

Declarative Phonology and Suppletion:
Non-stratal, non-derivational models of phonology
and morphological alternation

João Veloso
University of Porto, Portugal
jveloso@letras.up.pt

Abstract:

This draft aims at opening a discussion about the adequacy of non-stratal, non-derivational models of phonology, such as Declarative Phonology, to give appropriate accounts of any kind of phonological variation of morphemes. Refuting the assumption that all variants of one single morpheme correspond to a unique underlying form consecutively respecified through ordered adjustments of phonological shape, Declarative Phonology seems able to integrate explanations of both suppletive and non-suppletive alternation. A rough application of this model to suppletive alternation in Portuguese will be sketched out.

Keywords: Declarative Phonology; Suppletion; Morphology; - Phonology; Portuguese

Declarative Phonology and Suppletion:
Non-stratal, non-derivational models of phonology
and morphological alternation

1 – Introduction

In this paper, it is our aim to exemplify how a non-stratal, non-derivational model such as Declarative Phonology (Coleman 1995; 2014; Scobbie et al. 1996; Angoujard 2003; 2006) can offer acceptable formalisations of phono-morphological variation “oddities” such as suppletive alternation.

This is part of an ongoing project whose main purpose is to achieve an exhaustive description of the phonological and morphological organisation of the grammar of Portuguese on the basis of Declarative Phonology (henceforth: DPh).

In this paper, we will give a brief presentation of the basic tenets and assumptions of DPh, relating it to the non-stratal, non-derivational approaches of phonology (section 2). In section 3, we shall argue in favour of the adequacy of non-derivational approaches (hence, of DPh) to describe suppletive alternation. In section 4, we shall sketch out a brief example of how DPh can offer us an acceptable account of a particular set of suppletive verbs of Portuguese, the so-called “Crazy Verbs”. Finally, some concluding remarks and hints for future research will be summarised in section 5.

2 – Stratality and derivationalism. The place of Declarative Phonology in non-stratal, non-derivational phonological approaches

2.1 – The traditional approach of stratal, derivational phonology

Most “conservative” phonological models – such as the first formulations of Classical Lexical Phonology – are, by nature¹:

- *multistratal*, as they split phonological qualia into more than one level;
- *derivational*, in the sense that any phonological object is conceived of as the output of a previous input; thereupon, different phonological representations are seen as the same object which is sequentially rewritten – “respecified” – in a serial order of stages as the result of the mechanical application of categorical rules or processes that “reshape” A into A’, A’ into A’’, A’’ into A''' and so forth.

Indeed, multistratality has been a basic assumption since the foundation of modern phonology itself. The founding trubetzkoyan proposal of a strict border between phonetics and phonology (Trubetzkoy 1939) illustrates the fundamental acknowledgment of different levels of observation in phonological analysis. Multistratal views of the phonological organisation of grammars were subsequently continued by widely accepted phonological models such as the standard SPE model (Chomsky & Halle 1968) and the earlier fundamentals of Lexical Phonology (Kiparsky 1982; 1985) – the former through

¹ See Odden’s (2014, 4 ff., 7 ff.) discussion of the difference between rules and constraints for a broader framing of some of these issues.

the partition between Underlying *vs.* Surface Representations, the latter establishing a basic distinction between Lexical *vs.* Post-Lexical levels.

In tandem with multistratality, derivational models postulate that the phonological forms found in the consecutive phonological strata are ontologically the same object that is serially respecified in strictly ordered *representations* that differ in phonological specifications as the result of the application of mechanical procedures that reshape such representations, as in (1).

(1) Levels and Representations in Derivational Models

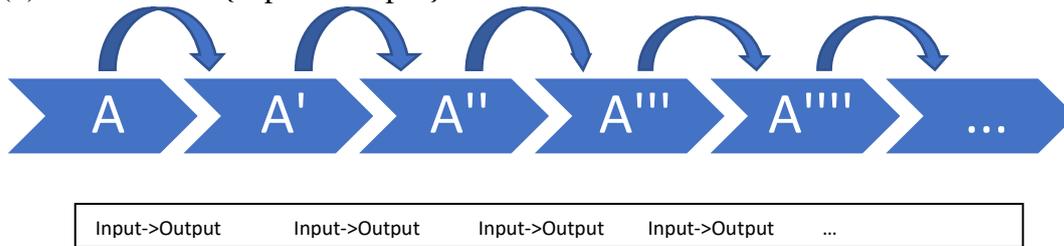
Level_{φ1}≡Representation_{φ1}→Level_{φ2}≡Representation_{φ2}→Level_{φ3}≡Representation_{φ3}→Level_{φ4}≡Representation_{φ4}→...

It should be borne in mind that, in this kind of approaches, Representation_{φ1} and, say, Representation_{φ4} (as in (1)) correspond to different “shapes” ((re)specifications) of **an object that is regarded as *ontologically the same* across the consecutive levels of respecification**. That is to say, they are different states (be it empirical or conjectural) of the same phonological reale – a phonological *primum* –, further phonologically reshaped into different qualia as far as phonetic/phonological substance is observed or hypothesised.

In other terms, derivational models assume, thus, a linear chain of {input→output} pairs, as in (2). In the figure, {A→A'}, {A'→A''} and the subsequent steps show this {input→output} relation: in {A→A'}, A is the input for A', whereas A' is the output of A *AND* the input of A'' (in {A'→A''}) and so on and so forth. On the whole, such {input→output} consecutive pairs are strictly ordered. What is more, as said above, importance has to be given to the assumption that, from an abstract perspective, A, A', A'', A''', ..., are *ontologically equated* (as different respecified instances of a unique,

theoretical A). That's why the ordered levels are labelled in this view as $A \rightarrow A' \rightarrow A'' \rightarrow A''' \rightarrow \dots$ instead of, say, $A \rightarrow B \rightarrow C \rightarrow D \rightarrow \dots$

(2) Derivational {Input→Output} chains



2.2 – An alternative view: non-stratal, non-derivational phonology

Underrepresented non-stratal, non-derivational (NSND) models offer us an alternative interpretation of phonological organisation. One major difference is that, contrarily to the basic assumptions summarised in section 2.1, NSND models do *not* postulate the existence of different levels to accommodate different phonological representations nor the existence of {input→output}-like chains. NSND models refute the presupposition that a phonological primum is consecutively respecified whilst its intrinsic essence is preserved across derivation chains such as found in (1) and (2) above.

Rather, different phonological forms of a single morpheme are viewed as items of phonological sets – that is, “*phonological clouds*”, as we shall propose later on – without any type of hierarchical relation between a phonological object X and a phonological object –X (where X stands for a set of phonetic/phonological properties). Consequently,

these models do not assume that an “underlying” representation is subject to any generative mechanism that gives birth to later subsequent representations. So, related phonological objects are not interpreted as serial inputs/outputs; instead, they are seen as coexistent forms grouped into “dispersion clouds”, i.e., sets of itemised objects that are linguistically single-levelled and mutually equivalent from a functional point of view, in spite of possible phonetic differences. Concomitantly, these equivalent items are strongly determined by formal distributional constraints, as we shall see below.

Declarative Phonology is chosen here as an example of an NSND model. Its roots can be traced to the 1970s’ models of *declarative* programming languages (Colmerauer 1978; Sebesta 2012, 728 ff.), like PROLOG (Colmerauer & Roussel 1996; Sebesta 2012, 734-736 ff.). Contrarily to *imperative* or *procedural* languages (Sebesta 2012, 22, 204 ff., 727 ff.) – which give instructions for computers to attain results following step-by-step fixed routines –, logic-based, declarative languages take into account large amounts of data in order to infer consistent generalisations from them.

Thus, when faced with different realisations of the same morpheme, DPh does not postulate an original primum from which all others are derived: its purpose is to gather attested equivalent forms into the aforementioned phonological clouds (into “sets”, according to the most widespread terminology among DPh authors – see, for example, Scobbie et al. 1996, 697). The different instances of one given morpheme are regarded as real *alternants* (\cong “conditioned options”), each of which is systematically related to well-identified grammatical (phonological/morphosyntactic) contexts.

For a better understanding of the main differences between both approaches, as far as this specific point is concerned, let us consider the well-known case of the different realisations of the noun plural morpheme in English. The examples of (3) show that this

morpheme can be phonetically produced either as [s] (examples in (3a)) or as [z] (examples in (3b)).

(3) The phonetic realisations of plural –s of English

(3a) Noun Plural = [s]	(3b) Noun Plural = [z]
<i>cups</i>	<i>mobs</i>
<i>tips</i>	<i>limbs</i>
<i>hats</i>	<i>hands</i>
<i>boats</i>	<i>floods</i>
<i>books</i>	<i>bags</i>
<i>leaks</i>	<i>frogs</i>

Derivational approaches would explain [s] and [z] as the surface realisations of a shared primum (the underlying representation, say, underspecified /S/), which “turns into” [s] or [z] as the by-product of a generative procedure categorically applied to such theoretical unit. The specification of the values of the phonetic feature [voiced] as a function of the same value in the preceding stop² is the main goal of a specific derivational procedure. Following the formalisms of standard phonological models, it is possible to extract such procedure by means of an SPE-like rule as in (4).

(4) A generative rule for the derivation of the alternant forms of English plural -s

$$\begin{array}{c} \text{C} \\ \left(\begin{array}{l} -\text{son} \\ +\text{cor} \\ +\text{ant} \\ +\text{CONT} \end{array} \right) \text{NounPlural} \end{array} \longrightarrow [\alpha\text{voiced}] / \begin{array}{c} \text{C} \\ \left(\begin{array}{l} -\text{son} \\ -\text{cont} \\ \alpha\text{voiced} \end{array} \right) [-]
 \end{array}$$

² For the sake of simplification, we are not taking into consideration here the cases of nouns whose singular forms show a final vowel, a final diphthong or a final non-stop consonant.

Quite differently, in DPh a possible formalisation of this variation could be the one which is shown in (5).

(5) A declarative-like formalisation of the different forms of plural –s in English

$$|\{\text{NounPlural}\} = \{[s]_{[1]} \vee [z]_{[2]}\} | \left\{ \begin{array}{l} [1] \text{ UnvoicedStop } \wp \text{ NounPlural} \\ [2] \text{ VoicedStop } \wp \text{ NounPlural} \end{array} \right\}$$

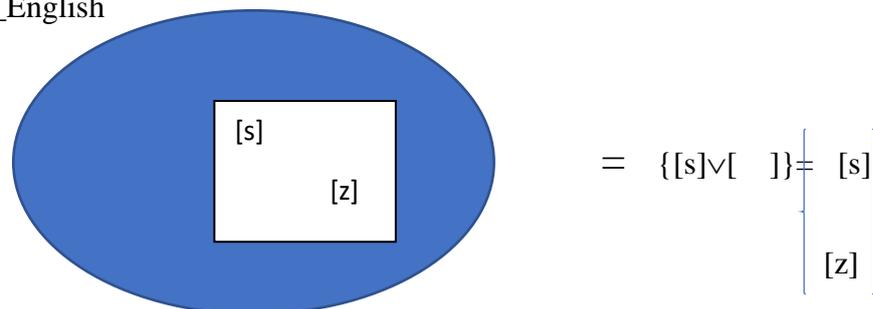
Whilst (4) must be read as “something like /S/ turns into [s] or [z] by means of the application of a rule, [s] and [z] being different qualia of a shared abstract /S/”, (5) just states (*declares*) that, in a given language (English, in this case), realisations of NounPlural can be either [s] or [z], none of which a prototype for the other or the result of something else that is generatively (re)specified as [s] or as [z]. In fact, within this framework, both [s] and [z] are single-levelled, grammatically equivalent alternatives for expressing NounPlural, systematically correlated to the contexts where [s] is found to the detriment of [z] and vice-versa (as indexed by [1] and [2] in (5)).

Then, NSND models like DPh do not pledge to the existence of any previous/prototypical/underlying abstract forms that work as inputs of subsequent outputs. Differently, NSND models aim at: (i) putting together attested linguistic forms (assumed as linguistically equivalent); and (ii) formalising exhaustive generalisations, displaying the linguistic contexts which prefer one form in detriment of the other(s). Together, these forms are to be accepted as items of a linguistic set, or, as we try to

illustrate in (6), as different points grouped into a cloud of linguistic forms (which is symbolised, in DPh formalisations, by means of the curly brackets found in (5), (6), (7), which must be read as the set of a number of linguistically equivalent objects).

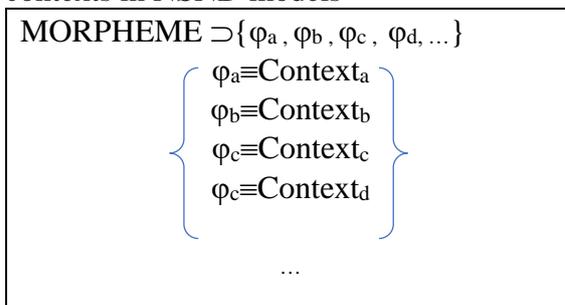
(6) Equivalent forms as “linguistic clouds”

NounPlural_English



Schemata like (6) are completed when each linguistic form of a cloud is systematically associated with the exhaustive identification of the contexts where it occurs. This can be achieved through logic-based formalisations like (7).

(7) Different forms of a given morpheme exhaustively associated with given linguistic contexts in NSND models



Notice that in DPh – whose conceptual roots should be traced, as said before, to the logic-based programming languages – formalisation plays a key role as the privileged way of giving exhaustive insights of linguistic data.

3 – Declarative Phonology and suppletive alternation

Suppletive alternation – i.e., the coexistence, for a given morpheme, of grammatically equivalent forms which are reciprocally opaque, in the same sense as “phonetically distant” (Bybee 1985), etymologically unrelated (Bauer 2004) and phonologically unmotivated – raises some problems within the framework of derivational models. As explained in the previous section and illustrated in (1), (2) and (4), these models assume that all alternants derive from a phonological primum which sees its phonological properties sequentially reshaped as minor (re)adjustments of limited subsets of phonological properties (as specially shown in (4)). In the cases such as the {[s]∨[z]} alternation of the English noun plural morpheme, derivational representations are acceptable, to a certain extent, as satisfactory accounts of the phonological dispersion of the morpheme: comparing [s] with [z], a blatant phonetic similarity between both (differing just in the voicing value) can be easily identified and related to the parameterisation of the same phonological property in the preceding consonant, rendering a phonologically-/phonetically-motivated explanation quite acceptable.

However, not all phonological variants of a phoneme present this kind of behaviour. Suppletive alternations like *go/went* in English make it very hard to postulate a common, shared, underlying phonological representation whose final phonetic/phonological shape is explained just by minor phonological readjustments.

NSND models, as seen above, make such {input→output} relations completely unneeded: for a complete phonological description of the language, a full inventory of the

attested forms of the same morpheme and an exhaustive list of their distributional behaviour are required, regardless (and needless) of the phonetic similarity of variants and not referring to the phonetic-phonological motivation/generation of the variation itself. One major descriptive advantage of NSND models, in our view, results from this possibility of unifying *all* kinds of phonological variants of morphemes without being strictly bound to phonetic or phonological constraints (which are unable to fully explain alternations such as *go/went* in English, for instance).

We assume, therefore, that the same type of generalisations can be reached, within this framework, both for non-suppletive alternations (as in (5)) and for suppletive alternations, as in (8). This fact illustrates the robustness of NSND models for the formalisation of morpho-phonological cloud-like dispersion of grammatically equivalent forms: (7) is appropriate to describe suppletive alternation, as in (8), *AND* non-suppletive alternation (as presented in (5)).

(8) A declarative formalisation of the *go/went* suppletion in English

$$|\text{VERB_}\{\text{Root_go-}\vee\text{Root_went}\}|\wedge \left\{ \begin{array}{l} \text{go-}_{\{\text{PresentTenses}\}} \\ \text{went-}_{\{\text{PastTenses}\}} \end{array} \right\}$$

4 – A declarative account of the Portuguese “Crazy Verbs”

In Portuguese, verb inflection determines complete homophony between Inflected Infinitive and Future Subjunctive forms. However, a limited set of verbs have heterophonous forms of the said tenses. What is more, in these verbs the root form that is found in Inflected Infinitive is regularly present in a well-defined subset of tenses, whereas the root form that is found in Future Subjunctive is present in another well-defined subset of tenses, too. Hence, such verbs can be described as comprehending two

different roots, easily identified in the non-homophonous forms of Inflected Infinitive and Future Subjunctive (say, Root 1 and Root2, respectively). Besides, the tenses that include Root1 *or* Root2 are exactly the same across all these verbs (see (9)). This is the reason why they are labelled as “Crazy Verbs” by Camara (1970, 111).

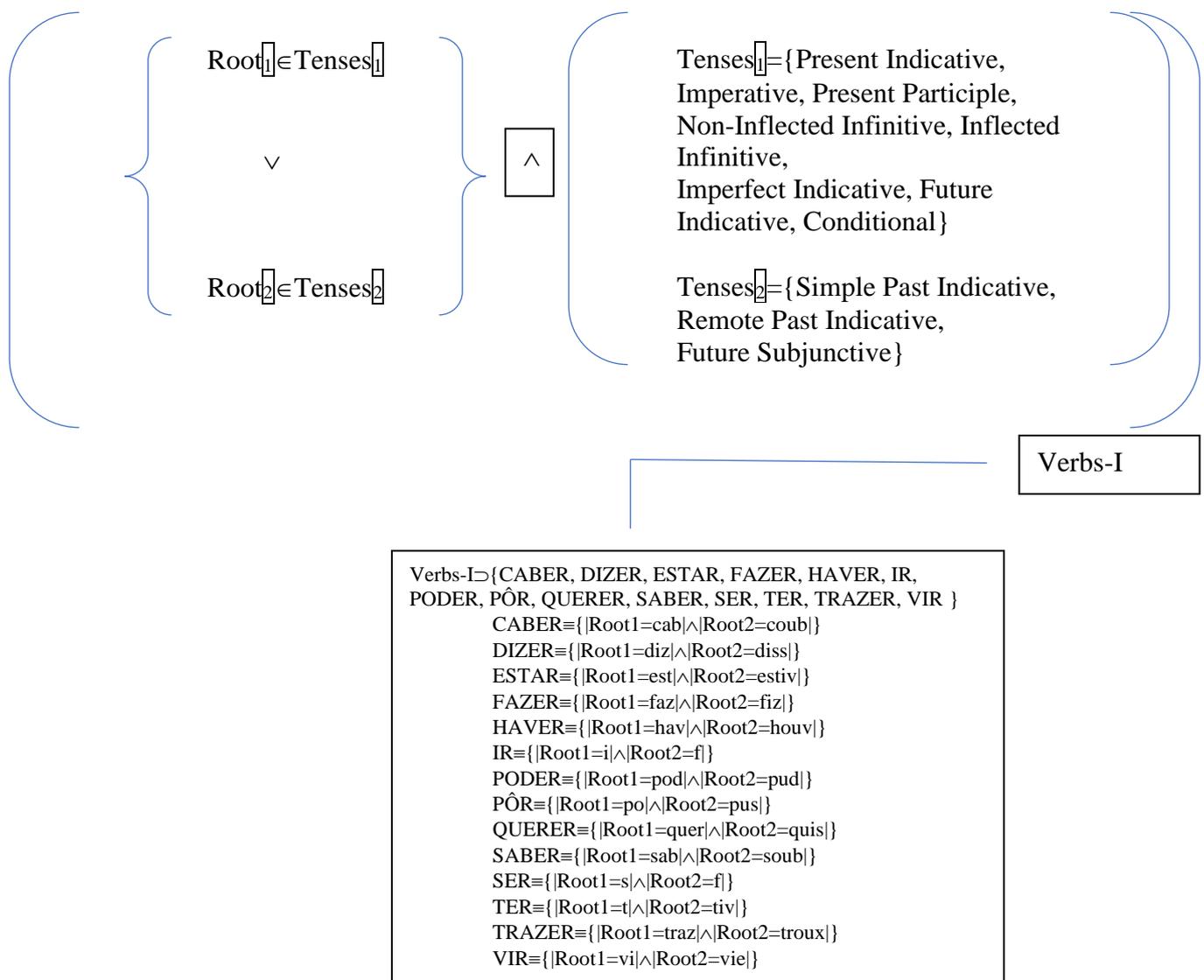
(9) The Crazy Verbs of Portuguese

VERB	Root1 Found in: <i>Present Indicative, Imperative, Present Participle, Non-Inflected Infinitive, Inflected Infinitive, Imperfect Indicative, Future Indicative, Conditional</i>	Root2 Found in: <i>Simple Past Indicative, Remote Past Indicative, Future Subjunctive</i>
<u>C</u> ABER ‘to fit’	cab-	coub-
<u>D</u> IZER ‘to say’	diz- ([dig-])	diss-
<u>E</u> STAR ‘to be’	est-	estiv-
<u>F</u> AZER ‘to do’	faz- ([faç-])	fiz-
<u>H</u> AVER [existential]	hav-	houv-
<u>I</u> R ‘to go’	i- ([v-])	f-
<u>P</u> ODER ‘can’	pod- ([poss-])	pud-
<u>P</u> ÔR ‘put’	por- [pON-]	pus-
<u>Q</u> UERER ‘to want’	quer- ([queir-])	quis-
<u>S</u> ABER ‘to know’	sab- ([s-])	soub-
<u>S</u> ER ‘to be’	s- ([é-])	f-
<u>T</u> ER ‘to have’	t- ([tEN-/tinh-])	tiv-
<u>T</u> RAZER ‘to bring’	traz- ([trag-])	troux-
<u>V</u> IR ‘to come’	vir- ([vEN-])	vie-

As suggested by the data shown in (9), most of these coexistent forms are phonetically highly unrelated (and unpredictable). By the other hand, though, they are systematically related to specific grammatical contexts (determined by Tense Inflection). A purely derivational single mechanism – or even a derivational rule for each verb –, taking into consideration phonological information only, is hardly attainable. In fact, for these verbs, in view of the lack of phonetic similarity between Roots 1 and 2, as well as because a clear phonetic/phonological motivation for the alternation is not immediately observed, this is quite difficult to postulate {input→output} relations similar to those assumed by phonologically based rules like (4).

On the contrary, a DPh-based formalisation such as proposed in (10) provides us with a descriptively satisfactory account of the form inventory inherent to this specific case of suppletion, including the formalisation of the stable relations between each form and the grammatical (morphosyntactic, inflectional) context which determines which form is attested in each case.

(10) A declarative formalisation of Root Suppletion of Portuguese Crazy Verbs



5 – Concluding Remarks

In this section, we try to summarise some final remarks about the main points that were dealt with in this exploratory study. Moreover, we shall outline a brief discussion of some aspects of our work that need further development.

The main concluding remark that could be drawn from this study is that DPh can offer an integrated view of phono-morphological variation, given the fact that DPh-based formalisations can apply quite adequately both to non-suppletive *and* to suppletive alternation.

DPh, as an NSND model, does not assume the need of (i) an abstract primum shared by all variants of the same morpheme or (ii) a set of generative procedures of successive respecifications of such primum. This allows a set of postulates which, irrespectively of the phonetic/phonological substance of morpheme realisations, makes it possible to explain opaque, phonetically distant, etymologically unrelated variants of the same morpheme as well as the cases of phonologically motivated variation.

As for the examples and formalisations given in this paper, we should make it clear that they do not intend to be fully finished analyses: as mentioned earlier, schemata like (4) and (5) do not take into consideration other contexts of variation for English Noun Plural. Similarly, the formalisation which is given in (10) for the Portuguese Crazy Verbs does not explain a sub-suppletion that is found, in Root1 forms, among some Present Tense inflected forms. Rather than proposing definitive formalisations, the main goals of our formalisations were to exemplify how a DPh-based description can be drawn and must be accepted as an acceptable account of morpho-phonological variation. Indeed, we acknowledge that the formalisations presented throughout this paper require further review and testing.

The preference of NSND models over multistratal, derivational approaches faces us with the need to relate NSND phonology, at a rather theoretical level, to important debates and issues that were not sufficiently considered in this paper, namely: (i) the debate between serial and parallel models in phonology (McCarthy 2000; Vaux 2008); (ii) the fundamental views of exemplarist models on the organisation and learning of phonology (Bybee 2001; 2002; Pierrehumbert 2002); and (iii) the central tenets of substance-free phonology (Reiss 2017). In fact, it is our intention, as a development of this work, to look deeper at the theoretical implications of NSND phonology in light of such recent proposals. In our view, early DPh assumptions – within its non-stratal, non-derivational orientation – seem compatible, at least partially, with (and can be somehow renewed and legitimised by) some central ideas found in the models we have just referred to. Indeed, DPh founding assumptions like (a) the acceptance of non-serial phonological organisation, (b) the focus on data occurrence and association, and (c) designing phonological explanations irrespectively of strict phonetic/phonological variables are interestingly echoed by recent work within exemplarist approaches and substance-free phonology. A thorough match-making between all these theoretical perspectives is assumed here as an important goal of the development of this work.

MAIN SYMBOLS

\rightarrow	Phonological derivation
\wp	Immediately precedes
\vee	Or (disjunction)
\wedge	And (conjunction)
\neg	Not (negation)
\equiv	Corresponds to (equivalence)
φ	Phonological level
\supset	Contains (superset)
$\{\}$	Set

References

- Angoujard, Jean-Pierre. 2003. Phonologie et diachronie [Phonology and Diachrony]. In J.-P. Angoujard and S. Wauquier-Gravelines (eds.) *Phonologie: Champs et perspectives*. Lyon: ENS Editions. 173-194.
- Angoujard, Jean-Pierre. 2006. *Phonologie déclarative [Declarative Phonology]*. Paris: CNRS.
- Bauer, Laurie. 2004. *A Glossary of Morphology*. Edinburgh: Edinburgh University Press.
- Bybee, Joan L. 1985. *Morphology. A Study of the Relation between Meaning and Form*. Amsterdam: John Benjamins.
- Bybee, Joan L. 2002. Word frequency and context of use in the lexical diffusion of phonetically conditioned sound change. *Language Variation and Change* 14. 261-290.
- Bybee, Joan. 2001. *Phonology and Language Use*. Cambridge: Cambridge University Press.
- Camara, Joaquim Mattoso. 1970. *Estrutura da Língua Portuguesa [Structure of the Portuguese Language]*. 19th ed. Petrópolis RJ: Vozes.
- Chomsky, Noam and Morris Halle. 1968. *The Sound Pattern of English*. New York: Harper & Row.
- Coleman, John S. 1995. Declarative Lexical Phonology. In J. Durand and F. Katamba (eds.) *Frontiers of Phonology: Primitives, Architectures and Derivations*. London: Longman. 333-382.
- Coleman, John. 2014. Phonology and computation. In J. A. Goldsmith et al. (eds.) *The Handbook of Phonological Theory*. 2nd ed. Cambridge: Wiley-Blackwell. 596-630.
- Colmerauer, Alain and Philippe Roussel. 1996. The birth of Prolog. In *History of programming languages-II*. New York NY: Association for Computing Machinery. 331-367.
- Colmerauer, Alain. 1978. Metamorphosis grammars, Natural Language Communication with Computers. In L. Bole (ed.) *Lecture Notes in Computer Science* 63. Berlin: Springer Verlag. 133-189.
- Kiparsky, Paul. 1982. From Cyclic to Lexical Phonology. In H. van der Hulst and N. Smith. (eds.) *The structure of phonological representations*. Dordrecht: Foris. I, 131-175.
- Kiparsky, Paul. 1985. Some Consequences of Lexical Phonology. *Phonology Yearbook* 2. 85-138.
- McCarthy, John J. 2000. Harmonic serialism and parallelism. *Proceedings of the North East Linguistics Society*. 40.
- Odden, David. 2014. Rules v. Constraints. In J. A. Goldsmith et al. (eds.) *The Handbook of Phonological Theory*. 2nd ed. Cambridge: Wiley-Blackwell. 1-39.
- Pierrehumbert, Janet. 2002. Word-specific phonetics. *Laboratory Phonology VII*. 101-139.
- Reiss, Charles. 2017. Substance Free Phonology. In S. J. Hannahs and A. R. K. Bosch (eds.) *Handbook of Phonological Theory*. London: Routledge. 425-452

- Scobbie, James M., John S. Coleman and Steven Bird. 1996. Key Aspects of Declarative Phonology. In J. Durand and B. Laks (eds.) *Current Trends in Phonology: Models and Methods*. Manchester: ESRI/University of Salford. II, 685-709.
- Sebesta, Robert W. 2012. *Concepts of Programming Language*. 10th ed. Boston: Pearson.
- Trubetzkoy, Nikolai S. 1939. *Grundzüge der Phonologie* [Principles of phonology]. Prague: Travaux du Cercle Linguistique de Prague.
- Vaux, Bert. 2008. Why the phonological component must be serial and rule-based. In B. Vaux and Andrew Nevins (eds) *Rules, Constraints and Phonological Phenomena*. Oxford: Oxford University Press. 20-60.