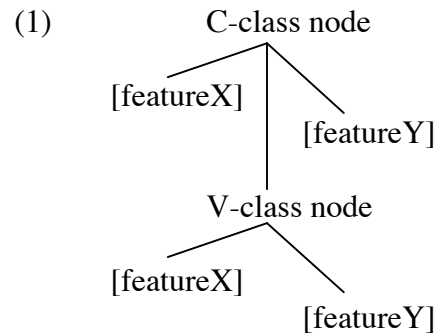


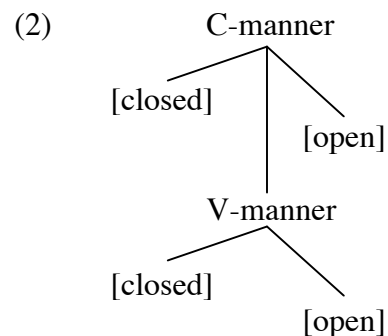
**The Parallel Structures Model of Feature Geometry:
Some Manner/Major Class Feature Acquisition Predictions**

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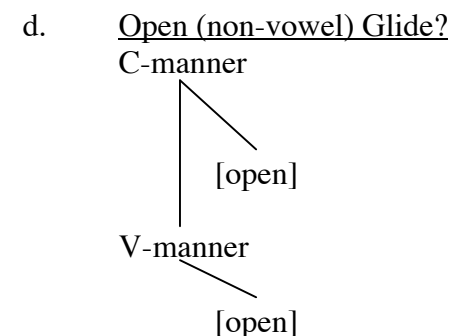
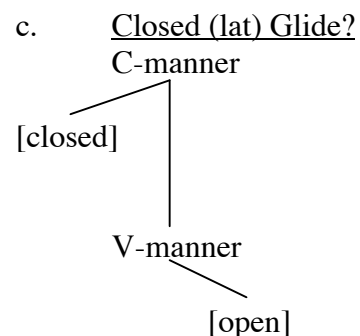
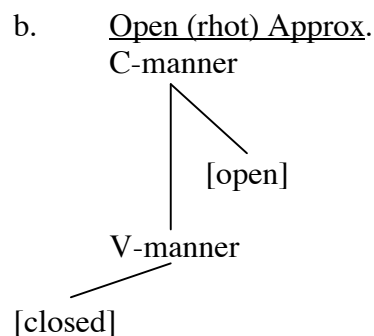
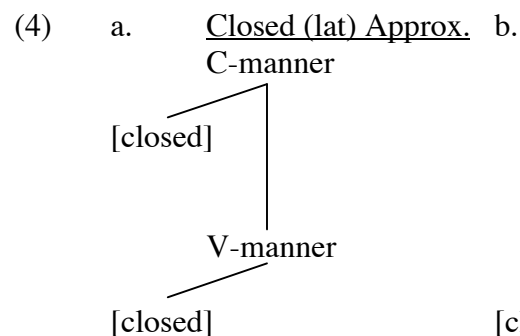
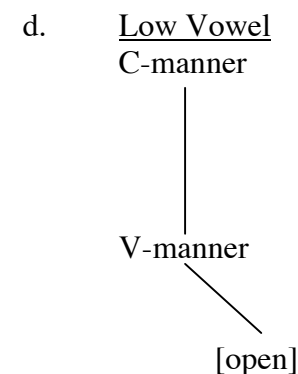
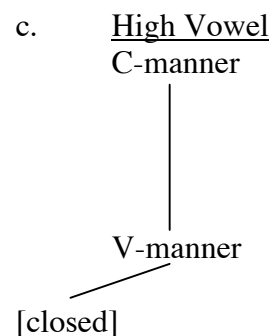
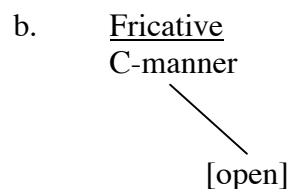
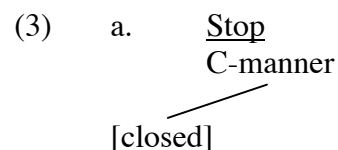
The general premise of the Parallel Structures Model (Morén 2003) is that there is a single, universally available, structure of the form given in (1), as well as a very limited set of constriction-based features and articulator-based (place) features. However, the PSM assumes that the grammar is economical in that features and class nodes are not immediately available, and must be built from less complex to more complex structure given overt, positive evidence from the linguistic environment. One might expect this incremental growth of complexity to result in natural stages in the acquisition of different segment types.



Today, I will concentrate on manner of articulation, and limit the discussion to the features [open] and [closed], ignoring the feature [lax]. For the time being, I will also not discuss nasal, although that will be discussed below. Given the structure in (1) and adapting it to degrees of constriction of the supra-laryngeal vocal tract, we get the structure in (2).



The representations in (3) and (4) illustrate some of the simpler manner/major class segment types. There are eight structures, total. The four given in (3) are simple manners, and those given in (4) are a type of complex segment in which there is more than one feature, but each feature is associated with a different manner-class node. We can think of these as doubly articulated manners.



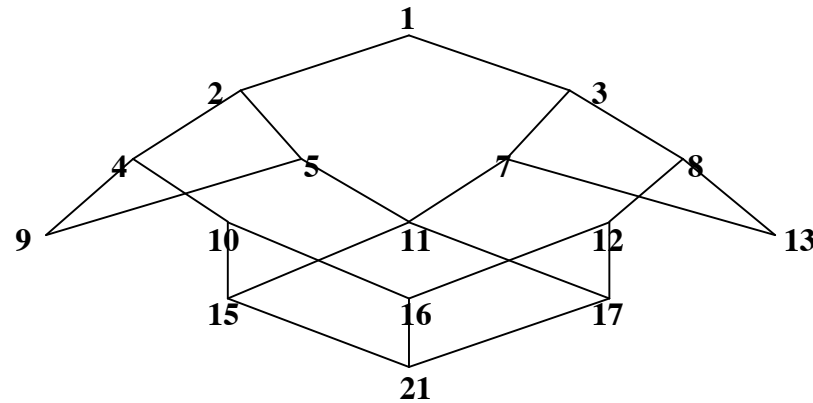
Given these structures, and building complexity one node and feature at a time and refining the constriction contrasts from more extreme to more subtle, we derive the following potential inventories:

1 - (3a), (3b)	Consonant, Vowel ¹
2 - (3a), (3b), (3d)	Stop, Fricative, Vowel
3 - (3a), (3c), (3d)	Consonant, High, Low
4 - (3a), (3b), (4d), (3d)	Stop, Fricative, Open-Open Approx., Vowel
5 - (3a), (3b), (4c), (3d)	Stop, Fricative, Closed-Open Approx., Vowel
6 - (3a), (3b), (3c), (3d)	Stop, Fricative, High, Low
7 - (3a), (4c), (3c), (3d)	Consonant, Closed-Open Approx., High, Low
8 - (3a), (4a), (3c), (3d)	Consonant, Closed-Closed Approx., High, Low
9 - (3a), (3b), (4c), (4d), (3d)	Stop, Fricative, Closed-Open Approx., Open-Open Approx., Vowel
10 - (3a), (3b), (4d), (3c), (3d)	Stop, Fricative, Open-Open Approx., High, Low
11 - (3a), (3b), (4c), (3c), (3d)	Stop, Fricative, Closed-Open Approx., High, Low
12 - (3a), (3b), (4a), (3c), (3d)	Stop, Fricative, Closed-Closed Approx., High, Low
13 - (3a), (4a), (4c), (3c), (3d)	Consonant, Closed-Closed Approx., Closed-Open Approx., High, Low
14 - (3a), (3b), (4b), (3c), (3d)	Stop, Fricative, Open-Closed Approx., High, Low
15 - (3a), (3b), (4c), (4d), (3c), (3d)	Stop, Fricative, Closed-Open Approx., Open-Open Approx., High, Low
16 - (3a), (3b), (4a), (4d), (3c), (3d)	Stop, Fricative, Closed-Closed Approx., Open-Open Approx., High, Low
17 - (3a), (3b), (4a), (4c), (3c), (3d)	Stop, Fricative, Closed-Closed Approx., Closed-Open Approx., High, Low
18 - (3a), (3b), (4b), (4c), (3c), (3d)	Stop, Fricative, Open-Closed Approx., Closed-Open Approx., High, Low
19 - (3a), (3b), (4a), (4b), (3c), (3d)	Stop, Fricative, Closed-Closed Approx., Open-Closed Approx., High, Low
20 - (3a), (3b), (4b), (4d), (3c), (3d)	Stop, Fricative, Open-Closed Approx., Open-Open Approx., High, Low
21 - (3a), (3b), (4a), (4c), (4d), (3c), (3d)	Stop, Fricative, Closed-Closed Approx., Closed-Open Approx., Open-Open Approx., High, Low

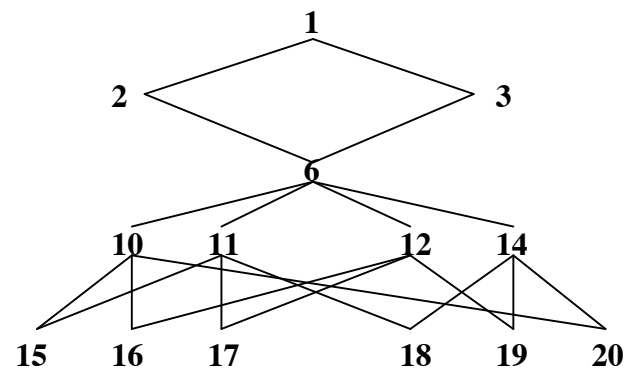
¹ Note that the “C” and “V” labels of these class nodes are something of a misnomer. That is, consonants can have V-class features and vowels can have C-class features. They are labeled as consonant and vowel nodes due partially to tradition (Clements 1991) and partially due to the fact that if a language contrasts the class nodes for particular classes of sounds, the vocalic elements have the dependent class node (V-class).

The figures in (5) and (6) show the featural and structural relationships among the inventories above. These may also be thought of as decision trees for learning manner/major class since acquisition of each more complex structure implies the presence of minimally different less complex structures. We may also think of them as structural markedness trees since they illustrate structural complexity relationships.

(5)

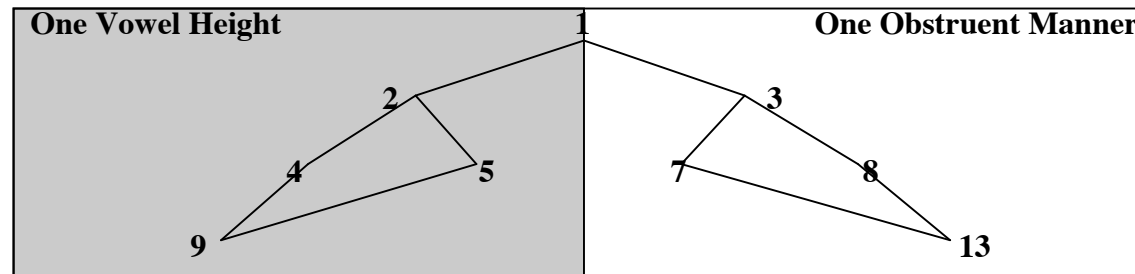


(6)



Just to illustrate the point, the figure in (7) shows a subset of (5), in which the inventories either have only one vowel height, or one obstruent manner. All other inventories have both a stop-fricative and a high-low vowel contrast.

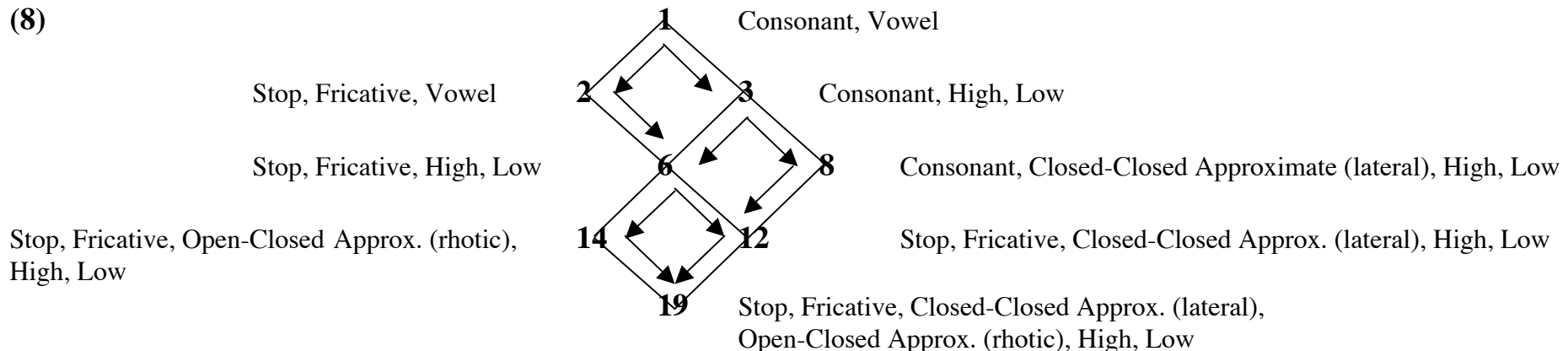
(7)



From an acquisition perspective, the prediction of the decision trees is that major class/manner should be learned in a set order depending on either the structure of the language (what features are more or less prominent, therefore likely to be perceived as relevant to the child - frequency effects?), or the individual preference of the child (some children may attend to one set of perceptual cues, while others may attend to other cues). So, as we descend through the matrices adding complexity to the feature set and structures, there should be only certain paths available to the child at any given stage of acquisition.

Since it is not clear that spoken languages use as many approximate classes as are predicted by this model (due to articulatory and perceptual difficulties in keeping them distinct from one another), and since only the approximates with V-manner[closed] (lateral and rhotic approximates) seem to be widely and unambiguously attested, let us assume that V-manner[open] approximates are not available to language learners (see (4c) and (4d)). Thus, we greatly reduce the possible acquisition paths, and the expected language types and acquisition stages are those given in (8).

(8)



These inventories seem perfectly reasonable in that they either exist in one language or another, or they are attested as developmental stages. Just to be clear, some of the inventories that we do not expect to find are:

4 - (3a), (3b), (4d), (3d) - Stop, Fricative, Open-Open Approximate (non-vowel glide?), Vowel
 5 - (3a), (3b), (4c), (3d) - Stop, Fricative, Closed-Open Approximate (lateral glide?), Vowel
 7 - (3a), (4c), (3c), (3d) - Consonant, Closed-Open Approximate (lateral glide?), High, Low
 etc.

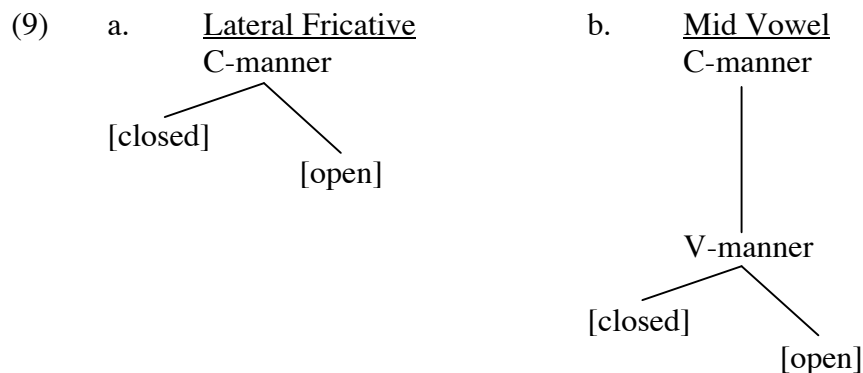
NB - Since our understanding of glides is not very advanced, it is possible that these languages do exist, but that we have not understood them properly at this point.

Some Concrete Predictions:

- 1) **sonorants are only available if there is also a distinction between high and low vowels**, and
- 2) non-lateral (e.g. rhotic) approximates are only available if there is a distinction between high and low vowels and a contrast between stops and fricatives.

Complex Manner

Once both [closed] and [open] are available on a given class node, they are then available to combine with one another in the form of lateral fricatives or mid vowels. This further increases the complexity of the segment inventory, and makes predictions regarding the sequence of acquisition of lateral fricatives with respect to stops and non-lateral fricatives on the one hand, and mid vowels with respect to high and low vowels on the other.



So, we expect to see lateral fricatives only occurring in languages, and at developmental stages, that have stops and non-lateral fricatives, and we expect mid vowels only in languages/stages that have high vowels and low vowels.

Nasals - Interesting and Puzzling Segments

Nasals are quite common cross-linguistically, and they have been the subject of much research. However, they remain the focus of debate and uncertainty in the literature. This is due to a variety of peculiar properties, including:

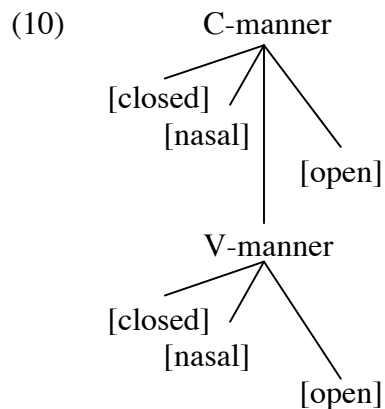
- they do not fall neatly into any of the feature-geometric structures proposed in the literature,
- they seem to be partially consonantal and partially vocalic, and
- they seem to sometimes act as sonorant consonants (pattern with approximates), but sometimes they act like stops.

In addition,

- both consonants and vowels can be distinctively nasal,
- there can be assimilation between nasal consonants and adjacent vowels, or nasal vowels and adjacent consonants, and
- there can even be nasal harmony among vowels, but not nasal harmony among consonants (without the intervening vowels partaking).

To summarize, it is this somewhat schizophrenic behavior of nasals (sometimes obstruents, sometimes sonorants) that makes them such a puzzle.

However, the PSM is built on comparisons between consonants and vowels and the assumption that they share the same features and basic structures. Therefore, it is not surprising to find nasals behaving in different ways in different languages and/or contexts, nor that they should sometimes be consonantal and sometimes vocalic. If we assume that nasality is related to manner of articulation, as is often assumed in the literature, then we might suggest the following revision of the PSM manner geometry.



This representation allows:

- consonants to be nasal (e.g. C-manner[closed][nasal]),
- vowels to be nasal (e.g. V-manner[closed][nasal]),
- consonants to spread their C-manner[nasal] feature to adjacent vowels,
- vowels to spread their V-manner[nasal] features to adjacent *approximates*,
- V-manner[nasal] to harmonize across intervening *obstruents*, but
- C-manner[nasal] not to harmonize across intervening non-nasal vowels.

While I have not had an opportunity, yet, to confirm these predictions, let us assume the structure in (10). If we assume (10), then we can expand our acquisition/structural markedness trees in (5), (6) and (8) to include the possibility of the nasal feature (not shown here).

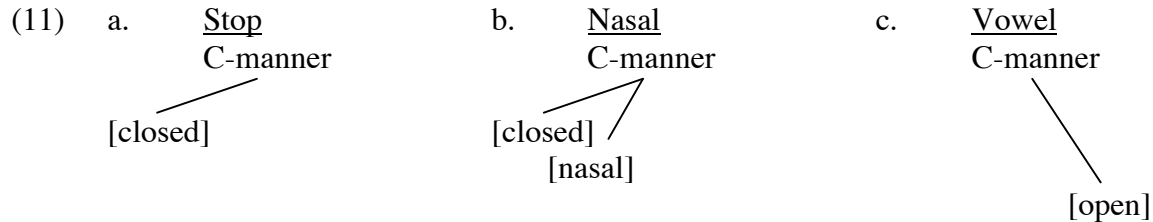
The Puzzle of Nasal Acquisition

Interesting, most of the literature on major class/manner acquisition follows Jakobson's lead in showing that nasals are learned very early in onset positions. Recall that Jakobson's sequence of acquisition stages were the following (ignoring place of articulation):

- I. Consonant versus Vowel
- II. Oral versus Nasal Consonants
- III. High versus Low Vowels
- IV. High versus Mid Vowels

Note that the discussion so far has provided a structural explanation for Jakobson's stages I, III and IV. The question is, how and why are nasal consonants (which are supposed to be sonorants) acquired so early, when the PSM predicts that sonorant consonants should not be acquired before a differentiation between high and low vowels?

The answer is found in one of the basic tenets of the PSM, namely, structure is minimal unless there is overt evidence supporting more complex structure. What this means for nasals is that they are initially analyzed as obstruents with a nasal feature, and not sonorants at all. Thus, Jakobson's stage II grammar has the segments given in (11).



This allows the following syllable types: OralC+Vowel, NasalC+Vowel.

Stage III introduces a difference between high and low vowels, thus the following syllable types: OralC+HighV, NasalC+HighV, OralC+LowV, NasalC+LowV.

Unless there is overt, positive evidence that the nasals are sonorant consonants, and not obstruents, they will remain with only C-manner features. This may explain two observations.

- 1) Cross-linguistically, nasals sometimes behave like obstruents and sometimes behave like sonorants.
- 2) In Dutch acquisition, there is a stage in which “some children treat the nasals like obstruents, but others treat them like liquids” (Fikkert, 22 Oct 2003 lecture).

So, the children who treat the coda nasals as obstruents (i.e. delete them after long vowels) represent the nasals as obstruents. However, those children that treat the nasals as sonorants (i.e. do not delete them after long vowels) have learned that the nasals are structurally more complex than their first hypothesis. Thus, they add a V-manner[closed] feature. If this is the case, it should not be surprising that it is at this point in their development that those children also seem to assign weight to the coda nasals (displayed in the vowel length correlations) and allow nasal-obstruent coda clusters. If early clusters are allowed only if they follow the Sonority Sequencing Generalization, the nasals must be more sonorous than stops for those children to allow them in clusters.

Conclusion

The Parallel Structures Model of Feature Geometry makes very specific claims regarding the universally available set of features, sets of class nodes and ways in which they can combine. Further, it makes very specific and principled claims regarding structural and featural complexity within segments and segment inventories, which predict that acquisition of segments should occur along a limited set of structurally determined paths. Thus, the PSM is somewhat Jakobsonian in believing that acquisition should follow universal markedness dictates, but it is in keeping with other researchers in allowing for some restricted individual variation in the order of acquisition.

Some specific results/claims:

- 1) Jacobson's major class/manner developmental stages are explained, not merely stipulated (i.e. C-V --> HighV-LowV --> HighV-MidV).
- 2) The acquisition of sonorant consonants presupposes the acquisition of high vowels.
- 3) The acquisition of rhotic approximates presupposes the acquisition of fricative consonants.
- 4) The puzzling acquisition of nasal consonants before the acquisition of high vowels is explained if the nasal consonants are not initially sonorants (i.e. do not have a high vowel feature). Nasal consonants only become sonorant given positive evidence.

In phonological research today, a lot of time and effort is dedicated to the question of which is a better way to do phonology, using rules or using constraints. However, those engaged in this debate seem to have forgotten about the issues and possibilities raised by autosegmental phonology, in which representations play a major role in explaining inventories, processes and developmental stages. I would suggest that it is possible that some of the answers to current phonological and/or acquisition puzzles are hiding in the dark recesses of autosegmental representations.

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