

The Articulatory Syllable: Saussure to Stetson

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1. Introduction. The theories of the syllable sketched by Saussure, Grammont, and Stetson occupy an important position in the development of modern syllabic theory. Their work taken together is the most vigorous exposition of the view that the syllable has an essentially articulatory basis. It offers insights of value into the nature of the concepts of syllabicity, vowel, and consonant, as well as that of the basic asymmetry between syllable onset and syllable coda.

As exponents of an articulatory syllable, Saussure, Grammont, and Stetson rejected the dictum of Eduard Sievers that "there can be no purely articulatory definition of the concept 'syllable'" and his view that the syllable is a perceptual event. Together with Otto Jespersen's perhaps better known theory of the syllable, their work can be seen as a reaction to Sievers' masterful and seminal synthesis, first published in 1881, which held that the sonority profile and the expiratory force contour ("breath pulses") of a string of segments interact to produce its perceived organization into syllables.¹ Jespersen developed one aspect of Sievers' theory, whereas Saussure and Grammont, and subsequently Stetson, developed the other. Roughly speaking, Jespersen elevated sonority to the sole principle of syllable formation, and treated force contours as an unnecessary complication.² Saussure and Grammont took exactly the opposite tack, relegating sonority to a minor and subsidiary role. This opposition between the Jespersenian and Saussurean theories seems not to have always been noticed in some of the currently popular discussions of the role of sonority in syllable structure, which attribute a sonority theory of the syllable to both Jespersen and Saussure. For example, [Bybee] Hooper 1976 remarks that "a similar proposal [to Jespersen's] was made by Saussure ... who formulated a definition of the syllable on the basis of the degree of opening of ... sounds" (198). Steriade 1982, commenting on a version advanced by Selkirk of Jespersen's principle that syllables consist of segments with a single rise and fall of sonority, says that "versions of this principle have been known at least since Saussure's *Cours d'introduction* [sic] and its relation to the process of syllabification has not escaped attention."

2. Saussure and Grammont: Releasing sounds versus arresting sounds. Saussure and Grammont³ were impatient with theories such as Sievers' and Jespersen's for the following reasons: 1) they provided no adequate account of syllable division; 2) equating sonority peaks with syllable nuclei required explaining away subsyllables in words like Eng. *stop*, Russian *lba*, etc.; and 3) Sievers' invocation of breath pulses seemed to be circular, i.e. another way of saying that a sound was syllabic just if it was pronounced as syllabic. Thus they abandoned sonority as a fundamental determinant of syllable structure, and sought some alternative to Sievers' force contours.⁴

This alternative was the concept that all sounds are produced either by opening or by closing gestures. In sequences like *pop* (or *appa* with geminate p's), both stops are characterized by labial closure, but they differ essentially in that the acoustic effect of one is produced by opening the lips and the other by closing them. One must thus recognize two distinct types of sound, opening sounds and closing sounds, a distinction which is collapsed by our usual phonetic categories, for they are in the main based upon a static view of articulatory gestures, and abstract away from their dynamics or direction. Two other pairs of terms were used to label this distinction—explosive and implosive, and rising and falling aperture or tension. It seems best to avoid the latter terms to avoid confusion with aperture, the term Saussure and Grammont employ to label their sonority scale. And since "implosive" is now the common label for a particular stop manner, I will hereafter refer to opening sounds as "releasing" and closing sounds as "arresting".

Let us take this distinction as given, postponing for the moment questions of its theoretical basis and practical determination. A syllable is then defined as the maximum sequence of sounds such that it contains no arresting sound immediately followed by a releasing sound. Usually syllables begin with a releasing sound or sounds and end with one or more arresting sounds. For example *ten clams* is schematically

t e n k l æ m z
< > > < < > > >

where < indicates the sound is releasing and > indicates that it is arresting. Moreover, this case is also typical in that it consists of two rise-falls of sonority or aperture. This need not be the case, however. When two successive sounds of equal aperture occur, as in Russian *kto, sxod, mno*, it is their pronunciation as releasing that leads to their perception as the onset of a single syllable; their relative aperture plays no role. The importance of the releasing-arresting distinction is seen more clearly in sequences containing Sievers' subsyllables--Eng. *stop, lapse*, etc. The more sonorant fricatives do not form separate syllables because they are pronounced as releasing and arresting, respectively: *stop* <<>>, *lapse* <>>>. And presumably more sonorant onsets and codas with reversed sonority would be accounted for in the same way: Russian *lba* <<>, *mxom* <<>>.

Grammont's treatment of syllabicity within this framework is original and insightful. He begins with a modification of Saussure's concept of the vocalic peak. Every syllable contains a vocalic peak; it is the onset of the first arresting segment, e.g. as in *stop* <<*>, where the * indicates the vocalic peak in the schema. If the syllable contains a vowel, then vocalic peak and vowel onset coincide. If, however, there is no vowel, as in, say, [pst] pronounced in isolation, the location of the vocalic peak depends on how the s is pronounced; if as releasing, [pst] <<*>, it falls after the s; if as arresting, [pst] <*>, it falls before it. In such cases, the vocalic peak indicates where, if the form is pronounced with a vowel, the vowel will appear. In French, the interjection [pst] is <<*>, for the vocalic variant is [psit]; in other languages, Grammont claims, one finds [pst] <*> varying with [psit]. This view has the consequence that although every syllable has a (unique) vocalic peak, not every syllable contains a syllabic nucleus. Furthermore there is no longer need for a distinction between syllabic and nonsyllabic segments; the vowel-consonant distinction is sufficient.⁵ Although Grammont does not remark on it, this view of the syllable's structure also implies that there is a natural opposition between the onset, i.e. the releasing segments and the remainder of the syllable, i.e. the arresting segments, which consists of a vowel, if there is one, plus the final marginal consonants of the coda.

The boundary between syllables is easily determined once given the identification of the segments as either releasing or arresting. Syllable boundaries separate sequences of arresting segments (which belong to the preceding syllable) from immediately following sequences of releasing segments (which form the onset of the next syllable). Thus an intervocalic sequence, such as in *apsta*, has four possible syllable divisions, depending upon the dynamic natures of the consonants: *a.psta* ><<<>, *ap.sta* >><<>, *aps.ta* >>><>, and *apst.a* >>>>>. (The problem of *apst.a*, where the syllable boundary falls between two arresting segments, is discussed in the paragraph below.)

Saussure did not claim that he had worked out a complete theory of the syllable, but rather a framework that could facilitate a coherent study of its nature. Grammont's emendations eliminated some contradictions and advanced the theory somewhat, but even so, few issues that are problems for the theory were confronted. One important exception is the proper characterization of vowel hiatus and of diphthongs. A sequence of vowels, each belonging to a separate syllable, -a.a.a-, say, constitutes a sequence of implosions >>> and is thus structurally equivalent to Eng. *arm*, etc., which is also >>>, but which is, in contrast, monosyllabic, as the theory of releasing and arresting sequences would predict. What then permits -a.a.a- to be partitioned among three syllables? Saussure says that it is simply a broken arresting sequence. (The brief discussion of hiatus is introduced by the remark that his theory doubtless does not resolve all questions.) Just

why this should lead to separation into distinct syllables is not clear, for while he cites initial *kt-* << and final *-sr* >> as examples of broken releasing and arresting sequences, respectively and characterizes them as unnatural because of their reversed sonority, neither their brokenness nor unnaturalness necessarily requires that they belong to separate syllables. On the other hand the sequence of two syllabic n's in Ger. *berittenen* is treated by postulating a releasing nonsyllabic n between the two arresting and syllabic n's: [beritn.nn], ending with the aperture schema <tinn as <><>. Whether justified here or not, this interpolation of an assumed releasing segment cannot be a general solution. Saussure makes this clear with his own example of two contrasted pronunciations of Fr. (*meur*)trier, one with an explosive onset in the final syllable, [-tri.<<><>, and one without, [-tri.e] <<>>. Grammont's treatment of the hiatus-diphthong distinction is similar; vowels in hiatus are two separate arresting sounds, whereas diphthongs but a single arrest (but still two segments, apparently). Their discussions of the role of arrest/release in hiatus reminds one very strongly of Sievers' continuous/discontinuous for contour opposition, and is difficult to reconcile with their original core distinction of opening and closing sounds.

One consequence of the theory is that the final l or r in French words such as *table, sab*, *aigle*, and *aigre* are necessarily syllabic. Such words are schematically <>>< with releasing final l or r, both because their pronunciation is characterized by a release and because in certain contexts, speech registers, or dialects, a vowel appears, it follows the liquid rather than precedes it, thus indicating that a vocalic peak follows the liquid. If such words are monosyllabic, in accordance with the view of most scholars of French phonology, the theory is left with an unresolved contradiction.

Where does the sonority hierarchy fit in here? Both Saussure and Grammont regard syllables with a rising-falling sonority profile as more usual, more "normal" syllables than those which do not match this pattern. To paraphrase Grammont slightly, in typical syllables, releasing consonants that precede the vocalic peak occur in order of increasing sonority, and arresting segments following it occur in order of decreasing sonority. Hence there must be preference for sequences of increasing relative sonority to be composed of releasing segments and for sequences of decreasing sonority to be composed of arresting segments. Yet he emphasizes that it is not the rise and fall of sonority of a sequence of segments that is the decisive factor determining whether they constitute a syllable, for the typical rise-fall sonority profile may be reversed without thus diminishing the integrity of the syllable. Beyond this, the question of how relative sonority and the releasing/arresting distinction might interact is not addressed.

3. Stetson: Syllables are chest pulses. Stetson is chiefly remembered for his claim that every syllable is produced by a specific articulatory gesture, the chest pulse. His work is considerably richer than this highly reductionist statement might imply. It makes two major contributions to syllabic theory. First, it is a comprehensive attempt to provide an explicit physiological basis for the syllable. Stetson embraced Saussure's concept of an articulatory basis for the syllable, and moreover attempted to provide a comprehensive account of just what the articulatory basis was in detail comparable to articulatory accounts of the production of vowels and consonants. A second notable characteristic of Stetson's theory is that it does not derive the syllable from segments but rather segments from syllables.⁶

3.1 The syllable as a sublaryngeal gesture. The production of most speech sounds begins with the flow of air from the lungs, which is interrupted or otherwise modified by gestures of the larynx or other articulators of the vocal tract. That this pulmonary source of air flow or air pressure is usually taken more or less for granted in phonetic descriptions is a reflection of the overwhelming predominance of the segment as unit of phonetic description. Nevertheless the supply of pulmonary air is not simply constant, but is regulated by gestures of several sublaryngeal muscles

groups. It is in the coordination of sublaryngeal gestures with those of the larynx and vocal tract that Stetson sought the organizing principles of the syllable.

Sublaryngeal control of pulmonary air flow is controlled by two pairs of muscle groups, the chest muscles and the abdominal muscles. Both groups are of course also used for inspiration and expiration. One set of chest muscles, the external intercostals, raises the ribcage, increases the volume of the lung chamber, and is used in inspiration. The opposed set of chest muscles, called the internal intercostals, lowers the ribcage, which reduces the lung volume and pushes air out. The abdominal muscles are the diaphragm, used for inspiration, which is opposed to various muscles of the abdominal wall, whose contractions act through the viscera to push air out the lungs.

The fundamental principle of Stetson's theory is that every syllable is produced with a contraction of the internal intercostals, i.e. with a chest pulse. This notion may be seen as a development of the contours of expiratory force which Sievers invoked to explain how a continuously prolonged vowel such as [-a:::] could be uttered with no change in the vocal tract and yet be a sequence of syllables ...a.a.a.a... . Stetson not only attributed such perceived peaks of intensity to a specific gesture, the chest pulse, which seems highly plausible for sequences of vowels, but also claimed that the same mechanism is involved in the production of syllables of more complex structure as well.

This extension may also be seen as providing an explicit articulatory mechanism for an earlier proposal, namely Saussure's distinction between releasing sounds and arresting sounds. A syllable may be initiated by a chest pulse alone, as in the above example, but more ordinarily the chest pulse interacts with a consonantal gesture which releases the chest pulse. Stetson uses the analogy of flicking a coin to illustrate the interaction: just as the forefinger restrains the thumb against growing tension and suddenly releases it to strike the coin, a constriction in the vocal tract first restrains the compression of the ribcage and then releases it to permit a pulse of air. In this case the restraint is not accomplished by direct contact but indirectly through force transmitted by the column of compressed air in the chest and vocal tract. The chest pulse can end in three ways. In the case of repeated vowels, and in many open syllables, the momentum of the chest walls is arrested by the opposing chest muscles (the external intercostals), i.e. the syllable is chest-arrested. It may also be consonant-arrested by a constriction in the vocal tract, which arrests the momentum of the chest wall by the increased pressure of the air column. Finally, in cases of lengthened syllables, the opposing chest muscle groups may work together to continue the initial chest pulse in a "controlled" fashion.

Syllables are thus defined independently of segments, as a unitary gesture of the chest muscles. The interaction of segmental gestures with the syllabic gesture provides a functional characterization of segments: Those which have neither arresting nor releasing function, and hence whose sole function is to give the syllable a particular quality, are syllabics, usually vowels, but potentially any continuant. Opposed to them are nonsyllabics, which have either a releasing or arresting function. This is of course consonant with a traditional view that the fundamental division of speech sounds is between vowels and consonants, if these terms are taken in a functional sense. It is quite incompatible with one common extension of this view, that consonants are perturbatory ripples riding on the stream of vowels. Their functional interaction with the chest pulse organizes vowels and consonants into syllables, which are thus the primary units of speech production. With regard to the role of sonority, Stetson is entirely in accord with Saussure in rejecting any fundamental role for sonority in syllable structure. That it may play an auxiliary role in making some articulations more suitable for some functional roles than others is suggested by his comments that liquids and nasals constrict the vocal tract sufficiently to act as arresting and releasing elements and that *h*, being essentially a "vocalic modification", is incapable of arresting a syllable pulse. While the resemblance of Stetson's theory to that of Saussure and Grammont is obvious (and acknowledged explicitly by Stetson) the theory goes beyond simply providing an

explicit substantive basis for the Saussurean releasing/arresting distinction in several important ways. The Saussurean syllable is derived from a fundamental dichotomy which places all segments of an utterance into one of two classes: releasing sounds and arresting sounds. The Stetsonian syllable is the fundamental organizing principle of utterances from which follows a tripartite classification of gestures: releasing, arresting, or neither. The arbitrary classification of vowels as arresting in the Saussurean system is thus avoided. The functional relation of vocal tract gestures to sublaryngeal gestures provides an explanation for the coherent quality of the syllable that is lacking in the Saussurean juxtaposition of an opening sound sequence with a closing sound sequence. Note also that the concept of the vocalic peak vanishes in the Stetsonian formulation.

3.2 Applications and consequences of the chest pulse theory. Stetson did not work out a theory of the syllable in any coherent detail; it is however possible to put together a schematic picture from comments he scattered here and there. To begin with, he held that the possible relations of segments to syllables were strictly limited. He denied the possibilities 1) that consonants could be functionally unrelated to the syllabic chest pulse, i.e. that segments could lie outside any syllable, and 2) that syllables could overlap, i.e. that a segment could belong to more than one syllable. Thus neither extrasyllabic, heterosyllabic, nor ambisyllabic consonants are permitted.

The Stetsonian syllable has an internal structure of onset+nucleus+coda, the onset and coda corresponding to the articulations that release and arrest a chest pulse, respectively, and the nucleus corresponding to those that lie in between (or follow the release, in the case of a "continued" chest pulse without arrest). For syllables of the shapes *v*, *cv*, *vc*, or *cvc*, this organization is straightforward. Instead of a simple vowel, the nucleus may consist of a long or prolonged vowel (controlled rather than arrested chest pulse) or a diphthong (changing vowel quality associated with a single chest pulse). Note that double-peaked syllables are perfectly consistent with this concept of the nucleus as long as they are not produced by two chest pulses. The nucleus may also consist of a continuant consonant, i.e. a nasal, liquid, or fricative. Onsets and codas may consist of clusters of consonants, in which case Stetson calls them "compound" consonants. Here certain inconsistencies arise which Stetson does not resolve. On one hand, Stetson appeals to the highly coarticulated nature of compound onsets and codas to help explain how a multiple articulation could have a single releasing or arresting function. Thus the separate gestures of *pta* or *pla*, for example, come so close together that, though there may be partial "releases" of the chest pulse, they all take place during the initial part of the pulse, so that the final consonantal gesture is able to release the pulse through the nucleus much in the same way it would have if it had stood alone. In some cases compound onsets or codas may not function as a single release or arrest; Stetson mentions three other possible sublaryngeal articulations for clusters. First, sonorant interior consonants such as the liquid or nasal in *spry* or *tempt*, for example, may not, strictly speaking, have a releasing or arresting function but merely occur during the chest pulse release or arrest. Although Stetson does not say so, this would presumably make them part of the nucleus. Second, in cases such as initial *st-*, *sf-*, etc., if the gestures for the two sounds are not close enough together, a second chest pulse, which Stetson calls an "adventitious" syllable, may develop during the cluster. This is more or less equivalent to Sievers' subsyllables (*Nebensilben*). Third, in some further cases, which are not well-defined but which presumably include external fricatives in clusters such as *spr-* and *-nts*, a slow "controlled" chest movement may provide the necessary airflow. This does not count as a separate syllable since it is not itself a sudden "ballistic" pulse; "it is counted part of the syllable generated by the ballistic pulse." Elsewhere (without remarking on the nature of the associated sublaryngeal gesture) Stetson calls the fricatives in the English clusters "prefixed" and "suffixed" consonants as opposed to the stops in the clusters which are the "principal" consonants in the compound.

There is evidently considerable conflict between this complexity in the roles of the members of consonant sequences and Stetson's confident statement that a sequence of consonants is "definitely grouped so that they act either as arresting or as releasing factors, either singly or as

compounds." A fuller development of the theory would have had to resolve a number of issues related to the releasing/arresting distinction. Some examples are the status of subsyllables; the difference (if any) between resonants which function as part of the nucleus and those which function as part of the coda in sequences such as *-an, -al, -ans, -als, etc.*; and why *s* in, say, *s.ta* does not have the same releasing function as *s* in *sa*.

In spite of these difficulties Stetson's theory offers some interesting insights. One of these is his treatment of the asymmetry in the phonetic and phonological behavior of onsets and codas. He noted that the maximum rate of repetition was greater for *cv* syllables (e.g. for *poe poe poe ...*) than for *vc* syllables (e.g. for *... ope ope ope ...*). Indeed, the rate for *... vc vc vc ...* was little different than for repetitions of the form *... cvc cvc cvc ...* (e.g. *... pope pope pope ...*) with geminate consonants between vowels. His explanation for this in terms of chest pulse function was that since the articulation of a releasing consonant overlaps that of the chest release, it "never adds to the length of a syllable", whereas an arresting consonant, because it acts indirectly upon the chest wall through the compression of the air column that results from its closure, takes more time than the chest arrest of an open syllable, which does act directly upon the chest wall. This also explains why a *cv.c* sequence (e.g. in *an aim*) will typically shift to a *v.cv* sequence (e.g. *a name*) at faster rates of speech; the increased rate requires the more rapid chest arrest in the first syllable and shift of the consonant articulation from arresting function to releasing function in the second syllable, where it overlaps the chest release. Stetson suggests that this additional duration of an arresting consonant makes it more vulnerable to processes of loss than releasing consonants, and that it is also the basis of the commonly observed rhythmic opposition of weak versus strong syllables, where possession of either a long vowel or a coda makes a syllable strong. It also accounts for a further peculiarity of some syllable-final consonants. Since the compression by which a consonant arrests a chest pulse must be released, if it is not absorbed in a following chest pulse, it may lead to an audible release, which, however, does not constitute a syllable. This helps explain why the strongly released final consonants that are typical of many languages such as French, e.g. in *patte* [patʰ] or even [patʰ], do not constitute syllables, and how the final segments of e.g. French *cadre* [kadʁ] or Norwegian *fugl* [fʉgl] can be nonsyllabic. Stetson hints briefly at a further distinction that is based on the interaction between chest arrest and consonant arrest that is strikingly similar to the above-mentioned distinction of Jespersen's between consonants that are tightly linked to the preceding vowel (*festen Anschluss*) versus ones that are loosely linked (*losen Anschluss*). In Stetson's terms, tightly linked consonants (as in English *sit*) occur in syllables that are consonant-arrested; loosely linked consonants (as in French *site*) occur in syllables that are partly chest-arrested and partly consonant-arrested.

A further contribution of Stetson's arresting/releasing distinction between initial and final consonants is that it resolves a contradiction of Saussure's similar opposition. In the Saussurean scheme, the classification of final consonants of *patte*, etc. as pronounced with "decreasing aperture" appeared inconsistent with their conspicuous release, which was an increase in aperture. Their classification as arresting by Stetson does not conflict with their release, for it is their function with respect to the chest pulse that is crucial: a release that is not a release of a chest pulse does not affect the consonant's role in the syllable.

A second important insight of Stetson's theory was its concept of the syllable as a fundamental rhythmic event integrated in the overall rhythmic structure of speech. The largest unit recognized by Stetson is the phrase, which is a stretch of speech between inhalations. Phrases may be composed of one or more breath groups, which correspond to a single expiratory movement of the abdominal muscles. Stetson's breath group corresponds closely to what in English is often termed the tone group, the domain of a single intonation contour. According to Stetson, the main accent of a breath group is produced by the "culmination" of the abdominal gesture. Breath groups contain one or more feet, which are composed of syllables grouped about a single stressed syllable. Feet, like breath groups, are abdominal gestures according to Stetson, although he does not make clear just how the gestures for breath groups and feet differ, remarking only that "breath groups,

and often component feet, are marked off by low points in chest pressure." A stressed syllable produced by a chest pulse of increased force reinforced by an abdominal gesture, which of course usually also affects the pitch and increases the syllable's duration. It is fair to say that the essence of the Stetsonian syllable is that it is a single event of speech production, which like other repeated skilled gestures is rhythmically organized within other, slower gestures. Complementary to this rhythmic aspect of the syllable is the syllabic organization of segments, whose mutual coherence within syllables derives from their functional relationships of modifying the primal chest pulse gesture. The intellectual elegance of this fusion of the rhythmic and segmental aspects of the syllable is a glorious and magnificent achievement, unsurpassed by later theories.

3.3 Empirical basis of the Stetsonian syllable. Ah, if it were only so. So far Stetson's theory of the syllable has been presented as a theory on a par with his predecessors--an attempt to account for observations of phonetic and phonological behavior in various languages by postulating phonetic mechanisms. Stetson, however, regarded his theory as firmly supported by his instrumental observations of the coordination between the gestures of the vocal tract and the sub-laryngeal gestures of the chest and abdomen. His account refers constantly to oscillographic tracings which show the ripples that he attributed to chest pulses. Impressive as Stetson's observations are, considering the limitations of instrumental phonetic analysis before 1950, they have important limitations. First, they were based on the utterances of American English speakers, and these utterances were largely strings of nonsense syllables or words, e.g. *tas tas tas ...*, *pup pup pup ...*, and *up Bob up Bob up Bob ...*. Second, and more crucially, he did not observe the action of sub-laryngeal muscle groups directly, but inferred their action from measurements of changes in air pressure (above and below the larynx) and of movements of the body wall. When Ladefoged and his colleagues Draper, McKinney, and Witteridge made direct observations of muscular contractions, using electromyographic techniques, they indeed found chest pulses and abdominal pulses, but failed to find the correspondence between chest pulse and syllable that was the cornerstone of Stetson's theory.

In order to understand the force of Ladefoged's findings, it will be helpful to consider another principle than Stetson's there might be for the organization of sub-laryngeal speech gestures. One such principle is that these gestures have no immediate connection with the segmental gestures of the vocal tract, but rather that they serve to provide a quasi-constant source of air that makes the gestures audible at an appropriate level. The timing of sub-laryngeal contractions would still of course not be completely independent of segmental articulation, for aspirated stops permit more air to escape than unaspirated ones, voiceless fricatives more than voiced ones, etc., and greater airflows require greater compensating decreases in lung volume to maintain pressure.

Ladefoged's observations of the activity of chest and abdominal muscles supported the regulatory pattern to a great extent, although some of Stetson's claims were also supported. The typical pattern of activity during a sequence of repeated stressed syllables after an inspiration (that the internal intercostals (the expiratory chest muscles) are the most active muscle groups, and the bursts of activity of these muscles become more intense as the lung volume decreases. The activity also occurs mainly in pulses which immediately precede each syllable. The abdominal muscles of expiration, however, do not normally become active except at the end of a very long utterance. It is notable that in the majority of conversational utterances no activity of the external intercostals (inspiratory chest muscles) was observed at all. Recall that Stetson claimed that unless the initiating chest pulse of a syllable was arrested by a consonant or prolonged by a "continuing gesture, it was arrested by a gesture of the external intercostals. In most subjects Ladefoged found that the external intercostals were active only during speech at a moderate level following a deep inspiration. In these circumstances, the expiratory pulses of the chest muscles are typically lacking; the pressure exerted by the elastic recoil force of the fully expanded lungs and its enclosing structures is enough to provide the necessary airflow. Thus shortly after a deep inspiration there are chest muscle gestures after syllables which brake this elastic recoil force. These bursts

muscle activity were observed to follow both open and closed syllables, e.g. *tea, teal, teak*. For some subjects, the external intercostals were held in a state of varying tension after deep inhalation, increasing the air pressure before some syllables by slightly relaxing them.

It is evident from these results that Stetson's elegantly conceived connection between syllables and gestures of the chest cannot be true. First, syllables are not necessarily initiated by chest pulses. If the pressure exerted by the chest wall is great enough, no extra pressure is needed, or else a relaxation of the inspiratory muscles is sufficient. Even in the more ordinary case when expiratory muscles come into play, Ladefoged found frequent cases where there was no expiratory pulse for unstressed syllables, e.g. in the words *pity* and *around*. Second, it is not even the case that expiratory pulses only occur at the beginning of syllables. For prolonged syllables, such as *road* when it occurred at the end of phrase, there may be two expiratory pulses. Two expiratory pulses were found also in words like *sport* and *stay* beginning with a sibilant+stop cluster. Second, Stetson's distinction between consonant-arrested and chest-arrested syllables is unsupported. In most conversational speech there is no activity of the inspiratory chest muscles at all. When these muscles do come into play after deep inhalations, their peaks of activity come after both open and closed syllables. Third, Stetson's neat separation of the functions of chest and abdominal muscles according to the rhythmic units of syllable, foot, and breath group does not hold up. Typically the chest muscles alone are used for most stretches of speech, with the abdominal muscles becoming active only toward the end of a long utterance. It should also be mentioned that Ladefoged and his colleagues found a significant amount of variation in some of these patterns from subject to subject.

Stetson's approach to explaining how speech is organized in terms of syllables may yet turn out to be correct even though his specific proposals were wrong. His picture of the role of subglottal gestures in speech is evidently an oversimple one, and, in particular, the claim that a chest pulse characterizes syllables in the same way that, say, lip closure characterizes labials is unwarranted. It is nevertheless obvious that there are highly regular relations between segmental articulations and subglottal gestures. In a sense, Stetson's work may be seen as having established Sievers' "breath pulse" as a viable basis for some syllables and having provided some understanding of its production in articulatory terms. To what degree this mechanism might play an extended role in an overall theory of the syllable is still an open question.

Notes

¹Sievers first presented his theory in the second edition of *Grundzüge der Phonetik*, which appeared in 1881, and later expanded it in the 3rd (1885) and 4th (1893) editions. His theory is essentially an account of the acoustic and articulatory properties of sounds that are the basis for the auditory impression of the syllable as a coherent unit. The prominence of individual sounds of speech determines their perceived grouping as syllables. The two possible sources of prominence are sonority, which is an inherent property of each segment, and expiratory force, which is a property that may vary independently of the segment's identity. Sievers proposed three principles of syllable structure which implement this general point of view:

1. Every syllable is uttered with a continuous force contour. A continuous force contour is one that contains no perceptible minimum. It is such minima that account for the multiple syllables of a sequence of identically sonorant segments, e.g. *a.a.a*. The converse statement does not hold: It is possible that within a continuous force contour there may be more than one syllable.
2. Every syllable contains a single sound whose prominence dominates all others—the syllabic.
3. Relative prominence within the syllable is primarily determined by the inherent sonority of its segments. In some cases the prominence of normally highly sonorant segments

may be diminished at the beginning or end of a force contour; this is what permits monosyllables such as *ui* or *iu* (vs. *u.i*, *i.u*), or even, exceptionally, monosyllabic *ula*.

There exist, however, two cases of sonority peaks which are not perceived as syllabic peaks and whose lack of prominence is not reasonably explained by the modifying effect of a contour of expiratory force. Sievers called such peaks subsyllables (*Nebensilben*) if they appeared on the syllable margin; syllables containing an extra peak in the nucleus he called double-peaked syllables (*zweigipflige Silben*). He suggested that principles of perception prevented these elements from disrupting the impression of coherence that caused them to be heard as single syllables.

²Jespersen's theory appeared in *Lehrbuch der Phonetik* (1904), a translation of the original Danish work which had been published in 1897-99.

³Saussure's *Cours de linguistique générale*, which was published posthumously in 1916, contains his theory of the syllable. Grammont's theory, which he describes as a modification of Saussure's, is presented in *Traité de phonétique*, which appeared in 1933. Grammont notes that Saussure developed his theory well before Jespersen's ideas were published, and that they were thus independent. He omits to mention the common influence of Sievers and his predecessors, which were familiar to both Jespersen and Saussure.

⁴The following discussion relies upon Grammont's account of the syllable for the most part, since he fills in a number of gaps in Saussure's exposition.

⁵Grammont and Saussure differed on this point. Saussure retained the notion of a syllabic nucleus and the opposition between syllabic and nonsyllabic segments, defining "vocalic peak" as the first implosive segment after silence or after a releasing segment. A syllabic nucleus was necessarily arresting. Part of his motivation, perhaps, was the need for syllabicity to distinguish vowels from semivowels, for in other respects he treated them as identical. Grammont's treatment can however be regarded as a logical and consistent development of the releasing/arresting basis of the syllable. It of course demands an alternative to nonsyllabicity to distinguish the class of semivowels, which Grammont ascribed to their somewhat greater occlusion than that of vowels.

⁶Stetson's theory is presented in *Motor Phonetics* (1951). Its rambling style makes it hard to understand. Its studious avoidance of the phonemic framework made it even harder to understand for the American linguists who were Stetson's contemporaries; Twaddell 1953 reinterpreted Stetson's conclusions in structural phonemic terms. The most important commentaries on Stetson's work, however, are those of Ladefoged and his coworkers, based on their measurements of subglottal muscle activity (Ladefoged et al 1958; Draper et al 1959, 1960; Ladefoged 1960, 1968; Ladefoged and McKinney 1963). Pike 1967 (Chapter 9) attempts to reconcile Stetson's theory with Ladefoged's findings.

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What Was Funny? Discourse Referents in Pronoun Use of Young Children

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I. Introduction. The subject of this paper is the distribution of the pronouns *it* and *that* in the evaluative statement "X was funny." The discourse unit being studied here is the conversational narrative, or a story told in the course of conversation. The data used in this study was collected by Mark Clarke and a group of speech pathologists under the direction of Ann Morrison Clemens in the spring of 1982. The data consist of videotapes of school children in conversational dyads with peers or teachers. The age of the children ranged from 5 years to 9 years, and their general development ranged from normal to educationally handicapped. The data were collected expressly for samples of children's narratives within conversations. The children were told that they were being taped, and that they were to perform specific tasks such as making cookies or carrying on conversation during the taping.

For the purposes of this study, the sections of discourse that are treated as narratives were identified first of all by the evaluative expression "It was funny" or "That was funny." The boundaries of the narratives were arrived at by including all the conversational turns that were necessary to answer the question "What was funny?" In this sense, a narrative is a stretch of discourse that is retellable—that is interesting or has a point outside the context of the conversation in which it was told.

I have chosen to focus on the feature of evaluative language as a sufficient but not necessary feature of a narrative. I interpret "funny" as clear evidence of the speaker's intention to evaluate something in the speech event as humorous. The past tense of the verb increases the probability that what was funny was some narrated construct. The purpose of this analysis is to determine whether the pronouns *it* and *that* in the evaluative statements "It was funny" or "That was funny" are interchangeable or if each corresponds to a distinction in discourse structure.

The relationship of evaluative language to the narrative is given by Labov to be a feature of fully-formedness.

Some narratives contain only narrative clauses; they are complete in the sense that they have a beginning, a middle, and an end. But there are other elements of narrative structure found in more fully developed types. Briefly, a fully-formed narrative may show the following: 1. Abstract 2. Orientation 3. Complicating Action 4. Evaluation 5. Result or resolution 6. Coda. (Labov 1972:362-63)

He goes on to say that the evaluation of the narrative captures the point of the story—the reason why the story was tellable. Thus, by only focusing on stretches of discourse that are evaluated by the statement "It or That was funny," this analysis only covers potentially fully-formed narratives which are speaker-evaluated as funny.

II. Analysis of the data. In over 22 hours of taped conversations, the data contained only 5 occurrences of "It was funny" or "That was funny." Out of a total of 33 children in the data base, only 5 children produced either evaluative utterance, and only 3 children produced the 5 evaluative utterances associated with a fully developed narrative. Two of these three children were noted to be normal in development and these two stood out from the rest as notably mature and articulate in conversation. From this preliminary scan, it would appear that evaluative language in discourse