Harmony and tonality
The vertical dimension

HST 725 Lecture 11
Music Perception & Cognition

(Image removed due to copyright considerations.)
Upcoming topics

Thursday, March 18 (Cariani)
Term project topic presentation & discussion (Stephan)
Melody
Reading: Handel (Chapter 10); Deutsch (Pitch sequences)
Hand out problem set (due April 8th)

Tuesday, March 30 (Cariani)
Presentation on automated music recognitions (Tristan)
  Rhythm I: Rhythm perception and production
Reading: Handel (Chapter 11); Deutsch (Clarke chapter)
Also begin looking at Snyder, Music & Memory
Upcoming topics II

Thursday, April 1 (Cariani)

Grouping and expectation
- Time perception, event structure, and temporal expectations
- Auditory spectral and temporal integration; chunking of segments
- Auditory scene analysis and organization of voices
- Grouping of sounds – onset, harmonicity, rhythm
- Sound streams (Bregman, Deutsch), polyphony
- Grouping processes and musical structure
- Reading: Snyder, Music & Memory; Handel, Ch. 7 Stream Segreg

Tuesday, April 6 (Cariani)

Music, speech and language: parallels and contrasts
- Presentation on tonal languages and music (Stephan)
- Reading: Bigand chapter in Thinking in Sound
Upcoming topics III

Thursday, April 8 (Cariani)
Emotion and meaning in music
Musical semantics, music and pleasure
Music and long-term memory
Musical style recognition (Victor)
Problem set due

Tuesday, April 13 (K. Howland, music therapist)
"Clinical applications of the neuropsychology of music." Guest speaker Kathleen M. Howland Ph.D., MT-BC, CCC-SLP.

Thursday, April 15 (Oxenham)
Clinical issues. Music exposure and hearing loss.
Music perception: hearing impaired listeners & cochlear implant users
Upcoming topics III

Thursday, April 22 (Tramo)
Effects of cortical lesions on music perception & cognition
Music and cortical function: Janata paper (Victor)
Auditory agnosia: Peretz paper (Stephan)
Music therapy: clinical problems and prospects

Tuesday, April 27 (Cariani)
Developmental psychology of music

Thursday, April 29 (Cariani)
A question of origins: comparative & evolutionary psychology of music
Reading: McDermott & Hauser; other readings TBA
Upcoming topics III

Tuesday, May 4 (Cariani)

Thursday, May 6
Special topics: absolute pitch, synesthesia, etc.
Synthesis: What would a unified theory of music perception & cognition look like?

Tuesday, May 11
Student Term Project Presentations

Thursday, May 13 (Cariani)
Overview and recap of major themes;

Monday, May 17  All term projects due, noon.
Tonality and harmony

- Harmony: concurrent sounds, vertical dim.
- Tonality: relating to a tonic (pitch)
- Keys formed by different tonics & scales
- Piston: tonality: note; modality: scale
- Triads, inversions, and degrees
- Krumhansl's probe-tone studies
  - Structure of note-note & note-key similarities
  - Is it just note frequency? Common harmonics?
  - Pitch memory & establishment of tonal centers
- Chord progressions, harmonic distances
- Key modulations, harmonic movements
- Tension-relaxation dynamics & pitch stability
C-Major diatonic scale
Modes

Ionian mode

Dorian

Phrygian

Lydian

Mixolydian

Aeolian
Ascending and descending scale intervals
(different notes for different directions
"melodic context"
E.g. melodic minor scale)

EX. 2

major scale

harmonic minor scale

melodic minor scale
Dyads: interactions between pairs of tones
Tonal system schematic (Bigand)

see also
http://www.musictheory.net
for introduction to keys

Please see Figure 8.1 in McAdams, and Bigand. *Thinking in Sound: The Cognitive Psychology of Human Audition*. Oxford University Press. 1993.
Triads, inversions, and degrees

Major: root-major third-fifth
Minor: root-minor third-fifth

Establishment of the tonic (tonal system, tonality)

• First note (most salient)
• Last note (most salient in memory)
• Most frequent or longest duration note
• Note pattern may imply a tonic
• Perception of tonic may be influenced by melodic and harmonic context
• Key-finding algorithms have been developed, but these can make errors (i.e. no strict rules apply)
• What does the existence of the tonic imply about pitch memory? about melodic order?
Triads, inversions, and degrees
Major: root-major third-fifth
Minor: root-minor third-fifth

Probe tone profiles for related keys

Please see Figure 2.5 in Krumhansl, Carol L. *Cognitive Foundations of Musical Pitch*. New York: Oxford University Press, 1990.
Note-key relations

Probe tone studies: how well does a given pitch "fit in" with a previously played chord or scale?

Measure of similarity or compatibility

Please see Figure 2.3 in Krumhansl, Carol L. *Cognitive Foundations of Musical Pitch*. New York: Oxford University Press, 1990.
Ranking: similarity to the tonic
Frequency of notes and pitch similarities

Statistics of pitches in Romanticist music

Debate over the meaning of the probe tone studies

Role of short term & long term memory internalized schemes or tonal grammars?

Please see Figure 3.3 in Krumhansl, Carol L. *Cognitive Foundations of Musical Pitch*. New York: Oxford University Press 1990.
Figure 4. Similarities between population-interval representations associated with different fundamental frequencies. Simulated population-interval distributions for pure tones (left) and complex tones (right) consisting of harmonics 1-6.
Octave similarity

Note-chord relations
(Harms 1-12)

Key-key relations


Perceived harmonic structure of chords in three related musical keys.

Krumhansl C L, Bharucha J J, Kessler E J.
Circle of Fifths

Which diatonic scales share the same notes (common pitches)

Relatedness of chords within a key

Similarity relations between chords in the key of C
Leman & Carreras (1997): 
Self-organizing neural nets 
& key relations

Chord progressions

"cadences": (ending) sequences of chords

tension & relaxation instability-stability


cadenceshttp://www.musictheory.net/load.php?id=55
Tonal hierarchies

Stimulus: dyad of 2 pure tones (440, 660 Hz) separated by a musical fifth (3/2)

Population-interval distribution (Cat ANF data)

A

Exponential windowing (\(\tau = 10\) ms)

B

Interval-sieve

C

Pattern-salience

Low pitch of the dyad \(F_0 = 220\) Hz

Note \(F_0\) 440 Hz

D

Distribution of pitch saliences

Note \(F_0\) 660 Hz
Pitch-stability of major and minor triads: a basis for tension-resolution?