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The Phoneme

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Traditionally, a phoneme is regarded as ***the smallest unit of sound in a language capable of causing a difference of meaning***.

As a ***distinctive sound unit*** at the level of language description (not a realised sound in speech), the ***phoneme*** has had a long life. But although it is generally accepted as the smallest sound unit distinguishing meaning, there has never been agreement on exactly what theoretical implications this function of the phoneme brings with it. Over the decades the phoneme has suffered a strongly fluctuating status as a theoretical unit of language description within the linguistic community. Noam Chomsky and Morris Halle (1965), among others, argued against the existence of a phonemic level of representation. But although many linguists declared the phoneme dead as a theoretical concept after the advent of generative phonology at the end of the 1960's and the subsequent general acceptance of feature matrices for speech-sound representation, it has strongly resisted burial. Its theoretical demise has meant that the many scholarly discussions, and even disputes over its exact nature and theoretical status now have only historical importance. Eli Fischer-Jørgensen (1975) presents many of the theoretical differences separating the linguistic schools in her historical survey of phonological schools, and Stephen Anderson (1985) weaves the fine threads of the often subtly different aspects of linguists' understanding of the "phoneme" into his account of developing phonological theory in the twentieth century. Present-day use of the term still rests on the basic function of the phoneme as a ***distinctive unit constituting the sequential sound structure of words*** and thus differentiating them from one another. However, in some groups it is also used much more loosely than the strict observance of this function might be expected to allow, simply to mean a speech sound without any particular theoretical status. This is particularly common among those working in speech technology. Nonetheless, the phoneme's distinctive function remains the basis of its widespread but by no means uniform use within the extended scientific speech and language community.

Minimal pairs, in which a single sound difference in the same context (in paradigmatic opposition) is responsible for the different meanings of two words (e.g. Spanish "pero" /ˈpɛɾo/ (Engl. *but*) vs. "perro" /ˈpɛro/ (Engl. *dog*)), demonstrate most simply and directly the phonemic status of two sounds. Phonemic symbols are traditionally placed between slashes, e.g., /ɾ/ vs. /r/, a convention which appears to be attributable to George Trager and Bernard Bloch (cf. Pike 1947, p.59, footnote 1). Different sounds which are phonetically similar and do not occur in the same context, i.e., are in ***complementary distribution***, are considered to be variants (***allophones***) of the same phoneme (e.g. the unaspirated and aspirated allophones of the English /p/ phoneme in "spade" [speɪd] and "paid" [pʰeɪd]). As shown in these examples, allophonic transcription is usually placed in square brackets. The ***phoneme inventory***, in terms of the number and types of

distinctive consonants and vowels in a language, and the phoneme ***distribution***, i.e., the way in which they can combine to form syllables, are a fundamental part of the ***phonology*** (the sound system) of any language. By definition, any phoneme can therefore only be associated with one language, and though the same graphic symbols (e.g. /p t k b d ɡ/) may be used to represent the phonemes of different languages, their relative equivalence across languages depends on the way they are realised phonetically, and how they function together with the other phonemes to form syllables and words. Phonetic differences that are only allophonic in one language can be phonemic in another (e.g. the [p] – [p^h] difference, which is allophonic in the above example from English, "spade" – "paid", is phonemic in e.g., Hindi where /pal/ and /p^hal/ are different words (/pal/ "look after", /p^hal/ "knifeblade"). Strictly speaking, due to the overall definition of each phoneme as part of the total sound system for its complete definition, no two phonemes from different languages can be considered completely equivalent, however similar they might appear to be phonetically.

Pre-generative views of the phoneme

The distinctive function of the phoneme is the common foundation from which a number of differing theoretical viewpoints on the phoneme's nature and status emerged. It was generally agreed that audible differences exist between sounds that have to be considered variants of what, *at another level*, must be classed as *the same sound*. One important issue was how this other level should be viewed; how concrete or abstract the phoneme as a descriptive unit should be. The allophonic variants of the phoneme are phonetically more narrowly defined and therefore apparently less abstract than phonemes, whether they are (i) the inevitable articulatory result of realising a phoneme in a particular context (e.g. the nasal release of a plosive in a homorganic plosive + nasal sequence, such as the /t/ in [bɪtn̩] ("bitten") compared to its oral release in a plosive + vowel sequence, [bɪtə] ("bitter")), or (ii) conventionalised positional variants (e.g., the velarized syllable coda [ɬ] ("feel"), vs. the clear prevocalic [l] ("leaf") in southern British English), or (iii) just subject to free choice within the language, e.g., the apical or uvular variants of "R" ([ɾ], [ʀ] or [ʁ]) in e.g., German ("rot" Engl. *red*). But as descriptive sound units they are still "types" rather than concrete "tokens" or ***phones*** produced in a particular instance by a particular speaker.

Although this language-philosophy problem of type vs. token can be seen as fundamental to the differing views of the phoneme, theoretical discussion of the phoneme's nature has not, in general, focussed on that level (cf. Bromberger & Halle 2000 for a discussion of "type" in phonology), though Daniel Jones approaches it in paragraphs 658-660 of *The Phoneme: Its Nature and Use*.

Rather, different and sometimes conflicting views of the different groups or "Schools" (as they are often called) arose out of the more practical matter of their general approach to the study of languages. Thus, under the common principle of distinctiveness, American and European groups developed their ideas in different directions, and within Europe, the Prague School, the so-called British School and the Copenhagen School again developed their own distinct flavour.

In terms of the relative degree of abstractness of the phoneme, it is often said that the American and British standpoints were not too far removed from each other. In both groups there were those who saw the phonetic grounding of the phoneme as important. But whereas many American linguists, with the task of recording, analysing and proposing writing systems for a large number of previously unrecorded (indigenous American) languages, were primarily interested in the definition of reliable and replicable procedures (cf. Pike, K. L. 1947), British phoneticians were working on known languages with existing writing systems and had a strong interest in how to learn to speak them. This difference in orientation and the emphasis on analysis procedures in American linguistics was strengthened by the scientific background of Behaviorism in the USA, which precluded the consideration of anything that was not observable in behavioural patterns. This meant that, strictly speaking, the meaning of an utterance could not be taken into consideration in the procedures developed for analysis. It resulted ultimately in the strict separation of the different levels of formal description; minimal pairs had to be sought in observed utterances of undefined length rather than in predefined word units. It has to be added that, in practice, single words remained the basis of phonemic analysis simply because the routine of eliciting repeatable utterances relied on the naming of everyday objects, parts of the body etc. Also, even Bloomfield uses the term "meaning" (cf. Bloomfield 1933, p. 136, and see the quotation given below), though with a particular, limited meaning of "meaning".

In the words of Daniel Jones (1967, Appendix I) who, despite his debt (which he gratefully acknowledged) to 19th century linguists such as Baudouin de Courtenay (Russian), Henry Sweet (English) and Paul Passy (French), can be quoted as representative of what may be seen as the view of the British School:
The term "phoneme" as used by Baudouin de Courtenay was a phonetic one, and I have never seen any reason to consider it otherwise. A comparison between his work and that of Sweet and Passy showed that this phonetic concept can be viewed in two ways, the "psychological" and the "physical". Viewed "psychologically" the phoneme is a speech-sound pictured in one's mind and "aimed at" in the process of talking. The actual concrete sound (phone) employed in any particular speech-utterance may be the pictured sound or it may be another sound having some affinity to it, its use being conditioned by some feature or features of the phonetic context. (…..) Viewed from the "physical" angle a phoneme is a family of uttered sounds (segmental elements of speech) in a particular language which count for practical purposes as if they were one and the same (paragraphs 12 and 13, p.258).

The American linguist and missionary, Kenneth Pike, on the other hand, wrote, "It is assumed in this volume that phonemes exist as structural entities or relationships; and that our analytical purpose is to find and symbolize them." (Pike, K. L. 1947, p. 57, footnote 1; underlined by Pike). Although he then proceeds to explain the procedures for phonemic analysis with the help of premises which are stated in terms of phonetic observations, the nature of the phoneme is not phonetic.

In one of the most important and arguably the most enduring European linguistic centre of the 20th century, Prague, Nikolai Trubetzkoy (1938) appears to have had a less

physical understanding of the phoneme. Despite the attention he paid to temporal and articulatory aspects of speech sound production, he was more concerned with the functional aspects of the sound system and saw phonemes as "differentiating signs" which can only be defined with reference to their function in the structure of a particular language (Trubetzkoy 1967, 4th edition, pp. 39 and 41), a view that is clearly related to de Saussure. In contrast to both the British and most American approaches, he did not regard the phoneme as an indivisible unit (though it was the smallest segmental element), but as "die Gesamtheit der phonologisch relevanten Eigenschaften eines Lautgebildes" (Engl. *the totality of the phonologically relevant features of a sound* (op. cit. p. 35)).

A more formally rigorous standpoint was that of Louis Hjelmslev and his colleague in the Copenhagen Linguistic Circle, Hans Jørgen Uldall, who pushed the idea of formal systems to its logical conclusion. At the level of general formal description of language systems, abstract phonemic oppositions without defined phonetic properties are possible. Substance presupposes form, but not vice versa. Therefore it is possible to construct a system of linguistic forms without attaching substance to them. While concrete languages naturally require a bilateral substance-form relationship, Hjelmslev's and Uldall's argument for unilateral dependence is that there may be several substances corresponding to the same form (Helmslev 1943).

The geographical separation apparent in the mention of these differing degrees of abstraction associated with the phoneme is not meant to imply that there was a unified point of view within any one national unit, nor even that a particular scholar adhered unswervingly to one view. Trubetzkoy, for example moved from a more psychological orientation, similar to Baudouin de Courtenay's (Trubetzkoy 1929), to his later functional approach, a shift which has been attributed both to his increasing recognition of the social aspects of language and to changing scientific methods (Anderson 1985, p. 94). His view of a phoneme as the sum of the phonologically relevant features may have been in part due to influence from Jakobson.

Within Britain there was strong divergence in theoretical approach even within one university, between Daniel Jones at University College London (UCL) and J. R. Firth, who taught first at UCL and later at the London School of Oriental and African Studies (SOAS), the former focussing on the phonetic structure of the word, while the latter took the sentence as his unit of analysis, examining the differing extension (a single sound or several, a syllable or several syllables) of any particular articulatory property. These were called ***prosodies***, hence the term "prosodic analysis" as the goal of the Firthian school. Consequently, he was loathe to talk of the phoneme at all (Firth 1948, p. 129), not feeling able to accept any of the then current definitions, and regarding phonemic analysis as monosystemic and thus inherently deficient for the study of polysystemically structured language.

In the United States, many different shades of scientific opinion developed, and there was, in consequence, inevitably a lively debate. Leonard Bloomfield (1933) expresses thoughts that are very akin to Trubetzkoy's functionalist view, "Once we have defined the phonemes as the smallest units which make a difference in meaning, we can usually

define each individual phoneme according to the part it plays in the structural pattern of the speech-forms." (*Language*, section 8.7., p. 136). Also, his phonemes are certainly not monolithic units, "Among the gross acoustic features of any utterance, then, certain ones are distinctive, recurring in recognizable and relatively constant shape in successive utterances. These distinctive features occur in lumps or bundles, each one of which we call a phoneme." (op. cit. p. 79). He expresses their abstract nature in terms which seem to be almost as rigorous as Hjelmslev's view, "The phonemes of a language are not sounds but merely features of sound which the speakers have been trained to produce and recognize in the current of actual speech-sound – just as motorists are trained to stop before a red signal, be it an electric signal-light, a lamp, a flag, or what not, although there is no disembodied redness apart from these actual signals." (op. cit. p. 80). William Twaddell (1935) expressed his opinion on the abstract nature of the phoneme even more strongly, describing them as "abstractional fictitious units" which have no real existence, either "physically" or "mentally". Morris Swadesh (1934), on the other hand, regarded phonemes as "percepts to the native speaker of the language" (op. cit. p. 118), a view that he acknowledged as being influenced by his teacher, Edward Sapir. However, he also saw a phoneme as "a speech sound type (…) defined by separate instances of the type." (op. cit. p. 119), which after examination of a number of occurrences, different phonetic instantiations of the type, can be defined in terms of norm and deviation from the norm.

While imbued with a distinctly psychological hue, Swadesh was not as dogmatically psychological in his approach to the phoneme as his teacher. Sapir held great store by the intuitions of his native North American subjects on the sameness or equivalence of sounds which he might have perceived as different, when carrying out his field-work. In production too, he stressed the psychological difference between a blowing gesture to extinguish a candle and an assumed identical gesture for the initial [ʍ] in words such as "what", "when", etc. (Sapir, 1925).

To show the international currents of scholarship and opinion, we note that Sapir's standpoint was seen by Daniel Jones as very similar to the psychological phonetic reality espoused by Baudouin de Courtenay, which he himself had accepted as one aspect of the phoneme. Similarly, there is more than a passing resemblance in Swadesh's definition of sound type as *norm and divergence* to Jones' *family of sounds*.

Non-segmental phonemes

While the idea of the phoneme as a distinctive sound *segment* was and is generally accepted, the use of the term phoneme in relation to distinctiveness at the *suprasegmental* level was restricted to American Structuralism, though it was not accepted by all linguists there (cf. Bolinger 1951). the American approach extended the phonemic analysis to ***stress, tone*** and (sometimes) ***length***. This was in adherence to the principle of the phonemic function as a change of meaning brought about by a single sound difference within a stretch of speech. Although a similar concept lies behind the expressions ***stroneme***, ***toneme*** and ***chroneme*** used by Daniel Jones, these were coined by him because he explicitly objected to the use of the word phoneme to characterize

distinctions above the segmental level, which were dependent on syntagmatic contrasts rather than paradigmatic opposition (Jones 1944, 1950). Despite its phonetically heterogeneous manifestation, *juncture* was also considered a phoneme. Length was subject to much disagreement, being easily attributable to the segmental level as short vs. long or single vs. double vowels or consonants.

Four levels of stress were set up (loud, reduced loud, medium and weak; cf. Trager & Bloch 1941), which were criticised as arbitrary but remained until they were overtaken by the spread of generative grammar. Four relative pitch levels – 1-4 representing either steps from low to high or from high to low – were proposed by Pike (1948) and by Trager & Smith (1951). These could be combined to form intonation contours which were allocated meaning and therefore had morphemic status, confirming the phonemic status of the pitch levels constituting them. If thoughts about phonemic status are pushed aside, the parallels between these ideas and the basic assumptions behind autosegmental accent tones as well as their information-structural interpretations are striking.

Juncture phonemes were differentiated (Trager & Bloch 1941) according to type – ***close juncture*** and ***internal open juncture***, distinguishing between mono- and di-morphematic pairs like *nitrate* and *night-rate*. This allowed segmental phoneme sequences which were identical to be differentiated without recourse to other (higher) levels of linguistic analysis, something the American Structuralist analysis principles forbade. Later Trager & Smith (1951) extended the juncture phoneme inventory, encroaching on what many people would consider to be an intonational phenomenon to sub-divide ***external open juncture*** into three types of phrase-terminal contour phonemes: level, rising and falling. Previously, the external open juncture phoneme had served merely the demarcation of utterances or phrases; with the differentiation, it signalled different types of transition between phrases. It is interesting that these juncture phonemes, perhaps less modified than the tonal levels, have also re-emerged in generative formalisms as grammatical and/or phonological categories: internal juncture as morpheme boundary (+) and external open juncture as phrase boundary (##); the phrase-terminal contour phonemes as boundary tones (– or %).

The phoneme and higher-level structures

The phoneme is, strictly speaking, defined without consideration of higher-level linguistic structures apart from recording differences in its immediate phonetic environment which condition allophonic variants. To define the phoneme it is merely necessary to note that two otherwise identical utterances (in practice usually words, since they constitute the minimal utterance length in a naming task) are different because of the presence of two different sound units. However, the existence of morpheme-dependent sound alternations of otherwise distinctive sound segments were a well established phenomenon and needed to be dealt with in the overall description. Depending on the overriding philosophies of the scientists involved, different solutions were offered.

For the American Structuralists, the definition of the phoneme inventory was important, as was the procedural principle of separating the levels of analysis. Thus, the question of alternations was dealt with as a separate morphophonemic level of analysis, and the phonemes involved in a morphological alternation, such as /k/-/s/ in electric-electricity (/ɪˈlektrɪk/ - / ɪlekˈtrɪsɪti/) constituted a ***morphophoneme*** (e.g. Swadesh 1934, Pike 1947, Hockett 1955). At the level of phonemic analysis, there was no interest in complicating the inventory by the introduction of archiphonemes to cover cases of positional neutralisation, as with German, Dutch or Russian final devoicing. Distributional gaps in the system were accepted. It was fairly late before the relationship between morphemes and phonemes was clarified (Hockett 1961): Morphemes were described as being *composed* of morphophonemes (a one-to-one relationship) which are *represented* by phonemes (a one-to-many relationship); at the same time Morphemes are *represented* by morphs (a one-to-many relationship) which are *composed* of phonemes (a one-to-one relationship). The complex relationship that thus exists between the morphemes and phonemes, namely via morphs on the one hand and morphophonemes on the other, is defined as "programming": Morphemes are programmed into a phoneme sequence.

When on the other hand the system of oppositions is of prime interest, as in Prague phonology or in Glossematics, neutralisation is an important property of a system. The Prague concept of the ***archiphoneme*** covers contextually and structurally determined neutralisation. The opposition involved must be bilateral and consist of a minimal (single feature) contrast. The example most commonly quoted is the neutralisation of voicing where, for example, the /p-b, t-d, k-g/ oppositions no longer operate. *Contextually* determined voicing neutralisation occurs in Russian before obstruents (anticipatory voicing assimilation). *Structurally* determined neutralisation is found for the German /s-z/ opposition, which only operates word-medially; initially, only /z/ occurs in singleton onsets and finally, only /s/ occurs. The archiphoneme may be represented either by one of the symbols in each pair, or by a capital letter (e.g. /P, T, K/ or /S/) to signal the archiphoneme status. Alternatively, as is often the case with vowel neutralisation, a symbol intermediate to the phoneme values (for example /ə/) may be selected.

In Russia, the Moscow School used the term ***hyperphoneme*** (Reformatski 1970, quoted from Fischer-Jørgensen 1975, pp. 333-334) for a concept very similar to the archiphoneme to capture the reduction in the number of vowel oppositions from five in "strong" (stressed) to three in "weak" (unstressed) position. Since only two vowel oppositions (/ɑ-o/ and /e-i/) are neutralised, while /u/ has no opposition partner to neutralise with, the *hyperphonemee* concept cannot be equated exactly with the *archiphoneme*. Previous work by Bernštejn (1962, quoted from Fischer-Jørgensen 1975, p. 336) had also addressed phoneme alternations of the "*first, second and third degree*", covering the phenomena dealt with elsewhere under the topics allophony, neutralisation and morphophonemics. Alternations of the first two degrees were called ***divergences*** (neutralisation also being termed ***substitution***), and morphologically conditioned alternations were called ***transformations***.

Direct Realism's view of the phoneme

In addition to the general theoretical dilution of the *phoneme concept*, due primarily to the reaction in Generative Linguistics to Behaviorism-dominated American structuralism mentioned in the introduction, ultimately allowing its later totally atheoretical adoption by speech technologists, a further appropriation of the term by psychologically oriented linguistic phoneticians has taken place, with a consequent new aspect to its meaning. Within a Gibsonian framework of direct perception, a theory of speech perception and production has been developed (e.g., Fowler 2003) which centres on the *gestural structure* of the phoneme as the basic unit. Links to traditional views of the phoneme are implicit in several aspects of its use in this framework. As a cognitively defined unit it harks back to psychological definitions of the phoneme. This association is strengthened by the fact that production models can generate surface-phonetic realisations that deviate from the underlying "phonemic" structure. On the other hand, the proponents of these models do not understand the underlying units as abstract correspondences of the morphemic structure, nor can they be ascribed the status of the "systematic phonemic" level which some generative phonologists accept. They are clearly defined in terms of their phonetic, more specifically of their gestural properties, and are seen as having a definite (though numerically unspecified) temporal extension. In this respect, they clearly deviate from any previous definition of the phoneme. It is the concreteness of their definition which allows structural changes to take place during production. Due to tempo specification and the allocation of relative strength values to adjacent syllables and their constituent phonemes, ***phoneme overlap*** occurs, and the gestural properties of stronger units change and even suppress those of the weaker units (Browman & Goldstein 1990). The fact that the gestures are considered the *phonological* primes makes the theoretical status of the underlying phoneme string more difficult to link in to previous discussions. In summary, we might say that Direct Realism and Gestural Phonology have made good use of the phoneme, taking a core term which has lost a lot of its theoretical definition during the past three to four decades and defining their own theoretical unit of speech production.

Conclusions

This survey of the phoneme has shown how its definition has varied both synchronically across locations of linguistic research and diachronically, both from stage to stage of any one scientist's development and, more inevitably, from one generation of scientists to another, as views on language structure have changed. Discussions have centred on the degree to which it is psychologically, physically or formally defined and how it is related to other aspects of language description, with all shades of liberal and categorical opinions being voiced. From the late 1960s onwards, feelings became less intense as the focus moved on to feature matrices and phonological rules. The debate subsided as the theoretical need for a central phoneme concept disappeared. But despite

being discarded, the phoneme as a basic distinctive sound unit remains as a background concept. This position allowed it to continue its contribution to work in speech and language without having to suffer criticism of its theoretical incoherence. It could be redefined as those who found it useful wished.

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