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# The Representational Hypothesis: a return to Cartesian Dualism?

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**Abstract**

What *is* the most adequate way to describe the level of mental representation which exists immediately prior to the physical occurrence of an utterance? In addressing this, the question to be answered in the projected thesis, I make two starting assumptions. Firstly, I assume that any principled description of this level of mental representation must obviously aim to reflect psychological reality, being as free as possible from *a priori* bias towards potential applications such as speech synthesis/recognition, or any such partiality as to the particular form that phonological descriptions should take (i.e. whether they should be rule- or constraint-based, featural or gestural, 'declarative' or 'procedural', and so on). Secondly, I assume that all potential answers to this question should be given a fair hearing. In this paper, then, I shall consider just one such answer, namely the Representational Hypothesis. In my discussion, I shall point out a number of problems with Burton-Roberts' proposal, compare his view with another which has become prominent in recent years, and suggest how the two might be integrated and thus contribute towards an improved theory of phonetic representation.

## 1 Introduction

Whilst the existence of a level of 'surface' or 'phonetic' representation has been assumed by several quasi-independent areas of linguistic inquiry, there is remarkably little consensus in the literature as to its exact ontological status.[1] For example, contemporary mainstream Generative Phonology holds that there is a segmental, categorical level of representation which functions as an intermediate device in the phonetic implementation of phonological contrasts (e.g. Keating 1990; Kingston & Diehl 1994). This is assumed to consist of 'clusters of feature values aligned with elements of internal segment structure' (Keating 1990:324), and is in most important respects equivalent to the 'systematic phonetic' representation of Chomsky (1964) and Chomsky & Halle (1968). These categories come into play at the stage in the derivational chain where the abstract, symbolic categories of the phonological component "interface" with continuously variable articulatory and acoustic

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parametric phonetic representations. By contrast, advocates of Declarative Phonology espouse a "semantic", extensional view of the phonology-phonetics relation, which demands a much more strict distinction between phonology and phonetics. Phonological representations are partial descriptions of phonetic reality: a particular phonological entity is said to denote a constrained set of possible phonetic events (Bird & Klein 1990; Scobbie 1991a, 1991b; Coleman 1992; Local 1992, 1996; Scobbie *et al.* 1996). On the one hand, phonological descriptions and representations encode relational information, and are assumed to consist of 'abstract algebraic objects appropriately formulated in the domain of set theory' (Local 1992: 193). On the other hand, phonetic representations are descriptions of physical events, formulated in a physical domain, and are held to represent how phonological categories are to be extended in spatio-temporal occurrence.

It is apparent, then, that an answer to the following question is urgently required: 'What *is* the most adequate way to describe the level of mental representation which exists immediately prior to the physical occurrence of an utterance?'. At the outset, I assume that any principled description of this level of mental representation must obviously aim to reflect psychological reality, being as free as possible from *a priori* bias towards potential applications such as speech synthesis/recognition, or any such partiality as to the particular form that phonological descriptions should take (i.e. whether they should be rule- or constraint-based, featural or gestural, 'declarative' or 'procedural', and so on). I also assume that all potential answers to this question should be given a fair hearing. In this paper, I shall consider just one such answer, namely the Representational Hypothesis. In my discussion, I shall point out a number of problems with Burton-Roberts' proposal, compare his view with another which has become prominent in recent years, and suggest how the two might be integrated and thus contribute towards an improved theory of phonetic representation.

## 2 The Representational Hypothesis

The *Representational Hypothesis* (RH) (Burton-Roberts 1994, 1995, 1996; Burton-Roberts & Carr 1995, 1996) is a preliminary proposal regarding the nature of the relationship between I(nternal)-language (Chomsky 1986) and spoken, written or signed 'utterances' ('E-physical events'). Burton-Roberts and Carr argue that phonology and phonetics cannot be seen as related in a 'classical' type/token sense, but rather that physical-phonetic phenomena are in a relation of representation phonological entities: the latter are seen as purely cognitive, having no intrinsic phonetic content. According to the RH, the relationship between phonology and phonetics must be regarded as purely conventional: the two levels have no sortal affinity — in that one is purely physical and the other purely abstract and cognitive. Thus, it is for them nonsensical to claim that one set of entities — such as 'systematic phonetic' representations (Chomsky 1964) or 'gestures' (Browman & Goldstein 1986) — could in any way be operative at both the phonological and phonetic levels.

The 'classical' distinction between *type* and *token* was introduced into semantics by the American philosopher C.S.Peirce (1940). According to this view, types are abstract, lacking occasion and location. By contrast, the tokens of a particular type are physical, having unique spatio-temporal occasion and location (*token physicalism*). Following Lyons (1977:13), we may refer to the relationship between (classical) types and tokens as one of *instantiation*, and say that tokens instantiate their type. Classical tokens instantiate their types by instantiating the properties in terms of which their types are defined. If we apply this distinction directly to the relationship between phonology and phonetics, we are obliged to state that physical-phonetic phenomena are tokens of phonological entities, and have whatever properties they have in virtue of instantiating phonological types. Thus, a strict interpretation of classical type/token in phonology/phonetics states that physical-phonetic phenomena have linguistic-phonological properties.

Burton-Roberts does not share this view. To avoid any possible misinterpretation of his position, let us quote him verbatim:

> In classical type/token thinking, types are *abstract* in virtue of being types and tokens are by definition *physical* occurrences (of those types). The fact is, I simply do not conceive of the linguistic, and hence linguistic expressions, in the way that this view demands. I do not conceive of linguistic expressions as types-of-physical-(spatio-temporal)-occurrence. As I conceive of them, linguistic expressions do not physically occur, not even as examples or tokens. Hence I cannot allow that they occur in the physical occurrences we call utterances.
> (Burton-Roberts 1994:187)

From this passage we are able to infer that whilst Burton-Roberts is seeking to reject the extensionalist rationale of classical type/token thought, he is doing this in a notably different manner from that of Chomsky (1959, 1965, 1980, 1986). The extensionalist would hold the view that linguistic reality is to be sought entirely in the physical world; that languages are wholly extended in spatio-temporal occurrence. The corollary of this is that if the linguistic is non-physical, it is abstract in the sense of having been derived (by abstraction) from the physical utterance phenomena which constitute 'real linguistic data'. In other words, this view holds that the real object of linguistic inquiry is the physically observable product of utterance behaviour; that what is abstract in linguistics is not 'of-language', but merely 'of-use-to-the-linguist'. By contrast, both Burton-Roberts and Chomsky espouse a mentalist, realist view of the linguistic. However, Burton-Roberts explicitly rejects token/linguistic physicalism (the view that language exists in the physical world), which Chomsky does not. Let us extricate these latter two positions in more detail.

According to Bergmann (1967:48), physicalism is the view that 'all mental terms can be defined in a schema whose undefined descriptive predicates refer to characters exemplified by physical objects'. In other words, the physicalist maintains that statements about mental events can be reduced to primitive (undefined) terms with physical characteristics as referents. Conversely, mentalism is the view that mental events cannot be described by means of a reductive analysis to the theoretical constructs of the physical sciences; that physical and psychological phenomena are ultimately only explicable in terms of a creative and interpretative mind. Indeed, 'extreme mentalism' might be defined as the view that the mind is spiritual, not physical. However, whilst these two positions might seem mutually exclusive, Chomsky (1965:193; 1980:5) and many other (pro- and anti-Chomskyan) philosophers have argued for versions of physicalism and mentalism which are compatible, taking a position which is in opposition to a strict, substantive variety of Cartesian dualism (e.g. Fodor 1975:9; Dennett 1978:94; Pattee 1970; Putnam 1973; Medawar 1974). All of these authors have claimed that mental events are special kinds of physical events, descriptions of which cannot be exhaustive if couched solely in physical, non-mentalistic terms. The coexistence or 'convergence' of physicalism/materialism and mentalism is seen by them to be parallel, if not identical to the interrelationship of mind and brain.

Burton-Roberts' position is quite different to that of these 'physico-mentalists', as we might begin to illustrate by returning to the type/token distinction. *Contra* Chomsky, Burton-Roberts (1994, 1995, 1996) suggests a way in which type/token might be retained in linguistics through the adoption of a principle of *type/token affinity*, which presupposes a sortal distinction between 'abstract types' and 'physical types' (1994:189). Thus, he proposes that whilst all types are abstract, a type is a physical type iff (if and only if) its tokens are physical. For instance, Burton-Roberts and Carr would postulate types of tree and types of cow as physical types, along with the letter 'p' and the note B-flat. By contrast, 'abstract types' have non-physical tokens, and subsume linguistic (cognitive) types which have linguistic (cognitive) tokens. By type/token affinity, then, Burton-Roberts is able to state that it is sortally incorrect to regard any 'E-physical' (physical-phonetic) phenomena as the token of a linguistic type. In other words, by denying that phonetic reality is capable of instantiating linguistic properties, he entirely eschews the concept of E(xternalised)-language as discussed by Chomsky (1986:19-21). Whilst Chomsky rejects E-language as a legitimate object of scientific inquiry, he does not question the intrinsic validity of the concept (he invented it), especially in the sense that E-language is an encoding of I-linguistic properties. This subtle but important difference brings to light a fundamental problem with Burton-Roberts' terminology. Since he does not admit of the extensional character of linguistic properties in the classical type/token sense, there is no justification for him to label phonetic reality and other 'utterance phenomena' as E(xternalised)-physical. The core of his thesis is that physical phenomena are not externalisations (manifestations/ realisations/ instantiations) of anything linguistic, but are instead representations of the linguistic. In other words, he denies that the 'I-physical' (i.e. Fodor's 1975:9 'ideally completed physiology') — of which the E-physical is an instantiation — has any linguistic character. Thus, Burton-Roberts seems to be tied to the strict, substantive kind of Cartesian dualism we mentioned earlier. For the sake of the exposition, we shall continue to employ Burton-Roberts' terminology, but we nonetheless draw attention to this inconsistency and suggest that it might be more appropriate to use the label R(epresentational)-physical in future.

Of course, whether or not we retain type/token in linguistics is not the central issue. Our most pressing concern at this point is to answer the following questions:

1. If we were to adopt the Representational Hypothesis, what would be the consequences

for our understanding of the phonology-phonetics relation?

2. What is the evidence that the Representational Hypothesis constitutes an improved perspective on the phonology-phonetics relation?

In answer to question (1), the first and most obvious consequence of adopting the RH is that we can no longer conceive of speakers as physically producing language. Under this view, 'utterance phenomena' are non-linguistic, 'E-physical' representations of the I-linguistic, which (by type/token affinity) have no natural relationship with what is represented. More specifically, if the phonological is I-linguistic, it has no more of a natural affinity with the phonetic than it does with other language-representational E-physical phenomena, and can — strictly speaking — no longer be called 'phon'-ology. Indeed, Burton-Roberts (1996:4) makes the explicit claim that writing is neither more nor less 'linguistic' than signing or vocal speech. Secondly, since E-physical phenomena are produced so as to be in a representational relationship to the linguistic, both the relation itself and the processes which give rise to the production/perception of 'utterance phenomena' must be regarded as non- or extralinguistic representational conventions. Thirdly, the RH advocate must be concerned with providing principled descriptions of what is represented, not the representation itself. He or she would insist that human beings (naturally, inevitably) think of and respond to what is only representational of the linguistic as itself linguistic.

Given the preliminary nature of the Representational Hypothesis, and the scarcity of published material, it is much more difficult to arrive at an answer to question (2). If, as it appears, Burton-Roberts is seeking to promote the Hjelmslevian idea of an 'immanent' linguistics, then he must deal explicitly with the kinds of objections which have been levelled against that paradigm. In a manner very similar to that of Burton-Roberts, Hjelmslev (1947:171, 1953:2) argued for the independence of linguistics from external considerations — especially phonetic facts — by claiming that the same linguistic system can be instantiated in radically different ways by radically different representational systems. Thus, the linguistic system of a given language can be instantiated by speech sounds, orthography, semaphore or any other representational system, such that the linguistic system has no primary, intrinsic connection with phonetic reality (to the exclusion of other possible representations). As Anderson (1985:148) points out, there arose two main objections to Hjelmslev's position, namely

1. that orthographic and other systems are obviously secondary in character, parasitic on the nature of spoken language and developed only long after spoken language had arisen, and

2. that such systems do not in general display the same system as spoken language.

To the first of these objections, Hjelmslev (1953:67) argued that the 'derived' character of orthographic representational systems is irrelevant, since what is important is the *possibility* of representing the linguistic system in another medium. Furthermore, he even went so far as to deny that writing was invented as a way of representing (realised/instantiated) speech, maintaining instead that orthography constitutes an independent representational analysis of the expression system of a given language. With regard to the second objection, he argued that this too was irrelevant, since 'it does not alter the general fact that a linguistic form is manifested in the given substance' (Hjelmslev 1953:67). In other words, he argued — in much the same manner as Burton-Roberts — for the existence of multiple, parallel representational systems. Thus, the possibility of implementing the RH in such a way that phonology is regarded as part of the representational system would enable Burton-Roberts to dismiss as epiphenomenal the evidence of Jakobson *et al.* (1952) and Stevens (1972, 1989) for phonological categories defined in terms of articulation and acoustics.

At this early stage, it is difficult to regard the Representational Hypothesis as anything more than an intriguing alternative perspective on the phonology-phonetics relation. In particular, further research must endeavour to provide a more concrete answer to question (2) in order to avoid the proposal being dismissed as mere aprioristic philosophising. However, I would like to suggest that there is some potential for convergence between the RH and another, more prominent view of the phonology-phonetics relation which holds that there is no "phonology-phonetics interface".

## 3 'There is no "phonology-phonetics interface"'

This view, at least as presented by Browman and Goldstein (1986, 1989, 1990, 1992), Ohala (1990) and Pierrehumbert (1994), is amenable to a non-procedural view of language sound structure. However, by contrast with the kind of semantic approach advocated by Pierrehumbert (1990) and those who associate themselves more explicitly with Declarative Phonology (e.g. Bird 1990, 1995; Scobbie 1991a, 1991b; Local 1992; Coleman 1992; Scobbie *et al.* 1996), it actually requires a declarative approach since no clear division between phonology and phonetics is recognised. In other words, these authors argue against the view that the dividing line between phonology and phonetics should be drawn at the place where algebraic, symbolic and abstract representations of invariant categorical knowledge "interface" with quantitative descriptions of real-world physical parameters. Instead, they see phonetics simply as one face of phonology, such that 'there is no interface' (Ohala 1990:153).

Let us briefly put this claim in its broader context. Many other areas of scientific inquiry have discovered some dramatic examples of the simultaneously gradient and qualitative nature of the physical world with particular respect to so-called "self-organisation phenomena". One example is the Belousov-Zhabotinskii reaction (discussed in Prigogine & Stengers 1984 and Browman & Goldstein 1990) in which the right concentration of reagents in a quiescent petri dish will suddenly display coloured concentric circles and rotating spirals, which eventually cover the entire surface and then disappear. These events may be described as either gradient, since spatio-temporal variation in the concentration of particular ions may be described in terms of mathematical equations, or qualitative, since there are a number of distinct, observable forms. Naturally, the reaction only occurs when the relative concentration of the reagents is within certain limits. Thus whilst concentration is gradient, the concentration continuum is *inherently* divided into regions which show qualitatively distinct behaviour. Such partitioning into distinct, long-term behaviours is known as *bifurcation*, and it has long been held by advocates and proponents of Chaos Theory that this is a common property of *all physical systems*. As Gleick (1987) and Hofstadter (1981:30) point out, even the simple equation $x_{next} = rx(1-x)$, which is used to describe population dynamics, shows these kinds of properties. When the equation is iterated to get the population of each successive generation, the long-term behaviour of the system will differ depending on the value chosen for $r$. At low values, the system settles down to a low value for $x$. As $r$ increases, there is an abrupt qualitative change, resulting in two values for $x$. Similarly, four values result after further increases in $r$. However, the doubling only continues until at some point the system becomes chaotic, and ceases to show any predictable pattern of repetition. So whilst the equation is defined in the world of continuous mathematics, a number of discretely different behaviours is provided as a function of the (gradient) value of the parameter $r$.

Returning to our topic, Browman & Goldstein (1990:414) have pointed out that speech, as a physical system, can also be seen as simultaneously gradient and qualitative. One obvious example of this kind of view is Quantal Theory (Stevens 1972, 1989), which holds that whilst it is possible to describe constrictions within the vocal tract in terms of continuous (geometric) parameters, the acoustic and auditory properties of the sound produced by the vocal tract are such that continuous parameter space is effectively partitioned into discrete domains. Within each of these domains, the auditory properties do not vary greatly as a function of small changes in articulation, and are qualitatively distinct from the auditory properties associated with other domains. Thus, these regions are seen as the basis of contrast, which for Stevens are also the basis of the universal inventory of distinctive features. Assuming the correctness of Quantal Theory, it would appear that speech is also a physical system which intrinsically displays both gradient and qualitative characteristics.

To summarise this position, then, Browman & Goldstein (1990), Ohala (1990) and Pierrehumbert (1994) — among others — are of the view that the cognitive (mental)/physical and qualitative/gradient dichotomies are not particularly useful for our understanding of the phonology-phonetics relation. Instead, Browman & Goldstein (1990:415) suggest, for instance, that the different phonological and phonetic representational goals be construed respectively as macro- and microscopic properties of a single system. Thus, properties such as paradigmatic and syntagmatic relations and contrast are macroscopic and relational, and hold between the units of the system. By contrast, the microscopic properties are the precise articulatory and acoustic characterisations of these same units.

An important characteristic of the view that complex physical systems show "self-organisation" is that it requires an interaction or reciprocity between the microscopic and macroscopic properties of the system. Any application of this macro-micro perspective to the phonology-phonetics relation must therefore show:

1. that both contrastive and combinatorial (i.e. macroscopic) properties arise out of the microscopic (articulatory and acoustic) properties of the individual primitives or

"atomisms" (such as articulatory gestures), and

2. that microscopic properties constrain the details of these units.

It is for this reason that Browman & Goldstein must reject the idea of a "semantic" relationship between the phonological and the phonetic. For these authors, even if the semantic mapping in question were analogous to that between a concept and its real-world extensions (such as the concept ELEPHANT and the set of elephants in the real world), it differs substantively in its possibilities for macro-micro reciprocities from the phonology-phonetics relation. In other words, whilst both concepts and phonological structure may be dependent on real-world conditions, their potential for affecting real-world properties is seen here to differ considerably. For example, whilst one's concept of ELEPHANT may affect one's relationship with a real-world elephant (i.e. liking it or hating it), this concept does not have the same potential to constrain the physical structure of the elephant as phonological structure has to constrain the physical properties of the speech signal.

Browman & Goldstein (1990:416) are the first to admit that no absolutely conclusive evidence has so far been adduced for the applicability of macro-micro reciprocity to language. However, they do cite a number of examples which could be interpreted as possible instances of the phenomenon. Among the most intriguing of these are those which seem to indicate that some kind of macro-micro linkage may be found in the detailed language-particular differences in the physical properties of the same phonological or categorical phonetic structures (Keating 1985, 1990). In some cases, microscopic language differences appear to be correlated with the macroscopic structure of contrasts. As Pierrehumbert (1990) points out, Wood (1982) has shown that a prepalatal constriction location is preferred for /i/ in languages which contrast /i/ and /y/, whereas a midpalatal location may be found in languages without the rounding contrast. He corroborates his claim with modelling evidence which shows that a prepalatal location yields a greater acoustic differentiation of /i/ and /y/. Thus, under Browman and Goldstein's interpretation, the macroscopic property of contrast is constraining the microscopic properties of the units. Other studies have shown that the amount of contextual variation evidenced by a phonetic unit may vary. This allowable domain for a given unit has been modelled by Keating (1988) as a 'window', and by Manuel (1990) and Manuel & Krakow (1984) as a 'target area'. The latter two papers have attempted to relate the size of the target areas for vowels to the number of contrastive vowels in the system, showing that the areas are smaller when there are more vowels in the system. Again, this might be interpreted as an interaction of macro- and microscopic properties.

# 4 Conclusion: potential for convergence

It is clear from the above discussion that there is considerable potential for the integration of the RH and Macro-Micro Reciprocity. This is for two main reasons. Firstly, the term "representation" crucially implies non-procedurality; "realisation" entails some unlikely kind of conversion between the abstract (cognitive) and the physically real, whereas the former does not. The RH is thus compatible with an entirely non-derivational view of the phonology-phonetics relation. In other words, a relation of representation, not realisation, is a declarative relation. Secondly, the occurrence of simultaneity and/or reciprocity between the phonological and the phonetic need not imply the existence of any sortal affinity. This is for the simple reason that the I/E-physical and the I/E-linguistic coexist just as the mind/brain does.

It is also apparent that the research programme of Declarative Phonology (DP) is heading for similar conclusions. As I have pointed out above, DP and Macro-Micro Reciprocity have radically different views of the phonology-phonetics relation (i.e. extensionalism vs. monism, or "semantic" versus "no interface", as Local and Ohala respectively might put it), but I think that this is more a case of people struggling to find the right analogy rather than anything terribly crucial. Bird (1995), for example, has argued for the absolute compatibility of Declarative and Articulatory Phonology. Browman & Goldstein (1992) also claim that their 'gestures' are absolutely and utterly equivalent to the 'phonological events' of Bird & Klein. It is quite clear, then, that the RH may offer — seemingly by coincidence — quite an apt metatheoretical device for the adequate description of the kind of relation both the declarativists and the articulatory phonologists would like to be talking about.

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