

‘Rest’ and ‘Open Transition’ in a Systemic Phonology of English

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In accordance with a practice that is not uncommon among linguists, I might have entitled this paper “Rest and Open Transition Revisited”, since much of what I have to say was originally worked out many years ago and presented in a talk at Edinburgh University in 1961. Its content, however, has been only partially published (principally in Catford 1965, 1966, 1977) and is not widely known. Moreover, I have, indeed, recently been ‘revisiting’ the topic and this is a further justification for putting it before you here.

The phonology of English can be described, as we know, in terms of a hierarchy of four units: *tone-group*, *foot*, *syllable* and *phoneme*. The first part of my paper deals with a phenomenon that occurs at the rank of the foot.

The elements of foot structure are commonly known as *salient* and non-salient, or *weak*. Salient is realized as a (strongly) stressed syllable in the first part of the foot, or (in a monosyllabic foot) occupying the whole foot. Weak is realized as one or more less strongly stressed syllable(s) occupying the remainder of the foot after the salient syllable. It is generally agreed that one must also posit what has been called ‘silent stress’ operating at the place of salient in some feet. As David Abercrombie has most cogently pointed out (Abercrombie 1965, 1971) a complete account of the rhythmic structure of English prose or verse is impossible without the recognition of ‘silent beat’ or ‘silent stress’. Silent stress is a pause that does not interrupt the rhythm of an English utterance, and occupies the time-span of a stressed syllable, or a whole foot, according to circumstances.

It is, for example, silent stress that takes up the time of an entire foot in the middle of the line:

To be or not to be . . . that is the question.

Since every normal foot begins with salient, realized as a stressed syllable, the convention has been adopted in systemic phonological transcriptions of English, of treating any initial unstressed syllables as being, in fact, the tail-end (the realisation of the element ‘weak’) of a foot with silent stress. Representing foot-boundaries by slant lines, and silent stress by a *caret* (^), we can transcribe that line from Hamlet as:

/ ^ To/be or/not to/be/ ^ / that is the /question/

The initial unstressed *to* is here represented as the final, weak, element of a foot whose salient is realized by silent stress. The same line may be rendered with three silent stresses as:

/ _^ To/be/ _^ or/not to/be/ _^ / that is the /question/

and this is how the great 18th century actor David Garrick spoke the line, as we are told by Joshua Steele (1779).

I shall have something to say later about the procrusteanism inherent in the representation of *all* initial unstressed syllables (or 'pseudosyllables' as I shall call some of them) as if they had a silent stress before them. There is another kind of pausal, or pause-like phenomenon that can occur within the foot, but since this does not occur at salient (the locus of stressed syllables) it cannot be called 'silent stress'. I am referring to a brief pause, or, better, sustension (shown here by . . .) that may serve to differentiate (b) from (a) in such pairs of sentences as the following:

- 1 (a) / That was a/man-eating/fish/ (a barracuda perhaps?)
 (b) / That was a /man . . . eating/fish / (a sea-food lover?)
- 2 (a) / _^ I'll /be there from/ ten to /two / (from 1:50)
 (b) / _^ I'll /be there from/ ten . . . to /two / (from 10:00 until 2:00)

The members of these sentence-pairs *could*, it is true, be distinguished from each other by silent stress, as in: 1(b) / That was a /man / _^ eating/fish/.

The distinction I am referring to is *not* silent stress, however, since it does not occupy the place of salient, but is merely a momentary hesitation, or sustension, occurring in the middle of foot.

This hesitation may be realized, though rarely, as an actual brief silence, produced as a rule by momentarily closing the glottis. More often, perhaps, there is no silent pause at all, the pausal effect being created by a prolongation of the preceding syllable. This prolongation may be effected by increasing the duration of the final consonant or of both the final consonant and the vowel.

Measurements were made of the durations of the vowels and consonants of the words *man* and *ten* in sentences 1(a,b) and 2(a,b) and of the words *cat* and *mantis* in the parallel sentences 3(a,b) and 4(a,b)

- 3 (a) / That was a/cat-eating/fish/
 (b) /That was a/cat . . . eating /fish/
- 4 (a) /That was a / mantis-eating/fish/
 (b) /That was a / mantis . . . eating/fish/

The data derived from these measurements are presented in detail in Table 1. The following, however, is a brief summary of the most important part of the data, indicating the *percentage increase* in the duration of the final consonant and of the immediately preceding vowel in the pre-pausal (b-sentence) realisations of *man*, *cat*, *ten*, and *mantis*.

	V	C
man	34%	50%
cat	38%	110%
ten	-	36%
(man)tis	11%	51%

These figures mean that the final /n/ of *man* in 'man . . . eating' is 50% longer than the final /n/ in 'man-eating': that the vowel of *man* in 'man . . . eating' is 34% longer than the vowel of *man* in 'man-eating', and so on.

It is interesting to observe that, though in every case the major increase is in the duration of the final consonant, the vowel /a/ of *man* and *cat* is also substantially lengthened (by more than 30%), while the /e/ of *ten* and the /i/ of *mantis* are either unchanged or only minimally lengthened. This no doubt reflects the well-known fact that the vowel /a/, alone among the English 'short' or 'checked' vowels, is noticeably susceptible to lengthening.

To come back from these merely statistical details, it is clear that we must recognize this particular kind of lengthening as a feature of English phonology. Since it may be realized either as an actual momentary cessation of sound, or, more

Table 1

		Foot	C	V	C	
<i>man</i> -eating	Duration	60.15	8.2	12.5	6.6	cs.
	% of foot	100	13.6	20.8	11.0	%
<i>man</i> _Λ eating	duration	69.3	8.8	19.3	11.14	cs.
	% of foot	100	12.7	27.9	16.5	%
	% of increase	-	-	34	50	%
<i>cat</i> -eating	duration	64.5	13.8	11.8	5.3	cs.
	% of foot	100	21.4	18.3	8.2	%
<i>cat</i> _Λ eating	duration	75.5	13	19	13	cs.
	% of foot	100	17.2	25.2	17.2	%
	% of increase	-	-	38	110	%
man(<i>tis</i> -eating)	duration	73.8	4.4	7.5	9.0	cs.
	% of foot	100	6.0	10.2	12.2	%
man(<i>tis</i> _Λ eating)	duration	77.6	4.6	8.75	14.25	cs.
	% of foot	100	5.9	11.3	18.4	%
	% of increase	-	-	11	51	%
<i>ten</i> to:	duration	32.6	7.3	9.5	7.8	cs.
	% of foot	100	22.4	29.1	23.9	%
<i>ten</i> _Λ to:	duration	42.3	9.1	11.2	13.8	cs.
	% of foot	100	21.5	26.5	32.6	%
	% of increase	-	-	-	36.4	%

The effect of rest (Λ) on preceding consonant and vowel: actual average durations in centiseconds, percentage of total foot-duration, and the percentage increase in these percentages in passing from utterance without rest, to utterance with rest.

commonly perhaps, as a sustension of the preceding consonant, which has the effect of a brief pause, it might as well be called by the musical term *rest*.

Moreover, being a pausal phenomenon in non-salient position, it is in complementary distribution with that other pausal phenomenon which occurs in salient position—silent stress. It seems reasonable, then, to regard both of these pausal phenomena as realizations of the same thing. We therefore want to call them by the same name; but since we obviously cannot label the unstressed, non-salient, hesitation ‘silent stress’ we are obliged to rename ‘silent stress’ *rest*. And this is what I have, in fact, long practiced. As Abercrombie has pointed out (1971 p.154) ‘rest’ is but one is several names that have been given to the phenomenon of silent stress.

So we can now describe *rest* as a pausal phenomenon which can occur either at the element *weak* in a foot, or at the element *salient*. In this latter position it may also be called ‘silent stress’.

I want to turn now to another English phonological feature, at a lower rank in the phonological hierarchy. It will be best to approach this new topic by way of some examples.

There are great numbers of minimal, or near-minimal, pairs of words or phrases in English that are differentiated as in the following examples, listed in two columns A and B.

A	B
plight	polite
broke/brock	baroque
train	terrain
claps	collapse
scum	succumb
sectors	secateurs
Tiflis	syphilis
damsen	amazon
Skelton	skeleton
tusk	tussock
scalp	scallop
Sindh/sinned	synod
flatly	philately
cracks	Caracas
take part	take apart
some dresses	some addresses

The traditional way of describing the difference between the examples in the two columns is to say that in the items of list A we have either consonant clusters, or sequences of abutting consonants, whereas in the corresponding items of list B we have the same sequences of consonants separated by a short, unstressed, *schwa*-type vowel /ə/. There is, however, another way of describing this difference. The short schwa-like transition between consonants that we observe in the B-items may be

regarded not as a vowel, but as nothing more than a particular way of making the transition between consonants—an 'open transition' in contrast to the 'close transition' between consonants exemplified in the items of the A list.

It is well known that one difference between English and French is that in what are universally accepted as sequences of consonants in English the second consonant follows extremely closely on the first one—the articulations of the two consonants may, indeed, overlap, so that there is no audible release of the first. In French, on the other hand, the first of two successive consonants is often quite clearly and audibly released. Thus in the English word *actor* the /k/ is not released until the articulation for the /t/ has been formed, and consequently the /k/ is virtually inaudible. In the corresponding French word, *acteur*, the /k/ is often audibly released before the /t/ is formed. We can describe this difference by saying that in French, the transition between the abutting consonants in *acteur* can be indifferently *close* or *open*, the latter probably being more usual. In English, on the other hand, the transition between the abutting consonants in *actor* is always *close*. This is necessarily the case, since in English, though not in French, the distinction between close and open transition is phonologically utilized—as in the examples listed above.

The precise nature of the difference between close and open transition between consonants depends upon their relative articulatory locations. It depends, that is, on whether the successive consonants are *homorganic* (articulated by the same part of the same organ, as in -pp- -ff- mb- etc.), *heterorganic* (articulated by completely different organs, as in -kp- -fs-, or by distinct and separately manoeuvrable parts of the same organ, as in -kt-) or *contiguous* (articulated by adjoining parts of the same organ as in -tr- or -kj-).

The characteristics of close and open transition with respect to the three articulatory relations are as follows—the examples will be most convincing if the reader articulates each of them silently, several times, so that the proprioceptive sensations can be appreciated.

Homorganic

Close transition, as in *top part*, *tough fowl*, *nice seat*—articulatory continuity, that is, the articulators maintain their position unchanged throughout the two consonants.

Open transition, as in . . . *top apart*, *so tough a fowl*, *so nice a seat*—articulatory non-continuity, that is, the articulators are momentarily and minimally separated, or the articulatory channel is momentarily and minimally enlarged, and the original articulatory posture is immediately resumed.

Heterorganic

Close transition, as in *back part*, *tough kid*, or *plight*—articulatory overlap, that is the stricture for the second consonant is formed before the stricture for the first is

released. Measurements made by means of palate electrodes recording the making and breaking of tongue-palate contacts show that, in my pronunciation at least, the duration of the overlap averages approximately one third of the combined duration of the successive, overlapping, consonant articulations.

Open transition, as in *back apart, so tough a kid, polite*—no overlap, the stricture for the first consonant is released immediately before the stricture for the second consonant is formed, at the moment when the articulators are already moving towards the second stricture.

Contiguous

Close transition, as in *back yard* or *train*—articulatory accommodation, the articulation of the first consonant is accommodated to the articulation of the second one. In *back yard* the /k/ anticipates the palatal articulation of /j/ and its place of articulation is shifted forward (/k/ is palatalized). In *train* the apex of the tongue may anticipate the postalveolar location of /r/ and form the /t/-closure at that point. In my own pronunciation the tongue-tip goes first to the alveolar location but accommodates to the /r/ by immediately sliding backward to the apico-postalveolar /r/ location. This backward sliding motion is not only clearly kinaesthetically perceptible, but can be seen in real-time ultrasound tongue-scans.

Open transition as in *back a yard, terrain*—absence of accommodation. The /k/ in this case is velar and the forward tongue-shift to /j/ occurs immediately upon release of the /k/. In *terrain*, the shift of tongue-tip location from alveolar to postalveolar is performed by a minimal release, retraction and reapplication at the second position.

Open transition contrasts with vowel in such examples as these:

-CC-	-C · C-	-CVC-
(take the) cop part	. . . cop apart	copper part cop up, Art
a tough fowl	so tough a fowl	a tougher fowl
a brief lunch	a Brie for lunch	a briefer lunch
take part	take apart	take up art
make names	make an aim	make Ann aim

There are characteristic differences between open transitions and vowels with respect to duration, articulatory channel area, phonation and system, which can be summarized as follows:

Duration. In C·C, the duration of the open transition from C to C is extremely short. In CVC, the duration of the vowel is much longer. In a short study of 35 pairs, like *take apart* vs. *take up art* etc., the durations of the open transitions ranged from 1 to 6 cs., with a mean duration of 3 cs. The duration of vowels in the same environments ranged from 6 to 20 cs. with a mean of 11 cs. Thus, on the average, vowels in –CVC– are nearly four times as long as open transitions.

Channel area. In C·C the articulatory stricture is minimally released: in CVC the articulatory channel is very much more widely opened than is necessary for the mere, minimal direct-path transition from C to C. As reported in Catford (1977 p.221) a highspeed ciné recording of the lip movements in *cop apart* (C·C), *copper part* and *cop up, Art* (CVC) showed that while the labial orifice for the two vowel articulations reached maximum areas of 250 mm² and 220 mm² respectively, the maximum area of the articulatory channel for the open transition was only 20 mm². This is about the articulatory channel area of a wide-channel fricative or a narrow approximant. Experimenting with the silent articulation of such pairs as *cop apart* and *cop up Art* or *so tough a fowl* and *tougher fowl* one can easily feel the great difference between the minimal opening for open transition and the wider opening for the vowel.

Phonation. Open transitions may be fully voiced, partially voiced or totally voiceless. Thus the open transition between the first two consonants in such words as *potato*, *catharsis* can be voiceless. Again, in the sentence *He went to Trafalgar Square* the open transitions in *to* and *Traf* are normally completely voiceless. Vowels, on the other hand, are virtually always voiced: ‘virtually’ always, because there are occasions when English (RP) vowels are not voiced but whispered, or pronounced with creak, creaky voice or whispery voice. But they are never totally voiceless as open transitions can be.

System. In RP by far the commonest open transition has a neutral, schwa-like, quality. We may represent it as /^ə/ . Many RP speakers also have open transitions with an ɪ-like and u-like qualities, which we may represent as /^ɪ/ and /^u/ . It is difficult to find minimal triplets exemplifying all three, but they are represented in *a mission*, *emission*, and *omission* as in such sentences as:

1. We don’t like a mission.
2. We don’t like emissions.
3. We don’t like omissions.

It is probable that some speakers of RP or near-RP do not possess the third transition, /^u/ . In any case, whether the system of open transitions consists of three terms, /^ɪ/ /^ə/ /^u/ , or only two, it is noticeably different from the system of vowels, consisting of six simple vowels /i, e, a, o, u, ə/ as in *pit*, *pet*, *pat*, *pot*, *put*, *putt* and 13 or so complex vocalic nuclei such as /i^ɪ, a^ɪ, i^ə, e^ə, ə^ə, ə^u/ etc. as in *bead*, *bide*, *beard*, *Baird*, *bird*, *bode*.

Additional examples of open transitions contrasting with each other and with vowels are:

They lack <i>quality</i>	–CC–
They lack <i>a quality</i>	–C·C– / ^ə /
They lack <i>equality</i>	–C·C– / ^ɪ /
A <i>lacquer quality</i>	–CVC– /ə/
A <i>lackey quality</i>	–CVC– /i/
<i>Dad mended it</i>	–CC–
<i>Dad emended it</i>	–C·C– / ^ɪ /

Daddy mended it	–CVC– /i/
Dad amended it	–C·C– /ə/
Dadda mended it	–VC– /ə/

Examples of contrast between /ʊ/-transition and /u/ vowel are hard to come by, but the following are possible:

That's my <i>bouquet</i> .	/ . . . b ^ʊ keʔ/
That's my <i>book</i> A	/ . . . bukeʔ/
Is that <i>Boleyn</i> ?	/ . . . b ^ʊ lin/
Is that <i>bull</i> in?	/ . . . bulin/

The schwa-type transition /ə/ is by far the commonest: a rough check shows that in my own pronunciation the percentage occurrences of the three types are approximately /ə/ 90%, /ʊ/ 9%, /u/ 1%.

So far, we have looked at open transitions only between consonants –C·C. But they also occur initially. That is to say, we can observe the difference between 'close' and 'open' in the transition between pre-speech zero (#) and an initial consonant, and we can contrast this with initial vowel. Some examples are:

#C–	#·C–	#VC–
pending	appending	upending
praised	appraised	unpraised
Nemo	anaemic	un-emic
name	an aim	Ann aimed
state	estate	S. Tate
Brian	O'Brien	Oh Brian!

The difference between #C– and #·C is that in the close transition, the articulators are already fully in position for the articulatory stricture before the initiatory effort begins. In open transition, #·C, the pulmonic initiation begins at about the same moment as the articulatory organs begin to move together to form the articulatory stricture. In the third case, #VC–, the pulmonic initiation for the vowel starts long (ie. 10cs. or so) before the articulators begin to move into position for the C–.

If #C, #·C– and #VC– all occur, it is reasonable to ask if an analogous set of three transitional possibilities exist for final consonants. In other words, do we have close transition –C#, open transition –C·#, and vowel transition –CV# between a final consonant and post-speech zero? The answer is no; at least not as three phonologically distinct possibilities.

It is true that something resembling the difference between close and open transition can be observed in unreleased versus released final consonants, especially stops. In the word *stop*^ʔ, for example, with unreleased final [p^ʔ] the initiatory activity ceases while the articulatory structure is still in place, and this implies an abrupt, or close, transition from the consonant to zero, thus –C#. In *stop*^h, on the

other hand, with a final [p^h], the articulatory stricture is released, allowing the energy in the pent-up initiatory air-stream to dissipate in a momentary aspiration. This relatively slow dissipation of the initiatory air mass constitutes a kind of gradual passage from –C to zero, somewhat analogous to the open transition from zero to C– in initial #·C. We might, then, say that with final consonants there is a possible difference between close transition (–C#) and open transition (–C#) exemplified by the difference between final unreleased and released stops.

But in English this distinction is always optional, as a variable realization of final –C# in some varieties (some idiolects, accents and dialects). It is never linguistically, phonologically, pertinent, in the way it can be in languages that distinguish between unaspirated and aspirated voiceless stops.

In English, then, corresponding to the ternary opposition that occurs medially (–CC, –C·C, –CVC–) and initially (#C–, #·C–, #VC), in *final* position there is only a binary opposition, exemplified in such pairs as:

–C#	–CV#
cheat	cheetah
road	Rhoda
rose	Rosa
loaf	loafer
hip	hippy
boot	booty
cab	cabbie
race	racy

Now a legitimate question might be: “Why assign the analysis CV# rather than C·# to the items in the right-hand column? Since there is no phonological opposition between open transition and vowel in this position, could we not regard these as actually examples of –C·#, thus equating the final sound of *cheetah* with the open transition /^ə/ in *cheat a man*, or the final sound of *hippy* with the open transition /ⁱ/ in *epicure* etc.?”

The answer is that the *duration* of these finals associates them squarely with vowels, not open transitions. In 48 samples of words like *cheetah hippy* etc. the durations of the final vowel ranged from 13 to 28 cs., with a mean of 21 cs. This is almost twice the average duration of medial, interconsonantal, short vowels (–CVC–) and *seven times* the average duration of open transitions. Moreover, when some of the words with final –V listed here are placed in a non-final position they can *contrast* with obvious open transitions, in such pairs as:

They rowed <i>across</i> .	/ ^ə /
Was Rhoda <i>cross</i> ?	/ə/
Race <i>equality</i> .	/ ⁱ /
A <i>racy</i> quality	/i/

Additional evidence for the non-occurrence of open transition in final position can be derived from the observation in Abercrombie’s discussion of English disyllabic

feet (1965:30,31) that the 'long-short' type of foot, exemplified by /Grey to/ in /_^Take/ Grey to / London/ or /tea for/ in / Tea for /two/ always implies a word-division between the two syllables. Occurrence of such feet, which typically contain an open transition, not a vowel, in their second 'syllable' only at word-division, of course implies their non-occurrence in absolute final position.

We have now looked at the occurrence of open transition between (–C·C–) and before (#·C–) consonants, and noted their non-occurrence after final consonants (*–C·#). We must now briefly consider their occurrence with vowels.

Consider such pairs of words as:

A	B
bid	beard
bed	Baird
good	gourd
tap	type
cup	cope

In the examples in Column A, the final consonant cuts off the vowel in full flight, as it were. That is to say, the tongue is still more or less in position for the vowel when the consonantal stricture is formed. This is particularly clear where the vowel-articulation and the consonant articulation are heterorganic, as in *tap* or *cup*, but it can also be observed in such words as *bid* and *good*. This kind of transition from vowel to consonant is clearly analogous to close transition between one consonant and another, and we can represent it as VC.

On the other hand, in the examples in Column B, the consonantal stricture is not formed until the tongue has already given up its articulatory posture for the vowel and has begun to make a /^ə/-like, /^ɪ/-like or /^ʊ/-like transition to the consonant. This kind of transition is analogous to open transition between consonants, and we can represent it as V·C.

The vowels of at least one variety of RP thus fall into two major groups: simple vocalic nuclei V, and compound vocalic nuclei V·. At greater delicacy, the latter group falls into three sub-types, according as the transition is of /^ə/-type, /^ɪ/-type or /^ʊ/-type. In the following lists of examples, compound vowels that are rare or occur only idiosyncratically, are enclosed in parentheses.

V	V·		
	V ^ə	V ^ɪ	V ^ʊ
/i/ bid, hid	beard	bead	(Theodore)
/e/ bed	Baird	bayed	(Beowulf)
/a/ hat	heart	height	out
/o/ cot	court	coy	–
/u/ good	gourd	(ruin)	goo'd
/ə/ bud	bird	–	bode

There are also complex vowel nuclei, $V\cdot$, such as $/a^{1\alpha}/$ in *fire*, $/a^{u\alpha}/$ in *tower* etc.

Pursuing the analogy with consonantal transitions we next consider the possibility of open transitions from consonant to vowel ($-C\cdot V-$) from zero to vowel ($\# \cdot V-$) and from vowel to zero ($-V\cdot \#$). All of these may occur, but the first two types are very rare, and may be somewhat idiosyncratic in their occurrence. The following are examples arranged in contrasting lists.

CV	C · V	CCV
curse $/k\alpha^{\alpha}s /$	coerce $/k^{u\alpha}e^{\alpha}s/$	quern $/kw\alpha^{\alpha}n/$
pourer $/p\alpha^{\alpha}r\alpha /$	Peoria $/p^{u\alpha}o^{\alpha}r^{i\alpha} /$	purer $/pjo^{\alpha}r\alpha/$

#V-	# · V
ology $/ol^{\alpha}d\alpha i/$	ology $/^{u}ol^{\alpha}d\alpha i/$
oleo $/\alpha^{u}l^{\alpha}e^{u}/$	Aeolia $/^{\alpha}\alpha^{u}l^{\alpha}e^{\alpha}/$

-V#	-V · #
wheaty (-i)	wheatear (-i ^α)
Nancy (-i)	Landseer (-i ^α)
booty (-i)	bootee (-i ⁱ)
khaki (-i)	car-key (-i ⁱ)
chauffeur (-α)	show-fur (-α ^α)
cater (-α)	Cato (-α ^u)

It will be clear from the above that I am treating *open transition* as something *sui generis*, distinct not only from close transition, but also from *vowels*. In most descriptions of English, the open transitions $/\alpha/$ $/i/$ $/u/$ are regarded not as forming a distinct system of units, but simply as instances of the regular vowels $/\alpha/$ $/i/$ $/u/$ under *reduced* or *minimal* stress. This means, of course, that they can be accounted for only in terms of a system of differential stresses.

One of the few scholars to recognize a special system of items corresponding in part to our open transitions is Bolinger (1981). But, as the title of his paper, *Two kinds of vowels, two kinds of rhythm*, shows, even he firmly associates his separate system of 'reduced vowels' with the vowels, rather than with open transition between consonants. Moreover, the examples of 'reduced vowels' that he adduces (specially on pp. 7–8) are quite heterogeneous. They include some that we would call open transitions, such as the ultra-short $/\alpha/$ represented by *o* in *atom*, and the ultra-short $/i/$ represented by the *e* in *seduction*. But they also include some that are quite clearly *not* open transitions, such as the moderately long final vowels of *Minna*, *Minnie*, *Lhasa*, *Lassie*, and yet these, too, are classified as 'reduced

vowels'. Bolinger gives examples, on p. 8, of contrasts between 'reduced' and 'full' vowels, and these include the pair *booty* (with final reduced vowel) and *bootee* (with final full vowel). Now this is one of the pairs we have listed above, as examples of contrast between final simple vowel (-V #) and final complex vowel (-V·#). In a number of recordings of pairs of this type, we find that the mean duration of final -V# is 21 cs., and that of -V·# is 25 cs. Both are obviously much too long to be counted as open transition. It is possible, in this and similar cases, that the surprising identification of final vowel with non-final transition is due to a difference of dialect or accent. But it seems more likely that it is due to the fact, mentioned above, that open transitions simply do not occur in final positions. Consequently, in the opposition *non-tense* vs. *tense* or *simple vowel* vs. *complex vowel* the simple vowel may be interpreted (or misinterpreted, as I would say) as an open transition, contrasting with a (full) vowel.

The establishment of open transitions as a category distinct from vowels leads to some curious consequences, relating to their syllabic status.

The normal carriers of syllabicity are vowels. The existence of syllabic /n/ in *eaten* etc. and syllabic /l/ in *bottle* etc. does not contradict this generalization, since these are widely conceded to be realizations of /ə/ + /n/ and /ə/ + /l/. Vowels, then, are the syllable-formers. Consequently if we deny the status of vowel to open transitions, we also deny them the status of syllable-formers. Thus the initial transition in *appending* and the interconsonantal transition in *catapult* or in *polite* are not the centers, or nuclei, of syllables, but merely of *pseudosyllables*. The word *catapult*, with the phonemic structure /CVC·CVCC/, thus consists of only two syllables. And the words *plight* and *polite* may both be regarded as monosyllables, each of them beginning with two consonants but differing in the way of transition between these consonants is made. The two words may be symbolized as *plight* /CCVC/ and *polite* /C·CVC/.

One consequence of recognizing the non-syllabic status of open transitions is that some cases of initial *rest*, or 'silent stress' become unnecessary.

Consider, for example, such sentences as:

- 1 (a) Skewer that fish!
- (b) Secure that fish!

- 2 (a) Praed Street's where we're going.
- (b) Parade Street's where we're going.

Since every foot begins with a stressed, salient, syllable the unstressed initial *Se-* and *Pa-* in the (b) sentences must be regarded as realizing the weak, final, part of a foot. Since nothing audible precedes that syllable, the assumption has to be made that this weak element is preceded by a silent salient or *silent stress* (a foot-initial rest) and the (b) sentences are conventionally transcribed:

- 1 (b) /_^ Se/cure that /fish

- 2 (b) /_^ Pa/rade Street's /where we're going/

This procedure seems artificial and procrustean, but it can hardly be avoided so long as we regard *Se-* and *Pa-* as unstressed syllables, since such syllables cannot begin a foot. But the moment we recognize that they are merely pseudosyllables we remove the necessity for regarding them as realizing the weak element in an imaginary initial foot with 'silent stress' at salient! We can thus re-transcribe the sentences as:

1 (a) /Skewer that / fish/

(b) /S·cure that/ fish/

2 (a) /Praed Street's /where we're going/

(b) /P·rade Street's /where we're going/

Clearly there are other cases where there is an initial unstressed chunk that *cannot* be regarded as a pseudosyllables, for example:

That man we met yesterday

which probably must be transcribed as:

/_^ That/man we met/yesterday/

In such a case we must presumably continue to describe and transcribe in terms of an initial silent stress, or rest, and a question may well arise as to how many pseudosyllables can legitimately be tacked on the beginning of an initial foot, but that is a problem I cannot pursue here.

I want to turn now to another, and more far-reaching, consequence of the recognition of the open transition and the pseudosyllable. In order to do this I must point out a difference between a systemic phonology of English and more 'traditional' approaches.

Most traditional phonologies proceed as if the phoneme were the basic or only fundamental unit. Every utterance is realized as a string of segmental phonemes, or, at most, a string of syllables. This string of segments or syllables is modulated by suprasegmental features superimposed upon it at various points.

On this view the *foot*, if recognized at all, would be regarded as a kind of derivative phenomenon—as a stress contour *resulting* from the varying degrees of stress carried by the successive syllables or phonemes in the string. In systemic phonology, however, we look at the foot from the opposite point of view. The foot is a stress-contour in its own right, and the causation operates in the opposite direction. It is the stress-contour of the foot that imposes different degrees of stress upon the successive syllables it dominates, according to their location within the foot.

One way of characterizing the difference would be to say that the traditional view represents a digital-to-analog conversion—you start with a digitized sequence of different stress-values from which you derive a continuous stress-curve. The systemic view is analog-to-digital—you start with a smooth stress-curve of a certain shape from which you derive a digitized sequence of different stress-values.

On the systemic view it would be misleading to say that there are as many feet in an utterance as there are stressed syllables: the correct version would be 'there are as many stressed syllables as there are feet'. For example, it is *not* the case that /*John was a lighthouse/keeper*/ has three feet *because there are three stressed syllables, John light and keep*. On the contrary, there are three stressed syllables *because there are three feet*.

Feet are logically, and physiologically, prior to syllables or segments. The foot is a unitary quantum of 'vocal effort', that is, of *initiator power*. Initiator power is the force employed to initiate airflow in the vocal tract. It is the product of initiator velocity and the pressure-load imposed by the air driven forward by the initiator, or, more simply, for voiced sounds it is the volume-velocity of transglottal airflow times subglottal pressure. (See Catford 1977: 80–84). The power-quanta, or stress pulses, that constitute feet characteristically start with a rapid rise to a maximum followed by a slower decline, until the moment when the power build-up for the next foot begins.

We can picture the initiator-power curves of feet thus:



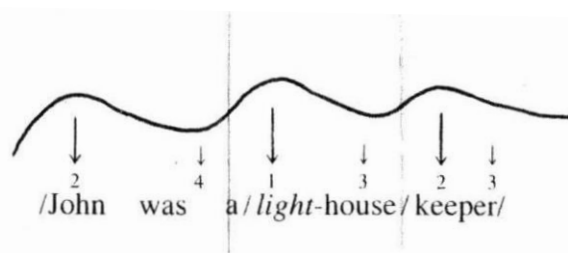
If a foot is realized by a single syllable, the power-curve is spread over the whole syllable. If there are several syllables in the foot, the first one, coinciding with the power peak, will be the strongest, or salient, syllable, subsequent ones being weaker.

This model of the initiator-power curve of the foot accounts for most of the observed stresses within a foot. But there is one rather common type of anomaly. This is where we have an apparently very weak syllable right in the middle of a foot, followed by a stronger syllable. An example might be /*Photographs/decorate/architects/manuscripts*/. In each of these feet, the middle syllable is extremely short and weak, and this seems to run counter to the view that the power-curve of foot has an early peak and then steadily declines. The anomaly disappears, however, when we realize that the middle syllable in these feet is not, strictly, a syllable at all, but a pseudosyllable, containing an open transition.

It turns out, then, that we can account for four degrees of perceived stress in English without having any independent system of stresses at all. The strongest stress is the power-peak of a tonic foot, the next is the power-peak of a non-tonic foot, the third corresponds to the later, declining, part of the power-curve, and the fourth, and weakest stress, is that of the open-transition. Summarizing in a different way we can say:

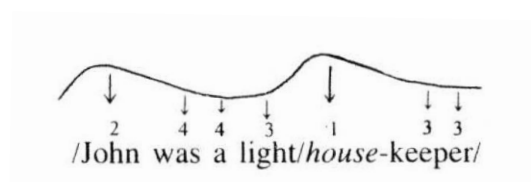
1. Primary Stress = Salient in tonic foot.
2. Secondary Stress = Salient in non-tonic foot.
3. Tertiary Stress = Non-salient in any foot.
4. Weakest Stress = Open transition (pseudosyllable).

For example, we can display the stress-pattern of the sentence *John was a light house keeper* as follows. Power curve:



(The arrows imply that the initiator-power curve of the foot is imposing stresses upon the syllables, and not vice versa.)

And if we change the *footage* of the utterance the stresses of the individual syllables automatically rearrange themselves, as, for example, in:



In a similar way we can ring the changes on Chomsky and Halle's famous 'eraser' phrases:

2 1 3 4 2 3
/ /John's /black boarde/raser/ /
(. . . chalk remover for blackboard)

2 3 1 4 2 3
/ /John's black /boarde/raser/ /
(. . . black eraser for boards)

2 2 1 4 2 3
/ /John's /black/ boarde/raser/ /
(. . . eraser for black boards)

The necessary rearrangement of stresses automatically follow from (1) changes in tonicity, and (2) changes in footage (i.e. in the locations of the divisions between feet). There is no need to invoke an independent system of stresses, or cyclical stress rules.

There are still some problems left relating to the theoretical status of open transition within a systemic phonology, but enough has been said, I think, to show that the concept is a useful one in accounting for some aspects of English phonology. Moreover, I believe it closely reflects a certain kind of physiological reality—a point in its favour for those (like myself) who believe that this is what phonology is primarily concerned with.

Finally, there is something to be said for the recognition of open transition as a useful concept in the teaching of English pronunciation. A common error among foreign learners is to give too much 'value' to these extremely short and weak elements. Pointing out that these are not *vowels*, but merely ways of passing from one consonant to another, or from initial silence to a consonant etc. is very helpful in inducing a correct pronunciation of words like *t·morrow phot·graph ·dvantage* etc.

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