi, and Kimatuumbi vowel shortening.

10.2.5. Phonology

We shall reserve the word phonology for the remainder of the rules mapping syntactic and lexical representations into phonetic. A more explicit term would be automatic phonology, but it seems preferable to use a one-word term if confusion will not result. To some extent, our usage represents a return to an earlier tradition in American linguistics, when phonology (or phonemics) was assumed to be purely automatic and not morphosyntactically conditioned. Phonology, then, consists of the rules which have effects only on phonetically defined material and which are automatic in Kiparsky's sense.

This class of rules is heterogeneous. It includes the automatic morphophonemic rules (like the one governing the /s/~/z/ alternation in English cats and dogs), i.e. the rules that may neutralize surface contrasts but nonetheless do this in a way that does not depend on membership in morphological or syntactic exception classes. It includes allophonic rules, both obligatory and optional. The familiar argument given by Halle (1959: 22–3) against the level of autonomous phonemics is thus no paradox for this conception of phonology; Russian devoicing is a phonological rule in our technical sense, though sometimes morphophonemic and sometimes allophonic.

A defining feature of phonological rules is that they have prosodic, not morphosyntactic, domains of application. In so far as they apply across word boundaries, they coincide with what are referred to as fast speech rules by Kaisse (1985); an example is the rule of American English that turns intervocalic /t/ into a voiced apico-alveolar flap (Kaisse 1985: 25ff).

10.3. Syntax in morphology and phonology

Given the articulated theory of the mapping between syntax/lexicon and phonetics that we have sketched, a question about syntactic influence on phonology is likely to split into a number of distinct questions with differing answers. To agree that shape conditions make reference to syntactic structure is not by any means to admit that allophonic rules can do the same, for example.

Some things are almost indisputable. One sort of syntactic information that is certainly necessary for morphophonological and even strictly phonological rules is the location of word boundaries; that this much is needed is a
view that goes back at least to Pike (1947). But other matters are less clear. And because generative phonologists have not in general assented to a strict articulation into components such as the one we advocate, the literature on syntax–phonology relations over the past thirty years can be somewhat frustrating to someone seriously interested in this topic. For example, Postal (1968: ch. 6) has an extended discussion headed ‘Nonphonetic properties in phonology’ arguing emphatically that there is syntactic influence on phonology, but he does not provide much of a basis for characterizing such influence.

Postal asserts that underlying phonological representation must contain the full surface syntactic structure of the sentence because some phonological rules are sensitive to such ‘categorial properties,’ and in English ‘the rules of stress assignment are largely of this character . . .’ But a close examination of the stress rules in Chomsky & Halle (1968) reveals very little that actually depends on syntactic category or constituent structure (as opposed to broader notions like ‘beginning of a word’ or ‘end of a stressful constituent’), and in some reanalyses, e.g. that by Fudge (1975), this is even clearer, morphological conditions being abundant but syntactic ones virtually non-existent.

Some generalizations abstracted from Chomsky & Halle’s work that related English stress to syntactic category are cited by Kenstowicz & Kisseberth (1977: 77–8); for example, in verbs and adjective but not nouns, ‘stress appears on the final syllable if it . . . ends in more than one consonant.’ Kenstowicz & Kisseberth cite pairs like ásterisk (N) vs. éléct (V) to illustrate this. Now, of course, linguists use the word asterisk as a verb (sentences are asterisked to indicate ungrammaticality), and the stress pattern is not changed to the expected verbal stress pattern *asterisk. There is some very insightful and well-supported discussion of facts of this sort in Kiparsky (1982: 11–12ff), the upshot being that surface syntactic structure is exactly what the stress rule does not look at; stress is sensitive (in a fairly exception-ridden way) to lexical classes of words, in a way that we might wish to analyze using lexical implication statements (and which for Kiparsky is the domain of level 1 word stress rules). The summary by Kenstowicz & Kisseberth oversimplifies; just because some syntactic category membership is relevant to some stress assignment rule, that does not imply that the phonological rules have access to surface syntax. The access to the relevant information could be entirely mediated by the lexicon, as it is in Kiparsky’s theory.

After mentioning English stress, Postal gives two Mohawk examples as further illustrations of syntactic reference in phonology. He claims that ‘no Verb may have less than two vowels in its phonetic representation’ (p. 116) and that ‘word initial glides drop in nouns’ (p. 118); but it is not at all clear
that these are morphonological rules in our sense rather than, as we suspect, rules of allomorphy. The rest of this chapter pertains exclusively to nonphonetic lexical features, and not to syntax.

We do not wish to claim that morphonological rules cannot make reference to syntactic category. Kenstowicz & Kisseberth (1977: 78–83) cite several examples that suggest that they can: a tonal downstep rule in Igbo that applies only to nouns, a vowel shortening rule in Hausa that applies only to a verb followed by a direct object noun, a palatalization rule in Dakota that applies only to a lexical subclass called the ‘active’ verbs, an accent retraction rule in Russian that applies only to feminine and neuter plural nouns, and a voicing rule in Rundi that applies only in a morpheme immediately preceding a root. We suggest, however, that such rules are not as common as some accounts would imply, and that some of Kenstowicz & Kisseberth's cases may turn out on closer analysis to be allomorphy rules or shape conditions rather than morphonological rules in Dressler's and our sense.

Placement of sentential accent is a topic that has led some linguists to postulate much more extensive integration of syntactic and phonological information than has been established elsewhere. Bresnan (1971a) is a particularly interesting example, allowing phonological rules to apply interspersed between transformational cycles in the syntax. However, we have criticized the reasoning that led Bresnan to regard sentence stress as syntactically predictable (Pullum & Zwicky 1984; see also Berman & Szamosi 1972 and Bolinger 1972 for earlier critiques), and Culicover & Rochemont (1983) have recently provided an important reanalysis of this domain. The Culicover & Rochemont analysis does not postulate Bresnan's interleaving of syntactic and phonological rule applications, and thus does not carry the implication that phonological properties of subordinate clauses are in principle accessible to syntactic rules on later cycles (cf. Lakoff 1972: 301 on this point).

It is clear that assignment of stress and intonation contours to sentences will refer in certain ways to the surface constituent structure of sentences. But we do not believe that the non-surface strata of syntactic representation that various theories postulate (be they the functional structures of lexical-functional grammar, the D-structures or other strata of GB, the initial grammatical relations of relational grammar, or ‘logical form’ representations of whatever sort) have been clearly shown to play any role in phonological rule systems.

Two celebrated cases from the non-prosodic phonology of English have often been argued to provide evidence that at least some information from syntactic representations at non-surface strata has relevance to phonology. These are the phenomena of ‘auxiliary reduction’ (the pattern of strong
and weak phonetic forms of function words such as auxiliary verbs and prepositions) and to-contraction (the encliticization of infinitive-marking to onto certain verbs. The literature on these two sets of facts (wrongly implied to be a unified class of facts in some works, e.g. Lakoff 1970) is now enormous, and we cannot review it thoroughly here. We have space only to provide a rough sketch of the competing lines of theoretical attack, which we do in the next two subsections.

10.3.1. Strong and weak phonetic forms in English

As Selkirk (1972: 160, n. 1) observes, the fact that English has strong and weak phonetic forms for certain minor grammatical elements was noted as early as 1890 by Henry Sweet in his Primer of spoken English, and all careful phonetic descriptions of English pay some attention to them. The full description of the phenomenon is a complex business, involving automatic morphophonemic rules like assimilation of voice in fricative suffixes, allomorphy rules for the various auxiliary verbs, and syntactic conditions on a pre-phonological cliticization (see Selkirk 1972: 22ff; Kaisse 1985: 40ff). The facts that have been of most interest to generative grammarians concern the syntactic conditions, and were pointed out by King (1970); they involve contrasts like I know where it is and *I know where it's, and the acceptability judgements involved are extremely clear in most cases. Selkirk notes (22–37) that not only auxiliaries like is are involved; pairs like Who are you looking at? and Look at that! show a clear difference in the phonetic form of at under analogous syntactic conditions. The descriptive problem we are concerned with is how to characterize the conditions.

Five main lines of analysis are represented in the literature. The first is informally suggested by King (1970), and more explicitly endorsed by Lakoff (1970). It claims that if the constituent immediately following an auxiliary verb is moved or deleted by a transformation, the auxiliary in question is ipso facto forbidden to contract. The arbitrariness of this approach should be apparent: linguistic theory offers no reason whatever to suppose that deletion or movement of a constituent would affect the phonological behavior of some adjacent constituent. Moreover, it incorrectly predicts that contraction will be blocked in Where's the party?, since where is immediately after is at an earlier stage of the derivation in all transformational accounts.

The hypothesis of Bresnan (1971b) is something of an improvement. Bresnan proposes that a procliticization rule applying during the syntactic cycle attaches auxiliaries to their immediately following constituents. The inability of the auxiliary to contract in I know where it is to yield *I know where it's is explained under the assumption that once 's has cliticized onto
where, the structural description of wh-movement is not met. However, Selkirk (1972: 74–93) provides convincing arguments that this counterintuitive but ingenious analysis does not work correctly. (The arguments are complicated, and we omit them here.)

Selkirk’s own proposal is that word boundary symbols are placed in syntactic terminal strings at deep structure and remain when transformations move or delete elements. A rule called the ‘monosyllable rule’ that weakens stress level on auxiliaries (and also other ‘dependents’ that Selkirk incorporates into her account) is blocked by a following sequence of two or more word boundary symbols, so moving or deleting a constituent (or inserting a parenthetical constituent) immediately after such an element prevents the monosyllable rule from applying.

There is no crucial support for Selkirk’s assumption that deep structure is the level at which word boundaries are inserted. Cyclic rules like there-insertion do not disrupt auxiliary reduction (cf. There’s a moon out tonight, with deep structure [a moon is out tonight], but *He’s, I think, out tonight). Her account would have the same consequences if modified in such a way as to have word boundaries inserted at the end of each syntactic cycle (Pullum 1979: 162–8), which would mesh well with the hypothesis of Bresnan (1971a, b) that there is a class of phonology-related rules that apply at the end of each transformational cycle in the syntax.

An account along the lines of Selkirk’s achieves a very considerable measure of success in accounting for the facts. Moreover, Kaisse (1983) shows that it continues to do well when a range of new facts about auxiliary reduction are considered. But Selkirk herself has described the actual mechanical details of her (1972) analysis as involving ‘a certain amount of formal legerdemain’ (1984: 446, n. 41), and it must be acknowledged that her rejection of the view that an encliticization rule is involved, and the dependence of her analysis on the peculiar assumption that constituent boundary markers can be stranded by movement rules, have probably stimulated the search for a more elegant and unified account of the facts.

That search is not over. Selkirk (1984: 401) now accepts that a cliticization rule brings auxiliaries and other dependent items ‘junctionally . . . closer to what precedes,’ agreeing with most work on the topic, and argues for a ‘rhythmic restructuring’ rule, which ‘alters only the metrical grid alignment of the sentence, affecting syntactic relations not at all’ (1984: 405). Selkirk leans toward a purely prosodic explanation, in other words.

Some significant ongoing work based on the assumption that there is a syntactic principle involved is that of Karen Zagona and others at the University of Washington (see Kaisse 1985: ch. 3, for some details and references). The line of attack is related to an idea put forward by Wood (1979), namely that what is wrong with a string like *I know where it’s is that
it has a wholly empty VP in its surface syntactic structure, the cliticization of is having shifted out the VP's only member. The strategy they are pursuing is to attempt to make Wood's idea follow from a more general principle, viz. the 'empty category principle' of GB (see Chapter 2, on 'Syntactic theory' in this volume).

We have insufficient space to review the recent literature in detail here, but we wish to make one observation about the trend we observe. Selkirk (1984), Kaisse (1985), and other recent works seem to share the assumption that only surface syntax is relevant to the solution of the auxiliary reduction puzzle. In Selkirk's view, this is because of a more elaborate and highly structured conception of phonology; in that of Kaisse and others, it is because of a conception of surface structure that embraces empty categories. But both confirm the generalization that phonology accesses only surface syntactic form.

10.3.2. Contraction of the infinitival marker

A large literature has developed around the phenomenon we will call to-contraction, found in pronunciations like the one graphically represented as wanna (for want to). (At least the forms wanna, gonna, hastia/hasta, gotta, oughta, uesta, and suppostas/posta are relevant; some writers claim that there are others.) Again, the situation is complex, involving fast speech rules of English (the relation between [wanta] and [wana] can clearly be connected to the reduction of [winter] 'winter' to [wina]) but also special lexical and syntactic conditions. The discussion in the literature rarely touches on the phonological rules involved, concentrating on the syntactic conditioning. Much of the literature has been predominantly polemical in its aims; the argument of Lightfoot (1976) that to-contraction has relevance to claims about 'trace' and 'PRO' to syntactic theory stimulated a long series of papers arguing for or against this conclusion, and analyzing the facts of to-contraction only in passing. (The debate up to that point is summarized, from a standpoint opposed to Lightfoot's conclusions, by Postal & Pullum 1982. The dispute continued until the winter of 1986, when as three more papers on the topic appeared, the editor of Linguistic Inquiry took the unprecedented step of declaring a moratorium.)

The descriptive problem that is involved can be encapsulated in this observation: while the want to in Who do you want to see? can be contracted to wanna, the same word sequence in Who do you want to see this memo? cannot. (A large percentage of English speakers agree on this judgement, though the percentage is by no means one hundred.) Why the difference? There have been at least six basic proposals around which specific answers to this question have been developed.
First, there are analyses which in effect state global conditions. Lakoff (1970) implies such an account. The idea is, roughly, to say that the presence of who between want and to at an earlier point in the derivation blocks the pronunciation of want to as wanna: the phonology is sensitive not just to the string being phonetically interpreted but also to the representation of it that is found at a distinct and less superficial stratum of the derivation. A problem arises in that classical derivations of I wanna leave from [sI want [sI leave]] make it unclear why wanna is not forbidden here too; but Pullum (1979: 161) offers a version of this sort of account that covers the facts correctly in classical TG terms, by identifying the stratum that must be referred to (the end of the transformational cycle on the clause most immediately containing the crucial verb).

Second, Bresnan (1971b) offered a solution that depended on ordering of rules: a rule joining want and to together syntactically was stipulated as applying at the end of each transformational cycle. Crucially, even if you want to see . . . is assumed to be derived from a structure like you want you to see . . . by ‘equi-NP deletion,’ want and to will be adjacent by the end of the cycle on the want clause in Who do you wanna see?, whereas in Who do you want to see this memo?, the NP who would still intervene at the corresponding stage, and the structural description of the rule would not be met. The proposal of van Riemsdijk & Williams (1981) is in effect a theoretical rephrasing of Bresnan’s approach.

Third, numerous authors (too many to cite here) have maintained that the inhibiting factor for to-contraction is the presence of a ‘trace’ between want and to. This idea originates with Baker & Brame (1972), and was first worked out in detail by Selkirk (1972), though the (essentially phonological) form it took in Selkirk’s work was very different from the form it took in later works such as Lightfoot (1976) and Chomsky & Lasnik (1977). The problems with the idea have always been of the same sort: under assumptions that were needed for other purposes, there always turned out to be additional traces that blocked contraction incorrectly in some environments (see Postal & Pullum 1982 and previous works cited there).

Fourth, there have been several proposals that to-contraction is sensitive to the relation of government: the verb (want, or whatever) must govern to if contraction is to take place, where ‘governs’ is not the traditional notion of that name but is a technical notion usually explicated in terms of a relation between nodes such as c-command (see Pullum 1986). The first such proposal seems to be that of Bouchard (1982). Given a carefully phrased definition of the government relation (many different definitions have been offered, and many are poorly drafted) and appropriate ancillary assumptions, a close approach to covering all the relevant facts can be achieved in these terms.
Fifth, it has been suggested (first by Frantz 1977) that to-contraction takes place in precisely the contexts where 'clause union' (also known as 'verb raising,' 'restructuring,' etc.) is observed in many languages. Taken together with the claim that the correct analysis of to is as an auxiliary verb (independently argued in Pullum 1983), the claim could be strengthened to make to-contraction actually an instance of clause union, with a matrix verb like want uniting syntactically with the verb (to) of its object complement clause.

Finally, it has been repeatedly suggested that lexical rather than syntactic uniting might be in evidence, i.e. that wanna, gonna, etc. might be lexical items. However, this has never been more than a brief aside on the part of those suggesting it. No one has worked out in detail a defensible analysis in such terms that it overcomes the morphological problems it raises – problems that seem to us insuperable (the alleged lexical item wanna in I wanna lacks all the word forms that are found in she wants to, we wanted to, wanting to, etc. – precisely because it is not really a word at all, we would claim).

We draw from this bewildering profusion of analytical proposals just a single point: more recent analyses almost uniformly agree on one thing, namely that it is surface syntactic structure (moreover, a very small portion of the surface syntactic context, local in terms of both adjacency and bracketing) that is relevant for the determination of whether a given word sequence can have the contracted pronunciation.

10.3.3. Other cases

The two causes célèbres from English morphology and phonology that we have just reviewed are not in any sense more important or instructive than dozens of other cases we could have discussed.

Selkirk (1972) has an extended discussion of the phenomenon of 'liaison' in French. For certain speakers in certain styles, normally elided final consonants are retained; thus we find phrases like elle est oubliée [el etblije] 'she is forgotten' with est pronounced [et] before the vowel [u], but ce qu'elle est ou ce qu'elle a fait [skeluskelaf] 'what she is or what she has done' with est pronounced as [et] before the same vowel. Selkirk analyzes liaison using mechanisms identical to those she employs for English phonological reduction rules; the intuition is that a following major boundary inhibits liaison (or reduction), and a following weak boundary permits it.

Napoli & Nespor (1979) argue that the rule of initial consonant gemination in Italian is sensitive to the syntactic notion 'left branch' (but in the surface constituent structure, as our general position would predict).

The Celtic mutation phenomenon, mentioned in 10.1 above, is highly
sensitive to aspects of syntactic structure (but see Zwicky 1986 for an analysis reducing the syntactic reference somewhat).

Numerous other syntactically conditioned phenomena (tone sandhi rules, for example, which we do not treat here at all) could be cited, and many important questions remain open about the exact nature of the fit between syntax and phonology that these phenomena imply. What we believe to be true of them, however, is that recent trends in linguistics have somewhat decreased the emphasis on syntactic involvement in phonology, somewhat increasing the role of phonologically defined prosodic structures of various sorts, and that the syntactic reference that linguists can generally agree to be necessary is to superficial, not more abstract, syntactic structures.

10.4. Phonology in syntax

In this section we consider question (B), the question of what syntactic phonological information is available to syntactic rules. Large numbers of published arguments have attempted to establish that there can be phonological influence on syntactic rules. Hetzron (1972) and Rivero & Walker (1976), for example, are independent (and non-overlapping) reviews of several such putative cases. However, after close examination of every case that has been brought to our attention over the past fifteen years, we remain convinced that the extent of truly phonological influence on truly syntactic rules is zero. The cases that have been put forward are of extraordinarily diverse sorts, but fall into clear categories. We will attempt to give a brief overview here.

We will assume that it is fairly straightforward to identify information as phonological: if it is phonological information it will have a direct correspondence to an interpretation in phonetic (articulatory, auditory, or acoustic) predicates. Phonological information will thus include information about properties like voicing, nasality, stridency, vowel height, tone, stress level, syllable count, syllable structure, and so on. (We ignore here certain attested types of human language, in particular the sign languages of deaf communities, not because of a policy decision but simply because we know too little about the analogous issues for those languages.)

A genuine violation of the principle of phonology-free syntax would be a generalization about a specific language which is correctly expressed as a syntactic rule referring to phonological constructs. An apparent violation could thus fail to be genuine in any of the following five ways.

(i) The generalization might be spurious.
(ii) A real generalization might involve not a rule, but rather a preference or tendency.

(iii) A real generalization might involve a rule not of grammar, but rather of some extragrammatical domain.

(iv) A rule of grammar might be located not in the syntactic component, but rather in one of the other components: for example, it might be a morphological rule.

(v) A rule of grammar might be subject to a phonological condition or constraint that is universal, and therefore is not to be stated as part of the rule.

We have encountered many examples of each of these in the literature. We will try to illustrate each mode of failure briefly, or at least clarify what would count as an instance of it.

10.4.1. Spurious generalizations

In a number of cases we have examined, alleged generalizations involving phonological conditions in syntax simply turn out to be spurious: there is no generalization to capture. An example would be the occasionally encountered suggestion that the dative movement rule in English is subject to the phonological condition that the triggering verb should be monosyllabic (thus we have give someone something but not *donate someone something, send someone something but not *contribute someone something, and so on). Of course, in current grammatical frameworks there is no syntactic rule corresponding to dative movement anyway; under GB theory movement into object position is impossible, so that the relationship in question would be a lexical one concerning multiple subcategorizations, and under GPSG and LFG the same would be true a fortiori. But even when we consider a framework like RG, which would certainly state the analog of dative movement as a syntactic rule, we find that the generalization evaporates. Dative movement verbs include promise, offer, cable, advance, permit, deliver, telephone, and guarantee, none of which are monosyllabic, and, on the other hand, the dative movement construction is not found with lift, raise, lips, yell, prove, or voice, which are monosyllabic and do permit the construction V NP to NP. Monosyllabicity is neither a necessary condition nor a sufficient one for a verb to admit the dative movement construction.

The proposed analysis of some interesting facts of Somali agreement discussed in Hetzron (1972: section 5) seems to represent another case of a spurious generalization. Hetzron notes there are Somali sentences in which a subject noun, the article in the subject NP, and the obligatory resumptive
subject pronoun are masculine plural but all happen to 'look' feminine singular, through accidents of (i) irregular noun plural formation, (ii) morphological ambiguity in pronouns, and (iii) gender polarity-switching in articles and in the gender-indicating tone patterns of nouns. In such sentences, the verb may optionally show feminine singular agreement form instead of the expected masculine plural. Under Hetzron's interpretation of these facts, the verb agreement is a 'playful' reflection of the superficially feminine-looking phonology of the sentence, and a syntactic account deprived of access to phonological properties cannot capture what is going on. Zwicky & Pullum (1983b) shows in detail why this is not so. Phonological references in a syntactic rule would come nowhere near what would be needed to formalize what Hetzron suggests is going on. The phonology of distinct sentences with feminine nouns (feminine nouns that do not exist in the language, moreover) would have to influence the syntax of sentences with masculine plural nouns. Such a trans-sentential constraint is not countenanced in any current accepted theory of grammar, and no theories in which they can be stated seem to have been seriously developed. Our own description of Somali agreement is simple and unsurprising: an optional rule assigns the feminine singular agreement form to verbs whose subject NPs contain irregular masculine plural nouns. The fact that there are suggestions of feminine-like phonology in the sentence where this occurs may be part of the explanation of how this rule developed historically, but in our account it is not (and could not be) part of the synchronic grammar. Our description makes verb agreement depend on morphological properties of subject nouns (as it does in many languages, e.g. the Bantu languages), but it does not involve reference to phonology in the syntax. Such reference not only is not needed, but apparently could not do what needs to be done.

Preferences and tendencies

Some putative cases of phonological influence on a syntactic rule illustrate in fact only a phonetic aspect of a preference for some form of expression over another, or a tendency for some collection of properties to cluster. Thus we find Chomsky & Lasnik (1977: 433) remarking that they assume 'stylistic rules' apply after phonological rules have applied, and 'may refer to phonetic properties.' No basis for this surprising assumption is cited, but it seems likely to us that what Chomsky and Lasnik have in mind is the well-known group of phenomena involving apparent 'heaviness' effects in syntax (first discussed by Ross 1967: ch. 3). We note also that Fiengo (1974: 85) claims that it is more felicitous to right-shift the position of a long word than a short one (his examples - none too convincing – are I found in the dictionary the word
flaucinaucinhilipilification vs. I found in the dictionary the word amah). He concludes that ‘Heavy-NP Shift is not a transformation’ because the crucially phonetic length property 'cannot be stated as a Boolean condition on analyzability.' Thus Fiengo appears to agree with Chomsky and Lasnik: there are phonetically sensitive movement rules that are not ‘transformations’ in the strict sense.

The view that there are both movement transformations that cannot refer to phonology and later movement rules that are not transformations but can refer to phonology is highly permissive. It is hard to imagine what interactions of phonology and syntax it rules out. Certainly, imaginary rules like ‘A verb moves to sentence-initial position if it contains a liquid’ (Perlmutter 1971: 87) or a rule fronting time adverbial phrases if the first segment of the head adverb is not [b] (Zwicky 1969: 413) would appear to be permitted by it. This seems both undesirable and unnecessary.

Suppose it were the case (which we do not think it is to any significant extent) that passive sentences were judged to sound better than corresponding actives if the agent phrase was phonetically long and the patient NP was short (e.g. if The Llanfihangel-y-Creuddyn rugby team beat Rhyl were consistently judged less acceptable than Rhyl was beaten by the Llanfihangel-y-Creuddyn rugby team regardless of discourse context.) The obvious conclusion, we submit, would be that the choice of syntactic construction could affect the prosodic properties of the sentence and thus the stylistic acceptability, but that no syntactic condition was involved, since presumably even Chomsky, Lasnik, and Fiengo would not suggest that a construction as centrally syntactic as the passive is defined in partly phonetic or phonological terms. Exactly the same can be said about the rightward shifting construction referred to as ‘heavy NP shift’, so the postulation of a class of ‘stylistic rules’ that can move constituents but can also access phonetic properties is quite unmotivated.

We note that Fiengo himself, rejecting his earlier position, has since argued (1977: 48–9) that whatever phonetic heaviness condition there may be on the heavy NP shift construction, it cannot be on the rule itself, but must be a surface-structure ‘filter that evaluates the output for relative heaviness’ of VP constituents. This is exactly as argued by Ross (1967), not cited by Fiengo. We would simply add that we do not think the evaluation of relative heaviness is the work of a component of grammar at all. What is correct is that the crucial factor influencing the acceptability is simply whether a long and complicated constituent has been placed at the end of the sentence or not, and no syntactic rule needs to deal in issues of 'relative heaviness'. What is not correct is that the stylistically poorer sentences with nonfinal heavy constituents are linguistically ill-formed; they are simply not preferred by
speakers, probably for processing reasons (crudely, it is easier to complete a lengthy processing chore if there is nothing left on the stack to return to when it is done).

0.4.3. Extragrammatical domains

Some cases of alleged syntax–phonology interpenetration that linguists have cited involve rules that are perfectly genuine but simply do not belong to the grammar of the language concerned. The domain that is confused with grammar most frequently seems to us to be that of verbal art and play. To cite just one example from a fairly rich field, we believe that the infixing of expletive forms inside English compound words (Santa-bloody-Cruz) or even morphemes (Kalama-goddam-zoo) is better understood as a kind of verbal game than as a grammatical rule of English. This is not to say that there are not intricate connections between the phonological structure of English and the ways in which expletives can be inserted; attempts like ?Los-bloody-Angeles and ?Abi-goddam-lene sound thoroughly lame, for thoroughly phonological reasons (see McCarthy 1982 for an interesting metrical study). Nonetheless, the word coinage involved here looks to us like a verbal game, at which some speakers will be much better and more creative than others (see McCawley 1978 for some informal experimental evidence that this is indeed the case). It is not a part of the syntax of English, but rather, it is something verbal that (some) English speakers do with their language. (See Zwicky & Pullum 1987 for further discussion.)

0.4.4. Nonsyntactic rules

Where a rule of grammar is involved, it is not necessarily a syntactic rule, even if it has been discussed as such in the literature. Plainly morphological facts were often treated syntactically in the earlier transformational literature. For example, both Cook (1971), on Sarcee, and Brandon (1975), on Swahili, discuss interesting facts about deletion rules being blocked when the deletion would leave too few remaining syllables, and both assume they have discovered a phonological constraint on syntax. But an examination of the facts reveal that the rules involved are purely morphological; they operate entirely in a word-internal domain, and the phonological conditions are just such as would be expected in realization rules, making reference to disyllabic and monosyllabic stems, and so on. We have discussed these and several similar cases in Zwicky & Pullum (1983a).

To say that the phenomena belong to morphology is not to say the facts do not pose intricate descriptive problems; we only wish to point out that our claims are about sentence structure and cannot in general be extended to
become claims about word structure. Early transformational studies that treated morphology and syntax as something of a seamless web, attaching derivational affixes with transformations and so on, may have blurred the syntax/morphology distinction during part of the last thirty years, but it was traditionally taken to be an important distinction in the theory of grammar, and we believe that the tradition in question is correct.

10.4.5. Universal conditions

Our claim about phonological influence in syntax is that there is no direct reference to phonology by the syntactic rules of any language. This does not exclude the possibility that there are universally based interconnections between syntactic and phonological form. Relevant here are the several cases of allegedly showing phonological identity affecting omissibility of constituents in coordinate ellipsis and coordination of subsentential constituents of various sorts. Phonology can clearly be ignored in some constructions: in *I haven't yet done my homework, but I will 0, the ellipted material is (or means) do my homework, and in John absented himself and so did Susan, it is absent herself that is missing; in neither case would the ellipted material have been phonologically identical to any other constituent if it had been overtly realized. However, in other cases, phonology seems to matter. *He has not spoken and he will not speak cannot reduce to either *He has not and will not spoken or *He has not and will not speak. (Many speakers will find the latter preferable to the former because the offending sequence *has not . . . speak is interrupted, but most speakers reject both options.) What is crucial is that has governs the past participle and will governs the bare infinitive, and these are phonologically distinct for the verb speak.

But now note that there are verbs where the past participle and the infinitive are accidentally identical; come is one such irregular verb. When we use one of this class of verbs, we find that we get a sentence that most speakers will accept: He has not and will not come.

We do believe that phonological facts are crucial here. Moreover, there is evidence from German and Xhosa (reviewed in Pullum & Zwicky 1986) that it is a superficial level of phonology that is relevant, the level at which contrasts are perceptible to the native speaker and available for purposes like rhyme (something like the level that is input to natural processes in David Stampe’s theory of natural phonology, probably the same as the lexical level of Paul Kiparsky’s theory of lexical phonology). The position taken in Pullum & Zwicky (1986) is that the outlines of how phonology may contribute to ellipsis possibilities in natural languages are given by general linguistic theory. This position is not entirely secure; we discuss some problematic facts indicating variation between speakers regarding what they will and will not
tolerate on the grounds of phonological identity between forms. However, we set forth a framework for the description of such variation, and circumscribe the range of facts as narrowly as possible in universal terms. Whether our account is fully successful or not, we hope the strategy is clear: we aim to substantiate the claim that if there are systematic phonological influences on syntactic phenomena at all, they do not vary idiosyncratically from language to language.

10.5. Conclusion

We have tried to make two major points, and to indicate, while elaborating them, something of the content of the research that is currently going on at the syntax–phonology interface. The two major points are these:

(1) While many have suggested that the influence of syntax on phonology is complex and pervasive and can involve nonsuperficial aspects of syntax, this is turning out not to be the case; superficial syntax seems likely to suffice as a basis for phonological description.

(2) While it has often been suggested that there is phonological influence of various kinds on syntactic rules, this does not appear to be the case. Many different types of phenomena have been taken for phonological conditions on syntactic rules, but no indisputably genuine cases have been attested as far as we know.

We continue to think, therefore, that the generalizations we have referred to as the principle of superficial constraints in phonology and the principle of phonology-free syntax (Zwicky 1969, 1970) represent strongly confirmed hypotheses about the organizational principles of grammars for natural languages. In this regard, we think it is promising that some recent developments in syntactic theory have come closer to making these two principles consequences of the theory of grammar as opposed to mere stipulations. This point is discussed further in Pullum & Zwicky (1984) and in Zwicky & Pullum (forthcoming).

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