ARTICULATORY SETTINGS OF ENGLISH CONSONANTS

Edward T. Erazmus

University of Kansas

This paper proposes to describe the articulation of English consonants following the articulatory setting principles of Beatrice Honikman (1964). As such it is a sequel to an earlier paper done on the articulatory settings of English vowels (1983) and completes an articulatory settings analysis of English phonemes.

The articulation of English consonants is conveniently summarized in the literature by the use of a consonant chart which displays in two dimensions the convergence of points of articulation in the vocal tract (physiological dimension) versus the manner of articulation (phonotactic dimension) with the phonemes represented by phonetic symbols at the points of convergence. From these data the individual phonemes are described briefly in terms of the convergence, as, for example, /p/ is a voiceless bilabial stop and /d/ a voiced alveolar stop, as we note in Table 1.

While the consonant chart has proved an invaluable tool to theorists and students for the conceptualization and description of phonological parameters, it has one major weakness and that is its failure to specify the activity of the tongue, which is, after all, the principal articulator in language. The activity of the tongue must be inferred from the data which can be readily done with one's own native language but offers little help to the grasp of the phonology of other languages in a practical sense. This paper will utilize the consonant chart as a point of departure for the discussion of articulatory parameters and make an attempt to modify it in the direction of providing more comprehensive physiological data, particularly tongue activity.

The notable contribution of Honikman to phonology has been to introduce the notion of tongue anchorage and its function in language. Tongue anchorage is related to the elusive concept of "phonological base" which 19th century phonologists suspected was operating in language but which they were unable to define(Kelz, 1971; Wadsworth, 1979). Unfortunately, Honikman fails to include sufficient data in her short article to provide a conclusive grasp of tongue anchorage and the notion completely escapes the grasp of her critics some of whom continue to speculate about and search for the enigmatic "base" (Drachman, 1972; Schourup, 1981).

Table 1. LADEFOGED'S CONSONANT CHART (1982, p. 33)

Manner of articulation \ Place of articulation	bilabial	labio-dental	dental	alveolar	palato-alveolar	palatal	velar
nasal (stop)	m			n			ŋ
stop	p b			t d			k g
fricative		f v	θ ð	s z	ʃ ʒ		
(central) approximant	(w)			ɹ		j	w
lateral (approximant)				l			

A phonetic chart of the English consonants we have dealt with so far. Whenever there are two symbols within a single cell, the one on the left represents a voiceless sound. All other symbols represent voiced sounds. Note also the consonant [h]*, which is not on this chart, and the affricates* [tʃ, dʒ]*, which are sequences of symbols on the chart.*

The anchorage of English will be treated in detail in this paper with its implications for determining the articulatory parameters of consonant formation. To understand the workings of anchorage we must have an elementary grasp of the physiology of the mouth, including the names of the teeth and parts of the tongue. We will begin with the teeth, 32 in total, identified by their common dental names, four in number: incisors or front teeth (8), canines (4), premolars (8), and molars (12). The teeth are subdivided into two hemispheres or jaws, upper and lower, each hemisphere subdivided into a right and left quarter. Linguists recognize four parts of the tongue, beginning from front to back: tip, blade, back and root, with indefinite boundaries separating each. To these we may add the important sides or periphary of the tongue which play the major role in anchorage formation.

The tongue is essentially a flat surfaced, oval organ, emerging from the throat region and attached by soft tissue on its underside to the lower jaw. It is pure muscle and has the properties of stretching or lengthening and contracting or shortening, as well as lowering and raising itself in the mouth. In the natural closed jaw state the tongue can be felt to be filling the mouth with the sides in contact with the inner faces of the teeth, for English speakers mostly the upper teeth. During speech the tongue is confined to the inner mouth, the teeth acting as a boundary of forward movement. In the natural state the sides of the tip touch the incisors, the sides of the blade rest on or near the canines and premolars, and the sides of the back of the tongue touch the premolars and molars. With speech onset, the tongue will tense and take up the anchorage position of the language being spoken.

The relationship of the sides of the tongue to the inner walls of the teeth is extremely important in speech for it is in the contact between these two that we establish the phenomenon of anchorage. In the anchorage of a given language one specific, limited area of the total periphary of the sides of the tongue attaches permanently to the inner walls of contiguous teeth. This may be, for example, the sides of the tip to the incisors, the sides of the blade to the canines or premolars, the sides of the back to the molars, etc., separately or in combination. The anchorage will involve either the lower teeth or upper teeth but not both. The parts of the tongue which are not anchored are free to move about and articulate the consonants and vowels in the domain of the tongue. At this juncture we note certain prerogatives of anchorage: (a) anchorage is universal, that is, language cannot function without anchorage; (b) each language has a unique anchorage, different from all others; (c) all the speakers of a language have an identical anchorage. If anchorage is functioning in all languages, why are we not aware of it? Simply because no one has pointed it out to us, but ontologically speaking, the anchorage of our native language is formed at the early childhood stage when the tongue is permanently set and maintains this position at all times, in and out of speech except when foreign matter is ingested into the mouth. When the anchorage position is raised to the level of consciousness, its operation is unmistakable, and with linguistic training we can map out its operation and functions.

In terms of consonant production there are three distinct physiological areas of speech production in the vocal tract: the labial area, the important inner frontal consonant area, and the velar area to which we may add the post velar area. We should bear in mind that all vowel phonemes are produced from the anchorage position in the inner mouth through modification of the tongue shape but with no closure of the tongue

taking place. The most significant of these areas is the inner upper frontal consonant region, for as we shall see, the tip and blade, the most active and sensitive parts of the tongue, working together or separately, produce the largest number and most productive consonant phonemes of the language, and, in fact, set the fundamental patterning for the entire phonological system. At this point we will engage in a short anchorage test for native speakers of English which will undubitably convince speakers of the existence of English anchorage. Instructions for the test follow and will require the cooperation of the reader to perform certain activities. In a natural manner without pause repeat the word 'ten' and with each repetition open the jaws slightly until maximally opened. At the point of largest opening introspect on where the tongue is in the mouth and what it is doing. If the test was done correctly, the body of the tongue will be found in the upper hemisphere or jaw with the sides of the back of the tongue clinging tenaciously to the inner walls of the upper molars and premolars while the tip and blade are articulating the phonemes of 'ten.' This, in brief, is the anchorage of English: the sides of the back of the tongue are permanently attached to the inner face of the upper premolars and molars while the forward part of the tongue, the tip and blade, freely moves up and down, closing and opening on the alveolar ridge to form the vowels and inner frontal consonants of English. At onset, the tip and blade acting in concert are resting on the alveolar ridge at the point where the alveolar ridge begins its upward curve to the hard palate. They release to form the phoneme /t/, at the same time shaping the phoneme /e/ and then quickly closing for the phoneme /n/ on the identical point of the alveolar ridge as for the /t/. If we looked into the open mouth with a mirror at this stage, we would see the underside of the tongue, the back rigidly immobile, while the slight wiggling of the tip and blade phonate the word 'ten.' If we released the hold of the tongue from the upper teeth and tried to say 'ten' we would produce linguistic garbage, akin to the beginning learner who tries to pronounce English while using his native anchorage. To recapitulate the anchorage of English: the sides of the back of the tongue hold firmly and permanently against the inner face of the upper premolars and molars while the tip and blade articulate for the inner frontal consonants on the alveolar ridge at the point of upward curve and open for the emission of vowels. It is important to note the two significant functions at work here simultaneously, the permanent positioning of the tongue via the action of sides and teeth called anchorage and the articulation of the inner frontal consonants by the free or moveable portion of the tongue, the combined tip and blade. Both are necessary for the understanding of what transpires phonologically in English.

To complete the open mouth experiment close the jaws gradually while saying 'ten' and note that the position of the tongue

on the sides of the molars and premolars remains intact while speech continues in a natural and relaxed manner. With a little practice of this experiment the anchorage will establish itself in our consciousness, and we are now ready to examine the parameters of consonant articulation, for intense observation of our own articulatory activity is the major basis for validation of our views.

With the concept of anchorage physically established for English we now proceed to examine its effect on the consonant phonology. The sides of the tongue while in anchorage position have the privilege of moving vertically up and down the inner face of the premolars and molars, this action being an important condition for providing changes in tongue height, one of the requisite parameters of vowel formation. In addition to height variation the body of the tongue also exhibits the property of stretching or lengthening and shortening or bunching while in anchorage to accommodate the demands of consonant and vowel formation. The nexus or most rigid point of anchorage is on the last molar. While the anchorage is absolutely basic to language use, the management of the free and articulating part of the tongue creates the phones of the inner frontal consonant area of the language and it is the observation of the manner in which this is accomplished that we arrive at the selectional features and qualities of the phones of individual languages. In English this function is furnished by the tip and blade as they swing freely, in an opening and closing motion on a given point of the alveolar ridge. The opening is necessary for vowel formation and also clears the alveolar area for the production of consonants in the labial and velar areas while the closing or partial closing of the tip/blade forms the stops and fricatives of the upper frontal or alveolar consonants.

A crucial fact regarding the tip/blade closure in English is that all the upper frontal consonants, and this is a large group, are formed on a single or unitary point of the alveolar ridge. The approximate point is the crown of the alveolar ridge at the point where it begins its upward curve to the hard plate. The formation of vowels is accomplished by a slight drop or opening of the tip/blade from this point since vowels or vocoids by definition are produced without constriction in the vocal tract (nasal vowels appear to be an exception). The contention that there is a uniform point of formation of the frontal consonant group departs from the traditional view of the situation, an example of which occurs in Table 1. Published consonant charts of English invariably display minor differences of parameter interpretation by the authors though there is general consensus. In Table 1 we note the internal frontal consonants are articulated in the dental area /θ-ð/, the palato-alveolar area /$\overset{\vee}{s}$-$\overset{\vee}{z}$/, /$\overset{\vee}{c}$-$\overset{\vee}{j}$/ (the latter are not listed on this chart but so interpreted by

others), and the palatal area /j/ (in my interpretation a velar) and the remainder are alveolars.

Evidence for the unitary view derives from the introspective observation of our own articulation of phones spoken in words and in isolation. Knowledge of tongue anchorage assists in plotting the activity of tongue and articulatory musculature by noting changes in pressures and movement and correlating them with acoustic output. Of help also is the logic of the system, that is, the oppositions and similarities of features operating in the limits of the system. It is obvious that one language will not utilize all possible human sounds in its code. Quite the contrary, it operates through an extremely limited range of possibilities and, within the parameters at hand, formulates its logical-physical-acoustic system, preserving its historical endowment but at the same time gradually restructuring and adapting it to new conditions. Given this orientation we can move with some confidence in making decisions regarding phonemic entities, their occurrence, co-occurrence, onsets, durations, pressures, releases, similarities, differences, etc. No one would dispute the identical point of articulation of select phonemes in such examples as 'ten' /t-n/, 'tent' /t-n-t/, 'tense' /t-n-t-s/, 'tender' /t-n-d-r/, 'stencil' /s-t-n-s-l/, 'tens' /t-n-z/. To this list we add examples of the disputed phonemes mentioned above: 'tenth' /t-n-θ/, 'stench' /s-t-n-č/, 'stringent' /s-t-r-n-ǰ-n-t/, 'tension' /t-n-š-n/ and 'incision' /-n-s-ž-n/. In such tests by association, particularly clustering, the single point of closure seems conclusive. The final phoneme in question /j/ (in my notation /y/) I consider a velar after the following argument with reference to Table 2. The stops /k-g/ are undisputably velar. By the test of association utilizing the forms 'core' /k/, 'whore' /h/, and 'yore' /y/, we include /y/ in the inventory of velars. Thus, by virtue of the anchorage and resultant tongue movements in English there is only one point of articulation for this large group of alveolar consonants among whose members are found the highest frequency phonemes in the language.

If the upper frontal consonants have only one point of articulation, how does the system maintain differentiation among the members of the group since every acoustic difference found in phonology must be accompanied by a discrete physical correlate, a well established principle of operation in phonetics. The work of differentiation in the alveolar area, and for that matter in the labial and velar areas as well, is effected through the manner of articulation, or, in other words, by permissable alternate behaviors accorded the articulators which culminate in discrete acoustic effects in the system. Functionally, these are different movements allowable to the same articulators and linguists provide a nomenclature for identifying them such as stops, liquids, trills, fricatives, etc. In this paper the

Table 2. ARTICULATORY PARAMETERS OF ENGLISH CONSONANTS.

TONGUE ANCHORAGE: The sides of the tongue opposite the premolars and molars are permanently fixed (anchored) to the inner face of the upper premolars and molars; the tip and blade acting in unison close for articulation at the point of the beginning backward slope of the alveolar ridge for the inner frontal consonants (alveolars) and remain suspended (open) for vowels, labials and velars.

Manner of Articulation	Point of Articulation		
	Labial	Alveolar	Velar
Tongue Contact Part:	None	Tip/blade	Back
Stops			
Full	p/b	t/d	k/g
Nasal release	m	n	ŋ
Soft release		ʧ/ʤ	
Lateral release		l	
Fricatives			
Full spread	f/v*	θ/ð	
Slit open		s/z	
Half open		ʃ/ʒ	h/
Full open	w	r	y

*Labio-dental
Note: Homorganic consonants are separated by a slash; left member is voiceless.

analysis of articulatory parameters being presented with its particular features and terms applies to English only. We take the view that there are two types of consonant movements at the generic level, namely, stops and fricatives. Within these two categories we are able to demonstrate the consonant movements of English. In conventional terms, stops are a complete closure of the breath stream at some point in the vocal tract while fricatives are sounds made by the breath forced through a constriction of the articulators, resulting in a hissing, rushing or gliding sound. Given the anchorage of English with its constraint on the tip/blade to articulate on a single point, how do the articulators manage to do the work of phoneme differentiation for the rather large group of upper frontal consonants? To map the strategies taking place we find it convenient to devise some ad hoc descriptive terms to portray the differentiating parameters at work. We will begin by describing conditions in the alveolar area for it is here that the tip and blade, the

most active and sensitive part of the tongue, develop the phoneme patterning at work in the system. At this stage reference should be made to Table 2.

In the alveolar area the stops are subdivided into four types, full stops, nasal stops, soft release stops, and lateral release stops. These will be described in turn. In the full stops /t-d/ the breath is stopped by the combined action of the tip/blade at the point where the alveolar ridge begins its upward curve to the hard palate. It is to be recalled that for all consonants and vowels of the language the sides of the back of the tongue are anchored to the upper premolars and molars. This fact will not be reiterated in ensuing descriptions of phonemes. Also, to establish a point of reference we will consider the phoneme /t/ as the kingpin of the alveolar group. The nasal stop /n/ is formulated at the identical point as /t/ but differing in release, as the velum simultaneously closes with the tip/blade closure to effect the release of air through the nasal passage; hence the designation of the phoneme as an alveolar nasal stop. The soft release stops /ʧ-ʤ/, otherwise known as affricates, are similar in point of closure as /t/ but with a gradual release of air with friction accomplished by the tip rolling open to the blade (the roll-back action, engaging the back blade, possibly accounts for the palato-alveolar description the phoneme receives). Finally, the lateral release /l/ in which the tip/blade make full closure on the alveolar ridge similar to /t/ but accomplish the release by dropping the anchorage held on the molars briefly, allowing air to escape laterally at about the molars. /l/ is the only phoneme in the language for which the anchorage is released, however briefly.

The physical differentiations in the fricative class are occasioned by the degree of the size of the opening or channels created by the tip/blade through which the air passes to form friction over the alveolar ridge. There are four types of fricatives called full spread, slit, half open, and full open. The size of openings should be considered relative to each other rather than in an absolute sense. In the articulation of the full spread phonemes /θ-ð/ the tip/blade is lightly touching the alveolar ridge at the common point of articulation over its entire length as if for a stop. The air is forced through gently, forming a soft friction. At release the tip/blade moves slightly forward and down. This forward movement in the release possibly contributes to the phoneme being called dental. Acoustically a fairly authentic full spread friction can be created with the tip/blade thrust between the incisors, but this is an incorrectly learned version. The /s-z/ phonemes are activated by the creation of a thin slit or groove at the center of the tip/blade as it rests on the alveolar ridge. The result is a sharp whistle like sound. The term 'slit' occurs in the literature for this phoneme, and it is an apt choice.

The half open /s̬-z̬/ creates a considerably larger channel than the slit with the aid of the sides of the blade grasping the premolars, thus providing the leverage for deepening the center groove of the tongue. The acoustic result is a more liquid, softer friction. The muscular tension felt at the sides of the tongue in contact with the premolars is probably the reason this phoneme receives the description of palato-alveolar. One full open alveolar phoneme exists, the /r/. The progressive opening seen in moving from /s/ to /s̬/ goes a step further to produce a wider gap at the alveolar ridge. The bulk of the tongue is bunched back with the side pressure that sustains the tongue and creates the gap being felt on the molars. The gap is wider in pre-vocalic position 'red,' than in pre-consonant position 'desert.' This pull back is sometimes mistaken for retroflection which does not exist. However, there is secondary lip rounding which is thought to be a reflex of the down pressure in the central back of the tongue, a similar effect to the lip rounding and back lowering found in lip rounded vowels.

We will now proceed to a consideration of the velar and labial consonants. The full stop features felt in the production of the phoneme /t/ 'ten' are likewise felt in the bilabial phoneme /p/ 'pen' and the velar /k/ 'Ken'. By features in this context are meant such articulatory effects as pressure, tension, onset, timing, release, duration, aspiration, speed, etc. These can be considered underlying features shared by the three articulatory areas. The arrangement of these phonemes on the same manner line, for example, full stop: /p/, /t/, /k/ is more than just a fortuitous or accidentical matter. It indicates that the articulatory action occurring at different contact points is being managed or maintained in the same manner. The acoustic effect is different, but the underlying articulatory performance is the same. The phenomenon of articulatory management is a reflex of the complex structural organization and the highly integrated, interdependent, efficient and economic operation of the parts of the system. The overriding consideration is to get the process of communication accomplished with the minimum amount of effort, muscular involvement and energy and the maximum speed, smoothness and accuracy. The action of anchorage is not a detriment to these goals; quite the contrary, it stages the required number of discrete phonemes out of the least amount of physiological effort. As described for the full stops, the bilabial nasal stop /m/ and velar stop /ŋ/ share the underlying features of alveolar nasal /n/, even though /ŋ/ has rather restricted prerogatives of occurrence. The minimal triads 'some' /m/, 'son' /n/, 'sung' /ŋ/ and others such as 'ram', 'ran', and 'rang' and 'simmer', 'sinner' and 'singer' illustrate shared underlying features, the chief of these being velar closure coinciding with labial and alveolar closing to produce nasal air release.

In the fricative group the full spread type of articulation described for /θ/ 'thigh' applies to the labiodental articulation of /f/ 'fie', as also in the voiced counterparts, /ð/ 'than' and /v/ 'van,' Note also 'thresh' and 'fresh' and 'these' and 'v's.' The upper incisors lightly contact the lower lip on its inner side, and the air is gently pushed through the contact until the release for the vowel takes place, similar to what occurs on the alveolar ridge with /θ/. On less secure grounds is the assignment of velar /h/ to the half open fricative line of /š/ since the two designated velar fricatives /h/ and /y/ occur in the back of the mouth, a region less accessible to intuitional observation. /h/ is assigned to the half open line largely on the basis of the relaxed manner in which the two phonemes are rendered. Thus, 'shut' /š/ and 'hut' /h/, 'sheet' and 'heat', 'shell' and 'hell' are spoken with the same soft and easy onset, duration and release, a number of their underlying parameters. If /h/ were uttered with the same strident pressure as the /s/ or slit line 'see,' we would get a harsh, strident /h/ (try it with 'he' as in 'see'-'he') but this is not the case.

Ladefoged, whose consonant chart served to guide a number of decisions made in this study, treats /w/, /r/ and /y/ as approximants and as such they presumably share some kind of articulatory features. Called semivowels or continuants in other studies, they are treated here as full open fricatives or the extreme members of a fricative continuum progressing from full spread /θ/ to slit open /s/, to half open /š/ and full open /r/ as witnessed in the alveolar region. The primary articulation in /w/ 'wine' is bilabial action just as labial action is the primary articulator in /m/ 'mine' and /v/ in 'vine'. Traditionally, /w/ is called labio-velar in recognition of the back tongue action felt in its production. The velar action in /w/, however, appears to be a depressing and tensing of the central back of the tongue which is a reflex or secondary effect of the lip rounding, both of which work together in the production of lip rounded vowels (see Table 3). This is viewed as the opposite condition to /r/ where the back tongue tension on the molars causes some secondary lip rounding.

The /y/ or full open velar phoneme is produced in the velar region through the action of the raising of the central area of the tongue back to approach the velum or soft palate. In this action the /y/ is related to the high tense lip spread vowel phoneme /i:/. Due to the size of the opening the acoustic effect is a rushing or gliding sound rather than the strident one we usually associate with fricatives. The construction of a wider channel for the air passage results in gliding effects as the onset and release are performed in a wider space. This feature applies to the three full open phonemes /w/, /r/, and /y/. A prominent underlying feature of the three full open phonemes is

Table 3. ARTICULATORY PARAMETERS OF ENGLISH VOWELS

TONGUE ANCHORAGE: The sides of the back of the tongue are permanently fixed to the inner face of the upper premolars and molars; the tip/blade is suspended under the alveolar ridge (open); the sides of the back move vertically (up and down) on the face of the upper molars and premolars to provide the parameter of height; the crux of the anchorage is on the last molar; the tongue lengthens and shortens but does not move forward or backward; the central back of the tongue is raised for lip spread, lowered for lip rounded vowels.

Tongue Height on Molars	Tongue Tension	Lip Action: Spread	Lip Action: Neutral	Lip Action: Round
High				
(Gum, upper face)	Tense	i: 'seat'		u: 'suit'
	Lax	i 'sit'		u 'soot'
Mid				
(Center face)	Tense	e: 'sate'		o: 'soap'
	Lax	e 'set'		o 'sought'
Low				
(Lower face)	Tense	a: 'sat		a 'sot'
	Lax		v (ə) 'sup'	

Diphthongs: ai 'sight' au 'south' oi 'soil'

Transcription: 'She spoke to Jeff last night'.
#ši: spo:k tv ǰef la:st nait#

fairly strong muscular tension as we may note in 'wail' /w/, 'rail' /r/, and 'Yale' /y/, or, before a lax vowel, 'west', 'rest,' 'yessed.' This tension contrasts with the soft, relaxed rendition of the half open /h/ in 'hail.'

A very significant consideration in the discussion of consonants is the relationship of consonant to vowel in the natural stream of speech. A sign of intimate relationship between vowel and consonant is the occurrence of simultaneous articulation of vowel and consonant in the production of labials and velars. A sample will serve to illustrate the phenomenon. When bilabial /p/ is onset, the tongue is already in set position, called anticipation, for the vowel which follows before the /p/ is ever released. This is true of all labials and velars. In the case of alveolars, the closure action of the tip/blade precludes such simultaneous vowel activity. But another type of coarticulation exists in the relationship of succeeding vowels and consonants. The underlying features of the vowel are imposed on

the preceding consonant in an anticipatory action. Thus, in the formation of syllables and words the vowel is in command or dominates its immediate environment with its features. To fully understand this phenomenon we are required to look at the articulatory parameters of vowels, and these are displayed in Table 3. In brief, the principal parameters are lip action (spread, neutral and round); height (high, mid, low) decided by the position of the anchored sides of the back of the tongue on the face of the premolars and molars; and tension, that is, the tense or lax condition of the tongue musculature in rendering vowel phonemes. In the following example we will witness the imposition of vowel parameters on a given phoneme /t/ in the form of secondary features. The phoneme /t/ in (a) 'teen' /ti:n/, (b) 'tune' /tu:n/ and (c) 'ton' /tɒn/ is (a) lip spread, tip/blade tightly pressed against the alveolar ridge, back arched with sides high up on the gums of the molars and premolars; (b) lip rounded, tip/blade tense but slightly lower and more forward on the alveolar ridge than (a), the central back depressed sharply with the sides tense on the gums of the premolars and molars but a bit lower than in (a); (c) is firmly but lightly touching and releasing on the forward portion of the alveolar ridge with lips immovable, neither spread nor rounded, and the sides of the back of the tongue flacidly touching the lower face of the molars and premolars. In effect, we have described three allophones of /t/ conditioned by the vowels in its environment. Given this concept of allophone, the least possible number of allophones of a consonant would be a function of the number of vowel phonemes occurring in its environment. The entire question of phonotactics or strategies of permissable phoneme cooccurrence and the effects of cooccurrence in words and at junctures is a challenging and wide ranging topic deserving further investigation.

An area requiring comment is the homorganic consonant. The grouping of homorganic consonants, e.g., /t-d/, /p-b/, etc., in pairs and treating them as units with one or the other member deleting or adding a component of voicing belies the complexity of the articulatory movements involved in this phenomenon. The amount of articulatory activity required to produce the voiced member of the pair is considerable. The onset of voicing engages the entire musculature of the glottis which results in a downward pull of the throat-tongue structure. The management of succeeding voicing and devoicing stages, speech pause and termination, sustaining tone and pitch, activating stress and associated phenomenon are topics that lead into suprasegmental conditions, a subject beyond the scope of this paper but one that needs to be studied from the point of view of tongue set.

As a final note, it is expedient to express a caution regarding the judgment and description of articulatory movements. The present analysis represents a description of my own articulation.

Its validity as a model of English speech will depend on the consensus of other speakers, particularly linguists. Such personal description, however, is the only way we can conduct refined articulatory analysis since it is impossible to get into the mouth of another person to describe the intricacies of muscle movement which represent our research goal. Each individual speaker has a unique speech output, the result of a complex of inherited physiological features and learned articulatory behaviors. The general rule of articulatory judgment is that any deviation from a given or supposed norm whether individual or dialectical will have an effect carrying through all parts of the articulatory system and the acoustic output and our ability to map, explain or predict these effects confirms the validity of our knowledge and principles. In conclusion it can be said that this paper has merely touched upon a host of interesting phonological materials that lend themselves to further exploration.

REFERENCES

Drachman, Gaberell. 1972. Phonology and the basis of articulation. Die Sprache. 19:1-19.

Erazmus, Edward T. 1984. English vowels from the point of view of articulatory settings. Proceedings of the Mid-America Linguistics Conference, 1983, 144-155. Boulder: University of Colorado.

Honikman, Beatrice. 1964. Articulatory settings. In honour of Daniel Jones, ed. by D. Abercrombie, et al. 79-84. London: Longmans.

Kelz, H. P. 1971. Articulatory basis and second language teaching. Phonetica. 24:193-211.

Ladefoged, Peter. 1982. A course in phonetics. New York: Harcourt Brace Jovanovich.

Schourup, Lawrence. 1981. The basis of articulation. Ohio State University Working Papers in Linguistics. 25:1-13.

Wadsworth, Stafford. 1979. Articulatory settings: the mechanics of variety. Revue de Phonetique Appliquee. 52:255-269.