



Pitch Spelling – A Computational Model

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Why Pitch Spelling at all?

- There is a link between enharmonic spelling and musical structure; there IS a difference between Ab and G#.
- Although intervals may have the same number of semitones, the way in which they are perceived depends on the context – the notes before and after color our perception of the interval.



Pitch Spelling Algorithms

- Line of Fifths model
- Interval optimization model




Line of Fifths Model

...Bbb Fb Cb Gb Db Ab Eb Bb F C G D A E B F# C# G# D# A# E# B# Fx...

Intervals are prioritized by their distances on the line of fifths

Distance	1	2	3	4	5	6	7	8	9	10	11	12	
Intervals	4P	M2	m3	M3	m2	A4	A1	d4	A2	d3	A3	d2	
		5P	m7	M6	m6	M7	d5	d1	A5	d7	A6	d6	A7


Smaller numbers get a higher priority



Interval Optimization Method


- Intervals are divided into 4 classes :
 - Class A is most preferred and Class D most avoided
 - Ordering within classes is irrelevant

Class	A	B	C	D
Intervals	P4 , P5	m2 M7 M2 m7 m3 M6 M3 m6	A2 d3 d4 A4 d7 A6 A5 d5	D1 A3 d2 A1 d6 A7




Implementation

- Input the MIDI pitch values in a string
- Choose a window length
- Drag this window over the string, moving by one-third of the window length at a time
- Optimize notes based on:
 - Notational parsimony – less accidentals
 - Interval Optimization – avoid class C and D
- Move on to the next one-third



Implementation

- Penalty values are assigned to the intervals
- Double flats and Double sharps are disallowed
- All permutations of notes in the window are generated yielding $(n - 1)n/2$ intervals
- Penalty values are computed
- The sequence with the lowest penalty wins
- The spelling for the first third of the notes in the window is taken to be correct, and the window slides to its next position.



Application

- Transcription of MIDI to note names
- Can be useful in key-finding



What Next?

- Use more 'intelligence' rather than a brute-force algorithm
- Account for 'Voice Leading'
- Choose spellings in which the higher quality interval appears last