

Adapting Language Parsing to Automate Score Reduction

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Outline

- Goal
 - Data mining over features of music-theoretic interest
 - To acquire such features: **automated score reduction**
- Steps
 - 1 `xml2abc` – convert MusicXML to ABC format. (Off the shelf.)
 - 2 `abc` – Read ABC to create an in-memory representation of the score. Enables a wide range of manipulations.
 - 3 `abc/abcwriter` – Classify and write out **verticalities**.
 - 4 `parser` – Probabilistic parser takes verticalities, produces a tree structure.

Example: BWV 36.8

bwv36.8-2.mxl

bwv36.8-2.mxl

J.S. Bach

Soprano
Nun komm, der Hei - den Hei - land, der Jung - frau - en Kind er - kannt,

Alto

Tenor

Bass

S.
des sich wun - dert al - le Welt, Gott solch' Ge - burt ihm be - stellt.

A.

T.

B.

The image shows a musical score for a chorale by J.S. Bach, BWV 36.8. It is in G major and 4/4 time. The score is divided into two systems. The first system includes Soprano, Alto, Tenor, and Bass parts. The lyrics for the Soprano part are: "Nun komm, der Hei - den Hei - land, der Jung - frau - en Kind er - kannt,". The second system includes Soprano (S.), Alto (A.), Tenor (T.), and Bass (B.) parts. The lyrics for the Soprano part in the second system are: "des sich wun - dert al - le Welt, Gott solch' Ge - burt ihm be - stellt." The music is written in standard notation with a key signature of one sharp (F#) and a 4/4 time signature. The Soprano part has a melodic line with some grace notes. The Alto part has a more active line with many sixteenth notes. The Tenor and Bass parts provide harmonic support with steady rhythms.

ABC format

```
X:1
T:bwv36.8-2.mxl
T:bwv36.8-2.mxl
C:J.S. Bach
%%score [ 1 | 2 | 3 | 4 ]
L:1/8
M:4/4
I:linebreak $
K:Bmin
V:1 treble nm="Soprano" snm="S."
L:1/4
V:2 treble nm="Alto" snm="A."
V:3 bass nm="Tenor" snm="T."
V:4 bass nm="Bass" snm="B."
V:1
  B B A d | c/B/ c !fermata!B2 | B/c/ d e d | e f !fermata!d2 |$ d e f/e/ d
w: |||||
w: Nun komm, der Hei-|den * Hei- land,|der * Jung- frau- en|Kind er- kannt,
  B B A d | c/B/ c !fermata!B2 |] %8
w: ||
w: Gott solch' Ge- burt|ihm * be- stellt.|
...
```

Internalizing Score

- Piece consists of “chords” (**verticalities**)
- Chords consist of notes
 - Note start/end in beats (rational number)
 - Each time a note starts or ends, there is a new “chord”
 - One note may belong to multiple chords
- Chord **signature**
 - Set of intervals, in semi-tones above bass
 - Determines a **quality** and **inversion**
 - Never ambiguous, but not all are classifiable
- Qualities: major, minor, major⁷, Mm⁷, mM⁷, each of those –5, dim, dim⁷, sus 4.
- **Category** = root letter + accidental + quality + inversion

- Chart
 - List of classified verticalities (input), defines **positions**
 - They provide the lowest **nodes**
 - Higher nodes are built by the parser
- Node
 - Spans start position to end position
 - Has an associated **chord**
 - Chord may be in the original input
 - Chord may be composite of multiple input chords (pool all notes, reclassify)
- **Operations** combine two nodes to create a new one

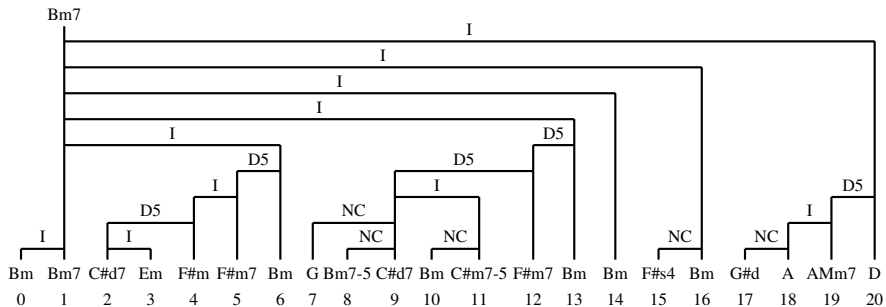
Operations

- Current list:
 - NC – passing or neighboring notes
 - I – integration (de-arpeggiation): pooling notes
 - D5 – descending fifth
 - R – resolution of sus 4
 - P – parallel minor/major
 - SD – ascending maj 2 (subdom–dom)
- NC
 - Chord is one beat or less, metrically weaker than neighbors
 - For each chord pitch class, a pitch class at most 2 semitones distant is found in a neighbor
 - Covers passing notes, neighbors, incomplete neighbors, suspensions, anticipations
 - Does not handle accented P/N

Ambiguity

- At most one node may exist with a given **category**, **start**, **end**.
- Ambiguity
 - Arises when there is more than one way of arriving at the same node.
 - Nodes are **scored**.
 - When attempting to construct a node that already exists, only the highest-scoring version is kept.
- Why
 - Keeps parser from taking exponential time.
 - Produces a single tree as output.
- Currently, no actual scoring. First version is always kept.

Complete parse example, Part I



Musical notation showing chord progressions and fingerings (2, 3) for the sequence from index 0 to 21.

- Integration (of an arpeggiated chord)
 - It is actually unheaded—output may be neither of the inputs.
 - Intended: combining partial chords (arpeggio) to create a chord.
 - Tricky to control. Is an added 7 really part of a 7-chord or just a passing note?
 - Is capable of combining e.g. Bm + G to get G7 (!).
- Big part of the problem with handling the D is actually the following C \sharp dim ...

Continued

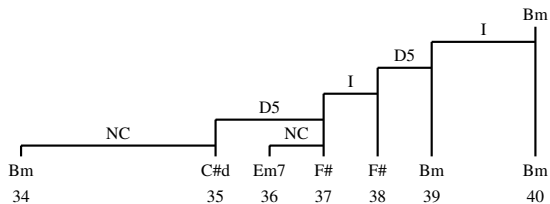
Chord diagrams and notation for measures 20-33. The notation shows a sequence of chords and melodic lines. Measure 27 includes a fingering '5' above the fifth fret.

Measure	Chord	Chord	Chord	Chord	Chord	Chord	Chord	Chord	Chord	Chord	Chord	Chord
20	D											
21	Bm	NC										
22	C#d											
23	D	D5										
24	Bm		NC									
25	D7-5			NC								
26	G											
27	D											
28	As4											
29	As4											
30	A											
31	D											
32	NC											
33	G											

Commentary

- There is a rule for combining subdominant + dominant, but it fails to apply to the $C\sharp$ dim, because
 - it is a raised IV (relative to G)
 - and also diminished
- Don't have a rule for VII dim⁶ (relative to D) as substitute for V.
- Integration versus NC again
 - The $C\sharp$ is treated as IN, but this time, it *should* be treated as added 7th
 - Whereas the Bm arises as an accident of the passing B

Continued



2 33 34

6 7

35 36 37 38 39 40 41 42 43 44 45

End

Chord progression diagram for measures 40-53:

Measure	Chord	Fingering/Technique
40	Bm	
41	Bm7	NC
42	C#7	I
43	E#d	
44	F#m	
45	A7	NC
46	D	
47	G7	
48	F#7	
49	Bm-5	NC
50	F#s4	I
51	NC	R
52	F#7	NC
53	B	

Musical notation for measures 39-53:

Measures 39-53 are shown on two staves. The top staff contains chords and the bottom staff contains a bass line. Measure numbers 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53 are indicated below the staves.