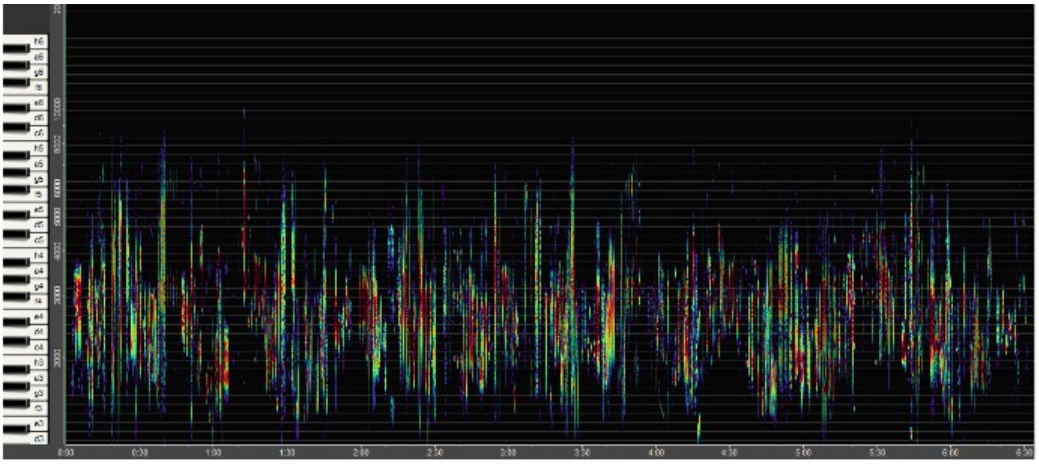
Mockingbird song (2) - 6 min singing

Singing at 1300-5000 Hz, core spectrum at 2-4 kHz, total spectrum up to 11 kHz

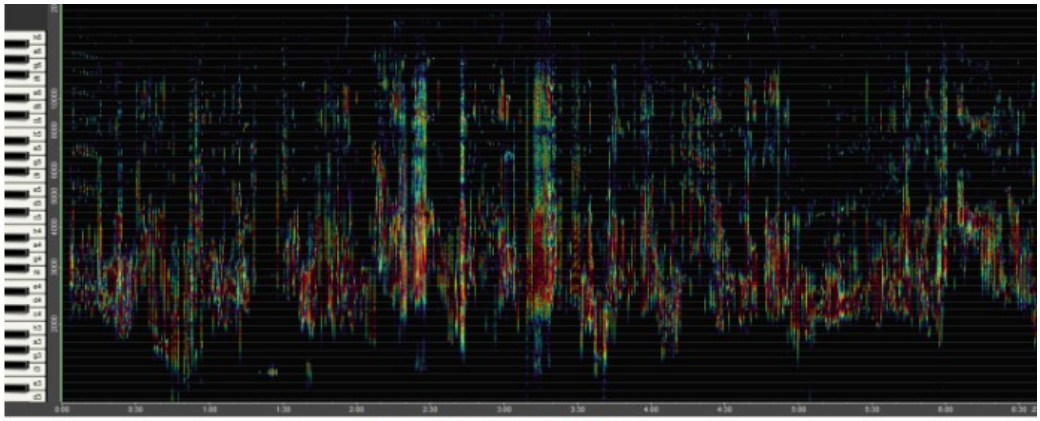
over 900 differently combined motifs, in motif chains or motif sequences
about 80 different motifs, few repetitions

Videos:
- Mockingbird song (2) - 6 min with spectrograms and motif sequences slowed down 8x - partly with notation - https://youtu.be/wKDX3j7V2X4
- Mockingbird song (2.1) - From the sound of chirping to the pure sound of singing - single motifs and motif sequences 0-2-4-8-16x slowdown - https://youtu.be/9wbDbXTjbyA

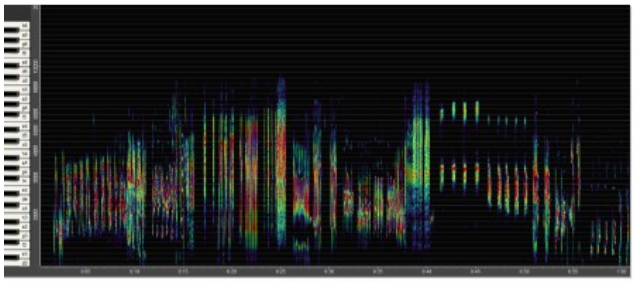


Mockingbird 2 – 6:30 min

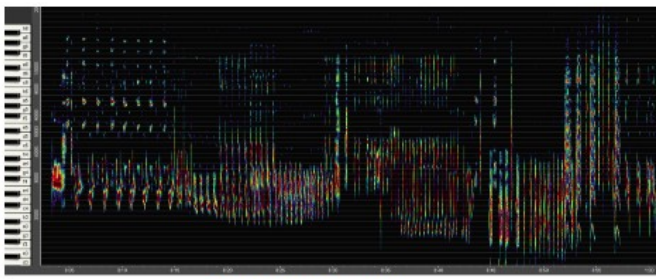
For comparison, 6:30 minutes from the 10 minute singing of “Mockingbird 1”:
https://youtu.be/5wJBfG9omAk



Mockingbird 1 – 6:30 min



Mockingbird 2 – 1 min



Mockingbird 1 – 1 min

See also the texts on the mockingbird's singing and the question of imitations:

- "Mockingbird song (1) - 10 min singing" (https://www.entfaltungderstimme.de/Klangkosmos.html)

- "Mockingbird song (3) - a polyphonic 2-voice singing"

The recording is obviously an excerpt from a longer singing of this mockingbird, as can be seen at the beginning of the recording. At the end, the singing becomes less intense and there is a fade out in the recording.

As with “Mockingbird (1)”, the singing of “Mockingbird (2)” is mainly a true chirping song without melodies and without verses, a succession of (for our perception) short motifs, often repeated in chains of certain motifs. As can be seen above in the comparison of the spectrograms, the singing of “Mockingbird (2)” is not as dense and intense; it has a lower range in the singing (“M 1”: 1500-7000 Hz / “M 2” 1300-5000 Hz) and a lower overall spectrum (“M 1” up to 20 kHz / “M 2” up to 11 kHz).

In difference to “M 1”, “Mockingbird (2)” often makes shorter or longer pauses, not only between different motifs or chains of motifs, but also between the repetitions of individual motifs. In contrast, “Mockingbird (1)” produces an almost continuous singing.
In other cases, there is an immediate change from a chain of motifs with pauses between the individual motifs to a completely different motif. It is quite astonishing that the bird can also make such an abrupt change when it repeats a complex sequence of motifs at a distance of 4 minutes, but completely different motifs are sung immediately before and after this repetition. This way of combining and composing seems to be a special ability of the mockingbird.
An interesting phenomenon in this singing is that it occurs several times that chains of motifs gradually develop in dynamics and scope in the repetitions of the motif. In addition, there are even motif sequences in which the bird builds up and assembles a complex motif in its elements step by step; or sequences in which it tries to optimally balance the coordination and synchronization of syrinx 1 and syrinx 2, but does not always succeed.
What is also noteworthy in comparison to the singing of “M 1” is that there are always chains of signal sounds or territorial sounds in the course of the singing.

In “Mockingbird (2)”, in comparison with “M 1”, one finds certain similar sound figures or comparable motif structures, but above all completely unique models of motif design.

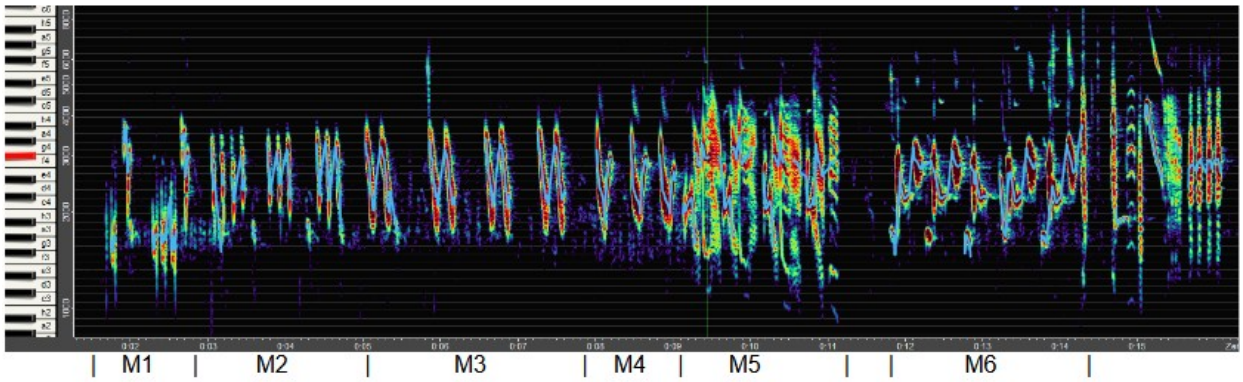
But the fact is:
<u>There is not a single motif in “M 2” that is also sung by “Mockingbird (1)” !</u>

Page 3:
Motifs and motif sequences - a selection of individual special motifs and motif sequences from the singing of “Mockingbird (2)”

Page 11:
Motif 5 in 4 versions (0:10) / Motif 5a in 5 versions (4:45)
Coordination of Syrinx 1 and Syrinx 2

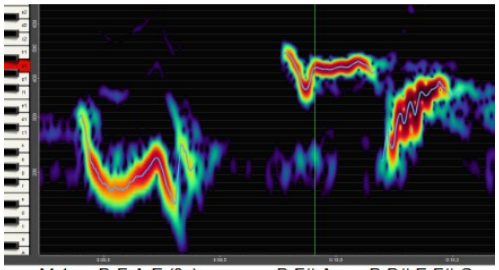
Page 17:
Mockingbird song (2.1) - From the sound of chirping to the pure sound of singing
single motifs and motif sequences 0-2-4-8-16x slowed down

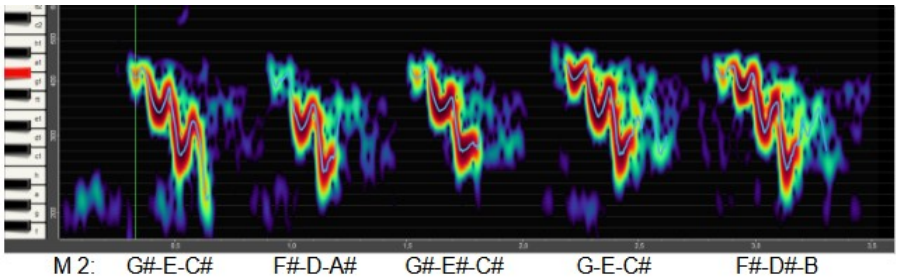
Beginning of the recording



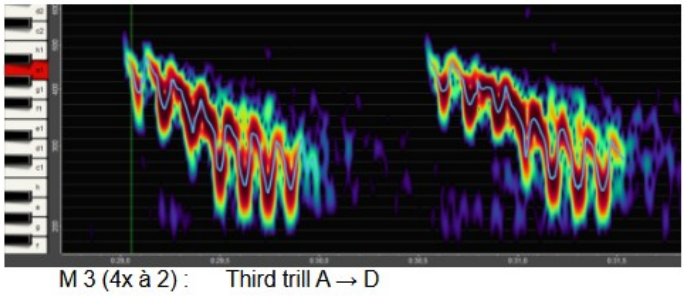
The motif at the beginning of the recording consists of 3 sound figures:
Glissando D-F-A-E / B-F#-A---- / tone sequence B-D#-E-F#-G.

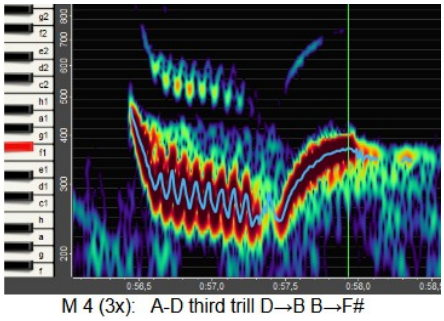
In motif 2, the bird sings 10 triads, which are arranged in 3 groups (4x-3x-3x).
(right picture a selection)





all triad figures:
C#-minor (2x) - G#-E-C
augmented triad (2x) - F#-D-A# / G-D#-B
C#-major (2x) - G#-E#-C#
diminished triad - G-E-C#
C-minor - G-Eb-C
G#-F#-C# / G-F-C#



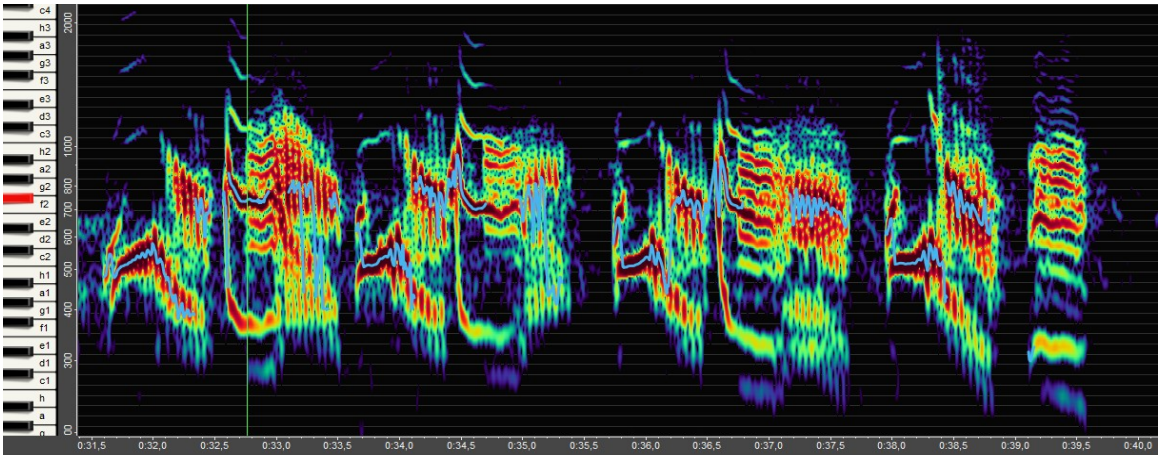


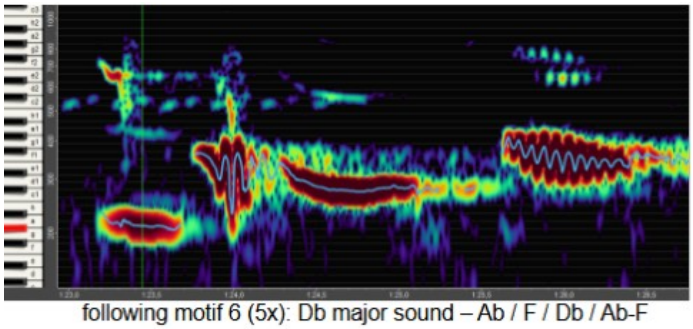
Motif 3: third trill through a fifth (A → D) - 4x 2 trill figures each

Motif 4 (3x): glissando A→D - third trill D → B - glissando B→F#

Motif 5: a sequence of 4 versions of the motif

Motif 5 is a complex motif composed of several sound figures in which syrinx 1 and syrinx 2 are coordinated and balanced in different ways. Apparently, the bird does not manage this coordination so well in versions 2-3, so that the motif breaks into two parts in the fourth attempt.
This motif 5 is repeated 4 minutes later, then in 5 versions, which lead to a simplification and shortening of the motif. A detailed analysis of this highly interesting process can be found on p. 11.



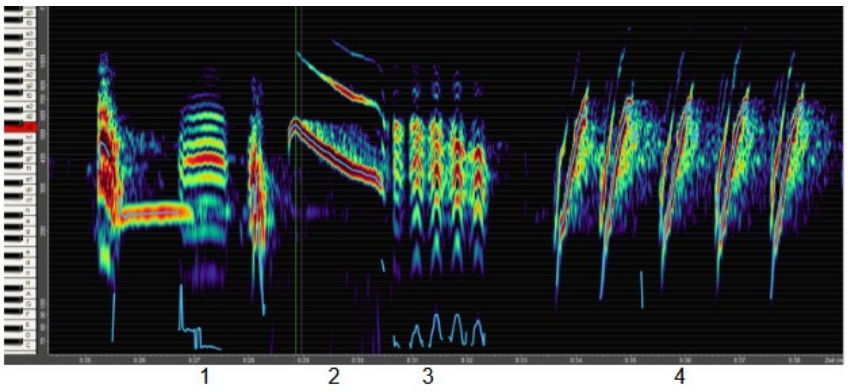


following motif 6 (5x): Db major sound – Ab / F / Db / Ab-F

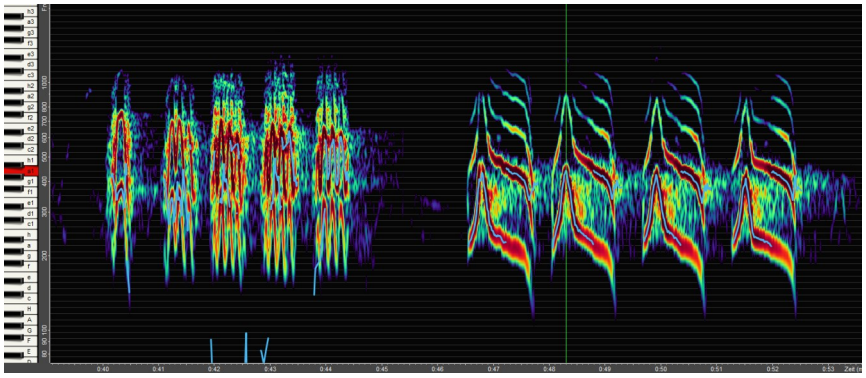
After motif 5, the bird takes an unusually long pause before continuing its singing with a beautiful sequence of sounds.
It is a D minor sound that can be heard in the 8-fold slowdown:
Ab--- / F-Bb-F-Db / Db---- / trill Ab → F

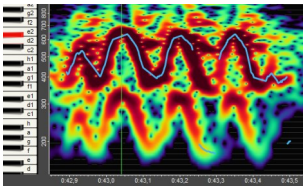
Motifs and motif sequences

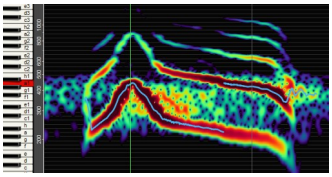
In the following I have compiled a selection of individual special motifs and motif sequences from the singing of “Mockingbird (2)”.



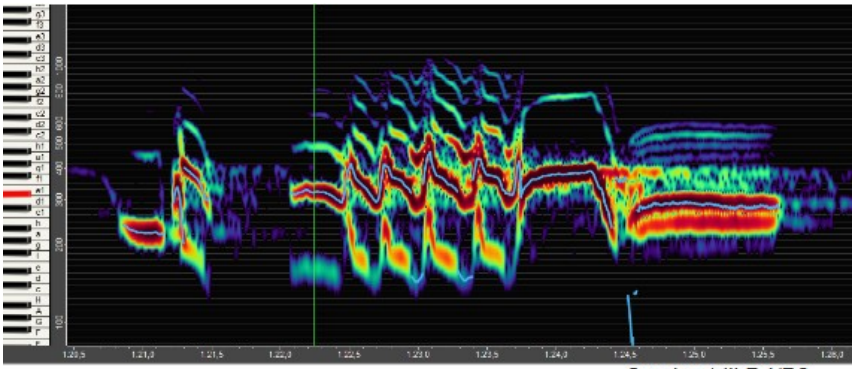
1) Spectral sound with virtual fundamental C (5th-9th partial)
2) Glissando C#5-E4 (5:3)
3) Spectral sounds: C / C-E-C / C-F-C (2x) / C-E-C (4th-7th partial)
4) Glissando A2-E5 (6:1)



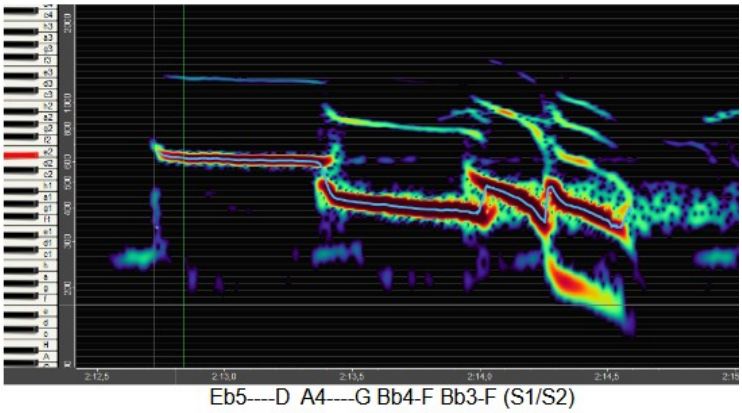




1) S1/S2 in octaves: F3-Bb3- G3-Eb4- G3-Eb4- F3-Eb4-Gb3
2) Glissando A3-A4-A3------G3

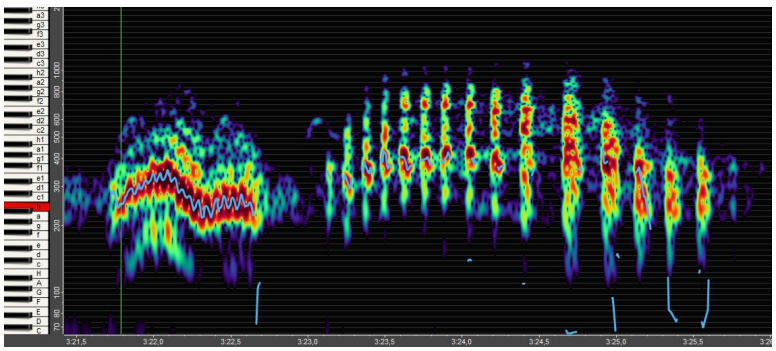


2-voice trill D4/B3

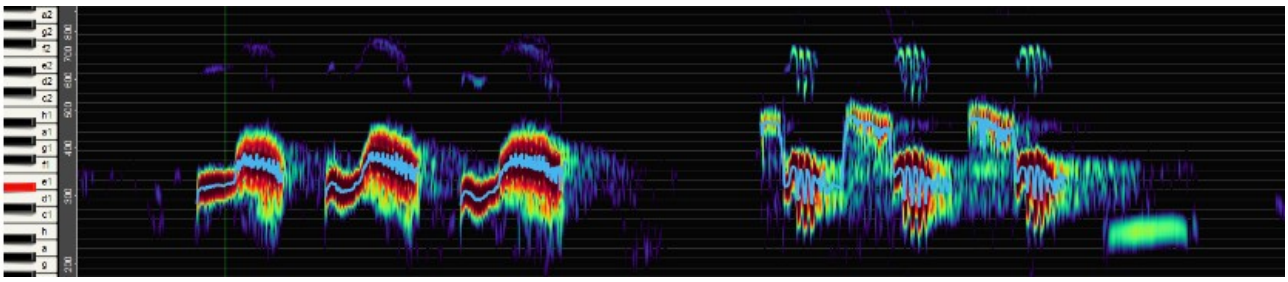


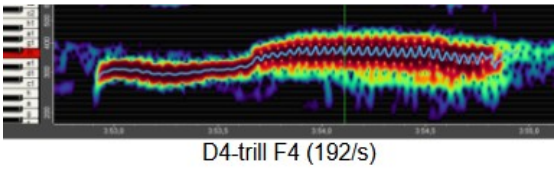
Eb5----D A4----G Bb4-F Bb3-F (S1/S2)

a) Bb4--F (1 syrinx) - b) Bb4/Bb3 → F4/F3 (S1/S2) - sounds 1 octave lower

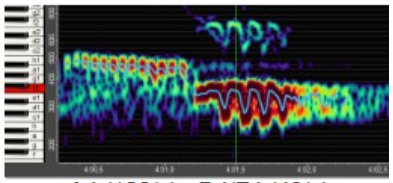


trill-glissando B3-E4-A3-B3 / territorial sounds

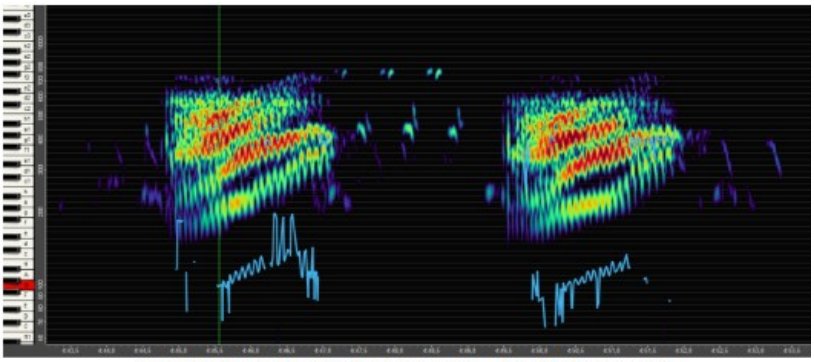




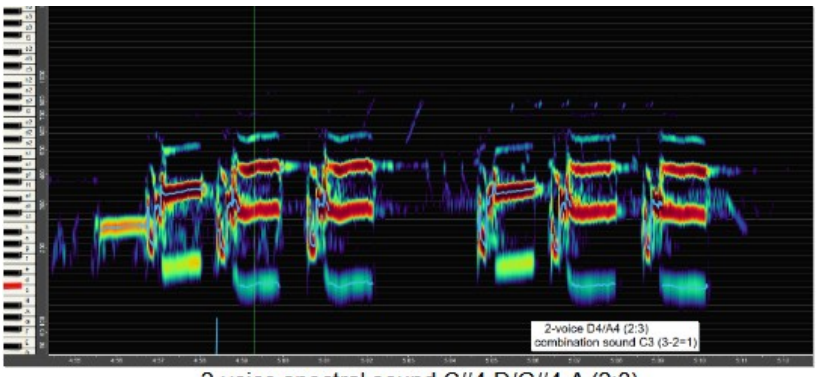
D4-trill F4 (192/s)



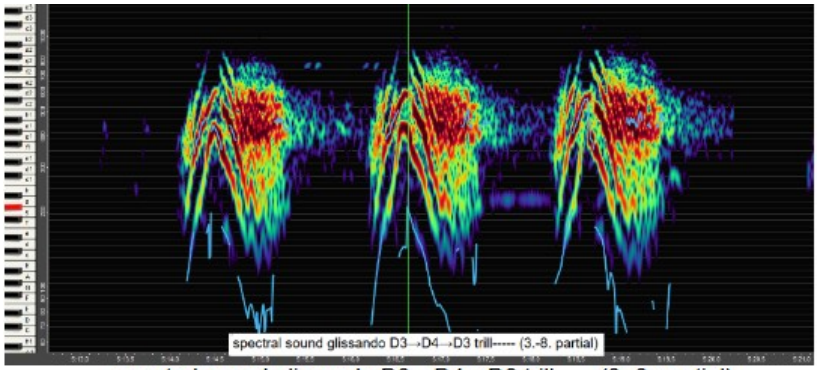
A4 (128/s) - D4/F4 (40/s)



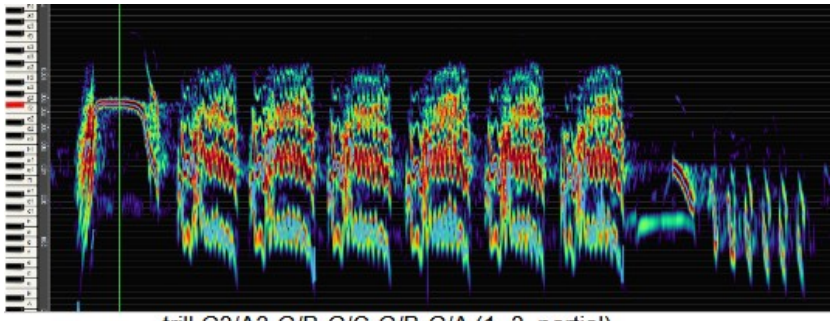
spectral sound trill glissando F3→F4 (2.-5. partial)

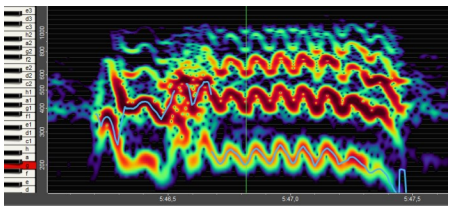


2-voice spectral sound C#4-D/G#4-A (2:3)

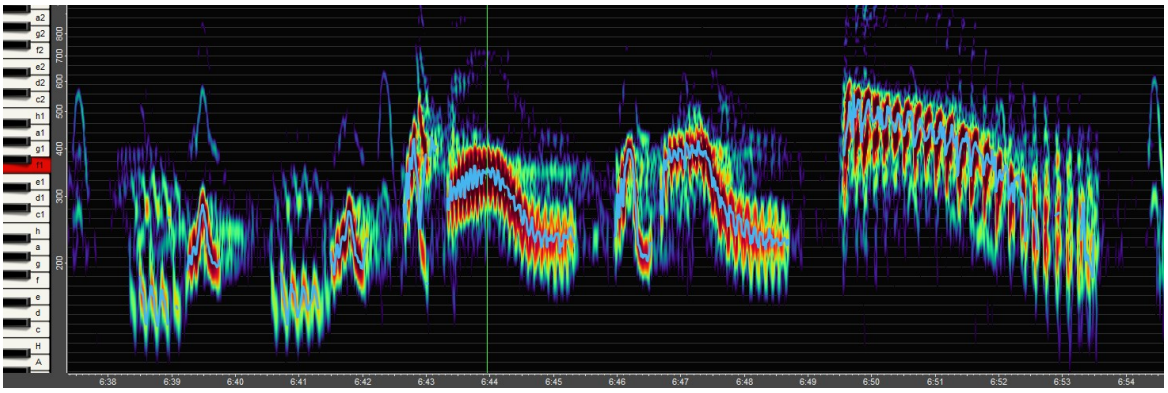


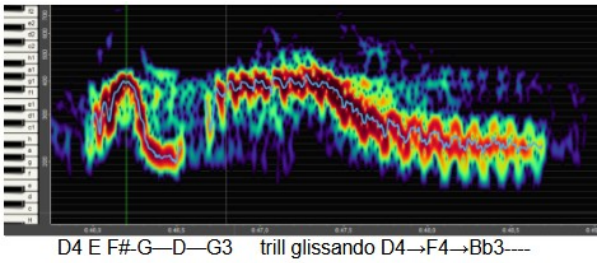
spectral sound glissando D3→D4→D3 trill----- (3.-8. partial)



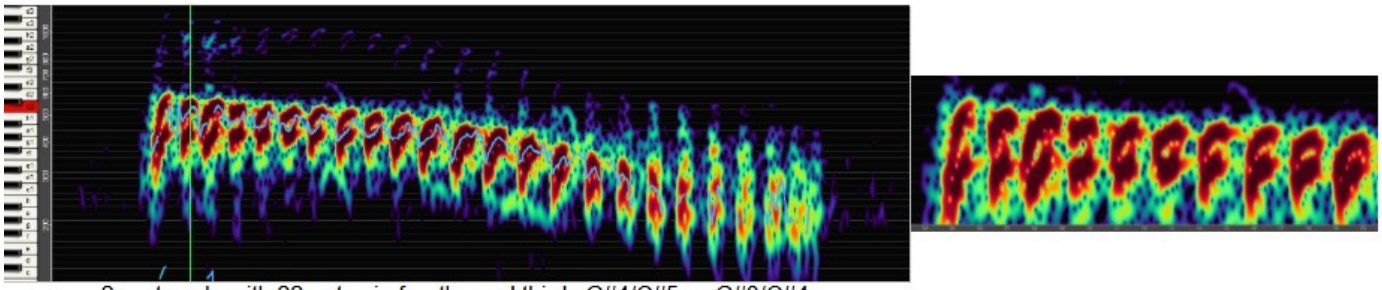


trill G3/A3-G/B-G/C-G/B-G/A (1.-3. partial)

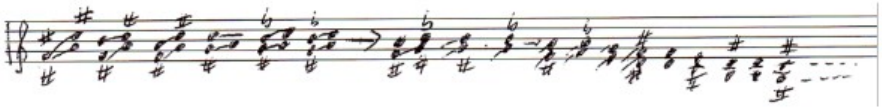


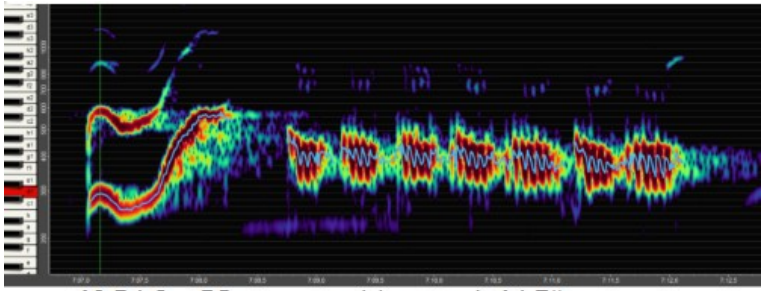


D4 E F#-G—D—G3 trill glissando D4→F4→Bb3----

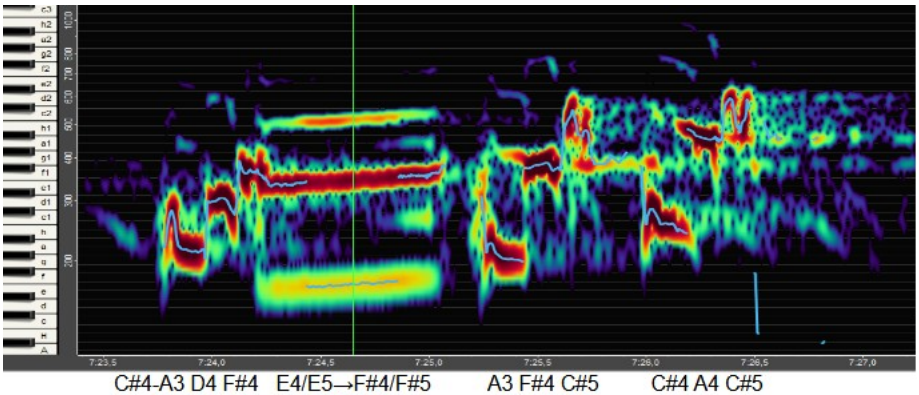


2-part scale with 22 notes in fourths and thirds G#4/C#5 → G#3/C#4

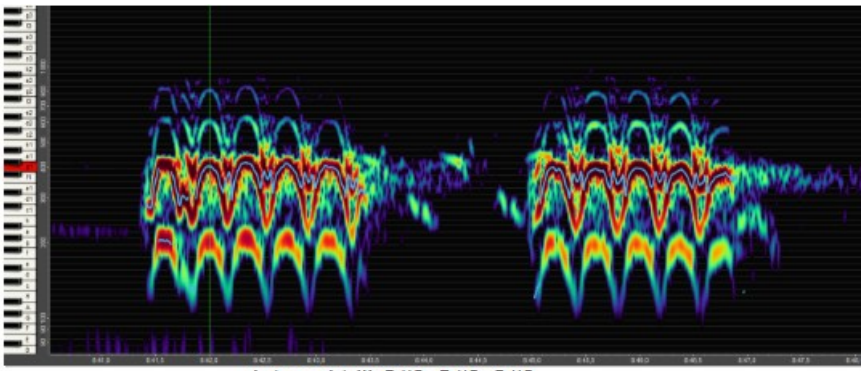




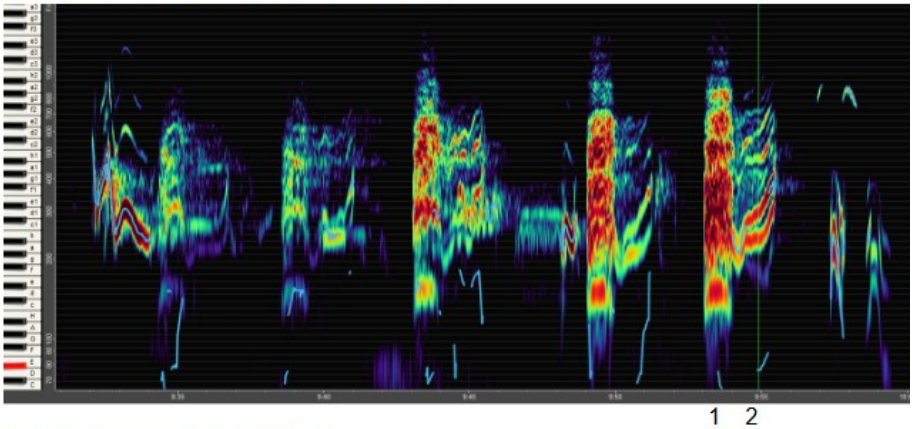
A3-D4-C----D5 pulsing sounds A4-F#



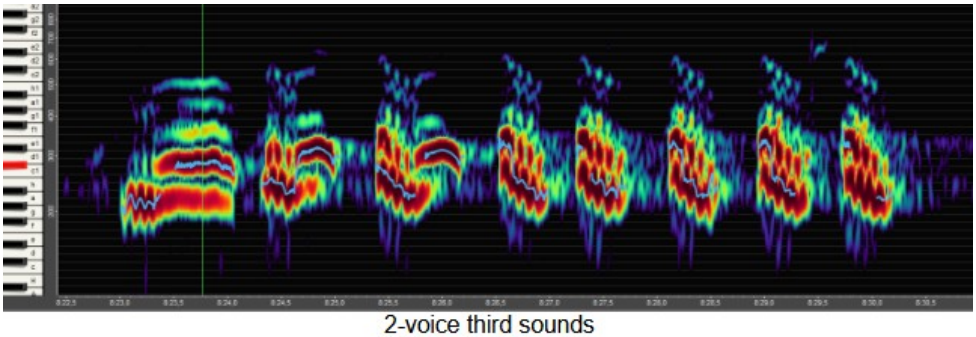
D major / F# minor = mediant (third relationship)

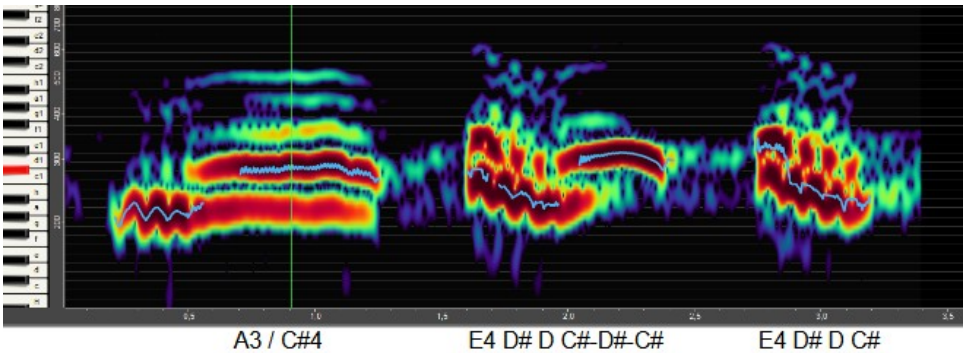

interval trill C#3-G#3-C#3

step-by-step development of the motif:

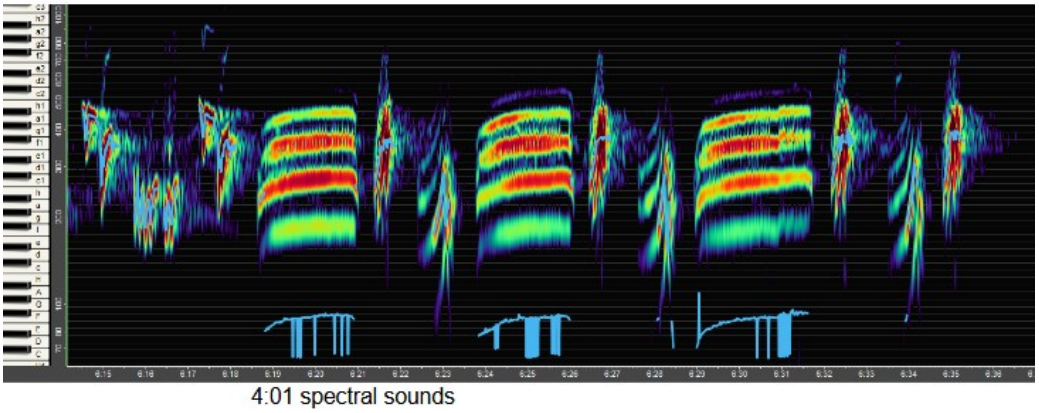


1) 2-voice sound: trill D3/B3
2) 2-voice glissando A3/C4→G3/B♭3→B3/D4→E♭4/G4

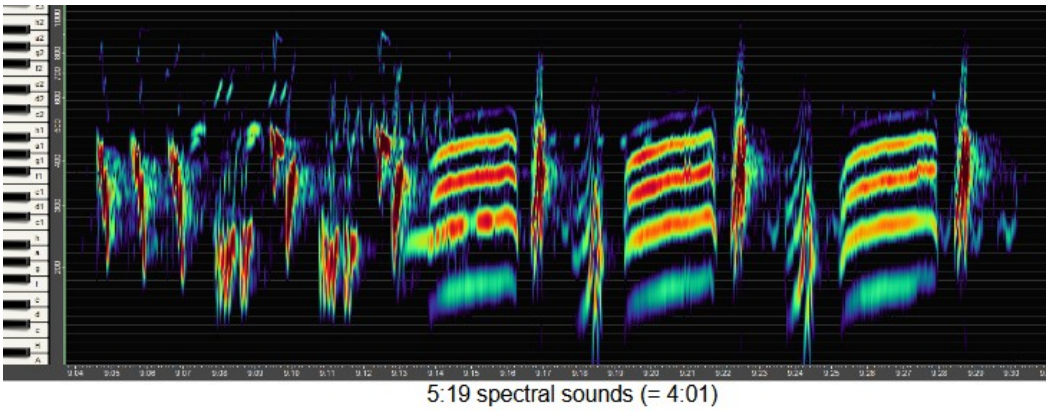

2-voice third sounds



A3 / C#4 E4 D# D C#-D#-C# C4 B3 Bb A E4 D# D C# C4 B3 Bb A

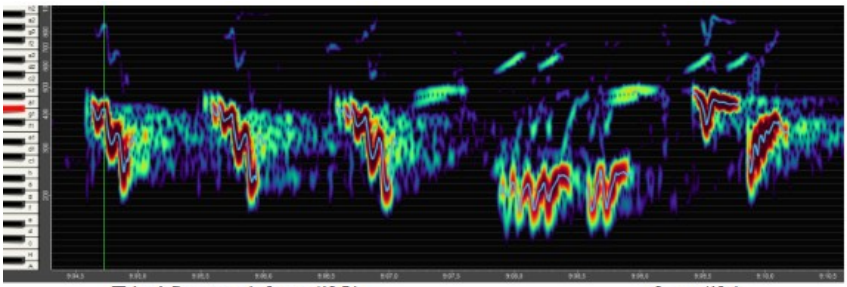


4:01 spectral sounds

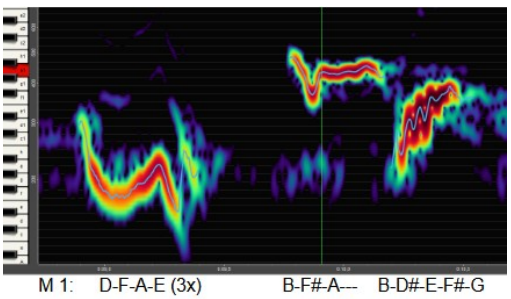


5:19 spectral sounds (= 4:01)

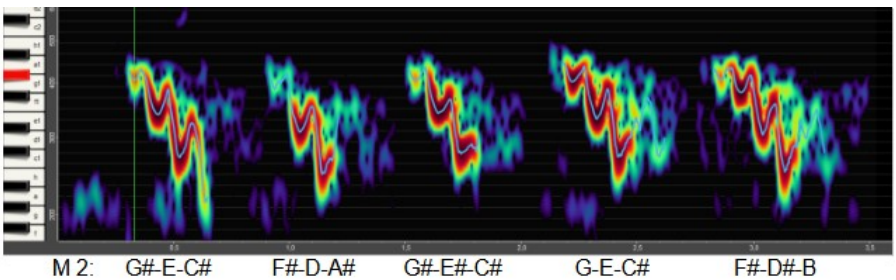
At 5:19, Motif 2 and Motif 1 from the beginning of the recording are heard before the spectral sounds.



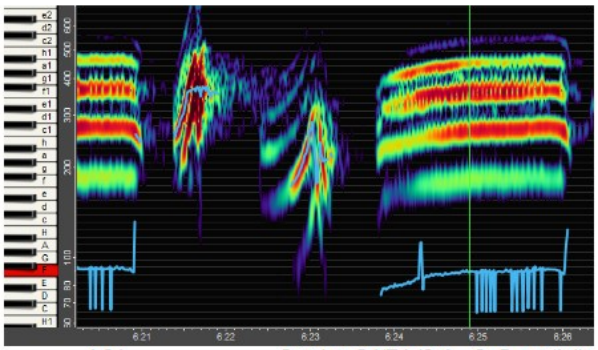
Triad figures (cf. motif 2) cf. motif 1



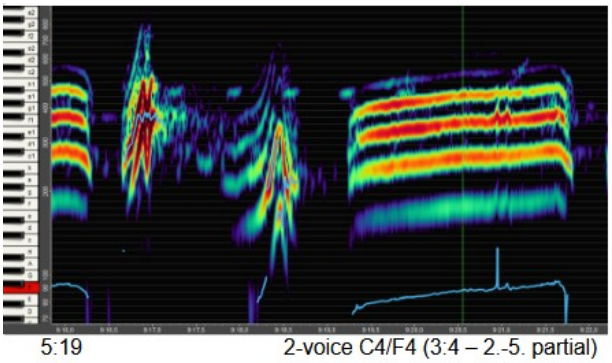
M 1: D-F-A-E (3x) B-F#-A--- B-D#-E-F#-G



M 2: G#-E-C# F#-D-A# G#-E#-C# G-E-C# F#-D#-B

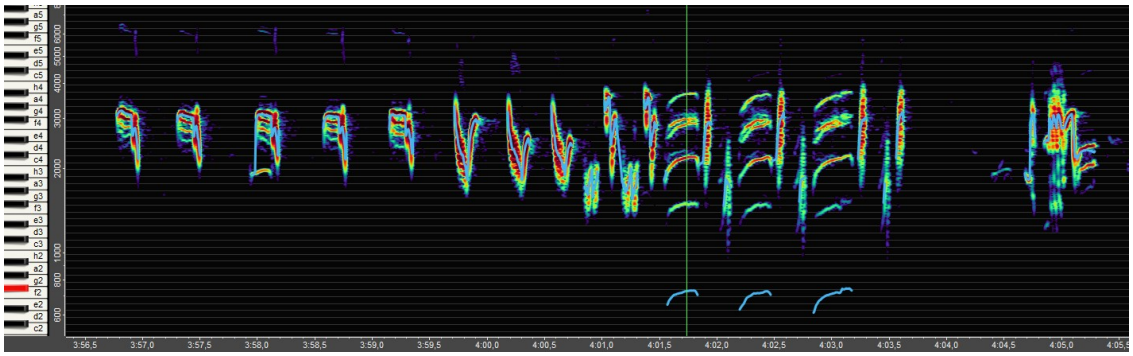


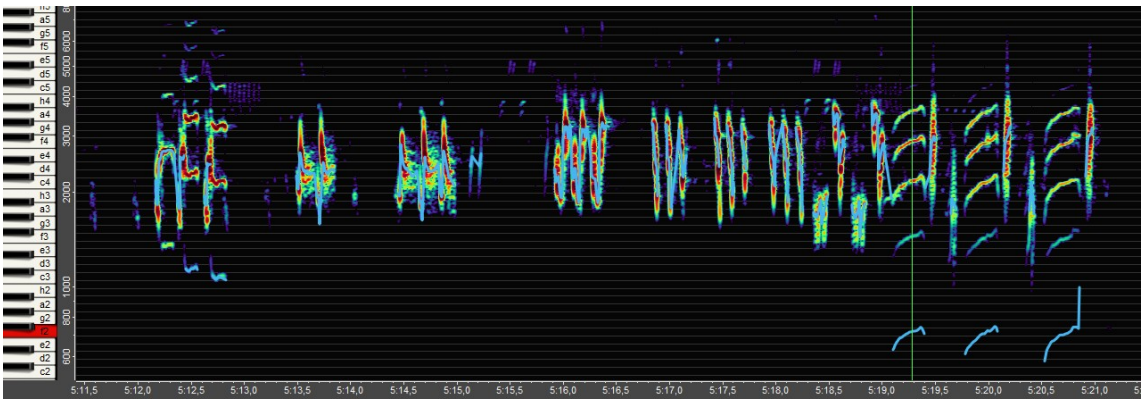
4:01 2-voice C4/F4 (3:4 – 2.-5. partial)



5:19 2-voice C4/F4 (3:4 – 2.-5. partial)

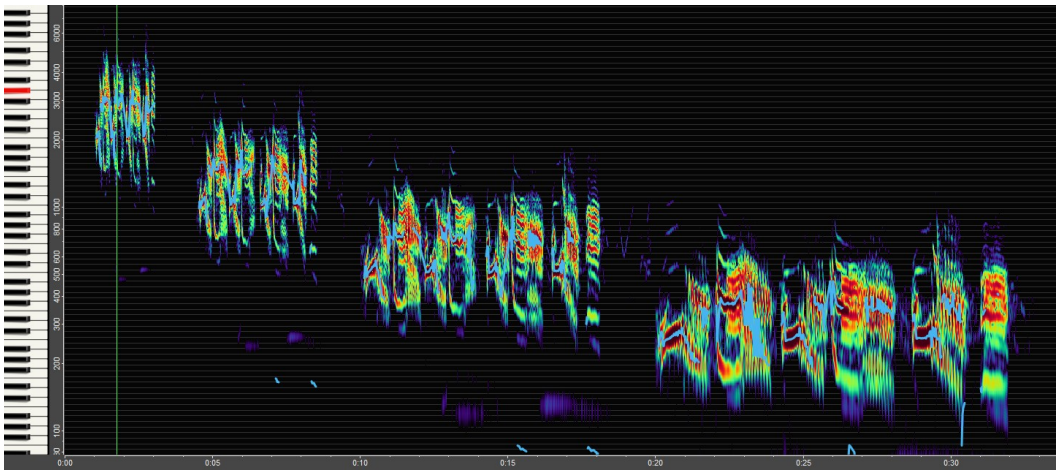
In the spectral sound at 4:01, the spectrum of C4 and F4 is not exactly coordinated. This is why there is a slight beating at F4. The virtual fundamental alternates between C2 and F2.
At 5:19 the coordination is perfect, a pure spectral sound with C/F/A (3rd-4th-5th), i.e. an F major fourth sixth chord.
Immediately before both spectral sounds, the bird sings completely different motif sequences - a highly virtuosic ability to combine and compose!



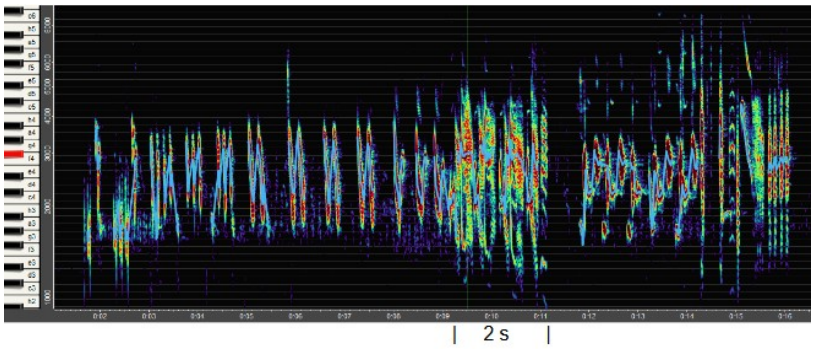


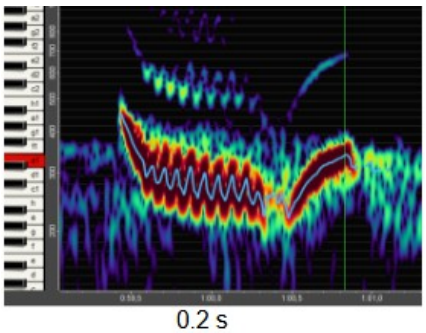
Motif 5 in 4 versions (0:10) / **Motif 5a in 5 versions** (4:45)

Coordination of Syrinx 1 and Syrinx 2



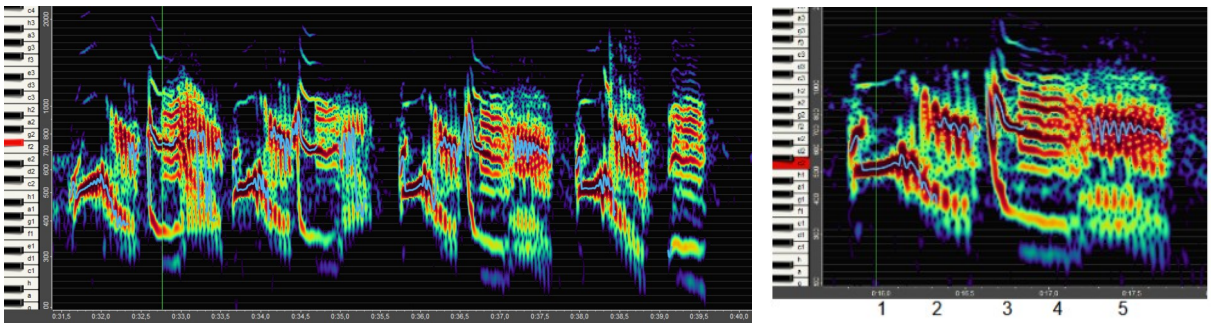
motif 5 - 0-2-4-8x slowdown





Motif 5 is the first complex sound figure that appears in this singing after 10 seconds, immediately after a series of chirps. It lasts just 2 seconds. The 3 very short sounds before it (0.2 s) appear in the 8-fold slowdown as a descending third trill (!) with an ascending fifth glissando (left image).

Motif 5 appears 3 times with its 2 parts in the same structure, but on the 4th time it falls apart.

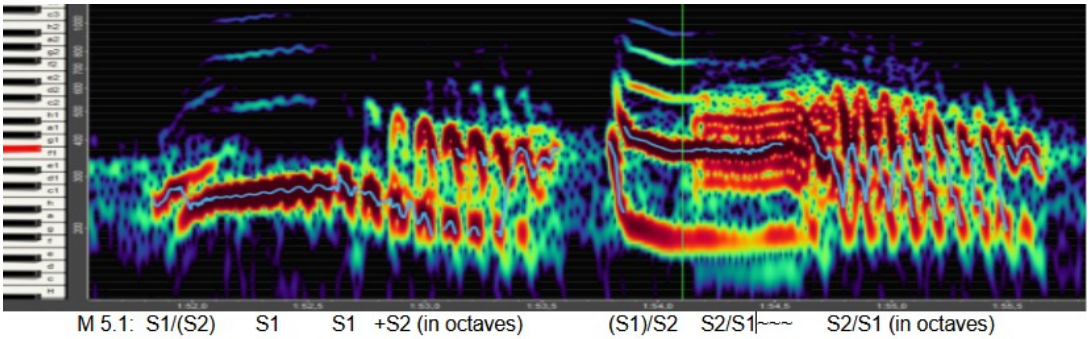


The model for motif 5 is obviously the following sound sequence:
1) an ascending whole-note glissando
2) descending intervallic pulses (thirds)
3) short octave glissando into a tenuto sound (F#/F)
4) Spectral sound in the interplay of S1 and S2
5) descending interval trill from a major to a diminishing ambitus.

In the 4th version (d) there is a completely different structure (1 - 2 - “4”, see below).

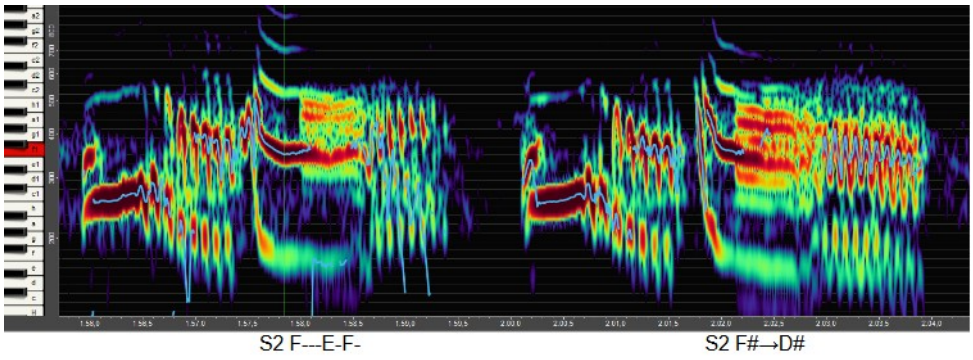
In the 3 complete versions there is a variable and delicate interplay between syrinx1 and syrinx2.

1a-c) glissando A-B→C#, d) C-----
2a) pulsating thirds D-B→F#-D, b-c) D→G, d) trill of thirds B-D4-B→B-D-D#3-B (1st/2nd partial)
3a) glissando F#4→F#3, b) A4→F3, c) C5→F3 (1st/2nd partial)
4) spectral sound a) S1-F#/(S2-D#) b) F→E# (C#), c) F→→E, d) E→D#
5) a) trill decreasing in ambitus (sixth→whole tone = F#-D-F#→F#-G#-F#):
5b) fifths/fourths trill (C#-G#-C# → C-F-C)
5c) trill of fourths E-A-E → C-F-C

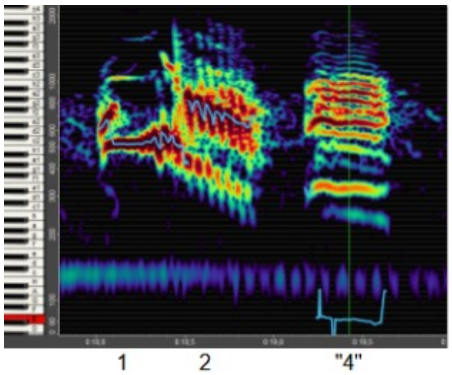


The motif begins with a short 2-part glissando in which both voices are coordinated with 3rd and 4th partials (B/E). Syrinx 1 glides solo with its spectrum (1st-4th) to C#. In the 2nd figure, S1 begins with a descending sequence of thirds, to which S2 is added in the octave: D4-B3 → F#3-D3. S1/S2 then begin again in octaves with a short glissando from F#4/F#5 to G#3/G#4 and with S2 as the dominant voice onwards to F#. On this F# something shifts in the interplay of the two voices, so that a spectral sound with a disproportionate, diffuse spectrum is formed. In the transition from figure 4 to figure 5, the two voices coordinate again. S2 is now the leading voice with S1 in the lower octave. The F# continues to form the basic sound, so to speak, and in an expansive trill figure that decreases in range, both voices move in octave parallels from a sixth trill to a whole-tone trill at the end (F#-D-F# → F#-G#-F#).

Motif 5 - What a highly complex sound shape in 0.5 s !



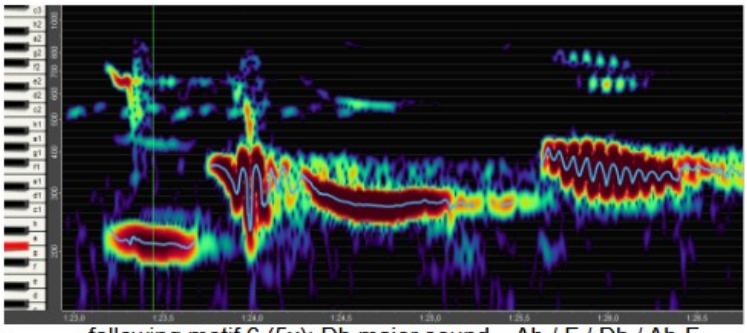
In the 2nd and 3rd versions (see above), the coordination of the two voices shifts significantly in the transition from figure 2 to figure 5, so that the large trill at the end takes on a different form in each case: 2) fifths/fourths trill (C#-G#-C# → C-F-C), 3) fourths trill E-A-E → C-F-C.



Version 4 begins on a stable tenuto note (C-----), as if the bird had heard and sensed that versions 2 and 3 were not as successful as version 1, and figure 2 now becomes an even third trill (B-D4-B → B-D#3-B). But then the motif breaks off, a pause follows, the same length as between two motifs, and then a newly balanced spectral sound with its virtual fundamental 2 octaves lower follows in place of figure 4 (blue line on the left in the spectrogram). This spectral sound is made up of Syrinx1 (D-E-D#---) and Syrinx2 (C--A#) with a virtual fundamental of E-C-E-D# and an approximately coordinated spectrum from the 4th to the 12th partial.

I could, of course, speculate as to why the mockingbird varies this motif slightly and why it does not combine it in the same way in the 4th version. It is clear that the combination of the sound figures in this model is a delicate balance in the interplay of the two voices. But I also know from a thorough analysis of the singing of 3 different mockingbirds that this bird species can string together motifs of the most varied quality in chains with multiple exact repetitions; and that it can also sing very complex motifs at very long intervals (7 min) in figure, rhythm and intonation in the same quality a second time.

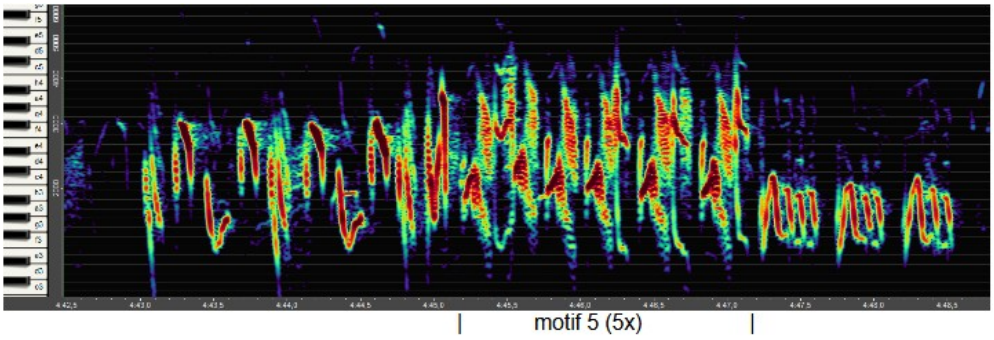
In any case, this motif with its versions proves that the mockingbird does not simply reproduce a certain “learned” repertoire, but that *it listens to itself while singing*, that it obviously recognizes whether and how something succeeds or fits in, and that it corrects itself or tries out individual elements of the motif again. This is probably why there is a longer pause before she continues with a completely different, harmonically composed motif with 5 exact repetitions.



following motif 6 (5x): Db major sound – Ab / F / Db / Ab-F

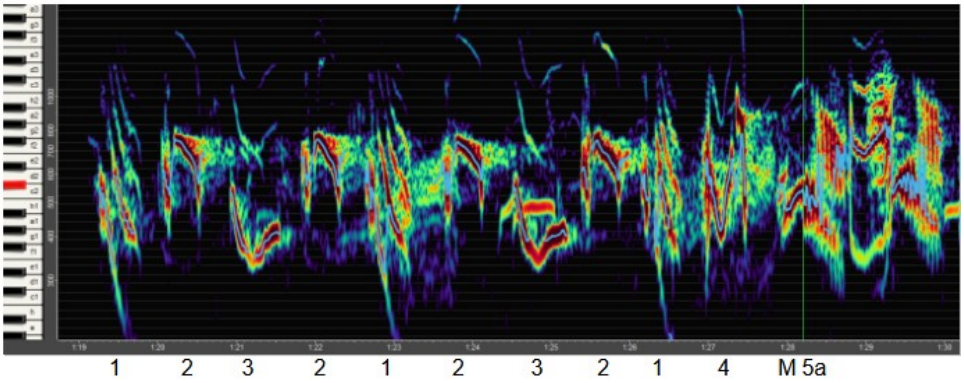
Motif 5 in 4 versions (0:10) **/ Motif 5a in 5 versions** (4:45)

The question of the mockingbird's abilities in the construction and composition of motifs is made even more interesting by the fact that the motif appears again about 4.5 minutes later, in five versions. It again lasts a total of 2 seconds and is inserted directly into a mixed sequence of other motifs.



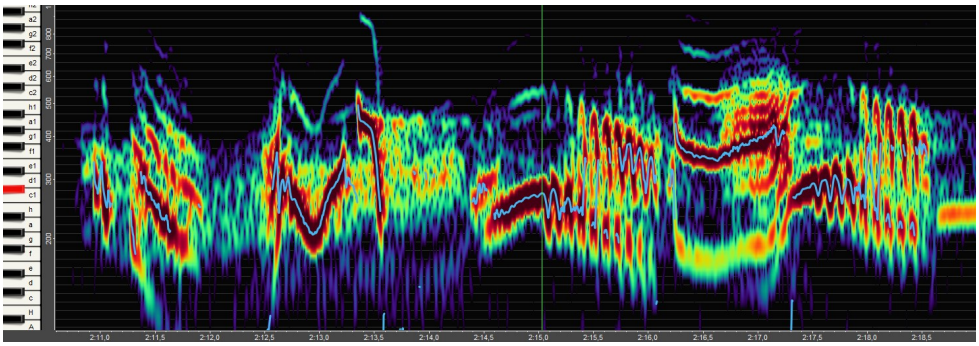
| motif 5 (5x) |

The 4 motifs before M5a are combined in different ways:

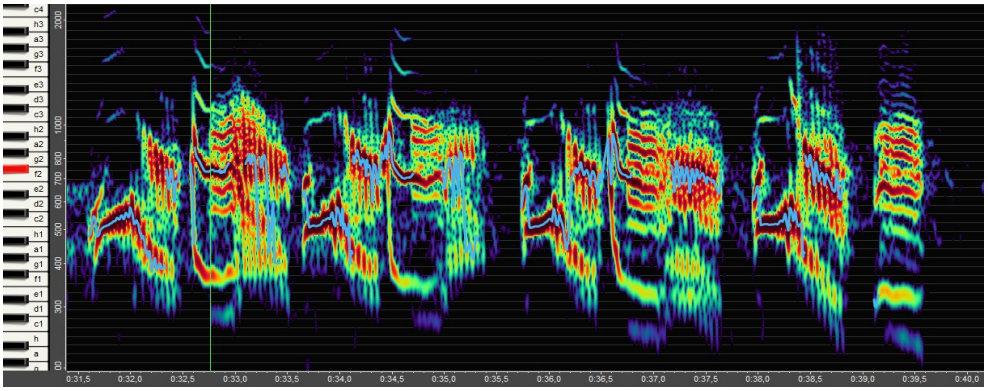


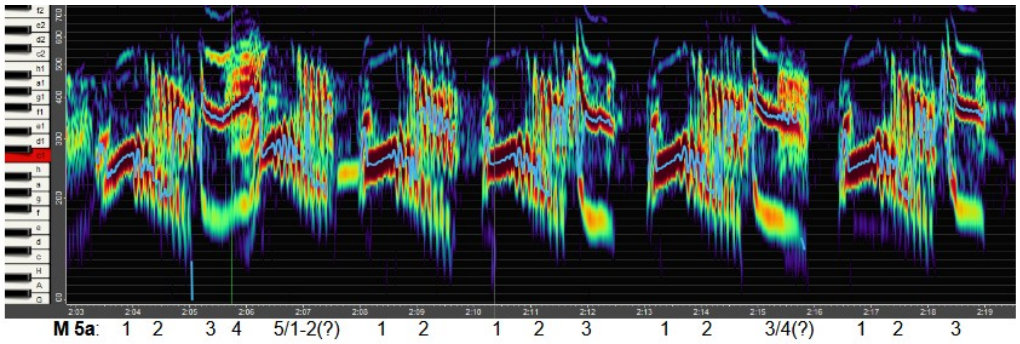
1 2 3 2 1 2 3 2 1 4 M 5a

The 2 motifs before and directly following the 1st version of M5a:



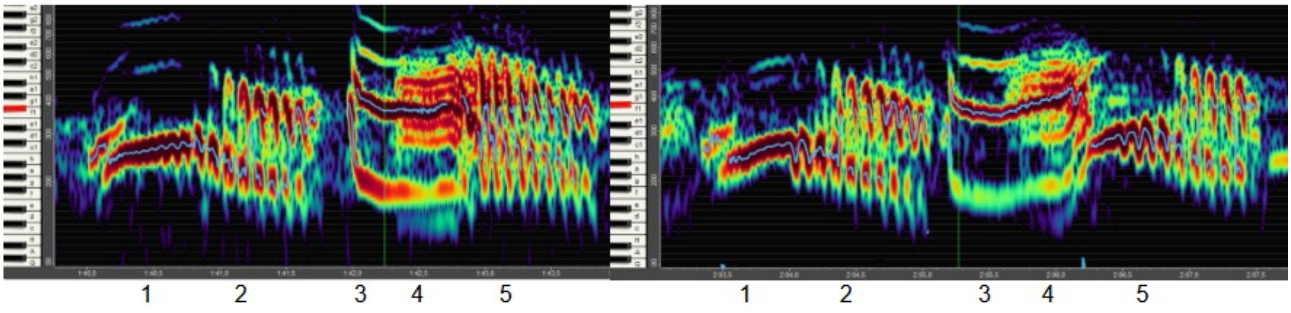
For comparison: the 4 versions of M5 and the 5 versions of M5a with its elements



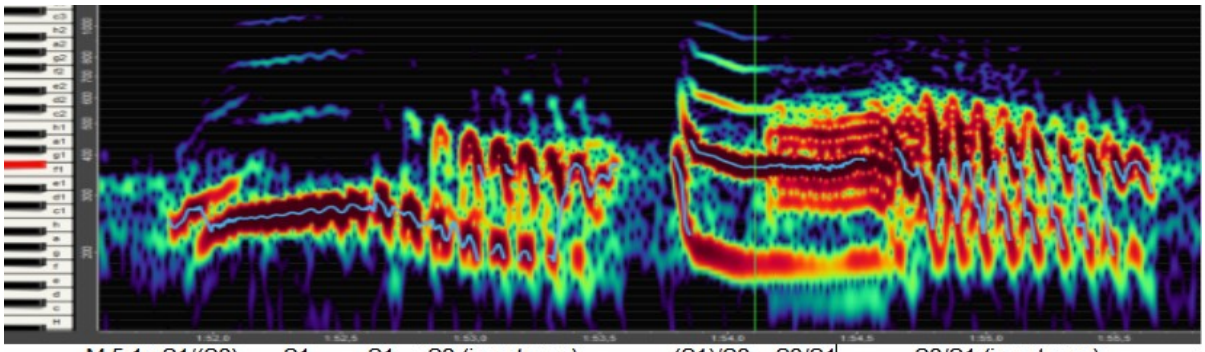


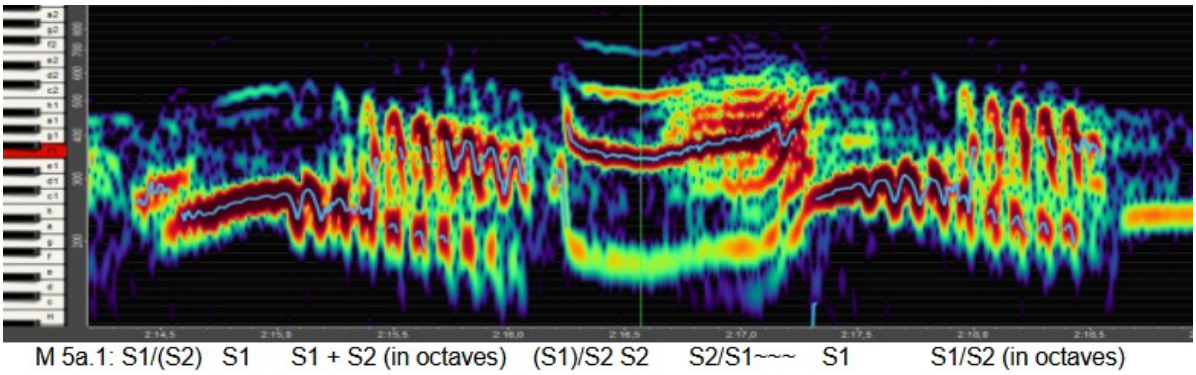
The sound figures: **1)** glissando A-B→C#, **2)** trill in thirds A#-C#-A# → C#-E#-C# / B-D-B → C-E-C / A#-C#-A# → D-F#-D (S1/S2 in octaves), **3)** glissando S1/S2 in octaves: S2 Eb5→F4 / F5→F4-E4 / G5→G4-F4 / A5→A4-G4-F#-F, **4)** ~ spectral sound F→C / F→D#, **5)** C-D → C-D-C → fourths B-F# → A-E

Comparison of 1st version of M5 and M5a

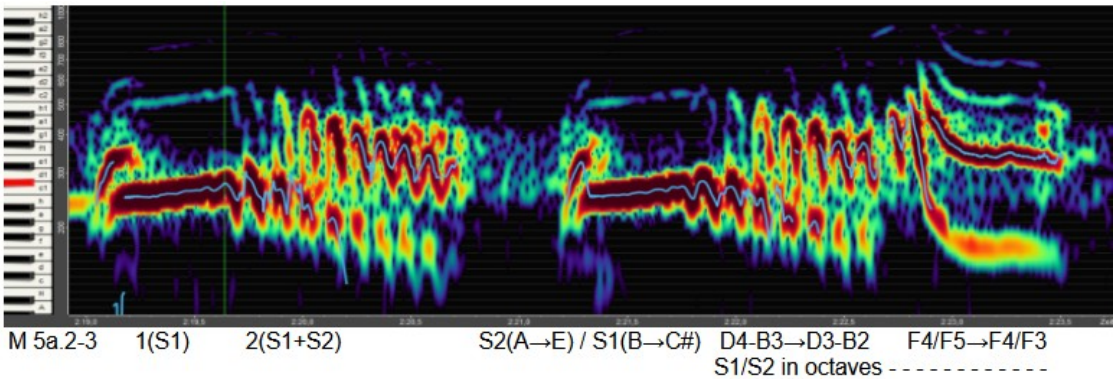


Coordination of S1 and S2 in M5 and M5a

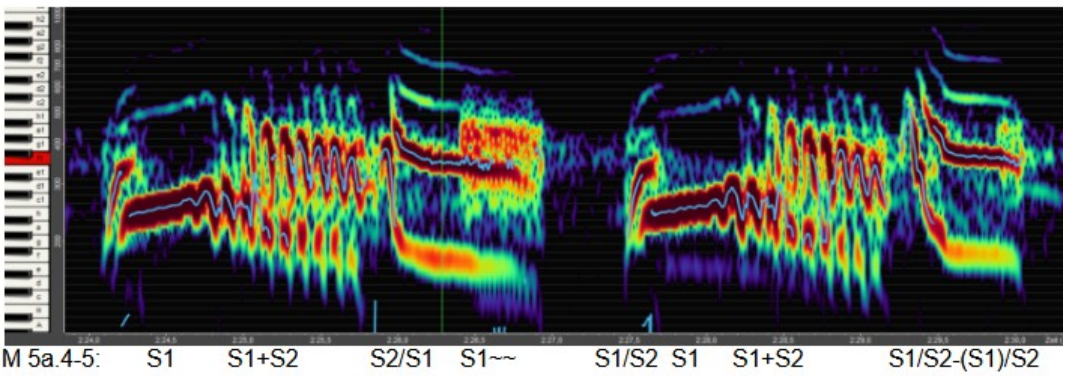




The 1st version of M5a begins exactly as in M5, after 4 minutes and hundreds of motifs!
But then the transition from the tenuto sound to the 2-voice trill slips away for the bird. According to the model of motif 5, S2 should retain the lead through the spectral sound into the upper voice of the trill, but S2 glides upwards from F4 to C5, the synchronization fails, and S1 takes over the lead (as in figure 1-2), and in the trill downwards S2 rejoins as the upper voice.

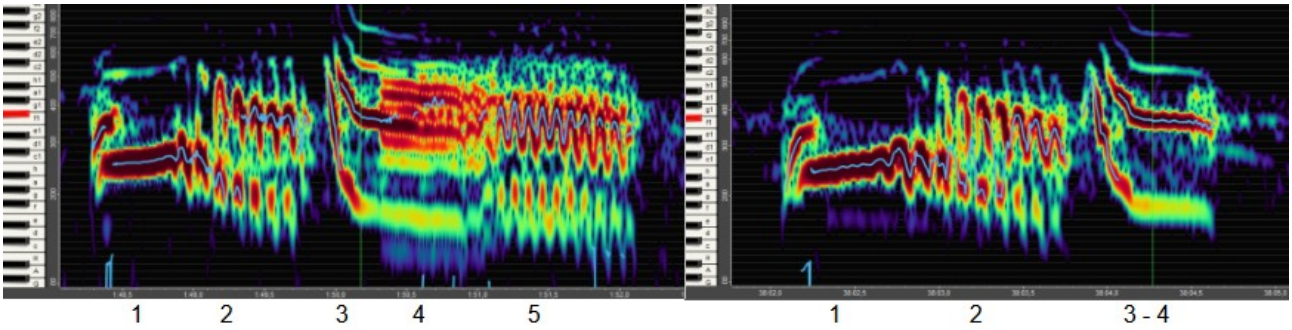


In the 2nd and 3rd versions of M5a, the bird apparently tries a new beginning again, but ends the 3rd version with the glissando into the tenuto sound.

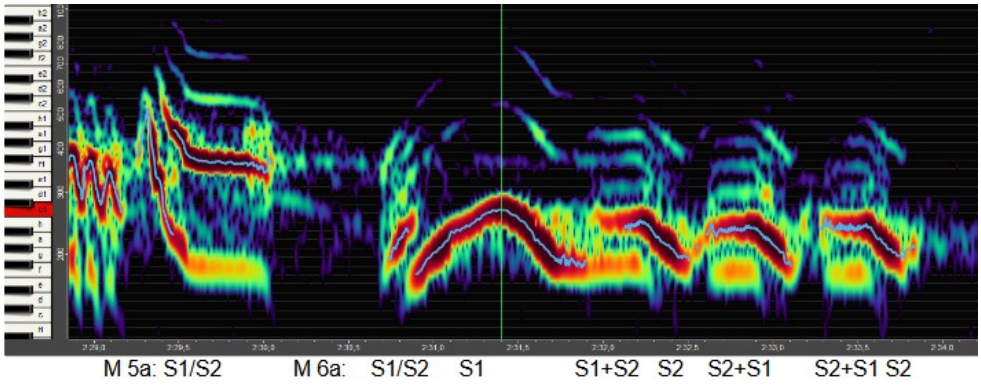


In the 4th version the diffuse spectral sound appears again briefly and in the last version the bird leaves it at the simple version of M5 with 4 sound figures.

For comparison, the 3rd complex version of M5 and the 5th version of M5a:



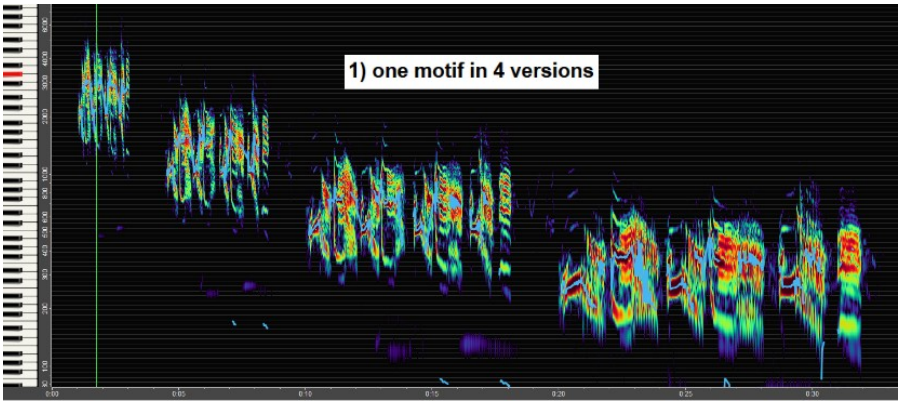
Interestingly, the following motif, which is repeated three times, again contains a special kind of coordinated sounding together of syrinx 1 and syrinx 2. Then there is a longer pause before he continues with isolated noisy signal sounds. It seems to me that the bird first needs to recover briefly after this demanding compositional and coordinating performance.

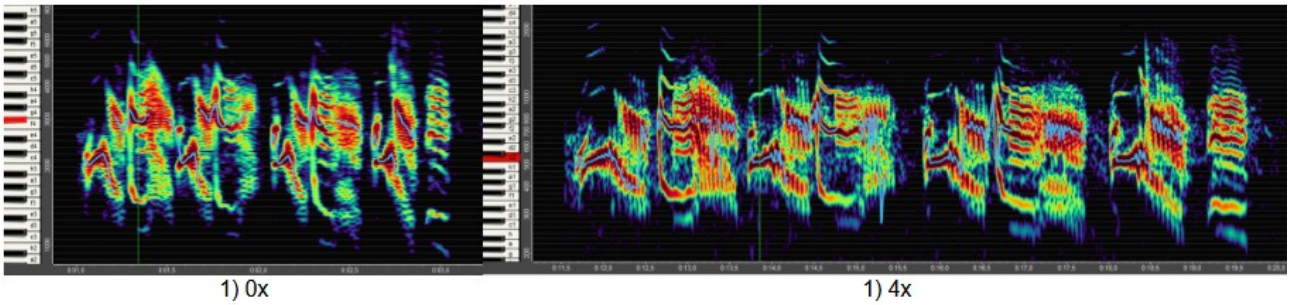


Mockingbird song (2.1) - From the sound of chirping to the pure sound of singing

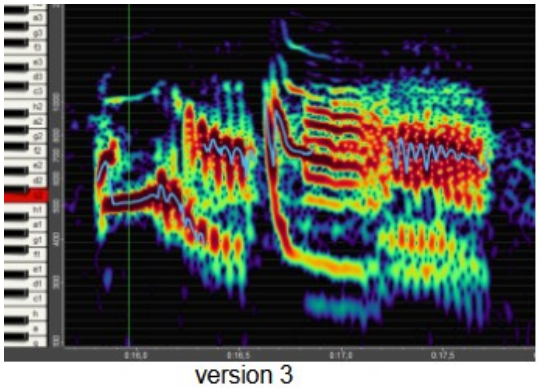
single motifs and motif sequences 0-2-4-8-16x slowed down
and at the end again in the original register and tempo

1) one motif in 4 versions

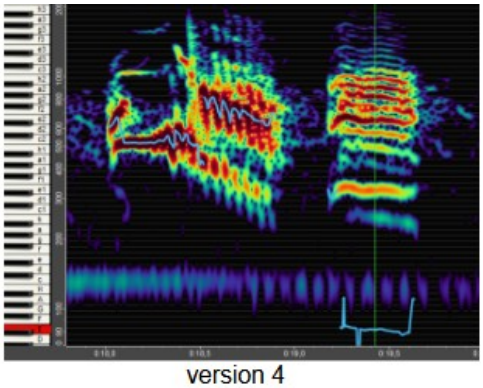




1) 0x 1) 4x

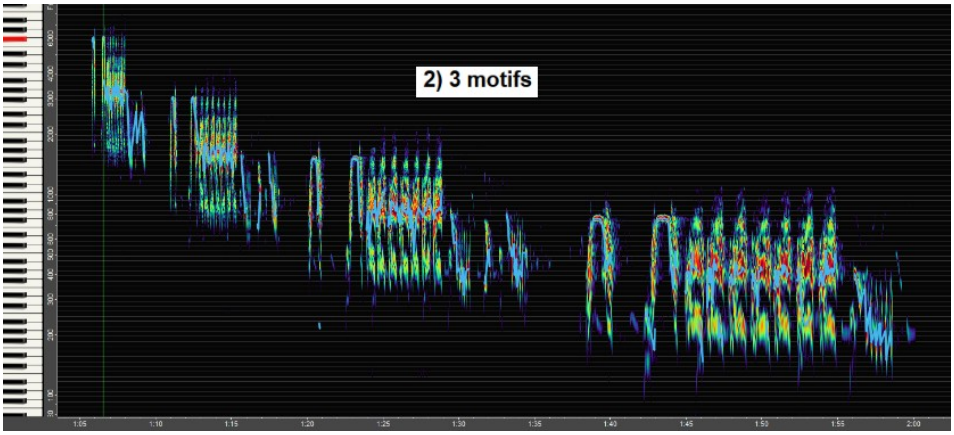


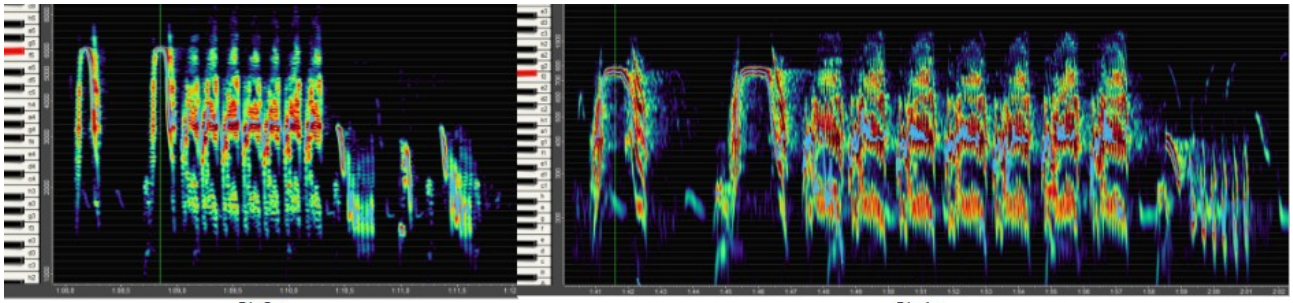
version 3



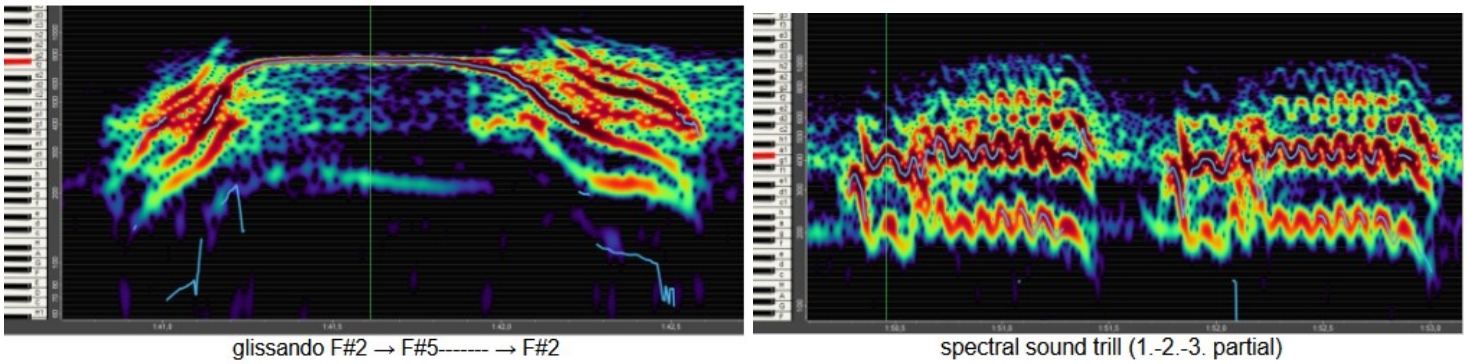
version 4

2) 3 motifs

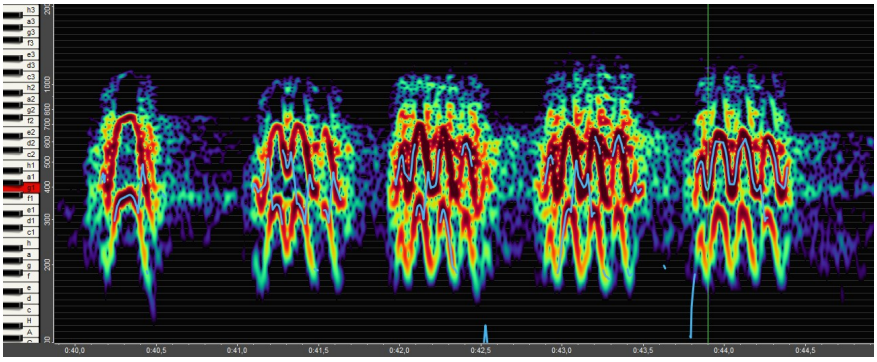




2) 0x 2) 4x

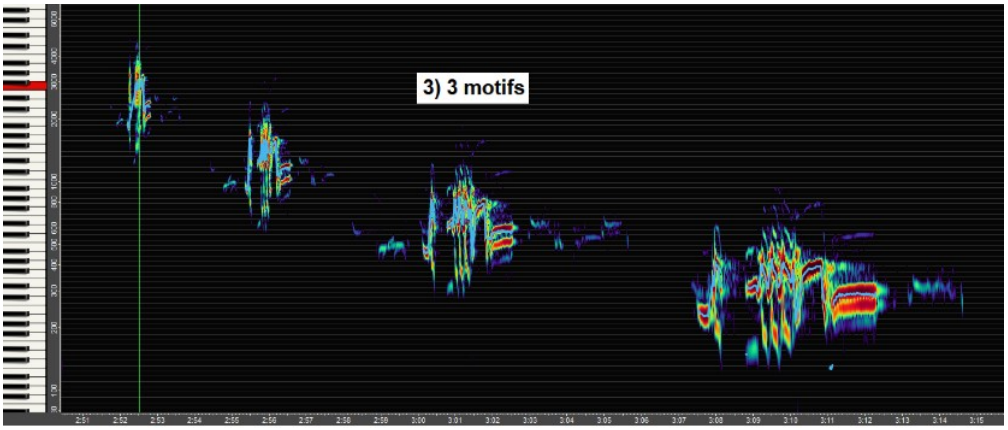


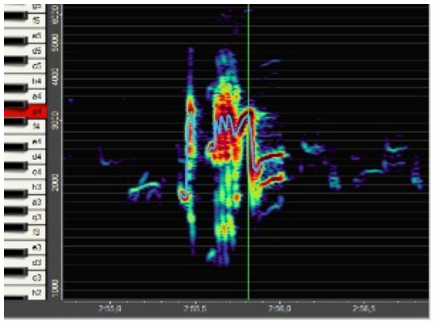
glissando F#2 → F#5------- → F#2 spectral sound trill (1.-2.-3. partial)



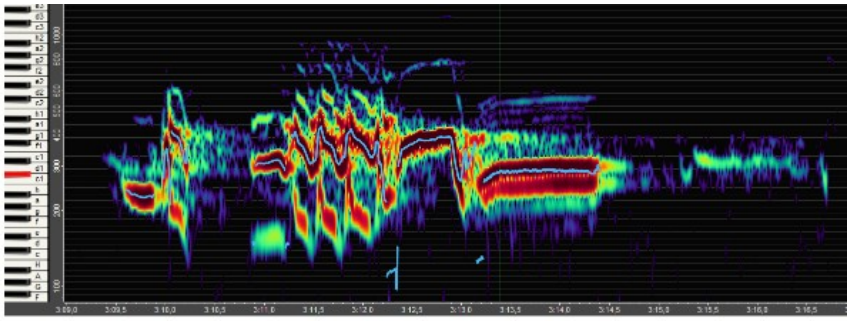
S1/S2 in octaves: F3-Bb3- G3-Eb4- G3-Eb4- F3-Eb4-Gb3 (last version)

3) 3 motifs

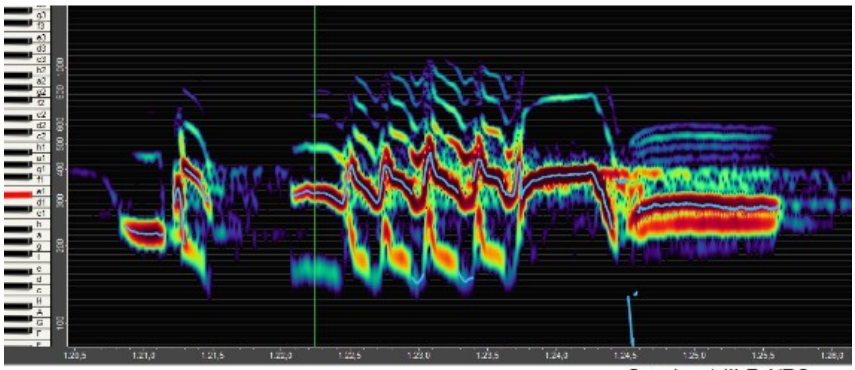




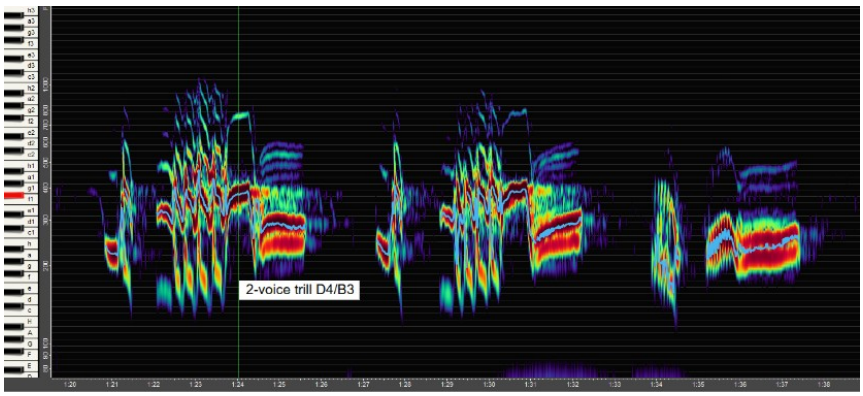
3) 0x



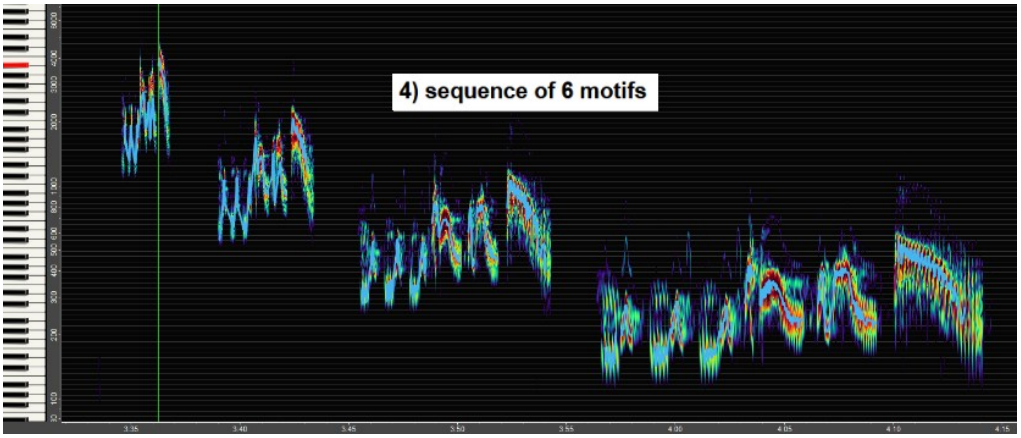
3) 4x

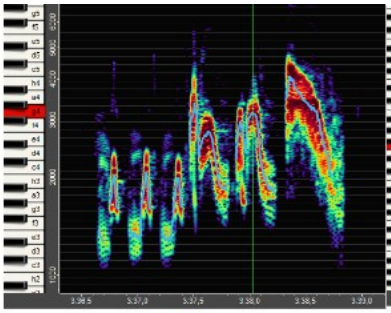


2-voice trill D4/B3

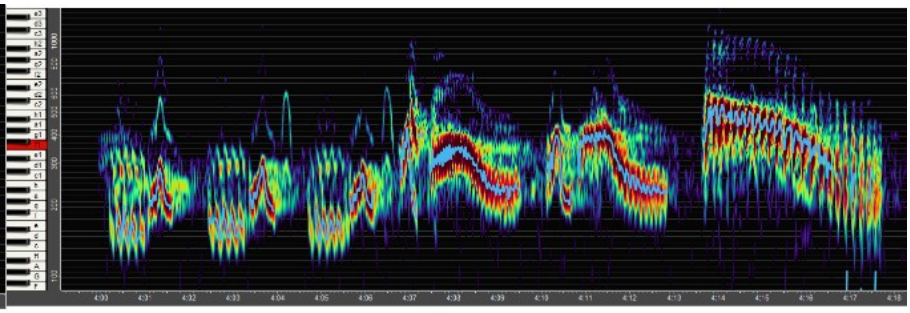


4) sequence of 6 motifs

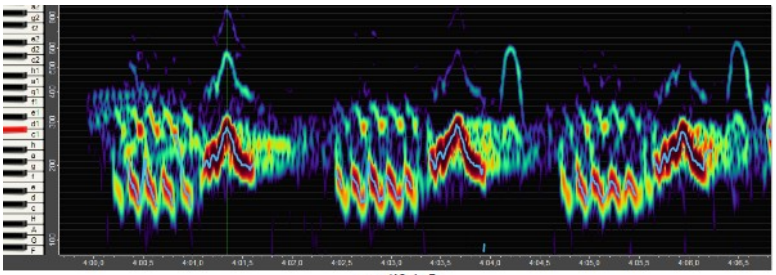




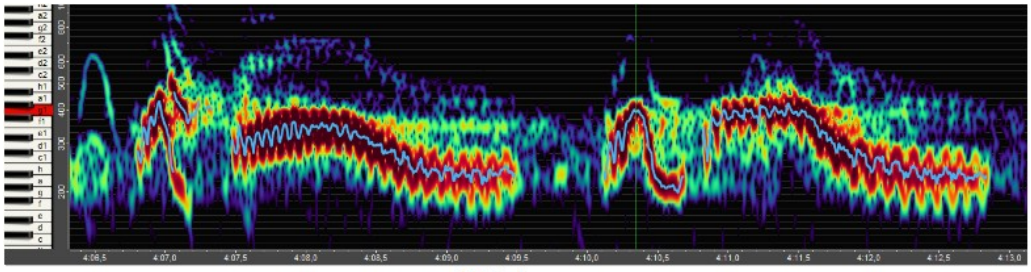
4) 0x



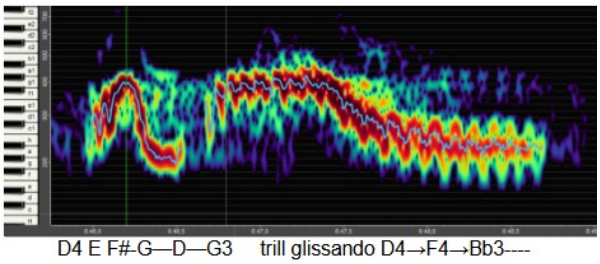
4) 4x



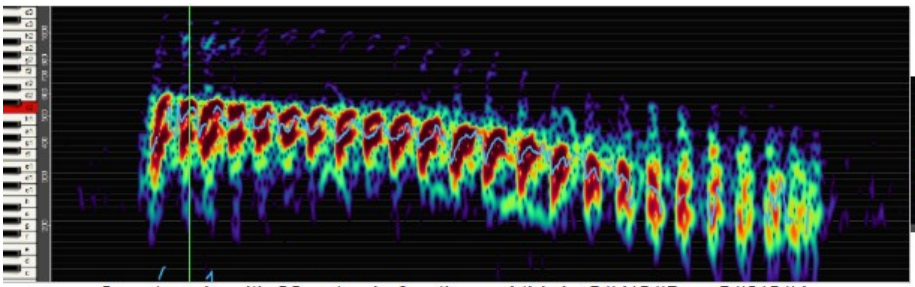
motif 1-2

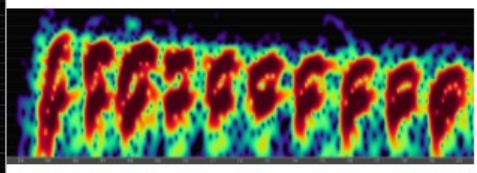


motif 3 / 4

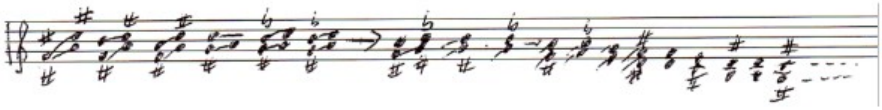


D4 E F#-G—D—G3 trill glissando D4→F4→Bb3----





2-part scale with 22 notes in fourths and thirds G#4/C#5 → G#3/C#4



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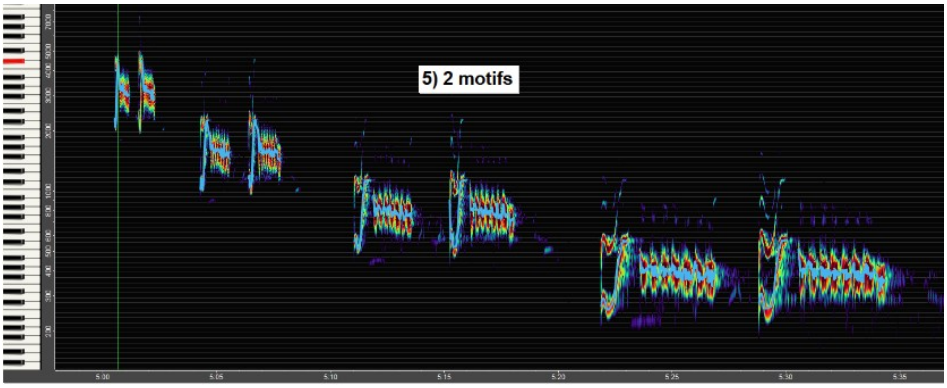
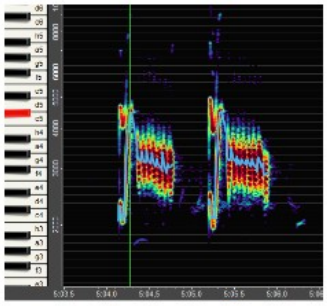
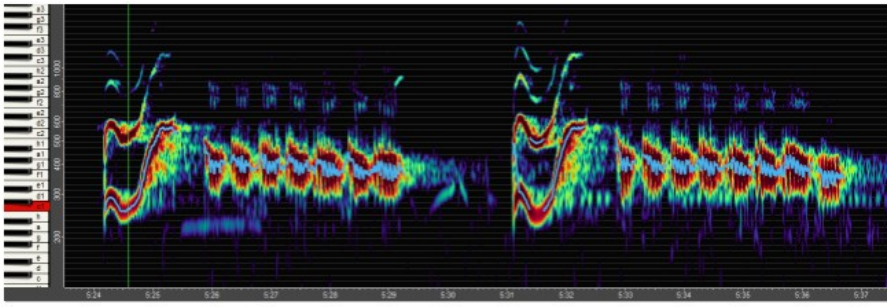
5) 2 motifs

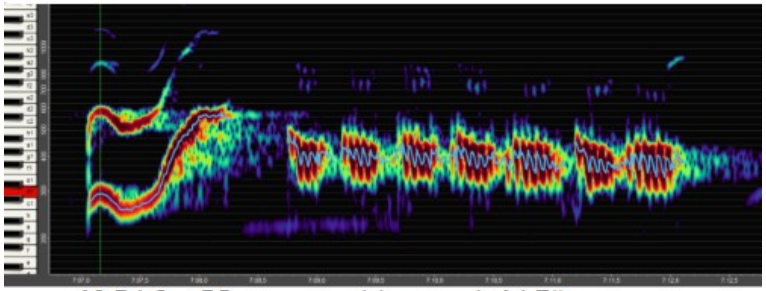




5) 0x

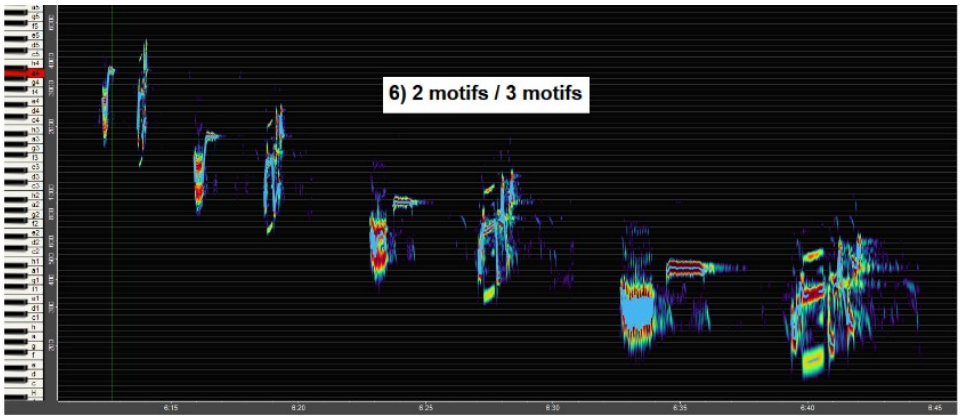


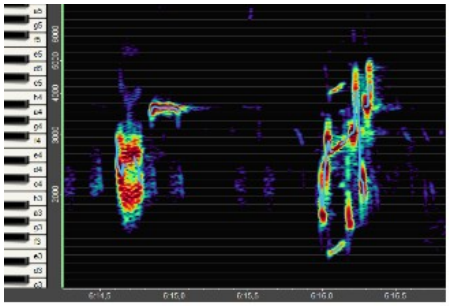
5) 4x



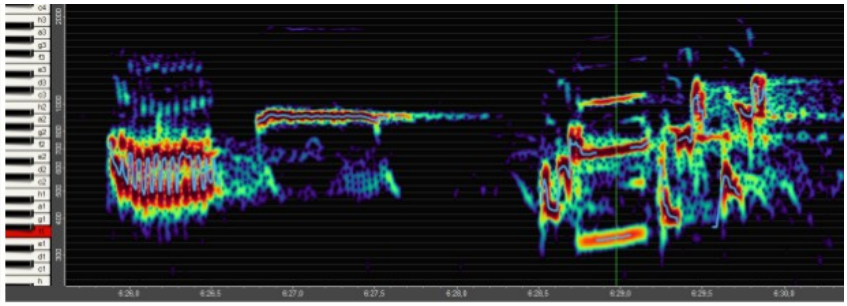
A3-D4-C----D5 pulsing sounds A4-F#

6) 2 motifs / 3 motifs

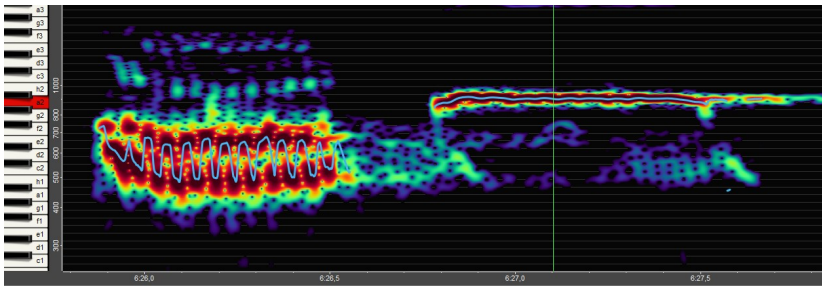


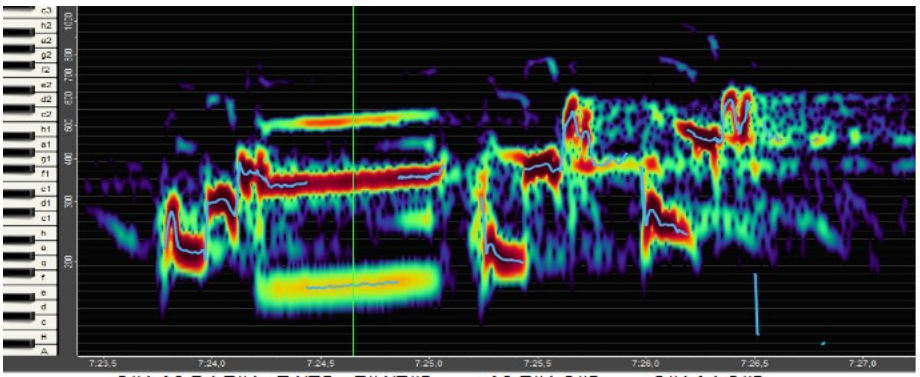


6) 0x



6) 4x





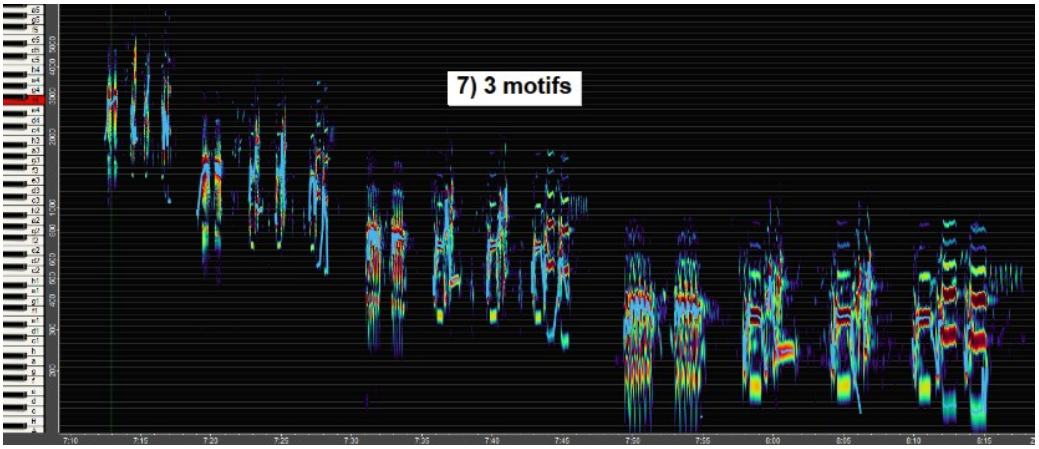
C#4-A3 D4 F#4 "D-major"

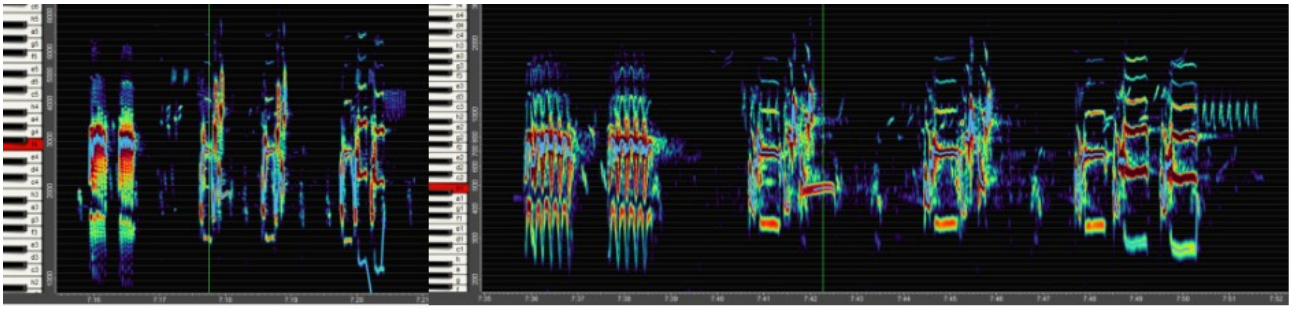
E4/E5→F#4/F#5 S1/S2

A3 F#4 C#5 "F# minor"

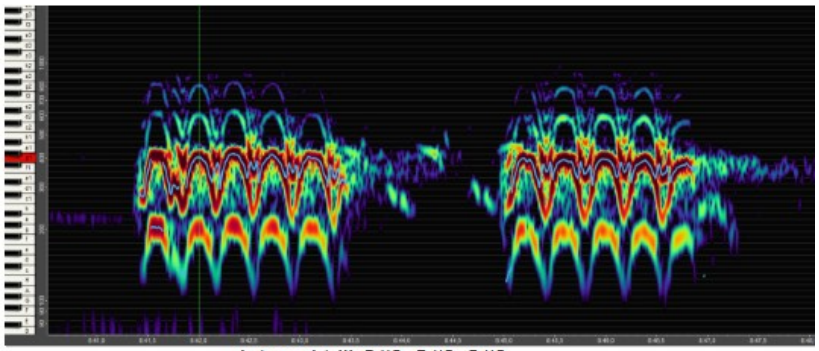
C#4 A4 C#5

7) 3 motifs

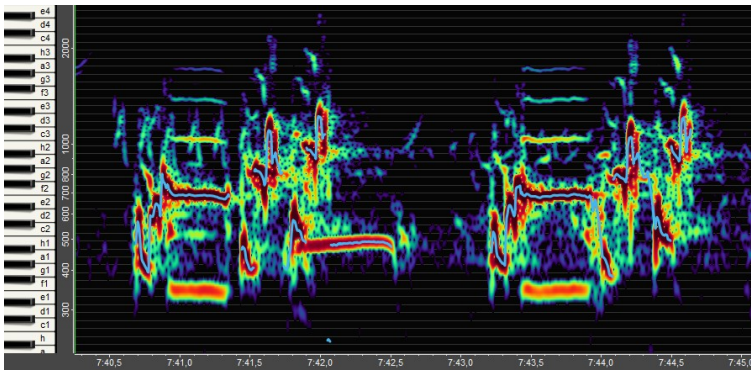


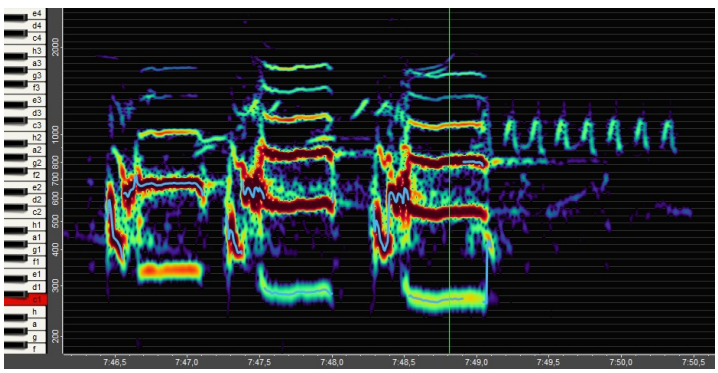


7) 0x 7) 4x

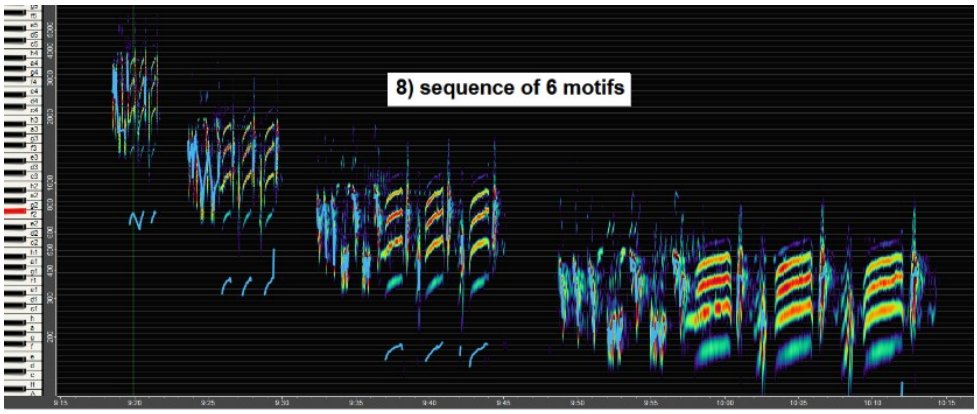


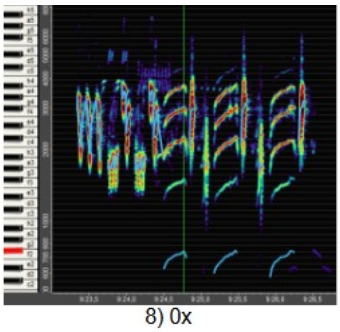
interval trill C#3-G#3-C#3

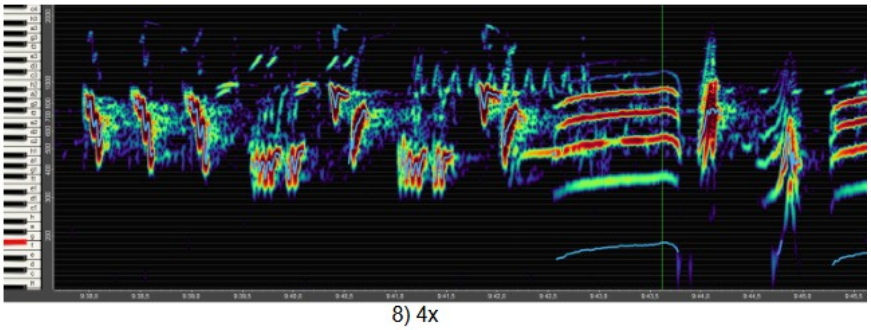


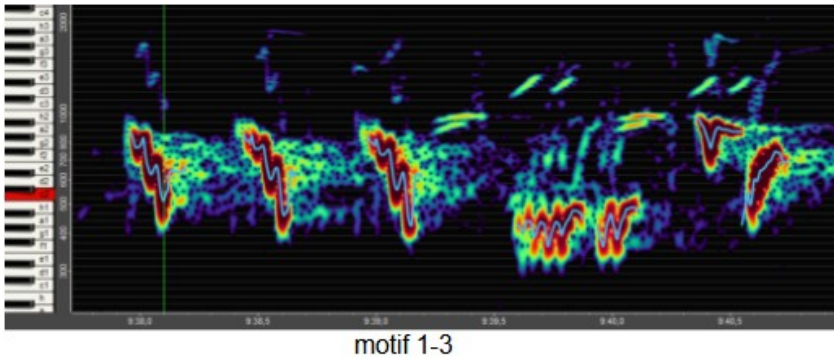


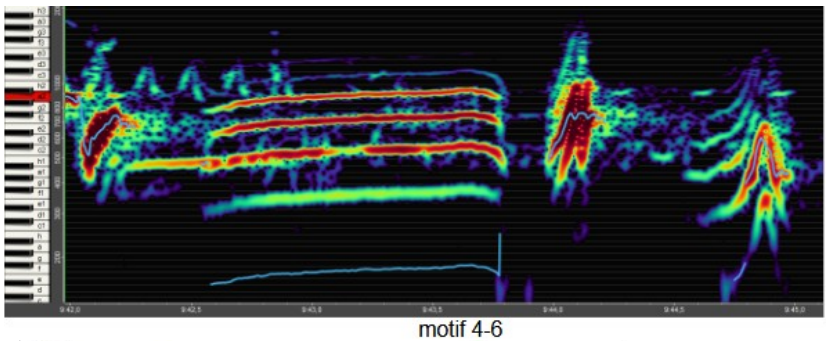
8) sequence of 6 motifs

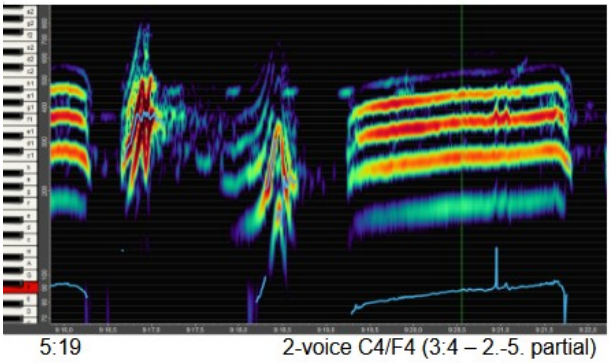



8) 0x


8) 4x


motif 1-3


motif 4-6


5:19 2-voice C4/F4 (3:4 – 2.-5. partial)