Structural representation of sounds in phonology

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1. Motivation

What we aim at is a theory of phonology that serves 2 criteria:

– as a theory about a cognitive capacity that deals with the representation of linguistic objects it should be as **abstract** and **minimal** as possible.

– as an interface between lexical representations, morphology and the physical realisation of sounds (perception/production) it should bare a certain **isomorphism** to what we can describe as **phonetic interpretation**.

Such a perspective strongly shapes the conditions on how a theory of phonology could be designed. In principle, the relevant formulations can be found in the outlines of Government Phonology (KLV85, KLV90, and especially Kaye 1995), the framework that this work builds upon, extending also on recent work by Markus Pöchtrager (2006, 2010, MP henceforth). What we will attempt here is to aim at a higher degree of both, abstractness and minimality. The second goal is tied to an empirically anchored question: how many sound systems is such a framework able to capture? Here, I want to emphasize the importance of a fine tuned generalizability of the model. Neither should it over-generate, nor should it leave certain sounds systems of particular languages un-representable. I will not comment on the notion of markedness, although it is also an issue not to be neglected.

2. Objectives

There are four objectives that comprise the core features of the proposed theory:

1. Sounds are not atomic segments, their representations are phonological structures and these **structures** receive a specific **interpretation**.
2. The set of melodic objects consists of only 2 elements **H**(igh) and **L**(ow).
3. **Headedness** plays a central role in the interpretation of these elements.
4. The constraints on structure as well as their interpretation crucially relies on **directionality**.

3. Historical background

For a moment, let us review the take-home messages from earlier theoretical work on phonology as a theory of sounds and sound systems. Paradigmatic shifts in science usually suggest that the whole perspective on a field has changed. But usually, there are certain traits taken over without much discussion, mostly because their content seems so obvious that they need not be highlighted within the new frame. But what if these assumptions are misleading?

3.1 Structural Phonology

Not very much to say, the method of lexical opposition remains as an empirical device. However, two assumptions are very problematic and seem to pertain with phonology until now:

- Sounds of a phonological system within a language constitute the minimal objects of linguistic representation. Peeking towards phonetics, these objects are often labeled and regarded as segments. (See also Pöchtrager 2012.)
- In order to determine classes of sounds, recurrence is made to phonetics, mainly to articulation (e.g., velar, palatal, labial etc.) In a structuralist view, these features do not define the content of a phoneme per se. Phonemes are still seen principally in contrast to other phonemes (which prohibits a universal conception of phonological representations of sounds).

A more straightforward view on phonetics, particularly acoustic phonetics (we are talking about sound, aren't we?) already undermines these two points:

- Certain sounds consist of more than one acoustic event: plosives for instance have at least three phases: closure/pause, burst, and a release phase that may or may not pass over to a vocalic part of the signal. See Fant (1964, 1974) for a precise analysis of (acoustic) phonetic segments, which definitly do not coincide with phonemes, using that historical term for phonological objects.
- Certain articulatory features do have a systematic correspondent in the acoustic signal (i.e., the position of tongue and the shape of lips viz. the position and distance of formants in vocalic sounds), others refer more to the systematic nature of sound systems (e.g., sonorant, continuant) while a third class just refers to phonological properties not of the sounds themselves (e.g., syllabic, long vs. short). This casts some doubt on the general applicability of such descriptive notions to phonological objects, given that we want to conceive them as cognitive entities.

3.2 SPE

The deception of the century: instead of looking behind the above mentioned notions, SPE merged them into one system: the segment was taken for granted, and a vast set of features (mainly articulatory) is determining its content.

Thinking in matrices may have inveigled to such a move. GP has always argued against features and offered an alternative in terms of autosegmentally inspired elements as melodic primitives that make up sounds.

Gunnar Fant, who as a phonetician has worked together with Jacobson and Halle on the concept of distinctive features, was rather explicit about the difficulties arising from different perspectives, meaning phonetics and phonology:

The speech wave is not a very good image of our abstract notion of speech as a sequence of discrete invariable units selected from a finite inventory. What we can see in the spectrogram is a mixture of continuous and discrete events. (Fant 1974: 223). *In general, one phoneme or one speech sound is encoded in the structure of several successive sound segments. Conversely, any sound segment generally contains information on the identity of several successive phonemes or speech sounds.* (Fant 1964: 223).

Regarding distinctive features, he remarks that *[t]he concept of distinctive features is a powerful tool in speech analysis. It is more economical to study how minimally contrasting pairs of utterances differ phonetically and to search for rules expressing such differences in all possible contrasting pairs where the feature operates than to attempt to describe each contextual variant of a phoneme by a set of absolute descriptors. However, the definition of features may vary according to the particular interest and background of the investigator.* (Fant 1974: 235)

3.3 Autosegmental Phonology

J. Goldsmith in his seminal dissertation (1976) elaborated and popularized the view of autosegmental tone that was developed earlier (?) by E. Williams (1971, but published at the same time as Goldsmith's dissertation).

Regarding tone, which in structuralist terms can be taken to constitute a distinctive property of 'phonological segments', the question is how and where tone should be placed in phonology (in particular phonological structure). It could be shown that it only makes sense to assume tone as objects (H and L) independent from phonological segments (whatever that should be –worst case scenario: phonemes) that can be attached to different positions.

Williams (1976: 483) states that *it has been argued that in the deepest representation, tones are not associated with segments or with syllables, but rather with morphemes. […] A rule, Tone Mapping, was proposed to relate the underlying string of tones of a phrase to its segmental (or syllabic) structure.*

Segments vs. autosegments – quotes from Goldsmith:

Autosegmental phonology is a particular claim, then, about the geometry of phonetic representations; it suggests that the phonetic representation is composed of a set of several simultaneous sequences of these segments, with certain *elementary constraints on how the various levels of sequences can be interrelated – or, as we shall say, "associated".* (Goldsmith 1976:28)

Features by themselves do not spread; they merely identify a segment for what it is. The domain of association of an "autosegment", on the other hand, does spread, quite automatically. (Goldsmith 1976:22)

Notice that the mere existence of autosegments undermines the concept of phonemes as minimal units of phonology.

3.4 Radical CV Phonology

In a series of papers, Harry van der Hulst (see 1994, 2000, as representative examples) has explored the idea to reduce the number of features encoding melody to two: C and V. Structural configurations determine the interpretation of these objects. The fundamental difference to various conceptions of GP, including this one, is that these structures are not phonological structures per se, but configurations expressing the geometry of features. Also, C and V are not taken as elements with an independent interpretations, but rather represent binary values in specific locations of the feature geometry.

3.5 Government Phonology

The two foundational papers of GP (KLV 1985, KLV 1989/90) took the autosegmental idea one step further and suggest that:

- all phonological objects are made up of <u>elements</u> that have autosegmental properties, i.e., they are privative (against features), primitive (meaning that they are not de-composable) and interpretable.
- melodic material (elements) is associated to phonological structure via the skeleton.

3.5.1 Elements for vowels: I, U and A

In KLV 1985, 3 elements are proposed for representing vowels. They can be combined in an asymmetric relation, where one element is the head and the others have the status as an operator. Melodic expressions (ME) may be operator-less and head-less (Kaye 2000, which I take to optimally represent Standard Government Phonology, SGP henceforth). For vowels, this seems to work fine, licensing constraints regulate the setup of individual inventories:[1] some (partially made-up) examples:

- all expressions are headed, elements may not combine: only <u>I</u>, <u>U</u> and <u>A</u> possible, representing [i], [u], and [a] (3 vowel system)

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[1] Conventions for SGP representations: heads are underlined and are separated from operators to the right by a dot. Empty heads are indicated by underscore: '_'

– all expressions are headed, I and U may not combine, I and U must be heads:
  A [a], I.A [e], I [i], U.A [o], U [u] (5 vowel system)

– I and U may not combine, no element can license the other:
  A -> [a], _.IA -> [ɛ], I -> [i], _.UA -> [ɔ], U -> [u] (a different 5 vowel system)

Nice side-effect: it does not make any difference if an element is associated to one position once and for all, if it spreads onto other positions (i.e. vowel harmony) or if it 'appears' only in certain constellations ('floating' elements) – it is always the same element that contributes to the ME of a certain position.

3.5.2 Elements for consonants (onsets): a controversy

The earliest attempt to transfer the element-theory based thinking of autosegmentally conceived elements to consonants stems back to KLV 1989/90: very tentative, still based on charm theory, only $H^{(-)}$ ('stiff vocal chords) and $L^{(-)}$ (slack vocal chords) are found to distinguish aspirated and voiced onsets from neutral ones.

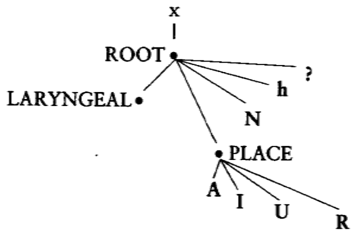
Perhaps the first comprehensive account for consonants within a GP framework was given in Harris (1994). The three elements A, I and U (in vowels), and H and L (for source contrasts) were not sufficient to represent consonants, specifically 'manner' and 'coronal/velar place' for consonants were missing, so he came up with a bunch of new elements:

(1)	a.	from KLV 1989/90:	b.	introduced by Harris 1994:	
		A		ʔ	'stop'
		I		h	'noise'
		U		N	'nasal'
		H		@	'velar' / neutral
		L		R	'coronal'

These are quite many, and Harris had to import a bunch of constraints from feature geometry in order to prohibit over-generalisation: elements are assigned to different nodes (in a sub-phonological) structure: ROOT (ʔ, h, N), PLACE (A, I, U, R), LARYNGEAL (H, L). These nodes resemble tiers, and can be shared between different positions of phonological structure. Although solving the immediate problem, such a setup suffers from rendering the theory a hybrid concept, and the large number of elements suggests that there must be a flaw in the overall design.

(2) a. geometry of nodes b. node sharing: homorganic /nt/

(49)



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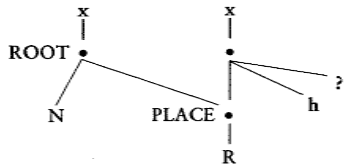


Harris (1994: 129f)

Various attempts have been undertaken to reduce the number of elements in a reasonable way. In SGP one finds the most minimal set, comprising the most intuitive merges of elements, that can account for most common sounds. To get any further, some other devices were needed to which I will turn now.

3.5.3 Trading elements for structure: Pöchtrager (2006)

What is of particular interest in MP's account are layered structures that express what has been traditionally encoded with the elements ʔ and H as part of an ME. His radically reduced set of elements consists of only 4 elements. Notice that it is deliberately asymmetric with the exclusion of H, while including L.

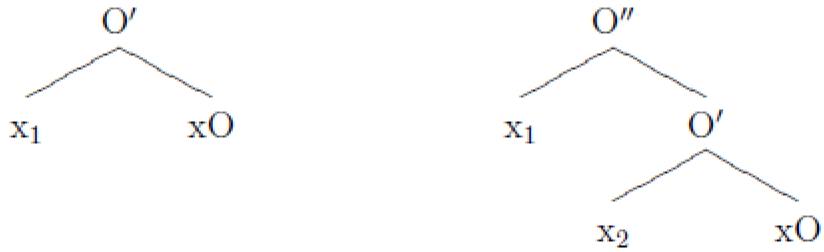
(3) MP (2006: 62)

(7) **The new set of elements E**
$E = \{\mathbf{A}, \mathbf{I}, \mathbf{U}, \mathbf{L}\}$

Concerning structure, MP discerns 3 types of terminal nodes: x, xO and xN, the latter two being heads of onsets and nuclei, respectively. Other nodes are simply projections of heads, hence labelled just O and N where levels of projection are discerned by bar notation. A terminal node can be annotated for categorial information (O or N) and also for melodic information (melodic elements A, I, U, L)

(4) MP (2006: 63)

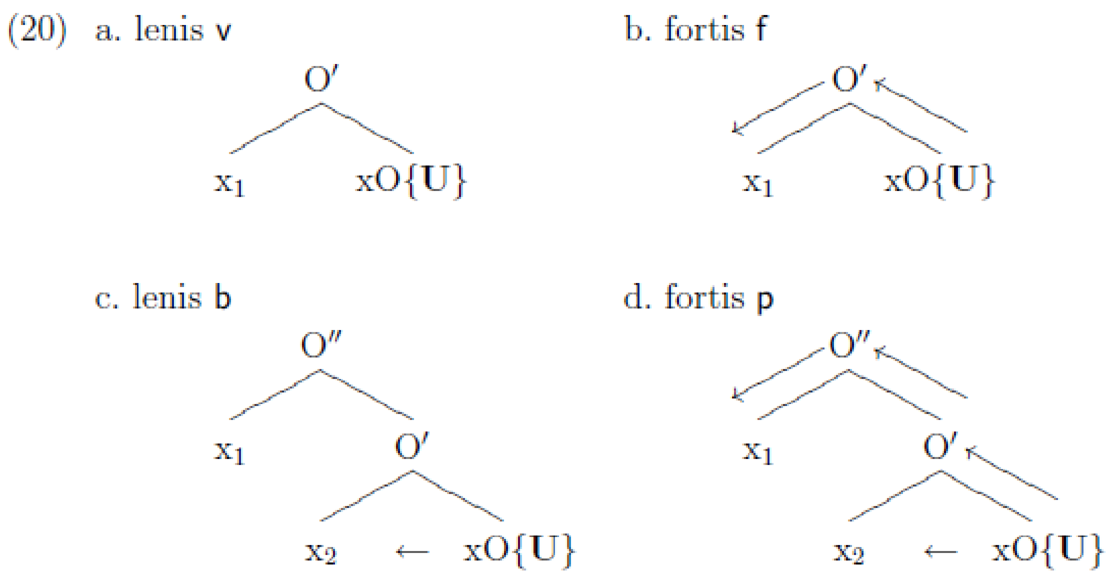
(8) a. fricatives (preliminary) b. stops (preliminary)



Note that heads and immediate projections always take their complements to the left, therefore both complements are on the same side with respect to the head.

The second function of the abandoned H element, to encode source contrast, cannot be reflected by structure itself, so MP assumes that a structural relation takes over this function, in particular m-command (melodic command), which is a binary relationship between a head and a non-head terminal that implies that the m-commandee receives the same interpretation as the m-commander. This relation is encoded by the arrows that follow the projection lines. To motivate this further, MP proposes that every un-annotated terminal (heads are always annotated) has to be licensed by m-command, or – for terminals that are not daughters of maximal projections (i.e., x_2 in MP's (20c,d)) – by control (horizontal arrows.

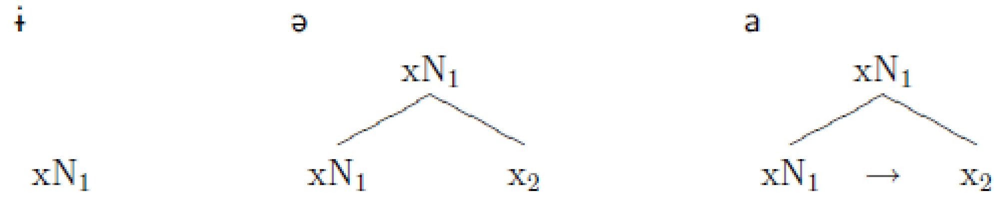
(5) MP (2006: 72)



Of course, this brief summary does not reflect the full scope of MP (2006). What is really striking is that a categorial distinction (lenis/fortis) is encoded by a structural relation, m-command, that may be 'on' or 'off', yielding fortis [f, p] or lenis [v, d], and that two different relations are needed for the same function (licensing of un-annotated terminals).

Regarding the set of elements, MP went one step further and proposed (2010) that the element A should also be replaced by a structural configuration, a head adjunction involving control. Regarding vowels, an empty (un-annotated) nucleus head would be interpreted as a central schwa, an adjunction structure without control as an e-schwa and with control as a full vowel (or perhaps a-schwa as well).

(6) Pöchtrager (2010, handout: ex. 30d)



Again, we find a structural relation where the presence or absence of this relation determines the phonetic interpretation.

4. Representing sounds with structure and melody

In Neubarth and Rennison (2005), we proposed a property with two values that can be applied to the elements needed in the then proposed system: ‘up’ and ‘down’. H and I would be ‘up’, while L and U would be ‘down’, A comprises both values. This in itself is not very meaningful, but what if we dispense with this property and just take the message seriously: there are only two elements, H and L (taken over from the representation of tones that lead to the autosegmental turn), whereas A is indeed structural. H and I are merged into H, likewise L and U into L.

(7) Melody: there are 2 elements **H**(igh) and **L**(ow)

These elements are interpreted according to their position in structure. First of all, we have to define what structures are possible. Two notions play a central role: headedness and directionality.

4.1 Phonological structures

Each structure consists of a head that may project and that can take a complement to its left (cf. Right-Hand-Head Rule, but with the exception of A-structures, see below). Further extensions are always to the right (cf. Anti-Symmetry, which actually guarantees some sort of symmetry within one constituent.)

Phonological structure has three levels:

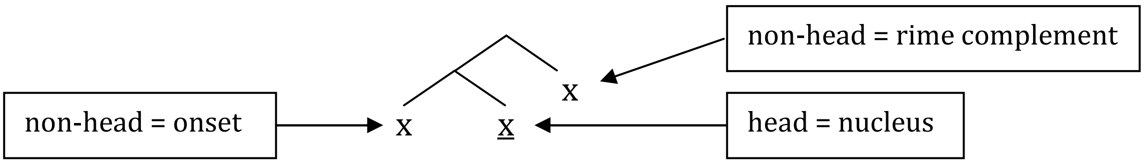
– <u>constituent structure</u>: onsets, nuclei, post-nuclear rime complement

– <u>melodic structure</u>: the structure of an onset or nucleus

– <u>A-structure</u>: structural representation of the A-element of SGP

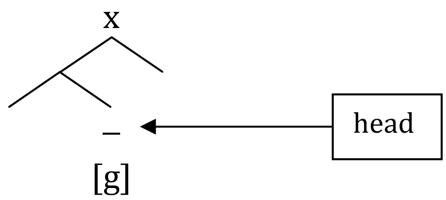
The labels ‘onset’, ‘nucleus’, as well as the traditional terms ‘consonant’ and ‘vowel’ can now be derived as structural configurations within constituent structure. Vowels/nuclei are in head-position, all other positions will be interpreted as consonants/onsets (or as a rime complement). As graphical conventions, heads are always underlined, maximal projections are not indicated. The terminal nodes of constituent structure are indicated by an ‘x’, in order to graphically discern constituent structure from melodic structure. That does not mean that they would constitute the skeleton of SGP, which is obsolete now: association of melodic elements H and L is mediated through melodic structure.

(8)



Melodic structure has exactly the same form. The only difference is that while we may conject that constituent structure always has at least a head and a complement (reflecting the existence of onset and nucleus), melodic structure can consist of only one head without complement or further extensions. A fully extended, simple onset would have the following structure (its interpretation would be a velar stop).

(9)



Notice that ‘onset’ and ‘nucleus’ are derived categories here. They have no theoretical status as special labels, whereas the terms ‘consonant’ and ‘vowel’ are mere descriptive notions, on a par with ‘nasal’, ‘aspirated’ or ‘labial’.

What is still missing is a characterisation of the A- structure. The notion is taken from MP (2010), but the definition is embedded within a different conception of structure. In particular, this is the first time where linearity comes into play:

(10) A-structure:

A structure with a complement (immediate sister) to the right, where
– the complement bears no elements or
– the head of that structure is not the head of the constituent
forms a sub-structure on its own and receives an interpretation akin to the A-element of SGP.

The formulation in (10) guarantees that structures will always have an unambiguous interpretation. Only if the conditions are met (complement to the right, empty complement or non-head position), the element-like interpretation obtains, otherwise, the configuration has to be interpreted as a regular melodic structure of a particular constituent. Consider the following structure, this time in a head constituent, resulting in the interpretation of an [a]. As graphical convention, the node above the A-structure will be marked with a short line if it is the melodic head position of the constituent.

(11)

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            x̲   ←——  head of constituent
           / \
          _      ←——  head of A-/melodic structure
           [a]
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Elements may reside in any position of melodic structure. Notice that there are only two cases of melodic structures, where an A-structure has to be identified by marking the head at a particular node, the example in (10) being one of them (see ex. 14 below, the other case involves the difference between /s/ and /l/). In all other structures, it falls our from the possibilities how to build structures, if a particular part of the structure has to be tagged as an A-structure, or if it is part of the melodic structure of the constituent. That structures are unambiguous is an important requirement, since structure explicitly determines interpretation.

4.2 Non-head constituents (consonants)

We are now in the position to talk about the interpretation of structures and elements residing in particular positions within these structures. Let us start with non-head constituents and the simplest configurations:

(12)	a.		b.		c.	
		x		x		x
		_		H̲		L̲
		[ʔ]		[j]		[w]

An empty onset position may receive an interpretation as a glottal stop (which undermines the common belief that this would phonologically be a ‘plosive’ sound). Elements H and L in head position receive an interpretation as an i- or u-glide. I assume that elements in head position always encode ‘place’, whereas in non-head position they may adopt different interpretations.

(13) Interpretation of elements:

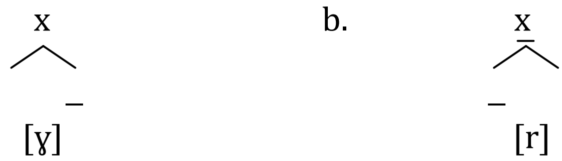
i. Elements in head position encode ‘place’, primary interpretations are:
   - the default interpretation of an empty head is ‘velar’
   - L is interpreted as ‘labial’
   - H is interpreted as ‘palatal’
   - an A-structure is interpreted as ‘coronal’

ii. Elements in non-head position encode ‘manner’ (fricative, nasal) or ‘source’ (aspirated, voiced) in non-head structures (onsets), ATR and nasality in head structures (nuclei).

iii. Regarding the interpretation of elements, the immediate complement to the right of the head of an A-structure inherits ‘headedness status’ from the constituent (onset –> non-head, nucleus –> head).

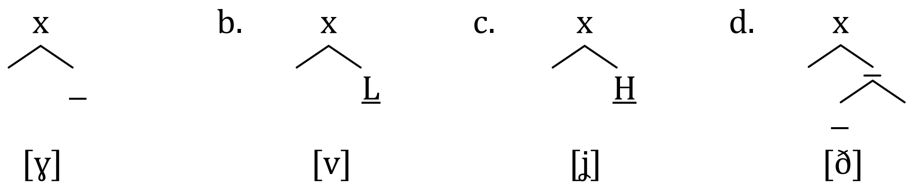
Extending the structure by one layer results either in a configuration of a head with its canonical complement to the left, or an A-structure. The former will be interpreted as a velar spirant, the latter receives an interpretation as an r-type liquid.

(14) a. b.



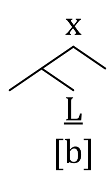
As for spirants, elements in the head positions yield different interpretations regarding ‘place’, an A-structure here behaves like an element:

(15) a. b. c. d.



Adding one more layer on top (head, complement to the left plus one complement to the right) yields plosives. Plosives acoustically as well as in articulation have a complex make-up: in order to form a plosive, one has to form a closure that has to be complete in order to release it with a burst. In terms of accoustics, there is a phase of silence and a burst. If we want to translate these physical facts into structure, it is immediately clear that the structure must contain a head (of course) and two positions that reflect closure and release, and also that these two positions must be on differents sides of the head. Remember that the head bears information about the place of articulation, meaning that it represents the location of the occlusion. Consider the representation of a labial plosive:

(16)



What about elements in non-head positions? I assume that there is a difference whether these primes occur to the left or to the right of the head, and also that there is a difference which element is found where:

(17) Interpretation of elements in non-head position:

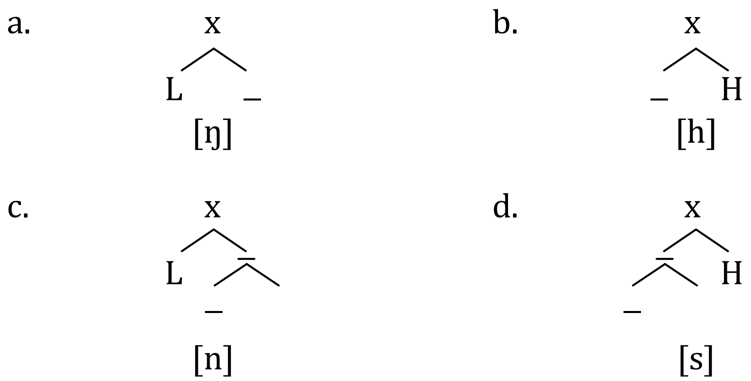
i. to the left of the head (complement):

– H is interpreted as aspiration (source contrast)
– L is interpreted as (pre-)nasal.

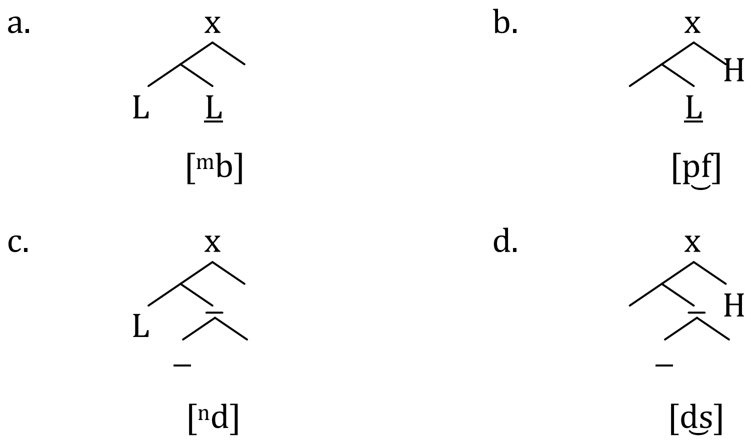
ii. to the right of the head:

– H is interpreted as fricative (or affricate)
– L is interpreted as voicing (source contrast).

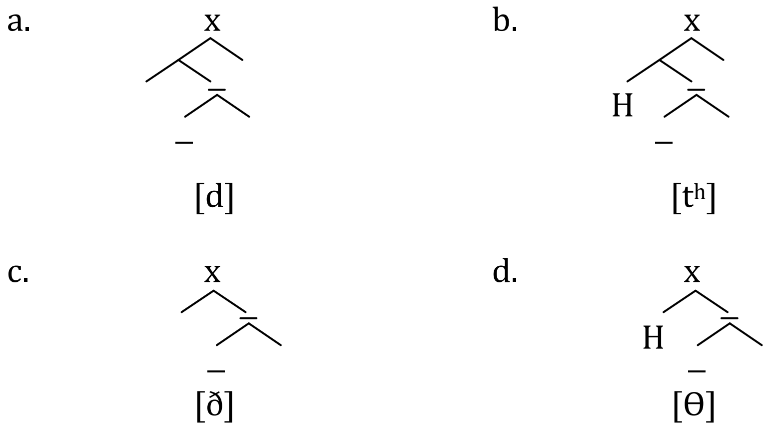
Consider the following examples:

(18)


An L element in the complement to the left of the head will always yield an interpretation as a nasal. Conversely, a H element to the right of the head leads to an interpretation of a fricative ([h], [f], [s], [ʃ]). (Notice that this configuration, even though the head is to the right of the complement, cannot be an A-structure since the head is the head of the entire melodic structure and the complement is filled with an element.) Within a two-layered structure, L to the left and H to the right result in complex sounds: pre-nasalised stops and affricates. Clearly, these must be homorganic, since there is only one head determining place.

(19)


On the reverse (linear) order – H to the left and L to the right of the head, these elements express source contrast, nothing new has to be said about that. Let me just comment on the directionality: it may strike as unintuitive that H, often phonetically manifest as aspiration (after the release or affricate), should be encoded in a position to the left of the head. However, one can conceive the phonetic correlation as follows: in order to produce aspiration, one has to have a stronger phase of closure (before the burst) in order to build up more pulmonic pressure. This is expressed by the H element to the left of the head. Additionally, one might expect to find a longer phase of silence in the acoustic signal. And it also was this particular position (the highest to the left of the head) that MP took for regulating a fortis/lenis contrast, in his terms by virtue of m-command [+ON], here with an H element residing in the relevant position.[2] At this point, let us include the A-structure in our inventory, such we can show the effect of source contrast with spirants, plosives and affricates:

(20)


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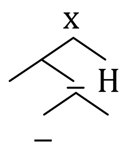
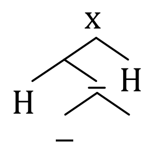
2 MP uses the representations in (5) to explain the contrast between long and short vowels followed by a lenis or fortis consonant in English. (E.g., *bead, beat, bid, bit*. See also Odden 2011 for a discussion – unfortunately not mentioning MP's analysis or data). This effect disappears when the last onset is followed by a phonetically realised vowel (E.g., *lady, Libby*). In his terms, every position has either to be annotated (filled by an element) or licensed by control or command. Having the higher complement of the last lenis onset not m-commanded by the head of the onset structure calls for command from outside. In case there is no following nucleus, the preceding nucleus can capture this position by m-command, thus becoming a bit longer itself. If a vowel follows, it will be structurally closer and exact m-command on the relevant position within the onset. In the proposed system, such a reasoning cannot apply, since there is no notion of command whatsoever. Also, I find it problematic to assume that phonological structures should be embedded into each other. Most problematic for me is the idea that a following nucleus (possibly arising from a morphological process) should be inserted between the hosting projection of the first nucleus and the following onset, tampering with hierarchical relations.

However, one can do without: an onset without following nucleus will form a prosodic unit with the preceding nucleus. If the (left) complement of that onset is filled by H, this position contributes to the length of the onset. Assuming that structurally identical prosodic units will be assigned a similar amount of time in speech, the onset without H will proportionally leave more space (or time) to the preceding nucleus than an onset with a filled complement. The circumstance that this effect disappears when the onset forms a new prosodic domain (with a following nucleus) is rather straightforward. Not so easy to capture is MP's analysis of three-way length contrasts in Estonian onsets and nuclei, which is far more complex and goes beyond the scope of this talk.

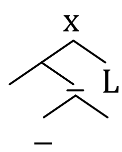
e. 

[d͡s]

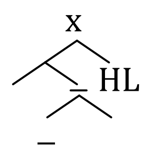
f. 

[t͡s^h]

Likewise an L-element to the right of the head encodes voicedness. Again, one is inclined to think of voicedness as a phonetic property that is most manifest on the left periphery of a speech segment, but this does not necessarily bear on the phonological representation. Crucially, there are no phonologically 'voiced' spirants or nasals, since they lack a position to the right by definition. On the other hand, it is straightforward to have truly 'voiced' fricatives/affricates.

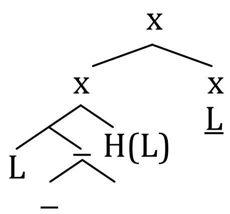
(21) a. 

[d̬]

b. 

[d͡z]

And finally, if we allow for adjunction of maximal structures (with their own domain and head under certain preliminaries), we may arrive at very simple representations of rather complex sounds. Take as an example [^{n}d͡z^w] – a labialised, prenasalised, coronal affricate:

(22) a. 

[^{n}d͡z^w]

What about liquids? It is quite uncontroversial to assume that they involve an A-structure. It can be shown that both liquids /r/ and /l/ in some languages have properties that indicate either the presence of an H or L element encoding place. Such facts suggest that neither of these elements contributes to the manner distinction between /r/ and /l/ and that they, if present, are indeed different place specifications.

(23) a. /r/ has $\underline{\text{H}}$:

ich-ach-Laut alternations ([ç] vs. [x]) in Standard German are triggered by the presence of front vowels (with H of course) and sonorants (/l/, /r/, /n/), which in turn have to be analysed to contain $\underline{\text{H}}$ within an A-structure. Interestingly, this effect disappears when the liquid /r/ is vocalised in Bavarian dialects (cf. Hildenbrandt 2013).

b. /r/ has L:

In Mandarin Chinese /r/ is retroflex and patterns with the palato-alveolar series of sibilants/affricates with respect to the 'neutral' vowel that articulatorily has only phonation but involves no change in place (both, with *shi* and *ri*, the vowel is a retroflex, central schwa).

Sibilants/affricates in Mandarin have three series: palatal, alveolar and palato-alveolar. Palatals are clearly associated with a H-element in head position. Therefore, it is quite plausible to associate palato-alveolars with the presence of L in the head of an A-structure. Phonetically, palato-alveolar sibilants are tentatively retroflex, the liquid /r/ is definitely retroflex and this property has been attributed to the combination of an U and an A element in SGP, which translates to an L element in the head of an A-structure. (Note that palato-alveolar fricatives can also be the result of a H element within an A-structure, which obviously is the case in palatalisation of velar stops, resulting very often in /ʃ/ or /ʒ/.)

(24) a. /l/ has H:

/l/-vocalisation in Bavarian dialects leaves in i-glide (e.g. [duɪpm̩] 'Tulpe' *tulip*), also in Spanish.

b. /l/ has L:

/l/-vocalisation in Slavic languages and Brazilian Portuguese results in a rounded vowel ([o], or [u]). /l/-vocalisation in many Bavarian Dialects spreads roundedness on the preceding vowel (e.g., [fyː] 'viel' *much*).

The proposal then is that /r/ is a simple A-structure. The lateral liquid is more complex, I adopt MP's analysis here and assume that /l/ involves an A-structure in non-head position, but contrary to MP I assume that /l/ forms only a 1-layered structure and keep 2-layered structures strictly reserved for plosives. This also has the advantage of allowing for fortis laterals (parallel to spirants), while elements occurring in head position do not contribute to the manner specification of the resulting sounds:

(25) a.

x

{_/H/L}

[r/ɹ/ɻ]

b.

x

_ {_/H/L}

[l/ɭ/ʎ]

4.3 Head constituents (vowels)

Surprisingly, the representation of vowels is less straightforward than one would expect. Simple vowels can be represented along the lines of SGP. What complicates matters that many languages employ diphthong (or even triphthong) structures. Another important question is how ATR is represented: it is involved in harmony processes, and also it sometimes correlates with length (e.g., Standard German).

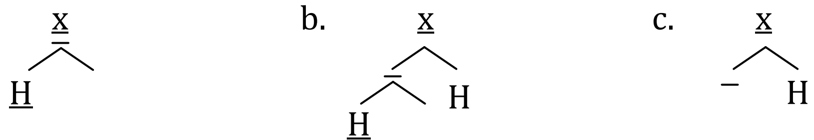
In the literature there are a few references to a connection of ATR to the properties of the SGP I element:

For example, there is a "tenseness" harmony in Igbo. Adopting the feature "Advanced Tongue Root" (ATR), this harmony system, we may say, insures that all vowels within a certain domain of the Igbo word agree in the value they sustain for the feature "ATR". There are four vowels marked +ATR: i, e, u, and o; and four marked –ATR: i, a, u, and o (these correspond to the more traditional "tense" and "lax" groups, respectively). […] We noted above, in Chapter Two, that the prefix /a/ that marks II Incomplete form will appear as /e/ if the verb stem to which it is attached begins with a tense (=+ATR) vowel. (Goldsmith 1976:252f)

While nasality has always been associated with an element, ATR in the beginning of GP was an element in its own right (barred I), later on it was taken to be a configurational property of MEs (headedness, cf. Charette & Göksel 1996). Since MEs as agglomerations of elements are abandoned in favour of structure, but associated headedness with the encoding of 'place', this second option is not viable here. Nevertheless, as demonstrated in SGP, it was very useful to use headedness in order to explain the 3 way contrast of mid vowels found in many languages.

Let us start with this contrast: In Viennese dialect, the differentiation between tense and lax front vowels [e] vs. [ɛ] is partially retained (e.g., [betn̩] 'Betten' *beds* vs. [bɛtn̩] 'beten' *pray*), whereas a difference between tense and lax labial vowels is systematic due to the rounding of regular /a/ (e.g., [ofːn̩] 'offen' *open* vs. [ɔfːn̩] 'Affen' *monkeys*). My proposal is that headedness indeed plays a role, but only in the sense that it applies to A-structures. ATR on the other hand is encoded by H in non-head position to the right of the head. Consider the following representations:

(26) a. b. c.

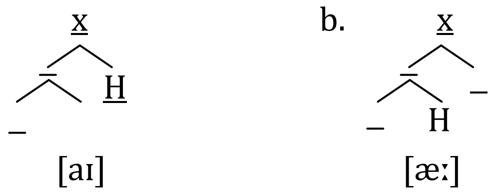


[ɛ] [e] [æ]

A H-element to the right of the A-structure, which has head status anyway, indicates ATR, the correlation with length (at least in German) falls out quite nicely under such an account. Example (26c) is more intricate. Recall that the complement of an A-structure inherits the head status from the constituent, hence we get ‘head status’, because the constituent is a nucleus. Therefore the H element can be interpreted as place, but not as the head of the A-structure. This way we receive an interpretation as a low front vowel (i.e. [æ]).

In Viennese dialect, low vowels (i.e., [æ], [ɒ], [œ]) arise as monophthongized counterparts to diphthongs in Standard German. The diphthong [aɪ] in (27a) has an A-structure in non-head position where the head of the whole melodic structure is H, representing the second part of the diphthong. The monophthong retains the structural configuration, but has the H element in a different position.

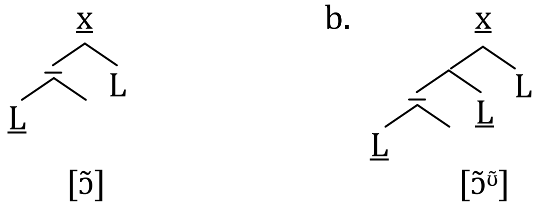
(27) a. b.



One question remains to be answered: why can low vowels never be [+ATR]? I have no good answer here, just notice that this would amount to an A-structure, an empty head and an H element as the right complement to this empty head.

Nasal vowels are represented by an L element also to the right of the head. Thus, the interpretation of L in non-head position mirrors the situation of L in non-head constituents (onsets). The advantage of this assumption is that nasal spread can be conceived as moving the L element from one position (leftmost of the onset) to an adjacent position of the left neighbouring nucleus. A nice consequence of merging the two SGP elements U and L into one is that with nasal spread we often receive a falling diphthong interpretation of the nucleus (e.g. Viennese “aunfongan” [ɔ̃ õⁿfɔŋɐn] ‘anfangen’ *to begin* in HC Artmann’s spelling).

(28) b.



Let us conclude with the seemingly least complex vowels, *schwa*. In order to discern mid/e-*schwa* and central *schwa* ([ɨ]), we assume with MP that the latter are indeed the least complex structures, i.e., they contain neither internal melodic structure nor elements. All other alleged *schwas* contain an A-structure and are in fact identical to full vowels. What makes them to be interpreted phonetically as *schwas* is that they reside in positions that receive no stress at all. *Schwa* elision, which in GP’s terms is a paramtetric option to have certain licensed nuclei remain phonetically un-interpreted applies now also to positions containing structure and melody. But such a behaviour is predicted to obtain anyway, and has already be attested (cf. Kaye 1973 on Odawa.) An interesting consequence is that there is good reason to believe that in Bavarian dialects the default realisation of empty vocalic positions is [a/ɐ] and not [ɛ] or [ɘ]. This is corroborated by the fact that more structure is needed for representing vowels anyway (e.g., regular simplex vowels are tense, length distinctions seem to have disappeared in certain dialects, such as for example Viennese).

(29) a. x — [ɨ]
b. x; – — [ɐ/a]
c. x; H — [ə/ɛ]
d. x; – H — [æ]

Thus far, we have said nothing about tone, yet. Remember that we have identified the complement to the right of the head as the host for L expressing nasality and H expressing ATR. The immediate complement position to the left has not been used, yet. This position could in principle host H and L representing tone. Why I am reluctant to elaborate further on this is that with non-head constituents (onsets/consonants), we observed an asymmetry between the elements: H representing aspiration is to the left, L representing voicing is to the right. Shouldn't that also hold in head constituents representing vowels? What speaks against this is that tone, lexically associated with structurally higher objects than nuclei, seems to be exclusive with respect to a single slot: either there is a high, or a low tone. Merging two different (linearly ordered tones) onto one position may well bring out contour tones. In addition, tone systems can obtain a high degree of complexity (indicating that more than one level of representation is involved), and where and how that complexity should be represented is still not very well understood.

5. Conclusion

The aim, to lay out a conception of phonology that is both as minimal and abstract as possible seems to be maximally fulfilled.

Most, if not all insights of SGP can be retained as they were proposed in KLV85, KLV89 and SGP.

Pöchtragers ideas about phonological structure are incorporated without recurring to arbitrarily active structural relations.

The premises to assign the sound systems of many languages a sensible, intuitively clear and phonologically plausible representation are quite good.

For future research: the interaction of various empty or filled positions may reveal even more sophisticated insights about the notion of phonological length.

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