

## 5/ The Analysis of Nuclear Tones

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The analysis of the pitch movements that expound the tonic syllable (or nucleus) of a tone unit has been much neglected in recent theoretical discussions of intonation, although this issue was very much to the fore in early pedagogical studies, and a number of phonetic classifications have been made. The approach presented in Crystal (1969a) argues that the range of nuclei in a language is best seen in terms of the interaction between two systemically distinct features—*syllabic pitch range* and *tone*. The former refers to the relative pitch height of a syllable, syllable onset, or syllable termination in relation to preceding or subsequent syllables; the latter refers to the pitch direction followed throughout a tonic syllable. For example, the traditional concept of a ‘high rising tone’ is seen as the product of two separate systemic selections: high (versus mid or low) and rising (versus falling, level, falling-rising, and so on). It is clear that there are in principle a very large number of phonetic possibilities that a language might use—high falling, high falling-rising, high falling-level, high level-falling, and so on. The problems are to determine the number of basic phonological categories required, to provide a model for their interrelationship, and to give adequate recognition to the range of functions that they possess.

Methodologically, this is probably the most difficult area of all for the intonation analyst; some of the reasons for this are discussed in Crystal (1969a, Ch. 7). However, this book did not pay sufficient attention to the underlying malaise in this area of intonation study, which is a failure to think theoretically about the subject: crucial theoretical terms tend to be used loosely, and their implications are missed. Three terms in particular are widely used, but their status remains largely uninvestigated; *context*, *system*, and *connected speech*. These terms are fundamental to any general explanation of intonation, but they must be used carefully and precisely in order for the explanation to succeed. As a general indication of my attitude, I would say that the concept of context has been much overrated, that of system much underestimated, and the complexity involved in constructing a model of intonation for connected speech largely ignored.

Statements referring to the importance of context in intonation analysis are found throughout the literature. They reflect a movement away from the view that a nuclear type (e.g., low rise) expounds a single, "basic" meaning, always present regardless of context (although contextual variations may add certain overtones), to a view that there is no common meaning underlying all instances of its use, the interpretation of each instance being totally dependent on the context in which the tone occurs. Certainly it is difficult to defend the first position, in any strong sense. A collection of instances of any tone bring to light a large number of possible attitudinal implications, and identity between the different instances seems possible only by a process of simplification (in which some attitudes are selected as being more fundamental than others, which are considered marginal) or by a process of generalization, whereby all the implications are subsumed under some extremely broad attitudinal label (e.g., "emphasis," "self-involvement"). Neither of these processes is desirable: the first approach may have pedagogical value, but it begs crucial theoretical questions as to what is central and what is marginal; the generality of the labels in the second approach is such that they are vacuously applicable to almost every nuclear type one might find. In any case, one might add, why *should* one be looking for a single meaning that can be traced through all instances of a given category? No one would expect this for other kinds of formal categories. The point has been much discussed, in linguistics, philosophy, and elsewhere, and I do not go into it further here.

The second position seems to have a lot in its favor. In particular, there is the difficulty of finding a single sentence with a *totally* unacceptable nuclear tone: it is always possible to think up some context that makes the sentence appear quite normal, even though the context discovery procedure may itself be an involved process, as Haas has pointed out (1973). Analysts asterisk intonationally transcribed utterances at their peril, as Bolinger regularly shows, and much of the discussion in recent years has taken the form of criticism of proposed semantic generalizations on grounds of contextual inadequacy. However, this position is not as clear-cut as it seems. For instance, it ignores the important question, discussed by Haas (1973), that contextualization is itself a complex process, involving various procedures and degrees of intuitive confidence: the degree of difficulty encountered in thinking up a context is itself a significant factor in deciding the overall acceptability of that utterance. More important than this, the position remains unintelligible without clarification of the term "context." It is a term that has been used in a variety of senses—or so it would seem, for it is rarely explicitly defined. It has been used to include some or all of the following: the concurrent formal structure of an utterance (whose intonation is being analyzed), the formal structure of utterances preceding or following the focal utterance, the intonation patterns preceding the focal utterance, the observable situation in which

the utterance takes place, factors in the observable situation preceding the focal utterance, the presuppositions in the mind of the speaker or hearer, and other things besides. Given such a broad interpretation, it would not be surprising for the meaning of an intonation pattern to be wholly dependent on context, but of course this says nothing, until the specific conditioning claimed to be operating within each kind of context is explained and some kind of criteria are set up. "Finding a context" for intonation patterns by adding a previous utterance or giving a brief cue specification in brackets provides pedagogic plausibility, but no explanation.

When one looks closely at the various possible senses of context, however, one finds that certain of them are quite inoperable or irrelevant for the specification of intonational meaning. One may, to begin with, dispense with general appeals to mental presuppositions and unobservable aspects of "the situation" in which the utterance occurs. It should be obvious that unless we are provided with some objective linguistic, visual, or other evidence to indicate that a presupposed state of affairs or a change in the concurrent situation is conditioning the structure or interpretation of an utterance, we have no alternative but to assume that nothing contrastive is presupposed, that no change is taking place, that mutual attitudes are constant, and that the process of interpretation based on an appeal to observable characteristics of the situation (see below) should continue unaltered. For example, if in a conversation the mood of one of the participants changed (e.g., boredom setting in), but at the time there was no formal sign that this had happened within the pattern of the utterance and retrospective analysis of a tape failed to produce any consistent interpretation of boredom at this point, then this information must be disregarded. (The fact that it is often not disregarded is due to the speaker-oriented approach to intonation, whereby the analyst uses his own intuition to interpret his own usage, and thereby frequently fails to realize which aspects of his semantic introspection were expounded in his utterance and which were not, which were a reflex of aspects of his personality, and so on. The danger is always to read too much meaning into a pattern.) The same reasoning applies when questions of ambiguity are raised: an utterance is not intonationally ambiguous until such time as the participants recognize it and accept it as relevant for the conversation. If A sees a possible ambiguity in B's utterance, but discounts it (as unintentional, or for some other reason), then it would be misleading to extract the feature concerned and refer to it as "potentially ambiguous," or something similar. A fortiori, if none of the participants detect any ambiguity at all, and retrospective analysis fails to produce any consistent interpretation of an utterance as ambiguous, appeals to potential ambiguity must be disregarded. (References to such notions are usually the result of looking at sentences in isolation instead of in connected speech. Of course many sentences are intonationally ambiguous in isolation: to take these

and then to say that "context resolves the ambiguity" is questionable, to say the least, since if connected speech had been studied in the first place, the question of ambiguity would never have arisen. Similar views have been expressed over the supposed ambiguity of sentences like "Flying planes can be dangerous," e.g., Noss, 1972.) Most of the time, we produce or interpret an utterance's intonation using the assumption that it will be unambiguous, and that there is no change taking place in the concurrent situation that could affect the process of interpretation. Only when there is clear evidence to the contrary do we need to talk about the notion of context.

Eliminating such matters from our discussion reduces the notion of context to more manageable proportions. Specifically, five senses of context need to be distinguished:

1. The concurrent syntactic and lexical pattern of utterance. There are a number of formal notions (e.g., sentence final versus nonfinal) that are prerequisite for any semantic analysis of nuclear types. This aspect of contextual influence is discussed further below.
2. Preceding and subsequent syntactic and lexical patterns. I have not explored discourse organization as a whole in relation to the selection of nuclear types, but in principle it should be clear that there could be a considerable influence here, e.g., a sequence of parallel sentence structures (as in a series of rhetorical questions) would strongly motivate a corresponding sequence of parallel choices of nuclei.
3. Preceding and subsequent intonational patterns (see further below).
4. Relevant concurrent and preceding semiotic behavior, especially facial expression but including all forms of kinesic and proxemic behavior. The importance of context in this sense is well known, although underestimated (see Crystal, 1969a, Ch. 7).
5. Concurrent and preceding observable alterations in situation. This is the traditional core of the notion of context in intonation studies. The choice of intonation is related to such situationally conditioned attitudes as politeness, surprise, anger, and so on; and it is this aspect of context that has been overrated. The range of "attitudes" to be considered under this heading is very wide, and it is the multiplicity of semantic labels and the problems of quantifying affect that have led to pessimism in the semantics of intonation and the extreme reliance on the notion of context. Doubtless it will be possible to make much progress in these areas once we have available more adequate analyses of affective states and their linguistic categorization, so that the idea of situational context might become more explicit. In the meantime, it is important to realize that this

aspect of context is by no means the cornerstone of intonational semantics: it is in fact very much dependent on the other senses of context (1-4) above.

The following dialogue provides an example of the interrelationship of the various senses of context:

- A /you've got something in your HĀIR/ (said in a jocular tone, thinking that it is no more than a fallen leaf)  
 B /HĀVE I/

The low falling tone here, where one might have expected a livelier reply (such as a high rise) to suit A's jocular mood, provides a contrast that indicates B's displeasure—let us call the tone "offended." However, it would now be most misleading to say, as is often said, "One of the meanings of the low falling tone is 'offended'." It would be absurd to see the low falling tone as "containing" a range of meanings, one of which is "selected" at this point in context, because obviously the range of meanings the low fall (or any other tone) could contain are as many as there are contextual conditions, and hence no analytic progress would have been made. Rather, this example shows the importance of the other contextual factors in accounting for a particular effect. Sense 1 is relevant, because with a less abrupt syntax and lexis there would be less likelihood of an interpretation of "offended." Sense 2 is relevant, since if B had been replying in this manner in previous discourse, A would have grounds for discounting the interpretation of "offended." The relevance of sense 3 has already been referred to—the contrast between A's and B's intonation—and sense 4 is relevant because the interpretation of "offended" could disappear entirely if an appropriate facial expression or gesture were involved. Indeed, when one considers senses 1-4, it is difficult to see what need there is to refer to sense 5 of context at all.

I would in fact want to argue that sense 5 is largely irrelevant to the semantic analysis of intonation. It is only occasionally that one may make a confident prediction of an intonational pattern from an observed situational event, and vice versa. There is no guarantee that, for example, an angry situation will produce an attitude of anger in any individual, and none that an angry attitude will produce an "angry" intonation pattern. The controlling variables are personality (e.g., some people are more controlled than others) and sociolinguistic (e.g., some social situations are more conducive to angry scenes than others). Even on the basis of a clearly observable situation, then, it would be misleading to assume that the interpretation of the situation should be allowed to influence one's semantic analysis of the intonation. Indeed, we are aware of this, because we say such things as "John kept very calm—there wasn't even a tremor in his voice," which indicate the possibilities of intona-

tional disassociation from the accompanying situation [or "displacement," in the terms of Hockett and Altmann (1968)].

The observable situation probably has an important role to play in the initial stages of any discourse, where it establishes norms (e.g., of formality, intimacy, or excitement) for the dialogue. It then proves unnecessary to refer again to situation unless major variations in it arise. There have been in fact only a handful of occasions in my own conversational data where an observable change in the accompanying situation directly influenced the intonation. One occasion was when a third speaker entered the room; since he was a stranger to one of the participants, the speech became more formal and the intonation altered. Another was when the doorbell rang, and a puzzled tone came into one participant's voice. These occasions were isolated. For the most part, one can listen to a tape without referring at all to the ongoing situation. (The impression of the opposite is probably due to the emphasis on the more action-packed kind of situation found to be important in foreign language teaching, which motivates so much of available intonational materials.) The language is self-contained, and the interpretation of the intonation depends essentially on the semiotic (linguistic and nonlinguistic) contexts. (The analysis of nonvocal semiotic features is not dealt with further in this paper.) The problem for the intonation analyst, therefore, is to develop an adequate model of the contrastive possibilities operating as one moves from nuclear tone to nuclear tone in the stream of connected speech. In order to do this, he has to clarify what is involved in the other vague theoretical notions mentioned above—the notion of an intonation *system* in relation to *connected speech*.




The concept of system is generally discussed with reference to three criteria: a system contains a finite number of members; it is reciprocally exclusive (two or more members may not be selected at a particular point in a syntagm); and it is reciprocally defining, i.e., the most precise and economical statement of the meaning of an item is in terms of the other members of the system of which it forms a part. The set of nuclear tones in English is normally referred to as a system, but little attempt seems to have been made to show that these conditions have been met. The notion of reciprocity of definition is particularly important. What this implies is that attempts to define the meaning of a nuclear tone cannot be successful until we know two things: what tone the previous discourse (or, in a discourse-initial position, the previous observable situation, semiotic frame, and so on) lead us to expect; and what tone we actually get. Regarding the first point, one might construct an arrangement of tonal possibilities such that, given a sequence of tone units and tonic syllables, the selection of any tone is made dependent on the selec-





tion of the previous tone or tones. Given the selection of the first tone in a string, one may then see a progressive influence of the type

A-B  
B-C  
C-D...

such that a primary factor influencing the selection of any tone is going to be functional compatibility with the previous one(s). For example, one might expect, given the occurrence of a rising-falling tone, to find clusters of such tones at a particular point in discourse; this is in fact what one finds (as reported in Crystal, 1969a, p. 241, where the notion of "tonal reduplication" is introduced, but the value of the statistical analysis reported in this earlier work is extremely limited, because little account was taken of the grammatical contexts of the various tones). A more important illustration of functional compatibility emerges from the statistical fact that, for any sample of data, between 50 and 60% of the nuclei will be falling tone, with the vast majority being low falling in type—in other words, the "neutral" intonation for statements, as generally reported. As Quirk et al. (1972, p. 1044) say, "a tone unit has a falling nucleus unless there is some specific reason why it should not." Of the remaining 40% of nuclei, half of these are low or mid-rising or level tones whose use is wholly conditioned by the accompanying syntax (see below) for the signaling of dependent nonfinal structures. In other words, between 70 and 80% of nuclei are semantically "neutral." The problem is in accounting for the remaining tones, and the non-neutral use of the low falling and rising tones. However, as a general principle, I would wish to argue that the vast majority of tones in connected speech carry no meaning—that is, they communicate no new information because their occurrence is syntactically predictable. The problem of specifying nuclear meaning comes when a tone is used unpredictably in a specific syntactic context, or when (as stated above) the discourse leads us to expect a particular tone and we are given another. Both of these cases involve us in looking at the nature of tonal relationships within the nuclear system.

For the rest of this paper, I restrict the discussion to the following nuclei:

Low fall		(symbolized as ↓)
High fall		(symbolized as ↑)
Low rise		(symbolized as ↓')

High rise		(symbolized as $\uparrow$ )
Level		(symbolized as $\bar{\quad}$ )
Rise-fall		(symbolized as $\wedge$ )
Fall-rise		(symbolized as $\vee$ )

The other phonetically distinct nuclei in English are not dealt with here (e.g., fall-level, rise-fall-rise): statistically they are a very minor group, and semantically it will probably be possible to see their analysis as a straightforward extension of that suggested for the major tones. Certainly, if the approach is not plausible for the above seven categories, it will not work for the others.

In this approach, then, we are given a tone unit and tonic syllable, along with all concurrent syntactic and lexical information. [These notions are introduced and justified theoretically in a separate paper (Crystal, 1973).] The first task is to determine the extent to which grammatical factors have to be taken into account in arriving at a semantic specification of the tones. Here one has to be very rigorous over what is to count as a grammatical function of intonation. If the criteria are not exact and explicit, the grammar quickly becomes overloaded with spurious categories and artificial distinctions (for example, degrees of 'exclamatory force' or 'personal commitment'). This is the difficulty that I find with Halliday's approach to intonation, for instance (see Crystal, 1969b). To avoid this difficulty, the present approach uses a much more restricting criterion: one allows as grammatical only those uses of intonation that can be shown to expound categories *already required* by a grammar. Given a grammar of English that uses such notions as dependent clause, negation, restrictive and nonrestrictive, and sentence completion, for instance, if one can show intonation expounding these concepts, this can then be said to be a genuinely grammatical function of intonation for this grammar. Note, too, that in all such cases we are dealing with a grammatical system in the strict sense—a finite, mutually defining and mutually exclusive membership, e.g., restrictive versus nonrestrictive, positive versus negative. In this way, one would need to establish six conditions for the use of nuclear tone, in order to account for the following grammatical distinctions (all of which are taken from recently published grammars of English):

- or ' Nonfinal tonic in sentence: *syntactic dependence*, e.g.,  
 /what he sAID/ was are you CÒMING/  
 /he won't go HÓME/ until she comes BÀCK/



Final tonic in sentence: *continuity*, e.g.,  
incomplete listing:  
/would you like TĒA/ or CŌFFĒE/ (cf. ... TĒA/ or CŌFFĒE/)

Final tonic in sentence: *expectation of response*, e.g.,  
tag question:

/he's CŌMING/ ISN'T he/ (cf. ... ISN'T he/)

question (versus exclamation):

/weren't they PŪNCTUAL/ (cf. ... PŪNCTUAL/)

\*/how WĒLL she sings/ DŌESN'T she/

↑  
*Contrastive question*, specifically  
echo utterance marker (cf. Quirk et al., 1972), e.g.,

A /John's going to the ŌFFICE

B /to the ↑WHĒRE/

also in certain types of rhetorical questions, and indicating the  
penult in a list, e.g.,

/we want ĒGGS/ BŪTTER/ ↑BRĒAD/ and TĒA

↑  
*Contrastive focus*, e.g.,

/he's HĀPPY/ in fact he's ↑VĒRY happy/

∨  
*Contingency*, especially negative implication, where the polar con-  
trast is clear, e.g.,

/I didn't give her ĀNYTHING/ (cf. ... ĀNYTHING/)

/I SHŌULD go/ (but I won't) cf. ... SHŌULD...

/we do admit STŪDENTS/ (but not ĀNY STŪDENTS/)

/it's GŌOD/ (but not THĀT GŌOD/)

/John won't sit still until the TĀXI comes (cf. ... STĪLL/

... TĀXI... /)

↓  
Final tonic in sentence: *unmarked*

Nonfinal tonic in sentence (see below under attitude)

It may be possible, with further study, to add to this list, but meanwhile it would seem prudent to restrict one's claims about grammatical function—which are extremely strong claims to make—to those cases about which there is clear and extensive evidence.

By distinguishing the three phonetic variables that underlie the above nuclei [general pitch direction (falling-type versus rising-type), pitch range (high versus low start) and complexity (viz. ^, ~, the following systemic relationship might be hypothesized between tonal type and grammatical functions:

∨ Neutral — +↑ = *contrastive focus*

∨ Continuity < +↑ = *contrastive question*

< + complex = *negative implication*

NOTE: 1) There seems to be no grammatically conditioned equivalent to fall-rise under the heading of falling-type tones. Rise-fall cannot be predictably related to any grammatical contrastivity, and its description thus falls under the heading of attitude, below. 2) Labeling  $\hat{\quad}$  as FINALITY, as is sometimes done, is to be misled by the labels used, with the term CONTINUITY suggesting its opposite. The only clear sense for which the term FINAL might be applicable, in a grammatical context, is "final in a string," such as a sentence, and this would handle only a small proportion of the low falling tones in the data.

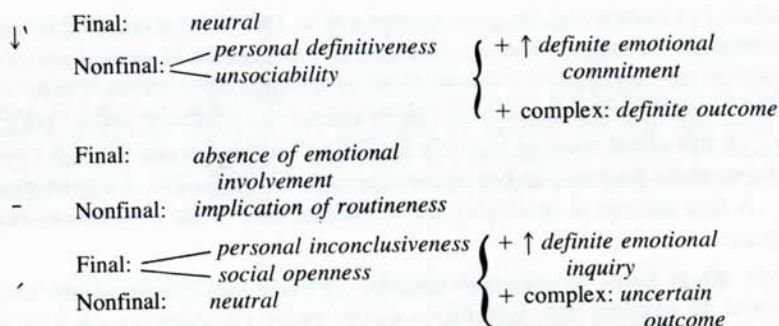
Specifying further semantic differentiation for the tones in the above contexts is a purely attitudinal matter, and here the problem of labeling arises. As I pointed out in an earlier work (Crystal, 1969a, Ch. 7), descriptive labels in intonation are generally unclear. It is often uncertain, for example, whether a label like *interrogative* is being used to refer to an attitude, a syntactic pattern or category, or a speech act. Likewise, labels tend to be used in a fairly arbitrary way, such that one is uncertain of the structural meaning relations that may be operating between them—a pair of labels, such as *sarcastic* and *ironic*, may be being used synonymously, hyponymously, incompatibly, and so on (see Lyons, 1968, p. 403, for these relations). In the absence of explicit criteria and an agreed semantic theory, it is not surprising that descriptions of nuclear meanings do not take us very far, and are often contradictory. However, although a great deal of empirical psycholinguistic work remains to be done on the use of these labels by judges, it should still be possible to develop some theoretical ideas about the way in which our semantic interpretations are organized and how they are arrived at, and thus reduce somewhat the amount of arbitrariness in our descriptions. One suggestion toward this end is developed below: it is based on the view that any explanation of intonational meaning cannot be arrived at by seeing the issues solely in either attitudinal or grammatical terms. It is precisely the interplay between the interpretation of an intonation pattern in grammatical terms and its interpretation in semantic (attitudinal) terms that is of interest, since there are grounds for believing that the two sets of "meanings" are to some extent mutually defining. A low rising tone, for example, may in syntactic terms be given an interpretation as "marker of syntactic continuity," but in attitudinal terms one might talk of "inconclusiveness" and a range of related labels. Likewise, the fall-rise might in a grammatical context be defined with reference to a category of contingent negation; attitudinally, it might be defined with reference to such labels as "uncertainty" or "doubt" (see below). There would seem to be a certain analogousness between the two dimensions of interpretation, which any analysis should take into account. The present approach insists on a dual account of the meaning of any nucleus that distin-

guishes, but interrelates, its grammatical and its attitudinal roles. In this way, it is hoped, one might arrive at a solution to the problem of nuclear meaning posed at the beginning of this section by postulating a stable "core" of meaning (partly grammatically and partly attitudinally defined) and a "periphery" of attitudinal nuances that rely for their interpretation on the concurrent lexis, semiotic features, and so on (see Crystal, 1969a, p. 284, for examples).

A first attempt at specifying the attitudinal core of the above tones is as follows:

- Final tonic in sentence: *absence of emotional involvement*, which may be interpreted as sarcasm, irony, or boredom, e.g.,  
/it was a FASCINATING lecture/
- Nonfinal tonic in sentence: *implication of routineness*—perhaps arising out of the dominant sense of the level tone in final position.
- ↓ Final tonic in sentence: *personal inconclusiveness* (cf. the continuity sense above)—specific labels used here are noncommittal, unaggressive, and so on, which are a short remove from polite, respectful, and so on.
- Final tonic in sentence: *social openness*, perhaps arising from the interest and so on implied in the expectation of response sense given above (p. 63)—specific labels used here are casual, friendly, persuasive, and (with appropriate kinesic accompaniment) warning, grim, and so on.
- ↓ Nonfinal tonic in sentence: *attitudinally neutral*.
- Final tonic in sentence: *attitudinally neutral*.
- Nonfinal tonic in sentence: *personal definitiveness*—specific labels used here are abrupt, insistent, and so on.
- Nonfinal tonic in sentence: *unsociability*—specific labels being cool, irritated, rude, and so on.
- ↑ In any position: *definite emotional commitment*—specific labels being emphasis, surprise, warmth; selection depending very much on kinesic accompaniment.
- ↑ In any position: *definite emotional inquiry*—specific labels being query, puzzlement, surprise, and so on.
- ∨ In any position: *uncertain outcome*—doubt, hesitation, and so on leading to suspicion, threatening, and so on.
- ^ In any position: *definite outcome*—impressed, satisfied, smug, and so on, or the reverse, depending on kinesic accompaniment.

In the same manner as above, the systemic relationship between these tones may be outlined as follows:



NOTE: The complexity and pitch range features are continuously variable (cf. Trim, 1971): the wider the overall tone, and the higher the beginning or end points of the tone relative to the preceding utterance, the more intense the attitude.

Figure 1 presents a schematic account of the main English nuclei, in the light of the discussion so far. The various tones are given a preliminary classification into two general types, the general directions being falling and rising, respectively. Various grounds for such a distinction were discussed in Quirk and Crystal (1966), but there was no discussion of the general theoretical implications. Level nuclear tone is placed at the top, rather than being midway between fall and rise phonetically; it takes on the functions of either fall or rise, depending on its distribution. Within each phonetic type, the tones are ordered on the basis of their twofold potential function—grammatical and attitudinal. The scale of *specificity of grammatical function* refers to the degree of restrictiveness of the syntactic conditions that predict the occurrence of a tone: some of these conditions are fairly general (e.g., "occurring finally in statements"), whereas others are quite specific (e.g., "occurring on words beginning with the morpheme *any-*"). The further down the scale a tone appears, the more specific the definition of the grammatical conditions required to predict it. *Degree of affective involvement* refers to the amount of attitudinal implication carried by a tone, with "amount" here referring to the consistent use of a range of descriptive labels (angry, pleasant, very . . .). The further down this scale a tone is placed, the more labels are needed for its complete semantic specification. The line A-A indicates the extent of the area of grammatical function: in other words, this model claims that all other nuclei in English can be described without reference to further grammatical constraints, and are assumed to be attitudinal intensifications of the attitude types already described. (Attitudinal intensification applies only within a phonetic type, however—e.g.,  $\sim$  intensifies,  $\sim$  intensifies  $\hat{\sim}$ , and so on.) Grammatically, all that can be said about complex tones is that they are

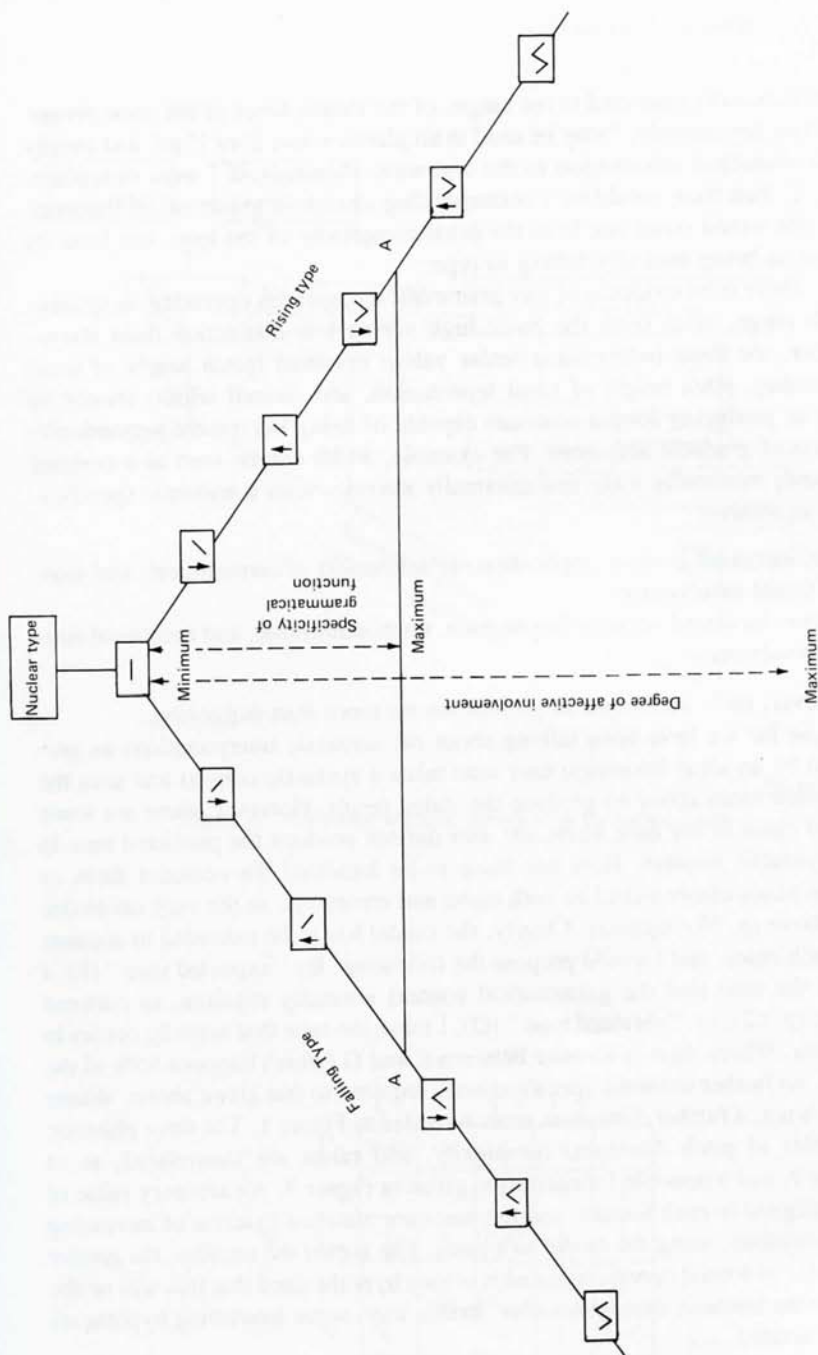


Figure 1. Nuclear-type interrelationships and functions.

distributionally restricted to the ranges of the simple tones of the same phonetic type: for example,  $\hat{\ }^$  may be used in all places where  $\downarrow'$  or  $\uparrow'$  go, and simply adds attitudinal information to the utterance. However, if  $\hat{\ }^$  were to replace, say,  $\downarrow'$ , then there would be a corresponding change in grammatical function, but this would result not from the pitch complexity of the tone, but from its status as being basically falling in type.

There is no evidence of any grammatical constraint operating on syllabic pitch range, apart from the basic high versus low distinction used above. Rather, the three independent scalar values involved (pitch height of tonal beginning, pitch height of tonal termination, and overall width) should be seen as producing formal contrasts capable of being interpreted semantically as sets of gradable antonyms. For example, width can be seen as a contrast between maximally *wide* and minimally *narrow*, with a semantic specification as follows:

*Wide*: increased positive implication, definitiveness of commitment, and emotional involvement.

*Narrow*: increased negative implication, noncommitment, and emotional non-involvement.

However, these comments at present are no more than suggestive.

So far we have been talking about the semantic interpretations as produced by an ideal intonation user who takes a syntactic context and uses the predicted tones above to produce the stated result. However, there are some 5% of cases in my data where the user did not produce the predicted tone in the syntactic context. How are these to be handled? To consider them as performance errors would be both naive and erroneous, as the very deliberate use above (p. 59) suggests. Clearly, the model has to be extended to account for such cases, and I would propose the following. By "expected tone" (E), I mean the tone that the grammatical context normally requires, as outlined above (p. 62); by "obtained tone" (O), I mean the tone that actually occurs in the data. Where there is identity between E and O (which happens 95% of the time), no further semantic specification is required to that given above. Where there is not, a further dimension must be added to Figure 1. The three phonetic variables of pitch direction, complexity, and range are interrelated, as in Figure 2, and a possible formalization given in Figure 3. An arbitrary value of 1 is assigned to each feature, and the tones are matched in terms of increasing differentiation, using the model as a basis. The higher the number, the greater the point of formal divergence; and it is then hypothesized that this will be the maximum semantic divergence also. In this way, some interesting hypotheses are generated, e.g.,

$$E = \hat{\ }, O = \downarrow' \equiv E = \downarrow', O = \hat{\ }$$

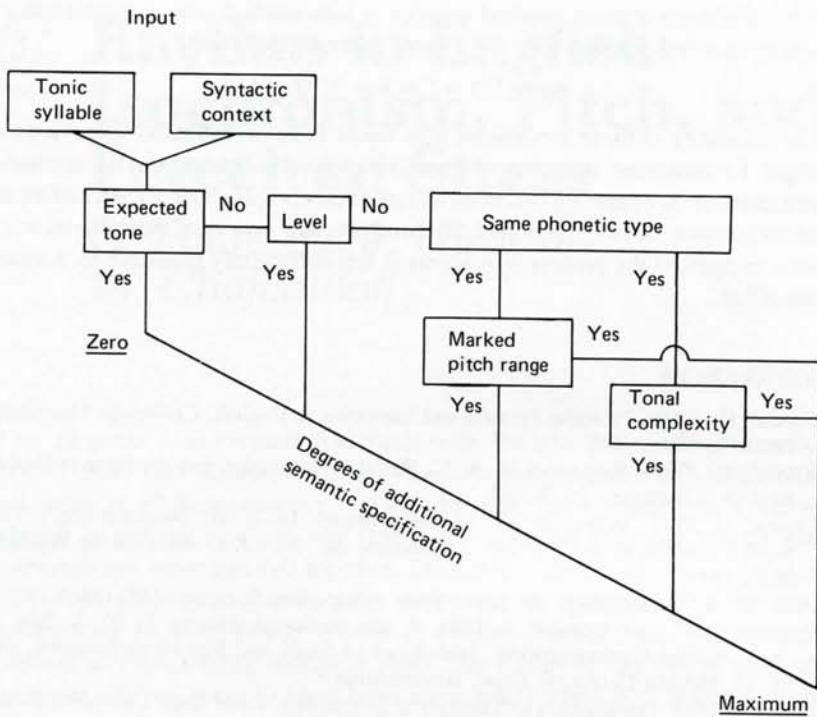


Figure 2. Additional semantic specification for nuclear types.

O

↘ — ↙ / ↑ / ∨

↘	E=0	1	2	3	4
—	1	E=0	1	2	3
E ↙	2	1	E=0	1	2
↑ /	3	2	1	E=0	1
∨	4	3	2	1	E=0

Figure 3. Hypothetical values for nuclear differentiation.

(i.e., replacing a more marked tone by a less marked one is equivalent to replacing a less marked tone by a more marked one), and

$$E = \downarrow'; O = \bar{\quad} \equiv E = \uparrow'; O = \downarrow'$$

The testability of these hypotheses now needs to be investigated. Equivalence might be measured in terms of quantity of labels, interrelated in semantic structure, or by obtaining reactions to sets of labels using Osgoodian differential techniques. It is to be hoped that analysts will now turn their attention to such matters, if the present hypothesis is felt sufficiently plausible to warrant the effort.

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