Computational Phonology

Paradigmatic Computing

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Paradigmatic computing (classification of categories)

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- Paradigmatic computing is essentially about
  - generalisations over entries in a lexicon
  - Lexica include inventories of
    - phonemes, tones or intonations
    - collocations, idioms
- Objective: to account for
  - Partial generalisations in terms of defaults (markedness)
  - Oppositions – express contrasts
    - Privative vs. equipollent oppositions (Prague School)
    - Markedness conventions (generative phonologies)
  - Redundancies – express generalisations
    - Morpheme structure rules
    - Redundancy rules
    - Implication hierarchies
    - Inheritance hierarchies

Inheritance Phonology

and the (partially) compositional phonological lexicon

Inheritance Phonology: Default Inheritance Hierarchies

Vowel features
(not necessarily binary)

- Vertical Position
  - high
  - mid
  - low
- Horizontal Position
  - front
  - centre
  - back
- Labial Position
  - relaxed
  - round

The task:

Combine

- Simultaneous compositional feature structures
- Similarity based classification hierarchy of natural classes

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VertPos: low
HorizPos: back
LabPos: unround

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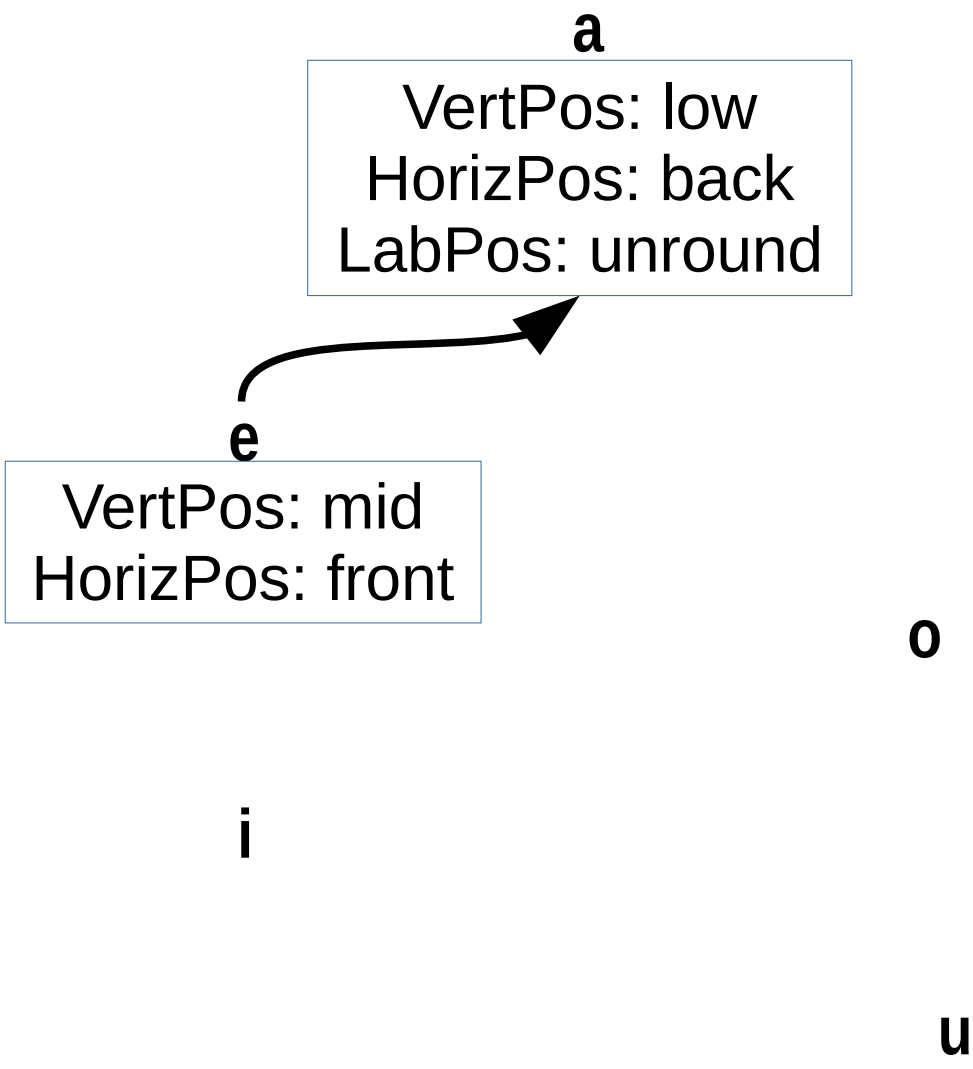

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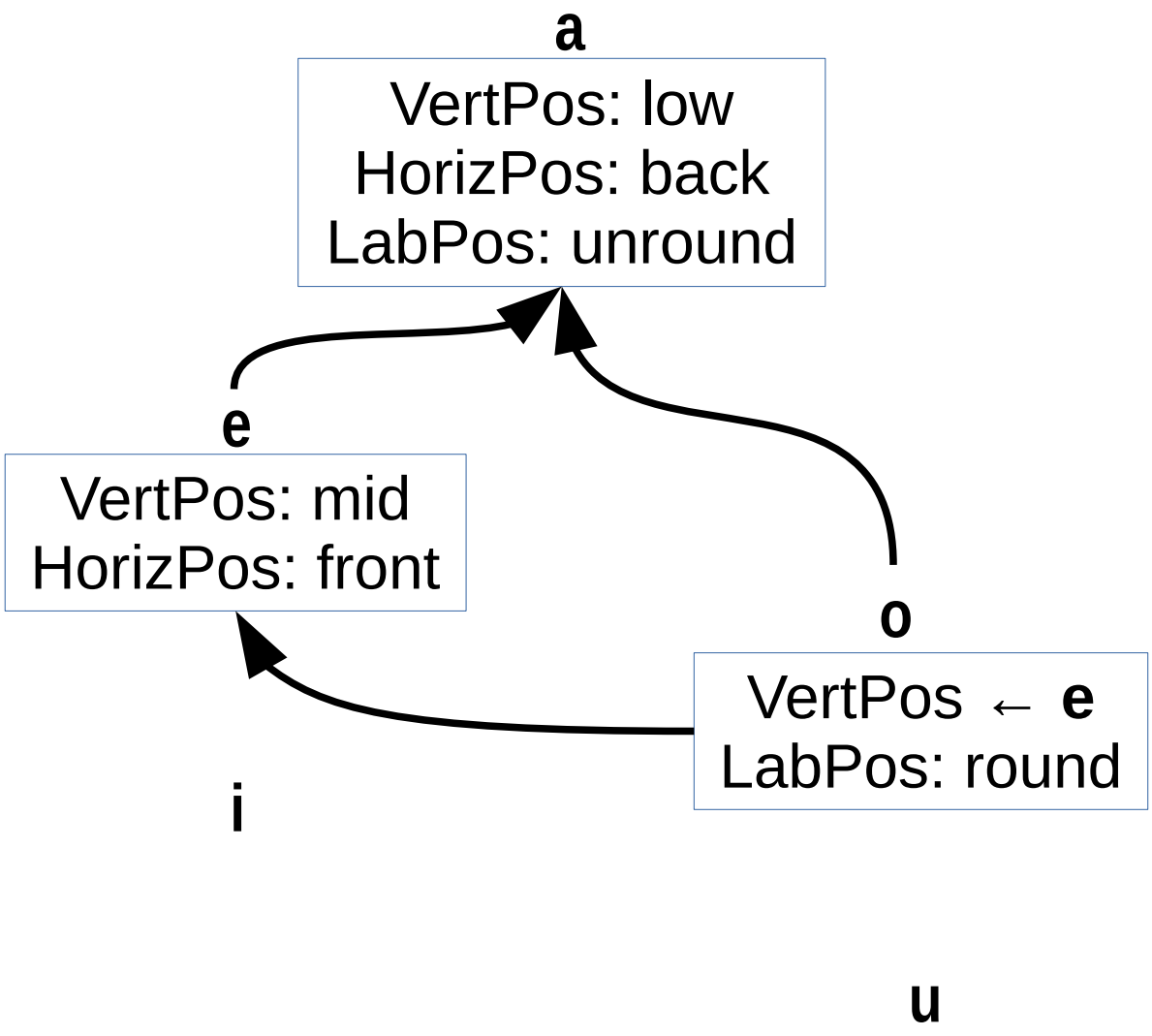

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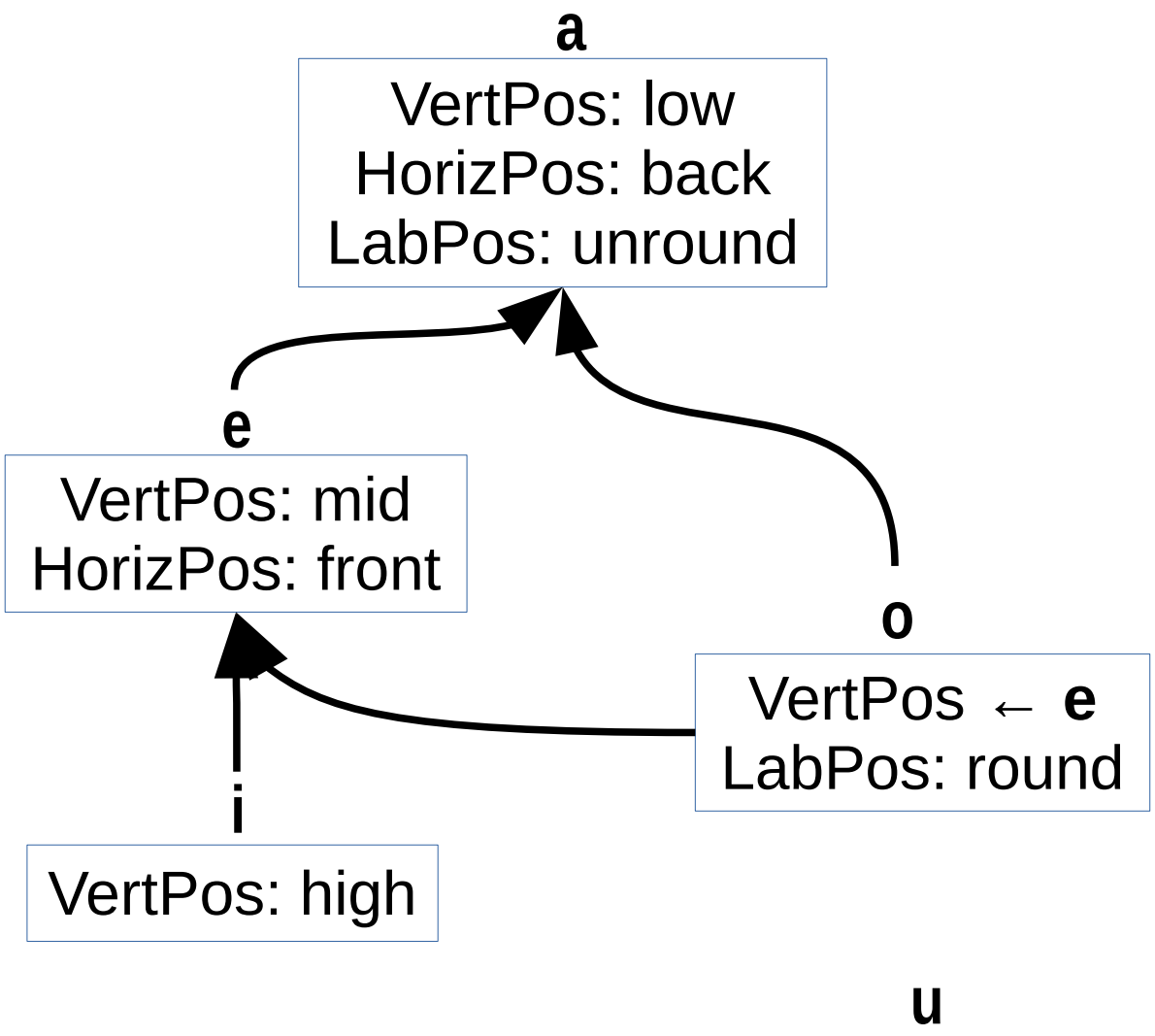

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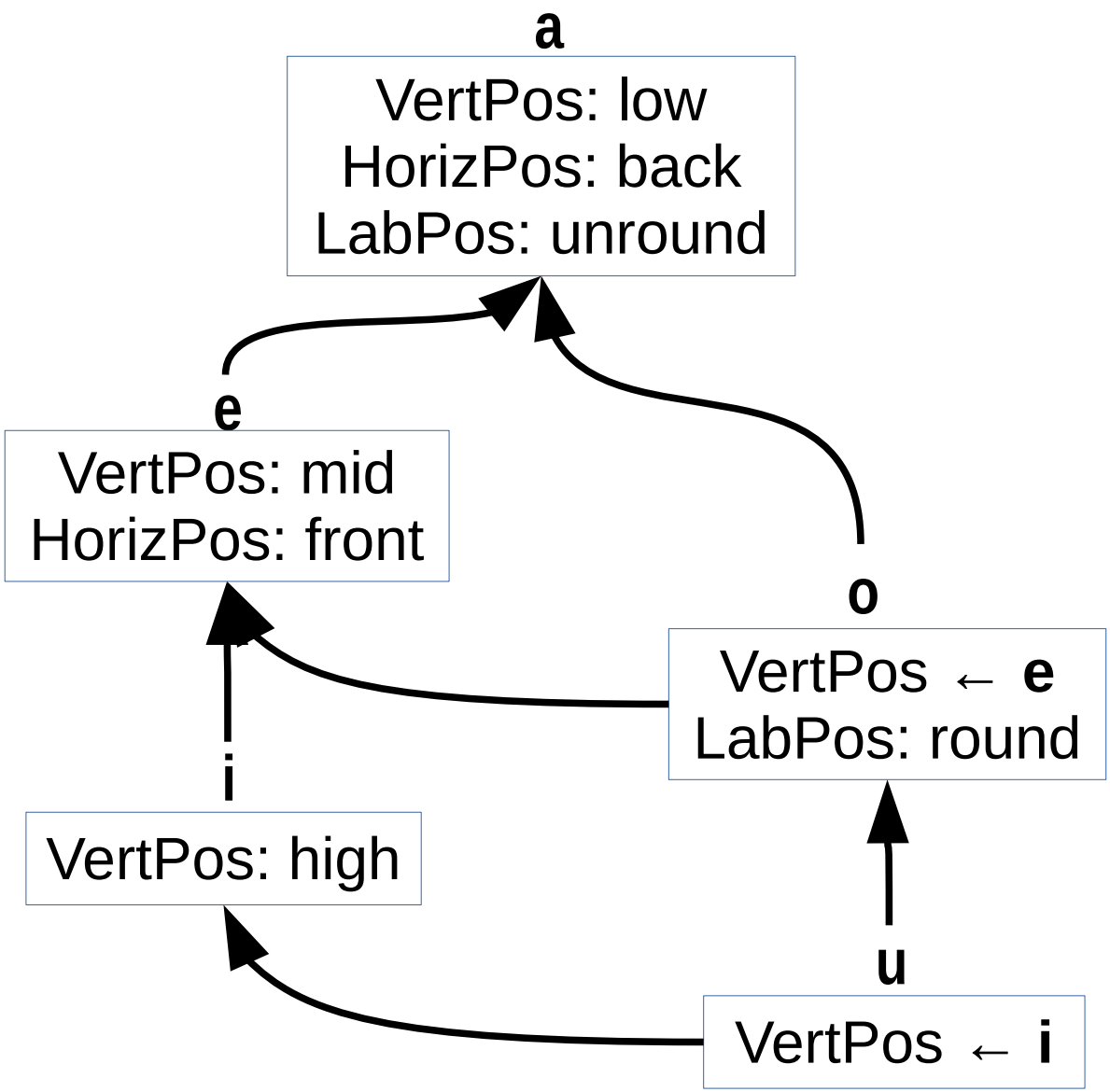

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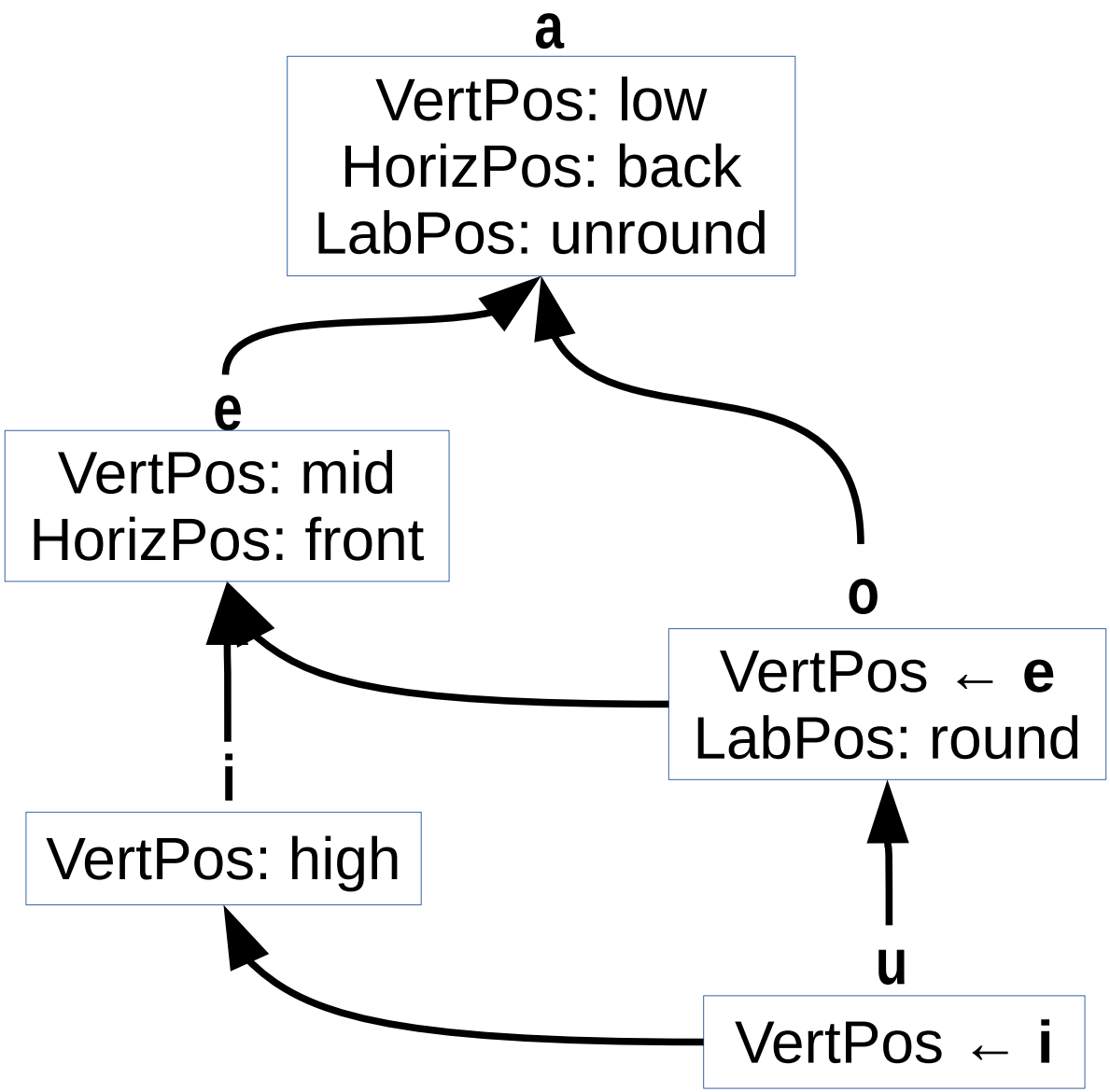

A typical computational (rather than empirical) problem:

Re-design this inheritance hierarchy using a binary system?

The (partially) compositional intonation lexicon

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Entries					
High					
Mid					
Low					
Rise					
Fall					
Rise_Fall					
Fall_Rise					

The (partially) compositional intonation lexicon

Entries	Categories	Inheritance			
High		**Prosody()**			
Mid		**Prosody()**			
Low		**Prosody()**			
Rise		**←(Low,High)**			
Fall		**←(High,Low)**			
Rise_Fall		**←(Rise,Fall)**			
Fall_Rise		**←(Fall,Rise)**			
	CompPros	**Prosody()**			
	Prosody				

The (partially) compositional intonation lexicon

Entries	Categories	Inheritance	phon	sem	prag
High		**Prosody()**	H	continue	small
Mid		**Prosody()**	M	hesitate	normal
Low		**Prosody()**	L	stop	big
Rise		**←(Low,High)**	L-H	incomplete	suspense
Fall		**←(High,Low)**	H-L	complete	certainty
Rise_Fall		**←(Rise,Fall)**	L-H-L	appraisive	surprise
Fall_Rise		**←(Fall,Rise)**	H-L-H	incomplete	emphatic
	CompPros	**Prosody()**			
	Prosody				

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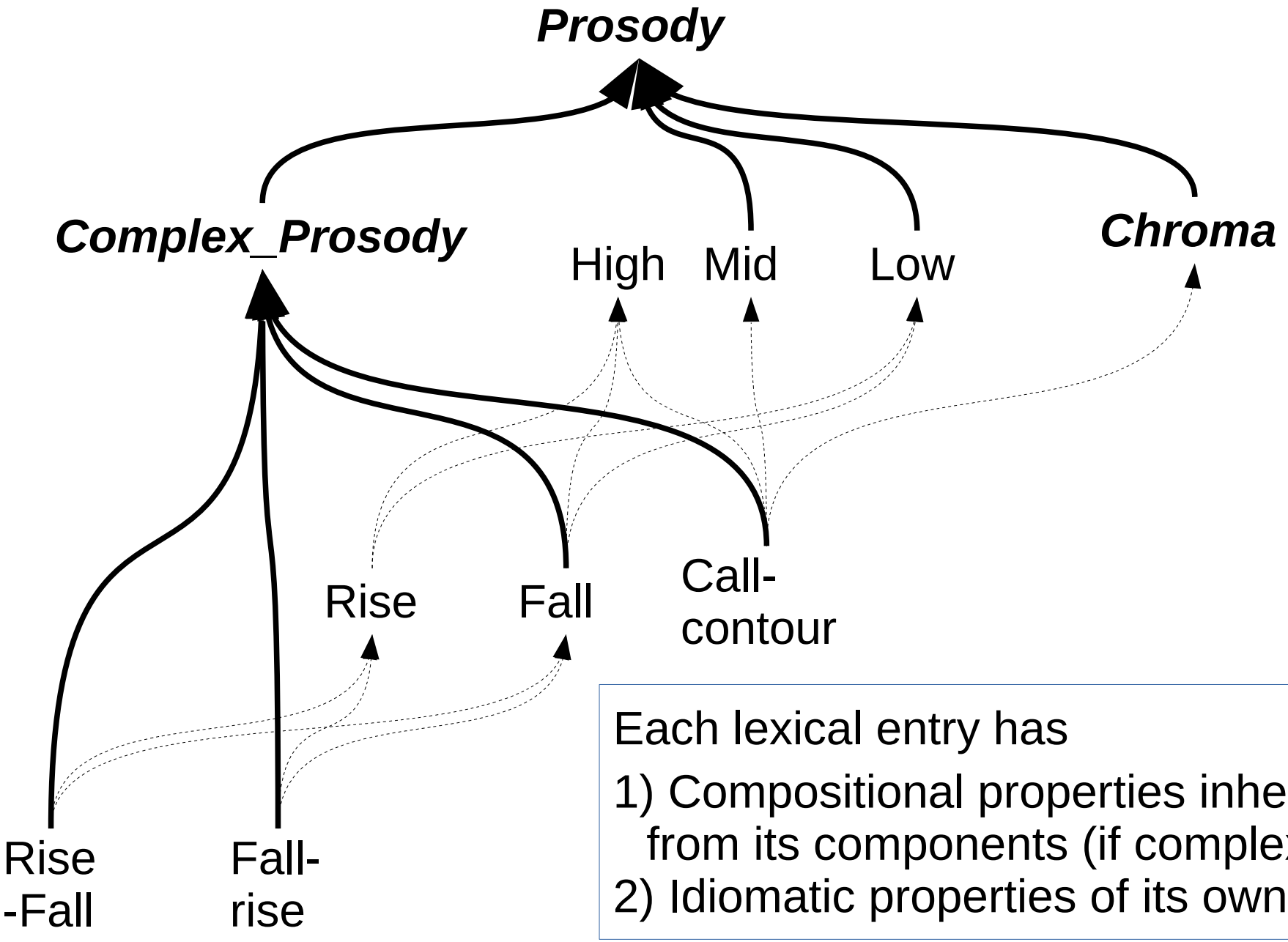

Each lexical entry has

1) Compositional properties inherited from its components (if complex)
2) Idiomatic properties of its own.

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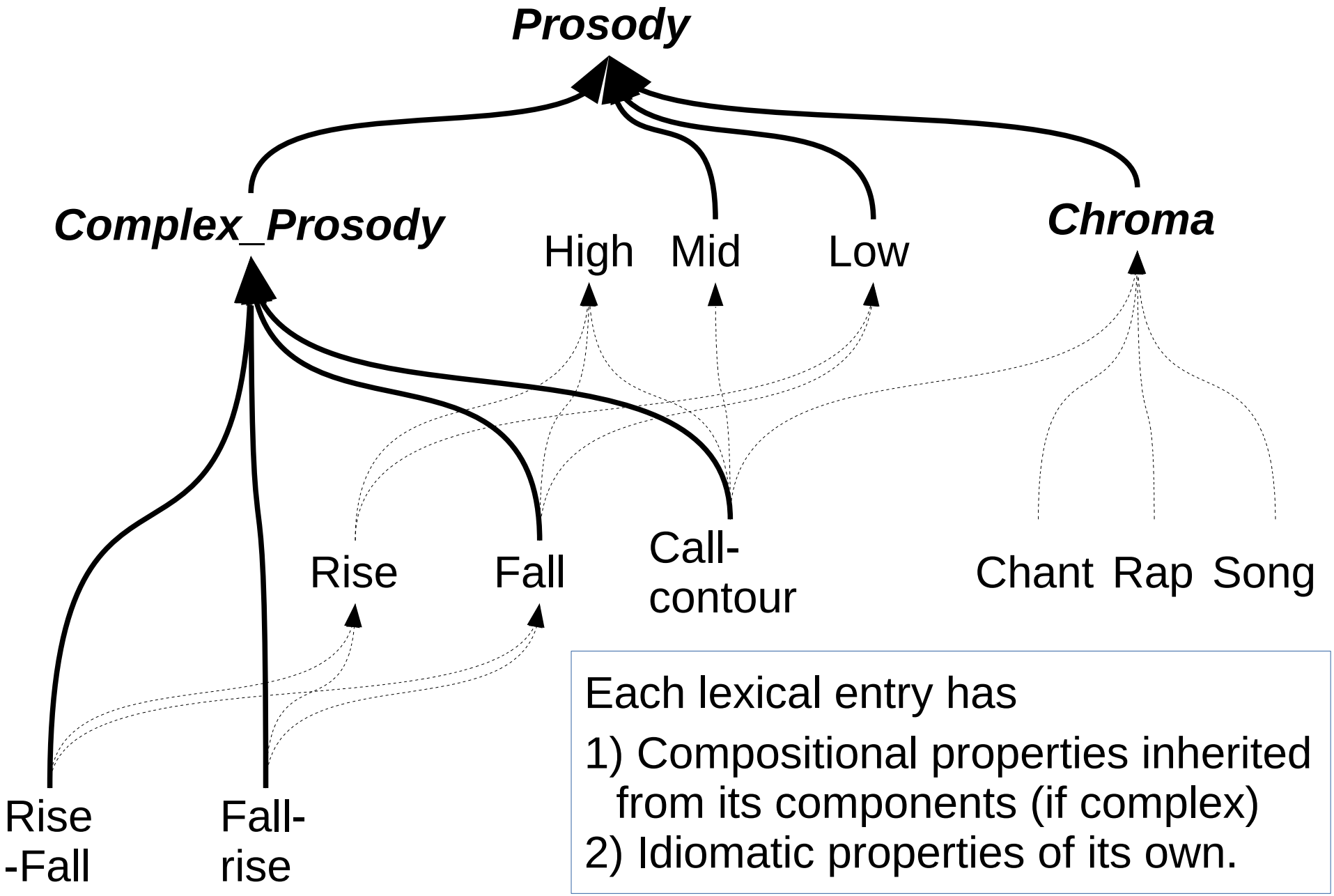

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The (partially) compositional intonation lexicon

```
High:
  <phon> == high
  <sem> == continue
  <> == Prosody.
Low:
  <sem> == stop
  <phon> == low
  <> == Prosody.

Rise:
  <spec> == "Low:<>"
  <head> == "High:<>"
  <phon> == incomplete
  <sem> == suspense
  <> == Complex_Prosody.
Fall:
  <spec> == "High:<>"
  <head> == "Low:<>"
  <phon> == complete
  <sem> == certainty
  <> == Complex_Prosody.
```

```
Call_Contour:
  <spec> == "High:<>"
  <head> == "Mid:<>"
  <phon> == minor_third
  <sem> == phatic
  <> == Complex_Prosody.


Complex_Prosody:
  <entry> == Prosody
                ‘← (‘ "<spec int>" '&' "<head int>" ')'
  <> == Prosody.


Prosody:
  <entry> == '{ SEM:' “<sem>”
                  'PHON:' “<phon>” '}'
  <sem> == "<sem>"
  <phon> == "<phon>"
  <>    == .
```

The (partially) compositional intonation lexicon

Compositional lexical access:
- the lexicon as a theory,
- the query results as derived theorems

High:< int > = { SEM: continue PHON: high } .

Mid:< int > = { SEM: hesitate PHON: mid } .

Low:< entry > = { SEM: stop PHON: low } .

Rise:< entry > = { SEM: suspense PHON: incomplete }
← ({ SEM: stop PHON: low } &
{ SEM: continue PHON: high }) .

Fall:< entry > = { SEM: certainty PHON: complete }
← ({ SEM: continue PHON: high } &
{ SEM: stop PHON: low }) .

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To be continued ...