

Systematic Exploration of Schenkerian Reduction

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Schenkerian Analysis

Progressively reduces a score, removing less essential features, to reveal the 'background' structure.

Mozart:



A musical score for a piece by Mozart, likely a minuet. It is written in treble and bass clefs with a key signature of two sharps (F# and C#) and a 6/8 time signature. The score consists of four measures. The first three measures feature a complex texture with many notes, including ornaments and grace notes. The fourth measure shows a simpler texture with fewer notes, representing the 'background' structure.

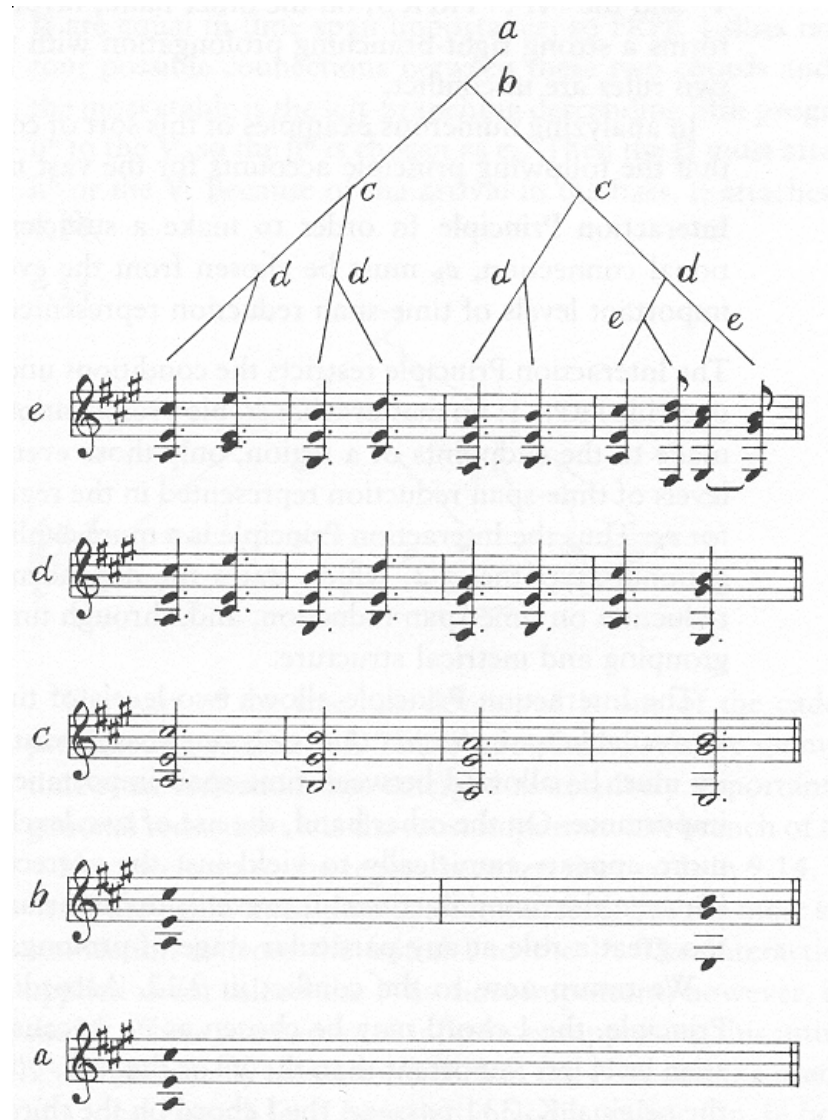
Schenker:



A Schenkerian analysis of the Mozart piece. It shows a simplified structure with a few notes and a long line. The top staff is in treble clef and the bottom staff is in bass clef. The key signature is two sharps (F# and C#). The top staff has a single note on the first line, followed by a long line that curves down and then up, ending on the second line. The bottom staff has a single note on the first line, followed by a long line that curves down and then up, ending on the second line.

Lerdahl & Jackendoff GTTM

F. Lerdahl & R.
Jackendoff,
*A Generative Theory
of Tonal Music*
(1983), MIT Press



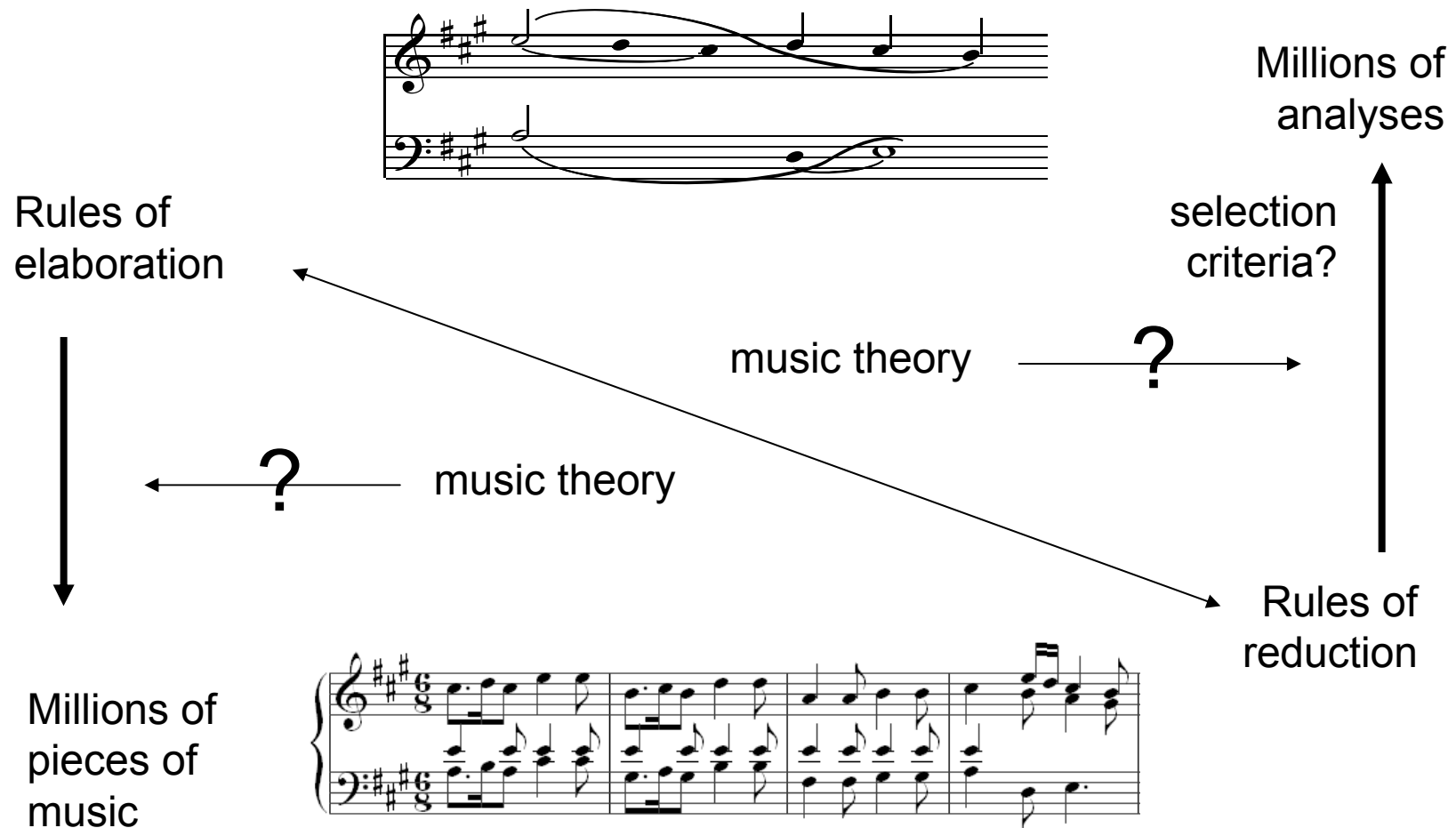
Is it Systematic?

- Schenker: ‘laws’, ‘art’, ‘secrets’.
 - a taxonomy of diminutions
 - a large set of asserted examples
- Musical ‘grammar’ (e.g., Baroni)
 - mostly demonstrated by generation of music
 - parsing often restricted to chord sequences (e.g., Steedman)
- Lerdahl & Jackendoff
 - explicitly rule-based
 - ‘preference rules’ to guide reduction
- Computational approaches
 - Kessler’s proof of correctness and completeness of Schenkerian middleground theory (1967, 1975)
 - Derivations of analyses more limited

Previous Computational Work

- Kassler (1967, 1975, 1977, 1988)
 - program which successfully analyses three-voice middlegrounds
- Smoliar et al. (1976, 1978, 1980)
 - program capable of verifying an analysis
- Mavromatis & Brown (2004)
 - demonstration of theoretical possibility of Schenkerian analysis by context-free grammar
- Hamanaka, Hirata & Tojo (2005-7)
 - implementation of Lerdahl & Jackendoff reduction with adjustment of parameters (now moving towards automatic parameter-setting)
- Gilbert & Conklin (2007)
 - probabilistic grammar for melodic reduction

The Research Problem



A Framework for Empirical Research

1. Formalise rules of reduction.
2. Derive all possible reductions of a fragment of music.
3. Measure certain characteristics of a sample.
4. Measure the same characteristics in 'correct' analyses of the same fragments.
5. Compare the distribution of values from the sample to the values from the analyses.
6. Characteristics where the analyses are consistently distinguished in the sample distribution suggest possible selection criteria.

1. Formalisation of Rules of Reduction

- See Alan Marsden, 'Generative Structural Representation of Tonal Music', *Journal of New Music Research*, 34 (2005), 409-428
- 1. All elaborations are binary.
 - elaborations producing more than one new note accommodated by special intermediate 'notes'
- 2. Elaborations generate new notes within the same time-span (cf. Lerdahl & Jackendoff, Komar).
- 3. Only certain kinds of elaborations are possible.
- 4. Elaborations have harmonic constraints.
- 5. Some elaborations require specific preceding or following context notes.

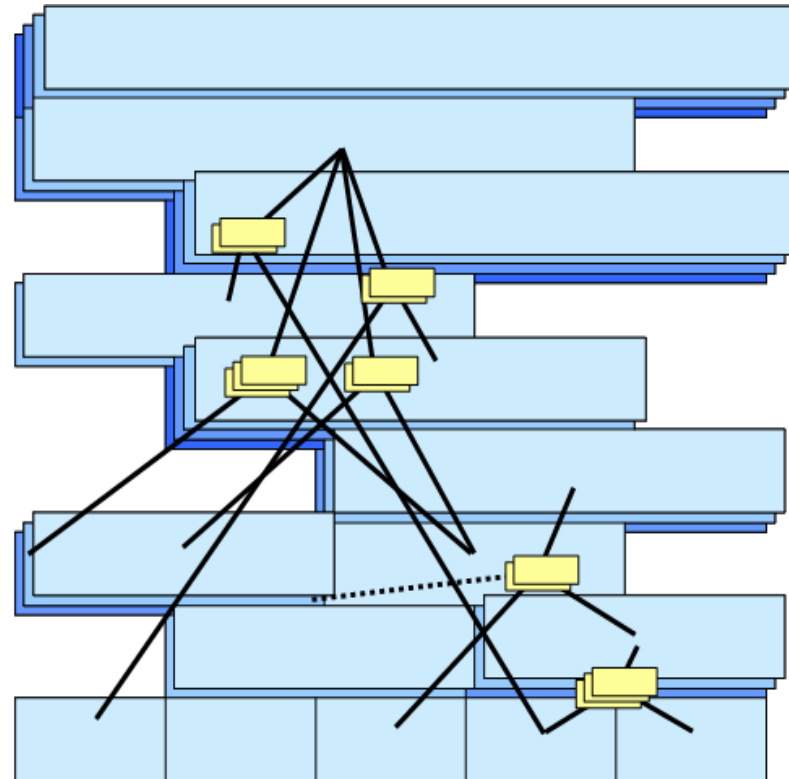
Elaborations

The image displays two systems of musical notation, each consisting of two staves. The first system is divided into two sections: the first two measures are in 2/4 time and labeled '(G maj.)', and the last three measures are in 2/4 time and labeled '(E min.)'. The second system is in 2/4 time. Labels in yellow boxes are connected to notes by lines, and labels in orange boxes are connected to notes by dotted lines. The labels are: 'repetition' (two instances), 'consonant skip' (two instances), 'neighbour note', 'passing' (two instances), 'appoggiatura', 'suspension', and 'unfolding'.

Further detail in Marsden, *CHum* (2001) and *JNMR* (2005).

2. Derivation of All Possible Reductions

- Not possible explicitly, because of ‘combinatorial explosion’
 - number of possible reductions related to $n!$ (where n is the length of the music)
- Derivation of a matrix of local solutions, from which all possible reductions may be derived
 - size theoretically related to n^3



Example of Reduction Matrix

Row 5					
0-5 6					
64 D5					
64 Bb4					
64 D4					
64 Bb3					
Row 4					
0-4 5	1-5 5				
67 D5	67 D5				
50 Bb4	67 Bb4				
67 D4	67 <u>D</u> 4				
100 Bb3	67 Bb3				
Row 3					
0-3 4	1-4 4	2-5 4			
80 D5	20 Eb5	100 D5			
60 Bb4	40 D5	100 Bb3			
60 D4	40 Bb4				
	80 <u>D</u> 4				
	100 Bb3				
Row 2					
0-2 3	1-3 3	2-4 3	3-5 3		
80 D5	33 D5	67 Eb5	100 D5		
60 Bb4	50 C5	67 C5	100 Bb3		
60 D4	33 Bb4	100 Bb3			
	83 <u>D</u> 4				
	33 A3				
Row 1					
0-1 2	1-2 2	2-3 2	3-4 2	4-5 2	
50 C5	67 D5	50 D5	67 Eb5	100 D5	
50 Bb4	67 Bb4	50 C5	67 C5	100 Bb3	
100 D4	100 <u>D</u> 4	100 A3	100 Bb3		
Row 0					
0 1	1 1	2 1	3 1	4 1	5 1
100 C5	100 Bb4	100 D5	100 C5	100 Eb5	100 D5
100 D4	100 <u>D</u> 4	100 A3	100 <u>A</u> 3	100 Bb3	100 <u>Bb</u> 3

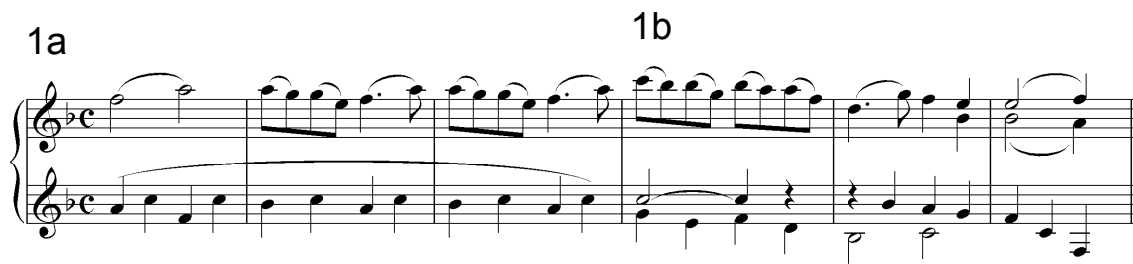
3. Selection and Measurement of a Sample

- Selecting a random sample is not trivial
 - selecting an option at one point in the matrix affects options at other points
 - currently selects top-down giving equal likelihood to each remaining option at each point
- Which measures to try?
 - guesses based on expertise
 - suggestions from Schenkerian literature (Plum, Schachter, teaching materials)
 - Lerdahl & Jackendoff preference rules

Sample Fragments

Rondo themes from Mozart piano sonatas

1a 1b



Fragment 1 consists of two parts, 1a and 1b, in C major, 3/4 time. Part 1a (measures 1-4) features a treble staff with a melodic line of eighth notes and a bass staff with a simple accompaniment of quarter notes. Part 1b (measures 5-8) continues the melody with more complex rhythmic patterns and includes a fermata over the final two measures.

2a 2b



Fragment 2 consists of two parts, 2a and 2b, in B-flat major, 3/4 time. Part 2a (measures 1-4) features a treble staff with a melodic line and a bass staff with a steady eighth-note accompaniment. Part 2b (measures 5-8) continues the melody with a more active bass line.

3



Fragment 3 is in B-flat major, 3/4 time. It features a treble staff with a melodic line and a bass staff with a simple accompaniment. A triplet of eighth notes is marked in the first measure of the treble staff.

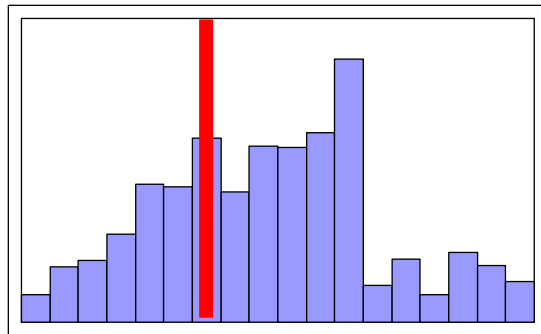
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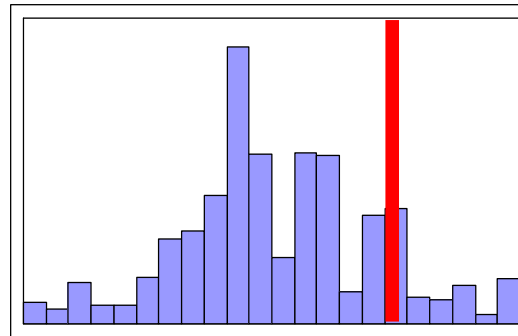
Fragment 4 is in 2/4 time. It features a treble staff with a melodic line and a bass staff with a simple accompaniment. The melody is characterized by a mix of eighth and quarter notes.

1 & 2 were analysed
in two halves

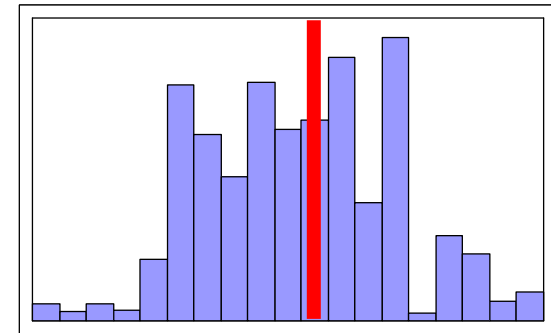
Number of Notes



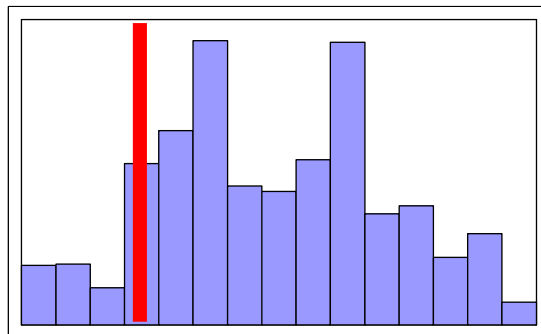
1a



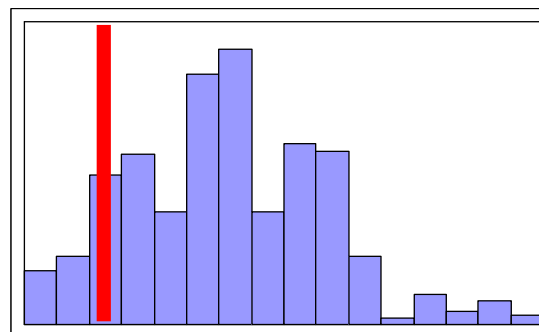
2a



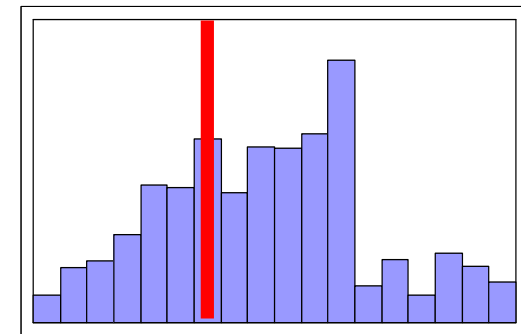
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1b

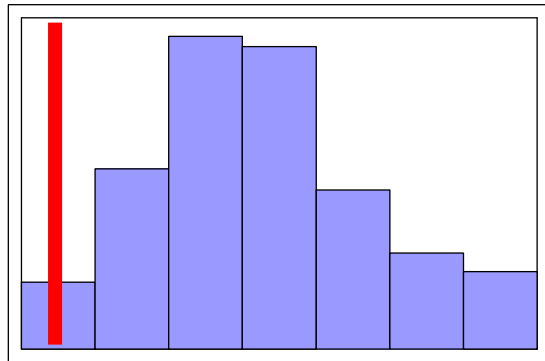


2b

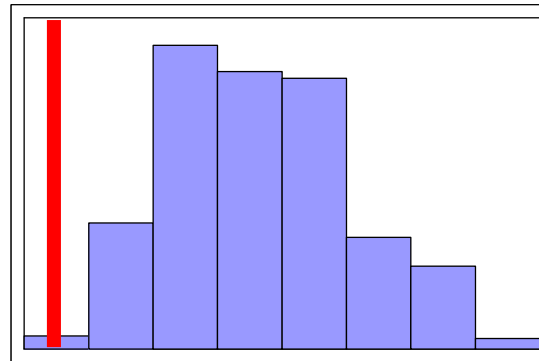


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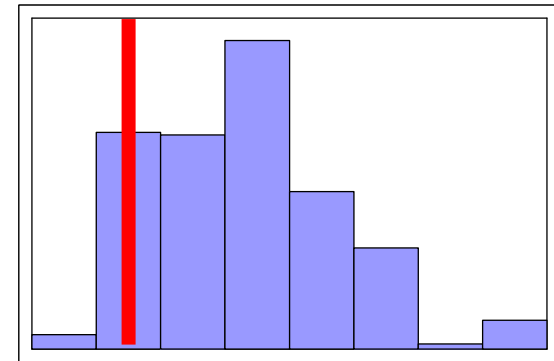
Number of Reductions with Fewer Voices



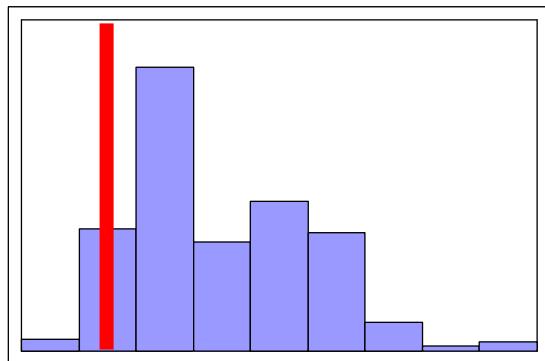
1a



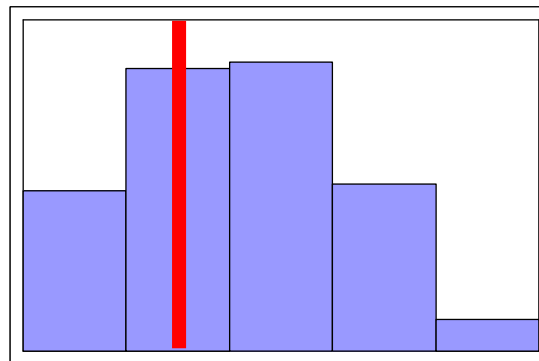
2a



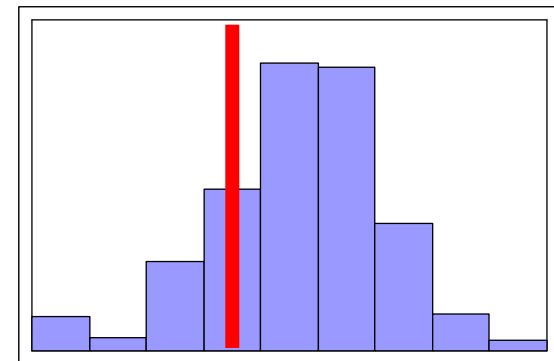
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1b

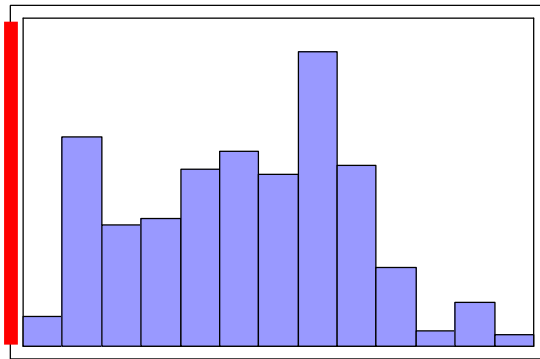


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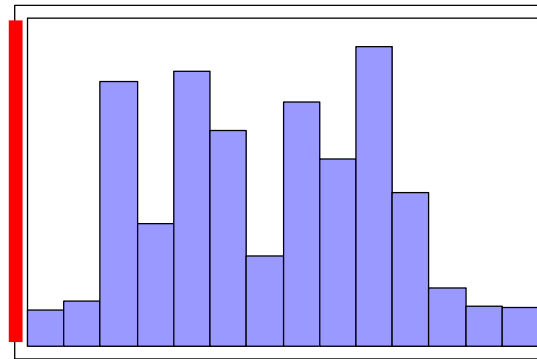


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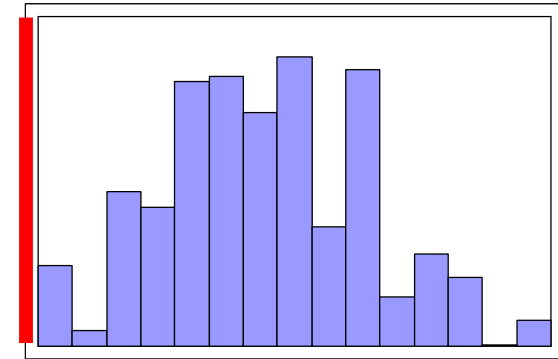
Ratio of Durations



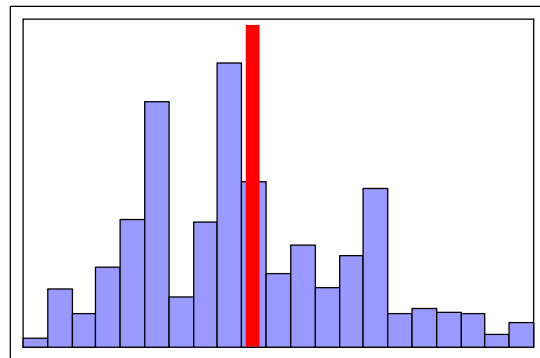
1a



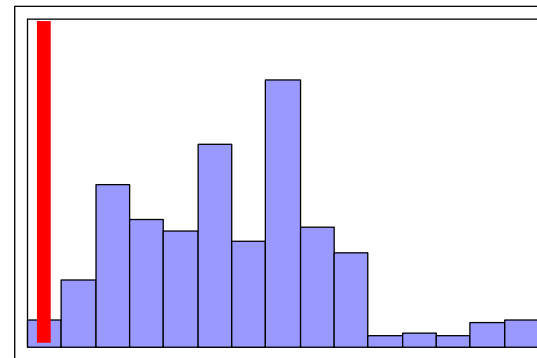
2a



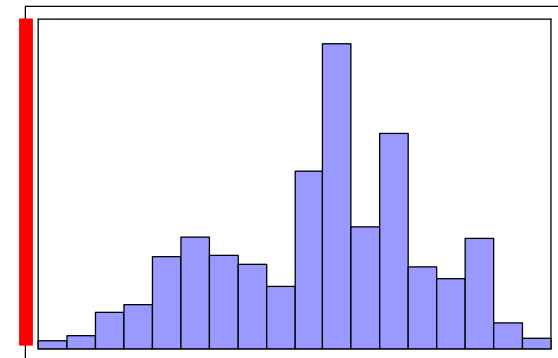
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1b

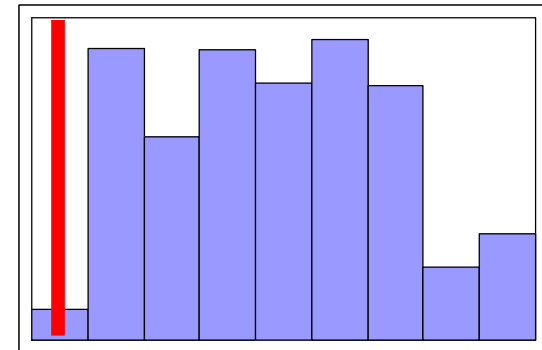
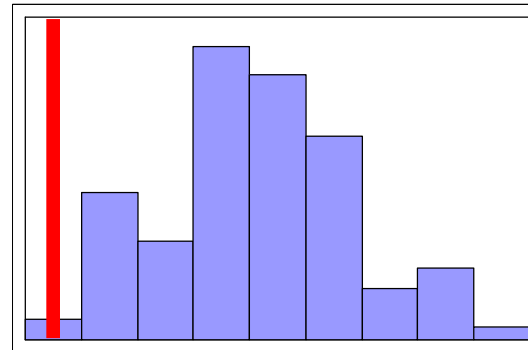
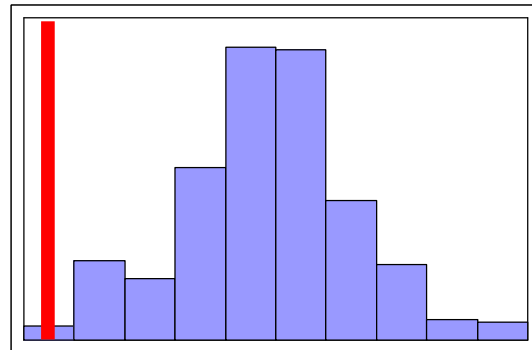
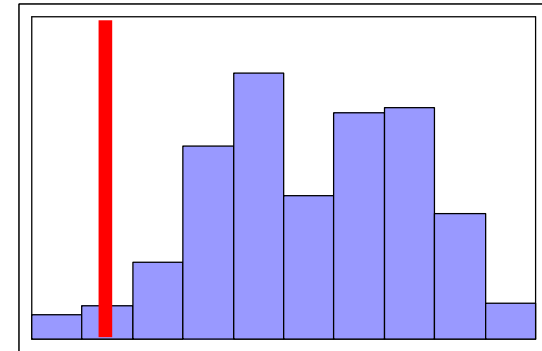
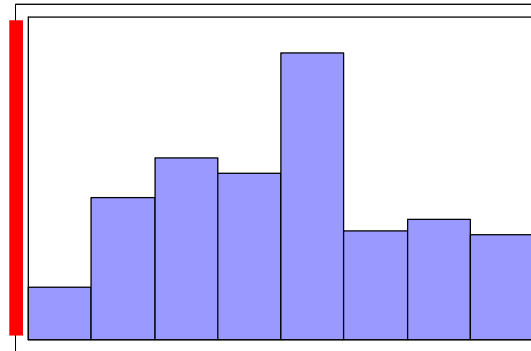
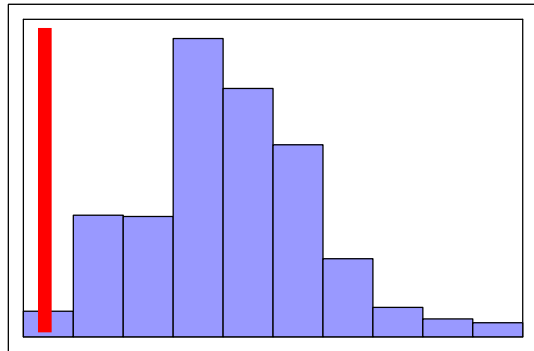


2b

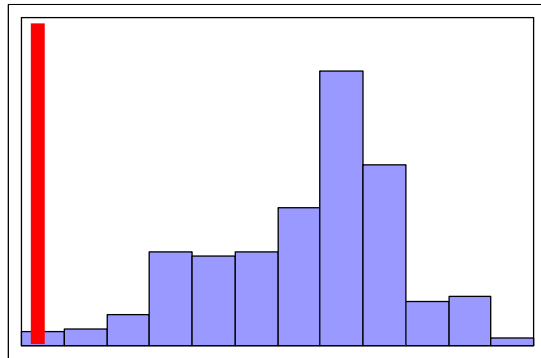


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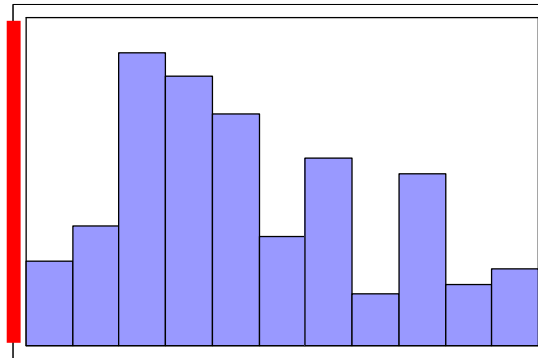
Number of Short-Long Reductions



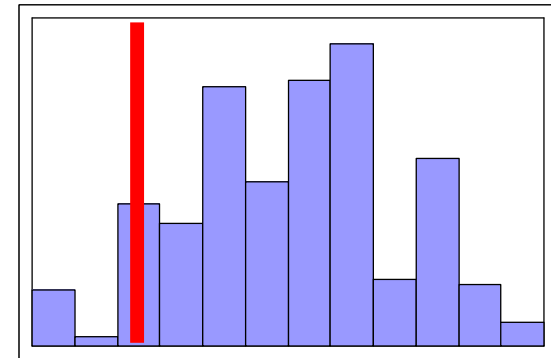
Number of Syncopations



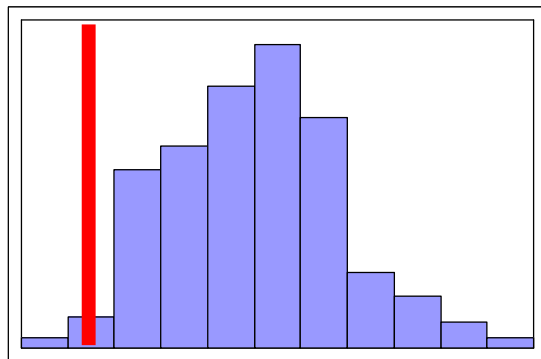
1a



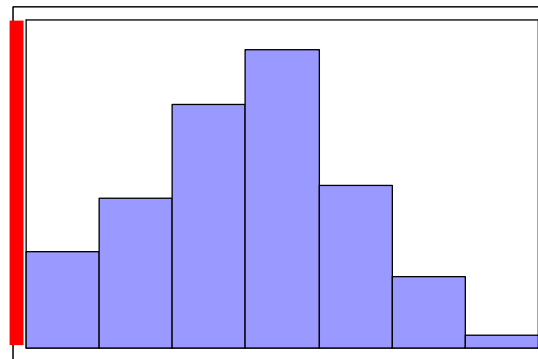
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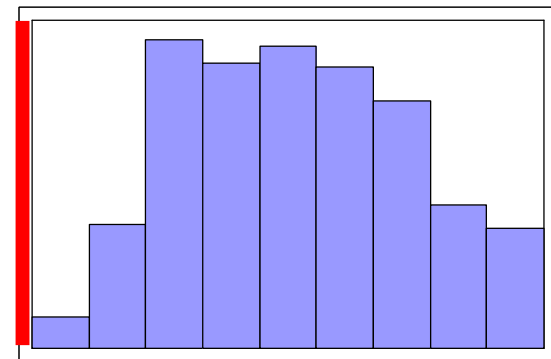
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1b

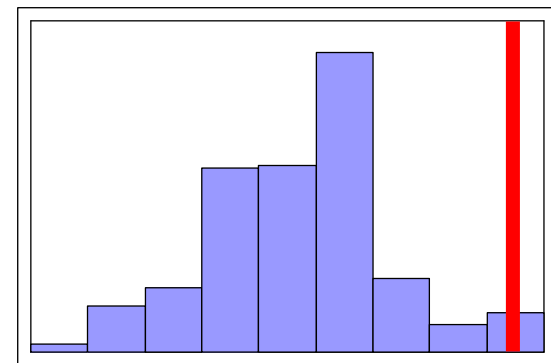
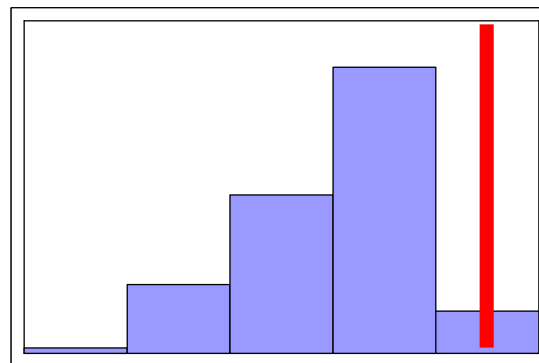
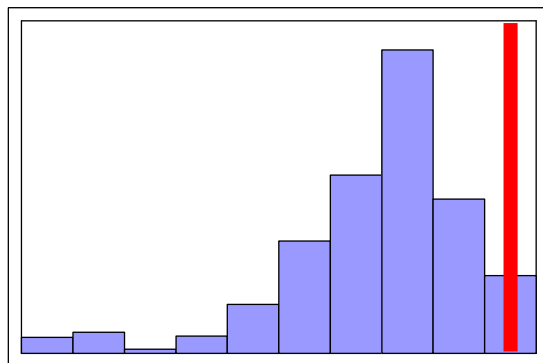
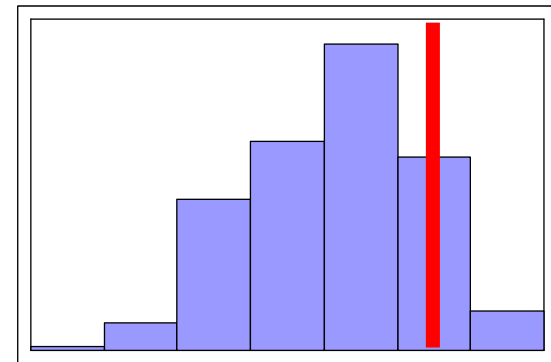
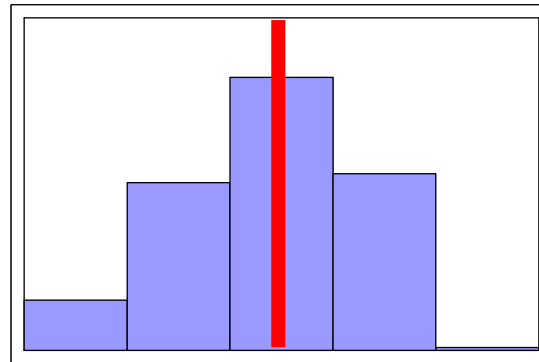
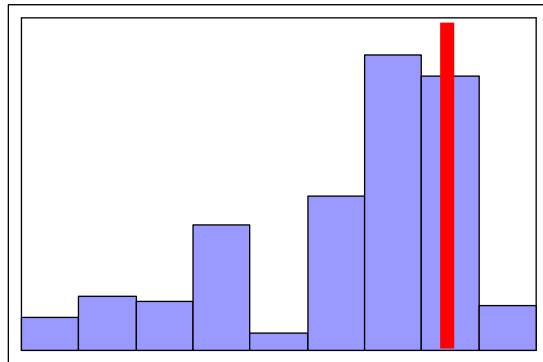


2b



4

Harmonic Support



Further Work

- Incorporation of the most obvious selection criteria to prune derivation
- Experimentation on search procedures (with Geraint Wiggins)
- Testing for derivation of published analyses
 - Oster archive (Chopin, Beethoven)
 - *Das Meisterwerk in der Musik*

Further detail at www.lancs.ac.uk/staff/marsdena/research/schenker

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