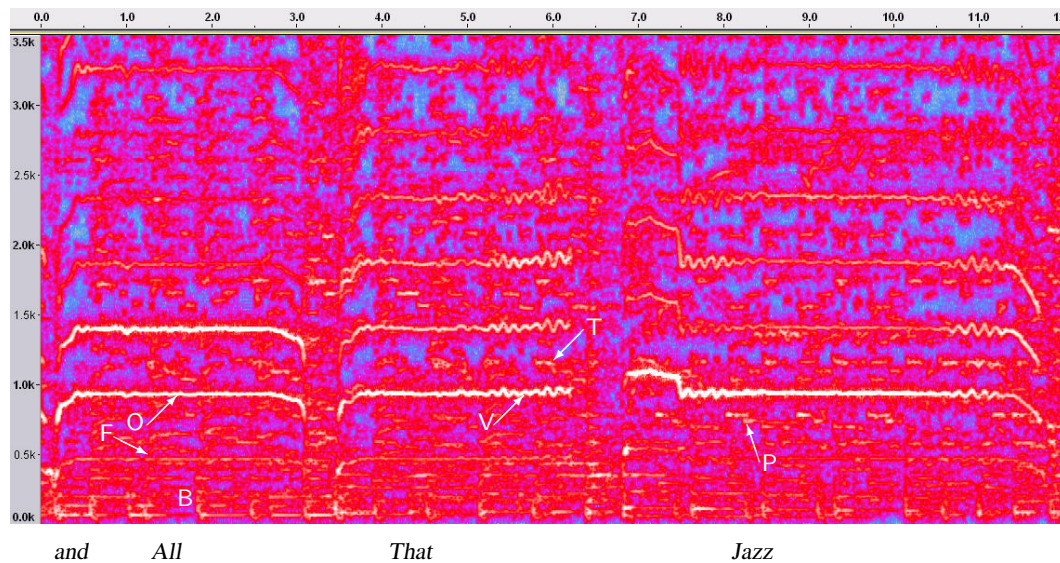
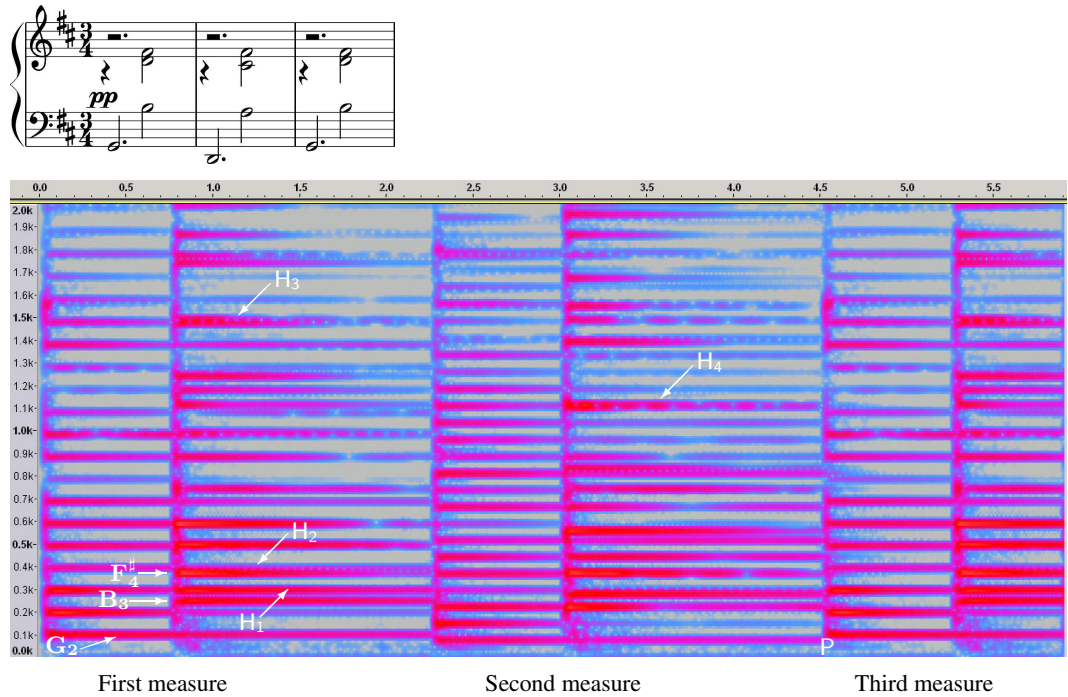


Color Figure 1. Top: Score of first three measures of Beethoven's *Moonlight Sonata*. Bottom: Spectrogram of a recording of these first three measures. Bottom two arrows point to fundamentals for C_2^\sharp and C_3^\sharp . Triple arrow points to fundamentals for G_3^\sharp , C_4^\sharp and E_4 . Top arrow, pointing straight down, indicates beating between 2nd harmonic of E_4 and 5th harmonic of C_3^\sharp . Magnified view shown at top right. Arrow in second measure also points to beating between harmonics. (In color spectrograms: yellow-white is loudest, red is medium loud, purple is faint, blue is barely audible or inaudible. Within those color ranges, brighter is always louder.)

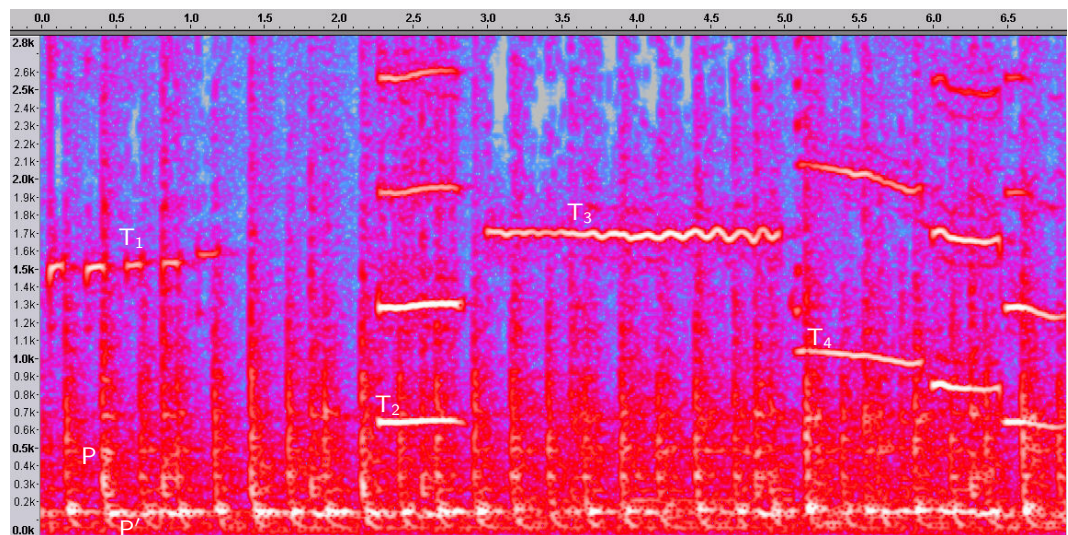


Color Figure 2. Spectrogram from *And All That Jazz*. Arrow O points to 2nd harmonic of singer's note. Arrow F points to its fundamental, which is much fainter and corresponds to a B_4^b note. Letter B marks some bass notes. Arrow V points to vibrato in singer's voice. Arrow T points to trumpet notes. Arrow P points to piano notes.

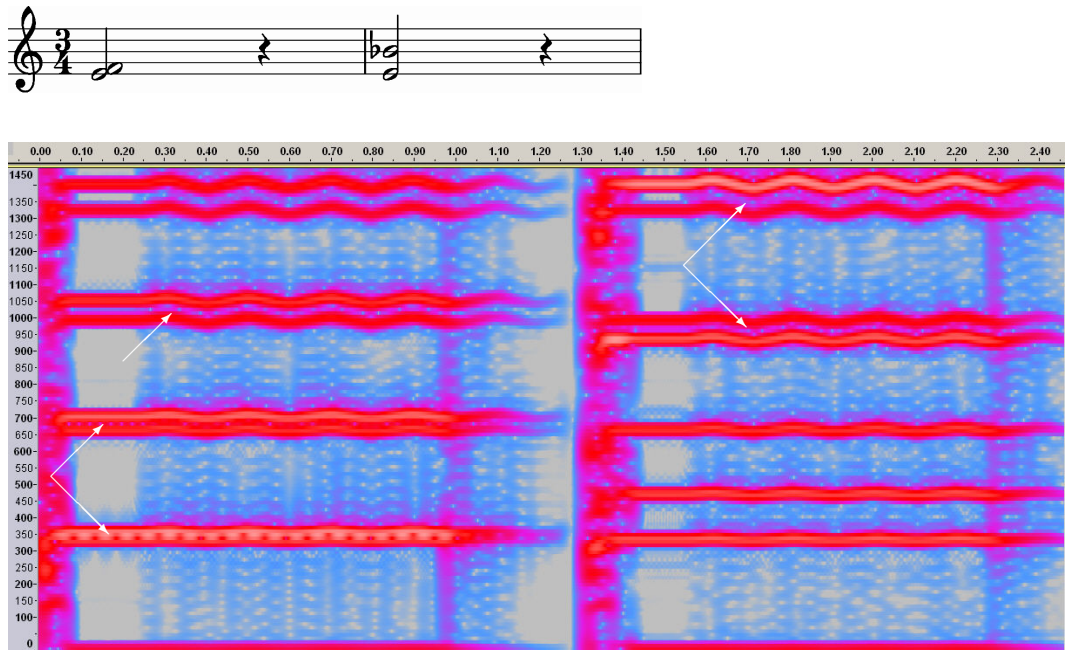
A PDF file for these color figures, [ColorFigures.pdf](#), is available at the book's web site.



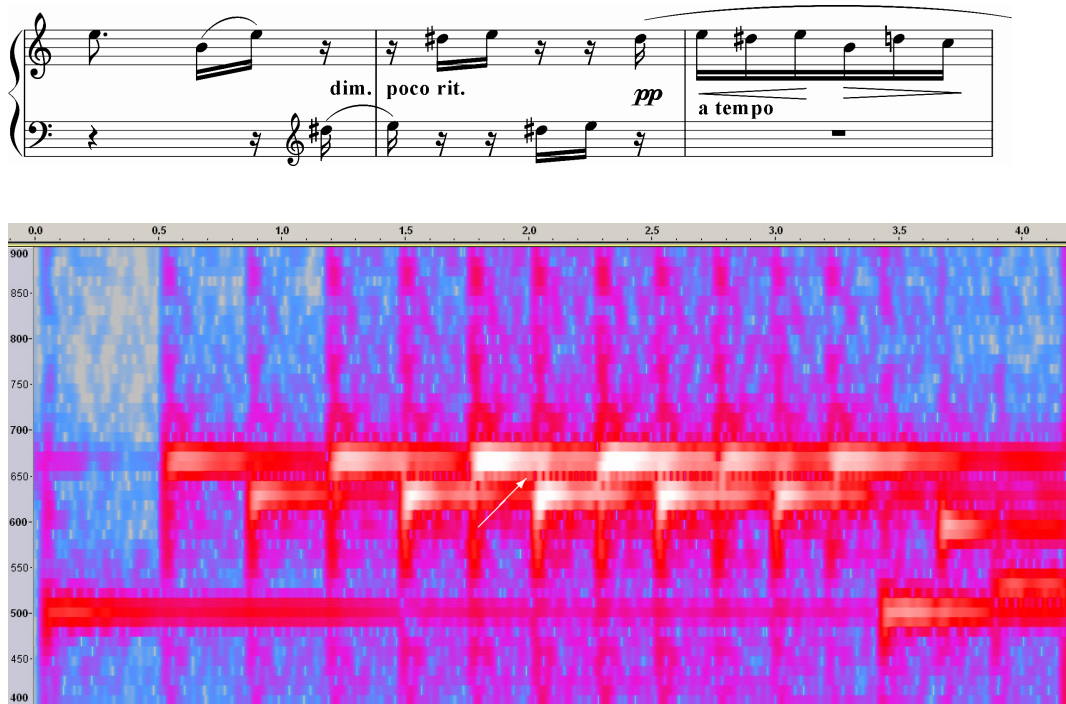
Color Figure 3. Top: Score of first three measures of Satie's *Gymnopédie I*. Bottom: Spectrogram of first three measures of *Gymnopédie I*. Fundamentals indicated with arrows labeled by the corresponding notes, G_2 , B_3 , F_4^\sharp . Arrow H_1 points to a near match of fundamental of D_4 with 3rd harmonic of G_2 . Arrow H_2 points to 4th harmonic of G_2 , not quite matching with fundamental of F_4^\sharp lying just below it. Arrow H_3 points to approximate matching of overtones of G_2 , B_3 , D_4 , and F_4^\sharp . Arrow H_4 points to another near match. Percussive striking of notes appear as vertical bands; one lies directly above letter P at time 4.5 seconds.



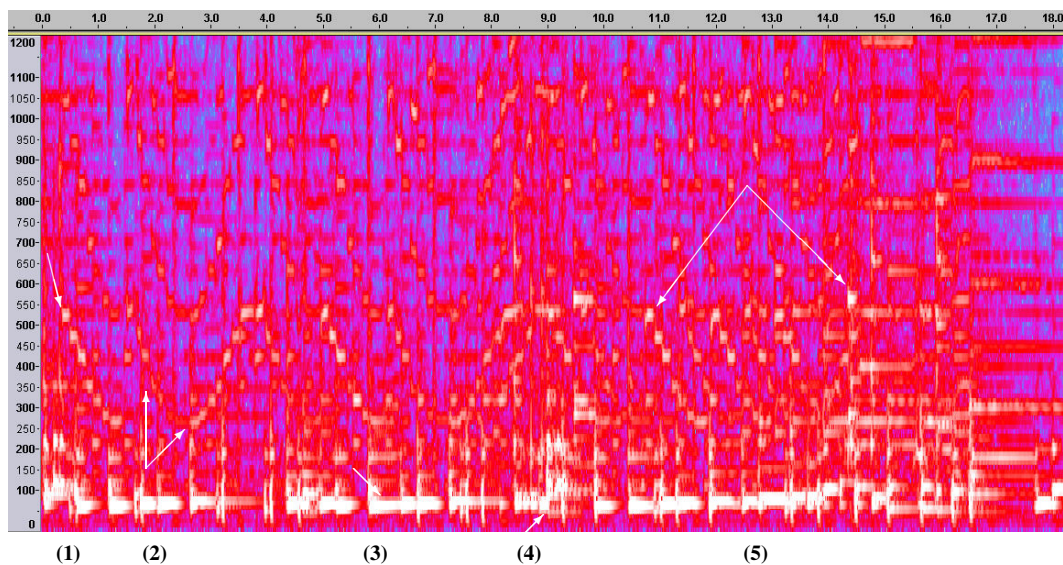
Color Figure 4. Spectrogram from a recording of *Sing, Sing, Sing* by the Benny Goodman Orchestra. P lies between two drum strikes. P' lies below a bass harmonic from a drum strike. T_1 lies near five brief clarinet notes, with pitch bending on the first two. T_2 lies above a mostly straight clarinet fundamental. T_3 lies above a clarinet fundamental with increasing vibrato. T_4 lies above a clarinet fundamental with descending pitch.



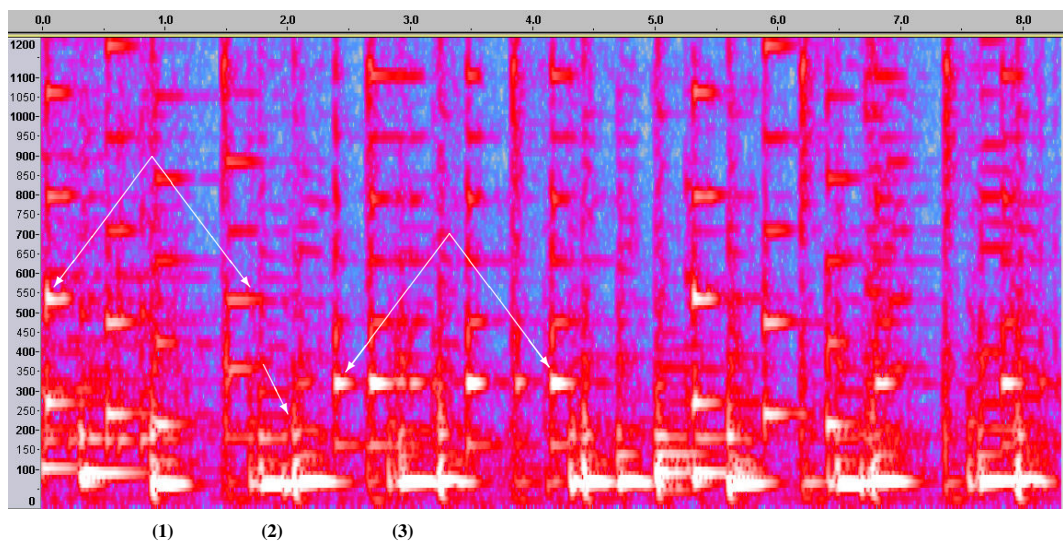
Color Figure 5. Dissonant harmonic intervals. Top: Score for minor second and tritone. Bottom: Spectrogram of these notes played on a violin. Arrows point to beating interference between harmonics.



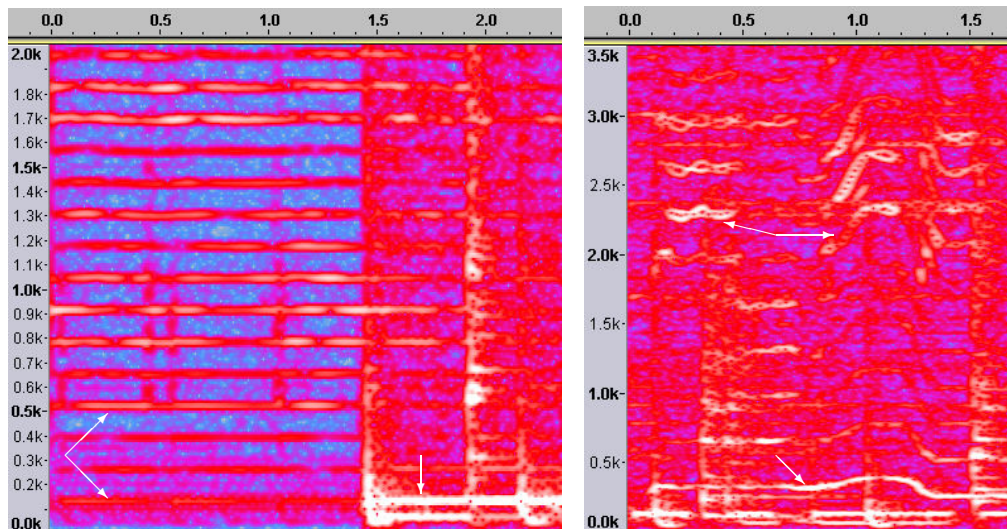
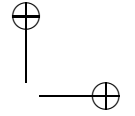
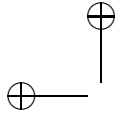
Color Figure 6. Passage from Beethoven's *Für Elise*, *WoO 59*. Top: Score shows repeated D $_5^{\sharp}$ and E $_5$ notes. Bottom: Arrow points to beating between fundamentals for these notes.



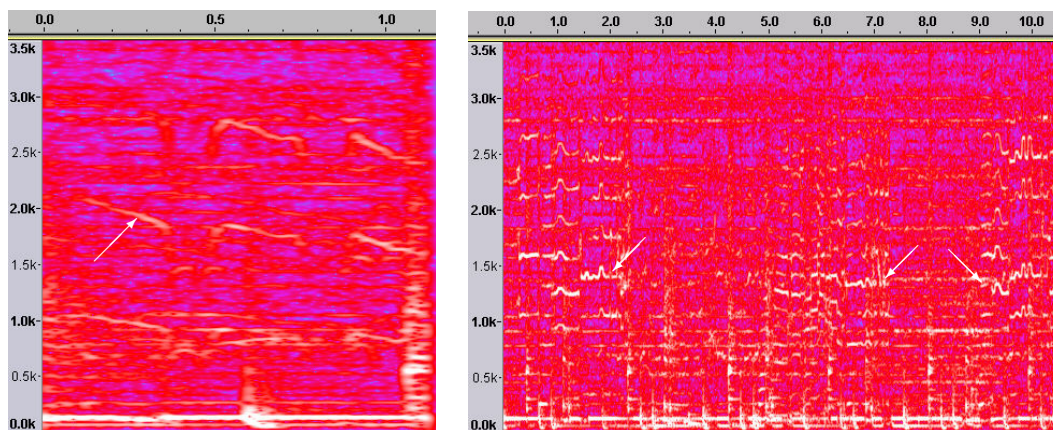
Color Figure 7. Spectrogram of portion of *Strasbourg/St. Denis*. Arrows above (1) through (5): (1) descending saxophone tones; (2) descending trumpet tones followed by ascending saxophone tones; (3) fundamental of bass note; (4) brief burst of drumming; (5) between two arrows, a call and response between saxophone and trumpet.



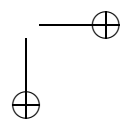
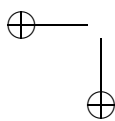
Color Figure 8. Spectrogram of portion of *Strasbourg/St. Denis*. Arrows above (1) through (3): (1) between two arrows, piano notes played on keyboard; (2) plucked bass notes; (3) between two arrowheads, piano notes played by plucking the piano strings.

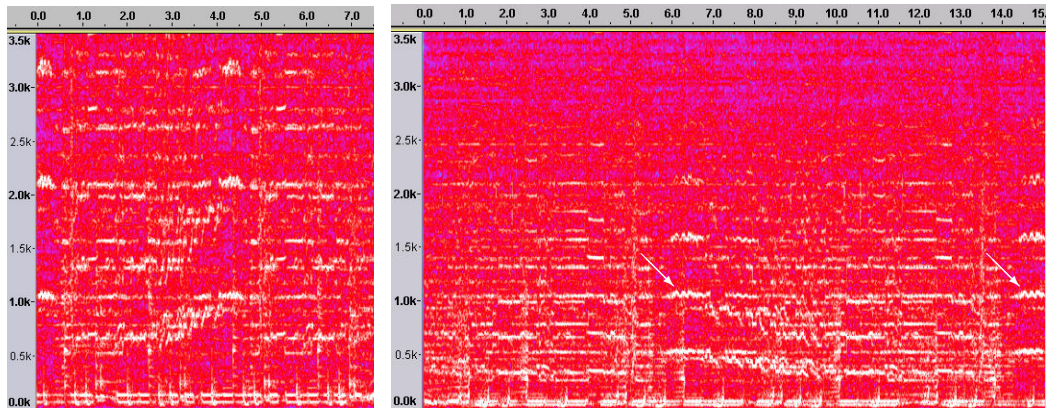


Color Figure 9. Spectrograms from the Beatles' song, *Tomorrow Never Knows*. Left: Introductory passage. Double arrow points to 1st and 4th harmonics for a drone of note C_3 . Single arrow points to harmonic from drum strike matching with the drone's fundamental. Right: Clip showing vocal track. Lower arrow points to fundamental tone for vocals. Double arrow points to 7th and 6th harmonics, showing beating and fading.

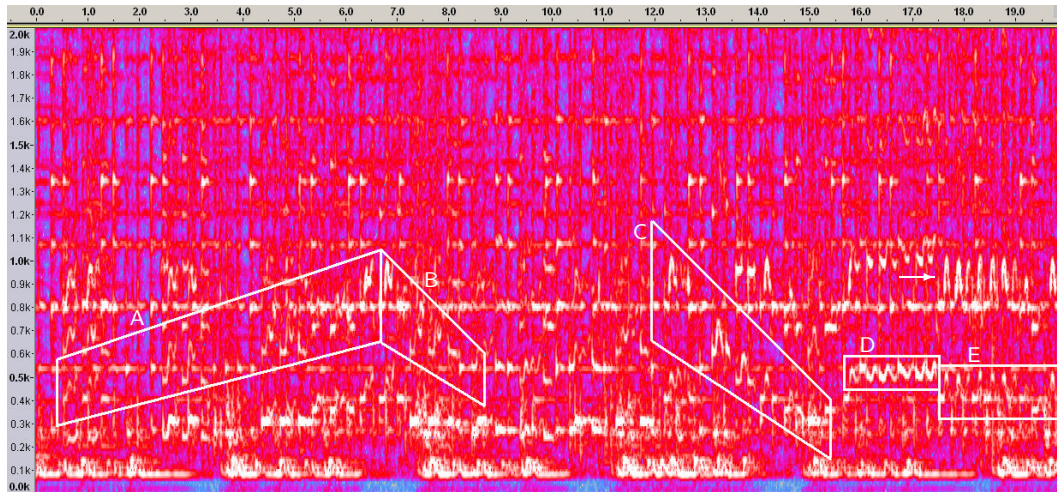


Color Figure 10. Spectrograms from the Beatles' song, *Tomorrow Never Knows*. Left: Three rapid tones resembling bird calls. The arrow points to 2nd harmonic of first of these tones. When the recording is slowed to half speed, these tones sound like someone laughing: "Ha, Ha, Ha." Right: Time-reversed guitar solo. Three arrows point to harmonics from these time-reversed tones.

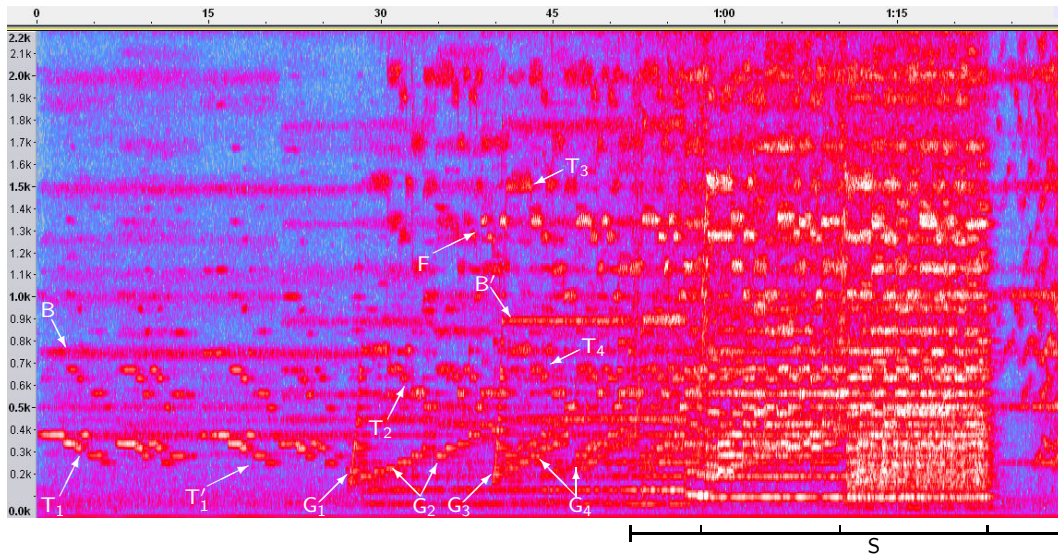




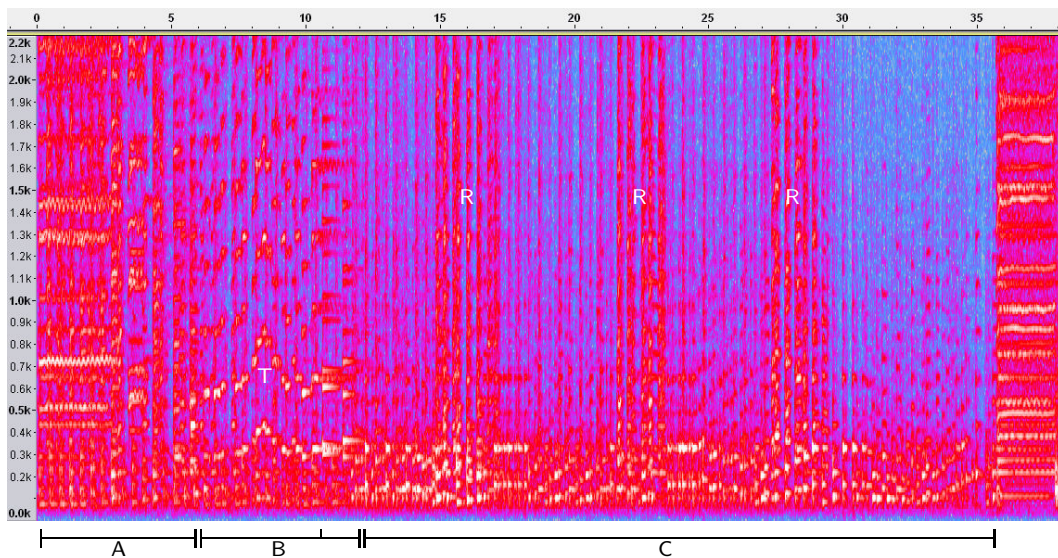
Color Figure 11. Multiple tape looping in the Beatles' song, *Tomorrow Never Knows*. Left: Spectrogram of clip from original recording. Right: Spectrogram of clip after time-reversal and slowing down to half speed. Two arrows point to vibrato in string instrument tones.



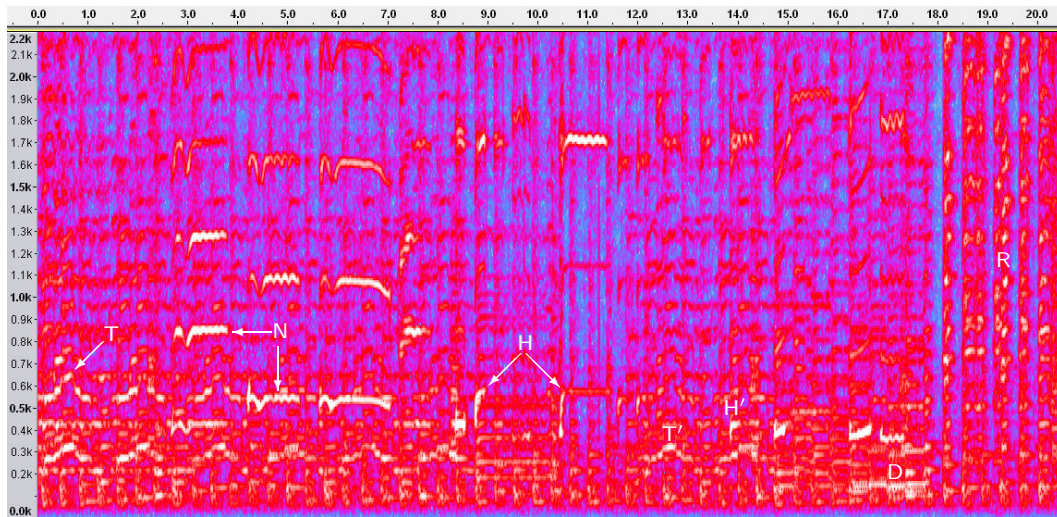
Color Figure 12. Spectrogram from Ravi Shankar composition, *Megh*. Quadrilaterals A through E contain harmonics for sequenced sitar tones: (A) ascending sequencing of a motif; (B) descending sequencing; (C) another descending sequencing; (D) rapid sequencing producing a vibrato-like sonority; (E) more vibrato-like sequencing, transposed down in pitch from D, but with greater frequency spread. Arrow at 17.0 sec, 900 Hz, points to bright 2nd harmonics for vibratoed sequencing of sitar tones with fundamentals shown in E. Ostinato of tabla drum strikes indicated by repetitive percussive and tonal structures (five and half in all), whose fundamentals lie at bottom of spectrogram, between about 80 to 180 Hz.



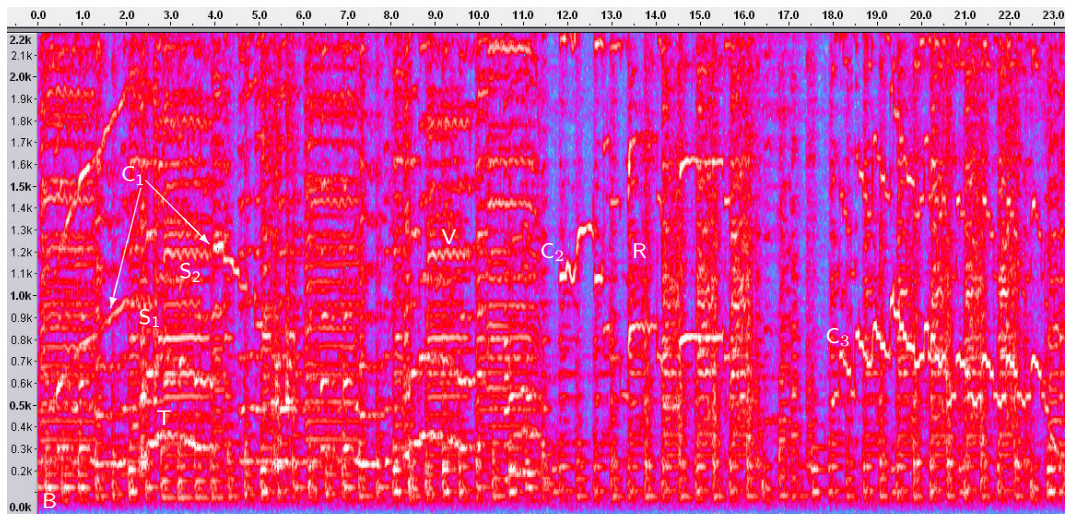
Color Figure 13. Spectrogram from finale of *Firebird Suite*. T₁: horn motif, main theme. B: constant pitch string background. T₁': variation of horn motif. G₁: fast string glissando. T₂: strings playing transposition upwards of main theme. G₂: two slow string glissandos. F: bird-like flute motif. G₃: fast string glissando. B': constant pitch string background. T₃: flutes playing transposition upwards of main theme. T₄: strings repeating transposition of main theme. G₄: overlaid slow string glissandos. S: consecutive strata, containing multiple glissando overlays and repetitions of main theme by flutes and strings, strata boundaries marked by fast string glissandos, final stratum contains “swirling” string motif.



Color Figure 14. Spectrogram of finale of *Jack the Bear*. A: bass note fundamentals at about 73 Hz, saxophone fundamentals at about 725 Hz with significant vibrato, brass fundamentals at about 440 Hz and 523 Hz with less vibrato. B: first part contains main theme, indicated by saxophone 2nd harmonics labeled T. Second part contains piano notes forming accented completion of saxophone theme. C: extended melodic section of bass notes, punctuated by three rhythmic bursts of orchestra in vertically striped regions labeled R. After C, finale ends with a combination of orchestral notes of varying vibrato.



Color Figure 15. Passage from Duke Ellington’s *Jack the Bear*. Arrow T points to 2nd harmonics of main theme, played by saxophone section. Fundamentals of this theme repeat six times from 0 to 8.5 sec. Second harmonics of trombone notes are indicated by arrow pointing from left of N. An arrow points down from N to fundamentals of these trombone notes. Arrows from H point to two fundamentals of horn tones, with very rapid attacks and differing amounts of energy in their harmonics (the 3rd harmonic is very bright for second horn tone, creating a ringing timbre). T’ marks repetition of main theme by saxophone section. H’ marks fundamentals for more horn tones. D marks low pitch saxophone notes with beating effects (a growling “low down” sound). R marks rhythmic ostinato provided by rapid playing of orchestra.



Color Figure 16. Another passage from Duke Ellington’s *Jack the Bear*. Label B at lower left corner indicates bass note fundamentals. Arrows from C₁ point to clarinet solo. First arrow points to upward pitch excursion, which cuts off abruptly and is followed by vibratoed saxophone note indicated by S₁. Immediately following S₁, there is a higher pitch fundamental for saxophone note indicated by S₂, cutting off abruptly with entry of clarinet (pointed to by right arrow from C₁). Below this sequence of clarinet, saxophone, clarinet, there is theme T played by saxophone section. Label V marks third harmonic of vibratoed saxophone note. Clarinet begins again with high bent pitches marked by C₂. Label R marks vertical bands for the rhythmic playing of orchestra. C₃ marks rapid succession of clarinet descensions, punctuated by rhythmic orchestral tones.