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### **An Acoustic Study of the Phoneme as a Physical Reality: Aspects of Segmental Phonology in View**

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#### **Abstract**

*The phoneme is undoubtedly a crucial and indispensable aspect of the study of phonetics and phonology. Giegerich (31) defines the phoneme as a minimal contrastive sound unit of a language. They are contrastive units because they distinguish words. Jowitt (2005) further affirms this by adding that segments or phonemes are vowels and consonants, of which syllables are composed. In spite of this, the phoneme has over the years, to speakers and learners of English Language appeared to be only a theory or letter representation of phonetic notations. This research examines the above notion and corrects it by analysing some vital aspects of segmental phonology as evidence to the fact that the phoneme is and can be realised*

*physically. Using the systemic functional approach and specifications, the study intends to categorically analyse and further reveal how minimal pairs, free variation, suspicious pairs and segments go a long way in establishing the phoneme as a physically concrete and not an abstract reality. It is pertinent to note however, that the paper limits itself to those central aspects of segmental phonology. It also, lends credence to research works on the phoneme as a mental or psychological reality but for the sake of this study, the researcher is primarily concerned with the phoneme as a physical reality.*

### **Introduction**

For an effective study of the phoneme as a physical reality, it is pertinent to note as has been highlighted, what the phoneme is and how it can be recognised as a physical reality, not just as a mental or psychological reality.

The definitions of the phoneme which have been proposed fall into two general groups: definitions in terms of a mental reality and definitions in terms of a physical reality. One type assumes that the phoneme is a physical reality while the other looks at it as a psychological reality but Giegerich (89) says the phoneme cannot be broken up into shorter successive units. It is also the smallest segmental unit of sound employed to form meaningful contrasts between utterances. It is the smallest unit of sound that differentiates it from another. The phoneme can also be said to be an abstraction meant to account for the smallest functional unit of the phonological system of a language. Twaddell asserts this by arguing that the phoneme could not reliably be said to have either psychological or physical reality and so could only be an abstractional fictitious unit. Simply put, it is the minimal linguistic sound unit in a language which cannot be another exactly but can be permanently similar. Thus, in any given language, we can identify a small number of regularly used sounds called phonemes and it must be put to cognizance that phonemes are sounds and not letters. Acoustically, what we call the same sound might be different and etymologically, no two different sounds are exactly the same but can be permanently similar as stated earlier.

There are a variety of opinions on what the phoneme actually is. The empiricist notion is that, it is a collection of sounds (a fictitious unit), the mentalist notion as propounded by Chomsky say it is a mental category that corresponds to a coherent set of sounds in a language. American Structuralist tradition asserts that it can only be defined according to its allophones and

environment while the generative tradition says it is a set of distinctive features. Being that the theoretical status of the phoneme has ever since been in doubt, it must be noted that whatever difficulties are encountered in the identification of phonemes must be mere impediments testing our analytical ingenuity; they do not disconfirm the phoneme as a theoretical construct.

Regarding the exact number of phonemes in English language, Adam Brown in Abercromble (1991 b) say... “One cannot give a global figure for the number of phonemes in English...” He attributes this to three factors namely; historical change, sociological variation and differences in analysis. Giegerich adds that...

On the level of precise phonetic description, the number of different sounds of English is practically infinite. Speech sounds will always differ in context since no two speakers pronounce the same word in exactly the same way. How can we then realistically hope to establish a manageable inventory of English sounds? (30)

Not to dwell much on the number of phonemes, the fact as is proven in this research is that the phoneme is not just theoretical or abstract but a physical reality. He further asserts that the phoneme was not originally established as a theoretical construct.

### **What then is physical reality?**

When describing the sounds of a language, it is imperative that it is done independent of any particular speaker of that language. In describing for instance the word *who*, we say among others that it has a degree of lip rounding. To be more precise, we may try to state the degree of the feature round that occurs in the production of the sound. But there would be no point trying to state the degree of this feature in terms of say, a measurement of the number of millimeters between the lips of a particular speaker and another. As such, physical reality can be understood as the existence of phonemes as can be perceived through experience. In other words, it is how the pronunciation of sounds is brought into concreteness, experimented and described to listeners of the language by its technical terms.

In essence, the phonetic characteristics of a sound cannot only be determined by measuring the absolute values of the physical phenomena involved or by

mentally/psychologically ascertaining it, but must be a practical visible perception of sounds not just the thought of it.

### **The Phoneme as a physical reality**

A question that is often asked is, what sort of entity is the phoneme? As earlier stated, the definition of the phoneme largely falls under two categories, as a mental or psychological reality and as a physical reality. The following scholars according to Giegerich have this to say... Twaddell opines that the phoneme is a physical reality... "count for practical purposes as if they were one and the same". Jones (1967) says it is a mental notion, a mental or psychological reality as it is a constant acoustic auditory image. Sommerfelt says "it is a thought sound" while Beni says "it is some sort of a mental representation". Generally, as opined by Giegerich, the phoneme cannot be acoustically defined as it is a feature of language structure.

Having stated what phonemes are and what is meant by the term 'physical reality', it is most appropriate to state that the phoneme can be physically realised. In as much as phonemes are not letters but sounds, they can to an extent be visualised not only mentally or psychologically realised. Since phonemes are represented by the phonetic alphabets, they can to this extent be perceived and as such physically realised.

The notion of the phoneme as a phonetic or physical reality sees the phoneme as representing primarily a concrete segmental reality. It looks at the phoneme at the level of segments. In other words, it is essentially concerned with the study of phonemes in their distinctive and separate entities rather than in organised speech (supra segmental phonology) The phoneme is here affirmed to be the sound unit that can be ordinarily perceived and tried by experience to have an existence not merely in appearance, thought or language. This is to say, phonemes can be analysed in a distinctive environment not in relation to how they overlap in rapid speech.

The study of the phoneme as a phonetic or physical reality brings to focus the examination of the notion of minimal pairs, complementary distribution, free variation and suspicious pairs. By this, the phoneme as a physical reality can be examined in five key areas of segmental phonology thus:

- The segment
- Minimal pairs
- Complementary distribution

- Free variation
- Suspicious pairs

### **Segment**

A segment is an individual phoneme with its distinctive features which describes each individual phoneme in terms of its articulatory, acoustic and auditory criteria such as place of articulation and manner of articulation or voiced and voicelessness of sounds. This can be brought to reality by the demonstration of words like *Bad* and *Bat*. From the example, the /d/ in the first word is a voiced alveolar plosive while in the second, the /t/ sound is a voiceless alveolar plosive. The distinctive feature here is thus, the voiced or voicelessness of the two.

Also, in the words ‘though’ and ‘vast’, the sound /ð/ as found in ‘though’ is a voiced dental fricative while /v/ in vast is also a labiodental fricative. The difference or distinctive feature is thus the place and manner of articulation and not in the voiced or voicelessness of the sound. David Eka (34) states that, “segment involves a well thought out reduction of the almost infinite distinctions noticeable within the basic sounds of English and then, a reordering of such distinctions into a small viable number for descriptive purposes”. It has been defined that a segment, is any discrete unit that can be identified either physically or auditorily in the stream of speech. Giegerich(209) says the segment is “a somewhat abstract, idealised representation of the facts: in the reality of the speech continuum, the constant changes in the articulator settings are not so well co-ordinated as to happen in discrete steps”.

For further understanding of the segment as consisting of individual phonemes with their distinctive features for descriptive purposes, we can consider the simple classification dimension below:

	Pb	td	fv	sz
Voice	-t	-t	-t	-t
Stop	tt	tt	--	--
Alveolar	--	tt	--	tt

This approach i.e. (distinctive features approach) to phonological analysis enables us to compare the features of sounds even at a cursory glance. We are able to observe the sounds in terms of their feature differences and

similarities. Indeed in classical pragan phonology, the relevant distinctive properties such as exemplified above are regarded simply as classificational dimensions, which permit an arrangement of phonemes into a system. Daniel Jones opines that, the main object of grouping the sounds of a language into phonemes is to establish a simple and adequate way of writing the language.

With this simple test of segmentation, it cannot be overemphasised that the phoneme does not exist only in abstraction but can be physically and practically realised.

### Minimal pairs

When a sound difference gives rise to a meaning difference in at least one word, it is termed a minimal pair and it is phonemic in that language. The phoneme of a language can be identified by setting up a series of contrasting pairs of words and showing that by altering the sound at any position, i.e. initial, middle or final positions, the meaning is altered. Such pairs are technically called minimal pairs.

The minimal pair test is a key principle of phoneme analysis. The study of minimal pairs is relevant to Phonologists in many ways. Among other reasons, minimal pairs are studied to further emphasise the relevance or importance of the phoneme to a language. Hence A.C Gimson (64) describes the phoneme as 'the smallest contrastive linguistic unit which may bring about a change of meaning'.

Furthermore, minimal pairs reveal the distinctive features of a language and can occur in any position. A minimal pair proves the ability of two sounds to occur in identical contexts, as /b/ & /h/ in bat and hat. They constitute proof of the phonemic status of segments e.g.

-Initial	Final	Middle
- <u>D</u> ear/ <u>g</u> ear	- <u>d</u> ig/ <u>f</u> ig	- <u>s</u> hip/ <u>s</u> it
- <u>p</u> ie/ <u>t</u> ie	- <u>l</u> eak/ <u>m</u> eek	- <u>m</u> eat/ <u>s</u> eat
- <u>T</u> ame/ <u>g</u> ame	- <u>s</u> tuff/ <u>e</u> nough	- <u>q</u> uest/ <u>g</u> uest

In view of the above, the knowledge of minimal pairs have further established the fact that the phoneme identifies minimal pairs and as such, can be said to be a physical reality as seen in the examples above.

### **Complementary Distribution**

The term complementary distribution is a technical term. Two or more elements are said to be in complementary distribution when each occurs in a fixed set of contexts in which none of the other occurs. Complementary distribution refers to the mutual exclusiveness of a pair of sounds in a certain phonetic environment. This has to do with the different positions that the phoneme is capable of occupying within the structure of a word or utterance. The quality of the phoneme changes as a result of the position it occupies. That is, the phoneme remains the same but the realisation is different due to the position it occupies.

For instance, the English phoneme /k/ has three variants which are in complementary distribution in these three words: *key* /ki:/, *cure* /kʊə/, and *car* /kɑ:/. This velar stop thus has three different points of colour conditioned by the vowels in the three words.

'k' is fronted in *key*, centralised in *cure* and retracted in *car*. This is because *key* has a front vowel, *cure*, a central vowel and *car* a back vowel. So, the fronted, central and retracted variants are allophones or variants of the phoneme /k/. Also, in the words *cat*, *kate* and *kite*, the /k/ adjusts itself to the vowel in its new environment. In *cat*, /k/ adjusts itself towards /a/, in *kate*, it adjusts itself towards the glide /ei/ and in *kite*, /k/ adjusts itself from /a/ to /i/. David Eka (19) affirms this when he says.... "phonemes in complementary distribution are those which cannot be replaced by other phonemes without bringing about a change in the meaning of the words concerned".... "items in complementary distribution have no contexts in common; they operate in mutually exclusive environment".

There are other phonemes that can also occur in complementary distribution e.g. the glottal fricative /h/ and the voiced velar nasal /j/ cannot occur in the same environment, they are realised in strict separation of places. With this, the phoneme has been further established as a separate entity that is physically realisable. Note that speech sounds may be in complementary distribution if their distribution is governed by an optional rule. /ŋ/ and /h/ are examples of sounds in complementary distribution.

### **Free Variation**

Free variation is the ability of one sound to be a substitute for another within a word without it affecting meaning. A substitution of one for the other does

not produce a different word but merely a different pronunciation of the same word. Example, the difference between the two pronunciation of economics /i/ and /e/ as in /i:kɔn'ʌmiks/ and /e:kɔn'ʌmiks

The word *economics* is sometimes pronounced from a vowel found in the word bet and sometimes the sound pronounced in the word eat. The word 'either' is sometimes pronounced with the vowel in the word bit and other times, it uses the vowel in the word iron. The fact that the difference of the vowel serves to distinguish at least some words in English means that it is always recognised as a 'phoneme'. Eka, emphasizes that the choice of a sound does not involve allophonic variation, the phonemes in free variation must be legitimate ones. Giegerich is of the view that, the notion of free variation is only valid when the range of possible variables that may determine allophony is restricted to purely phonological ones. It is by no means certain whether 'absolutely free variation' exist in phonology but some degree of free variation is identifiable.

Some other examples are: The voiceless alveolar fricative /s/ and the voiceless palato alveolar fricative /S/ in the word *issue* /isu:/ and /iSu:/. These are considered as free variants. There are times when we have different spelling forms realising the same phonemic sound as:

/f/ - Far, Elephant, Rough

/k/ - Cat, Kite

/dz/ - Judge George

/I:/ - eats, these, knee

/a:/ - arm, father, car

### Sounds in free variation

<b>Word</b>	<b>Free Variation</b>
Semester	I, /si:mestɔ/ II, /se'mestɔ/
Enemy	I, /'enimi/ II, /'enɔmi/
Effusive	I, /I'fju:siv/



## II, /ɔ̃fjusiv/

The difference in accent has been identified as one of the reasons in these phonemic variations. This is due to the social status of factors in the environment.

Having understood free variation as the ability of a sound to be substituted for another without affecting the meaning, we can further establish that the phoneme can be realised physically.

### **Suspicious pairs**

As we have observed above, only those sounds which show considerable phonetic similarity can be grouped together as allophones of the same phoneme. A practicing Phonologist can normally, safely assume that sounds like /n/, /l/ and /p/ which show no phonetic resemblance are distinct phonemes. As a rule, methods for determining whether or not sounds belong to the same phoneme are only employed where suspicious pairs have been identified. That is to say, pairs of words containing sounds which only differ slightly and possibly be members of the same phoneme. The knowledge of suspicious pairs can be used to emphasize that individual phonemes are capable of being realised physically not until they occur suprasegmentally.

Following the allophonic variations in complementary distribution, free variation and suspicious pairs, allophonic variation explains why sounds of the same phoneme could be differently realised due to the environment in which they may find themselves. For instance, in the word ‘tact’, the two /t/s are differently realised as the first is aspirated while the last is inspirited, as in t(h)act.

### **Phonetic notations in furtherance of the phoneme as a physical reality**

Phonetics like many scientific subjects such as mathematics, physics, chemistry etc. makes use of special notations. While for example, simple notations symbolise elements in chemistry, phonetic notations represent sounds of speech; they are used to represent pictorially on paper what is said and heard. C.F Hocket (1958) as cited in Abercromble (1991b) likens phonetic notations to the special notations in chemistry and illustrates it with this structural formula for methane where each symbol represents only a component atom. Thus, H represents hydrogen, carbon and the dash (-) a relational bond of the components

H  
I  
H - C - H  
I  
H

Just as these symbols bear no semblance to what they represent, phonetic symbols do not have the appearance of sounds which in any case does not exist. We cannot see sounds, just as we cannot see the form of hydrogen and carbon which I and C represent respectively. A symbol then represents or stands for something else. It is not a reproduction of the thing symbol as an arbitrary designation has an inherent relation between it and the sound it represents.

Despite the fact that the alphabetic principle which underlies the spelling system of English, states that the letters in the spelling should represent the sounds (phonemes) of the pronunciation, it is not the case with English. Although some languages like Finnish and Malay are close to having a one-to-one correspondence, some others including English have many-to-one and one-to-many according to Abercromble. Nevertheless, that is the underlying principle.

### Conclusion

From this research work, we can say that the study has to a justifiable extent, dealt with the subject in question. The parametric features of minimal pairs, complementary distribution, free distribution and suspicious pairs have been used to establish that the phoneme is a physical reality not just a mere thought or theory.

Conclusively, it is worthy of note that the phoneme as a physical reality has its limitations in this research. One of which is that it has been restricted to the segmental aspect of phonology only and not considering the supra segmental aspect of it.

From this presentation of the phoneme as a physical reality, it is ideal that one think of the phoneme not as “the sounds that letters make” but the sounds of speech that can be represented by letters.

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