A Multiple-Trace-Based Proposal for Linguistically Unconditioned Variability

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Abstract :*In his study of the casual speech of some East London English (ELE) speakers, Tamimi (2002) finds unconditioned variability in the phonetic behavior of' h' under a number of linguistic conditions, including a) different lexical functions (content vs. functional words), b) different stress conditions (stressed vs. unstressed), c) different positions in the utterance/word, and d) different phonetic environments (among other conditions). He also observes the same type of variability in unstressed non-initial function words appearing in the casual speech of some speakers of Southern British Standard (SBS). This paper introduces a Multiple-Trace-Based-Proposal to account for such variability, after revealing some explanatory inadequacies in a number of available phonological theories, including a) Coexistent Phonemic systems, b) Standard Generative Phonology, c) Variable Rules, d) Bailey's Polylectal Grammar, e) Lexical Diffusion, f) Articulatory phonology and g) Optimality Theory. Unlike these, the proposal, based on the multiple-trace theory and some views already available in the literature, appears to be bale to explain the unconditioned variability of the glottal fricative in ELE.*

1. Introduction

The fundamental traditional dichotomy between competence and performance entails a disregard of variation. Since data from language use must come, by definition, via performance, they are often seen as not necessarily relevant to the development of linguistic theory, which is defined as treating competence (Chomsky 1965: 3). Many linguists, however, contend that variation, impeded in performance, is an essential characteristic of language as well as a prerequisite to linguistic evolution (Langacker 1987: 494, Kiparsky, 1988: 370, Hinskens, Van Hout and Wetzel, 1997: 2, Guy, 1997: 125, Bybee 2001, to mention only a subset). Operating within the latter view, the present research raises the problem of linguistically unconditioned variability as concluded by Tamimi (2002), and seeks to find a reasonable phonological account for it.

In his investigation of the phonetic behavior of 'h' in four ELE speakers' casual speech under some linguistic conditions, including stress and phonetic

environment (among other conditions such as position in word/ utterance), Tamimi (2002: 204) concludes:

- Stressed non-initial content words display more incidence of realized 'h' (28/82 = 34.1%) than unstressed non-initial content words (5/61= 8.1%). Nonetheless stress does not appear to strictly condition the presence of 'h' for two basic reasons: (a) 'h' is present, though to a lesser extent, in unstressed content words, and (b) there is variability in the pronunciation of many similar lexical items under the same stress condition for the same ELE speaker (termed set 1 items in this study). Examples:

(a) Stressed Lexical Items Pronounced With 'h'

1. I was fourteen when I met my husband.
2. And then I met my husband.
3. And that was their holiday as well.
4. Years ago we never had a key to our house.
5. They used to spend about five or six weeks like down in Kent hop-picking

(b) Stressed Lexical Items Pronounced Without 'h'

6. I didn't see my [ϕ]usband a lot.
7. Though my [ϕ]usband is an East Ender [ϕ]is family was a bit affluent
8. Because people started [ϕ]aving little [ϕ]olidays at Clacton.
9. No one was barred from our [ϕ]ouse.
10. I'd always make out I was sick all of September time I work and go [ϕ]op-picking.

- There is some evidence of natural selectivity where each ELE speaker consistently pronounces some stressed non-initial h-content words with 'h' (Set 2 items) and some other h-words of the same conditions without 'h' (set 3 items).

2. Phonetic Environment

There are some indications that point to some effect from the English preferred syllable structure (CVC) on the phonetic behavior of 'h'. Nonetheless, the presence of 'h' is unpredictable in both postvocalic (16/80 = 20%) and post consonantal (17/137 = 9.8 %) environments. Examples:

1. I would rather wait until [ϕ]e (A V) passes his (A C) Knowledge.
2. I only have (AV) the one grandson from my daughter.
3. My [ϕ] obbies (AV) changed.

It is obvious from the previous examples that the ELE speakers introduce h-ful and h-less forms of h-words, irrespective of stress and phonetic environment (for detailed information about stress, phonetic environment and some other linguistic conditions, (see Tamimi 2002: 76- 123). Close examination of the conclusions demonstrated above reveals that variations in 'h' are of the unconditioned type.

The purpose of this study is to examine how a number of available phonological theories can accommodate unconditioned variability. These include Coexistent Phonemic Systems, Standard Generative Phonology, Variable Rules, Bailey's Poly-lectal Grammar, Lexical Diffusion, Articulatory Phonology, and Optimality Theory. It also presents a proposal based on the Multiple-Trace Model that seems to provide more explanatory insight into the subject matter than these theories.

3. Phonological Theories

Assuming the readers' reasonable knowledge of the assumptions/mechanisms of the following theories, the discussion below is concise and restricted to their shortcomings in embracing unconditioned variability.

3.1 Co-existent phonemic system. (Pike and Fries (1948)

Two systems operating partly in harmony and partly in conflict in the speech of a monolingual native of a language (say Southern British Standard SBS that has 'h' as a functional unit and ELE that presumably lacks it) provides no insight into the speaker's variability in the same lexical items in the same speech type under the same linguistic condition (i.e. stress in 1-10 above).

3.2 Standard generative phonology (SGP)

SGP can handle conditioned variability by means of its obligatory phonological rules. As for unconditioned variability, the best that the theory can offer is an optional rule that may or may not apply to a lexical item. It assumes that 'h' is included identically in lexical representations for the ELE speakers as is the case with SBS speakers (homogeneity) and disallows exceptions. According to Tollfree (1996: 3), this assumption implies that SGP "rejects accents at least underlyingly." Tamimi's (2002: 50-51) casual speech data point towards individual differences in the use and non-use of 'h' amongst the ELE speakers, which seems to cast some doubts on the SGP's basic assumption. The optional rule itself operates blindly on idealized lexical entries: none of the speakers' knowledge of when to apply the rule is represented.

3.3 Variable rules

Labov's variable rule (1969) fails in its lack of explanatory adequacy and in its rejection by the linguistic community as a possible formalism of linguistic behavior. In fact, there is little support for this approach in the literature, especially since it assumes a probabilistic competence thus violating a basic

belief about human psychology**.** (See Guy, 1973: 59, 1997: 130, Kay and McDaniel, 1979: 154). In this context Romaine (1982: 251) states:

> To describe the utterances of speakers/groups in terms of probabilistic laws which are said to be variable rules in a model of grammar is one thing; but to project such rules onto the competence of individual speakers of a language, and then to suppose that speakers or their mental capabilities are in any way constrained by them is, in my opinion, methodologically inadmissible.

3.4 Bailey's Poly-lectal grammar (1973)

According to this grammatical and lexical approach, variation is a natural consequence of a speaker's competence in more than one variety of a language**.** It thus allows the ELE speakers (presumably as a consequence of their inevitable contact with 'h'-pronouncing accents to have a passive competence in the SBS system). That is they may have competence in more than one grammar/lexicon: Grammar/lexicon 1, for example, may yield one phonetic output (e.g. the 'h'-less form of a given item), and grammar/lexicon 2 may give the other output (i.e. the 'h'- full form of that item). Though the approach provides such insightful remarks, it does not provide a formal mechanism to this effect.

3.5 Lexical diffusion (Chen and Wang, 1975)

Assuming that phonologization or lexicalization of 'h' is in a process of lexical diffusion in the East End, we can only conclude, according to this model, that 'h' has diffused into some words and has not yet into some other words. This may explain the absence and the presence of 'h' in many words in the data, but fails to account for a number of similar words pronounced sometimes with 'h' and sometimes without it (again set 1 items above).

3.6 Articulatory phonology (Browman and Goldstein, 1986-1993)

Increase in overlap among gestures and reduction in the magnitude of individual gestures, central to the theory, are assumed to underlie a variety of phonological processes (Browman and Goldstein 1990: 360). Among these, segment deletion is not allowed in the theory: it is viewed as 'gestural hiding' (op cit, 365). The theory is said to explain a variety of different types of phonological variation. It however has no obvious way of explaining variation in the speech of a single speaker, across speakers and accents when conditions remain identical. It can explain how hiding takes place, but not why.

3.7 Optimality theory (OT)

OT, in its original version (Prince and Smolensky 1993) can account for systematic and predictable variation between different languages and accents by means of its fixed relative constraint ranking. In its more recent and flexible version (i.e. Boersma, 1998), where constraints are

ranked freely and probabilistically, it is claimed that OT can account for variable phonetic outputs of the same lexical input within one accents. Like Variable rule, however, it fails in its lack of explanatory adequacy. It is also likely to receive rejection in linguistic circles as a plausible formulation of linguistic behavior, especially since it adopts the probabilistic approach. (Shockey 2002: 75)

From the foregoing, we conclude that none of these theories has offered a complete explanation for the unconditioned variability in the ELE data. The Multiple-Trace- Model may provide better insight.

4. Multiple- Trace-Model

Before, I introduce the Multiple-Trace Model (MTM) and present my proposal (based on it), I touch briefly, for relevance, on some longstanding assumptions in phonology.

4.1 Longstanding assumptions in phonology

4.1.1 Invariant lexical representation and phonological rules

Most early generative theories assumed that there is a limited a mount of storage space in human memory, but tat the mind is particularly adept at spotting and extracting regularities in phenomenon and formalizing them into rules. According to Halle and Clements (1983: 2), "Our memory is so constructed that when we memorize words, we automatically also abstract their structural regularities. We suppose, to be specific, that human storage space is at premium so that every word must be memorized in a maximally economical form in which redundant (predictable) properties are eliminated …it is to our advantage to memorize the rule than to clutter up our memory with redundant facts.". See Anderson (1985: 10) for a full argument.

It follows from this that the lexical representation is unique in the sense that there should be one and only one lexical representation for each morpheme. The "Uniqueness Hypothesis" is the term commonly used to express this relation (e.g. Shane 1972: 266; Myers 2000: 260). This tradition has continued in more recent linguistic theories. For example, within Optimality Theory, the "faithfulness constraints" can be seen to "roughly" correspond to invariant lexical representation (Vihman and Velleman 2000: 307).

4.1.2 Views casting doubts on these longstanding assumptions

There are, however, many views that cast doubt on these longstanding assumptions. For examples:

Ladefoged (1972) reports:

> the indications from neurophysiology and psychology are that instead of storing a small number of primitives and organizing them in terms of a

> large number of rules. We store a large number of complex items, which we manipulate with comparatively simple operations. The central nervous system is like a special kind of computer which has rapid access to the items in a very large memory, but comparatively little ability to process these items when they have been taken out of memory".

Similar remarks were made by Derwing (1973: 154) and by Linell (1979: 73-76).

Bybee (2001) points out that a child cannot learn that [-ed] marks the regular past tense of English without first learning a number of verbs containing this suffix, such as 'played', 'spilled','talked', and so on. Langacker (1987: 42) argues that even when the generalization is formed, such words are not necessarily flushed from memory. As he puts it: "If all the regularity is factored out of a linguistic structure, the residue is seldom if ever recognizable as a coherent entity plausibly attributed to cognitive autonomy" (p. 329). Bybee (p.21) explains that if our memories for dogs excluded all the predictable features (two ears, a muzzle, fur, a tail, wet nose, etc.), what is left would not be a recognizable or a coherent entity. For a similar argument, see Ohala and Ohala (1995: 58).

Jaeger (1986: 74) remarks that nearly all studies of speech perception and production indicate that something close to surface forms exists in memory (e.g. confusion studies, similarity judgment, speech errors and word association), and that words are stored with much redundancy, so that they can be accessed from a number of paths". As evidence of this Jaeger cites the 'tip of the tongue' (TOT) phenomenon: although a person may be in this state (that is when he cannot quite remember the word being searched for), he can still remember a great deal about the phonological shape of the word; e.g. how many syllables it has, its stress pattern, what sound it begins with or ends with, and even information about its spelling (loc cit).

Evidence in the same direction has given rise to an alternative approach to lexical representation, particularly that offered by the Multiple-Trace Model.

5. MTM: Basic Assumptions and Implications

Multiple-trace model (also called 'exemplar' or 'episodic', Goldinger 1997: 33) is a subset of Parallel Distributed Devices. In brief they are (normally computer based) networks which recognize input through a process of class formation: they are given multiple examples of tokens containing a feature of interest (in the speech domain, something like 'vocalic' or [b]) and create maps which show areas of shared by all the training data and peripheral areas not shared by all tokens (McClelland and Elman 1986: 59). There has been some success in using these for automatic speech recognition by matching input with derived maps and calculating goodness of fit (McClelland, Rumelhart and Hinton, 1986: Chapter 1). These devices are said to learn because they can change their maps depending on their degree of success at recognition: if input is correctly

recognized, the part of the map corresponding to the input is reinforced. If the input is not correctly recognized, the map is correspondingly altered so as to differ from that token (McClelland et al, p: 31). Multiple –Trace theory assumes that a lexical item in the human brain is trained through hearing repetitions of it and that the 'map' made of the lexical item is used to recognize ensuing tokens as well as providing a target for speech production.

The theory simply suggests that listeners do store specific instances of words that they have heard/recognized (Hintzman 1986: 411, 1988: 529; Nosofsky 1991; 3; Jusczyk 1997: 210). Implied in this is that variability is directly encoded in the lexical representation. Some claims that this places a great demand on memory (e.g. Johnson, 1997: 146 and Jusczyk, 1997: 210), while others believe that thee is enough memory available to allow some version of an exemplar repetition (e.g. Bybee 2001: 21).

Anyway, the theory is supported by a growing quantity of evidence, which suggests that indexical information (such as speakers' voice, gender, accent, etc), which held to be unconnected to speech perception or word recognition, do appear to play a significant role in decoding the linguistic properties of the speech signal. For example Geiselman and Bellezza (1976) presented subjected with 20 sentences to remember; half were produced by a male talker and half were produced by a female talker. On a surprise memory test that quizzed the ability to recall voices as well as the sentences, subjects did retain information about which voice produced which sentence. (For an overview of evidence, see Pisoni and Lively 1995: 439-444; Pizoni 1997: 21-25; Juczyk 1997: 231).

Such evidence, according to Docherty and Foulkes (2000: 119) has given rise to multiple-trace model as "a reasonably plausible theory of lexical representation". Interestingly Fitzpatrick and Wheeldon 2000: 137) conclude that if the MTM view of lexical representation appears to proponents of the generative approach as 'going to the extreme", the generative approach itself (positing the storage of a small number of primitives) may be seen as constituting the other end of this extremes.

However, as we have said earlier, one important implication from this theory is that variability is directly encoded in the lexical representation as illustrated in Figure (1) below.

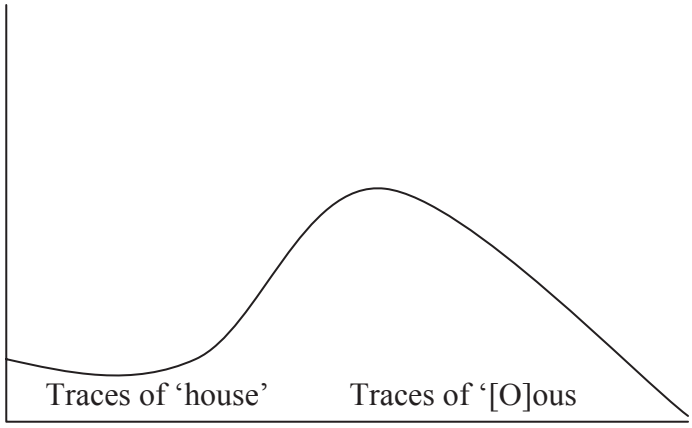

Figure (1): An illustration of variable traces for the same lexical entry

As figure (1) shows, the lexical representation of the word 'house' is equal to the sum of traces being stored for the word.

This view applies in theory to all lexical entries that demonstrate variability. For an East Ender, for example, the lexical representation of the word 'house', for instance, is equal to the sum of traces being stored for the word. This view applies in theory to all lexical entries. For example, the lexical representation for 'economics' may include traces for the word 'with the mid-close vowel' and with the high front one. This view thus poses a challenge to the long-standing assumption that "speakers' knowledge of their lexicon is embedded exclusively in a set of unique representations for lexical items" (i.e. the uniqueness hypotheses). And this clearly means that the theory provides a reasonable potential for accommodating variability.

6. MTM- Based- Proposal

Carrying this step further and making use of some views already available in the literature, we suggest the following proposal for unconditioned variability as sketched in figure (2) below.

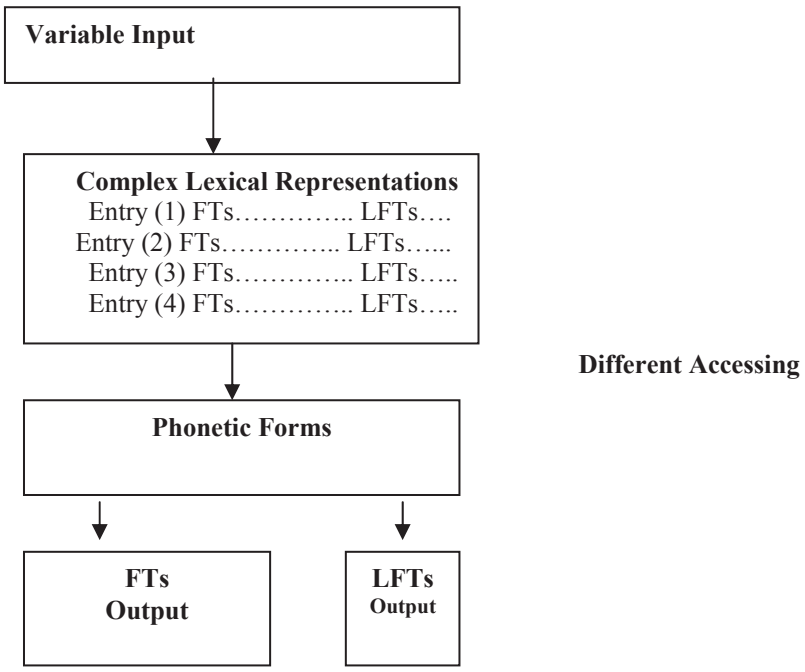

Figure (2): An MTM-Based Proposal for Unconditioned Variability

The proposal as shown in figure (2) is composed of three basic components:

(1) Variable Input;
(2) Complex lexical representation, comprising (a) frequent traces (FTs) for each lexical entry, and (b) less frequent traces (LFTs) for the same entry; and
(3) Output: phonetic forms reflecting a prior accessing of either FTs or LFTs.

Variable Input provides for the assumption that all speakers should not necessarily be expected to acquire the same representation for individual lexical items. Variable input can make it possible to explain (a) across speakers' variability and (b) within speaker's variability.

In this proposal the mapping between complex lexical representations and phonetic forms is very simple: it does not involve phonological rules, as the case would be if invariant and abstract lexical representations were posited. The protocol is complex lexical representations, simple mapping onto the phonetic forms. In other words, we adopt the "Identity Condition", which allows "the least divergence between lexical representations and their associated phonetic forms" (Kenstowicz and Kesseberth 1977). Our inclusion of this notion is in harmony with the nature of MTM view of lexical representation that seems to obviate the need for rules. It is also consistent with some views that call for pronounceable lexical representations (e.g. Venneman 1974), which entails that the level of representations must correspond to the systematic phonetic forms. It is, moreover, congruent with some views that cast doubt on the underpinnings of rules as summarized in MacWhinny (2000: 122):

> In recent years, the biological and epistemological underpinnings of rules have become increasingly shaky and vulnerable…No developmental psychologist ever observed a child learning a rule…No neuroscientist ever traced the neural substance of a rule…Attempts in the 1970s to demonstrate the psychological rules in adults (Fodor, Bever, and Garrett, 1974; Linell 1977; Ohala (1974a, b and c) and Trammell 1978) yielded uniformly disappointing results.

Consistent with Bybee's (2000: 253 and 2001: 28) distinction between traces of words, we classify the traces of a given lexical item into Frequent Traces (FTs) and Less Frequent Traces. We suggest that the Frequent Traces are typically the ones that the speaker tends to access most of the time (e.g. in casual speech), whereas the Less Frequent Traces, following Miller (1994), are the ones the speaker tends to access on particular occasions (e.g. reading aloud). We further suggest that representational strength of items play an important role in steering the speaker to either FTs or LFTs. Presumably there is some threshold beyond which a form is adopted as the normal standard and below which forms are

thought of as variants, but we can only speculate about this at present. Resultant phonetic forms are the outputs op a prior accessing of either FTs or LFTs.

7. Applicability

Now how can this proposal account for the ELE speakers' unconditioned variability in stressed non-initial content words categorized into the three sets stated above.

In Explaining the absence of 'h' from many items (set 3 items), we suggest that the ELE speakers followed the norm of accessing the frequent traces of these items (which are 'h'-less-trace- represented).

In accounting for set 2 items (i.e. those pronounced solely with 'h'), we suggest that the speakers were accessing the LFTs of these items as they have strong h-ful-trace representations

Finally, the variability in pronouncing set 1 items (items pronounced sometimes with 'h' and sometimes without it), is the consequence of the speakers' accessing of either their FTs or LFTs, where these items are almost equally trace-represented. That is they have the choice of accessing either source.

The same argument can be used to explain unconditioned variability in different linguistic data.

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