The Status of the Concept of 'Phoneme'
in Psycholinguistics

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Abstract   The notion of the phoneme counts as a break-through of modern theoretical linguistics in the early twentieth century. It paved the way for descriptions of distinctive features at different levels in linguistics. Although it has since then had a turbulent existence across altering theoretical positions, it remains a powerful concept of a fundamental unit in spoken language. At the same time, its conceptual status remains highly unclear. The present article aims to clarify the status of the concept of 'phoneme' in psycholinguistics, based on the scientific concepts of description, understanding and explanation. Theoretical linguistics has provided mainly descriptions. The ideas underlying this article are, first, that these descriptions may not be directly relevant to psycholinguistics and, second, that psycholinguistics in this sense is not a sub-discipline of theoretical linguistics. Rather, these two disciplines operate with different sets of features and with different orientations when it comes to the scientific concepts of description, understanding and explanation.

Keywords   linguistic sign · arbitrariness · connectionism · functional linguistics

Introduction

The ambitious aim of this article is to clarify the conceptual status of the concept of 'phoneme' in psycholinguistics. In this context, several claims are made and argued for. First, we claim that identifying the conceptual status of the phoneme is an enterprise of demarcation relative to the scientific concepts of explanation, understanding and description. Second, we claim that there is confusion concerning the linguistic sign with regard to these three concepts. Third, we claim that these two claims are strongly related, and that they must both be investigated in order to clarify the conceptual status of the phoneme. The notion of the phoneme

originates from the linguistic tradition focusing on description, whereas psycholinguistics has a stronger focus on explanation. In the present article, developmental arguments are brought into play to shed light on the key issue of explanation.

We consider the concept of *understanding* to be primarily about the immediate experience of a phenomenon, involving empathy. Understanding is not static, but may deepen according to the principle of the hermeneutic circle and may interact with the concepts of explanation and description. The concept of *description* is primarily about the relationship between language and the reality referred to by means of language. For this reason, we can talk of the hypothetical status of descriptions. The description is not objective, owing to a lack of precision in the language and to restrictions in our perceptual abilities. Finally, the domain of *explanation* is reserved for causal relationships. The present article is an attempt to elaborate a procedure for distinguishing between explanation, description and understanding as regards the phoneme.

In the following, we first describe and analyse aspects of the phoneme as it is conceived of in the recent history of linguistics, and then go on to question established ideas about the linguistic sign which are used in linguistic explanations. Next, we discuss the concept of the phoneme from the perspective of the concepts of description and explanation. And finally, it is described how the phoneme should be related to the domain of description, and why greater value should be placed on non-segmental descriptions in psycholinguistics.

The Phoneme: A Controversial Notion

The Blurred Notion of 'Phonology'

> We object to the abandonment of the notion of the phoneme: even though the distinctive features are primordial, the phoneme has its place in language structure. (Jakobson et al. 2002, p. 3)

The Jakobsonian position quoted above is interesting in at least two respects. First, it claims the relevance of the notion of the phoneme at a time when major branches of phonological theory are moving away from it; and second, it uses the term 'language structure' instead of 'phonology', the reason being the blurring of the latter notion: 'And we avoid the words of "phonology" and "phonological"—terms which Jakobson himself had helped to launch decades earlier with Trubetzkoy—because we felt that their meaning had become too blurred.' (Jakobson et al. 2002, p. 4).

While the Jakobsonian position remains structuralist, these two respects pinpoint two pertinent problems concerning branches of contemporary research on speech, writing and dyslexia: (1) the status of the concept of 'phoneme'; and (2) the flawed conception of 'phonology' in behavioural studies. These two problems are closely connected, but this article will focus on the first one; the second problem is dealt with at length in Uppstad and Tønnessen (2007).

Instead of stating that the phoneme has its place in language structure, one should ask: Where does it have its place? Even though the notion of 'phoneme' has had a turbulent existence in linguistics over the past century, it is still a widespread conceptualization of sound structure in interdisciplinary research fields involving speech and writing, as well as in the pedagogical domain of written language. Instead of judging whether the phoneme exists or not as such, we should ask about the purpose of a given description and then question its relevance to the application of the description in a given behavioural domain. A description should be evaluated primarily with respect to the purpose it serves, and not as an ontological entity.

The Concept of 'Phoneme' in Linguistic Theory

In structuralism, the concept of 'phoneme' and the notion of 'distinctive features' came to constitute the foundation for structuralist description of language in general. It is, no doubt, a very powerful conception of sound structure, even though Jakobson et al. (1952) presented a model of acoustic features which was a less abstract conception of sound structure than traditional, phoneme-based structuralist theory. In generative phonology, however, the phoneme has been degraded to a bundle of highly abstract features (Chomsky and Halle 1968), which involves less focus on the phonemes as units in favour of their constituent features. The development of auto-segmental-metric theory can be said to have fulfilled the degradation or discarding of the phoneme. Chronologically, these changes at the level of theories have moved towards a discarding of the phoneme, towards a non-segmental phonology. Nevertheless, the different positions referred to here are all highly present in contemporary discourse.

What we find strange is that in discussions of the linguistic sign, the phoneme always crops up, and the other conceptions of sound structure are omitted. It is a well-known fact that the notion of 'phoneme' is strongly associated with the structuralist understanding of the arbitrary linguistic sign. Given the new assumptions regarding sound structure, should we perhaps reflect more on the notion of the linguistic sign when discussing the conceptual locus of the phoneme?

The Linguistic Sign: Aspects of Autonomous Linguistics in Functional Grammar

The term 'autonomous linguistics' (Derwing 1973; Newmeyer 1986) implies a conception of language structures as abstract and autonomous. A large part of twentieth century linguistics, including psycholinguistics, adheres to this view of language structure. However, most functional approaches to language deny autonomous linguistics, by claiming that structure is a product of cognition and communication. In the field of functional grammar, the inseparable relationship between expression and meaning is used as the main argument. Still, when it comes to the sign, to the lexicon, we may ask whether aspects of autonomous linguistics are not actually maintained in functional approaches to language. For instance, in his functional grammar, Givón states: 'The peripheral sensory-motor codes of human language are the domain of phonetics, phonology and neurology' (Givón 2001, p. 11). He also holds on to the Aristotelian doctrine of arbitrariness for the linguistic sign but, like most functionalists, he rejects the arbitrariness position for grammar: 'It is true, of course, that Aristotle's doctrine of the arbitrariness of the linguistic sign—thus the arbitrariness of cross-language diversity—referred only to the coding of concepts ("words") by sounds and letters. But latter-day structuralists unreflectively extended the arbitrariness doctrine to grammar.' (Givón 2001, p. 4). Most functionalists concern themselves with grammar, especially syntax; and cognitive linguists deal in particular with the lexico-semantic level. Therefore, functionalists seem to be occupied with issues of 'iconicity' or 'the inseparability of form and function' for these parts of grammar, but not for the linguistic sign. In other words, for functionalists claiming the ability not only to describe but also to explain change, it remains a question how the linguistic sign has come about:

> Just as autonomous linguistics distinguishes between a speaker's purely linguistic knowledge, determined by the language faculty, and his non-linguistic knowledge, derived from pragmatic competence and the conceptual system, so autonomous phonology splits off the act of speech as an articulatory, acoustic, and perceptual event from

the abstract linguistic system which is claimed to underlie the physical data. (Taylor 1991, p. 28)

In structuralism and generativism, this autonomy is maintained by the strict divisions of langue–parole and competence–performance, respectively. This can also be seen in Saussure's position, even though his focus is on the relationship between expression and meaning as similar to that between the two sides of a sheet of paper: '[le son] n'est pour [la langue] qu'une chose secondaire, une matière qu'elle met en œuvre' (Saussure et al. 1969, p. 164).

It is hard to see how functional grammar can justify its claim that grammar and the acquisition of grammar are qualitatively different from the lexicon and the acquisition of lexicon with regard to arbitrariness. If language structure is the product of communication and cognition, why are the issues of phonology and the linguistic sign treated differently?

The Phoneme in Functional Linguistics

In functional linguistics, the idea of the prototype is applied to the phoneme. Unlike in the structuralist approach, the basic principle of description here does not come from phonology. Rather, the principle of prototypes first gained success in semantics and has then spread to other parts of linguistic description (Taylor 1991). That is probably why semantics and syntax have attracted the most attention in functional grammar. According to the principle of prototypes, category membership is a matter of varying distance from a prototype, with no clear boundaries between categories. The idea of prototypes stands in contradiction to the generative claim of either 'marked' or 'unmarked' features (binary values) as well as to the 'necessary' and 'sufficient' conditions of structuralist and generative theory. Interestingly, as mentioned above, in structuralism—and in generative theory—, description by means of the principle of necessary and sufficient conditions first achieved success in phonology and was only later applied to other parts of linguistic description. This gave phonology a fundamental position, and this is probably one reason why the conception of necessary and sufficient conditions for category membership has been so dominating in phonology. From the new perspective of functional linguistics, however, features are no longer binary—instead, category membership is a matter of degree. This shift of perspective represents a threat to structuralist and generative theory because it does not meet those theories' need for logical coherence; what we have instead is a fuzzier logic (Flanagan 1991; Tønnessen 1995). What is more, this kind of logic is probably better suited to behavioural studies in that the phoneme as defined by the idea of prototypes probably has greater explanatory power for behavioural studies than the phoneme as defined by necessary and sufficient conditions. While the derivations made in phonology certainly become more fuzzy and complex, the explanatory power is strongly increased.

Another interesting aspect of the notion of 'phoneme' in functional linguistics is the very fact that the cradle of functionalist theory is semantics, not phonology. Because of the semantic focus, the phonemic properties of sound may be hypothesized and explored, and not remain deadlocked in their role as foundation of the theory. In our view, this is a decent starting-point in searching for the status of the concept of the phoneme in language structure. As this starting-point has open ends, it meets the standards of good scientific method and may yield new assumptions about structure.

With all these different conceptions of the phoneme in mind, we should now ask ourselves whether we deal with explanation in any case. We do not think so. What we are dealing with is first and foremost matters of description, even though some conceptions of the phoneme are more relevant to the domain of explanation.

In the next section, we wish to investigate the notion of the arbitrary linguistic sign, keeping the differentiation of the concepts of description, explanation and understanding in mind. The question to be answered is: With this conception of the linguistic sign, do we ever enter the domain of explanation, or have we simply adopted aspects of description and dressed them up as causal relationships? As we see it, we cannot discuss the phoneme without also discussing the linguistic sign. Maybe there has been too much talk of units, and to little talk of the linguistic sign? And finally, in all this reasoning about the phoneme, we must ask: Are we dealing with matters of explanation or description?

On Defining 'Language' in Psycholinguistics

The discipline of psycholinguistics arose from the discipline of linguistics, and the purpose was to separate the study of psychological aspects of language from the study of language structure. This is, in our view, an unfortunate separation of what is psychological and not, and it contains the implication that these different aspects can be studied in their own right. We believe that this distinction is artificial and that there should be a definition of 'language' which goes beyond this artificial distinction. In the following, we will define 'language' as '*a set of codes with potential for meaning*'. In doing so, we are not confined by a representational view of language. Instead, we define language by performance—as a set of codes with potential for meaning. As regards the term 'potential', it should be underscored that this does not mean that performance lacks meaning, nor that performance has a defined, original meaning, and nor that there is a final, ideal meaning to be reached. Instead, it is underscored that meaning is dynamic and indeterminate, and is realized in overt language behaviour (see Rommetveit 1974). On this view, which is close to Quine's position, there is no isolated semantic representation which is associated with a phonological representation at a certain point in the language development of children and adolescents, but rather a progression of association from the time of birth, building performance as potential for meaning. And this development results in what we may traditionally identify as words, denoting common meanings. In accordance with this conception of language, we will talk of 'traces of meaning' in order to underscore that meaning is realized in multiple ways at every point in development.

The Linguistic Sign in Psycholinguistics

The Arbitrary Linguistic Sign Serves the Domains of Description and Understanding

According to Saussure, the phoneme is defined as a system of sound units that emerges on the grounds of lexical contrasts: minimal pairs. This position is problematic because it does not include an explanation of how contrasts came about in the history of a particular language or how contrasts emerge in ontogeny. According to Saussure's view, the lexical level is required for the acquisition of a sound structure. This is unfortunate, and the fallacy of this reasoning is made clear by the early Jakobson's claim that the young child's babbling is irrelevant to its phonological development (Jakobson 1941). This is exactly where the problem arises: how can one talk of phonemes as lexical contrasts and still consider the babbling as relevant? Owing to the dominance of structuralist and generative theory (and cognitive psychology) over the past decades, this problem has not been clearly stated, which is a consequence of these theories' incapability to explain development and change in psycholinguistics. It is often claimed that language is symbolic and that the vocabulary spurt in children is a result

of symbolic processing (Clark 1993). This is probably true, but probably also far from being the whole truth.

The rest of the truth may lie in the problem that can be identified in the relationship between lexical (or symbolic) and sub-lexical (or sub-symbolic) processes. If phonological structure and the linguistic sign are defined solely at a lexical (symbolic) level, we may ask what has happened to phonological structure and the linguistic sign prior to this point in development. As is claimed by Plunkett et al. '[t]here remains the fundamental problem of providing an account of the "hook-up" between symbolic and sub-symbolic processes.' (Plunkett et al. 1992, p. 294). They point out two different perspectives on this problem. The first one is called 'the symbol-grounding problem' and is formulated as 'How do syntactically governed and semantically systematic symbol tokens receive a referential-semantic interpretation in relation to sensory and perceptual information?'. The second, called 'the symbol-emergence problem', is formulated as 'How do syntactically governed and semantically systematic symbol types get into the cognitive system?' (Plunkett et al. 1992, p. 294). The symbol-grounding problem focuses on the symbolic, lexical level and seeks to ground this level in the sub-lexical level. The symbol-emergence problem turns the issue upside down and focuses on development towards the lexical, symbolic level. Plunkett et al. further claim that from the perspective of the symbol-emergence problem, there exists no symbol-grounding problem, because it is solved as a by-product of the former problem. According to them, there is a good reason why the symbol-emergence problem has gained little attention: 'More generally, the absence of discussion of the Symbol Emergence Problem is symptomatic of the widespread tendency in the cognitive sciences to treat functional and developmental issues as theoretically separate and methodologically separable.' (Plunkett et al. 1992, p. 294). In their approach, they claim to present a framework combining both developmental and functional issues. Interestingly, they relate the separation of these developmental and functional issues to imaginations of a 'language of thought', ideas originating back to St Augustine where language is merely a nomenclature of already-existing concepts (Gumperz and Levinson 1996). These are persistent ideas in linguistics and psychology over the past century, and they turn up even in theoretical frameworks where they are theoretically rejected, for instance in functional linguistics. In our view, the separation of developmental and functional issues concerning the linguistic sign represents a major challenge to functional linguistics, especially with regard to phonology. When focusing on the linguistic sign, we should ask: Does our level of description serve our particular object of study, or has our description become normative?

The strict division between a symbolic level and a sub-symbolic level must be regarded as artificial, even though proponents of the symbol-grounding problem claim that it is natural. The strict division into a lexical and a sub-lexical level leaves the way open for theories and models based on representations. Child-language research has traditionally valued vocabulary, in the way it can be identified by adults:

> [...] decontextualization is itself a process with a relative rather than an absolute end-point and the extent to which the meanings of individual lexical items can be characterized as context independent is itself a function of the communicative context. (Plunkett et al. 1992, p. 297)

Instead, Plunkett et al. suggest that the development leading up to the vocabulary spurt is continuous, with the mechanism being qualitatively the same before and after the spurt: 'As an increasing number of words become decontextualized in the child's vocabulary, new means of representation emerge' (Plunkett et al. 1992, p. 297).

Explanation Requires the Non-Arbitrariness of the Linguistic Sign

Saussure defines the linguistic sign as the association of a form (or signifier) with a meaning (or signified) (Saussure et al. 1969). In this relationship, Saussure chooses not to focus on the association itself, but instead on philosophical points which are indeed important and which made structuralist theory a major factor in linguistics over a whole century. Still, we ask whether some important points have been lost through the maintenance of the accepted truth of 'le signe linguistique est arbitraire' (Saussure et al. 1969). According to Saussure, the linguistic sign is arbitrary in two important ways. First, the association of a particular form with a particular meaning is arbitrary (Taylor 1991). This is easily shown when a common meaning is mapped onto different expressions in different languages. Second, the meaning itself is arbitrary, because there is no obvious reason why the meanings given names in various languages—and no other meanings—should have names; language is not simply a nomenclature for already-existing concepts. The first point may today be considered as quite obvious, and the second may be considered as not absolute with regard to claims made in cognitive linguistics (Lakoff and Johnson 1999).

Concerning the notion of the phoneme in functional linguistics, we claim that holding on to the arbitrariness doctrine on the grounds of these philosophical arguments is a side-track. The realization that the concept of 'horse' is expressed by 'cheval' in French and by 'Pferd' in German is irrelevant to the question of how symbols enter the cognitive system of the young child. As we have claimed, Saussure makes a choice of focus concerning the linguistic sign, and the other obvious choice he could have made was to focus on the convention, on the characteristics of the association. At the time, Saussure had justifications for making his choice, but we think we can make a case for how the ideas of our time provide us with good reasons for looking into this again. In a quotation from Taylor, the focus on arbitrariness is underlined, while the obvious alternative candidate is put in brackets: 'There is no reason (other than convention) why the phonetic form [red] should be associated with the meaning 'red' in English.' (Taylor 1991, p. 6). If we focus instead on the convention, and thus on the characteristics of the association, it is not obvious that the linguistic sign is arbitrary. As regards the association, the linguistic sign is in fact non-arbitrary, because it is not accidental that the association of a signifier with a signified is as it is, owing to convention. Conventions may well have arisen in a more or less accidental manner, but an established convention is non-accidental from the point of view of those subscribing to it. We are left with the experiences we have with language. Association is the basis of convention—and therefore of symbolicity. We will look into aspects of this argument in the next three sections.

The Non-Arbitrariness of Association

If we focus on the symbol-emergence problem, we ask how the unity of word and experience enters the cognitive system. And that is a very pertinent question. It amounts to selecting association as the core of the linguistic sign, and to considering the linguistic sign as a continuum of different strengths and varieties of associations. In other words: there is no strict distinction between a sub-symbolic and a symbolic level. In defining the linguistic sign, Saussure presents it as the opposite of the symbol (it should be remarked that Saussure's notion of 'symbol' is different from the notion of 'symbol' used about the lexical level). He claims that the symbol has some kind of similarity ('lien naturel') to what it represents, while the linguistic sign is arbitrary:

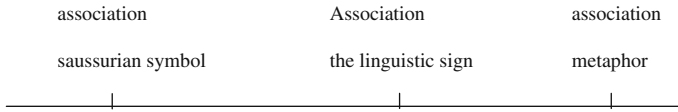| association	Association	association
saussurian symbol	the linguistic sign	metaphor

Fig. 1 The continuum of association in the non-representational view of language. The formerly distinct levels of representation are here considered as located on a continuum of association strength and nature

> Le symbole a pour caractère de n'être jamais tout à fait arbitraire; il n'est pas vide, il y a un rudiment de lien naturel entre le signifiant et le signifié. (Saussure et al. 1969, p. 101)

In most linguistic theories, the linguistic sign is defined by the Saussurian conception of arbitrariness. In our view, this is too strong a claim of form and meaning as separate entities. If we focus instead on association as the core of the linguistic sign, there is no important distinction between the Saussurian symbol and the linguistic sign, because in both cases it is a matter of form connected to traces of meaning (see the section "On Defining 'Language' in Psycholinguistics") by association: the difference between them lies primarily in the strength and nature of the association, and they may therefore represent positions on a continuum.

The Linguistic Sign: A Continuum of Association

What is the difference between the three positions in Fig. 1? First of all, the association of the Saussurian symbol is primarily more uniform than that of the pure Saussurian linguistic sign, but probably also stronger. The Saussurian distinction between symbol and linguistic sign can be justified only if one insists on keeping form and meaning separate. If the focus is on developmental—and explanatory—aspects of the linguistic sign, this strict division cannot be justified.

This is so because structuralism, generativism and cognitive psychology are all unable to explain historical or individual change and development. In this paradigm, the Saussurian focus on arbitrariness in defining the linguistic sign provides a static, descriptive level of representation on which theory has been built.

The inseparability of meaning and form is a central point in both connectionism and functional linguistics; but still, when it comes to the linguistic sign, the assumptions of the cognitive/structuralist paradigm are transposed to a large extent. The point of this article is therefore to pinpoint the demand for a new conception of the linguistic sign in a suggested combination of connectionism and functionalism, and further to show how an alternative conception of the linguistic sign meets good standards of empirical science. These ambitions can be achieved only with a new paradigm, simply because their basic assumptions are incompatible with those of the old paradigm. Two of the positions (symbol and linguistic sign) in Fig. 1 are judged by Saussure as qualitatively different and opposites. The alternative view is to consider them as positions on a continuum of complexity and strength as regards association. As we all know, associations are to some extent unique, and we can therefore not exclude the possibility of unique associations. Where such associations belong on a continuum depends on what aspects of language we study. In diachronic studies of a language, unique associations represent extreme and irrelevant positions, but for the young child or for the adult second-language learner, unique associations are at the core of their language development. In social communication, and through frequent interaction, associations are made common to different degrees. And they are made common in different ways. This is

equally true of all contextual associations, which also vary in strength and variety. On this alternative view, the linguistic sign is not opposed to the symbol; instead, the non-arbitrary linguistic sign encompasses the whole range of the continuum, because this variety of association is reality for the language user—infant or adult. If competent adult speakers perform exactly what Saussure called symbols, why should this be excluded from the level of representation? Such questions make us look at association as the core of the linguistic sign, and make us leave behind the representational view of the relationship between form and meaning.

From the alternative view described above, it is considered simplistic that the child, at a certain point in time, searches for expressions that fit her/his experiences, and that this point of development is what is called the vocabulary spurt. Rather, it is suggested that form and meaning are closely intertwined and develop in an intricate way. Halliday's study of the speech functions of his son from nine months of age (Halliday 1975) can be interpreted according to such a position. With reference to the continuum of the linguistic sign proposed above, it is suggested that the child's attention is guided, from the very start, towards sequences of sound that associate with some traces of meaning. In this context, it is meaningless to talk of arbitrariness. It is also suggested that attention guides the mechanism of associating sound with traces of meaning. This means that language development is seen as a matter of association of cues of various sizes and kinds, where the characteristics of association are continuously changing. It is not a matter of simply mapping a lexical meaning with an expression, but rather a continuous alteration of cues that have potential for meaning. No wonder even the concept of 'word' is difficult in the linguistic literature (Dixon and Aikhenvald 2002)! The vocabulary spurt is then considered as a constructive experience relating to the continuum of the linguistic sign. Having reached this position in development, the child's exploitation of over- and under-extension (Clark and Clark 1977) shows the complexity of association. What is more, the mechanisms of association are still the same, but their outcome is different. We use words, but we base our judgement of their function primarily on our associations—that is, our experience of their intertwined form and function:

> On this epigenetic view, the symbolic processing level in human cognition is not an independent and autonomous system of symbols projecting onto the non-symbolic level, but the emergent outcome of interactive re-organizations of categorization processes operating upon both non-linguistic and linguistic input, integrated within a single developmental mechanism. (Plunkett et al. 1992, p. 310)

Yes indeed, the linguistic sign is the association of form with meaning. Unfortunately, the Saussurian double focus on 'form' and 'meaning' introduces two distinct levels of representation: a semantic one and a phonological one. The consequences of this should be thoroughly investigated. Still, it should be remarked that Saussure goes very far in unifying these levels of representation without leaving the distinction of langue and parole:

> On a vu [...], à propos du circuit de la parole, que les termes impliqués dans le signe linguistique sont tous deux psychiques et sont unis dans notre cerveau par le lien de l'association. Insistons sur ce point.

> Le signe linguistique unit non une chose et un nom, mais un concept et une image acoustique. Cette dernière n'est pas le son matériel, chose purement physique, mais l'empreinte psychique de ce son, la représentation que nous en donne le témoignage de nos sens; elle est sensorielle, et s'il nous arrive de l'appeler 'materielle' c'est seulement

dans ce sens et par opposition à l'autre terme de l'association, le concept, généralement plus abstrait. (Saussure et al. 1969, p. 98)

As we see it, the representational view of language is bound to confuse sign and object: 'Confusion of sign and object is original sin, coeval with the word' (Quine 1977). Because there cannot be identified any space for the semantic representation, it is tied to the referent.

Association and Language

When we consider association to be at the core of the linguistic sign, we avoid the representational position and we may define language by performance—as a set of codes with potential for meaning. Quine's position is interesting in this respect, as he considers individuation of objects to be a matter of progressed development, not the initial state of association (Quine 1977). This position is very pertinent with regard to mainstream, 'representational' thinking. The idea that the child goes from signal to sign—or, in other words: enters the symbolic stage—is valid according to a representational view, again owing to the concept of the arbitrary linguistic sign. But, if association is at the core of the linguistic sign, and if individuation of objects is an emergent property of association, there is a whole new framework for discussing phonological development. Paradoxically, it is in this new framework that the Saussurian slogan 'dans la langue il n'existe que la différence' becomes really powerful. The core of the non-arbitrary linguistic sign—association—is nourished by the same famous phrase, although there is no Saussurian 'langue' as opposed to 'parole', and the notion of 'difference' has become far more powerful as it is linked to association. Still, we must also consider 'difference' differently. Saussure's slogan is based on necessary and sufficient conditions for category membership. With an understanding of categorization as a matter of gradience and prototype, similarity to the prototype is central to categorization, not only contrast with other categories.

The Phoneme: Descriptive or Explanatory Power?

If we focus on difference and similarity as basic factors for association, we no longer favour lexical (representational) contrast as the basis for the phoneme. Structuralist theorists are of course also aware of this aspect of difference, but here the 'sub-lexical' distinctions are degraded and seen as secondary to lexical distinctions. Roman Jakobson and Linda Waugh claim that the distinction between 'distinctiveness proper' and 'sense determination' is crucial to understanding how sound functions in language (Jakobson et al. 2002). What is more, without such a distinction the notion of 'phonology' is blurred.

From the position of the symbol-emergence problem, phonology must be defined differently than from the structuralist position. From this perspective, Lacerda and Lindblom's model contains interesting aspects of the phoneme as prototype (Lacerda and Lindblom 1997). Their approach is based on the following assumptions: (1) early language acquisition is a matter of two processes (memory and perception); (2) variation is the learner's friend; (3) the system emerges as a consequence of rather non-linguistic processes; and (4) the child has no linguistic knowledge at the time of birth:

> According to the model, categories with prototypical properties emerge in a self-organizing way as a consequence of the distributional patterns that the exemplars

cumulatively form in the perceptual representational space and in phonetic memory. (Lacerda and Lindblom 1997, p. 14)

Lacerda and Lindblom's model is a simulation of isolated vowels cut from infant-directed speech. The simulations show how vowels perceived as belonging to the same category in speech also activate areas that are not associated with that category, for instance how some exemplars of /a/ tend to be categorized as /i/. But, importantly, prototypical properties emerge for each category. The simulations of vowel categories appear as neat X-ray pictures of the phonemic prototypical properties:

> [...] categories of speech sounds are fuzzy clouds of multi-dimensional (multi-modal) sensory representations that are spontaneously structured by cross-correlation, due to their simultaneity. (Lacerda and Lindblom 1997, p. 31)

However, this neat simulation of phonemic properties is placed in a quite strict framework concerning the linguistic sign and the focus on the phoneme as unit. In our view, the question of the conceptual status of the phoneme is not left open in Lacerda and Lindblom's approach. Therefore, the main problem presented in the introduction of this article remains unsolved, that is: the question of the conceptual status of the phoneme. To some extent, this is due to Lacerda and Lindblom's own theoretical framing of the simulations. Their position is certainly functionalist, but their adaptation of the conventional view of the linguistic sign and their focus on language structure as primarily phonemic may not fully exploit the potential of their findings. Interestingly, the strict phonemic structure is not part of the simulation— it is added by conventional theory. The limitations of memory are causally linked to the phonemic structure, but this point is only hypothetical and cannot be derived directly from the simulation. Moreover, there are other potentials that could be exploited in Lacerda and Lindblom's simulation: the phonemic properties shown are less important parts of language structures. The notion of phonemes as 'fuzzy clouds' fits with the insight of the phoneme as prototype with exemplars at different distances from the core. This insight carries primarily descriptive power. However, this description has a better potential for explanation than the structuralist notion of 'phoneme', because it is less abstract and demands fewer supporting hypotheses. The notion of phonemes as fuzzy clouds may explain why some words 'pop up' in the mind more readily than others and it may explain some 'slips of the tongue' or some errors, confusions and hesitations. It may also explain some developmental characteristics: as the nucleus grows 'harder'—in comparison to the loose cloudy environment—the person may become less hesitant and more accurate when choosing words and expressions. However, it still remains a crucial question how this insight can be operationalized differently from traditional segmental theory. We claim that this can be done only if one dares to think differently about the linguistic sign. In our view, there is a tendency towards unfortunate theoretical framing in Lacerda and Lindblom's model, despite all its highly interesting aspects. We would claim that their position represents a kind of functionalism that explains development as seen from the end product/the lexical level—even though they actually claim the opposite—, and that they thereby represent a position closer to the position that Plunkett et al. call the symbol-grounding problem. Their explication of the vocabulary spurt is a way to combine the established view of a universal phonemic structure with the established view of the arbitrary linguistic sign. In other words, the phoneme as hypothetical description has been mixed up with matters of explanation. This is unfortunate, because the units of description should not be taken a priori in the causal explanation, in order to avoid circular reasoning.

The Status of the Concept of 'Phoneme': Description

The scientific domains of understanding, description and explanation should be distinguished but not separated. We also need a coherent theory, which means that the explanation must dock into the description in some way. Therefore, the phoneme as description is not irrelevant to the domain of explanation. The problem arises when we use phonemic properties as part of a causal relationship. Descriptions are hypothetical, but descriptions can be evaluated as more or less adequate according to how well they fit the explanation and vice versa. With regard to the reasoning about the arbitrariness of the linguistic sign, the phoneme as 'fuzzy cloud' is considered to have a stronger descriptive power than the traditionally defined phoneme. While we are fully aware that most structures can usefully be described in various ways, the point here is to differentiate between the domains of description and explanation. Talking of explanation in phonology, we reject the assumption of the 'symbolic' level as a level having more to do with language than earlier individual development. Development is not a matter of going from signal to symbol—rather, it is a matter of language: of going from language to language. Further, language is a set of overt codes with potential for meaning, where these codes and their potential for meaning are established by differences and similarities concerning associations, without any important division between what we believe should be identified as form and meaning, respectively. Taking Quine's point of view—that individuation of objects is a consequence of progressed association—, we would suggest that the vocabulary spurt in the young child is primarily a matter of a rapid progression of associations, where the associations of differences and similarities concerning stimuli which have gained the child's attention reach a point where symbols emerge. Therefore, the view of a rather simple mapping of form onto meaning is rejected. The idea of limited memory capacity as an important factor for the vocabulary spurt is considered to be a weak supporting hypothesis, because this argument is valid only if we know for certain that language is primarily stored as symbols instead of as a complex web of associations. And we do not know that.

From this perspective, the phoneme as fuzzy cloud and prototype is simply a hypothetical and illustrative description of one effect of the basic mechanism in language, namely the association of differences and similarities of material which has gained attention in interaction between human beings. According to this position, the conceptual locus of the phoneme can be hypothesized to be primarily descriptive. The phonemic (and segmental) properties of a certain language make a language structure, but not the structure. This is in line with what auto-segmental-metric theory has shown us about structure in the world's languages. From this, it can be hypothesized that the phonemic effect is different in the world's languages—not just concerning different inventory, but also concerning the degree to which prototypical effects are attached to segments. Tone languages are hypothesized to have a different prototypical effect concerning the segment than, for instance, agglutinative languages with little tone. An interesting perspective on the phoneme is given by Per Linell in his book *The written language bias in linguistics* (1982), which highlights the problem of description. In his view, the notion of 'phoneme' is nourished by the alphabetical and segmental structure of (some) written language(s).

What we call 'language structures' should therefore be considered as constructions, and for the purpose of behavioural studies they should not be abstracted from overt language behaviour. This is because the notion of 'structure' rests on the same ontological relativity as all conceptual enterprise (Quine 1977) and is therefore restricted by the purpose of description and the domain of behaviour. From such a position, the different structural descriptions represent a continuum of adequacy for behavioural studies. Adequacy is related to the purpose of description. As regards the 'phoneme', the purpose of description in autonomous

linguistics is far from the purpose of description in behavioural studies. This issue has rarely been highlighted in the discussion of the phoneme. What a phoneme 'is' depends on the purpose it serves in the current theoretical framework, and any simple cross-positional discussion about this concept should be avoided. While we consider both structuralist and generativist descriptions as adequate descriptions of language structure, our claim is that they are distant from the part of the continuum which is hypothesized to be adequate for behavioural studies.

Conclusion

In the present article, the status of the concept of 'phoneme' in psycholinguistics has been characterized as vague; still, the phoneme defined as prototype and fuzzy cloud is important as an example of a basic mechanism of language: association. What is more, the widespread structuralist conception of the phoneme as the smallest meaning-distinguishing unit is judged to be simplistic, because it shows only the tip of the iceberg. It covers only those aspects of contrast that we are able to understand, for instance that there is a difference between /hæt/ and /kæt/. In order to be able to explain, we must search for descriptions that may serve our purpose of explanation. And that involves leaving the domain of understanding. We thereby go into phenomena that we may explain, but not understand. A parallel example can be given from medicine, where the phenomenon of depression is (often) *explained* on the basis of the neurotransmitter serotonin; however, we are not able to *understand* depression by means of this neurotransmitter.

Focusing on association as the core of the non-arbitrary linguistic sign, we have made an attempt to identify the boundaries of explanation, description and understanding when dealing with the categorization of sound in empirical studies of behaviour. This implies a larger focus on phonetics. Our claims of the phoneme as a concept with poor explanatory power, does not imply a rejection of the categorical nature of language, but rather a matter of relativizing the phonemic, segmental structure as the primary, universal sound structure of the world's languages.

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