

# **Rhythm and Melody**

## ***Aspects of Language and Music***

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# ***Orientation***

# ***Orientation - 1***

- Language:
  - focus on speech, conversational spoken language
    - not written text
  - focus on complex behavioural performance
    - more than speculation on language cognition or ‘competence’
- Music:
  - focus on solo song
    - more than instrumental music
    - and not ‘written’ or orchestral music
  - focus on complex behavioural performance
    - more than speculation on musical cognition or ‘competence’
- Method:
  - discipline: more phonetic than linguistic
  - syncretistic: intuition plus measurement

## ***Orientation - 2***

- What is rhythm?
  - Ella Fitzgerald: “I have rhythm.”
    - Spoken English type of ‘foot-timed’ rhythm
- What is melody?
  - Bob Dylan: “The answer is blowing in the wind.”
    - Spoken English type of intonation-like melody
- Rhythm and melody:
  - other cultures, languages, registers:
    - West African dirges (funeral songs / chants)
    - Chinese popular songs: tone match in speech and song?
    - Children’s chants: speech or music?
    - Surrogates: whistled speech (e.g. calls, interjections)

# ***Controversies***

# ***Controversies – musical relativity***

- Are there universals of language and speech?
- Is there language-specific ‘musical relativity’?
  - does music shape language?
  - Does language shape music?
  - Does music shape thought?

cf. ‘linguistic relativity’, the claim that language shapes thought
- A speculative example:
  - Robert Hall claimed
    - Elgar’s music is mostly popular in Britain because it is heavily influenced by Standard British English intonation:
      - very wide pitch range
      - sudden changes of pitch height (e.g. musical 7<sup>th</sup> interval)
      - Hall, R. A. Jr. 1953. Elgar and the intonation of British English. *Gramophone* 31, 6.

# ***Controversies – types of musical relativity***

- Musical relativity:
  - Is music shaped by speech? - To some extent:
    - chant: adapted to restricted rhythms and melodies of speech
    - song: often adapted to a broader range of rhythms and melodies of speech
    - instrument: phonaesthetic imitation of speech rhythms and tonal melodies
    - surrogates: drumming, whistling with speech rhythms and tonal melodies
  - Is speech shaped by music? - To some extent:
    - music-like contours in greetings and calls - “Good morning!”, “Jooohnnyy!”
    - song: speech rhythms and melodies adapted to musical conventions

# ***Controversies – conventions of music and speech***

- Speech and music are both
  - complex modes of human behaviour
  - complex modes of human cognition:
- Speech:
  - conventions shaped by local, especially family communication
  - formalised by public and written communication
- Music:
  - conventions shaped by social community activity:
  - increasingly formalised in larger communities: celebration, religion, courtship



# ***Controversies – co-evolution of music and speech?***

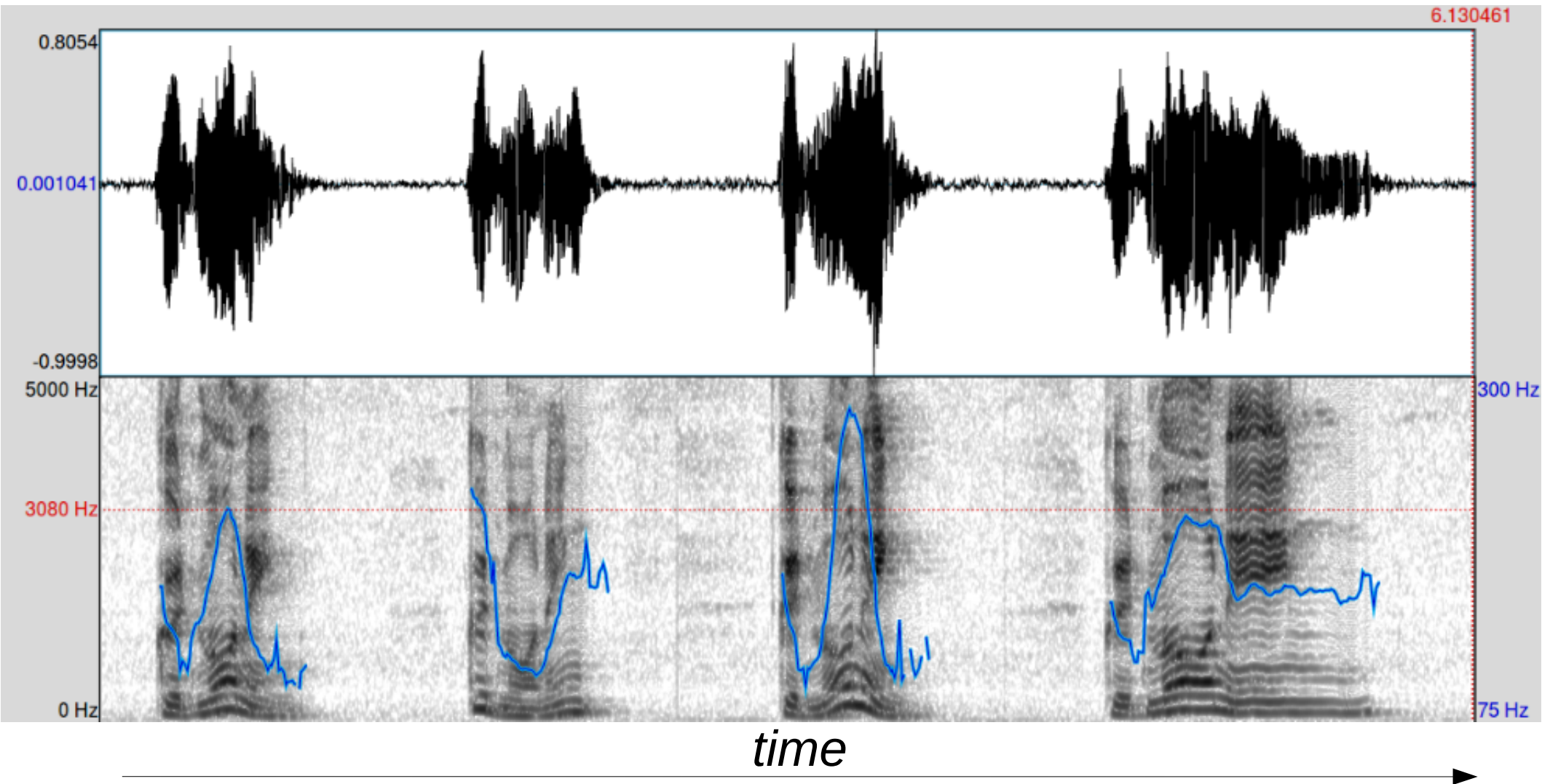
- Both speech and music may have
  - Shared phases in the evolution of behaviour
  - Shared phases in the evolution of cognition?
- A speculation on co-evolution:
  - first simple vocalisations and gestures
    - then sequential iteration leading to rhythm – synchrony with other bodily activities?
    - then parallel iterated signals
    - finally speech and music with complex recursive iterations
  - Compare language acquisition by children:
    - first rhythm and melody, then vocabulary and grammar
  - Compare animal behaviour:
    - simple rhythms of animal speech, from barking dogs to birds
    - simple melodies from birdsong to complex primate ape cries

# ***Other Aspects of Language and Music***

- Meaning in language and music
  - semantic: for example sound symbolism
    - such as imitating voices, animals, natural events
  - pragmatic:
    - for example emotions
      - It is claimed that music can express the emotions *joy, tenderness, longing, coquetry, surprise, fear, complaint, scorn, anger, sarcasm*  
Fonagy, I., K. Magdics (1963). Emotional patterns in intonation and music. *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung* 16, 293-313.
    - for example styles – classical, romantic, blues, ...
- But here we concentrate on sound patterns

***Pitch (melody) – Spectrum (timbre) – Time (rhythm)***

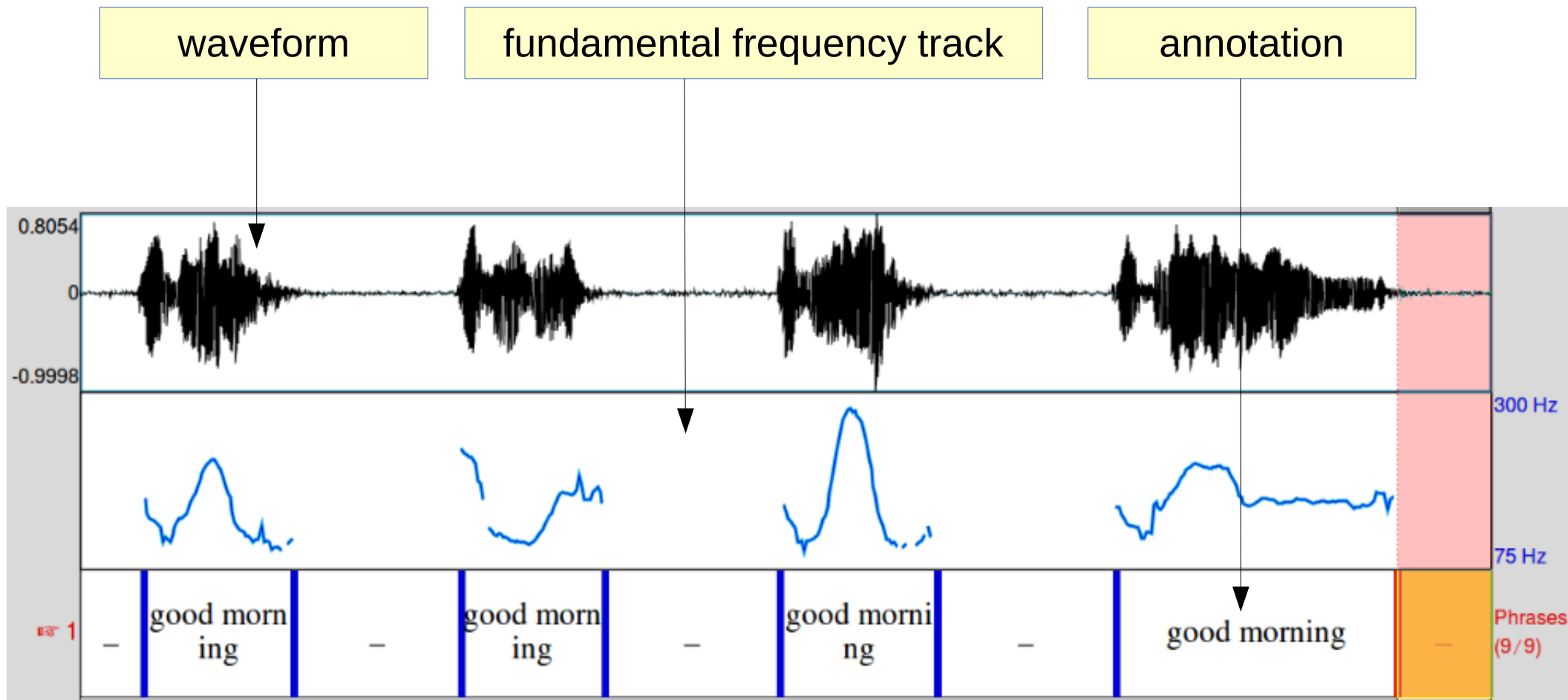
# *Pitch (melody) – Spectrum (timbre) – Time (rhythm)*



Signal time domain  $\approx$  waveform (oscillogram): top, black  
Melody  $\approx$  fundamental frequency ( $F_0$ ,  $f_0$ , pitch track/trace): bottom, blue  
Timbre  $\approx$  spectrogram (harmonics/overtones, formants)

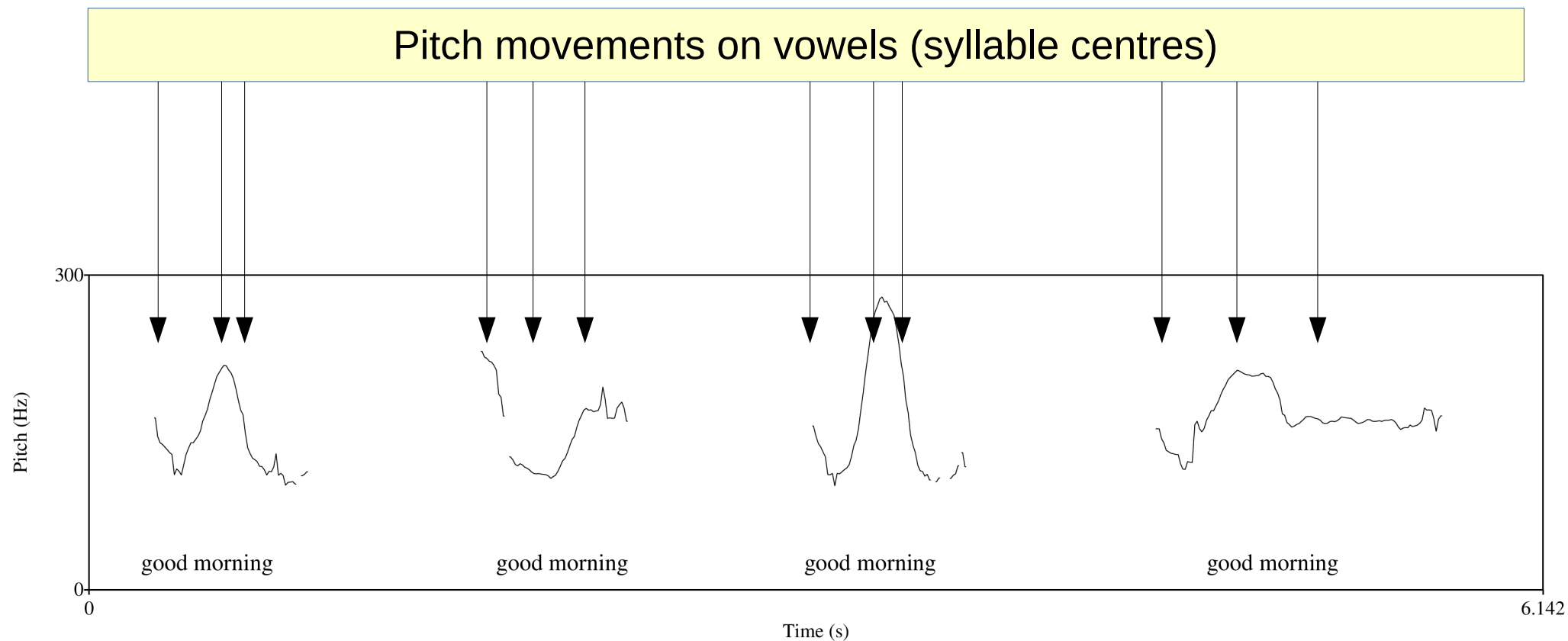
## ***Visualising Speech Melody: “Good morning!”***

# Four ways of saying “Good morning!”



*Visualisation with Praat phonetics software*

# ***Four ways of saying “Good morning!”***



*Visualisation with Praat phonetics software*

# ***Four ways of saying “Good morning!”***

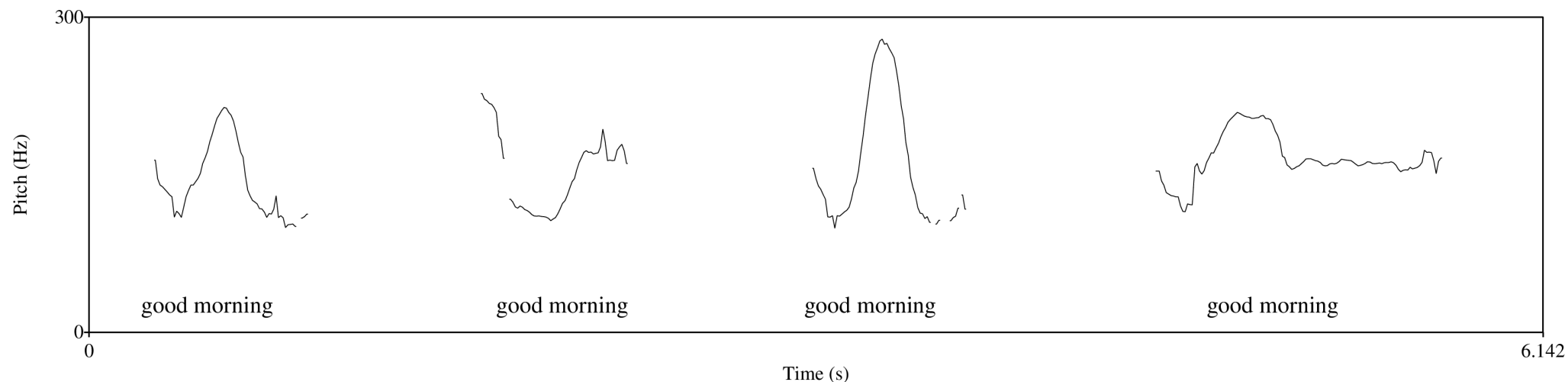
Approximate pragmatic meanings

Normal

Expecting  
interaction

Surprise  
encounter

Greeting at  
a distance



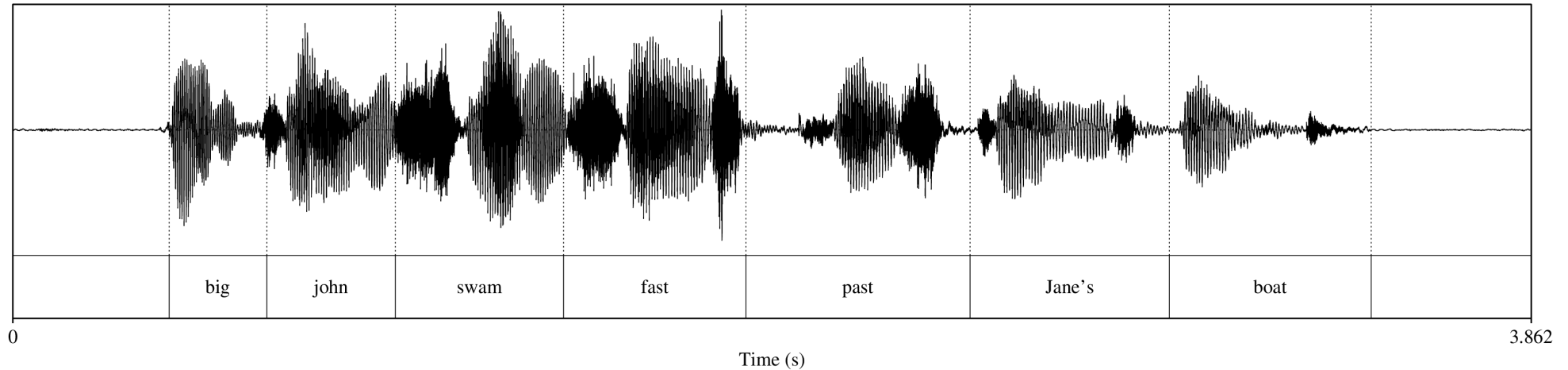
*Visualisation with Praat phonetics software*



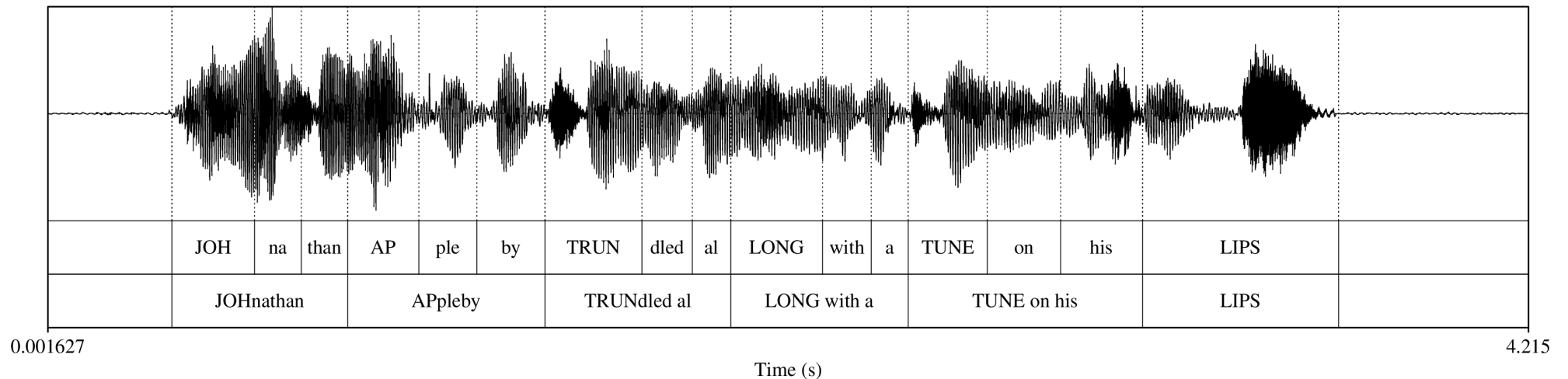
# ***Visualising Speech Rhythm***

# Visualising Speech Rhythm

Regular rhythm, 'syllable timing', 'syllable isochrony'



Regular rhythm, 'foot / stress timing', 'foot isochrony'



# ***Speech Rhythm and Grammar***

- Rhythm and phrasing:
  - Resolution of ambiguity of modifier scope:
    - old men and women will stay here
      - (old (men and women)) will stay here
      - ((old men) and women) will stay here
  - Resolution of ambiguity of operator scope:
    - he did not leave because he was tired
      - he did (not (leave because he was tired))
      - he did (not leave) because he was tired
  - Resolution of prepositional phrase attachment
    - I saw the man on the hill with a telescope
      - I saw (the man on the hill) with a telescope
      - I saw the man (on the hill with a telescope)

# Speech Rhythm and Grammar

- Rhythm and focus:
  - Neutral focus:
    - I like red SHIRTS
  - Emphatic focus:
    - I **LIKE** red shirts
  - Contrastive focus:
    - Jack likes red SHIRTS
    - Jack likes RED shirts
    - Jack **LIKES** red shirts
    - **JACK** likes red shirts
    - **JACK** likes RED shirts

...

With four constituents,  
there are 16 possibilities.

Depending on the  
intensity of the pitch  
accent, these may be  
ambiguous

... but not red HATS  
... but not BLUE shirts  
... but does not HATE red shirts  
... but not JIM,  
...

# ***Rhythm and Melody: Comparing Speech and Music***

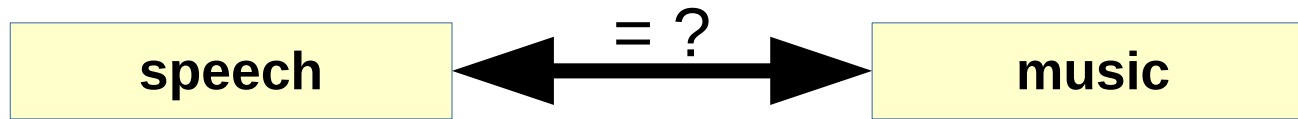
# ***Spoken language influences music (but not always)***

- Song:
  - spoken language may influence music in
    - rhythm
    - melody
  - but this is not always true
  - and may be completely wrong for instrumental music
- English popular songs: speech tends to influence music
  - Rhythm:
    - phrasing adapted to English grammar
    - accents adapted to English stress and focus
  - Melody:
    - local accents on syllables and words
    - global tunes and accents on phrases

# ***Rhythm and Melody***

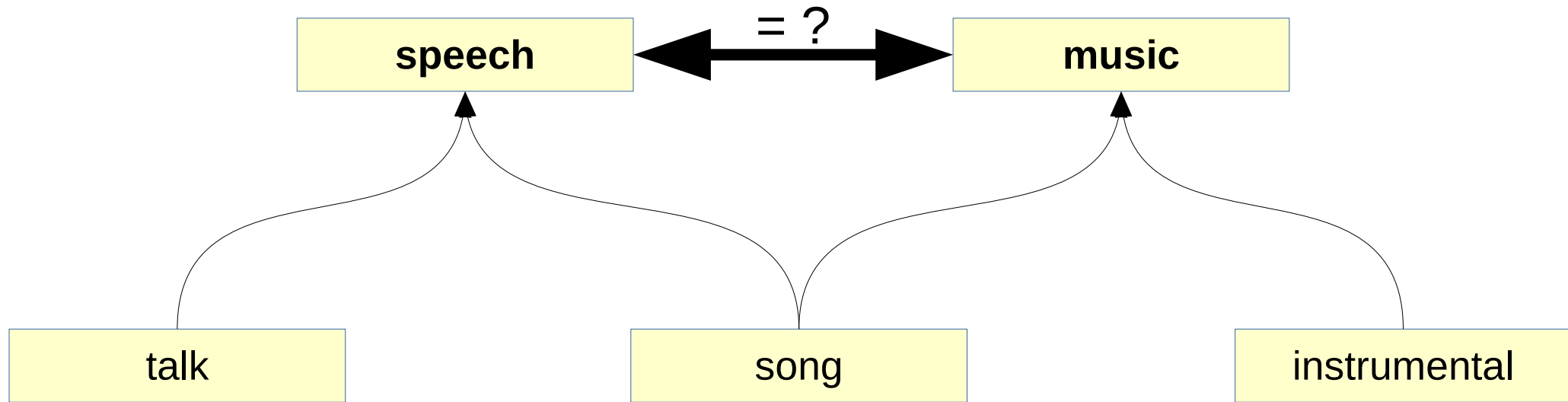
- Spoken language and music share
  - melody
    - changes in fundamental frequency of signal over time
  - timbre
    - overtone (harmonic) pattern of signal:
      - voice: different vowels, different voice qualities
      - music: resonance qualities of instrument
  - rhythm
    - patterns of
      - sequences of stronger and weaker elements
      - more or less regular intervals between stronger elements
    - types
      - voice: stress timing, syllable timing, mora timing
      - music: 3/4, 4/

# ***Rhythm***

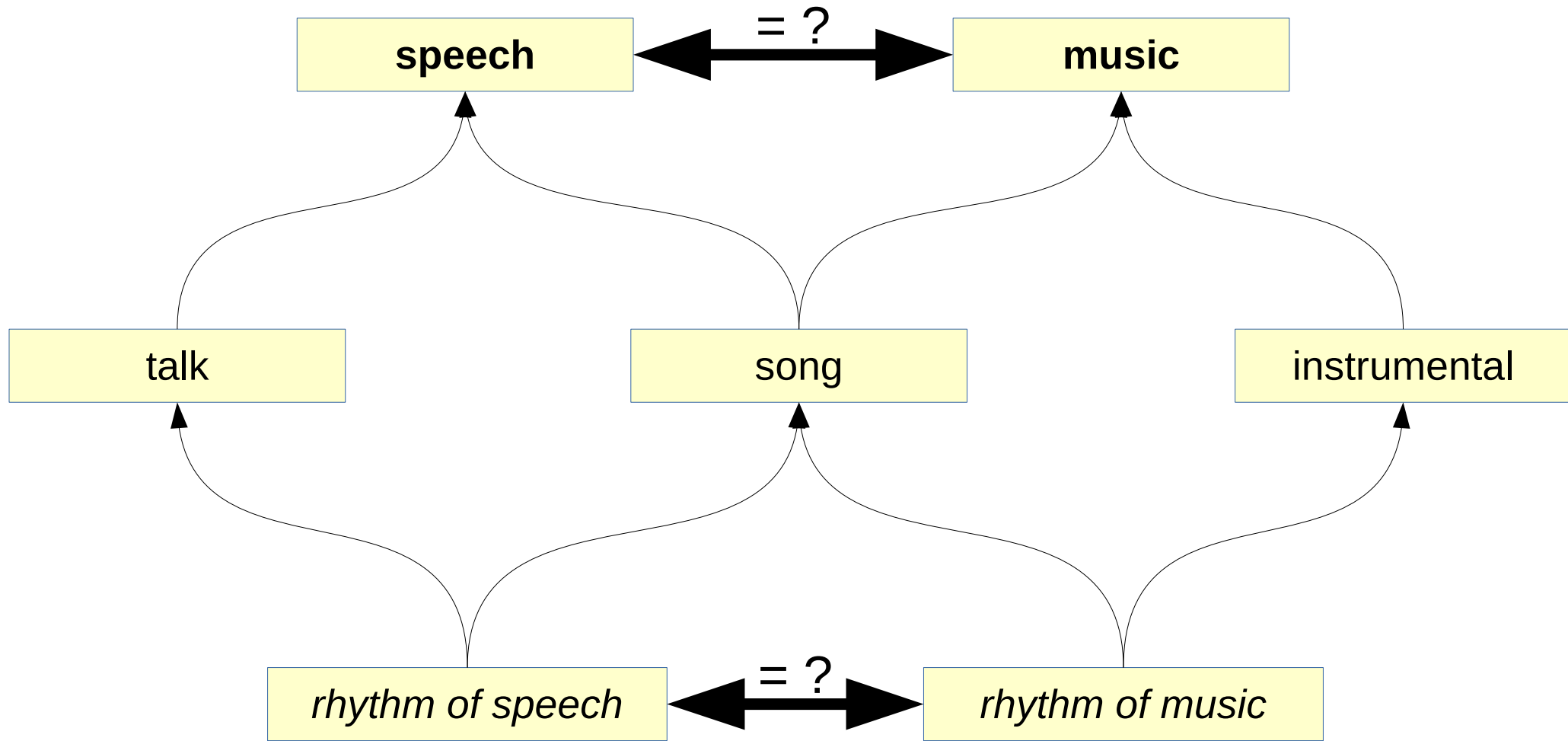




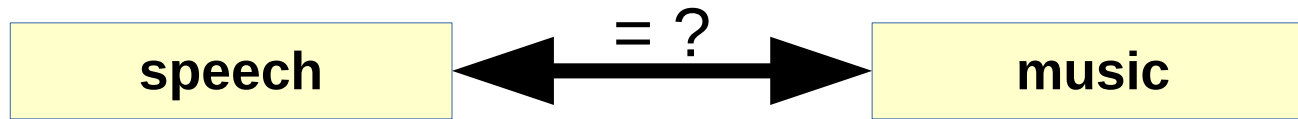
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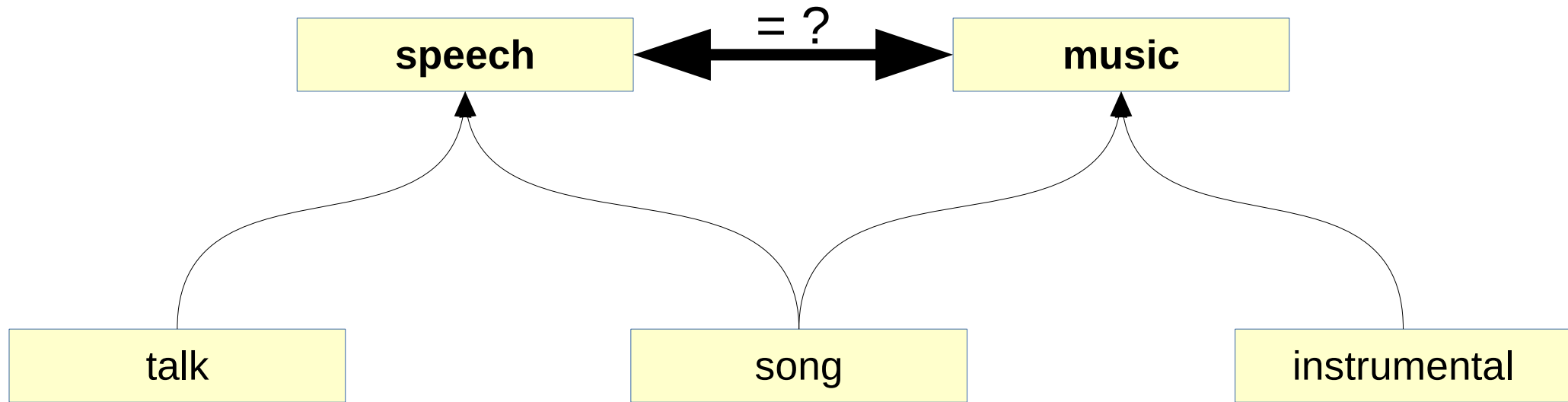
# ***Rhythm***



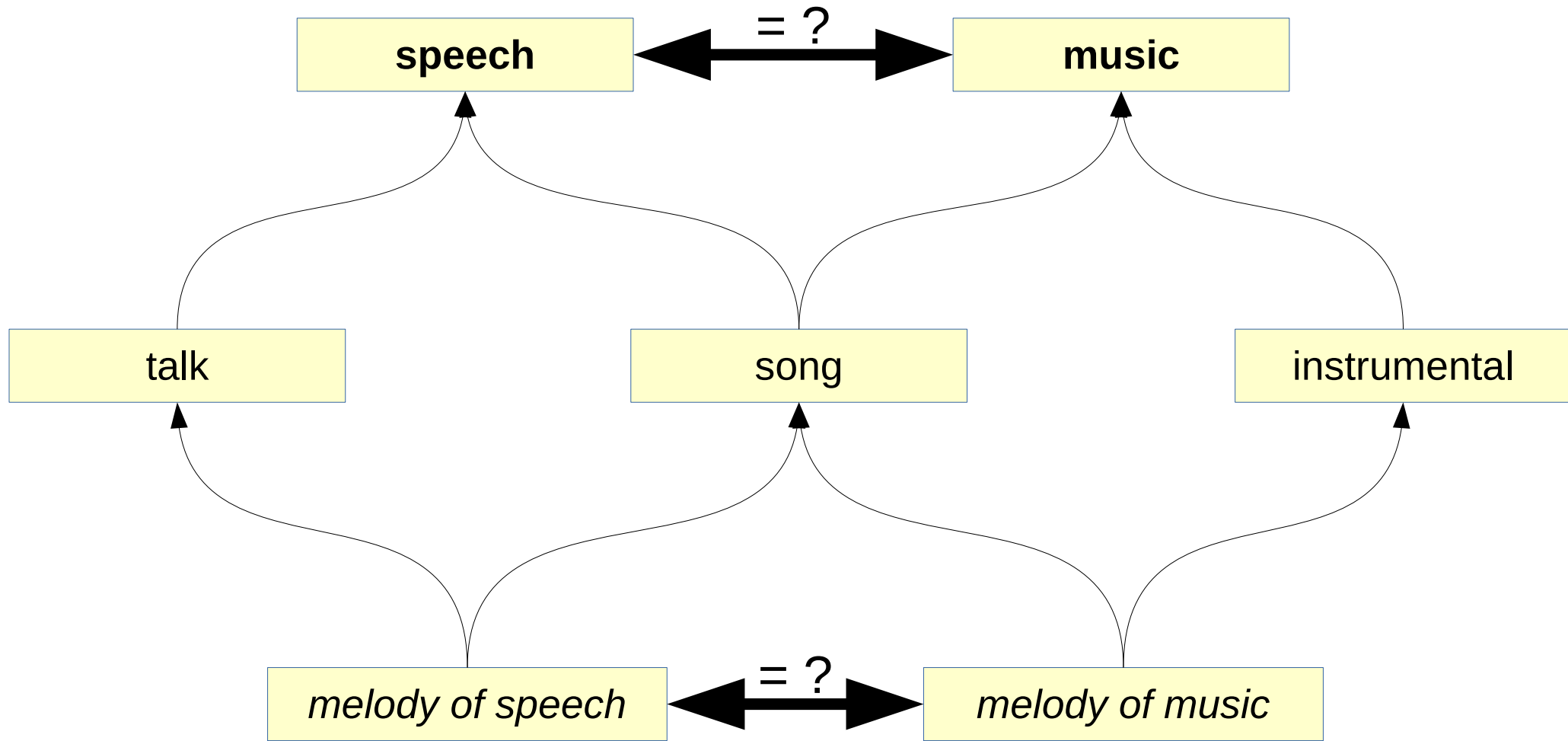
# ***Melody***



# *Melody*



# ***Melody***



***Putting Things Together:***  
***The Sounds of Language***  
***The Sounds of Music***

# ***Speech (Spoken Language)***

**SPEECH**

**tone**

**vowels  
(resonant)**

**consonants  
(noisy)**

**duration**

**WORD**

# ***Speech (Spoken Language)***

**SPEECH**

**intonation**

**tone**

**vowels  
(resonant)**

**consonants  
(noisy)**

**duration**

**phrasing**

**WORD**

**SENTENCE**



# ***Speech (Spoken Language)***

**SPEECH**

**speech  
sounds**

**intonation**

**tone**

**vowels  
(resonant)**

**consonants  
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# *Speech (Spoken Language)*

**SPEECH**

**melody**

**speech  
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**intonation**

**tone**

**vowels  
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**consonants  
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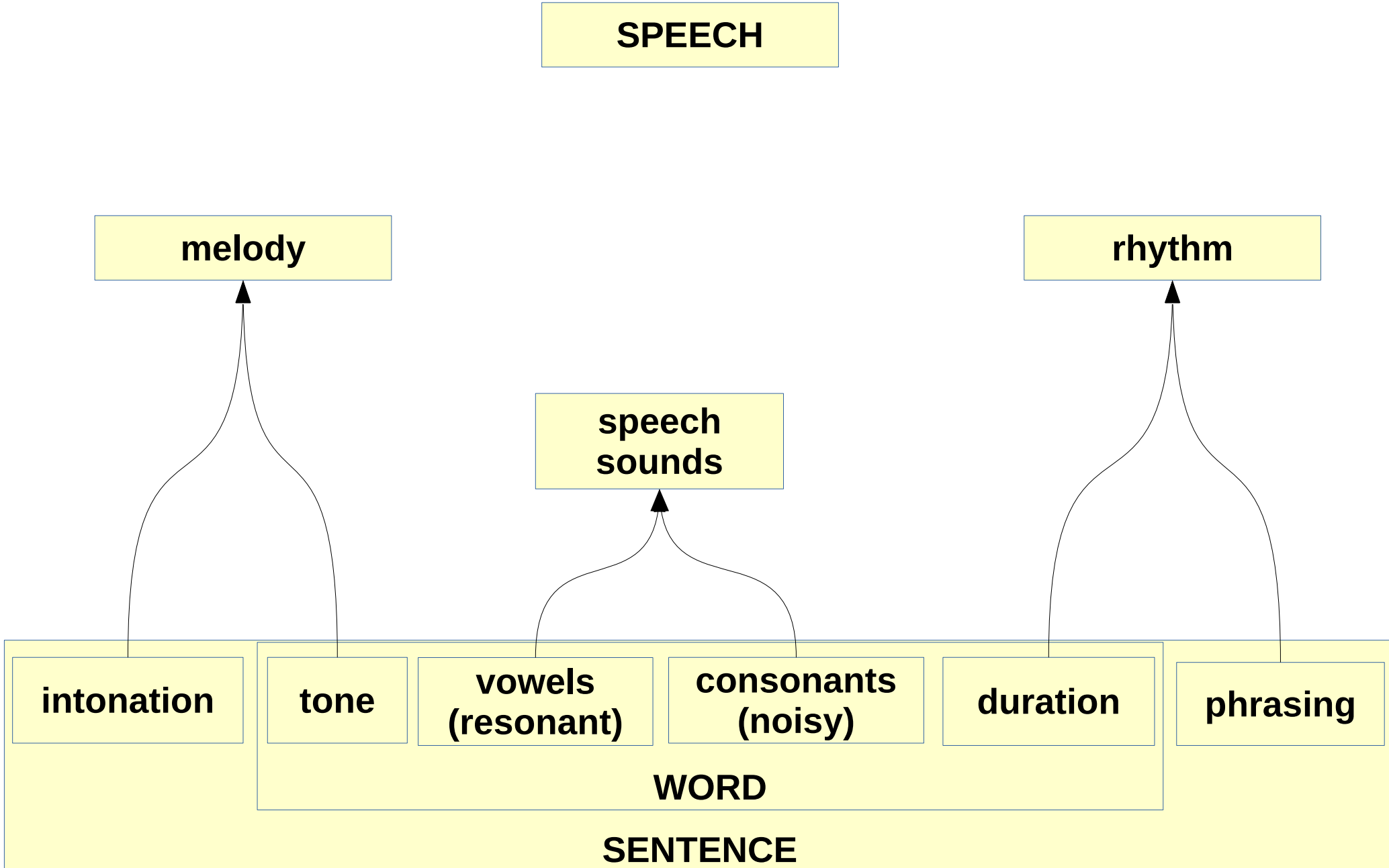
**duration**

**phrasing**

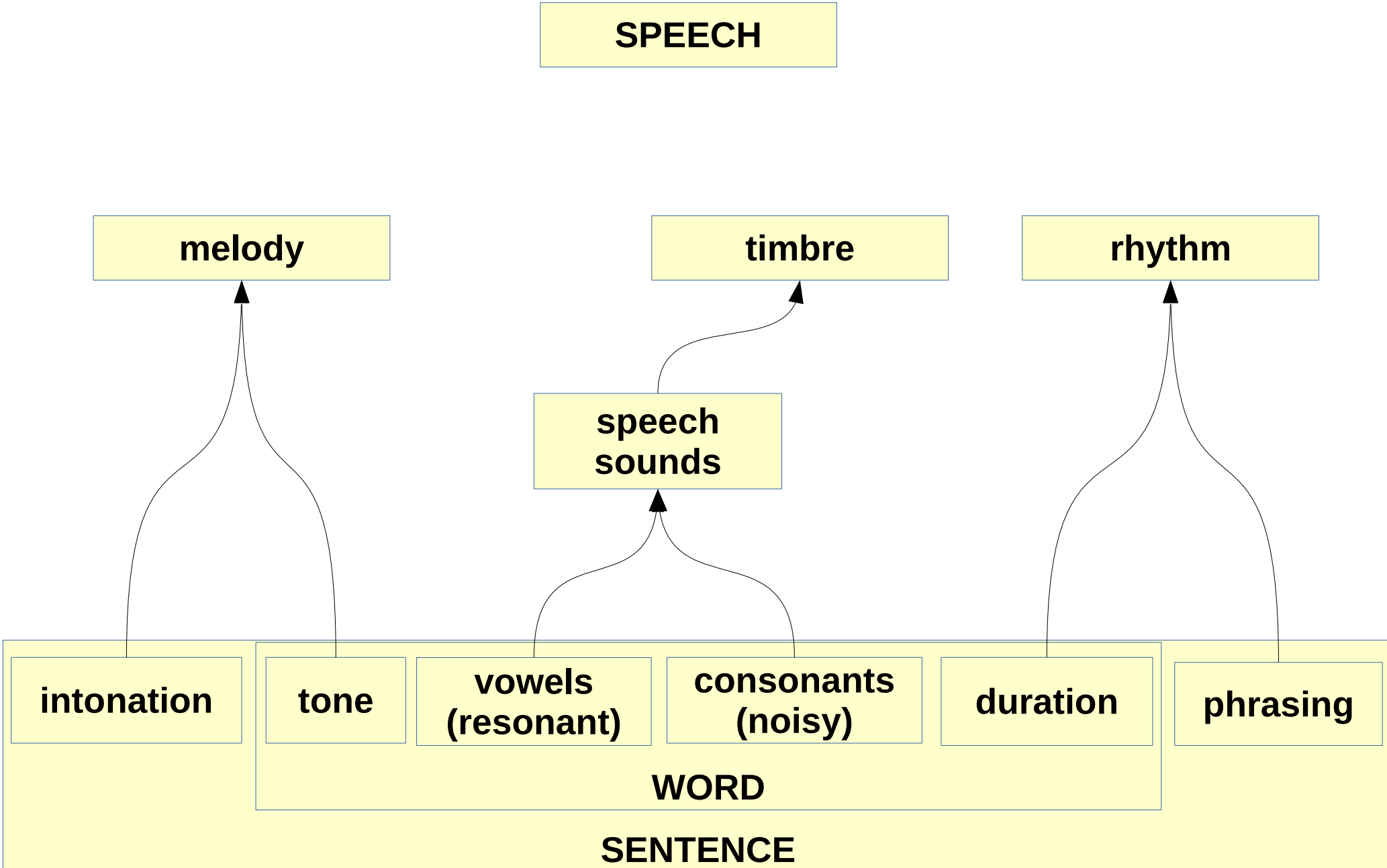
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**SENTENCE**

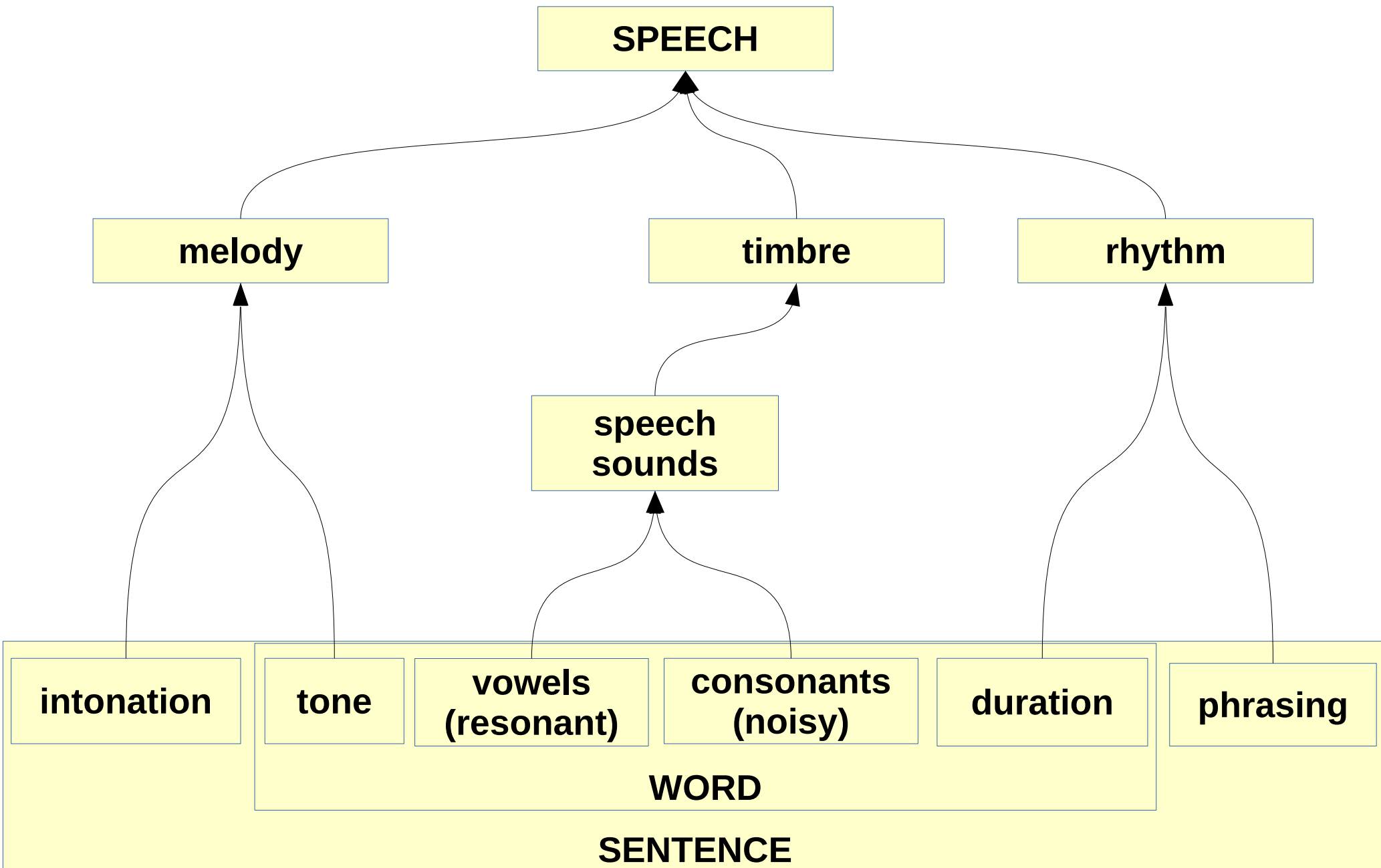
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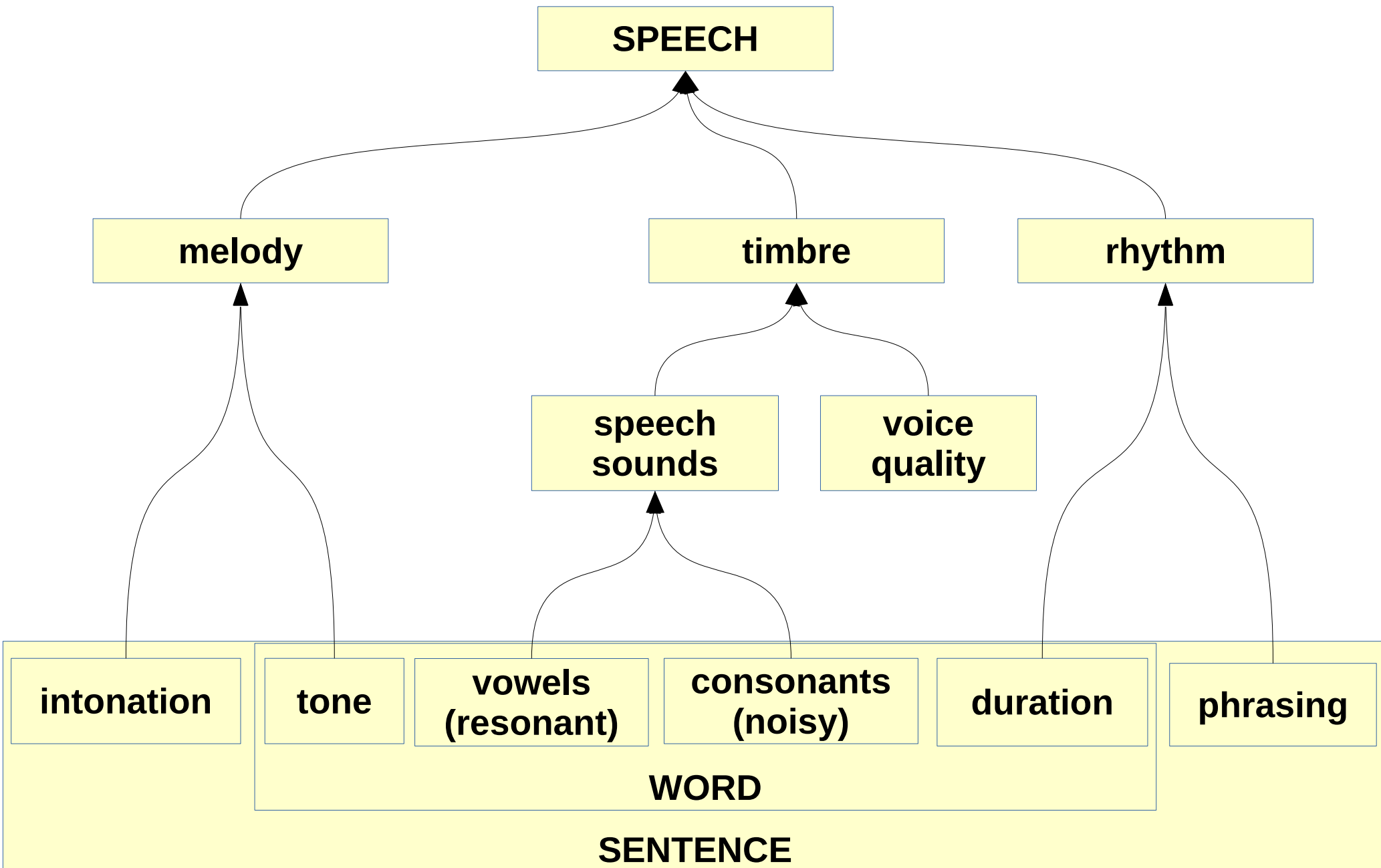
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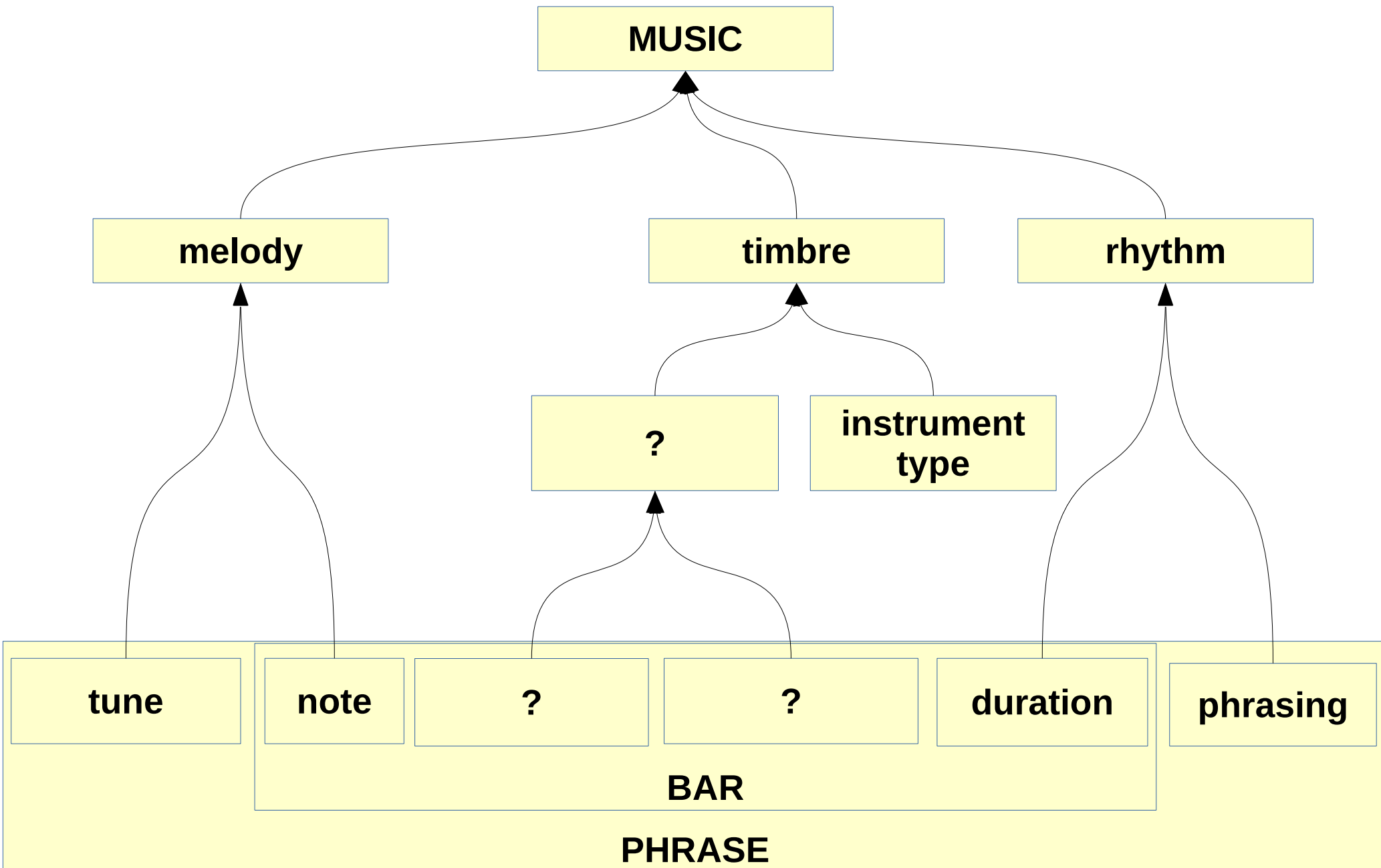
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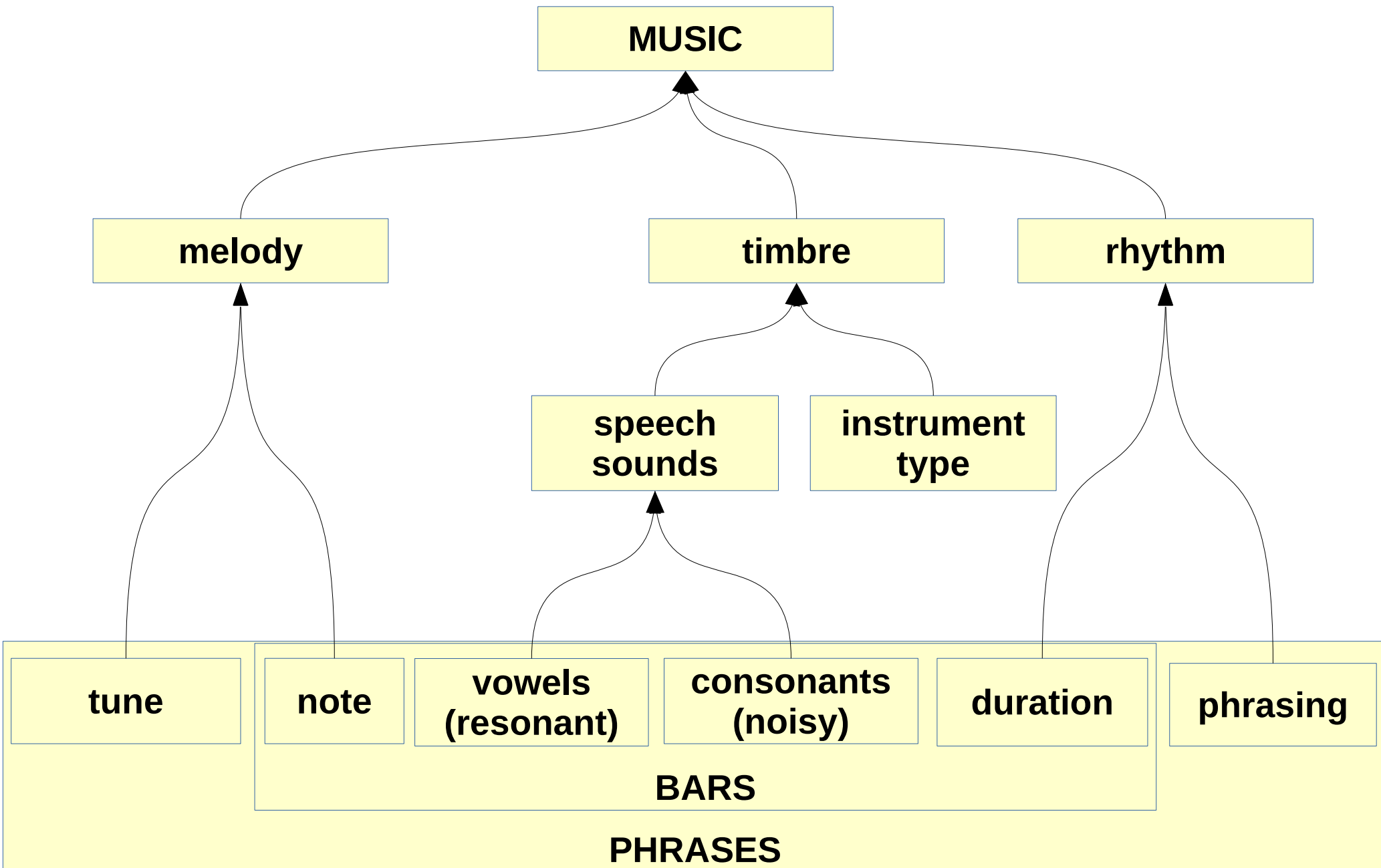
# *Speech (Spoken Language)*



# ***From Speech to Music***



# ***Music + Speech = Song***





# ***Parallel Signals in Speech and Music***

# ***Parallel ‘melodies’ in speech and music***

- Speech:
  - 2 (or more) speakers in dialogue: usually sequential
  - multimodal streams:
    - locutions
      - distinctive features
    - prosody
      - global intonation
      - local tones
    - gesture
- Music
  - 2 (or more) musicians in orchestra / band: usually parallel
  - multimodal streams
    - text, lyrics
    - music
      - harmonies
      -
  - accompanying behaviour

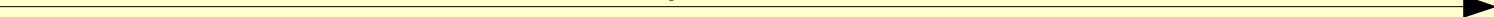
[http://www.ted.com/talks/bobby\\_mcferrin\\_hacks\\_your\\_brain\\_with\\_music](http://www.ted.com/talks/bobby_mcferrin_hacks_your_brain_with_music)

# ***Rhythm (or lack of it)***

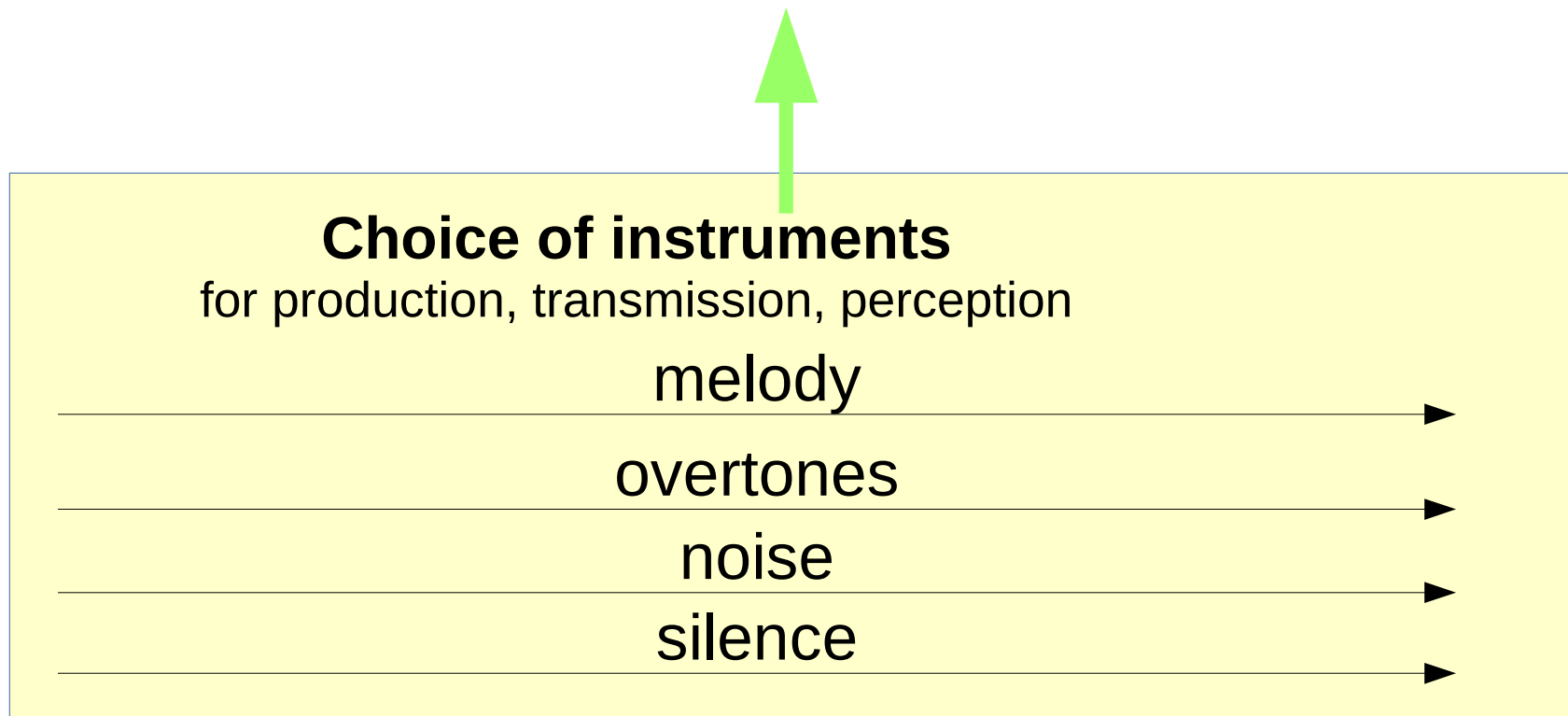
## **Speech (spoken language)**

with physical forms and  
semantic / pragmatic meanings

words, sentences



# ***Parallel signal streams in communication***

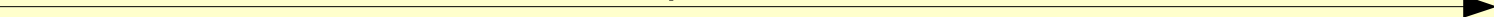


# ***Parallel signal streams in communication***

## **Speech (spoken language)**

with physical forms and  
semantic / pragmatic meanings

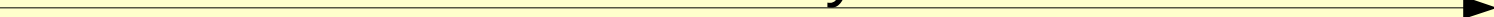
words, sentences



## **Choice of instruments**

for production, transmission, perception

melody



overtones



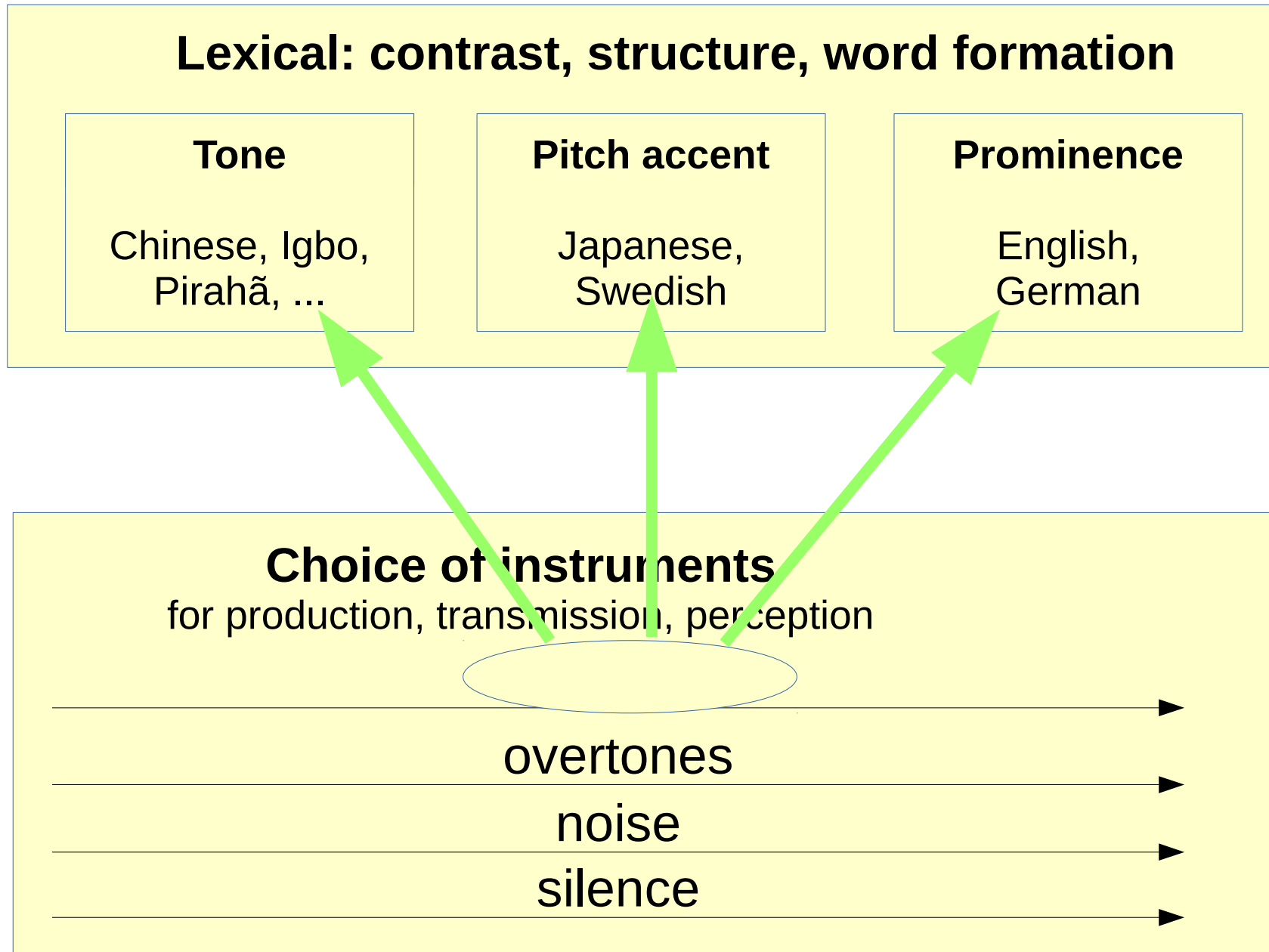
noise



silence



# Melody



# Melody

**Discourse: dialogue acts, turn-taking**

**Intonation**

All languages – but in different ways

**Choice of instruments**

for production, transmission, perception

overtones

noise

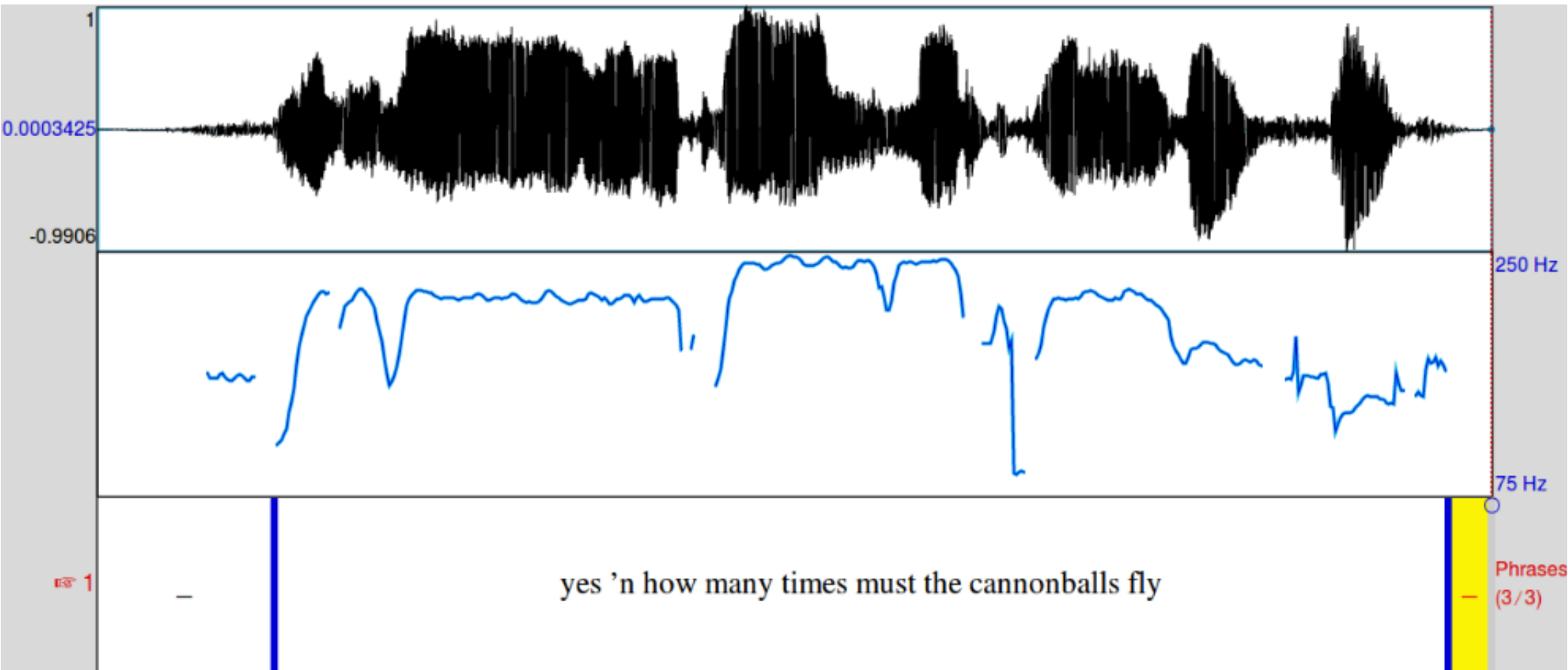
silence

## ***Melody in Song, an Example: Bob Dylan***



# *Spoken language influences music (but not always)*

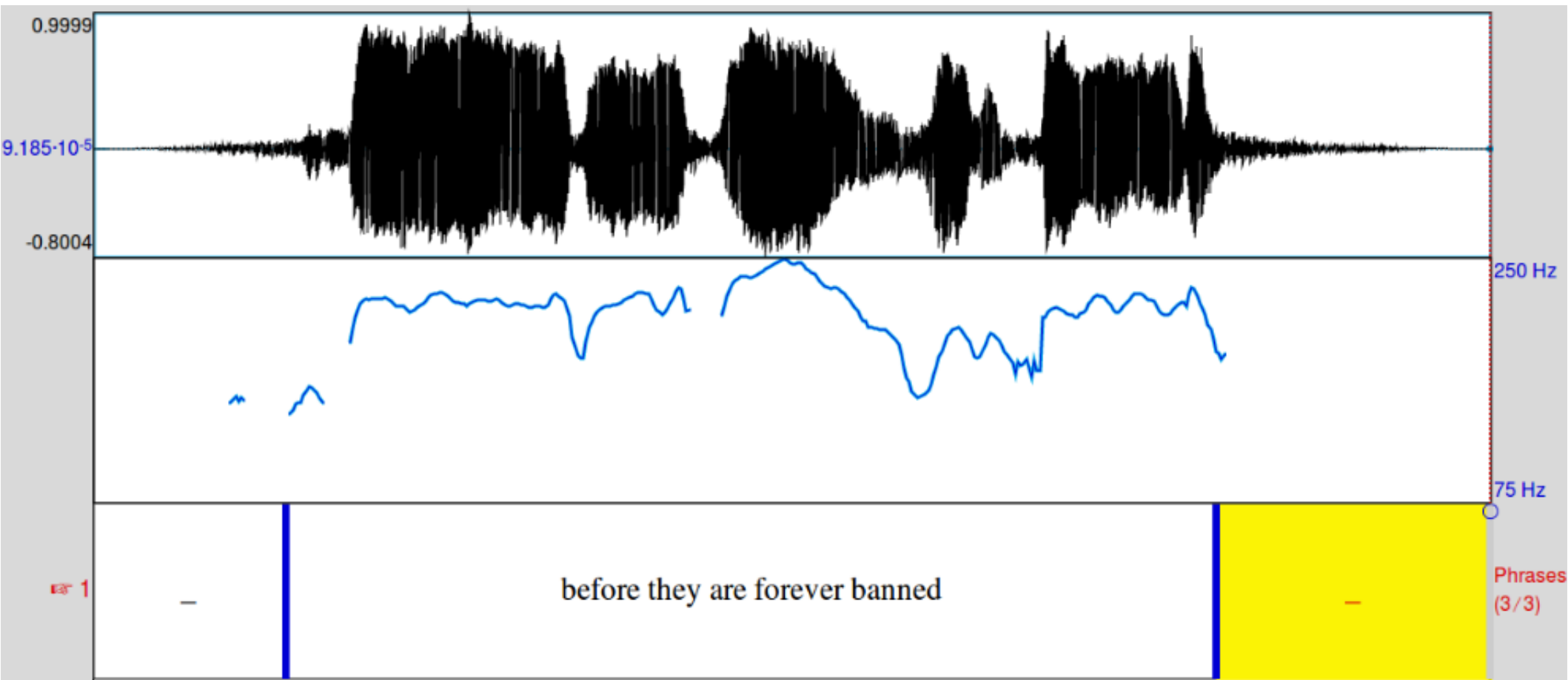
- Discussion:
  - check the pitch trace in relation to grammatical categories



Bob Dylan, *The answer is blowing in the wind.*

# *Spoken language influences music (but not always)*

- Discussion:
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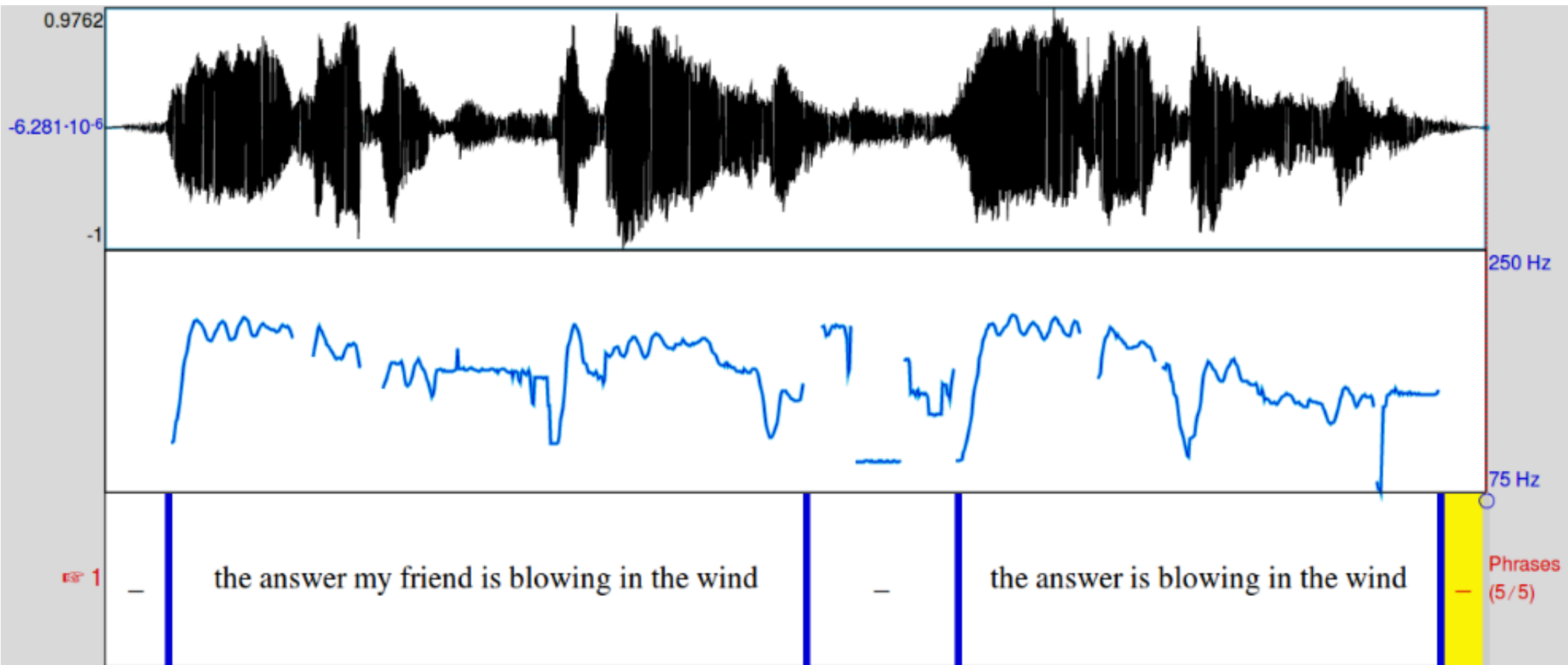


Bob Dylan, *The answer is blowing in the wind.*

# Spoken language influences music (but not always)

Check the pitch pattern in relation to grammatical categories, noting

- changes in pitch movement
- after each change, the direction of pitch movement
- (falling, rising, level)

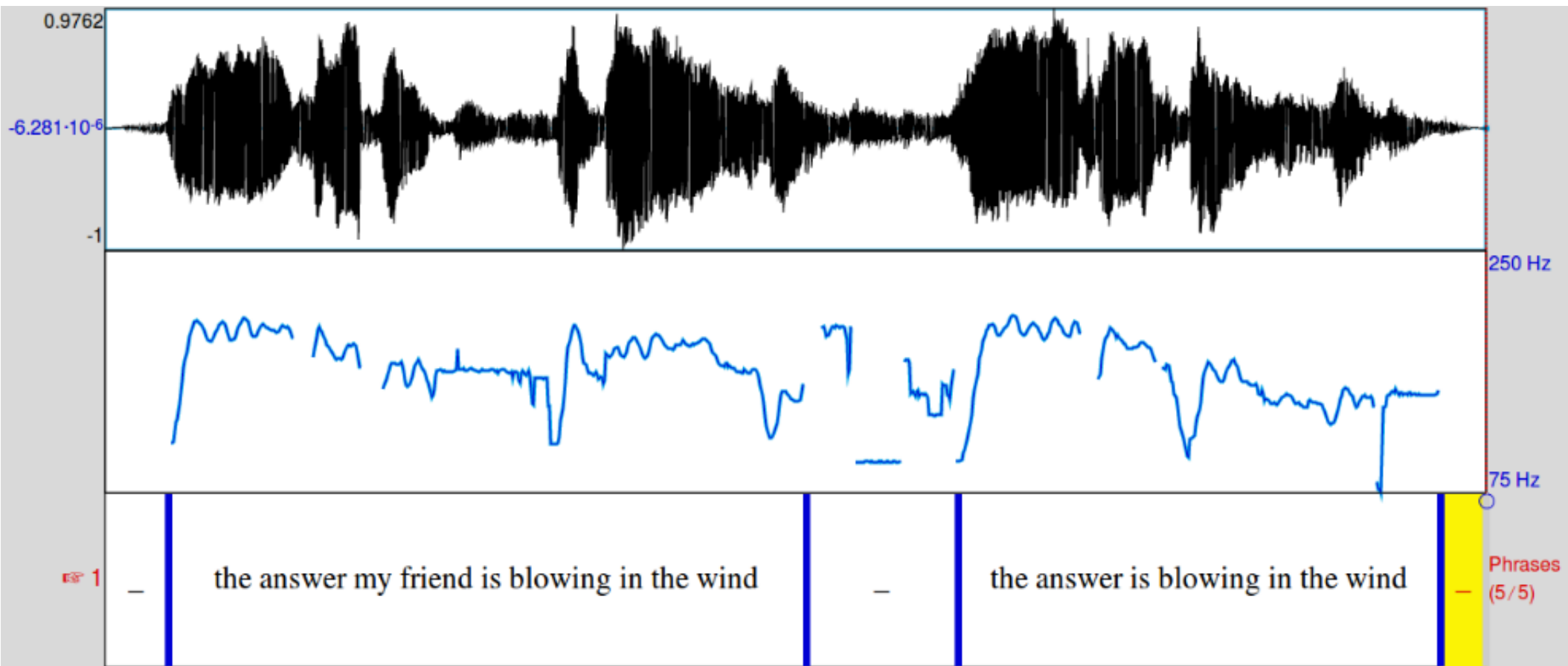


Bob Dylan, *The answer is blowing in the wind.*

# Musical Melody and English Grammar

Listen to and describe the way the phrases are expressed and separated:

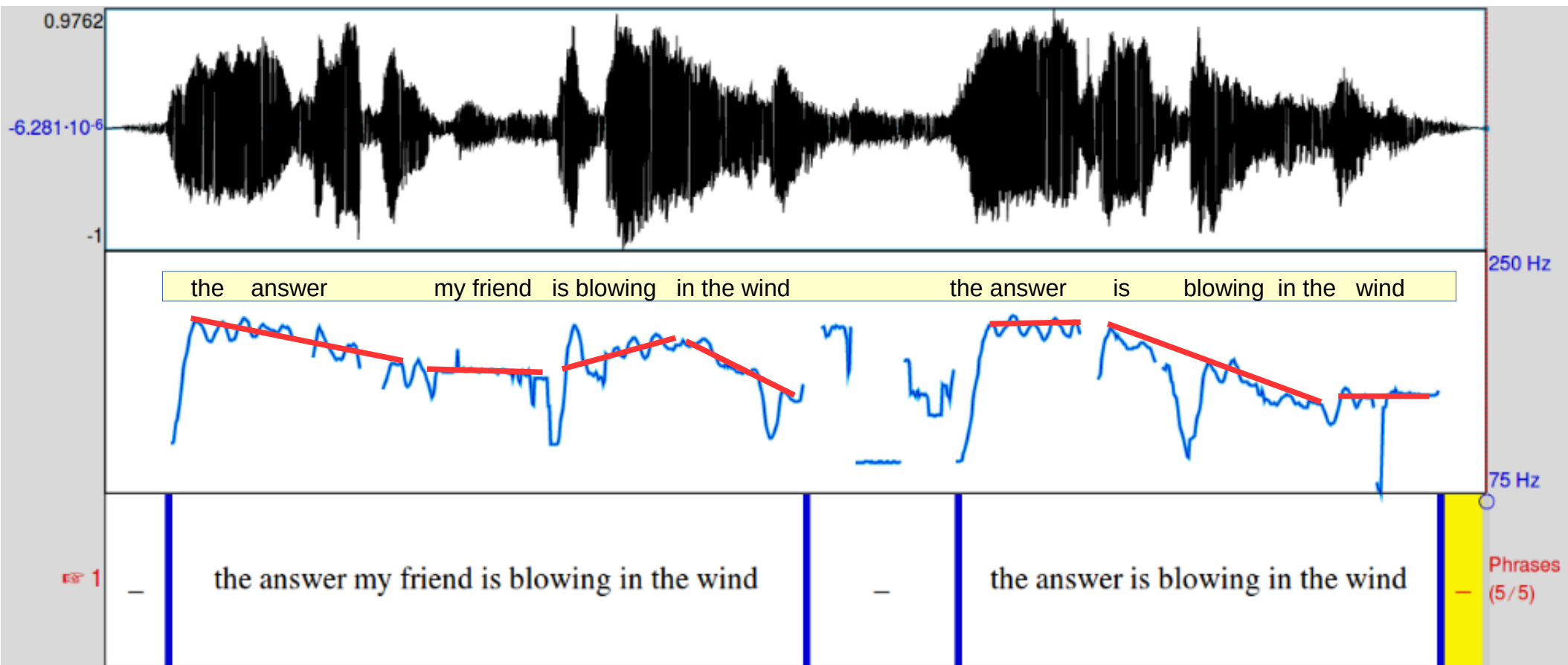
*the answer, my friend, is blowing, in the wind*



# Musical Melody and English Grammar

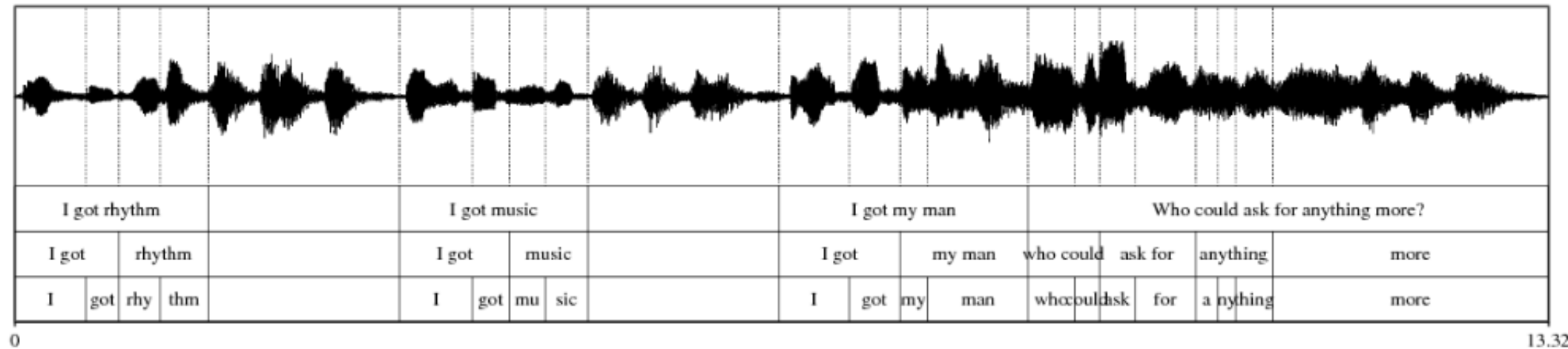
Listen to and describe the way the phrases are expressed and separated:

*the answer, my friend, is blowing, in the wind*



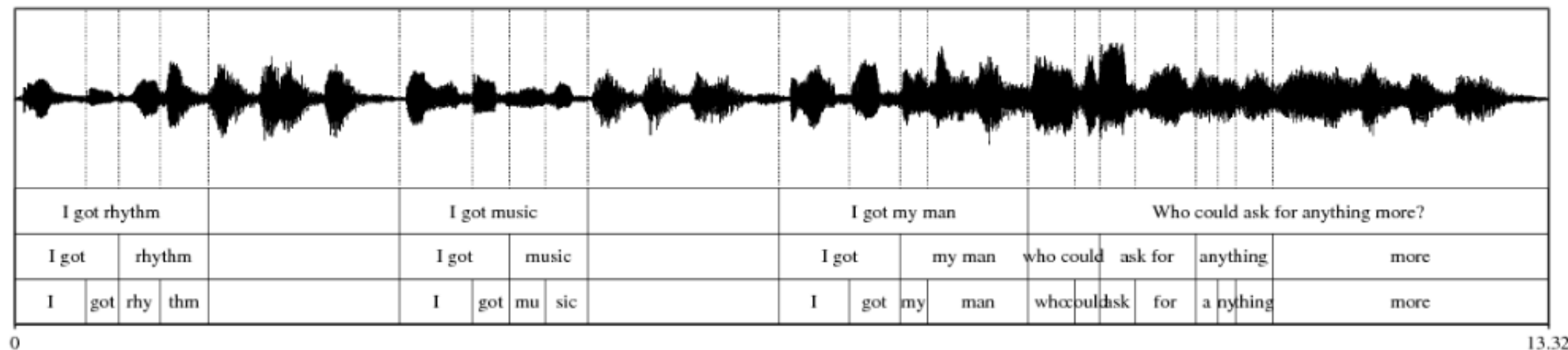
## ***Rhythm in Song, an Example: Ella Fitzgerald***

# Rhythm in Music



*Ella Fitzgerald, "I got rhythm"*

# Rhythm in Music

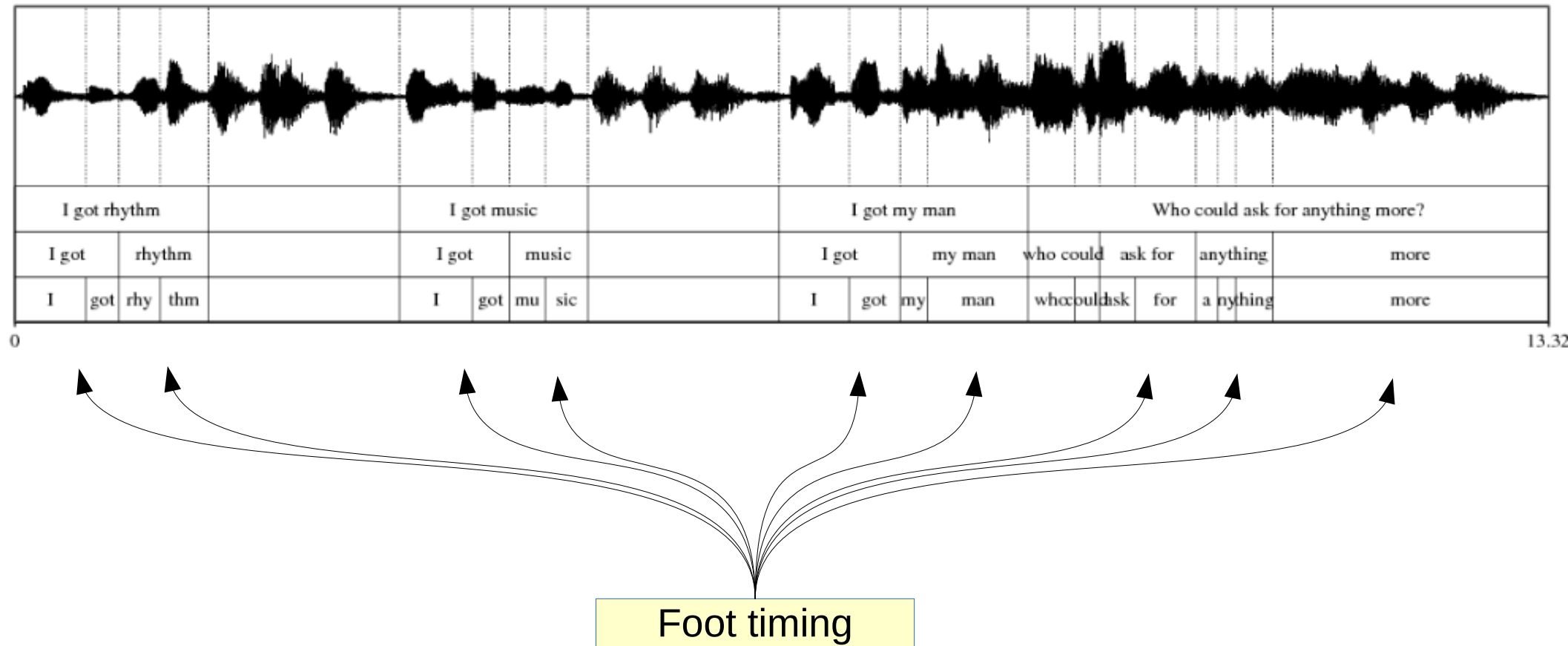


Foot timing

*Ella Fitzgerald, "I got rhythm"*

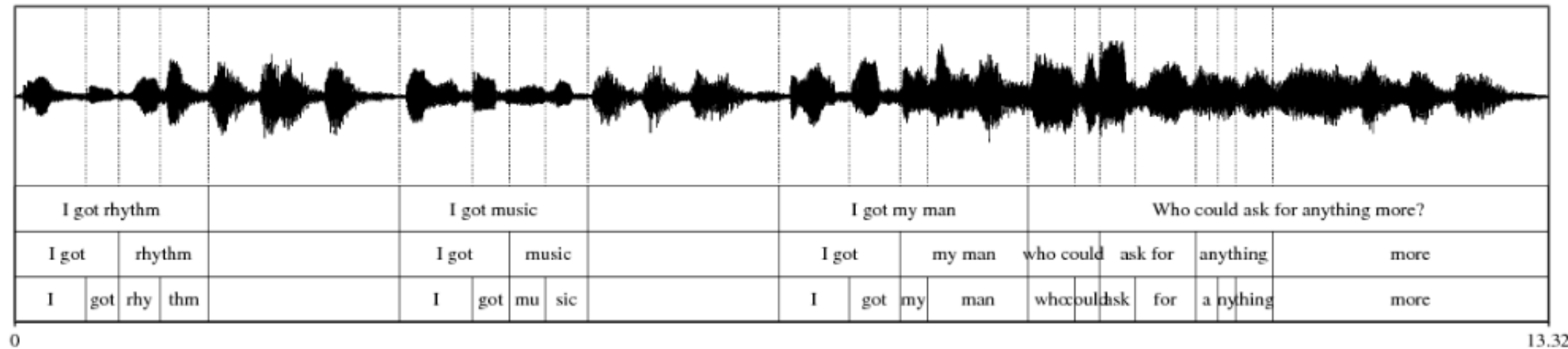


# Rhythm in Music



*Ella Fitzgerald, "I got rhythm"*

# English Rhythm in Music



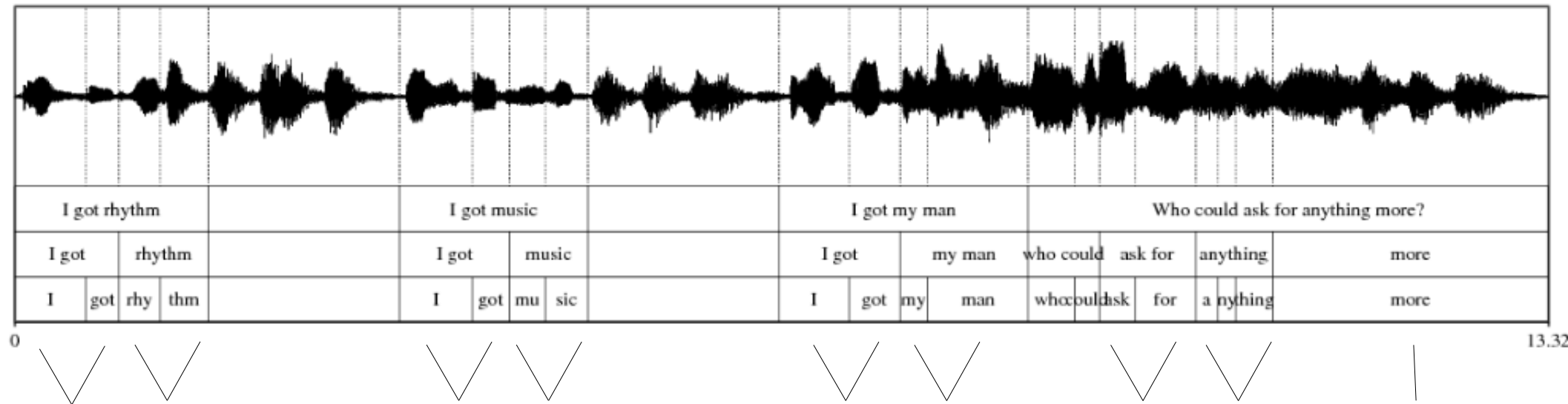
Foot timing

Special case: only unstressed syllables  
(anacrusis)

*Ella Fitzgerald, "I got rhythm"*

# Musical Rhythm and English Grammar

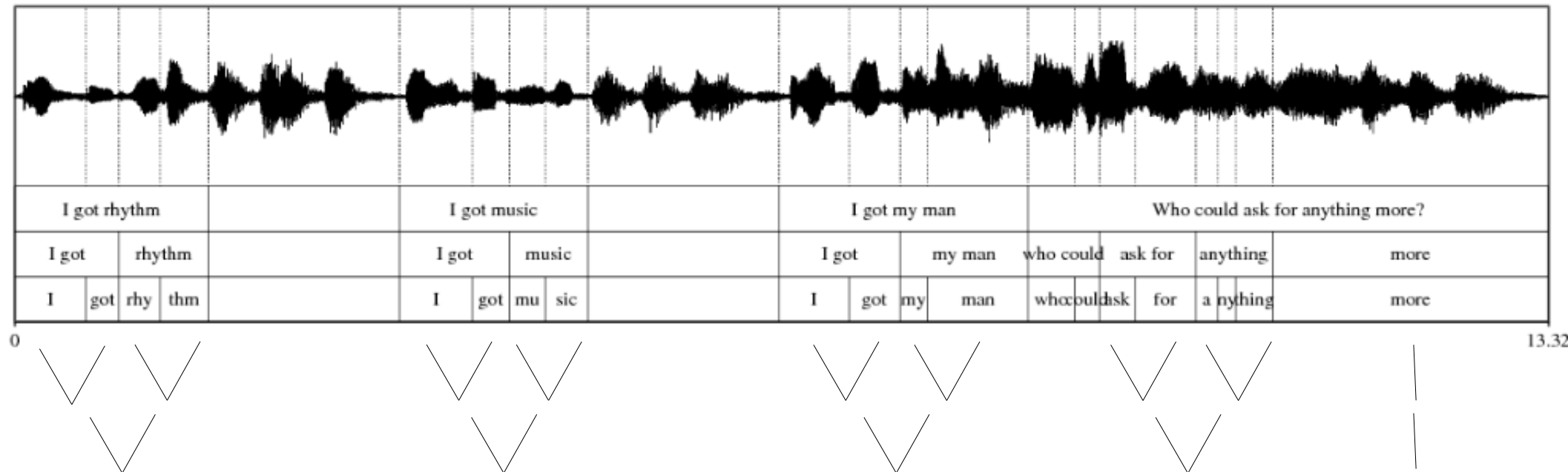
*Note that the musical structures ALMOST fit the grammatical structures!*



*Ella Fitzgerald, "I got rhythm"*

# Musical Rhythm and English Grammar

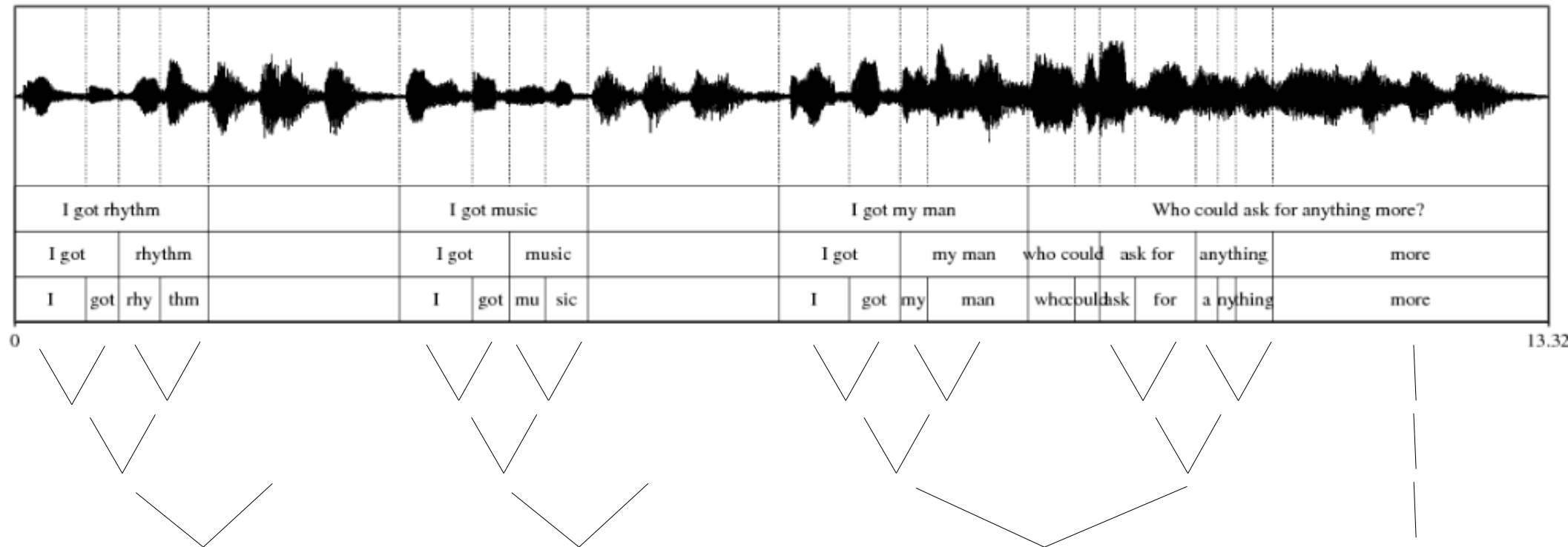
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# Musical Rhythm and English Grammar

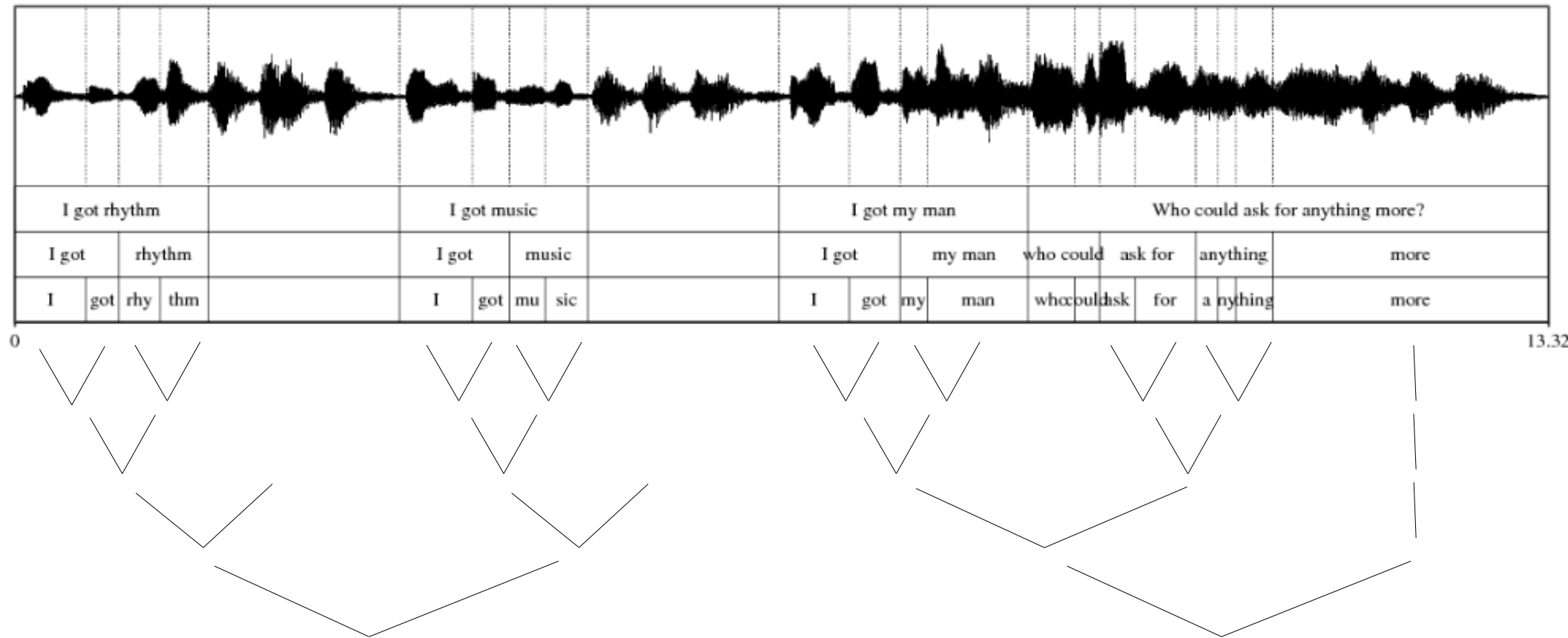
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# Musical Rhythm and English Grammar

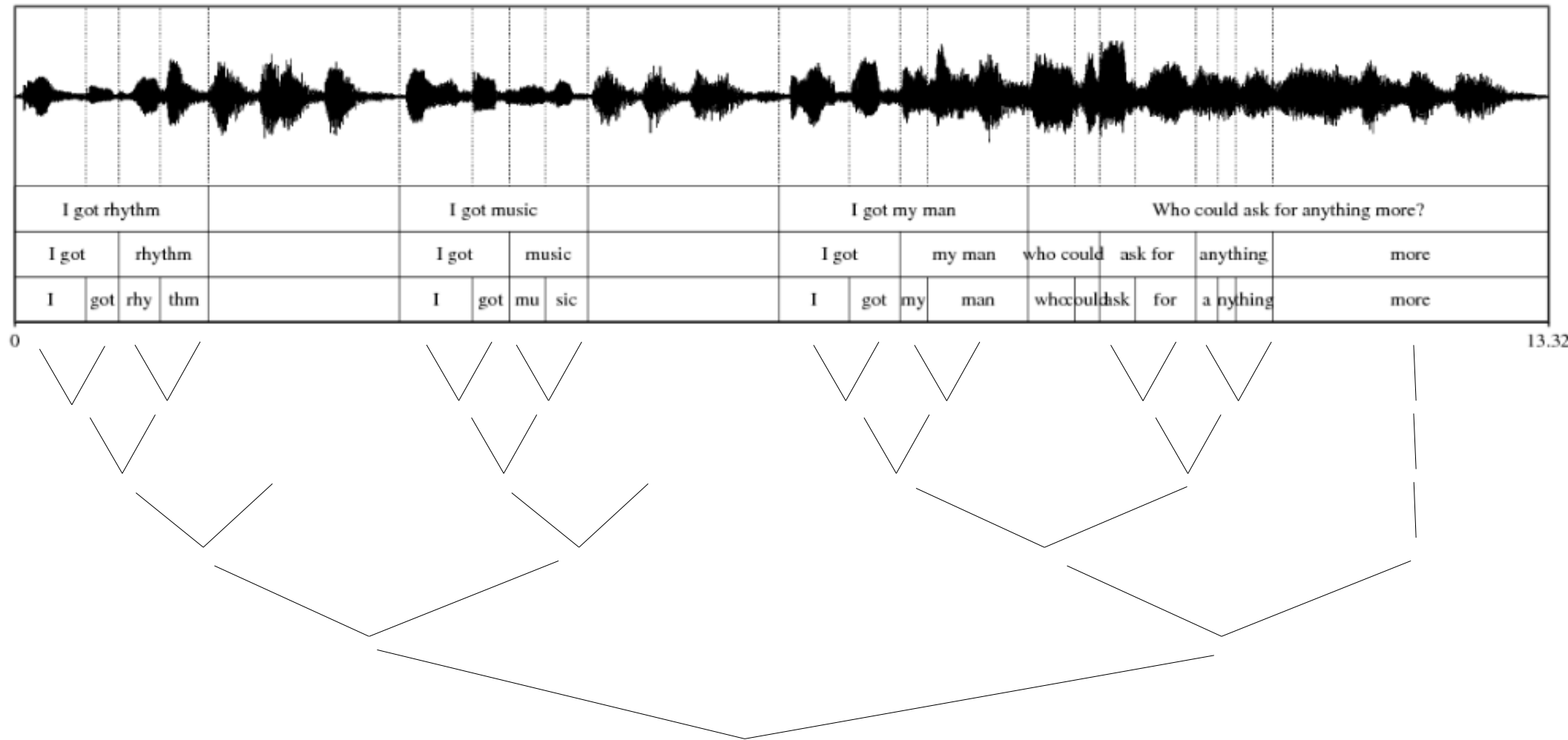
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# Musical Rhythm and English Grammar

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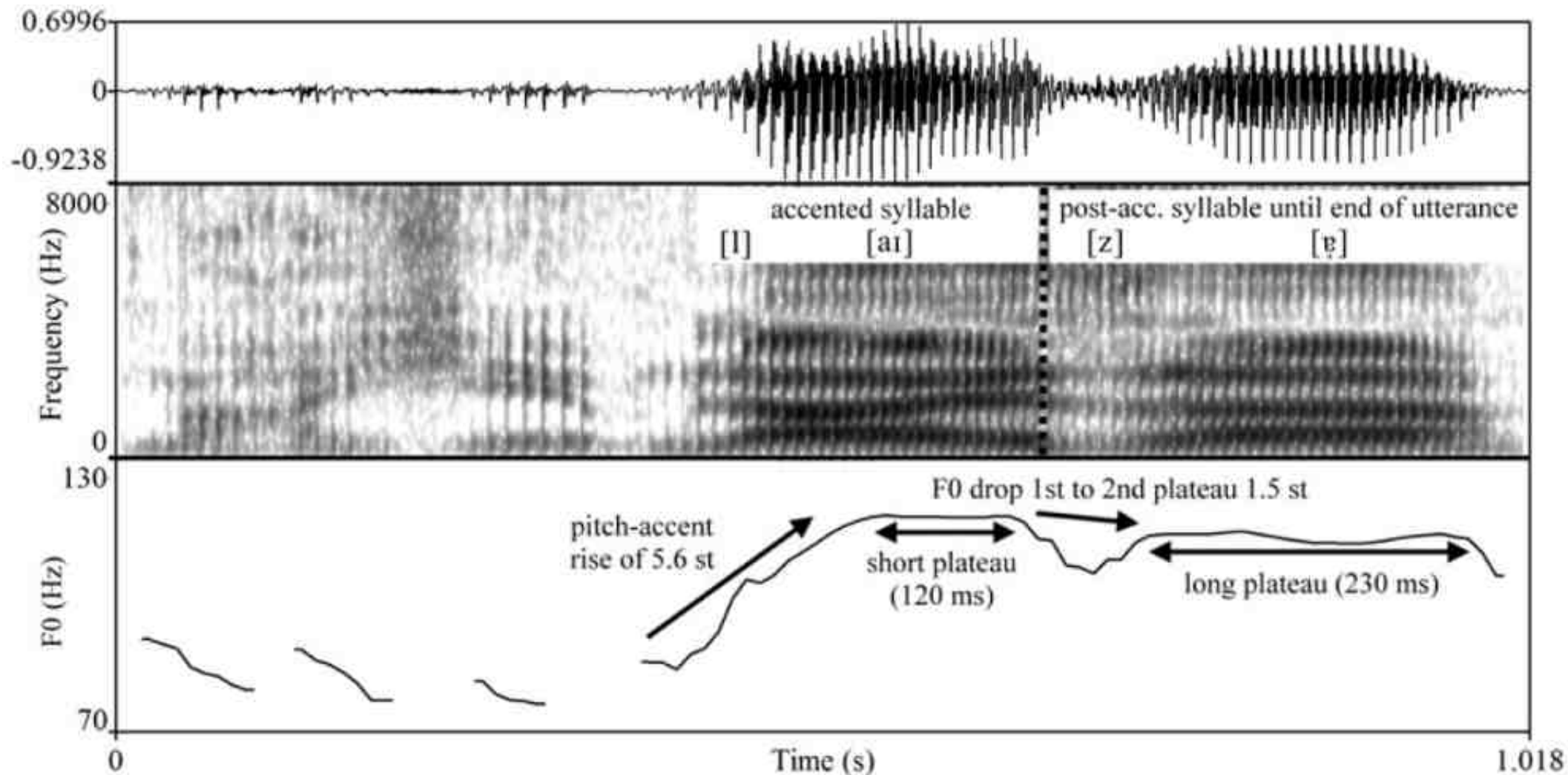
# ***Universals of Melody?***



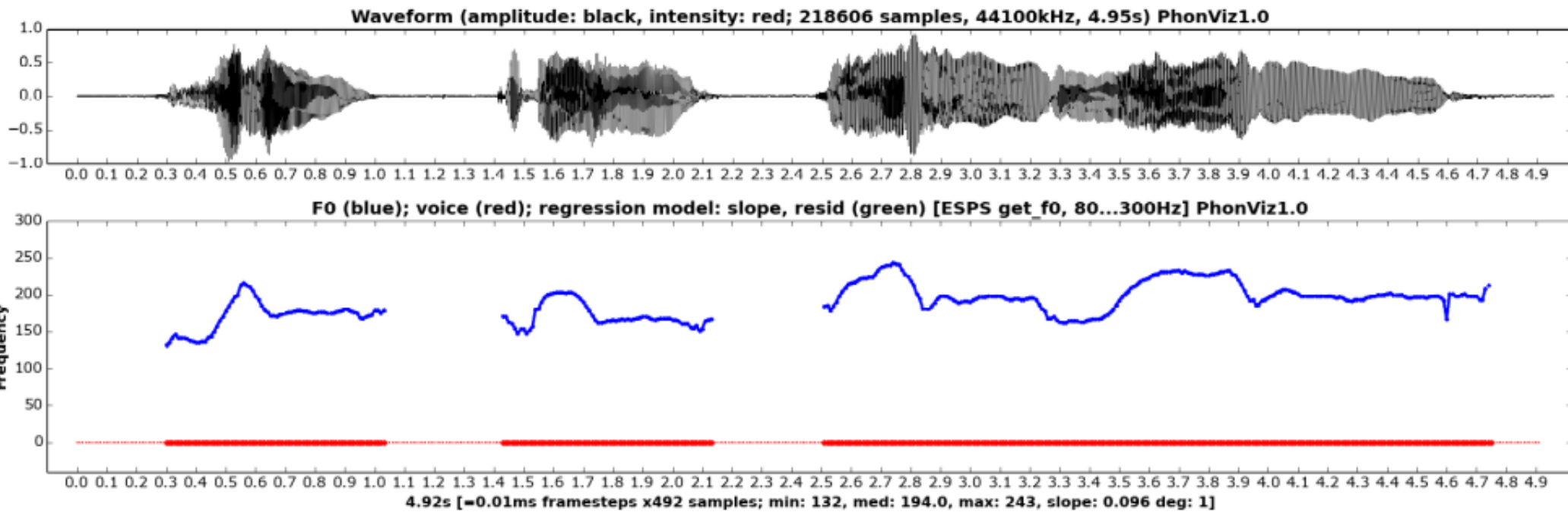
# ***Between Speech and Song***

- ‘Call contours’
  - stylised, flat pitches
  - musical intervals, e.g. minor 3<sup>rd</sup> (3 semitones)
- Chants:
  - childrens’ chants
    - it’s raining, it’s pouring, the old man’s snoring, ...
    - cowardy cowardy custard, your face is made of mustard
  - vendors’ sales chants
  - religious liturgical chants
  - rap

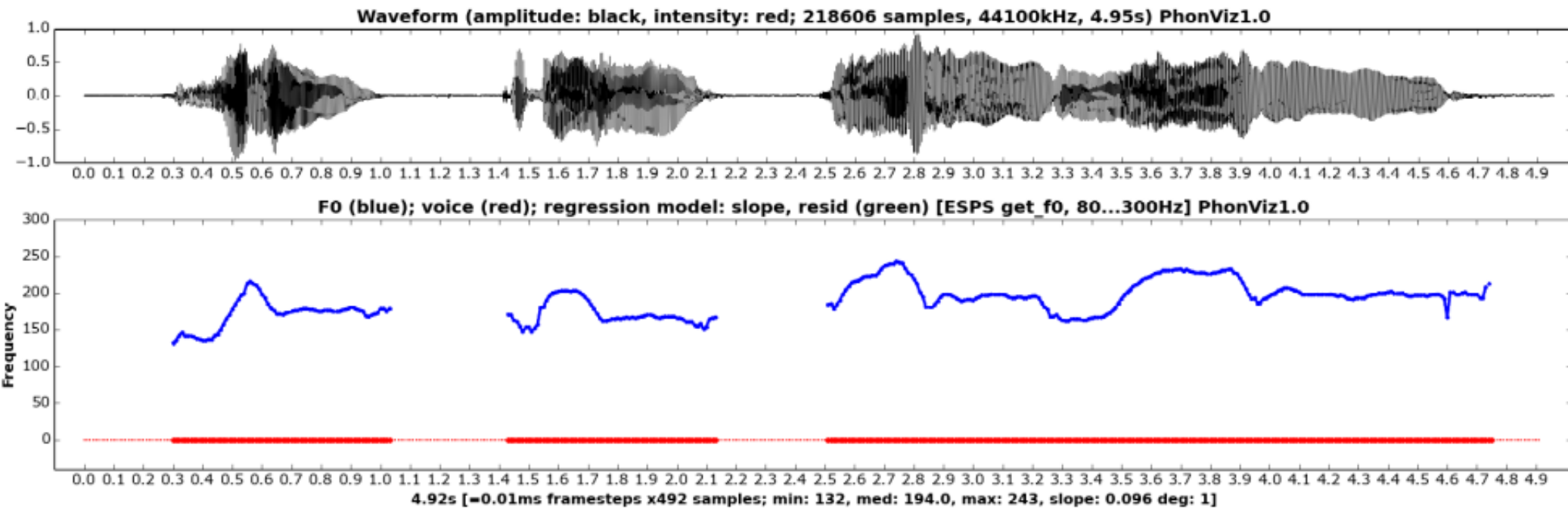
# *Universals of Melody: 'Call Contours'*



# *Universals of Melody: 'Call Contours'*



# Universals of Melody: 'Call Contours'



*Table 1: Chant contour frequencies averaged over the accent-bearing syllable; chant contour ratios compared with just and tempered minor 3rd.*

associated locution	1 <sup>st</sup> F0 level	2 <sup>nd</sup> F0 level	F0 ratio	minor 3 <sup>rd</sup> ratio	
				just	Tempered
<i>hello</i>	212	177	1.198	1.2	1.189
<i>goodbye</i>	201	168	1.196		
<i>Johnny</i>	240	196	1.224		
<i>where are you</i>	230	197	1.168		

# ***Universals of Melody: the Pentatonic Scale***

Bobby McFerrin 'playing' an audience like a piano:  
check your favourite search machine for a video clip with  
search key combinations like ...

***Bobby McFerrin pentatonic***  
or  
***Bobby McFerrin Science Festival***

# ***Speculations and Conclusions***

# ***Speculations on Rhythm, Melody and Evolution***

SHARED WITH  
BIRDS, ANIMALS

Communicative  
rhythm:  
pulse modulation,  
iterative patterns

Communicative  
melody:  
frequency modulation,  
parallel patterns

Communicative  
timbre:  
speech,  
recursive patterns

Music:  
recursive  
patterns

Song

Simple sound  
events

Increase in complexity over time

# ***Summary and Conclusion***

- Language and music many features
  - structural patterns:
    - linear
    - hierarchical
    - parallel
  - Language and music share functions:
    - identity:
      - individual
      - community
    - emotion
- But there are differences
  - which affect the speech-music relation in song
  - which may be due to partly independent evolution