



MTO 26.4 Examples: De Souza, Instrumental Transformations in Heinrich Biber's Mystery Sonatas

(Note: audio, video, and other interactive examples are only available online)
<https://mtosmt.org/issues/mto.20.26.4/mto.20.26.4.desouza.html>

Example 1. Three ways to retune a violin's open strings to an F-major chord: (a) and (b) are maximally close retunings identified by Lewin (1998, 38), each of which displaces 5 semitones overall; (c), by contrast, is relatively inefficient

a) E5 $\xrightarrow{+1}$ F5	b) E5 $\xrightarrow{+1}$ F5	c) E5 $\xrightarrow{-4}$ C4
A4 $\xrightarrow{0}$ A4	A4 $\xrightarrow{0}$ A4	A4 $\xrightarrow{0}$ A4
D4 $\xrightarrow{-2}$ C4	D4 $\xrightarrow{-2}$ C4	D4 $\xrightarrow{+3}$ F4
G3 $\xrightarrow{-2}$ F3	G3 $\xrightarrow{+2}$ A3	G3 $\xrightarrow{+5}$ C4

Example 2. Biber, *Mystery Sonata 7* (ca. 1678), *Allemande*, mm. 1–4. The top staff, which reproduces Biber's original handgrip notation, indicates the violin's tuning and the placement of the player's fingers. The middle staff shows the sounding results

The image shows a musical score for three staves: Violin (scordatura), Violin (sounding), and Continuo. The Violin (scordatura) staff is in treble clef with a key signature of one sharp (F#) and a common time signature. It shows fingerings (6, 5, 5, 6) for the first four measures. The Violin (sounding) staff is in treble clef with a key signature of one flat (Bb) and a common time signature. The Continuo staff is in bass clef with a key signature of one flat (Bb) and a common time signature. It shows a sequence of notes and rests, with fingerings (5, 6) for the first four measures.

Example 3. Excerpt from Biber's manuscript for Mystery Sonata 7, featuring an illustration of "The Scourging at the Pillar" (that also appears in documents of the Salzburg Rosary Confraternity)



Example 4. Overview of Biber's Mystery Sonatas

	<i>Sonata</i>	<i>Key</i>	<i>Tuning</i>
<i>Joyful Mysteries</i>	1. The Annunciation	d	<G3, D4, A4, E5>
	2. The Visitation	A	<A3, E4, A4, E5>
	3. The Nativity	b	<B3, F#4, B4, D5>
	4. The Presentation of Jesus in the Temple	d	<A3, D4, A4, D5>
	5. The Finding of Jesus in the Temple	A	<A3, E4, A4, C#5>
<i>Sorrowful Mysteries</i>	6. The Agony in the Garden	c	<A#3, E#4, G4, D5>
	7. The Scourging at the Pillar	F	<C4, F4, A4, C5>
	8. The Crowning with Thorns	Bb	<D4, F4, Bb4, D5>
	9. The Carrying of the Cross	a	<C4, E4, A4, E5>
	10. The Crucifixion	g	<G3, D4, A4, D5>
<i>Glorious Mysteries</i>	11. The Resurrection	G	<G3, G4, D4, D5>
	12. The Ascension	C	<C4, E4, G4, C5>
	13. The Descent of the Holy Spirit	d	<A3, E4, C#5, E5>
	14. The Assumption of Mary into Heaven	D	<A3, E4, A4, D5>
	15. The Coronation of Mary as Queen of Heaven	C	<G3, C4, G4, D5>

Example 5. Uniformity in violin scordatura: (a) Paganini, *Violin Concerto*, op. 6 (ca. 1818); (b) Halvorson, *Slåtter* (1905). The asterisk indicates a fuzzy transposition (Quinn 1996)

$\begin{array}{l} \text{a) } E5 \xrightarrow{+1} F5 \\ A4 \xrightarrow{+1} B\flat4 \\ D4 \xrightarrow{+1} E\flat4 \\ G3 \xrightarrow{+1} A\flat3 \end{array}$	$\begin{array}{l} \text{b) } E5 \xrightarrow{+3} G5 \\ A4 \xrightarrow{+3} C5 \\ D4 \xrightarrow{+3} F4 \\ G3 \xrightarrow{+5} C4 \end{array}$
T_1	$*T_3$
$\text{offset: } (0)$	(2)

Example 6. Smoothness in violin scordatura: (a) Saint-Saëns, *Danse macabre*, op. 40 (1874); (b) Haydn, *Symphonies 60 and 67* (1775/1779), and Adams, *Road Movies* (1995); (c) Bartók, *Contrasts* (1938)

$\begin{array}{l} \text{a) } E5 \xrightarrow{-1} E\flat5 \\ A4 \xrightarrow{0} A4 \\ D4 \xrightarrow{0} D4 \\ G3 \xrightarrow{0} G3 \end{array}$	$\begin{array}{l} \text{b) } E5 \xrightarrow{0} E5 \\ A4 \xrightarrow{0} A4 \\ D4 \xrightarrow{0} D4 \\ G3 \xrightarrow{-2} F3 \end{array}$	$\begin{array}{l} \text{c) } E5 \xrightarrow{-1} E\flat5 \\ A4 \xrightarrow{0} A4 \\ D4 \xrightarrow{0} D4 \\ G3 \xrightarrow{+1} G\sharp3 \end{array}$
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Example 7. Inversion in violin scordatura: Three maximally smooth ways to retune a violin in perfect fourths. Each displaces 8 semitones overall

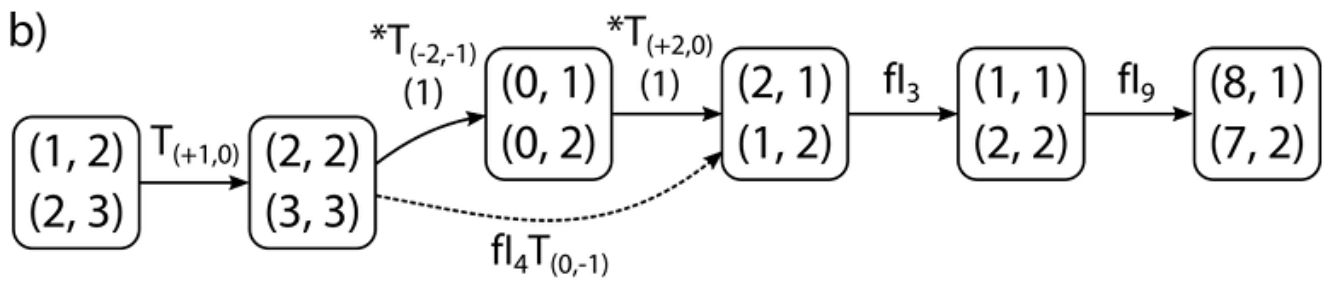
$\begin{array}{l} \text{a) } E5 \xrightarrow{-4} C5 \\ A4 \xrightarrow{-2} G4 \\ D4 \xrightarrow{0} D4 \\ G3 \xrightarrow{+2} A3 \\ \quad \quad \quad I_4 \end{array}$	$\begin{array}{l} \text{b) } E5 \xrightarrow{-3} D\flat 5 \\ A4 \xrightarrow{-1} A\flat 4 \\ D4 \xrightarrow{+1} E\flat 4 \\ G3 \xrightarrow{+3} B\flat 3 \\ \quad \quad \quad I_5 \end{array}$	$\begin{array}{l} \text{c) } E5 \xrightarrow{-2} D5 \\ A4 \xrightarrow{0} A4 \\ D4 \xrightarrow{+2} E4 \\ G3 \xrightarrow{+4} B3 \\ \quad \quad \quad I_6 \end{array}$
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Example 8. Balance in violin scordatura: (a) and (b) Pachelbel, *Musicalische Ergötzung* (ca. 1695)

$\begin{array}{l} \text{a) } E5 \xrightarrow{+1} F5 \\ A4 \xrightarrow{+3} C5 \\ D4 \xrightarrow{+5} G4 \\ G3 \xrightarrow{+5} C4 \\ \quad \quad \quad *I_4 \end{array}$	$\begin{array}{l} \text{b) } E5 \xrightarrow{-1} E\flat 5 \\ A4 \xrightarrow{+1} B\flat 4 \\ D4 \xrightarrow{+3} F4 \\ G3 \xrightarrow{+3} B\flat 3 \\ \quad \quad \quad *I_5 \end{array}$
offset: (2)	(2)
consistency: 2	2
displacement: 14	8

Example 9. Bach, Prelude from Partita no. 3 in E major (ca. 1720), BWV 1006, mm. 20–28

Example 10. (a) Excerpt from Krenek, Sonata no. 1 for Solo Violin, op. 33 (1925); (b) event network, emphasizing finger inversion



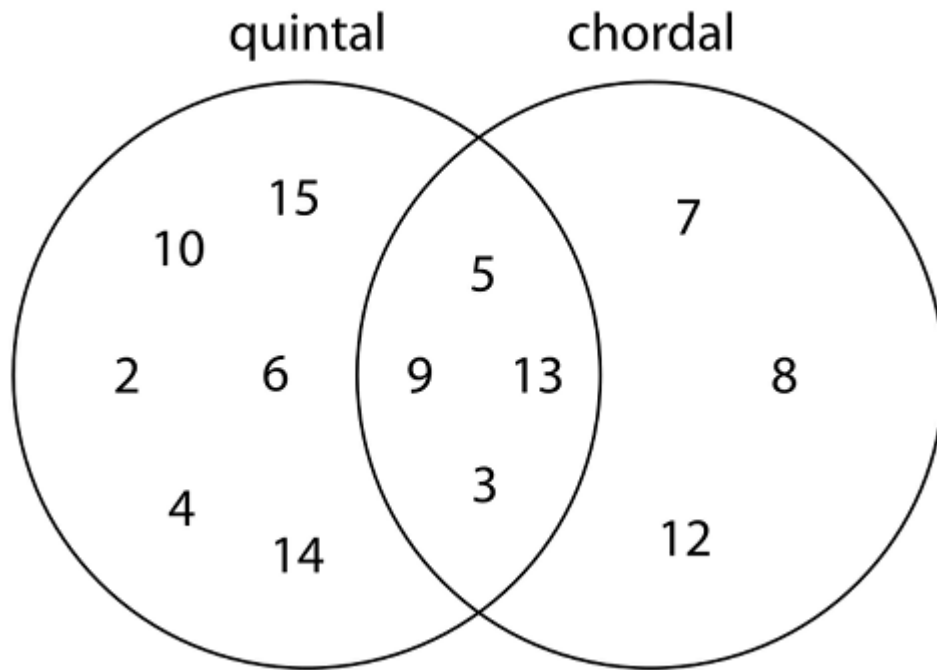
Example 11. Scordatura for Mystery Sonata 11, with crossed strings (Wikimedia Commons)



Example 12. Tunings from Biber's Mystery Sonatas, arranged according to their distance from standard tuning (decreasing consistency, then increasing displacement). In this ranking, Sonatas 10 to 3 are quintal scordatura, and Sonatas 5 to 12 are chordal scordatura. Note that none of these scordatura expand the violin's range by lowering the bottom string (cf. the tuning used by Haydn and Adams in Example 6b)

<i>Sonata</i>	<i>Tuning</i>	<i>Consistency</i>	<i>Min. Offset</i>	<i>Displacement</i>
1	<G3, D4, A4, E5>	4	0	0
10	<G3, D4, A4, D5>	3	2	2
15	<G3, C4, G4, D5>	3	2	6
2	<A3, E4, A4, E5>	2+2	4	4
6	<A \flat 3, E \flat 4, G4, D5>	2+2	6	6
4	<A3, D4, A4, D5>	2+1+1	4	4
14	<A3, E4, A4, D5>	2+1+1	6	6
5	<A3, E4, A4, C \sharp 5>	2+1+1	9	7
9	<C4, E4, A4, E5>	2+1+1	7	7
13	<A3, E4, C \sharp 5, E5>	2+1+1	4	8
3	<B3, F \sharp 4, B4, D5>	2+1+1	8	12
7	<C4, F4, A4, C5>	1	12	12
8	<D4, F4, B \flat 4, D5>	1	11	13
12	<C4, E4, G4, C5>	1	13	13
11	<G3, G4, D4, D5>	1	14	14

Example 13. Venn diagram categorizing scordatura from the Mystery Sonatas as quintal or chordal. Numbers within the diagram refer to sonatas from Biber's collection (Sonatas 1 and 11 are excluded here).



Example 14. Transposed passages with repeated fingering in sonatas whose scordatura include two adjacent perfect fifths

<i>Sonata</i>	<i>Tuning</i>	<i>Locations</i>
2	<A3, E4, A4, E5>	Presto, mm. 4–7, 12–15
6	<A _b 3, E _b 3, G4, D5>	Lamento, mm. 33–34, 67–68
10	<G3, D4, A4, D5>	Aria with Variations, m. 14
15	<G3, C4, G4, D5>	Variations, mm. 16–17

Example 15. Biber, *Mystery Sonata 10, Variations*, mm. 41–50. Fifths occur between strings 2 and 3, and strings 3 and 4

The image displays a musical score for strings and continuo, spanning measures 41 to 50. The score is organized into five systems, each with three staves: Violin (scordatura), Violin (sounding), and Continuo. The key signature is B-flat major, and the time signature is common time (C). The Continuo part is primarily a bass line with some chords, while the Violin parts feature complex rhythmic patterns, often with scordatura markings (diagonal slashes with dots) indicating altered tunings. The Continuo part includes figured bass notation (numbers 6, 4, #, #, 4, #, #, b) below the staff. The string parts are grouped into various sections: strings 1 and 2 (measures 41-42), strings 2 and 3 (measures 43-44), strings 2-4 (measures 45-46), strings 1 and 2 (measures 47-48), and strings 1-3 (measures 49-50). The Continuo part includes figured bass notation (numbers 6, 4, #, #, 4, #, #, b) below the staff.

Example 16. Biber, *Mystery Sonata 6, Lamento*, mm. 28–45. Fifths occur between strings 1 and 2, and strings 3 and 4

28 *strings 1 and 2*

Violin (scordatura)
Violin (sounding)
Continuo

6 5 $\flat 6$ 6 6 5 \flat

4-3 3 $\flat 5$

33 *strings 2 and 3* *strings 1 and 2* *strings 3 and 4* *strings 2 and 3*

b b 6 b 6 5

38 *strings 1 and 2*

b 4-3 $\flat 6$ 5 $\flat 6$ 3

42 *Adagio* *strings 2 and 3*

b b 5 \flat 5 \flat 6 5

4 4 5 b 5

Example 17. Biber, *Mystery Sonata 2*, final movement (complete). As in *Sonata 6*, fifths occur between strings 1 and 2, and strings 3 and 4

Presto

Violin (scordatura)
Violin (sounding)
Continuo

strings 3 and 4

5 strings 1 and 2

9 strings 2 and 3 strings 2 and 3 strings 1 and 2

14 strings 3 and 4 strings 2-4

19

Example 18. Open-string chords in sonatas with chordal scordatura

<i>Sonata</i>	<i>Tuning</i>	<i>Locations</i>
3	<B3, F#4, B4, D5>	First movement, m. 13; Courante, m. 3; final cadence
5	<A3, E4, A4, C#5>	Allemande, m. 16; final cadence
7	<C4, F4, A4, C5>	Allemande, m. 2; Sarabande with Variations, mm. 1 and 18
8	<D4, F3, Bb4, D5>	Gigue and Doubles, final cadences
12	<C4, E4, G4, C5>	Allemande, m. 1 and final cadence; Courante, m. 1 and final cadence
13	<A3, E4, C#5, E5>	First movement, m. 21; Gavotte, m. 4; Gigue, m. 19

Example 19. Biber, Mystery Sonata 12, Intrada (complete)

1

Violin (scordatura)

Violin (sounding)

Continuo

5

6

8

11

Example 20. Biber, *Mystery Sonata 8, Gigue* (complete). Asterisks mark moments where the violinist plays only open strings

Violin (scordatura)
Violin (sounding)
Continuo

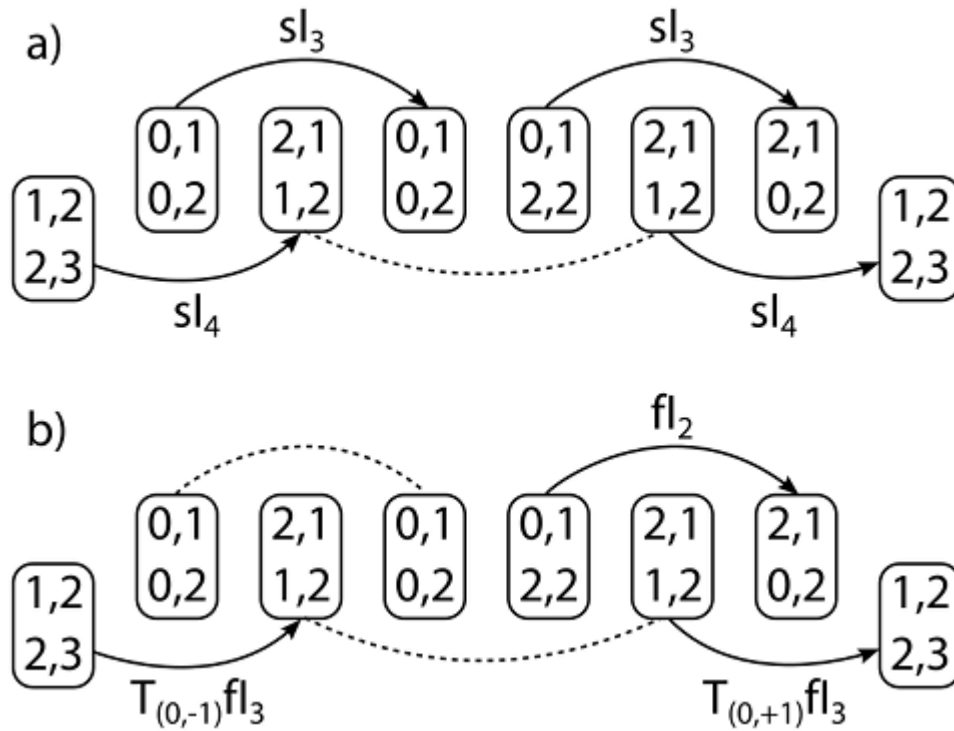
1 * * * * *
6 5 6 6 6 7 6 6 6

6 * * *
7 6 4 3

12 * * * * *
6 6 4 # 6 6 7 6 6

18 * * * * *
6 6 6 6

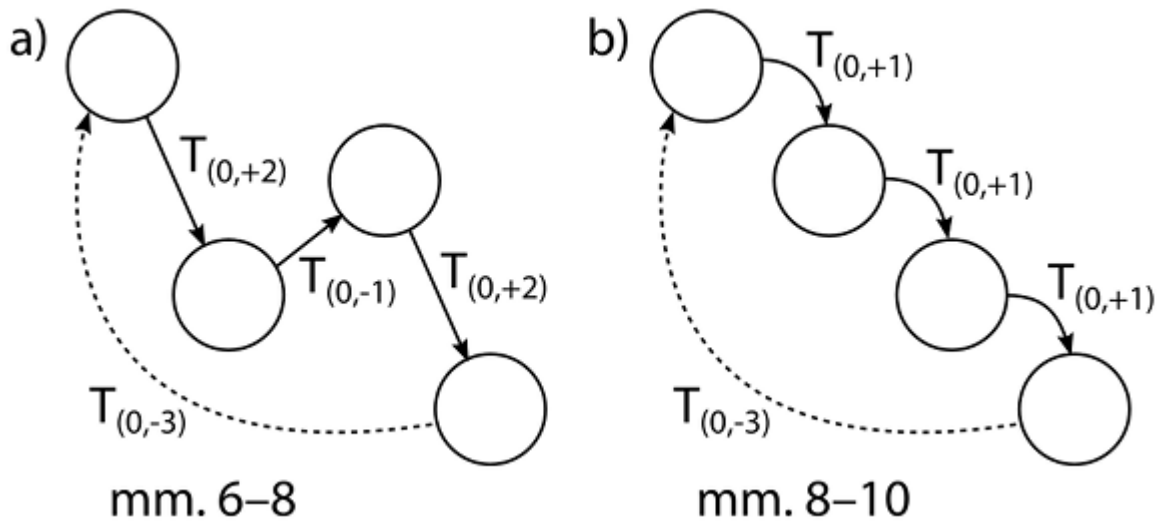
Example 21. Event networks for Mystery Sonata 8, mm. 3–5 (with upbeat): a) an interpretation based on string-space inversion; b) an interpretation based on finger-space inversion. Dotted lines indicate identity relations



Example 22. Biber, Mystery Sonata 11, mm. 6–10

The musical score is presented in two systems. The first system covers measures 6, 7, and 8. The second system covers measures 9, 10, and 11. The instruments are Violin (scordatura), Violin (sounding), and Continuo. The key signature is three sharps (F#, C#, G#) and the time signature is common time (C). Dynamics include *p* (piano) and *f* (forte). Measure 11 ends with a fermata and a repeat sign.

Example 23. Transformation graphs for the 3–2–1–0 finger pattern in Mystery Sonata 11, mm. 8–10: (a) in mm. 6–8, the finger pattern zigzags in string space, sounding a descending contour; (b) in mm. 8–10, the finger pattern descends through string space, sounding a zigzagging contour



Example 24. Biber, Mystery Sonata 11, mm. 112–21 (notated fifths continue until m. 133, returning in mm. 137–41, 145–52, and 161–76)

Violin (scordatura)

Violin (sounding)

Continuo

112

6 4 5 6

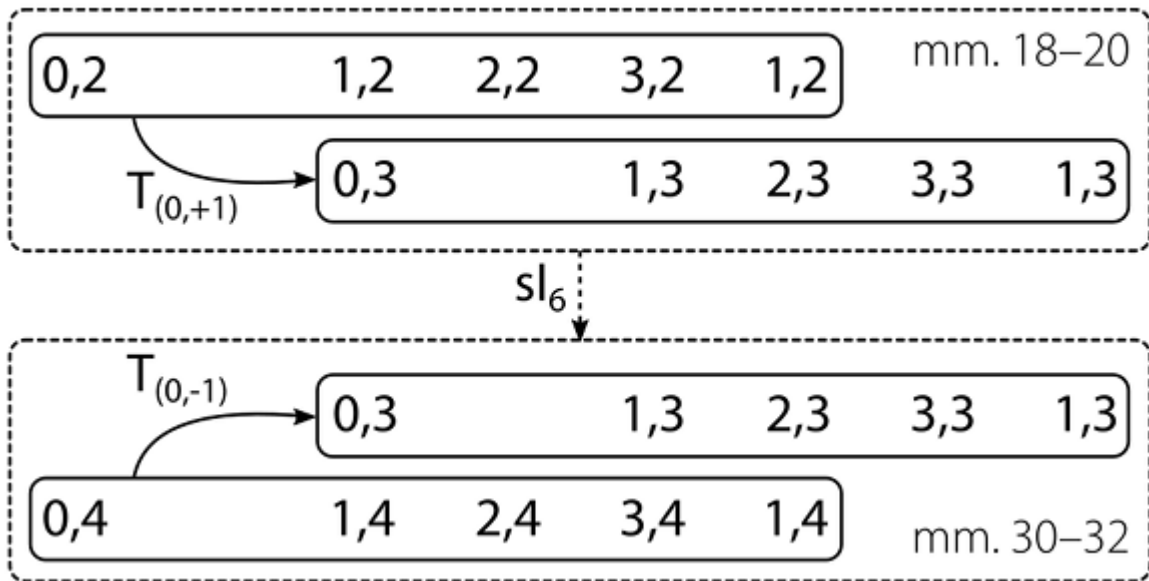
115

6

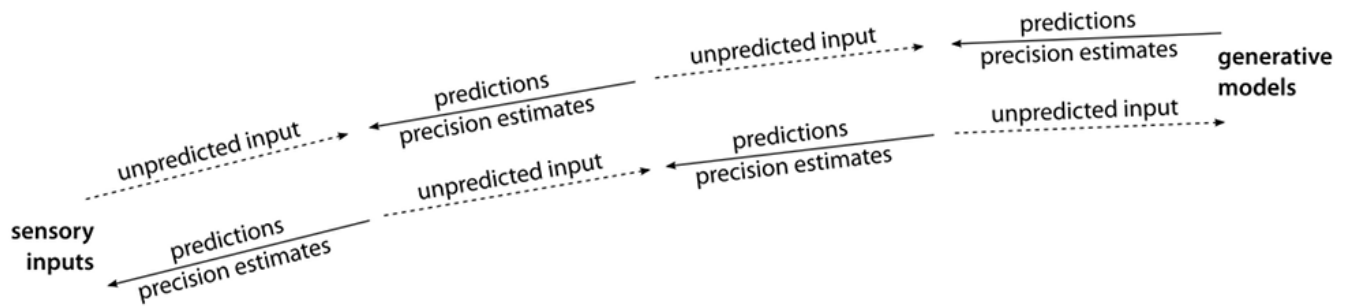
119

6 6 6

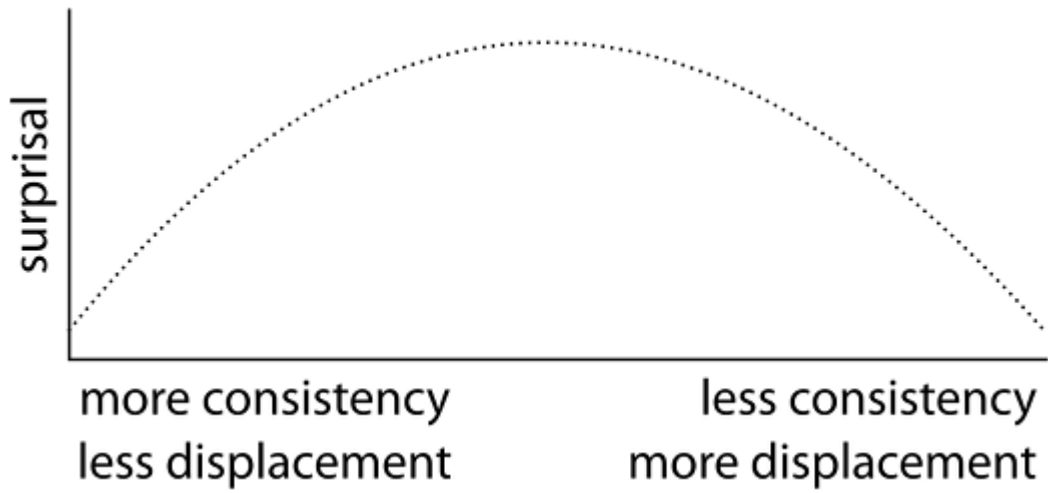
Example 27. Network for points of imitation in Example 26, showing invertible counterpoint with cross-string inversion



Example 28. Basic predictive processing schema (adapted from Clark 2016, 59), sketching top-down flows of predictions and precision estimates, and bottom-up flows of input (i.e., prediction errors)



Example 29. Hypothetical inverted-U function relating surprisal to distance from standard tuning



Example 30. Biber, Mystery Sonata 5, Sarabande-Double, mm. 1–10

The musical score for Biber's *Mystery Sonata 5, Sarabande-Double*, measures 1–10. The score is in 3/4 time and D major. It features three parts: Violin (scordatura), Violin (sounding), and Continuo. The Continuo part includes figured bass notation: 6, 6, 5, #6, 4 #.