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Syllable omission errors and isochrony

Introduction

English is said to be a stress-timed language. Stress-timing refers to a supposed tendency for stressed syllables to be produced isochronously, i.e. at regular intervals. The notion of isochrony has been criticised by many linguists, since experimental evidence shows that intervals between stressed syllables in English utterances are not, when measured by any technique whatsoever, physically equal. Nevertheless, the notion stubbornly persists in the literature and many arguments have been made in favour of its psychological if not physical reality. (For a review of the relevant literature see Lehiste, 1977.)

Isochrony has reality, for instance, in perception; listeners asked to match the rhythm of a sequence of noise bursts to the rhythm of an utterance will adjust the noises to a more regular rhythm than that of the utterance (Donovan & Darwin, 1979), indicating that they hear the utterance as more isochronous than it really is.

The perceptual reality of isochrony naturally leads one to suspect that there is indeed an underlying regular rhythm in production, and that it is this underlying rhythm which the listener picks up in spite of the multiple perturbations resulting from segmental variations which obscure it in the acoustic signal. In fact Lehiste (1977) has recently argued that the speaker imposes a rhythm for the purpose of being able to disrupt it to signal the presence of a syntactic boundary – e.g. in syntactically ambiguous strings such as "old men and women". Cutler and Isard (forthcoming) have examined productions of such syntactically ambiguous sentences and have found that far from an underlying rhythm being disrupted, it is preserved, with the presence of a boundary being signalled by "skipping a beat".

Furthermore it has often been pointed out that speakers of English have at their disposal a wide variety of devices by which sentence rhythm can be adjusted, and that they make considerable use of such options. For instance, lexical stress in certain words and compounds is variable;

thus we say "I counted fourtéen" but "I've fóurteen books"; "the com-
ment was mispláced" but "a mísplaced comment". Similarly, rhythmic
constraints can underlie the choice between synonyms – for instance,
"the man was drunk" versus "the drunken man". Redundant elements
can be inserted, e.g. "he waited half an hour" rather than "he waited a
half hour" (cf. "he waited a good half hour"). Bolinger (1965), in a
comprehensive discussion of such phenomena, argues that they can be
accounted for simply by the speaker's desire to avoid one stressed syl-
lable immediately following another, without postulating underlying
rhythmic tendencies. But this claim confines the adjustments under con-
sideration to the insertion of one or more syllables between stressed
syllables and thus implies that rhythmic manipulation does not occur via
the omission of syllables. In the following sections some syllable omis-
sion errors in spontaneous speech are described. Because these errors
have the effect of producing a closer approximation to isochrony, they
provide evidence against Bolinger's claim and in favour of the
psychological reality of an underlying regular rhythm in production.

Speech errors and rhythm

An error in speech performance can change the rhythmic pattern of an
utterance in two obvious ways: either one or more syllables can be added
or deleted, or stress can shift from one syllable to another. At times the
two occur together (e.g. when *botánical* is pronounced *bótnical,* i.e. the
stress is shifted back and the second syllable is deleted). The question of
whether such errors have a systematic effect on the regularity of speech
rhythms can be investigated by comparing the rhythm of the target utter-
ance and the rhythm of the erroneous utterance and determining which
of them provides a closer approximation to isochronous rhythm.

To do this analysis it is of course necessary to have recorded the
sentence context in which the error occurred. Since sufficient context is
only rarely included with published errors, the majority of examples on
which the following discussion will be based come from my own collec-
tion. In recording an error I have taken pains to include as much of the
phonetic detail as possible, noting, for instance, which syllables were
contracted, and which syllables were stressed. But the transcription
nevertheless falls far short of the ideal (a tape recording on which exact
measurements could be made, for instance), and of course no exactly
equivalent data are available for the target utterance. Most of the errors
in my corpus were corrected immediately, and it is the speaker's correc-
tion which I have taken to be the original target. The analysis which I will
present should be regarded as suggestive rather than definitive. It is

important to notice, however, that it is an analysis performed on data collected well in advance of the formulation of the present hypothesis.

The analysis consists in segmenting each and each target utterance into feet, where a foot is the interval between stressed syllables. The stressed syllables in question are all those syllables marked for lexical stress in the major lexical items of the sentence (i.e. not only those bearing sentence accent – though if sentence accent occurs on a word not normally marked for stress, such as an article or a conjunction, that word will also count as stressed for the purposes of division into feet). In the absence of any more rigorous measurement of foot length, the error-target pairs will be compared in terms of number of syllables within each foot.

It is not clear what the null hypothesis should be, i.e. what would be the chance effect of a syllable omission on rhythm. To determine this one would need to measure the effect on rhythm of deletion of each syllable of a very large corpus of spontaneous speech. Since this tedious chore is unlikely ever to be performed, I have arbitrarily assumed that 50% of syllable omission errors would result in a more rhythmic utterance by chance alone. This estimate may in fact be conservative, because if speech is more often than not rhythmic, an omitted syllable will more often than not disrupt the rhythm.

Syllable omission errors

Typical syllable omission errors include:

(1) Next we have this bicéntial rug.
    (Target: ... bicenténnial rug)
(2) ... inferences about what the speaker thinks his ínterlocker knows
    (T: ... interlócutor knows)
(3) In his life there seems to be ambíguty.
    (T: ... seems to be ambigúity)
(4) In the metrólitan area
    (T: ... metropólitan area; from Fromkin (1973))
(5) This kind of question can not be appróprally interpreted
    (T: ... apprópriately interpreted)
(6) a tiny mail-order firm ópering out of a front room in Waltham-
    stow (T: ... óperating ...)

It can be seen that some involve a shift of lexical stress, others do not. This kind of error, in which a syllable (occasionally two syllables) is omitted from within a word, appears to differ from errors in which the speaker skips from the middle of one word to the following word

(haplologies) or in which whole words are omitted. Haplologies and word omission errors will be discussed separately below.

Meanwhile, let us compare the above error and target pairs. Example (1), for instance – which was uttered fairly rapidly by an amateur auctioneer – is divided into feet as follows (each foot begins with a stressed syllable):

/Next we / have this bi/cential / rug

whereas the target utterance would have been:

/Next we / have this bicen/tennial / rug

In the target utterance the second foot contains four syllables, whereas the error reduces the length of that foot to three syllables, closer to the length of the preceding and following feet. The same tendency to equalise number of syllables per foot can be seen in:

(2) E: what the / speaker thinks his / interlocker / knows
     T: what the / speaker thinks his inter/locutor / knows
(3) E: /in his / life there / seems to / be am/biguty
     T: /in his / life there / seems to / be ambi/guity
(4) E: /in the met/rolitan / area
     T: /in the metro/politan / area
(5) E: can / not be app/proprally in/terpreted
     T: can / not be ap/propriately in/terpreted
(6) E: /opering / out of a / front room in / Walthamstow
     T: /Operating / out of a / front room in / Walthamstow

In (2), the error has the same number of syllables in the two marked feet, whereas the target would have had six syllables in the first foot and half as many in the second. In (3), the error has resulted in four successive feet of two syllables each whereas in the target utterance the fourth of these would have had three syllables. In (4), again, the foot length in the error is a constant three syllables, whereas the target would have four syllables in the first marked foot. In (5), the error has led to the second marked foot being reduced from five syllables to four, closer in length to the surrounding three-syllable feet. In (6), finally, the error has reduced the first marked foot from four to three syllables, thus matching the three-syllable length of the following feet. Clearly these errors have resulted in utterances more rhythmical than the intended utterances.

Although errors in which an extra syllable is inserted are rare, they too appear to result in a more regular rhythm:

(7) E: /That's transan/actional an/alysis
     T: /That's trans/actional an/alysis

In (7), the error has extended the first foot to a length more comparable with that of the following feet.

Space does not suffice for a complete listing of my corpus of syllable addition and deletion errors. I have in all 20 errors in which one syllable was deleted (eight of which involve a stress shift as well), three in which two syllables were deleted (all involving a stress shift), and five in which a syllable was added (no stress shift), making a total of 28 errors, in 24 of which the erroneous utterance was more rhythmic than the intended utterance would have been (a difference significant on the binomial test at a level beyond .001).

Other omission errors

In haplologies, words are telescoped – the speaker skips from one point in the sentence to a later point, and the intervening material is omitted. Usually such errors occur when segments are repeated, and the utterance skips from the first occurrence of the repeated element to the second, as in:

(8) It's a pritiotic idea
     (T: it's a pretty idiotic idea; from Fromkin (1973))
(9) a large number of words in the language seem to become
     unique aftoo (T: ... unique after two)

It is probably reasonable to assume that this type of error occurs at a point after the entire utterance has been assembled in a pre-output buffer; the sequential dependencies of individual elements become confused when elements are repeated in fairly close succession, so that, for instance, the [prIdi] of (8) summons up the [atIk] which should actually have awaited the utterance of another [Idi].

Whole words, of any length, may also be omitted, as in (10)–(12):

(10) I hope you mind my – I hope you don't mind my not going
(11) some more alternative ...
      (T: some more efficient alternative strategy)
(12) and most of what you'll doing
      (T: ... what you'll be doing)

Various explanations exist in the speech literature for certain kinds of word omission errors – for example, Freud's (1904) well-known explanation of errors such as (10). Neither haplologies nor whole word omission errors show any tendency to regularise utterance rhythm (in each case about half of my examples result in an error more rhythmic than the

target, while half result in a rhythmically indistinguishable or less regular utterance). Although pressure towards isochrony may be operative in a few isolated cases, it is probably true that these two error types, both of which produce a surface structure different from that of the target because substantial material has been omitted, usually arise in a manner different from the genesis of syllable deletion and addition errors, in which the error makes alterations only within a single word.

Lexical stress errors

Some of the syllable omission errors described above also involve a shift of lexical stress within the word. Very often, however, lexical stress errors occur with no syllable omission, as in (13)–(14):

(13) we do think in spécific terms
(14) I think those disambiguáting effects ...

Elsewhere (Cutler, forthcoming) I have given a detailed description of such errors; since the erroneous stress pattern is always that of some related word (in (13) and (14), *specify* and *disambiguation* respectively), I have accounted for them in terms of confusion within the lexicon between differently stressed derivatives of the same morphological base. There is no compelling reason, however, why a tendency to regularise utterance rhythm may not also play a part; a distinction can be drawn between mechanism (in this case confusion between conjointly stored related words) and cause (factors which might precipitate such confusion). Isochrony might act as just such a precipitating factor; when the lexical entry accessed contains, as well as the target, a related word with a stress pattern which would fit better into the overall utterance rhythm than the stress pattern of the target, then that better-fitting stress pattern might be selected by mistake, resulting in a typical lexical stress error. And indeed, almost two-thirds of the lexical stress errors result in an utterance with a rhythm more regular than the target utterance would have shown (a result significant on the binomial test at a level beyond .03). But this difference is also significantly less marked than the difference to be found in the syllable deletion/addition errors (chi square, $p < .02$). (On the other hand, deletion errors which do involve a stress shift, and deletion errors which don't, show no difference in their effects on utterance rhythm.) It is probably fair to conclude that while a tendency towards isochrony may quite often be the underlying cause of a lexical stress error, not all such errors arise in this way.

Conclusion

Certain kinds of speech errors tend to result in a closer approximation to isochronous speech than the target utterance would have achieved. This tendency appears to be most strongly at work in errors of syllable omission and addition. Lexical stress errors also appear to be to a somewhat lesser degree rhythmically determined, whereas errors involving omission of relatively large amounts of material, such as entire words, do not. Independent accounts have been offered for these latter types of error, but no explanation has hitherto been suggested for syllable deletion or addition errors. It is argued here that a sufficient account of their genesis is provided by a tendency to isochronous rhythm in the production of English. Many devices of syntax and vocabulary are available to the English speaker to adjust the rhythm of a target utterance; furthermore, the length of individual syllables can be fairly considerably contracted, or expanded even to the extent of allowing a complex pitch movement to occur on a single syllable. Nevertheless, the pressure to regularise the rhythm of an utterance is sufficiently strong that on occasion an utterance will be forcibly adjusted towards isochrony by the deletion or addition of a syllable. It is not surprising, we can now see, that syllable deletion errors are relatively common while syllable addition errors are rare. There are few constraints on how far a syllable can be stretched to lengthen a foot, but there are limits to the degree to which a syllable can be contracted to shorten a foot – in the extreme case it is contracted out of existence and becomes a syllable omission error.

It is clear that this discussion of omission errors raises many further questions, for instance:

1. To what extent is the effect of rhythmic regularity on speech errors confined to English? Does it show up in other stress-timed languages as well? Meringer & Mayer (1895) – the only extensive collection of speech errors in German and the first ever published collection of errors – contains a section on syllable omission errors of which only one is given with full context:

(15) E: Meine /Vorlesung /sinken /nach und /nach her/ab
      T: Meine /Vorlesungen /sinken /nach und /nach her/ab

In this case it would certainly seem that omission of a syllable has resulted in a more equivalent foot length. German is, like English, a language for which a tendency to isochrony has been claimed; an investigation of German syllable omission errors could well produce results similar to those of the present study of English errors. One would certainly not expect, however, any tendency towards isochrony to be opera-

tive in speech errors of nonstress-timed languages such as the Romance languages.

2. Does the nature of the omitted syllable itself play a role in the error? One might hypothesise, for instance, that syllables with fewer consonantal segments might be easier to contract and hence be less likely to be omitted than syllables with a greater number of segments. No evidence in favour of this hypothesis can be found in my present corpus, however; in most of my syllable omission errors the omitted material consisted of only one or two segments and in no case were more than two consonants omitted.

3. Is a tendency to regular rhythm also detectable in other types of speech error? For example, when two words with different numbers of syllables exchange position in the sentence, the sentence rhythm will be affected; do exchange errors show, like errors of omission, a consistent regularising effect on rhythm? Finally, can the pattern of pauses and hesitations in spontaneous speech be similarly correlated with rhythmic factors?