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1. THE QUESTION

I would like to present here some ongoing research centered on a problem of significant interest to phonologists: how do we define a segment? There are several aspects to this question. The one I am interested in here is the distinction between one segment and a cluster of segments.

In order to formulate the question more precisely, let's assume that we can segment any speech event into a sequence of articulatory units. There may be analytical difficulties involved in this task as well, but let us assume that articulatory phonicians can resolve them. Suppose now that we are analyzing a speech event in which we have isolated a sequence of three articulatory units [ABC] where A, B and C are distributionally independent of each other in the language under study - in the sense that each can occur independently of the others. Given this segmentation into articulatory units and these distributional facts, how many phonological segments do we have in this string? One, two or three? How do we decide the issue?

To use a concrete example: suppose that the string being analyzed is [mba], where [m] represents the gesture of oral bilabial closure accompanied by nasal airflow, [b] represents oral bilabial closure and [a] is some vowel gesture. In the language being analyzed, neither [m] nor [b] nor [a] are contextually predictable transitions from one sound to another. Does this mean we have three segments? Under what circumstances would we decide that we have fewer than three: more concretely, how would we decide that [mb] is one phonological unit?

This is the question I would like to address here. I will have some suggestions about what sort of answer we want, though not a complete solution.

1.1 How we came to ask the question

The problem of segmentation is being addressed here because recent developments in the theory of feature and segment structure have revealed that it is not only an unresolved issue but also that the range of empirical questions falling in its scope is significantly richer than previously assumed.

The recent history of this issue begins with Anderson's (1976) demonstration that a single segment may contain two distinct phases of nasality. Anderson showed that partially nasal consonants...
postnasals like [mb] - must be phonologically analyzed as being part oral and part nasal. He showed that any phonological description based on the assumption that the entire segment is phonologically homogeneous for nasality will fail to explain the cross-linguistic patterning of these sounds, as well as details of their behavior in individual languages. The significance of this finding for the problem of segmentation is this: there exist languages where a phonemic sequence [mb] must be analyzed as containing one phonological segment. However, internally to this one segment, there must exist two distinct values for nasality. The most obvious questions raised by Anderson's work on nasality are: under what circumstances do we get this type of segment-internal sequencing? And: what are the principles in virtue of which such articulatory sequences as [mb] are analyzed by native speakers as being mono- rather than bisegmental?

In the later literature, the class of configurations we discuss here is those sequences containing two values for a given feature - were called 'contour segments'. In figure 1, which reflects currently standard assumptions about the make-up of segments, the node labelled root designates the abstract notion one phonological segment.

\[ [\text{labial}] \]

The notation employed in (1) allows us to express both aspects of Anderson's discovery: that items like [mb] are single segments - as indicated by the fact that they possess a single root node - and that, nonetheless, they contain two sequenced values for the feature [nasal]. The same formalism can be extended to other varieties of contour segments: affricates, for instance, were presented by Sager (1986) as single root nodes to which a sequence of [continuant] [+continuant] feature values are associated.

But the fact that we can now point to an item in our representations which stands for the intuitive notion of a segment doesn't mean that we understand why certain phonetic sequences count as one segment, while others don't. This question has been taken up in a number of studies\(^2\), but the proposed answers are, in my view - overly technical, in the sense that they legislate an observed state of affairs rather than explain why it obtains. There is substantial agreement that pre- and postnasal consonants, affricates, pre- and postglottalized, as well as aspirated segments frequently function as single segments. Recently, Trubetzkoy (1992) has added to this class clusters such as [kt], [t], [k], which function as monosegmental units in Kashaya, a Pomo dialect. On the other hand, there is also substantial agreement that consonant sequences such as [tr], [br], [rl], do not, in the vast majority of cases, function as single segments. The interesting task for the phonologist is not to restate such observations in technical language but rather to understand why articulatory contours like [p], [b], [p], [b], [f], [s], display this systematic difference in patterning from other conceivable contours, such as [sm], [kr], [kr], [ls].

2. Three generalizations and a proposal

Some progress in this direction can be made by taking a new look at the circumstances under which distinctive intrasegmental contours occur. Several general observations can be made in this respect. First, only plosives - stops and affricates - can be contour segments: the most obvious fact illustrating this is that the pre- and postnasal segments are always plosives, never vowels, approximants or fricatives. Second, the plosives can display intrasegmental contours only if they are released: pre- and postnasalized consonants, for instance, are absent in contexts where stop releases may not occur. I will suggest here that this second generalization holds for a substantial subset of the contour segments enumerated previously - postaspirated stops, postglottalized stops, affricates - but not for all. The exceptions will be noted and explained. Third, distinctive intrasegmental contours never exceed two articulatory phases: we get, for instance, distinctive pre- or postnasalized consonants, but not distinctive medi-

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The positions thus defined can all anchor features. And we may reasonably hypothesize that **all features associated to a given aperture position are interpreted as phonologically simultaneous**. If we assume this, we will have come very close to explaining the observations made at the beginning of this section. We anticipated the descriptive result that contour consonants always belong to the category of released plosives: this is so because any featural sequence defining a contour - [\(\alpha F\)][\(-\alpha F\)] - will, under the convention sketched here, require two distinct positions in order to be realized. The only bipoential segments are released plosives. Therefore the only contour segments will be released plosives. QED. The observation that distinctive contours do not exceed two distinct articulatory states - recall the absence of ternary nasality contours like [\(\text{mbm}\)], or [\(\text{mbb}\)] - is also explained: a segment may have at most two aperture positions. It cannot support a tripartite contour.

2. THE EVIDENCE

2.1. Which contours are distinctive

I would like to sketch now the evidence supporting one generalization proposed in the last section: that contour segments are released plosives. First, however, we need to clarify the relation between the observable data and this claim. Consider the following pattern of association between /h/ - i.e. aspiration - and supralaryngealized oral consonants: this pattern is encountered in a Mazateco dialect studied by Kirk (1966:14-25), Mazateco de Flores. One must bear in mind that Mazateco is a language in which consonant clusters are exclusively onsets and thus pattern as single C’s. Further evidence for their monosegmental status is discussed elsewhere (Steriade 1992b).

(3) oral plosive + h continuant + h
    th, sh, jh, kh, kwh
    sh, jh,
    h + oral plosive h + continuant hy, hw, bwy [hu]

Both oral plosives and continuants are transcribed by Kirk as sometimes preceding and sometimes following /h/. But only the plosives are **distinctively ordered relative to /h/**: /th/ contrasts with /sh/ while no comparable contrast exists among the continuants. The relative order between /h/ and the continuants can be predicted: /h/ follows a voiceless (or fricated continuant) and precedes a voiced one. Because the sequencing can be predicted, there is no reason to encode it in the phonological representations. By this reasoning, we reach the conclusion that the **phonological contours involving aspiration in Mazateco de Flores occur among the plosives only**. The Mazateco plosives are necessarily released since they occur syllable-initially. This is then a first illustration of our claim that the phonological representations of nasal contours: only the plosives, the released plosives, yield distinctive contours. Note that Kirk’s transcriptions indicate quite clearly that some phonetic sequencing or temporal misalignment exists between /h/ and any oral constriction, whether it involves a plosive or a continuant. But phonetic sequencing is not what we’re interested in. We’re looking at the distinctive aspiration contours, and these are found among the plosives only.

Some explicit representations of the Mazateco contours presented in (3) can now be proposed. Note the close parallel between these structures and the representations of nasal contours in (2). ([spread] = [spread glottis], i.e. /h/)

```
(4) postaspirated stop    postaspirated affricate    aspirated fricative
   |                      |                        |
   A0A_max                A0Af                   Ap
   preaspirated stop      preaspirated affricate      aspirated glide
   |                      |                        |
   A0A_max                A0Af                   Ap
```

These structures help answer several questions. First, why do the hC an Ch clusters of Mazateco pattern as single C’s? The answer is that they are single C’s: aspiration does not occupy in the representations of (4) an aperture position i.e. a segmental slot - distinct from those projected by the basic consonant. It resides on the consonant, rather than next to it. Second, why do the distinctive contours occur only among the plosives? Because only the plosives are bipoential and, hence, only they can display a contrast between association to the first vs. last position.

Stepping back from our hypothesis, we should ask how the sounds in (3) could be represented in the absence of a closure/release distinction. The only possibility seems that of adopting representations comparable to (1), inspired by Sager (1986):

```
(5) Preaspirated stop vs. postaspirated stop
    (+spread)-spread       (+spread)[+spread]
    laryngeal              laryngeal
    root                  root
```

The difficulty with these representations is that we are left without an explanation for the asymmetry observed between plosives and continuants. The contours in (5) could reside inside a continuant’s matrix, as well as inside a plosive’s. The fact that they are distinctively present only on plosives remains unaccounted for. We may, alternatively, claim that the phonetic sequences in (3) are all bisegmental: but if we do, we fail to understand why these particular phonetic sequences act as single segments, not only in Mazateco but also in Mazateco other languages, while phonetic sequences like lysh, irkl, krl, km do not.

The Mazateco pattern of pre- vs. postaspiration is encountered in a number of other American Indian languages (cf. Buckley (1992) and Steriade (1992b). The same possibilities are attested with the feature of glottalization: we observe minimal contrasts between pre- and postglottalized segments, but only within the plosive class. A contrast between pre- and postglottalized stops, as association of /h/ to closure vs. release - is present in languages like Maidu (Shiple 1956), which oppose an ejective to an implosive series. Both series are limited to stops; neither is attested in contexts where Maidu plosives are unreleased.

```
(6) Ejective stop vs. Implosive
    A0A_max
    A0
```

...
2.2. Released vs. unreleased plosives

The proposal made here predicts that unreleased plosives should pattern like continuants: they have a single aperture position - $A_0$ - on which only one value for any given feature can be realized. Distinctive contours should be impossible on such consonants; for instance, in the absence of the stop release, a contrast like that depicted in (6) cannot be realized. We examine now the evidence supporting this aspect of our proposal. Illustrated first is the global effect of loss of release has for the phonotactics of a language. We turn then to a more careful consideration of the link between unrelease and the loss of glottalization contours.

2.2.1. Loss of contours in coda

The global loss of segmental contours in unreleased codas can be observed in a language like Tlahtuica (Muntzel 1982), which contrasts postaspirated and postglottalized plosives with plain voiceless ones; prenasalized plosives with full nasals; and the affricates /ts/, /\$/ with the plain stop /t/. Tlahtuica thus has practically all widespread types of contour segments. Significantly, all are missing from coda position. Tlahtuica codas are limited to plain stops (/p/, /m/, /l/, /n/, /h/), fricatives (/s/, /\$/) or approximants (/\h/, /\h/, /\h/); /\h/ from coda position is not the presence of aspiration but rather the fact that aspiration is realized, in these consonants, on the release. Similarly, since coda /\$/ and /s/ are attested in examples like /f\$/k\$/\$/all/ 'estropajo', /k\$/t\$/\$/t\$/ tautizate a los dos', we cannot explain the absence of coda /\$/ or /\$/ by focusing on the point of articulation or stricture type of these segments: the affricates are absent in coda because their release is absent.

Phonotactic paradigms similar to that of Tlahtuica are encountered in Slave (Rice 1989), Kiowa (Crowell 1949), Tolowa (Bright 1964), Tutunji (Colla 1976), Zuni (Walker 1972), Navajo (Sapir and Hoijer 1967) and others.

The converse of the generalization proposed here - that unreleased plosives do not support contours - can also be documented; in languages where codas are systematically released, postaspiration, postglottalization, affrication, and nasal contours are permissible coda features. Languages illustrating this phenomenon are: Wixaritami (coda affrication, postaspiration, postglottalization: Sémbie 1978); Tunen (coda prenasalization: Degast 1971); Tutuji (coda ejectives contrast with implosives; coda affricates: Dayley 1985); Hopa (coda ejectives, postaspirates and affricates: Woodward 1964).

2.2.2. Deglottalization in coda: which instances come from unrelease?

Taking now the specific case of glottalization, we can outline as follows the predicted developments of glottalization consonants in positions where stop releases are absent. Plosives which surface as postglottalized when released may turn, when unreleased, into plain closures lacking glottalization:

(7) $A_0 A_{\text{max}} \rightarrow A_0$

{[constricted]}

This is what happens in Kiowa (Crowell 1949), Tolowa (Bright 1964), Maidu (Shipley 1956), Slave (Rice 1989), Tutunni (Colla 1976), Zuni (Walker 1972), Tonkawa (Hoijer 1946), Navaho (Sapir and Hoijer 1967) as well as other, better known languages, such as Cambodian, Korean and Klamath.

In order to better appreciate the connection between loss of release and deglottalization, we must draw a number of distinctions. It is frequently the case that coda consonants lose certain components of their matrix, regardless of where these components are located. In the case of the laryngeal features - voicing, aspiration, glottalization - these are frequently excluded from the coda, independently of whether they are linked to stop releases or not. I will cite here only one immediately relevant example: Maidu (Shipley 1956) disallows coda ejectives, implosives as well as coda /\$/ in (6). \$/ is an approximant (A_{\text{max}} Position) associated to [constricted glottis]. Note that the loss of stop release in coda may explain the deglottalization of the ejectives, but not that of the implosives, or the loss of /\$. We must invoke in such cases a condition like (8).

(8) [constricted glottis] is disallowed in coda.

Thus the absence of postglottalization from the codas of Maidu, although consistent with our representations, is not a direct effect of unrelease. To observe the unmediated consequences of unrelease, we must consider cases in which loss of glottalization cannot be attributed to (8). Indeed a significant number of languages in our sample disallow ejectives but not /\$/ in coda: to this class belong, among others, Zuni (Walker 1972), Navajo (Sapir and Hoijer 1967), Kiowa (Crowell 1949), Tolowa (Bright 1964). Even more directly relevant patterns are attested in languages that disallow the coda ejectives but not coda glottalized sonorants - realized with preglottalization - or fricatives. In Tolowa, for instance, where all coda affricates, ejectives and postaspirated plosives are disallowed, the glottalized sonorants [m\$/] and [n\$/] as well as /\$/ - occur at the end of syllables. As Bright (1964) points out, the phonetic realization of Tolowa syllable-final glottalized nasals is transcribable as [m\$/], [n\$/] respectively, with the glottal gesture occurring during the period of oral closure: these sounds are not postglottalized nasals, but rather nasals with glottalized closures. They can be given representations consistent with the idea that Tolowa plosives are unreleased in coda.

(9) Tolowa coda [n\$/] (place features omitted)

\[
\begin{array}{c}
\text{[nasal]} \\
\hline
A_0 \\
\text{[cont]} \\
\end{array}
\]


Tolowa represents, therefore, a language in which condition (8) is inactive: the absence of coda ejectives - as opposed to plain /t/ or pre-glottalized nasals can be traced unambiguously to the loss of release.

A distinct prediction of our analysis is that in languages where coda plosives are unreleased and the constraint in (8) is inactive, ejectives will lose postglottalization but glottalized continuants, along with pre-glottalized segments, will maintain their feature of glottalization. Consider the following data from Tonkawa (Hoeijer 1946): all consonants may be glottalized syllable initially - stops, affricates, nasals, fricatives and glides - but only the continuants are allowed to be glottalized in syllable-final position: word-final /s/, /t/, /y/ occur. The representational difference between /st/ and /st/ is shown below:

\[(\text{Post}^{\text{plosive}} \text{ plosive (st')}) \text{ vs. } \text{glottalized fricative (st')}\]

\[\begin{array}{ccc}
\text{A}_0 & \text{A}_t \\
\text{[constricted]} & \text{[constricted]} \\
\end{array}\]

Given these structures, we understand that coda unrelease will affect the realization of the glottal feature in /st/ but not in /st/.

A much more interesting development is attested in the languages where glottalized plosives are maintained in coda but with altered timing between the oral and the laryngeal gestures. Several American Indian languages display a shift from post-glottalized onset ejectives to pre-glottalized codas: Chitimacha (Swadesh 1934) is perhaps the most revealing in this class. All Chitimacha consonants can be glottalized: there are ejective stops and affricates, post-glottalized nasals and post-glottalized glides in onsets. In coda position, however, the articulation of the glottalized stops changes. Swadesh distinguishes three realizations of the ejectives and post-glottalized nasal stops (1934:358): a syllable-initial allophone with "synchronous glottalization", a distinct syllable-initial allophone with "strong, slightly retarded glottal gesture"; and a syllable-final allophone "with glottal stricture slightly preceding the oral closure". We suggest the following representations for these three variants:

\[(\text{11}) \begin{array}{ccc}
\text{a. } & \text{b. } & \text{c. } \\
\text{A}_0 \text{A}_{\text{max}} & \text{A}_0 \text{A}_{\text{max}} & \text{A}_0 \\
\text{[constricted]} & \text{[constricted]} & \text{[constricted]} \\
\text{"synchronous} & \text{"retarded} & \text{"glottal stricture} \\
\text{glottalization"} & \text{glottal gesture"} & \text{slightly preceding oral closure"} \\
\end{array}\]

The syllable-final allophone appears in (11.c): note that the loss of release renders inevitable, some change in the glottal gesture. In the case of Chitimacha, this modification is the realignment of glottalization with closure, a timing change which obviates the loss of the feature. To show that the changes described here involve the phonological representations of these sounds rather than just their phonetic realization, we must show that the glottalized continuants are not similarly affected by their syllabic position. Indeed, glottalized glides are attested in Chitimacha, in syllable-initial as well as syllable-final position: syllable-finally they are, if anything, post-glottalized (Swadesh 1934:351). Our phonological representation for /y/, /w/- syllable initial or final - is that of an approximant (A_{max}) linked to [constricted]. Swadesh's observations indicate that the shift towards syllable-final pre-glottalization involves only the plosives. We claim that this is so because only the plosives are affected by unrelease.

A further prediction is that ejectives and implosives - represented as (6) - will be differently affected by unrelease: ejectives will lose glottalization altogether, or become pre-glottalized, while implosives may well just turn into unreleased implosives, with no significant change in the timing or nature of the laryngeal gesture. My data is very limited on this point, but suggests that if prediction is not far off the mark. In Adamawa Fulani (Siennes 1967) syllable-final stops are unreleased (p.7); as a consequence, the prenasalized stops at affricates of the language are excluded from coda position (p.10). But the implosives and the voiced stops are allowed syllable-finally: their laryngeal features are associated to closure and therefore immune to loss through unrelease.

3. CONCLUSION: WHAT ARE SINGLE SEGMENTS?

We have seen here that the designation contour segment is appropriate for certain classes of glottalized and aspirated segments: in particular, t-l, pre- and postaspirated plosives of Mazatlán, the distinctively pre- and postglottalized plosives of Maidu. The results obtained for nasality in Anderson (1976) can thus be legitimately extended to laryngeal features as well. Wherever such distinctive contours occur, they are realized on released plosives. This too is a property that holds of the nasal contours studied by Anderson.

We have also noted that postaspirated and post-glottalized plosives are affected by the loss of release, along with all other categories of laryngeal segments: unrelease triggers either the loss of the relevant laryngeal feature - else it induces a significant realignment of this feature inside the consonant matrix. Not all instances of laryngeal loss can be directly attributed to unrelease but a significant number can.

These considerations suggest that the most widely attested contour segments are simply varieties of released plosives in which the association of particular feature to closure or release is phonetically unpredictable. But what does this conclusion leave us in our search for solutions to the problem of segmentation?

Let's approach this problem indirectly by asking a narrower question: what is the sense in which a postaspirate like /tʰ/ is a single segment - albeit or involving a distinctive contour - instead of a tʰ-h cluster? My suggestion is that /tʰ/ is identified as a single segment because it contains no more than one of each featural component of a segment: it has one oral constriction and one laryngeal component (aspiration and voicelessness). These features happen to be realizations in sequence - the oral constriction precedes at least the perceptible portion - the laryngeal gesture - but they are, in principle, articulatorily compatible with each other. Similarly, a prenasalized postglottalized stop like /mWr/- functioning as a single segment in many Mazateco dialects - is, despite the distinctive contours of nasality and glottalization, a composite of mutually compatible features drawn from complementary sets: one oral constriction, one nasal gestural one laryngeal gesture. This property of featural coherence is, in part, what makes it one segment. A contributing factor to the monosegmental analysis, /tʰ/ and /mWr/ is the fact that the timing of the laryngeal features relative to the oral constriction is such that they can be phonologically analyzed as residing on the stop's release. Thus not only are the featural contents of the sequence threedimensional, but also the associations between them are potentially three-dimensional.
The answer suggested here is influenced by Trubetzkoy's second principle governing the distinction between single segments and clusters: "a phonetic cluster can be analyzed as one phoneme only if it is produced by a single articulatory movement or through the gradual dissolution of an articulatory complex" (1939:58). Trubetzkoy makes it clear that he views postglottalized and postspirated stops - instances of what he calls "an articulatory complex" - as representing always stops in which the oral and laryngeal gestures are simultaneously initiated: only the timing of their release differs. Thus he requires that a monosegmental unit involve some moment of actual rather than potential simultaneity between the articulations composing it. In this respect, his position is even stricter than the one suggested here: it appears that a phonetic sequence such as that involved in the Chitimacha postglottalized stops with "strong, slightly retarded glottal gesture" (11.6 above) might not qualify as monosegmental if the glottal gesture involves no significant temporal overlap with the oral constriction. But, aside from this difference, the idea of articulatory (i.e. featural) coherence as a prerequisite for monosegmental status is clearly present in Trubetzkoy's second principle.

It is useful to compare, in closing, Trubetzkoy's view of monosegmental sequences - a view from which ours derives - with the conception of contour segments implicit in representations like (1), repeated below. The reader will recall that such structures became, after Sagey (1986), the standard means of representing intrasegmental contours.

\[
(1) \quad [\text{mb}] = (\text{nasal})/\text{[nasal]}
\]

The prenasal depicted in (1) contains two incompatible values for [nasal]; thus, the notion that a segment is defined at least in part by the coherence of its featural components cannot be maintained within a theory employing (1). What then identifies [mb] as one segment, under the theory instantiated by (1)? The presence of the unique root node? But the root node is a simple diacritic, a concise way of stating All this is one segment, rather than a testable principle that could shed light on the observed behavior of contour segments.

I hope to have shown that, whether or not the proposals made here are on the right track, there is interesting work to be done in discovering such a principle.

NOTES


(3) For the term and exemplification, see Anderson 1976.

(4) The Kashaya contours transcribed as [h-k-h] are not ternary sequences of [h-k-h] but rather stop and postspirated stops. Their phonological representation is discussed in Steriade 1992b.

(5) On privativity in general, see Trubetzkoy 1939, who classifies the nasal/anal opposite as privativ. On specific arguments to this effect, see Steriade 1992a, b.

(6) Because vowels will not be discussed, the necessary distinction between vow approximants is left undefined.

(7) The results derived from this assumption - which essentially denies the cohere representations like (1) - can be equivalently obtained by assuming that all features, [nasal], are privativ. I believe there is support for this view, but cannot defend it here.

(8) Worse still, we could not even stipulate the correct restrictions. We cannot stipulate continuity is incompatible with the presence of feature contours, since affricates - like analyzed as containing a [-continuant] value in their matrix - do display contours of aspiration and glottalization. (On the latter see below.) And we cannot state the restriction in positive terms - something like intrasegmental contours must contain feature value [-continuant] - since unreleased plosives, which are clearly non-consonants, do not display contours, as will be observed in a later section.

(9) Additional instances of contrast between pre- and postglottalization are discussed in (1992) and Steriade (1992b).

(10) Kingston (1985) discusses other reasons to reject Greenberg's claim that implosives always be represented phonologically as [glottalized, +voiced].

(11) I cannot discuss in any detail the contexts where releases tend to be absent. Th common such locus is in the syllable codas. We should note however that there is consonant variation on this point: not all languages have unreleased plosives in their codas, nor do the behave identically on this score in any given language.

(12) Bright states that the glottalized nasals are restricted to the coda position. She is Referring to the plosives transcribed as [m-n], [n], which are indeed coda-bounded. There exist postglottalized nasals in the onset, as indicated by the example h/kel/ 'land'.

(13) Word medial codas are subject to the constraint in (8) in Tonkawa, since no glottal segments are allowed there. However, word-final codas are subject to a distinct restriction they disallow inappropriates, though not glottalized continuants; (8) is not in force, only the release in plosives. Interestingly, the phonetic realization of glottalized continuants in postglottalization, since Hjelmer transcribes them as sequences of [continuant] followed by /l/.

REFERENCES


1. APPROACHES TO SEMANTICS.

Semantics has been a lively and controversial field of research for centuries, and radically different approaches to it can be found within various disciplines and interdisciplinary combinations, involving such fields as linguistics, philosophy, logic, cognitive science, artificial intelligence, theoretical computer science, informatics, semiotics, and literary criticism. It is not surprising that there are a lot of competing approaches, rapidly evolving theories, and a mixture of mutual influence and mutual ignorance among contemporary semanticists; cannot pretend to be familiar with all the important contemporary approaches nor is it my aim to provide a representative survey, but I do want to set my central concerns within a slightly broader perspective.

One source of deep differences is the initial selection of the object of study: the central questions of semantics may come out quite differently if one focusses on language and thought, or on language and communication, or on language and truth. A more accidental but no less profound source of differences is the research methodology prevalent in the field within which one approaches questions of semantics: early linguists tended to see features and many linguists still see another level of tree structures; logicians see formal systems and model structures; psychologists see concept discrimination and principles for scaling semantic fields; artificial intelligence researchers see data bases and symbol manipulation. After an interdisciplinary conference fifteen years ago, the philosopher David Kaplan remarked to friends that philosophers are like black holes and linguists are like vacuum cleaners: philosophers will take any approach and show that it suffers from probably fatal foundational problems, while linguists will take any approach and absorb it into their arsenal.

I want to begin by very briefly characterizing certain broad classes of semantic theories; then I will turn my attention to the issue of how model-theoretic semantics has been evolving in the hands of linguists to meet more of the demands posed by the...