

HOW THE PHONEME INVENTORY CHANGES ITS SHAPE: A COGNITIVE APPROACH TO PHONOLOGICAL EVOLUTION AND CHANGE

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11

1. Phonetic prototypes, sonority and peripherality

According to Langacker (1991: 343), three general considerations should be borne in mind in order to assess the viability and potential insight of cognitive grammar for both synchronic and diachronic analysis: naturalness, conceptual unification, and theoretical austerity. *Naturalness* is understood here as the capacity to explain linguistic phenomena on the basis of well-established or easily demonstrable abilities. *Conceptual unification* implies that Cognitive Grammar (henceforth CG) posits only semantic structures, phonological structures, and symbolic relationships between them. Finally, *theoretical austerity* means that “the only elements ascribable to a linguistic system are semantic, phonological, and symbolic structures that occur overtly as (parts of) linguistic expressions, schematizations of such structures, and categorizing relationships.”

Following the work of, among others, Rosch and Mervis (1975), Lakoff (1987) and Hampton (1993), we will refer to categories with a graded structure as *prototype-effect categories*, where the prototype is the most typical member of the category, and prototype-effects are those of grading. The notion of prototype expresses the sense that objects being categorized are not defined by the presence or absence of criterial distinctive features, but rather in terms of similarity to what is perceived as the prototypical member of its category (Taylor 1995: 27; Valimaa-Blum 2006: 98; Blevins 2004).

To give a prototypical example, a sparrow would be a prototype of bird, whereas an ostrich (because of its atypical characteristics, notably its inability to fly) would not. In order to determine relative degrees of prototypicality, we can use such factors as frequency of occurrence, order of acquisition, and degree of universality (Langacker 1999: 514-515).

A first approach to phonological prototypes is given by Nathan (1986, 1995, 1996, 2006), who proposes *sonority* as the most important source of prototypical effects in phonology. Sonority (which he presents as a radial category) is measured in terms of loudness and openness of the vocal cavity.¹ In Nathan's analysis, the fact that language must be audible implies that the louder a sound, the more prototypical effects it possesses. Since any kind of closure will limit the amount of noise produced by the speaker, sounds articulated with a complete closure of the mouth (i.e. stops) are less prototypical than those sounds in whose articulation the air escapes evenly and freely through the speaker's mouth (i.e. continuants and, especially, vowels). This implies that the prototypical speech sound is a vowel, and whereas open vowels can be considered 'more phonemes' than non-open ones, voiceless consonants are 'less phonemes' than voiced ones.²

12

In order to complete Nathan's analysis, I will use here the term *peripherality*, introduced by Labov, Yaeger and Steiner (1972), who proposed that vowel nuclei in many northern European languages can be divided into peripheral and nonperipheral categories. This distinction is based on the configuration of vowels in F_1/F_2 space. Peripheral nuclei are those located on the periphery of the vowel space, whereas non-peripheral nuclei are those located on the inside. In addition, peripheral vowels are normally also phonologically tense, while nonperipheral vowels are usually (but not always) phonologically lax (Thomas 2000).

The concept of peripherality, which implies that those sounds articulated closer to the periphery of the vowel space are more clearly distinguished by the hearer than those sounds articulated nearer to the centre of the mouth, has been used to propose several principles of diachronic vowel shifting (Labov 1994: 170-177). According to these principles (which will be outlined in the next paragraphs), there exists an inverse relationship between peripherality and changes in openness, so that "in chain shifts, peripheral vowels become less open and nonperipheral vowels become more open" (Labov 1994: 262). Given this link between peripherality and openness, we can assume here that changes in the degree of peripherality of a vowel imply a modification in its degree of openness and, consequently, in its prototypical effects.

Peripherality holds both for articulatory position and acoustic properties of sounds. By combining peripherality and height, we can confidently affirm that open peripheral vowels are more prototypical than their nonperipheral counterparts, even

How the phoneme inventory changes its shape

when their degree of openness is identical. The open vowel /a/ appears thus as the most prototypical instance of a phoneme, in so far as it shows the highest degree both of frequency of occurrence and of universality (Lass 1984: 130-147) and it is the first sound to be acquired by infants (Vihman 1996: 16-29).

According to Labov (1994: 601), in Germanic languages long/tense vowels are peripheral, whereas short/lax vowels are usually nonperipheral. This explains why Present-Day English tense vowels, which require a relatively strong muscular effort and involve a greater movement of the vowel tract away from the position of rest, produce a relatively strong spread of acoustic energy (McCombs 2006), whereas short vowels, which are produced with less muscular effort and movement, are short and less distinct. In fact, in faster rates of speech short vowels may not reach their intended targets as completely as long ones, as before they have fully emerged from one consonantal transition, they are engaged in another one (as predicted by the target-undershot model described by Lindblom 1963, 1990).

2. Paths of phonetic change

From a diachronic point of view, the introduction of different degrees of phonetic prototypicality implies a new notion of sound change. Thus, in chain shiftings sounds can do one of two things: they can become either more prototypical or less prototypical. Moreover, a vowel can change its degree of prototypicality in one of these two ways: by changing its degree of openness, and/or by changing its degree of peripherality.

13

	MORE PROTOTYPICAL EFFECTS	LESS PROTOTYPICAL EFFECTS
height	close > open	open > close
peripherality	nonperipheral > peripheral	peripheral > nonperipheral

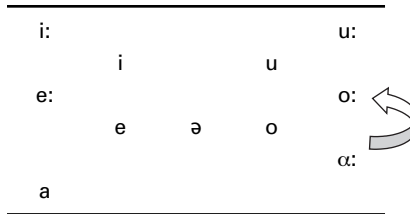
Following Labov's (1994: 601-602) principles of chain shifting, I will propose here a classification of sound change that is based on the cognitive notion of prototypicality.

Principle 1: In chain shifts, the relatively more audible sounds within a given phonological system will become less audible.

This principle explains why, throughout the whole history of the English language, long vowels and long consonants have shown a strong diachronic tendency to become either closer/unvoiced or, when closing/unvoicing was not possible, shorter. Here are some illustrations of this general tendency from the different periods in the early history of the English language:

1.1. Closing of open vowels: the Long Back Merger (LBM; Lass 1994: 18; Díaz Vera 2001: 116). The PrGmc³ LBM implies a decrease in the degree of prototypicality of IE */ɑ:/ in the primitive Germanic languages, where this phoneme becomes more closed and, consequently, less loud.

E.g. IE */ɑ:/ > PrGmc */o:/; e.g. IE */bhɑ:ghu-/ ‘shoulder’ > PrGmc */bo:ku-/ > OE *bōg* ‘bow’).



1.2. Closing of open consonants: Gmc long voiced fricatives (Lass 1994: 28; Díaz Vera 2001: 118-119): This change implies that WGmc long voiced fricatives became long voiced stops in OE, i.e. they underwent a process of closing from fricatives to stops, as can be seen in the following examples:

14

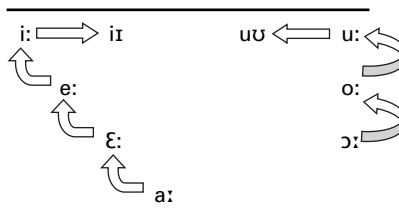
Gmc */ββ, ðð, γγ/ > OE /bb, dd, gg/; e.g.

Gmc */hαββan/ ‘to have’ > OE *habban* /’hαββan/

Gmc */’riððɑ/ ‘rider’ > OE *ridda* /’riððɑ/

Gmc */’froγγɑ/ ‘frog’ > OE *frogga* /’froγγɑ/

1.3. Shortening and loss of peripherality: the Great Vowel Shift (GVS; Guzmán González 2005): In most cases, the GVS implies a process of closing of ME long vowels (similar to the process of closing described above; see LBM); only in those cases where the ME vowel was already maximally closed (ME /i:/ and /u:/), the original vocalic sound became short (i.e. less peripheral) and an epenthetic vowel was developed immediately after it (with the subsequent process of diphthongization):



How the phoneme inventory changes its shape

Principle 2: In chain shifts, the relatively less audible sounds within a given phonological system will become more audible.

This explains why English short vowels and short consonants have always shown a strong diachronic tendency to become either more open/voiced or, when opening/voicing was not possible, longer. Here are some examples from the history of English:

2.1. Voicing of unvoiced consonants: the First Sound Shift (Grimm's Law Part I; Lakoff 1993): According to Grimm's Law (Part I), IE voiceless stops /p, t, k/ became voiceless fricatives in PrGmc (i.e. /f, θ, x/) and, under some circumstances (after a stressless vowel; Verner's Law), the resulting continuant consonants were voiced into /β, ð, γ/.

(1) Grimm's Law (Part I)⁴

W: [-obstruent][-cont, -voice]

|

P: [+cont]

15

*p	*f	IE <i>*peisk-</i> vs. OE <i>fisc</i> 'fish'
*t	*θ	IE <i>*tenu</i> 'to stretch' vs. PDE <i>thin</i>
*k	*x	IE <i>*krewð</i> 'raw meat' vs. OE <i>brēaw</i> 'raw'

(2) Verner's Law

P: If [V, -stress] X and X=[+cont], then X=[+voice].

*p	*β	*b	IE <i>*septm</i> vs. Gothic <i>sibun</i> 'seven'
*t	*ð	*d	IE <i>*pðtēr</i> vs. OE <i>fæder</i> 'father'
*k	*γ	*g	IE <i>*dukā</i> vs. OE <i>togian</i> 'tow'

In both cases, this mutation implies a gradual increase in the degree of openness of the mouth organs and, as a consequence of this, the production of a louder phoneme.

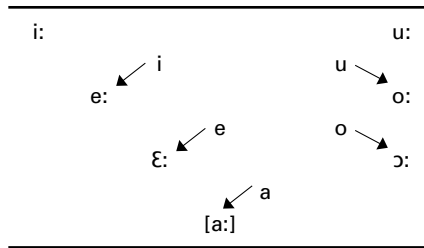
2.2. Lengthening of short phonemes: changes in ME vocalic length. ME short vowels became long and, consequently, peripheral, when they were found in an open syllable, as in the following examples:

OE /e/ > ME /ɛ/ > /ɛ:/: e.g. OE *mete* ‘meat’ > ME *meat* [‘mɛ:tə];

OE /o/ > ME /ɔ/ > /ɔ:/: e.g. OE *broken* ‘broken’ > ME *broken* [‘brɔ:kən];

OE /i/ > ME /e/ > /e:/: e.g. OE *wiku* ‘week’ > ME *week* [‘we:k];

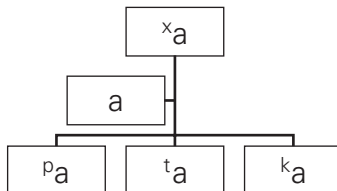
OE /u/ > ME /o/ > /o:/: e.g. OE *duru* ‘door’ > ME *door* [‘do:r]



3. Mechanisms of sound change: a mentalist view of allophonic variation

16

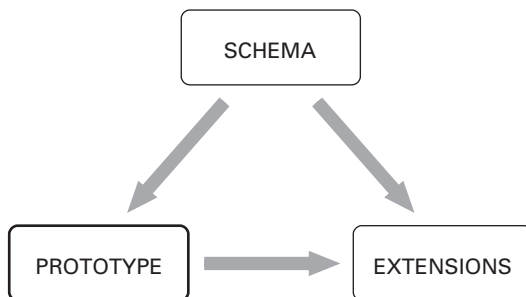
In the previous section, phonetic change has been divided into two main routes: the first route means a loss in the degree of prototypicality of the phoneme, whereas the second route refers to those diachronic processes that produce more prototypicality. In both cases, our usage of the term prototypicality implies factors that are both articulatory (degree of openness) and auditive (degree of audibility). Taking into consideration these two basic principles, we are going to consider now the nature of allophonic variation. In my analysis, I will consider a phoneme as a complex category (Nathan 1986, 1996; Eddington 2007) consisting of a hierarchical set of allophones. The basic allophone within a given category corresponds with the basic allophone of a phoneme, which can be equated with the category prototype. The other allophones will function as context-induced extensions of this prototype, as diagrammed in the following figure (based on Langacker 1991: 273):



How the phoneme inventory changes its shape

As Nathan (1996: 112) puts it, “we should expect to find that phonemes are organized into radial categories in the same way that cups are, and that there are general principles governing the relationship among the members of the categories.” Supposing that the phoneme /a/ in a given language occurs only in the syllables /a/, /pa/, /ta/ and /ka/, we can calculate a minimum of four allophones for this phoneme: [a], which stands alone as a syllable, and its three derivations [pa], [ʔa], and [ka], where the preceding consonant induces a given phonetic feature through a process of accommodation. It is precisely this need to be accommodated to their consonantal environment that prevents these three allophones of /a/ from reaching their highest degree of loudness, so that they become less peripheral and less open and, consequently, less prototypical than the central allophone [a].

The phonological system of a language is thus composed of a varying number of networks, each of which consists of one central allophone plus all its possible derivations. The network model extends beyond the realm of allophony: let us suppose for instance that *eat* is first learned with reference to the process of food ingestion by humans. The semantic pole of this verb is limited initially to that single value, which acts as a prototype of the whole category. However, the action expressed by this lexeme is not limited to that canonical view of eating, but includes a vast variety of more or less different actions: e.g. human and animals eat differently, and this difference is lexically expressed in some languages (such as German *essen* v. *fressen*). Moreover, the way we eat changes, depending on such different things as the type of food we are ingesting or the social context of the very act of eating. Finally, the set of actions expressed by the word *eat* is not reduced to food: we can eat words, fire, money, hats, and we can even be eaten by a negative feeling, such as trouble or jealousy. Each one of these prototypical meanings implies a semantic extension from the central meaning ‘to consume food’, which form a complex semantic network:

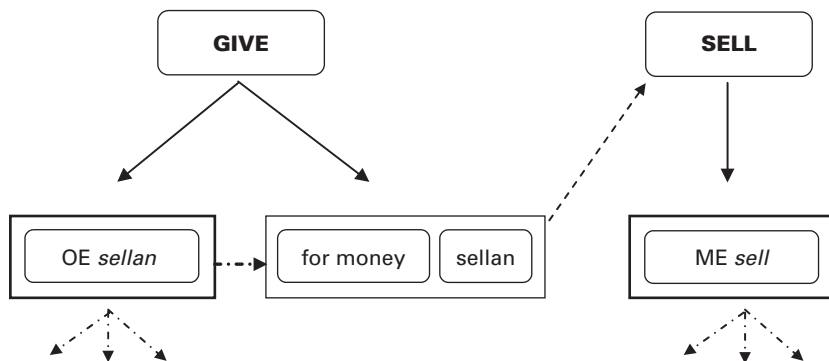


4. Semantic change and phonetic change: some steps towards conceptual unification

Within this framework, semantic change can be analyzed as the development of an independent semantic pole from a previously existing semantic extension. As can be seen in the following example, one of the numerous semantic extensions of OE *sellan* ‘to give’, which implied the action of ‘giving somebody something for money’, was able to lexicalize and create a new categorization schema, corresponding to ME *sell* ‘to sell’ (Vázquez González 2005: 57-60):

(1) OE *sellan* ‘to give’

(2) ME *sell* ‘to sell’



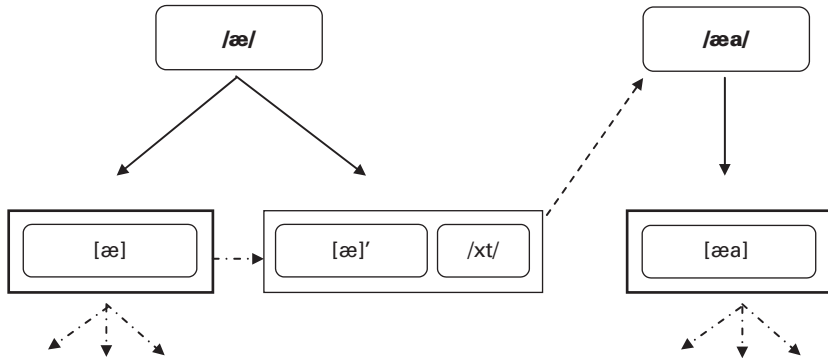
18

In similar fashion, phonetic change implies the phonologization of one of the allophones from that phonological pole. This way, a new phoneme is created, whereas the previously existing phoneme may either disappear (as in the case of unconditioned changes) or simply diminish its relative frequency (in conditioned changes). The following figure represents the results of the breaking of OE /æ/ by the consonant group /xt/ (e.g. OE *eabt* ‘eight’; Lass 1994: 45-48; Díaz Vera 2001: 129-132).

How the phoneme inventory changes its shape

(1) WGmc * /'æxt/

(2) OE *caht* /'æɑxt/

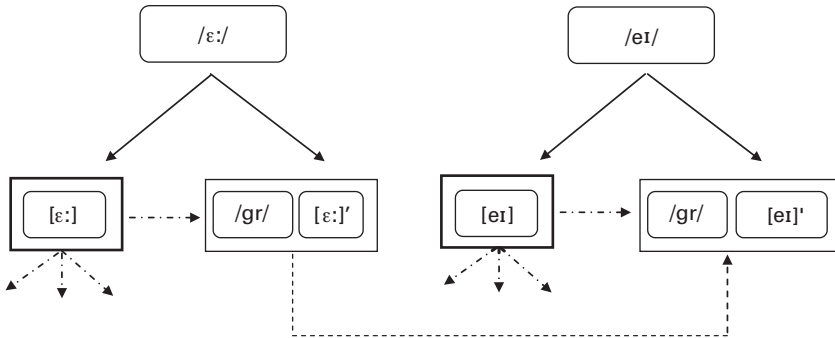


Like semantic change, phonetic change frequently implies a total or partial merging of two previously existing phonetic units, producing a growing degree of homophony within the linguistic system.

A short analysis of the evolution of ME peripheral vowels during the Great Vowel Shift illustrates this principle clearly. The evolution of ME /ɛ:/ into ModE indicates the existence in ME of at least two allophones for this phoneme: the more peripheral vowel [ɛ:] and the less peripheral [ɛ:]', which was found in such words as *break*, *great* and *drain*. The highest degree of prototypicality corresponds to ME [ɛ:], in so far as it is more peripheral than its extension, ME [ɛ:]'. The relationship between preceding obstruent + liquid clusters and degree of peripherality has been analyzed by Labov (1994: 180-182), who argues that front vowels preceded by such clusters tend to lower their F2 coefficient, moving them to a position significantly nearer to the nonperipheral area of the vowel space.

Things being so, the evolution of ME [ɛ:]' in ModE can be described as a change of one allophone from one phonemic network (represented by ME /ɛ:/) to another (represented by ME /ɑ:/):

- (1) ME /^ʔgrɛ:t/ (cf. ME *meat* /^ʔmɛ:t/) (2) ModE /^ʔgreIt/ (cf. ModE *mate* /^ʔmeIt/)



In the light of all this, some major parallels can be observed between phonological and semantic change. These parallels have to do with:

20

- (1) the regular character of both types of change (the possibility of systematically structuring meaning-change along more or less regular paths implying a new view of semantic evolution), and
- (2) the existence of processes of psychological categorization which are apparently common to the two domains.

Sweetser (1990) has observed three basic types of regularity in the history of phonological systems, which have parallels in the history of semantic systems:

1. It is possible to identify directions of change which are recurrent and natural;
2. Units can be observed to change *in parallel*, maintaining the contrast relationships between them, and
3. Completed change affects a unit completely (all instances of the unit are affected).

5. Concluding remarks

In our own analysis, and treating both meaning and sound units as mental categories, we have tried to show how the principles of categorization and generalization motivate similar diachronic patterns both in the semantic and in the phonological domains.

Using the notion of sonority as our main indicator of prototypical effects in phonology, we have included within its radial category the concept of peripherality (a term developed in the sociolinguistic tradition to refer to the location of vocalic

nuclei on the edge or within the vowel envelope). As we have argued, peripherality contributes, together with loudness and openness, to relatively higher sonority. Consequently, within this conception of sound change, changes in the degree of peripherality of a phoneme imply further changes in their relative degree of sonority. This means that in a process of chain shift as the ones described above, whole sets of phonemes become either less prototypical instances (I.1, I.2) or more prototypical instances (II.1, II.2) of the category phoneme in a coordinate manner. Chain shifts are thus seen as changes in the relative degree of prototypicality within a given phonological system of the phonemes involved and, subsequently, in the way speakers categorize the set of sounds that conform their actual inventory of phonemes.

Notes

¹. Nathan (1996: 118) proposes a very partial definition of the term sonority and its components: "...no single characteristic corresponds to pure sonority. Instead, a number of characteristics (loudness, openness of the vocal cavity, sustainability, etc) all contribute to relatively higher sonority".

². A similar approach is presented by sonority theory, according to which the pulses of pulmonic air stream in speech "correspond to peaks in sonority" (Giegerich 1992: 112). Speech sounds can be ranked in terms of their intrinsic sonority according to a

sonority scale, from "more sonorous" (vowels) to "less sonorous" (plosives). See also Gussenhoven (2007) for a detailed analysis of the articulatory effects of voiced and unvoiced consonantal contexts on PDE English vowels.

³. The following abbreviations will be henceforth used: IE: Indo-European; PrGmc: ProtoGermanic; WGmc: West Germanic; OE: Old English; ME: Middle English.

⁴. Where W = word level and P = phonetic level.

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