

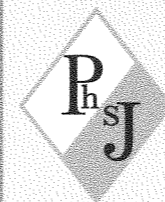
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論文/Articles

Phonetic Arbitrariness: A Cartography*

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ABSTRACT. This article discusses phonetic arbitrariness, i.e. the fact that the relationship between a phonological category and the way it is pronounced (its phonetic exponent) is arbitrary. A cartography of voices which endorse phonetic arbitrariness in one way or another is established; they come from different quarters, cut across theories and reach their conclusion for a variety of reasons. A question pursued is about the settings that enable, enforce or prohibit phonetic arbitrariness. It is argued that phonetic arbitrariness is a necessary consequence of modularity, except if the association of phonological and phonetic categories (spell-out) is made universal and innate. This is the direction taken in the work of Hale-Reiss-Kissock-Volenec. The assessment of this perspective requires discussion of L1 acquisition and learnability issues, which cannot be provided here due to space restrictions. But an argument challenging universal and innate mapping is made in the conclusion: would the equivalent at the upper interface with morpho-syntax be a serious candidate, i.e. if, say, past tense had the exponent *-ed* in all languages of the world because humans are genetically coded for this association? The alternative to universal and innate mapping is available in much of the literature: phonological categories (features) are emergent, i.e. constructed by the child during L1 acquisition solely on the grounds of environmental data. This perspective has phonetic arbitrariness in-built, since it will phonologize whatever the environment provides for. Finally, it is shown that a fully substance-free approach to phonological primes (features, Elements) is a radical departure from current systems on the conceptual side, but does not change much in the every-day practice of phonologists, who may happily continue to use the familiar substantive vocabulary when talking about sound patterns: these terms are simply shorthand for the true phonological structure where substance is absent and only comes in upon spell-out, just like chemists talk about *water* when they mean the real chemical object H₂O.

Keywords: substance-free primes, features, Elements, emergent features, phonetics-phonology mapping, arbitrariness.

1. Purpose

The relationship between a phonological category and the way it is pronounced (its phonetic exponent) is arbitrary (or conventional). This is what is called phonetic arbitrariness in this article. The pages below propose a cartography of how different theories conceive the relationship between phonological and phonetic categories: which are the settings that enable, enforce or prohibit phonetic arbitrariness?

It is first shown in section 2 that modularity entails the presence of a conversion system that translates domain-specific vocabulary from one domain into another: this is true for the interface of morpho-syntax with phonology where the system is called spell-out, and it must also be the case for the lower interface of phonology with phonetics. Spell-out by definition maps two sets of items by way of a dictionary (list-type conversion), which should guarantee an arbitrary relationship between the individual mappings (dictionaries enclose arbitrary pairings): there is no reason why English *table* is related to Polish *stół* in an English-Polish dictionary, and there is no more reason why past tense is tied to *-ed* in English (upper interface), or why the phonological (substance-free) prime α has the phonetic correlate "labiality" (rather than, say, "occlusion," "nasality" etc.).

Hence the phonology-phonetics mapping should produce phonetic arbitrariness for anybody who endorses modular workings, knowing that modularity is a defining property of the generative approach since it was applied to language by Chomsky (1965:15ff). In the classical state of affairs, i.e. Jakobsonian (or SPE) features and their manifold modern offspring, phonological primes (features) are universal and innate (all children are born with a fixed set of features) and come with a phonetic definition that is present *in the phonology*. In such a system, when phonological items are converted into phonetic categories, the phonetic value present in the former ([±labial]) is handed down in some way and determines the

phonetic output (a labial articulation). Hence there is no phonetic arbitrariness: rather, both phonological and phonetic categories share a phonetic definition, and the mechanism that converts one into the other may merely add some slack.

This system is not modular in kind since there is only one type of (phonetic) vocabulary, while modular conversion is necessarily based on two distinct vocabularies and a mapping mechanism mediating between them.

There is a way to subscribe to modular workings while dismissing phonetic arbitrariness, though: this is the direction taken by the work of Hale, Reiss, Kisko and Volenec (Hale et al. 2007, Volenec and Reiss 2018): unlike in the classical Jakobsonian situation, phonological primes are substance-free, i.e. do not have any phonetic property in the phonology (they are alphas, betas etc.), but the mapping mechanism that relates them to phonetic categories is universal and innate. That is, humans are born with a fixed and finite set of phonological primes (features), as well as with a specific association of each one of these items with a phonetic category. Since in this view the phonology-phonetics mapping is hard wired, there can be no phonetic arbitrariness.

On this backdrop, section 3.1 draws an inventory of voices which endorse phonetic arbitrariness in one way or another. These come from different quarters, cut across theories and reach their conclusion for a variety of reasons. Section 3.2 makes a point in favour of phonetic arbitrariness: all theories admit some slack between phonological items and their phonetic realization, but none can draw a red line between “admissible” and “outrageous” slack.

Section 4 is concerned with a necessary consequence of phonetic arbitrariness: melodic primes must not only be substance-free (contra the classical Jakobsonian system), but also language-specific and emergent in L1 acquisition (contra Hale et al.). The emergentist view holds that environmental information is sufficient for the child to arrive at the system of phonological primes and their mapping to phonetic correlates. That is, this can be done without prior knowledge of either any phonological prime or any association thereof with a phonetic category. Hale et al. argue that this is impossible, while other authors see no learnability problem here.

Section 5 shows that substance-free primes are a radical departure from the traditional position conceptually speaking, but in practice do not change a lot the life of phonologists: representations with substantive primes are merely shorthand for the substance-free reality.

Finally, section 6 concludes that the two means of avoiding phonetic arbitrariness, Jakobsonian substance-laden primes and a universal/innate mapping system, are unwarranted in a modular environment.

2. Modularity and arbitrariness

2.1 Nobody doubts that the upper interface (with morpho-syntax) is arbitrary

Since its inception in the 1950s, the Chomskian enterprise is modular in kind: distinct computational systems using distinct and mutually unintelligible vocabularies concur to produce and perceive language. This perspective represents the application to language of the more general take on how the human cognitive system works: Fodor (1983) has condensed the Standard Theory of Cognitive Science that emerged from the so-called cognitive revolution of the 50s-60s (Gardner 1985). The modular view contrasts with the connectionist approach that emerged in the late 1980s and promotes indistinction (there are no distinct computational systems or distinct vocabulary sets: computation is not symbolic). Optimality Theory applies the central connectionist tenet to language, parallel (instead of serial) computation (but not the non-symbolic claim: computation is symbolic also in OT).

The modularity of mind has a number of consequences when applied to language. The grammatical architecture resulting from this perspective is the so-called inverted T that was

introduced in Aspects (Chomsky 1965:15ff) where one concatenative system (morpho-syntax) and two interpretative modules (semantics and phonology) are distinguished (in production). The mutual unintelligibility of those systems is due to the distinct vocabulary that they process (a principle called domain specificity in Cognitive Science): things like person, number, animacy in morpho-syntax, against items such as labial, plosiveness etc. in phonology. As a consequence, modules are incommunicado as such and need a translation device in order to talk to each other: this is what interface theory is about.

In the history of generative linguistics the interface between morpho-syntax and phonology was always more developed than the one that relates phonology to phonetics. Regarding the former nobody doubts that the translational process is achieved through a lexical access (an operation called spell-out): a morpho-syntactic structure that describes, say, past tense of a weak verb in English is realized as *-ed* because there is a lexical entry stored in long-term memory that specifies this equivalence (past tense [weak verbs] ↔ *-ed*). Since lexical properties do not follow from anything by definition (at least synchronically speaking), the relationship between the input and the output of this spell-out is *arbitrary*: there is no reason why *-ed*, rather than, say, *-s*, *-et* or *-a* realizes past tense in English.

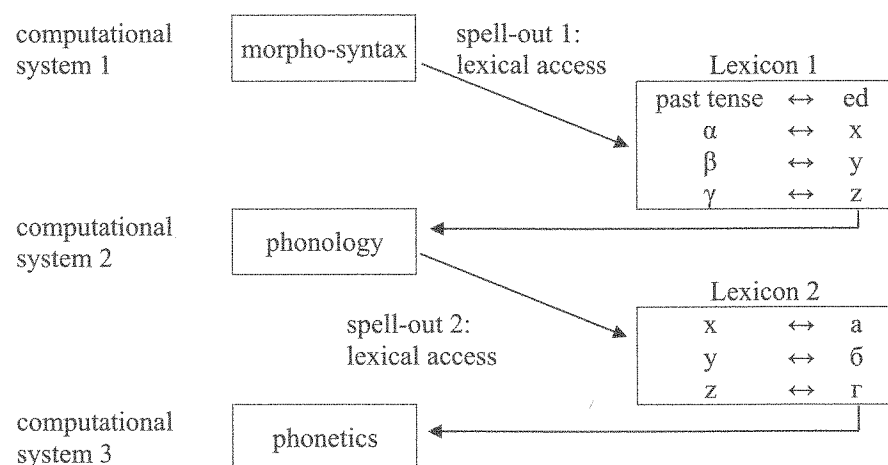
The arbitrary relationship of the categories that are associated through spell-out (one morpho-syntactic, the other phonological) is thus a necessary property of this process: it follows from the fact that vocabulary items on either side cannot be parsed or understood on the other side. By definition, the natural locus of arbitrariness is the lexicon: therefore spell-out goes through a lexical access.

2.2 The lower interface (with phonetics) must also be arbitrary

If grammar is modular in kind then all intermodular relationships must instantiate the same architectural properties. That is, what is true and undisputed for the upper interface of phonology (with morpho-syntax) must also characterize its lower interface (with phonetics): there must be a spell-out operation whose input (phonological categories) entertains an arbitrary relationship with its output (phonetic categories). That is, there is no automaticity or necessity for, say, [+labial] to be pronounced as a labial articulation [p,b,v,u,o etc.]. This prime could as well be pronounced as [χ] or [t]. Arbitrariness in the phonology-phonetics interface is counter-intuitive because unlike at the upper interface our experience is that the relationship is 99% faithful: what is labial in phonology is also labial in phonetics. There are distortions, though, which show that translation may be non-faithful, such as the variable pronunciation of the phonological sonorant /r/, which appears as [ʃ,ʒ] in Polish, [h] in Brazilian Portuguese or [ʁ,χ] in French and German and still in a number of other guises elsewhere (Chabot 2019).

The preceding is a short version of the argument made in Scheer (2014) where the issues are exposed in greater detail. The result is shown under (1) below: three distinct computational systems, each processing a specific vocabulary distinct from the two others, communicate through a translational device (spell-out) that is identical: an input item in some vocabulary is converted into an output item in another vocabulary through a lexical access. That is, correspondences between pairs of vocabulary items that belong to distinct vocabularies are stored in the lexicon (translation is list-based, not computational).

(1) fragment of grammar involving phonology



Scheer (2014) also discusses two reasons to account for the fact that 99% of lower translational relations are faithful (while faithfulness cannot even be expressed at the upper interface: the correlation of past tense with *-ed* is not any more or less faithful than if it were associated to *-a*, *-ub* etc.): on the one hand the ontology of morpho-syntax (only grammar-internal, no real-world categories are involved) as opposed to phonetics (concerned with real-world categories that lie outside of the cognitive system); on the other hand the diachronic origin of non-faithful relationships at the lower interface (rules and phonology-phonetic mappings are not born crazy, they become crazy through aging).

3. Arbitrary phonology-phonetics mapping

3.1 Convergence from different quarters

The divorce of phonological units and their phonetic exponent was commonplace in structuralist thinking, but typically phonemes were referred to by phonetic correlates, the ones that are distinctive. It is not always easy to look behind items that are referred to, say, as "E" or "k": are the phonetic properties used in order to refer to them present in the phonology, or are they just shorthand for naming phonological items that do not have any phonetic properties? Trubetzkoy (1969 [1939]) argues for the presence of phonetic properties in the phonology.

"As regards phonology, it is clear that it must make use of certain phonetic concepts. For instance, the claim that in Russian the contrast between voiced and voiceless obstruents is used to differentiate between words, belongs to the field of phonology. [...] Despite their fundamental independence, a certain amount of contact between phonology and phonetics is therefore inevitable and absolutely necessary." (Trubetzkoy 1969 [1939]:14)

But then he relegates the contact between phonology and phonetics to the "initial stages" (German *Anfangsteile* in the original, literally "initial pieces", appearing as "introductory sections" in the English translation) of phonological analysis, thus supposing a level of analysis devoid of any phonetic properties: "[b]ut only the introductory sections [Anfangsteile] (i.e., the sections on the base elements) of a phonological and a phonetic description should take each other into account. Here, too, the limit of what is absolutely necessary should not be overstepped" (Trubetzkoy 1969 [1939]:14).

Much more would need to be said about the variety of structuralist positions that were

taken on the subject matter, but the focus here is on the generative perspective. Anderson's (1981) arguments explaining why phonology isn't natural are certainly a landmark for the idea of a self-contained phonology that has no clue how the items that it manipulates are eventually pronounced. In the same vein, Hyman (2001) argues against phonetic determinism on the grounds of so-called crazy rules, i.e. which do not make sense phonetically speaking.

At the heart of the issue, Boersma (1998:461ff) contends that nothing is innate: all constraints as well as the mapping of phonology and phonetics are language-specific and learned. In principle any mapping can be learned. The quote below illustrates his position.

"For instance, the need for perceptual contrast requires /u/ to be labial and velar; these two articulations are subsequently learned as a fixed coordination ([back] → [round]), which is arbitrary from the point of speech production: any other coordination is equally learnable, but may be less suitable for use in a system for human communication.

Constraints are learned [...], not innate. Children start with empty grammars. Each time a perceptual category emerges, the relevant faithfulness constraints come into being; each time that the child learns to connect an articulatory gesture to a perceptual result, constraints against such gestures come into the picture." (Boersma 1998:461)

This approach was developed into the BiPhon model (Bidirectional Phonology/Phonetics) as exposed in Boersma (2011), Boersma and Hamann (2008:263) and Hamann (2011, 2014). In BiPhon the mapping between phonology and phonetics in production is done through a list: a phonological item is associated with a phonetic target in a constraint.

Mielke (2008) studies the sets of segments that appear in the statement of phonological computation (where they may undergo or trigger processes), i.e. what he calls phonologically active classes. He shows that they are recurrently unnatural cross-linguistically, i.e. lack any phonetic rationale that could unite or disunite their members. He concludes that melodic primes (i.e. features or bigger items such as Elements in Government Phonology) are not innate (there is no universal feature set) but learned on the grounds of environmental input (Mielke 2008:18). Hence associations between phonological primes and phonetic exponents thereof are language-specific and arbitrary: they only depend on environmental input and if this input varies randomly so will associations. (Universal) grammar does not object to any match.

Carvalho and Klein (1996) and Carvalho (2002) argue for substance-free melodic units, which they call *subsymbolic*: "[t]he units of the subsymbolic level are the real phonological primitives. These primitives are pure forms; as such, they lack any intrinsic phonetic content" (Carvalho and Klein 1996:97). The authors recognize two subsymbolic items, arbitrarily named x and y, which combine through the boolean operations *sum* and *product* in order to form particles (holistic primes of the Element type used in Particle Phonology, Schane 1984; Carvalho 1994). They make explicit that particles have no phonetic value ("why do particles have the particular content [= phonetic value] specified in [reference to particle-based structures]? This is what phoneticians, and only phoneticians, can explain" Carvalho and Klein 1996:115), but it remains unclear whether this implies phonetic arbitrariness: will phoneticians find a universal phonetic correlate for particles, or one that can vary in arbitrary fashion (or one that allows for some limited cross-linguistic variation only)?¹

Finally, like Boersma (1998) and Mielke (2008) so-called radical substance-free phonology (in reference to Hale & Reiss' substance-free phonology discussed in section 4.2) holds that not only melodic primes are substance-free, but also that any association of a phonetic and a phonological category is possible: associations are established by the child during L1 acquisition and exclusively depend on the environmental input. Anything dictated

by the environment will thus be phonologized, and if the environmental input varies randomly phonological categories and their phonetic correlates will follow.

Radical substance-free phonology is argued for, among others, by Odden (2006, 2019), Blaho (2008), Samuels (2012), Iosad (2012:6ff, 2017), Scheer (2017) and Chabot (2019). Dresher (2014, 2018) should also be counted in here.

3.2 All theories accept slack – how much slack exactly?

All theories of melodic representation must and actually do allow for some slack between the phonological representation of a segment and its phonetic realization. This is because of the trivial observation that the same segment (or phoneme) enjoys different phonetic realizations within a given language when pronounced by different speakers or by the same speaker (see Hale et al. 2007:648ff). Also across languages, items that are phonetically distinct may or may not enjoy distinct phonological representations, depending on systemic and other analytical properties. The mid vowels [ɛ] and [e] in different languages for instance may represent the same phonological makeup. Another example are three-vowel systems i-a-u, which are thought of as being phonologically identical if there is no reason to believe that their systemic properties induce a difference. Hence the fact that the low vowel in typical Arabic varieties is pronounced [æ], rather than [a] as in other three-vowel systems, is phonologically irrelevant. Hence the featural specification [+low, -high] (or the prime A in holistic approaches) is invariant across a number of languages, but enjoys different pronunciations language-specifically.

Usually theories also accept some slack in the other direction, i.e. when different phonological objects are pronounced alike. Cases in point are the two different [i]s in Inuit (Dresher and Compton 2011) or Czech (one palatalizing, the other not, while being phonetically identical), or the three different [ɛ]s in Polish that Gussmann (2007:56ff) identifies according to their behaviour.

Slack in the correspondence of phonetic and phonological objects is thus endorsed by all theories in some way or another. The question then is how much slack exactly should be allowed. As far as I can see, no theory has a systematic or principled answer to this question, which is usually not raised and in case it is asked drives phonologists into muddy waters. There is a broad agreement that, say, [-low, -high] (or A-I in a system of holistic primes) may be pronounced as [ɛ] or [e], maybe as [æ] – but can it also be pronounced [i] or [a] in some language? Or [u]? As the slack increases phonologists will intuitively say “oh no that’s not a possible pronunciation,” but they will be unable to draw the red line and come up with arguments why this much slack is admissible, but any more is not. When the amount of slack is too big they will talk about phonology-phonetic mismatches, which they will consider a serious violation of what is expected (while [ɛ]-[e]-[æ] variation will not fall into this category). Since phonologists know about the strange behaviour of “r”, a well-documented case, they will allow for /r/ being pronounced in all kinds of unpredictable ways, as was mentioned above: [ʃ,ʒ] in Polish, [h] in Brazilian Portuguese, [ʁ,ʁ̥] in French and German etc. It thus appears that the rationale driving the gut feeling of phonologists is just the empirical record that they have been exposed to: it is fine for /r/ to be pronounced as about anything because they have seen many cases of that, but [-low, -high] cannot be pronounced as [u] because they have never come across this kind of funny match.²

Some theories such as Hale et al. (2007), Volenec and Reiss (2018) or Government Phonology (Harris and Lindsey 1990:46ff; Gussmann 2007:25ff) have made explicit the post-phonological mechanism (called transduction in the former, phonetic interpretation in the latter case) which will decide about the phonetic variation that is encountered when a phonological object is pronounced. All of these theories are bound by some red line that may be more or less generous but exists (“this amount of slack is ok, but that amount isn’t”). The

reason for this is either the fact that they work with substance-laden primes (case of Government Phonology: the way phonological objects are pronounced is specified *in the phonology*), or that the phonology-phonetics mapping is hard wired for all humans (case of Hale et al. 2007). This is why in these approaches a gut-based calculus of the distance between the phonetic value of the phonological object and its actual phonetic realization is possible.

The BiPhon model and radical substance-free phonology take the position that there is no red line: any phonological item can be pronounced in any way and its reverse. This is phonetic arbitrariness, which necessarily entails phonological primes that do not carry any phonetic information: the presence of such information in the phonology would be meaningless since it would not have any consequences for either phonological computation or the pronunciation of primes.

As long as red lines separating admissible and non-admissible slack are randomly drawn according to gut feeling, rather than being the result of argument, there is no reason to believe they exist. In their absence, the phonology-phonetics relationship is arbitrary and melodic primes must be substance-free. This is the argument made by Chabot (2019) in greater detail, of which the preceding is a digest.

4. Innateness and universality of melodic primes

4.1 Universal and innate or language-specific and emergent?

Whether melodic primes are innate or emergent is a question that is intimately related to the issues of arbitrary mapping and substance-free primes. Somebody who believes that the phonetics-phonology mapping is arbitrary necessarily works with substance-free primes and must also hold that primes are not given at birth: they necessarily emerge in L1 acquisition through domain-general mechanisms (e.g. categorization) guided by environmental information (essentially contrast and phonological processes, see Odden 2019 and Dresher 2014, 2018). This is because phonetically substantive primes given at birth nail down possible phonology-phonetics mappings to the innate values (plus minus some slack).

By contrast, a defender of emergent primes may or may not warrant their substance-free nature: primes may emerge and be related to phonetic categories through environmental input, but these phonetic categories may then be carried into the phonology where primes will have phonetic labels. On this view (which may be instantiated by usage-based or exemplar theories, Bybee 2001), melodic primes are substantive, but not universal or innate.

4.2 Hale and Reiss: substance-free primes but universal phonology-phonetics mapping

Following Jackendoff (1990:40) in what they call the Innateness of Primitives Principle, Hale and Reiss (2003, 2008:28ff) argue that melodic primes could not possibly be emergent since the child would not know how to parse the sensory input: children must know in advance that they will encounter things like labial, occlusion, nasal etc., otherwise the environmental input will never be transformed into linguistically meaningful categories. These learnability concerns are addressed by Samuels (2012), Odden (2019), Dresher (2014, 2018) and a number of contributions in Clements and Ridouane (2011), but the debate cannot be further explored here in the interest of space restrictions.

Hale and Reiss (2000a and following) have coined the term substance-free phonology. They hold that both melodic primes and phonological computation are divorced from phonetic content. That is, computation is able to turn any phonological object (defined by melodic primes) into any other object in any context and its reverse. Melodic primes (features), in turn, have no phonetic properties in the phonology (see also Hale and Kisko 2007:84 and Reiss and Volenec 2018:253):

“Features are simply symbolic, ‘substance-free,’ primitives which are manipulated by the phonology and the transducers. The very fact that two separate transducers are required – one for articulation and one for perception – forces the separation of features from any physical substance.” (Hale et al. 2007:648)

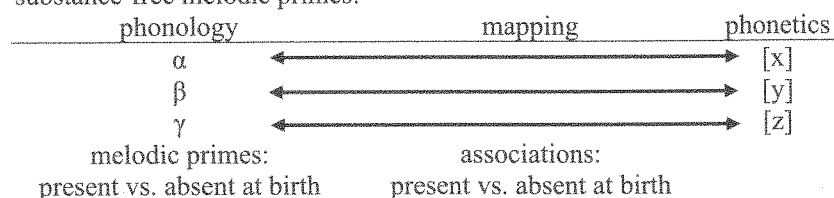
Like in the models discussed in sections 2.2 and 3.1, substance-free features are related to the physical world by means of a conversion system (which Hale and Reiss call transduction: one for perception, another for articulation). It is the properties of this system, and the ensuing consequences for the status of features, that make a significant difference with the other approaches discussed. Hale et al. (2007) (also Reiss and Volenec 2018) hold that both the set of features and the phonetic correlate of each feature are universal and innate: all humans are born with the same finite set of (substance-free) features, each of which is associated to a phonetic correlate at birth.

“We assume that these two transducers are innate and invariant – they are identical in all humans (barring some specific neurological impairment) and do not change over time or experience (i.e., they do not ‘learn’).

[...] A universal feature is not one that is found ‘universally’ but rather a feature, which is drawn from a universally available but finite inventory. We believe that the innateness of features follows directly from learnability arguments.” (Hale et al. 2007:647f)

Within approaches that grant substance-free primes there is thus a contrast between the innatist view (Hale et al.) where both features and their mapping to phonetic categories are present at birth, and the emergentist view (the other approaches discussed) where neither is given at birth. This is represented under (2) below.

(2) substance-free melodic primes:



Another important difference, following from the settings shown, is precisely phonetic arbitrariness: nothing can be phonetically arbitrary under Hale et al.’s innatist view since the association of phonological and phonetic categories is genetically hard wired and identical for all members of the species. There are no language-specific features, and there are no language-specific associations of features with phonetic categories.

4.3 The constructivist option: universal but not innate

A variant of the classical position according to which melodic primes enjoy a phonetic definition in the phonology, are universal and innate (the Jakobsonian feature system) is constructivist in kind and comes down to the same result. So-called phonetically-based phonology that was an important strand in OT in the early 2000s (Hayes et al. 2004) originates in Hayes’ (1999) inductive grounding and promotes the idea that phonology is based on phonetics. The central idea is that “constraints may be universal without being innate” (Hayes and Steriade 2004:6). This is because phonetic difficulties in production and perception are the same for all humans, as explained by the following quote.

“[C]ertain basic conditions governing speech perception and production are

necessarily shared by all languages, experienced by all speakers, and implicitly known by all. This shared knowledge leads learners to postulate independently similar constraints. The activity of similar constraints is a source of systematic similarities among grammars and generates a structured phonological typology.” (Hayes and Steriade 2004:1f)

As a consequence, markedness constraints are not given at birth: in a Piagetian constructivist perspective (Karmiloff-Smith 1998), they are built by the L1 learner based on the environmental evidence, universal phonetic conditions in perception and production as well as innately provided (and domain-specific) devices that are used for the construction of constraints. In Hayes’ (1999) account these include a generator of phonetic difficulty landscapes, a constraint generator and a constraint evaluator.

In this view, domain-general capacities such as induction, mimicking, analogy etc. do not suffice to discover linguistically relevant markedness generalizations of a given language: more is needed than just environmental input and inductive generalization. This is what Bermúdez-Otero and Börjars (2006) (see also Bermúdez-Otero 2006) argue for at length: markedness constraints “cannot be discovered by inductive generalization over input data, for infants depend upon it to overcome the limitations of induction” (Bermúdez-Otero and Börjars 2006:746). They maintain the universality of markedness constraints, i.e. their cross-linguistic invariability, even though they are not innate. This invariability, they argue, is due to the constraint construction mechanism which is the same for all humans: “[w]here all the relevant factors affecting development are universal, the emerging knowledge will be universal too” (Bermúdez-Otero and Börjars 2006:750).

There is one factor contributing to constraint construction that is not invariable cross-linguistically, though: the environmental input. Bermúdez-Otero and Börjars (2006:730ff) discuss the aforementioned crazy rules (ones which do not make any sense phonetically speaking, like $p \rightarrow r / _n$, Scheer 2015), which do emerge and are transmitted across generations: whatever the constraint constructing mechanism and its universal but non-innate ingredients, it allows them to exist. The question is thus what exactly the limitations are that the system based on universal but non-innate properties imposes: crazy rules appear to vary at random, whence their name.

If segmental patterns are indeed able to show random variation (even if craziness does not occur often), then it is unclear what exactly the labour is that the constructivist devices in the OT literature quoted afford: they are supposed to introduce universal bounds on variation, but the result is randomly variable.

In any case, the constructivist perspective is just as rigid regarding the phonology-phonetics mapping as the UG-based take where markedness constraints are themselves innate: there are universal limitations on the phonetic categories that can be related to phonological categories. Hence this approach must reject phonetic arbitrariness.

5. Phonological representations without phonetic information

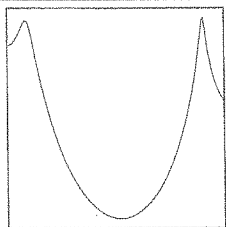
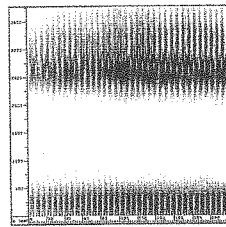
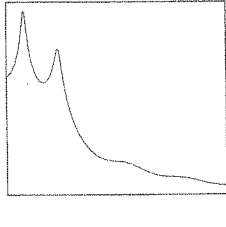
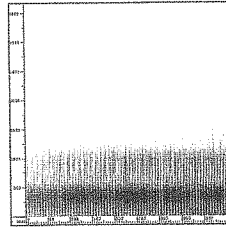
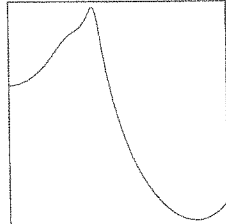
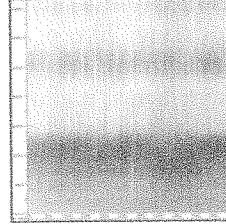
All approaches that provide for substance-free melodic primes agree that the basic melodic building blocks are unlabeled i.e. do not possess any phonetic property in the phonology. Hence instead of [labial], [continuant], [nasal] etc., segmental properties in the phonology are defined by colourless items, call them α , β , γ etc. Phonology works with this set of primes and has no idea what their phonetic value is or how they will eventually be pronounced.

The connection between phonological and phonetic categories is only made post-phonologically (in production).³ The relevant conversion mechanism comes in a number of labels: transduction (Hale and Reiss), cue constraints (BiPhon) or spell-out (Scheer 2014).

Let us illustrate the difference between melodic primes that do and do not bear phonetic

substance in the phonology. In traditional systems where melodic primes are phonetically substantive, their phonetic value is redundantly specified both in the phonology and in phonetics. Holistic primes like Elements for example have the phonetic correlates shown under (3) (descriptions and figures are taken from Backley 2011:22-26; see also Harris and Lindsey 2000:192-196). Everything that is said about them also applies to other types of primes, such as features. Note that Elements have an acoustic, not an articulatory definition. They are described by the mnemonic labels dIp (for |I|), rUmp (for |U|) and mAss (for |A|).

(3) Elements and their phonetic correlates

Element	acoustic value	spectral pattern	spectrogram
I	dIp two energy peaks with an intervening dip. First peak at about 500 Hz, second peak at about 2,5 kHz.		
U	rUmp concentration of energy at lower frequencies, falling spectral shape.		
A	mAss mass of energy in the lower central part of the spectrum, peak at about 1kHz, with a drop in energy on either side.		

The substance-free version of this setup is one where the same phonetic correlates are associated to phonological primes that do not bear any indication of how they are pronounced. This is shown under (4).

a. substantive	b. substance-free
I ↔ dIp	α ↔ dIp
U ↔ rUmp	β ↔ rUmp
A ↔ mAss	γ ↔ mAss

The difference is conceptually radical, but the substance-free perspective on melodic primes does not change the every-day life of phonologists: using primes with phonetic labels as under (4a) is just shorthand for the actual phonological structure (4b), which is substance-free. Talking directly about |I|, |A| and |U| is easier than consistently saying “the prime that is spelt out as [a],” or “gamma”. Greek letters or whatever other placeholders will confuse people, and as the number of primes increases nobody will know anymore what they are talking about. This is avoided by resorting to the familiar |I|, |A|, |U| (or equivalent features), which are shorthand for the phonological objects just in the same way as chemists for

example talk about *water* which is handy and shorthand for H₂O.

Shorthand representations are common in linguistics in general and phonology in particular. IPA transcriptions for example are shorthand for a complex phonetic reality (and they also encode phonological properties such as the difference between ts and t̥s). In the same way, IPA [kæt] “cat” under (5a) is shorthand for the representation under (5b) that provides syllabic but no infra-segmental information, which is turn is shorthand for (5c) where melodic primes are shown that confuse their phonological identity and the way they are pronounced. Finally, (5d) shows the most detailed representation where phonological primes and their phonetic values are provided in separate locations: the former in the phonological representation (which is thus truly phonological and not shorthand), the latter in the list-type correspondences that are stored in long-term memory and accessed upon spell-out.⁴

(5) representation of “cat” in increasing explicitness

a. IPA	b. segmental	c. infra-segmental	d. primes and spell-out
	O N O N	O N O N	O N O N
k æ t	k æ t	U A A	α β β
		? I ?	γ δ γ
		H H	ε ε
			α ↔ rUmp
			β ↔ mAss
			γ ↔ drop in energy (?)
			δ ↔ dIp
			ε ↔ raise of fundamental frequency (H)

Hence working with substance-free primes does not mean that phonologists will need to talk about alphas, betas and gammas when they describe languages, figure out generalizations, publish articles, talk to each other etc. All this can (and should) be done using the familiar substantive vocabulary. Having substance-free primes just means that when people talk about phonology with substantive vocabulary it is taken for granted that this is shorthand for (5d), which at some point of the analysis will be fleshed out.

6. Conclusion

The classical Jakobsonian view (including its constructivist version discussed in section 4.3) as well as the direction taken by Hale et al. (section 4.2) is designed to bypass, or undo, the crucial property of the modular architecture: list-based translation of one vocabulary set into another. The Jakobsonian perspective is not modular in kind since there is only one set of vocabulary items, i.e. phonetically defined features that occur both in phonology and phonetics.

Hale et al.’s system on the other hand does comply with modular standards in the sense that there are two distinct domain-specific vocabulary sets, substance-free phonological primes and the phonetic categories associated. There is also a list-based conversion mechanism, but the items that are related and the associations relating them are the same in all languages. This is quite different from what we know of the interface with morpho-syntax: imagine a situation where past tense comes out as *-ed* in all languages or, say, 2nd person identifies as *-s* all over the world – and where these mappings are innate, i.e. genetically coded.

True, the two interfaces are different in that one relates an item of the cognitive system (phonology) with the extra-cognitive world (phonetics) while the other mediates between two skull-internal cognitive systems (phonology and morpho-syntax). But it may be doubted that this is reason enough to stall active and language-specific conversion. The alternative is a

uniform conversion mechanism for both interfaces, which associates different items of the two vocabulary sets in different languages. The ensuing language-specific dictionary is thus acquired during L1 acquisition and undergoes diachronic evolution.

Notes

* I wish to thank the organizers of the annual venue of the Phonological Society of Japan, the Phonological Forum 2018, as well as the audience at this conference, where an oral version of the article was presented.

¹ Like Carvalho and Klein's (1996) approach, Hulst's (1994, 1995, 1999) Radical CV Phonology also derives segmental identities (as well as syllable- and other higher structure) from two basic building blocks, C and V. Representing vowel- and consonanthood, C and V are substantive in kind, though: when occurring under the stricture node in Hulst's (1999:95) Feature Geometry, C defines stops, C_v fricatives, V_c sonorants and V vowels. The same goes for other nodes of the structure (defining laryngeal properties and place).

² A case of a "really crazy" phonology-phonetics association is reported in South-East British English ("posh girls") where /uu/ is pronounced [ii] (*boot* is [biit]), while gliding in external sandhi (*see [j] it*) shows that this [ii] is still underlyingly /uu/: it produces w, not yod: *do [w] it* is pronounced [dii] [w] *it* (Henton 1983; Harrington et al. 2008; Uffmann 2010; Hamann 2014).

³ The BiPhon model and Odden (2019) describe the modular workings in perception, i.e. when the auditory signal is progressively filtered down to phonologically relevant information.

⁴ The primes and their acoustic properties that are used under (5) are Elements and the specific elemental makeup is roughly that of Backley (2011). But recall that the type of primes and their phonetic correlate are irrelevant for the purpose of the discussion: the situation is the same with features.

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Beyond Markedness: Default Segmentism Revisited*

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ABSTRACT. In Optimality Theory, the standard explanation of default segments is that they are the least marked segments available, following universal markedness scales (Lombardi 2002, 2003; de Lacy 2006). This paper argues against this view and proposes an alternative analysis according to which faithfulness plays a crucial role: Default segments bear fewer features than other segments, thus violating feature faithfulness constraints minimally. This approach not only provides a better empirical fit, it also allows us to propose a unified analysis of default segment insertions and spreading-based insertion, which have to be treated as independent, unconnected processes in the standard markedness approach.

Keywords: epenthesis, consonants, vowels, markedness, faithfulness

1. Introduction

Default segments are fixed segments in a language that are used when the featural content of the segment is otherwise unspecified. They are thus primarily found in cases of epenthesis (insertion) and reduplication. The focus in this paper will be on cases of default epenthesis, which is commonly prosodically or phonotactically motivated. Consonants are inserted to avoid hiatus (vowel-vowel sequences) or to satisfy a crosslinguistically widespread requirement that syllables have onsets. Vowel epenthesis is often found to break up illicit consonant clusters or to satisfy a prohibition against syllable codas. While other types of epenthesis do exist (see, for example, Žygis 2010), they are outside the purview of this short article. Another point to note (and to which we will briefly return in §4) is that default segmentism is not the only option available in epenthesis. Feature spreading or copying is also possible. Glides such as [w, j] are frequent epenthetic consonants; they usually share properties with an adjacent vowel. For vowels, vowel harmony or vowel copy are also observed epenthesis strategies (e.g. Kitto and de Lacy 1999).

For an example of default segmentism in epenthesis, consider glottal stop epenthesis in German. German inserts a glottal stop as the default consonant (a) stem- and word-initially in otherwise onsetless syllables and (b) to break hiatus, under the condition that the second syllable is stressed (see the alternation in (c) where stress shift to the onsetless syllable (same stress pattern as in English *chaos–chaotic*) triggers epenthesis (see also Alber 2001; Wiese 1998)).

(1) Glottal stop epenthesis in German

a.	[ʔapfl]	‘apple’	[ʔø:l]	‘oil’
	[bə-ʔaxtn]	‘to pay attention to’	[ʔam-ʔa:tmən]	‘to breathe in’
b.	[teʔa:tə]	‘theatre’	[ʔoʔa:zə]	‘oasis’
c.	[ʔka:əs]	‘chaos’	[kaʔo:tɪʃ]	‘chaotic’

The question that is the main topic of this paper is: Why is [ʔ] inserted, of all consonants? This question becomes even more pressing when considering that [ʔ] is crosslinguistically a very common epenthetic consonant. In fact, the set of default segments found in the world’s languages seems to be rather small. Then why are some segments very common as default segments, while others are robustly unattested? This point has received renewed interest with the advent of Optimality Theory (OT; Prince and Smolensky 1993), which argues for a universal set of markedness constraints (and markedness hierarchies). So is default segment epenthesis the insertion of an unmarked segment? This point has been made and is widely accepted in the literature (Lombardi 2002, 2003; de Lacy 2006). The goal of this paper is to reevaluate this claim, and I will argue that while markedness does play a role in epenthesis,