A Typology of Phenomenal Accent Patterns*

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1 Introduction

- Some aspects of linguistic metrical systems may be attributable to a more domain-general theory of sound organization
- Hyde (2016) suggests a metrical representation consistent with the musical theory of organization of sound
  - Underlying metrical grid: "basic timekeeper around which acoustic events are organized"
  - Acoustic events themselves are kept separate from this underlying grid
- This is a pilot computational study testing the viability of this approach

2 Today's Goals

- Propose a formalism in response to Hyde's suggestion
- Examine a typology produced by such a formalism, compare these patterns to attested patterns
- Explore possible expansions towards the full range of possible patterns

3 A Theory of Musical Rhythm

First, some definitions of the music-theoretical tools I'll be referring to:

- **Rhythm**: "The systematic patterning of sound in terms of timing, accent, and grouping" (Patel, 2007)
- **Beats**: Markings of a pulse that occur at regular time intervals (the sounds being patterned)
- **Meter**: Hierarchical organization of beats in a periodic fashion

Strong beats in a metrical structure are perceived as being accented, due to the listener's detection of periodicity at multiple levels of the musical structure or metrical grid. For instance, take the structure in (1). These hierarchies manifest as alternations (more cycles being marked at once = beat perceived as stronger)

(1)

[X							]	Division into 1 part
[X			]	[X			]	Division into 2 parts
[X	]	[X	]	[X	]	[X	]	Division into 4 parts
[X]	[X]	[X]	[X]	[X]	[X]	[X]	[X]	Division into 8 parts
X	X	X	X	X	X	X	X	The base of 8 beats
(1	2	3	4	5	6	7	8)	

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- These accents that form an underlying structure are **metrical accents**
- Accents with a salient acoustic correlate are **phenomenal accents**
  = changes in duration, intensity, or melodic contour (pitch) as compared to its surrounding context
- Phenomenal accents do not have to coincide with metrical accents, though they most often do (see (2))
  - (Acoustic cues here are notated with a '>' on top of the underlying metrical structure)

(2)

>		>		>		>	
X		X		X		X	
X	X	X	X	X	X	X	X

- Various phenomenal accent patterns can occur on otherwise identical metrical grids

(3)

>							
X		X		X		X	
X	X	X	X	X	X	X	X

4 Linguistic Meter

- Levels of (musical) metrical subdivision ≈ levels of a (linguistic) metrical grid.
  - In a traditional foot-based analysis: metrical accents at the level of the syllable, foot, and word
- Phenomenal accents would fall on syllables with acoustic correlates, such as:
  - Increased harmonic frequency (higher pitch, ex: high tone)
  - Increased duration (ex: long vowel)
  - Increased amplitude (ex: any sound louder than those around it)
- These are what linguists might refer to as stress

Table 1: Types of Perfect Alternation Patterns

Perfect Alternation Type		**Even Parity Form**	**Odd Parity Form**
a.	Left to right, start stressed	X X X X X X X X X	X X X X X X X X X X X
b.	Left to right, start unstressed	X X X X X X X X X	X X X X X X X X X X
c.	Right to left, start stressed	X X X X X X X X X	X X X X X X X X X X X
d.	Right to left, start unstressed	X X X X X X X X X	X X X X X X X X X X

5 An Analysis

- I'll be assuming the following:
  - Metrical patterns are given (1 of the 4 above), metrical & phenomenal must overlap
  - Forms must have at least one stress (cumulativity), 6- and 7-syllable forms only
- The constraints, partly adapted from Gordon (2002) to adopt the distinction between metrical and phenomenal accent, are defined as follows:

(4) NonFinality(σ) (NonFin): Assign a * if the final syllable in a word has a phenomenal accent, regardless of metrical accent

(5) MapAccent (MapAcc): Assign a * if a metrically accented syllable is not also phenomenally accented

(6) AlignLeft (AlignL): Aligns all phenomenal accents to the leftmost metrical accent

	>	>
Satisfied by:	X x X x X x	x X x X x X
	> > >	>
Violated by:	X x X x X x	X x X x X x

(7) AlignRight (AlignR): Aligns all phenomenal accents to the rightmost metrical accent

	>	>
Satisfied by:	X x X x X x X	X x X x X x
	> > > >	>
Violated by:	X x X x X x X	X x X x X x

6 Factorial Typology

- I generated all possible combinations of metrical and phenomenal accent patterns, evaluated these according to the constraints proposed above, and calculated a factorial typology.
- For the first pattern, we get the following:

Table 2: Left to right, start stressed

	6σ forms	7σ forms	Language	Constraint Ranking
a.	> X x X x X x	> X x X x X x X	Arawak	AlignL >> (MapAcc, AlignR)
b.	> X x X x X x	> X x X x X x X	Cairene Arabic	NonFin >> AlignR >> (MapAcc, AlignL)
c.	> X x X x X x	> X x X x X x X		AlignR >> (NonFin, MapAcc, AlignL)
d.	> > > X x X x X x	> > > X x X x X x X	Pintupi	NonFin >> MapAcc >> (AlignL, AlignR)
e.	> > > X x X x X x	> > > > X x X x X x X	Maranungku	MapAcc >> (NonFin, AlignL, AlignR)

- These cases are detailed in the tableaux that follow

- Form (a) (consistent with Arawak):

6σ (XxXxXx)	AlignL	MapAcc	AlignR
☞ a. > X x X x X x		**	**
b. > X x X x X x	*!*	**	
c. > > > X x X x X x	*! **		* **

7σ (XxXxXxX)	AlignL	MapAcc	AlignR
☞ a. > X x X x X x X		***	***
b. > X x X x X x X	*!*	***	*
c. > X x X x X x X	*! **	***	
d. > > > X x X x X x X	*! **	*	* ** ***
e. > > > > X x X x X x X	*! ** ***		* ** ***

- Form (b) (consistent with Cairene Arabic):

6σ (XxXxXx)	NonFin	AlignR	MapAcc	AlignL
a. > X x X x X x		*!*	**	
☞ b. > X x X x X x			**	**
c. > > > X x X x X x		*! **		* **

7σ (XxXxXxX)	NonFin	AlignR	MapAcc	AlignL
a. > X x X x X x X		**!*	***	
☞ b. > X x X x X x X		*	***	**
c. > X x X x X x X	*!		***	***
d. > > > X x X x X x X		* *!* ***	*	* **
e. > > > > X x X x X x X	*!	* ** ***		* ** ***

- Form (c):

6σ (XxXxXx)	AlignR	NonFin	MapAcc	AlignL
a. X x X x X x	*!*		**	
☞ b. X x X x X x			**	**
c. X x X x X x	*! **			* **

7σ (XxXxXxX)	AlignR	NonFin	MapAcc	AlignL
a. X x X x X x X	*!**		***	
b. X x X x X x X	*!		***	**
☞ c. X x X x X x X		*	***	***
d. X x X x X x X	*! ** ***		*	* **
e. X x X x X x X	*! ** ***	*		* ** ***

- Form (d) (consistent with Pintupi):

6σ (XxXxXx)	NonFin	MapAcc	AlignL	AlignR
a. X x X x X x		*!*		**
b. X x X x X x		*!*	**	
☞ c. X x X x X x			* **	* **

7σ (XxXxXxX)	NonFin	MapAcc	AlignL	AlignR
a. X x X x X x X		**!*		***
b. X x X x X x X		**!*	**	*
c. X x X x X x X	*!	***	***	
☞ d. X x X x X x X		*	* **	* ** ***
e. X x X x X x X	*!		* ** ***	* ** ***

- Form (e) (consistent with Maranungku):

6σ (XxXxXx)	MapAcc	NonFin	AlignL	AlignR
a. X x X x X x	*!*			**
b. X x X x X x	*!*		**	
☞ c. X x X x X x			* **	* **

7σ (XxXxXxX)	MapAcc	NonFin	AlignL	AlignR
a. X x X x X x X	*!**			***
b. X x X x X x X	*!**		**	*
c. X x X x X x X	*!**	*	***	
d. X x X x X x X	*!		* **	* ** ***
☞ e. X x X x X x X		*	* ** ***	* ** ***

An Overview of the Produced Factorial Typology

Table 2: Left to right, start stressed

	6σ forms	7σ forms	Language	Constraint Ranking
a.	> X x X x X x	> X x X x X x X	Arawak	AlignL >> (MapAcc, AlignR)
b.	> X x X x X x	> X x X x X x X	Cairene Arabic	NonFin >> AlignR >> (MapAcc, AlignL)
c.	> X x X x X x	> X x X x X x X		AlignR >> (NonFin, MapAcc, AlignL)
d.	> > > X x X x X x	> > > X x X x X x X	Pintupi	NonFin >> MapAcc >> (AlignL, AlignR)
e.	> > > X x X x X x	> > > > X x X x X x X	Maranungku	MapAcc >> (NonFin, AlignL, AlignR)

Table 3: Left to right, start unstressed

	6σ forms	7σ forms	Language	Constraint Ranking
a.	> x X x X x X	> x X x X x X x	Lakota	AlignL >> (MapAcc, AlignR)
b.	> x X x X x X	> x X x X x X x		NonFin >> AlignR >> (MapAcc, AlignL)
c.	> x X x X x X	> x X x X x X x	Seminole/Creek	AlignR >> (NonFin, MapAcc, AlignL)
d.	> > x X x X x X	> > > x X x X x X x	Choctaw	NonFin >> MapAcc >> (AlignL, AlignR)
e.	> > > x X x X x X	> > > x X x X x X x	Araucanian	MapAcc >> (NonFin, AlignL, AlignR)

Table 4: Right to left, start stressed

	6σ forms	7σ forms	Language	Constraint Ranking
a.	> x X x X x X	> X x X x X x X		AlignL >> (MapAcc, AlignR)
b.	> x X x X x X	> X x X x X x X	Cora	NonFin >> AlignR >> (MapAcc, AlignL)
c.	> x X x X x X	> X x X x X x X	French	AlignR >> (NonFin, MapAcc, AlignL)
d.	> > x X x X x X	> > > X x X x X x X		NonFin >> MapAcc >> (AlignL, AlignR)
e.	> > > x X x X x X	> > > > X x X x X x X	Suruwaha	MapAcc >> (NonFin, AlignL, AlignR)

Table 5: Right to left, start unstressed

	6σ forms	7σ forms	Language	Constraint Ranking
a.	> X x X x X x	> x X x X x X x		AlignL >> (MapAcc, AlignR)
b.	> X x X x X x	> x X x X x X x	Chamorro	NonFin >> AlignR >> (MapAcc, AlignL)
c.	> > > X x X x X x	> > > x X x X x X x	Nengone	MapAcc >> (NonFin, AlignL, AlignR)

- Assuming 4 types of metrical grids, we can produce 18 patterns, 13 of which we know to be attested
  - 5 different constraint rankings for all of these, with just 4 constraints

7 Mismatch Cases

- There are some patterns that I can't yet account for within this formalism
- I've assumed so far that the sets of metrical and phenomenal accent patterns overlap
- However, if they alternate, syncopation is heard (salient alternation between two accent systems):

(8)
```
      >     >     >     >
X     X     X     X
X  X  X  X  X  X  X  X
```

- This is an explicit defiance of expectations but does not shift perception of underlying structure
- One way this might manifest is in terms of a stress clash, as in the following "non-fluffy":

(9)
```
   >
      X
X     X     X
nɑn   flʌ   fi
```

- These types of forms can be derived, for instance by using a constraint:

(10) *Mismatch: Assign a * for every instance of a phenomenal accent that is in a position that is not also metrically accented

- By making this a preference instead of a stipulation, one can imagine the following case where phenomenal accents consistently fall on the penultimate syllable of a given word, which is sometimes but not always metrically accented (underlyingly left to right, starting unstressed):

6σ (xXxXxX)	AlignR	NonFin	MapAcc	*Mismatch
☞ a. x X x X x X			***	*
b. x X x X x X		*!	**	
c. x X x X x X	*!		**	
d. x X x X x X	*!	*	*	
e. x X x X x X	*!**		*	

7σ (xXxXxXx)	AlignR	NonFin	MapAcc	*Mismatch
☞ a. x X x X x X x			**	
b. x X x X x X x	*!		**	
c. x X x X x X x		*!	***	*
d. x X x X x X x	*!		*	

8 Conclusion

- Positing a more domain-general theory of sound organization might be useful to us as linguists
- I've shown one way to formalize this that produces a broad range of patterns
- It might be possible that the full range of stress patterns is smaller than we thought
- There are a few ways this would need to be extended before it can be compared to other typologies, but it seems to be a viable approach for future theories of metrical stress

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