Phonology

Linguistics for Computer Scientists
Session 3

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The Phoneme

Definition

The *phoneme* can be defined as the *minimal distinctive unit* of speech.
It is the basic building block of spoken language.

- Of course, other definitions have also been proposed.
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A brief history of phonology

- Modern phonology begins in the early 20th century with the Prague school (Jakobson, Trubetzkoy, et al.)
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The phoneme inventory

- The set of phonemes used in a language is specific to that language. A *field linguist* might attempt to discern the phoneme inventory of an unknown language from by studying lists of *minimal pairs*.
- If two words have different meanings but differ only in a single sound (*phone*), that sound must be a phoneme.
- Where two phones appear in *complementary distribution*, they might be *allophones* of a single phoneme.
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Phonemic structures

- Within a given phoneme inventory, groups of phonemes form *paradigmatic* and *syntagmatic* relations.
- Paradigmatic relations yield classes of phonemes, such as *consonants* and *vowels*.
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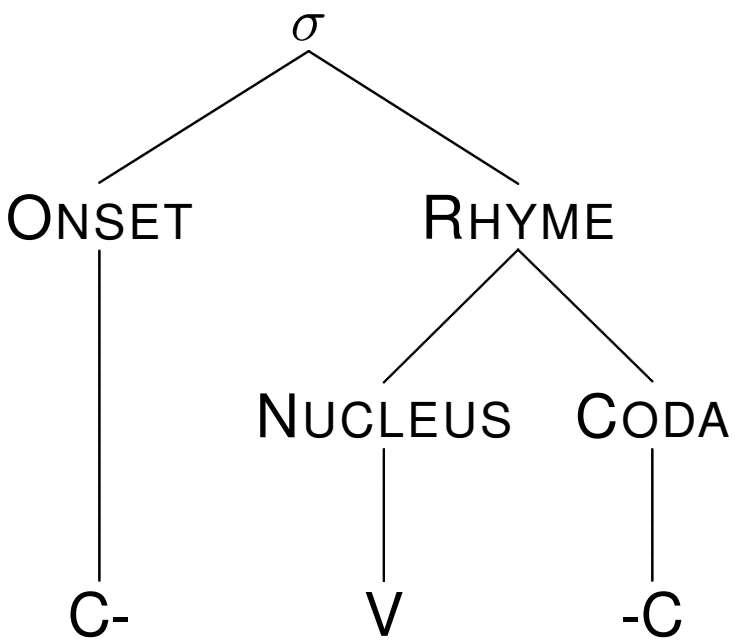
The syllable



- The simplest syllable type is (C)V.
- Syllables with empty codas are called *open*, those with filled codas, *complex*.
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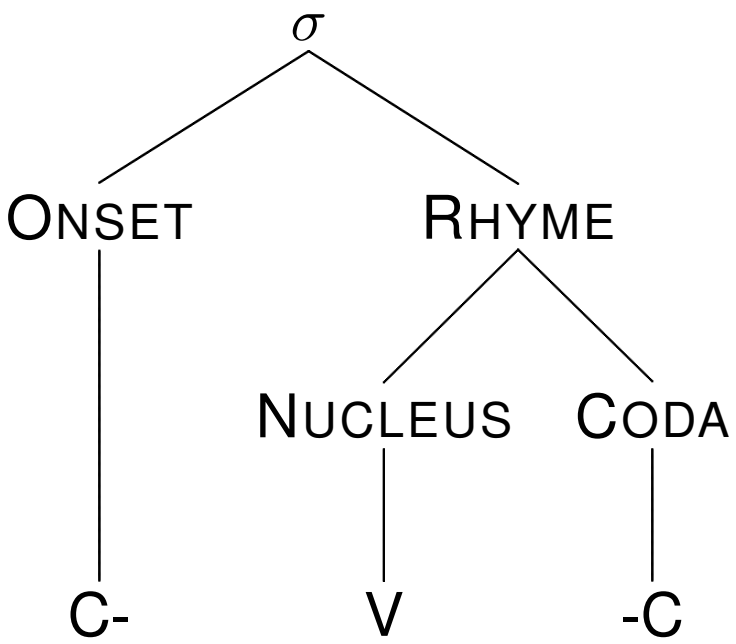

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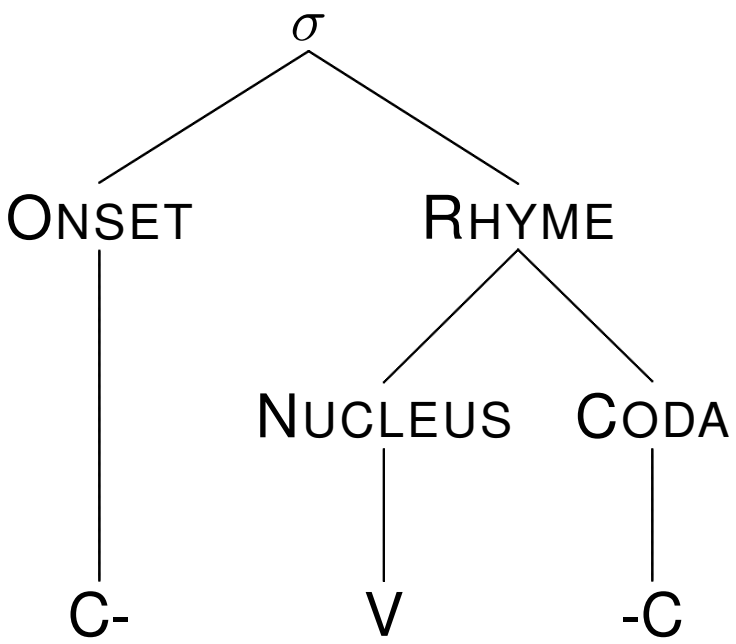

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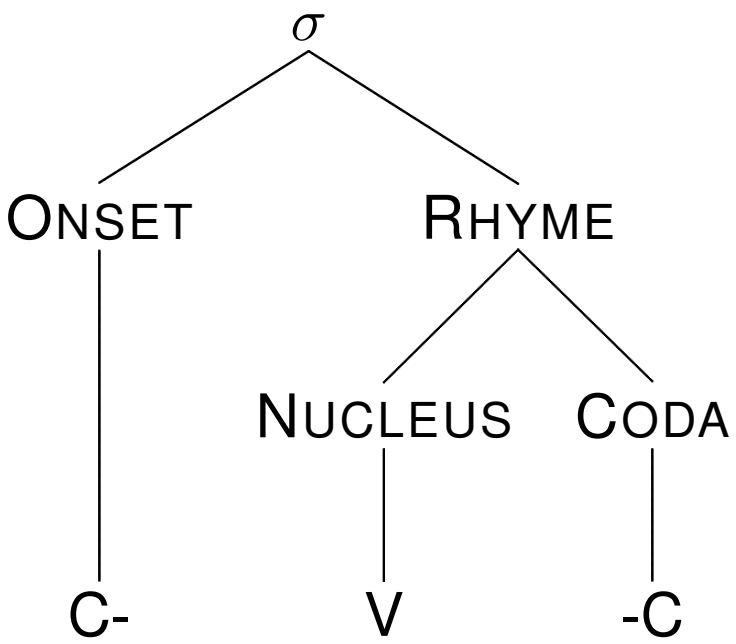

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- Syllable templates such as $(C_3)V(V)(C_4)$ can be interpreted as *generative rules*.
- However, a division into only 2 classes will yield many illegal syllables.
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Sonority scale

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Phonological features

- Phonemes can be “decomposed” into smaller, *distinctive features*.
- A set of phonemes can be described by a smaller set of features, each phoneme essentially a “bundle” of concrete values for each feature.
- Distinctive features can be defined arbitrarily, but are usually acoustically or articulatorily motivated.
- Feature values are normally *binary* ($\pm$), but could also be unary or multilateral.
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Phonological rules

- *Generative phonology* (Chomsky) introduces context-sensitive rules of the form $A \rightarrow B|X\_Y$
- This turns all sequences of XAY into XBY.
- $\{A, B, X, Y\}$ can be phonemes or feature bundles.
- A set of rules is not applied in parallel, but sequentially. This can give rise to rule *feeding* or *bleeding*.
- A rule ordering which prevents feeding or bleeding is called *counterfeeding* or *counterbleeding*, respectively.
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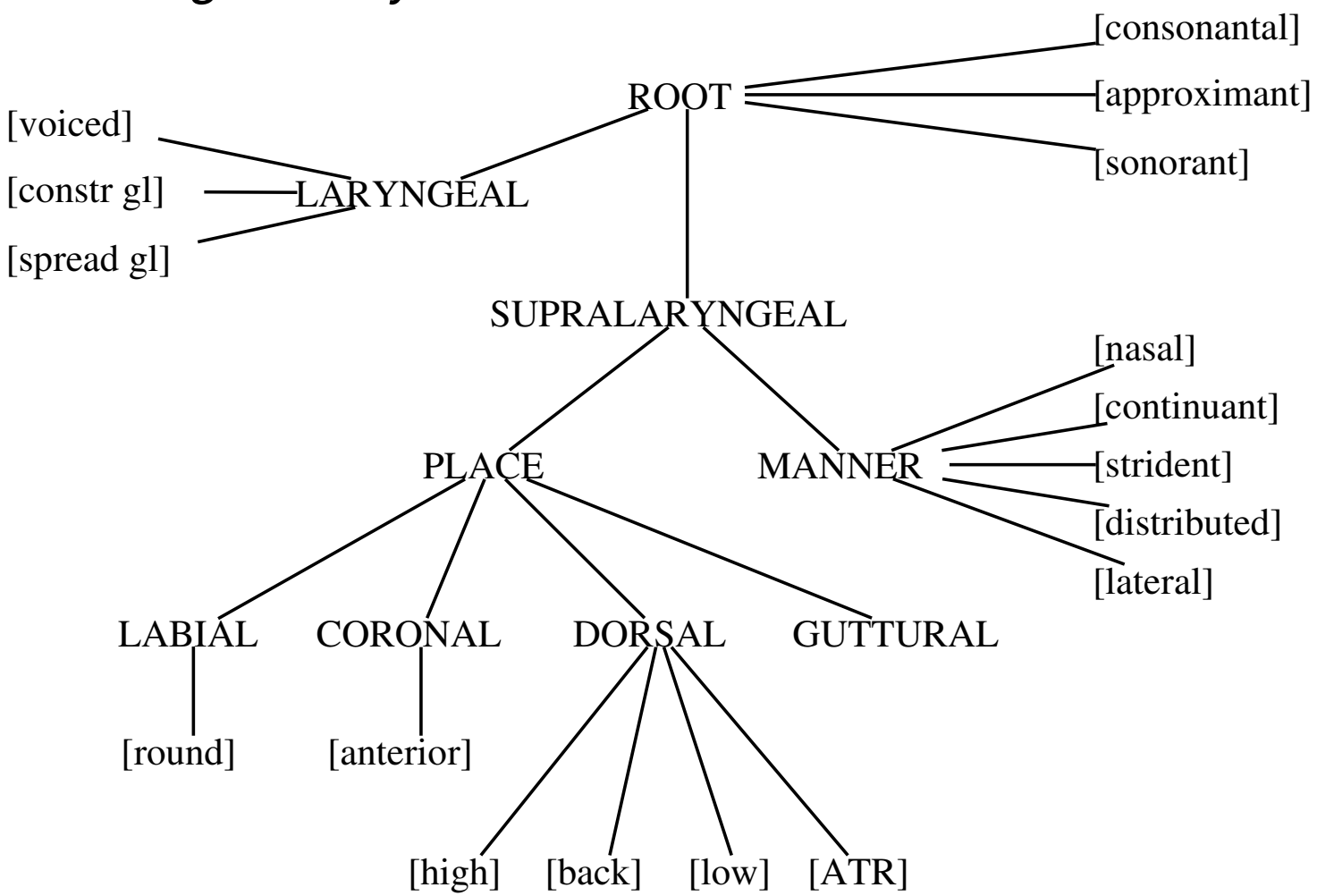
Feature geometry

An ordering of distinctive features by articulator leads to a *feature geometry*.



Autosegmental representation

- Feature nodes (terminals) that have negative or unspecified values can be omitted (underspecification).
- By arranging a sequence of phonemes, drawn as feature geometry trees, we can envisage several *tiers* by connecting the major class nodes (ROOT, LAR, etc.) of all trees.
- Two adjacent tiers form a *plane*.
- Where adjacent feature nodes share the same value, redundant nodes can be *delinked*, and the remaining node attaches to its former parent, in addition to the parents it is already a child of. This is called *feature spreading*.

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Articulatory phonology

- Articulatory phonology views each articulator as residing on its own tier, independent of the others.
- Each articulator can perform *gestures*, while the simultaneous performance of gestures by several articulators causes a different phoneme to be produced.
- The sequence of gestures on all tiers over time can be written as a *gestural score*.
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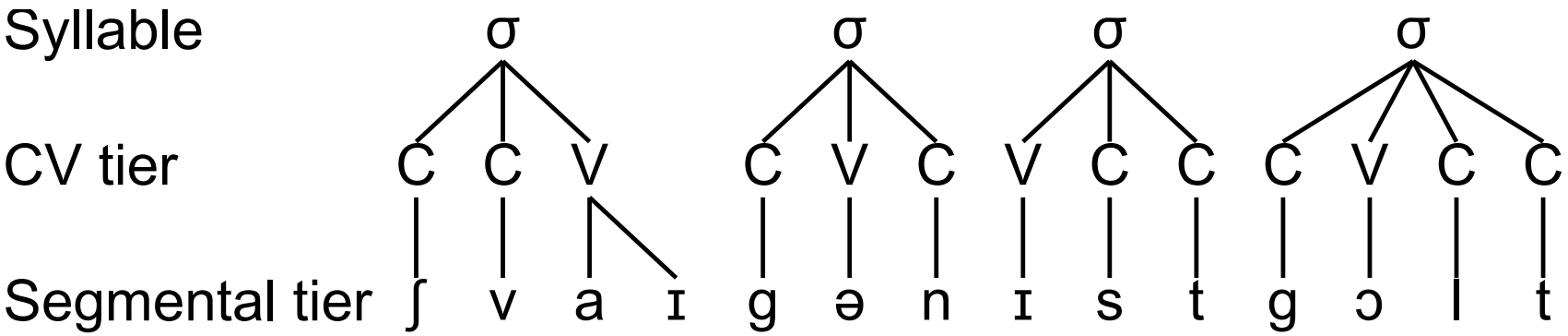

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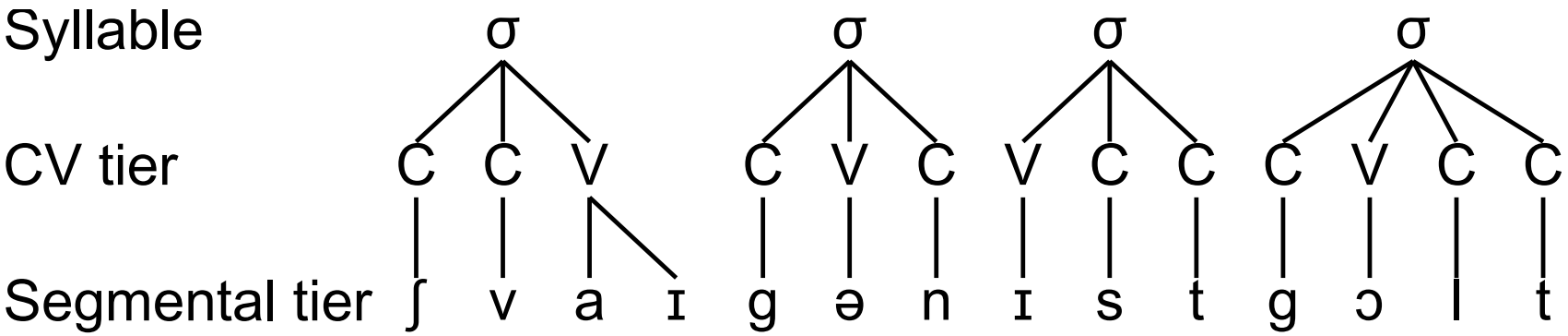

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Intonational phonology

The prosodic hierarchy

Φ	intonational phrase
ϕ	intermediary phrase
Σ	foot
ω	phonological word
σ	syllable

- The prosodic hierarchy adheres to the *strict layer hypothesis*

Intonational phonology (2)

- Events in the pitch (F_0) contour are described and modeled.
- In the ToBI system, high (H) and low (L) tones are used to signify both nuclear pitch *accents* and *boundary tones*.
- Pitch accents are written with an asterisk (*), while boundary tones have a − and/or % sign.
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- The domain of metrical (rhythm) phonology is the syllable.
- Metrical weight is a measure of *relative prominence*.
- Metrical trees are always binary branching.
- They can be converted into metrical *grids*.
- Tree and grid construction rules follow principles of *eurhythmy*.
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- In contrast to generative rules, OT uses *constraints*, which are evaluated on *candidates*.
- The constraints are taken from a universal set, but ordered in a language-specific *ranking*.
- Several possible *candidates* for a surface form are generated from an underlying representation.
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