TWO-LEVEL THEORY OF PHONOLOGY

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1. THEORETICAL DIFFICULTIES IN TREATING DISTINCTIVE FEATURES AS RELATIONAL ACOUSTIC ELEMENTS

In modern phonology distinctive features are treated as relational acoustic elements, i.e. the concept of distinctive feature is related to that of a definite physical substance.

This treatment of the distinctive feature concept is confronted with at least two theoretical difficulties:

1) The first theoretical difficulty is connected with the problem of identity. Let us take an example from Greenlandic.[1] In Greenlandic the vowel phonemes *i* and *æ* are opposed to each other with respect to the distinctive feature of diffuseness and compactness (*i* is a diffuse vowel, while *æ* is a compact one). In the pre-uvular position the vowel phoneme *i* changes into a, and the vowel phoneme *æ* changes into *a*, which can be illustrated by the following table:

In usual positions	In pre-uvular positions
i	a
æ	ɑ

In these oppositions the acoustic porperties clash with the distinctive features. It can be seen that different acoustic properties prove to be identical, and vice versa, the same acoustic properties turn out to be different. Thus, the diffuseness of *i* and the compactness of a prove identical as distinctive features, and the same acoustic properties – compactness in *æ* and compactness in a turn out to be not identical.

If distinctive features are acoustic properties, one may ask how different acoustic properties can be the same as distinctive features? If distinctive features are actually acoustic properties, then identity and non-identity of distinctive features must follow from the physical nature of the acoustic properties, and not contradict their physical nature.

[1] See E. Fischer-Jørgensen, "What can the new techniques of acoustic phonetics contribute to linguistics?", *Proceedings of the VIII International Congress of Linguists*, p. 474.

Thus we see that if distinctive features are considered to be acoustic properties, a contradiction arises between their semiotic, relational nature on the one hand, and their acoustic nature on the other.

This contradiction may be termed the antinomy of the identity of distinctive features.

It must be emphasized that the antinomy of the identity of distinctive features does not follow from the inadequacy of technical methods of investigation, but from inherent theoretical reasons, and therefore phonology must remove this contradiction, if it is to reflect linguistic reality correctly.

2. The second theoretical difficulty is connected with the inherent possibility of transposing acoustic substance into other forms of physical substance – graphic, chromatic, tactile. Any system of distinctive features can be presented not only as acoustic properties, but as graphic, chromatic, tactile symbols as well.

One may ask: if distinctive features are acoustic properties, how can their transposition into other forms of physical substance be possible?

This contradiction between the treatment of distinctive features as acoustic properties and the inherent possibility of their transposition into other forms of physical substance may be termed the antinomy of transposition of distinctive features.

Such are the two fundamental theoretical difficulties. Phonology must eliminate them before the concept of distinctive features can adequately reflect objective reality.

2. THE CONCEPT OF DISTINCTIVE FEATURE IN THE LIGHT OF THE TWO-LEVEL ABSTRACTION THEORY

What is the way out of the above-mentioned theoretical difficulties?

It seems to me that a way out of these difficulties is furnished by the theory of the modern logic of science which may be called the theory of two-level abstraction.

The theory of two-level abstraction distinguishes in any science two principal levels of abstraction: 1) the observation level and 2) the level of constructs. The observation level encompasses such terms as "white", "green", "heavy", "hard", "elastic", "heavier", "harder", "more elastic", i.e. terms denoting observable qualities and relations. The level of constructs includes such terms as "electron", "proton", "gene", i.e. terms denoting unobservable objects of science – these are called constructs. Constructs are related to observation terms through the so-called correspondence rules.[2]

If we proceed from the standpoint of the two-level abstraction theory we must distinguish between two levels of abstraction in phonology: the level of observation and the level of constructs. In connection with distinguishing between two abstraction

[2] See R. Carnap, "The methodological character of theoretical concepts", in H. Feigl and M. Scriven (eds.), *The Foundation of Science and the Concept of Psychology and Psychoanalysis* (= *Minnesota Studies in the Philosophy of Science*, I) (Univ. of Minnesota Press, 1956).

levels, we split the concept "distinctive features" as a relational acoustic property (this being the generally accepted concept in modern phonology) into two concepts: the distinctive feature as a purely relational notion, i.e. construct, denoting an object which cannot be immediately observed, and the acoustic substratum of the distinctive feature, with which we deal at the observation level. The acoustic substratum of the distinctive feature is in relation of, what may be termed embodiment to the distinctive feature. If we denote relation of embodiment by the symbol E, then in the above example with Greenlandic vowel phonemes the relation of embodiment between the acoustic properties and the distinctive feature can be expressed by the following formulae:

For usual positions:

$$E(D, \text{“D”})$$

(Acoustic property of diffuseness is in relation of embodiment to distinctive feature of diffuseness).

$$E(C_1, \text{“C”})$$

(Acoustic property of compactness is in relation of embodiment to distinctive feature of compactness).

For the pre-uvular positons:

$$E(C_1, \text{“D”})$$

(Acoustic property of compactness is in relation of embodiment to distinctive feature of diffuseness).

$$E(C_2, \text{“C”})$$

(Acoustic property of compactness is in relation of embodiment to distinctive feature of compactness).

We must strictly distinguish and never confuse the following three concepts: acoustic property, acoustic substratum of the distinctive feature, and distinctive feature.

An acoustic property is a physical fact, the acoustic substratum of a distinctive feature is a relational physical fact, while distinctive features are purely relational elements, i.e. constructs.

Thus, distinctive features are constructs, and constructs are connected with the observation level, as pointed out above, by means of correspondence rules.

Given below is the correspondence rule for distinctive features. The definition of distinctive feature as a construct may be expressed in terms of symbolic logic as follows:

$$D =_{Df} (x)\ (\exists\ y)\ [A\ (x).A(y).\ O(x.y) \supset R\ (x, D)]$$

where D is the differential element, A, the acoustic property, O, relation of opposition and E, relation of embodiment.

This formula, which is the correspondence rule between the term "distinctive feature" referring to the construct level and the terms of observation level reads: if x is an acoustic property and is in relation of opposition to at least one acoustic property y, then x is in relation of embodiment to the distinctive feature D.

In connection with the necessity of distinguishing strictly between cardinally different concepts – distinctive feature as a construct, substratum of distinctive feature and acoustic property – the term "differentor" may be recommended to denote the distinctive feature as a construct and the term "differentoid" to denote the substratum of the distinctive feature.

The correlation between differentor, differentoid and acoustic property can be represented by the following scheme:

Construct level	Construct	Differentor
Observation level	Relational physical concept	Differentoid
	Purely physical concept	Acoustic property

Thus, we see that though the concept of distinctive feature, as generally accepted in modern phonology, seems simple and indivisible at first sight, it actually splits up into two correlated concepts, those of differentor and differentoid, belonging to cardinally different levels of abstraction.

3. THE PHONEME AS A CONSTRUCT

In the light of what has been said above it is now necessary to consider the concept of phoneme. From the stand-point of analysis of a flow of sounds into its distinctive features the phoneme is defined as a bundle of distinctive features. But if, as we have shown, the distinctive feature concept is split into that of differentor and differentoid, then when dealing with phonemes we must distintinguish between the bundles of differentors and bundles of differentoids. We recommend that the term "phoneme" be used only to denote bundles of differentors. As to bundles of differentoids, they should be termed "phonemoids". Just as the concepts differentor, differentoid and acoustic quality should be strictly distinguished and never confused, so must the concepts phoneme, phonemoid and sound be just as strictly distinguished and never confused. Differentor and phoneme are purely relational concepts, i.e. constructs; differentoid and phonemoid are relational physical concepts; acoustic property and sound are purely physical concepts.

Phonemoid is a sound in relation of embodiment to phoneme. Returning to the above example from Greenlandic, the relations between phonemoids and phonemes may be represented by the following formulae.[3]

For usual positions:

E (i, *i*)

(Sound i is in relation of embodiment to phoneme *i*)

[3] Here we denote sounds by ordinary letters, and phonemes by italicized letters.

E (æ, *æ*)

(Sound æ is in relation of embodiment to phoneme *æ*)

In pre-uvular positions:

E (a, *i*)

(Sound a is in relation of embodiment to phoneme *i*)

E (ɑ, *æ*)

(Sound ɑ is in relation of embodiment to phoneme *æ*).

The correlation between phoneme, phonemoid and sound is graphically depicted by the scheme below:

Construct level	Construct	Phoneme
Obervation level	Relational physical concept	Phonemoid
	Purely physical concept	Sound

We term the above system of theoretical concepts the two-level theory of phonology. According to the two-level theory of phonology, phonemes and differentors are dealt with at the construct level, and phonemoids and differentoids, i.e. sounds and acoustic properties in relation of embodiment to the former, at the observation level.

As was shown above, the starting point for building up the two-level theory of phonology was the necessity of overcoming the fundamental theoretical difficulties confronting the generally accepted approach to the distinctive feature concept in modern phonology. Since the two-level theory of phonology overcomes these theoretical difficulties, we hope that this theory reflects more adequately the phonological reality than the traditional one-level theory of phonology.

It must be emphasised, that while two-level phonology solves the problem of the semiotic nature of distinctive features and phonemes, it does not deal with the problem of the nature of phonological oppositions – whether the latter are treated as only binary, or as polynomial as well. At present the binary theory of distinctive features, according to which phonological oppositions can be binary only,[4] is becoming more and more wide-spread. The problem of binarity and polynomiality of phonological oppositions is solved irrespective of the problem of the semiotic nature of distinctive features and phonemes, and therefore our two-level theory of phonology does not predetermine the choice between the traditional and the binary theories of distinctive features. If we accept just the binary theory of distinctive features, we do so only on the basis of arguments given previously.[5]

[4] See R. Jakobson and M. Halle, *Fundamentals of Language* ('s-Gravenhage, 1956).

[5] See C. K. Шаумян, *История системы дифференциальных элементов в польском языке* (M., 1958), pp. 7–22.