The Composer's Materials

Module 1 of *Music: Under the Hood*

John Hooker
Carnegie Mellon University

Osher Course
September 2018

Outline

- Basic elements of music
- Musical notation
- Harmonic partials
- Intervals and chords
- Keys
- Cadences
- Temperament
- Just tuning

Basic Elements of Music

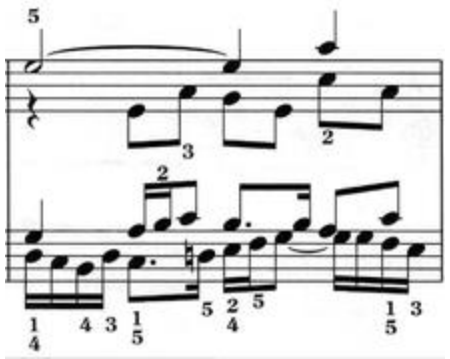
- **Rhythm**
  - Everyone loves music with a “beat”
    - Some composers emphasize rhythm
    - Stravinsky, jazz composers, pop stars
  - Rhythm is ever-present
    - Heartbeat, walking
    - Same tempos reflected in music!
  - Rhythm and dance are universal
    - Dance seems to be genetic in humans

Basic Elements of Music

- **Melody**
  - Based in song
    - Some composers emphasize melody
    - Chopin, Schubert, Broadway composers
  - Song is basic to human expression
    - May be original form of communication
    - Later replaced by language

Western Music

- **Harmony**
  - A fundamental characteristic of music
    - Even a single tone creates harmony (upper partials)
    - Allows us to make sense of tones sounded together
- **Counterpoint**
  - Interaction of different “voices”
    - We can follow the voices if they are in harmony.



Western Music

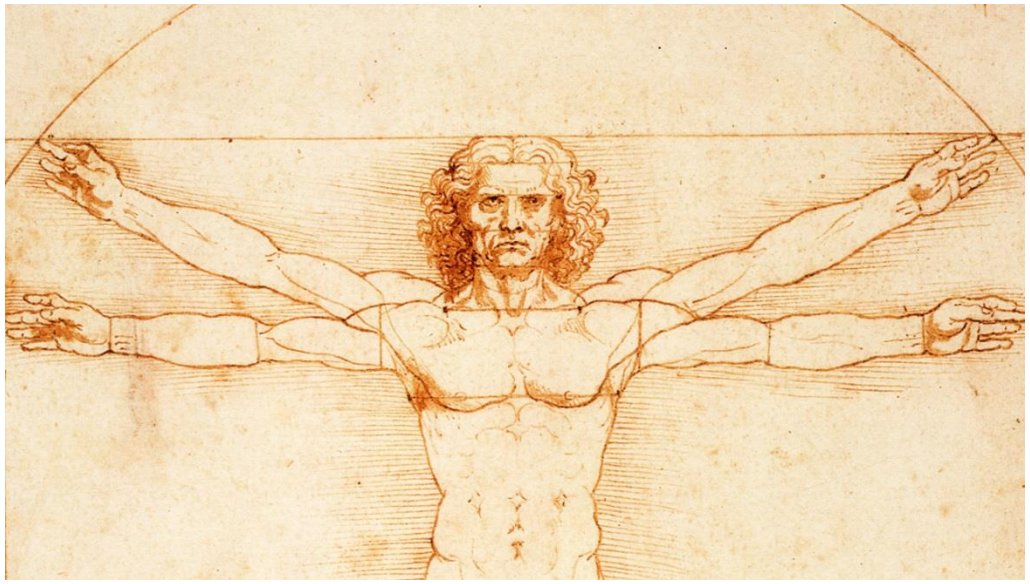
- **Abstraction**
  - Western music is fundamentally abstract
    - More accurately, nonrepresentational.
    - Exceptions: Beethoven's *Pastoral Symphony,* etc.
  - Most **visual** art is representational
    - Exception: Islamic art
    - Even "abstract" art is often representational

Western Music

- **It is complex**
  - The ear is analytic like no other sense
    - Breaks down every sound into its components
    - The eye cannot do this.
    - Western music takes advantage of this.
  - This allows us to understand multiple voices
    - Makes harmony & counterpoint possible.

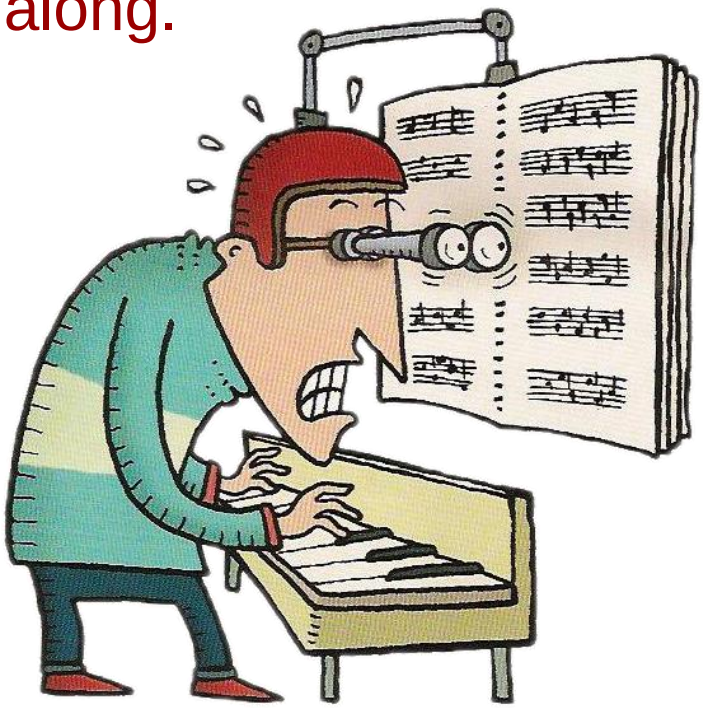
Western Music

- **Basic challenge of Western music**
  - Make abstract music intelligible
    - This course is about how composers do this.
  - Address the full human being
    - Intellectual as well as emotional.



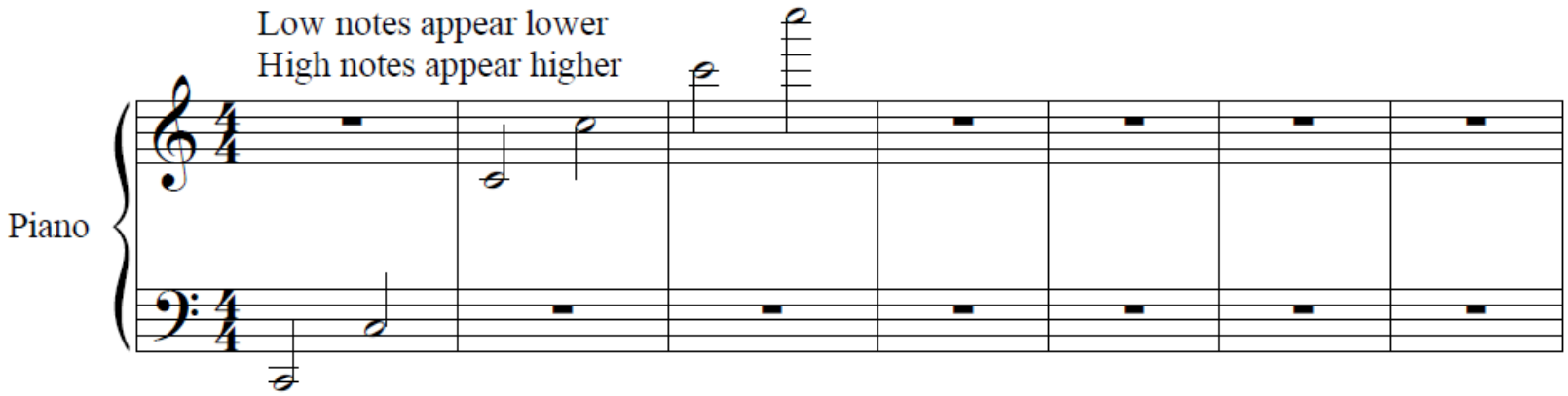
Musical Notation

- One doesn't "read" music as one reads French.
  - It is a **graphic** representation
    - The development of notation made Western music possible.
  - You will catch on as we go along.



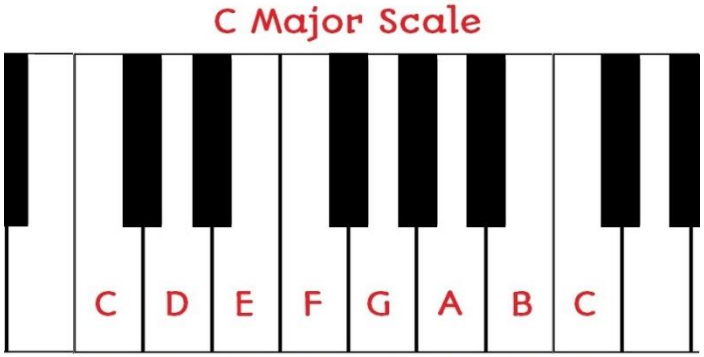
Musical Notation

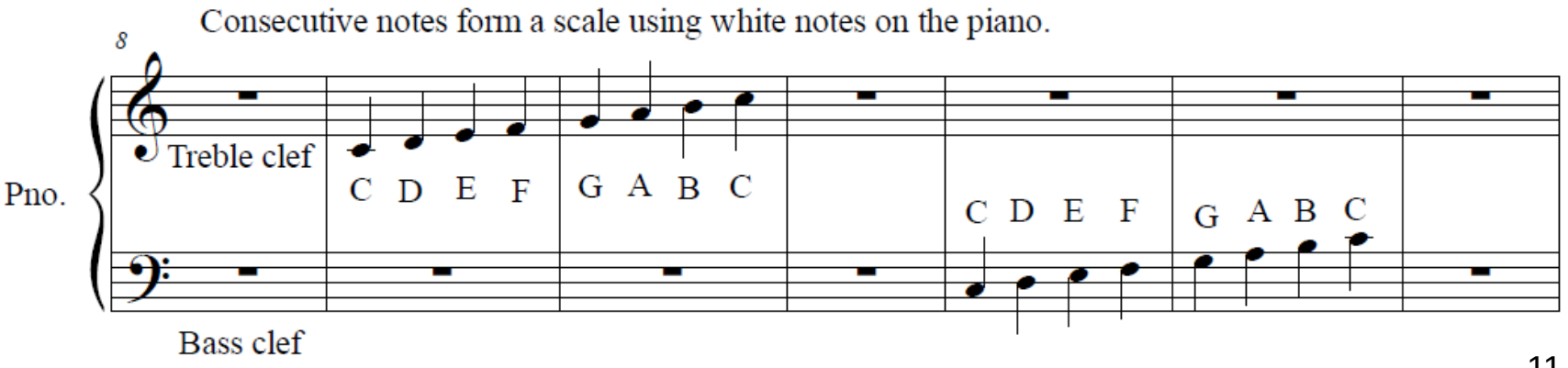
Audio file



Musical Notation

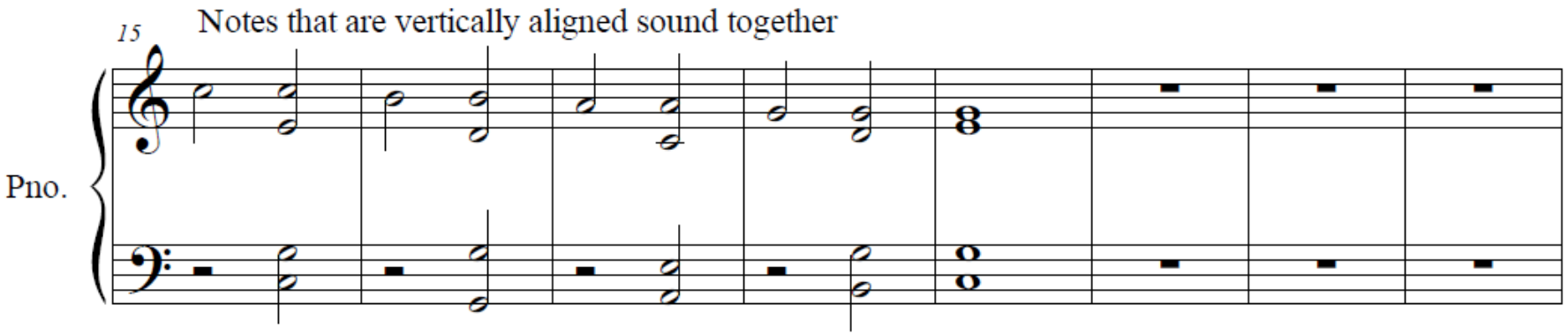
Audio file



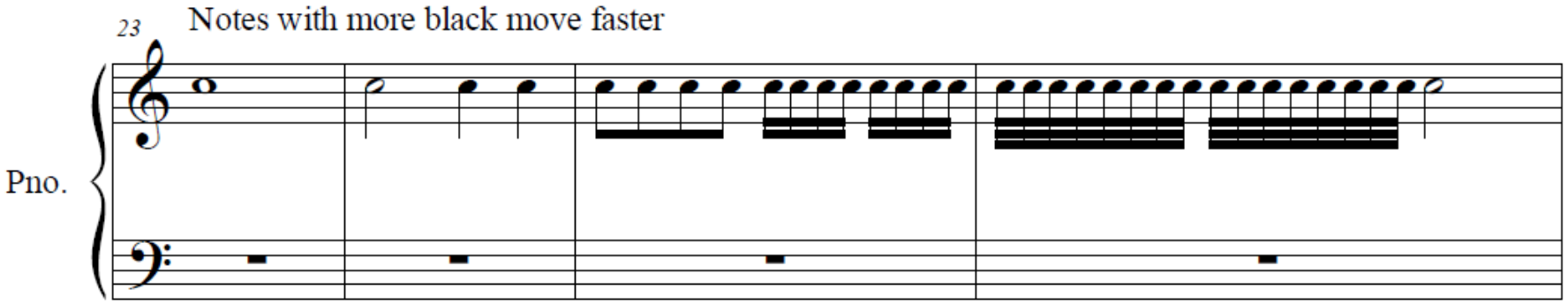


Musical Notation

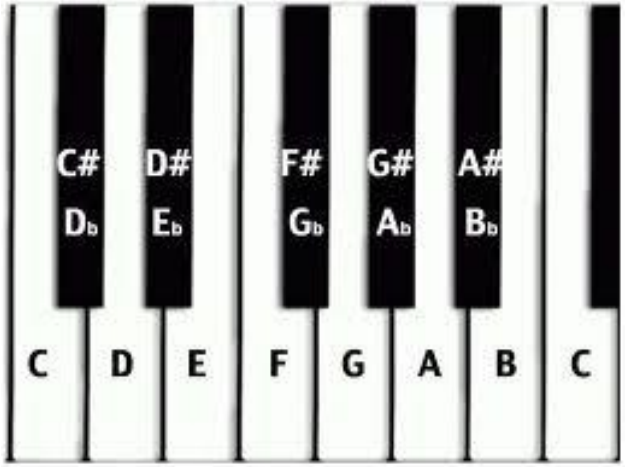
Audio file



Audio file



Audio file



27 Attaching a sharp makes the note a half-step higher (the next highest black key on the piano).

Pno.

This is called the chromatic scale.

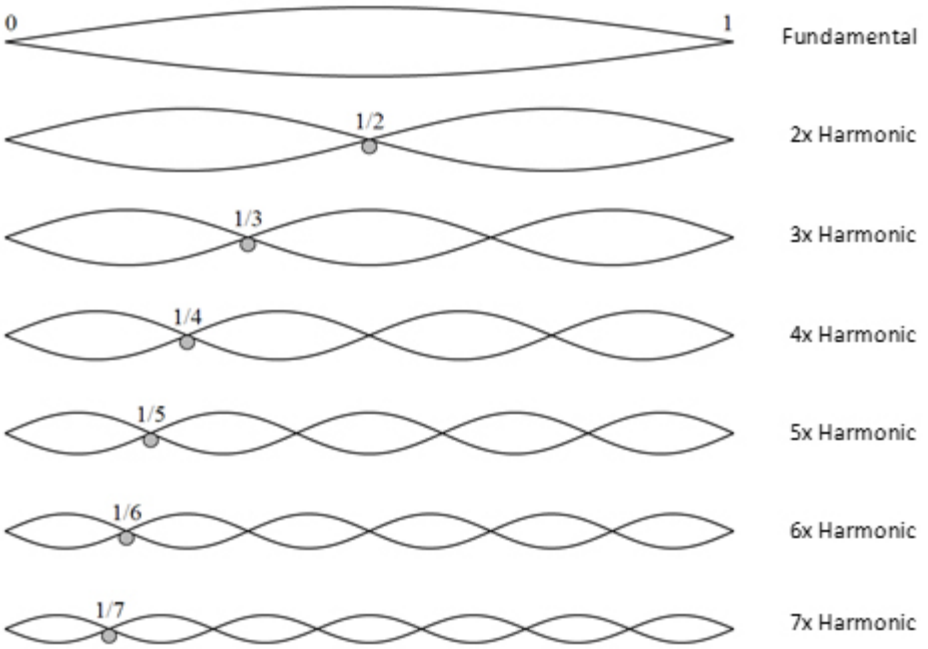
34 Attaching a flat makes the note a half-step lower (the next lowest black key on the piano).

Pno.

Harmonics

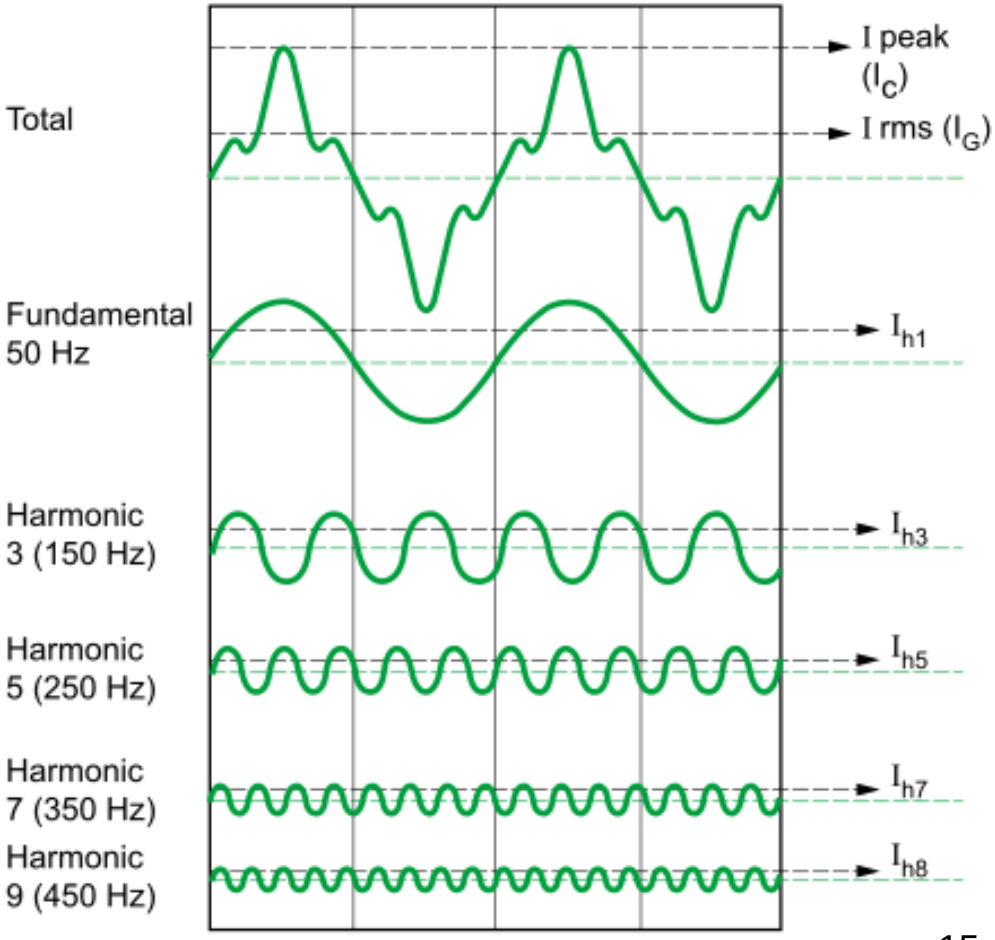
- Acoustic instruments generate **harmonics** of each tone
  - Multiples of the original frequency.
    - Also called **harmonic partials** or **overtones**
    - 1st overtone = 2nd harmonic

Piano or guitar string



Harmonics

- Musical timbre
  - is based on the relative strength of harmonics
    - This is **Fourier analysis**
    - **The ear** performs Fourier analysis!

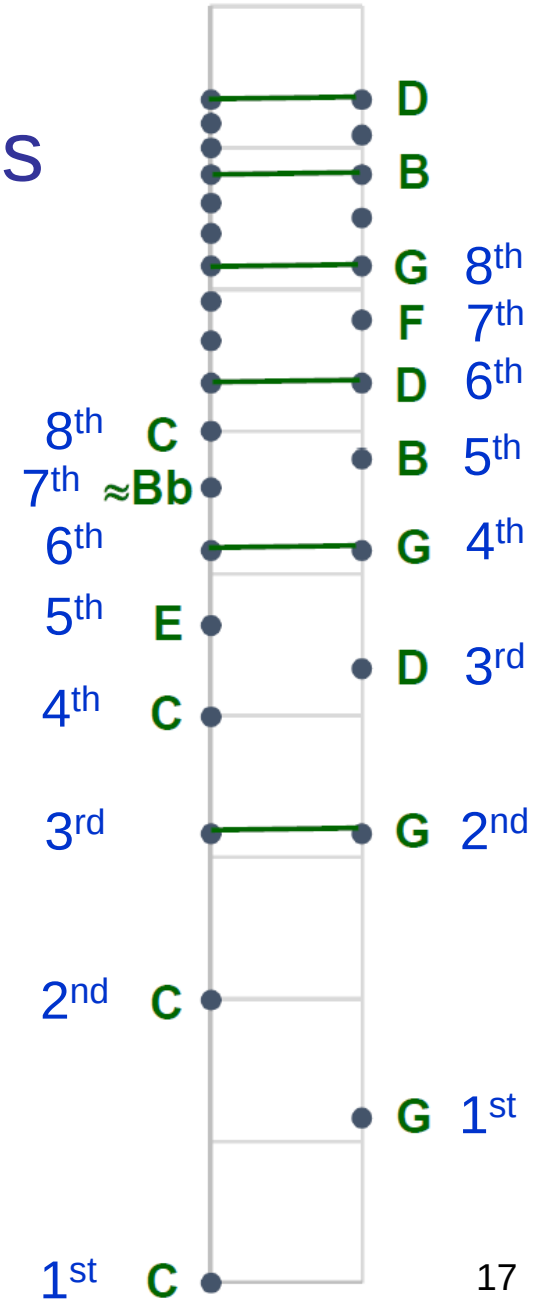


Harmonious Intervals

- It is easy to recognize intervals whose frequencies have simple ratios.
  - They have many harmonics in common.

Harmonious Intervals

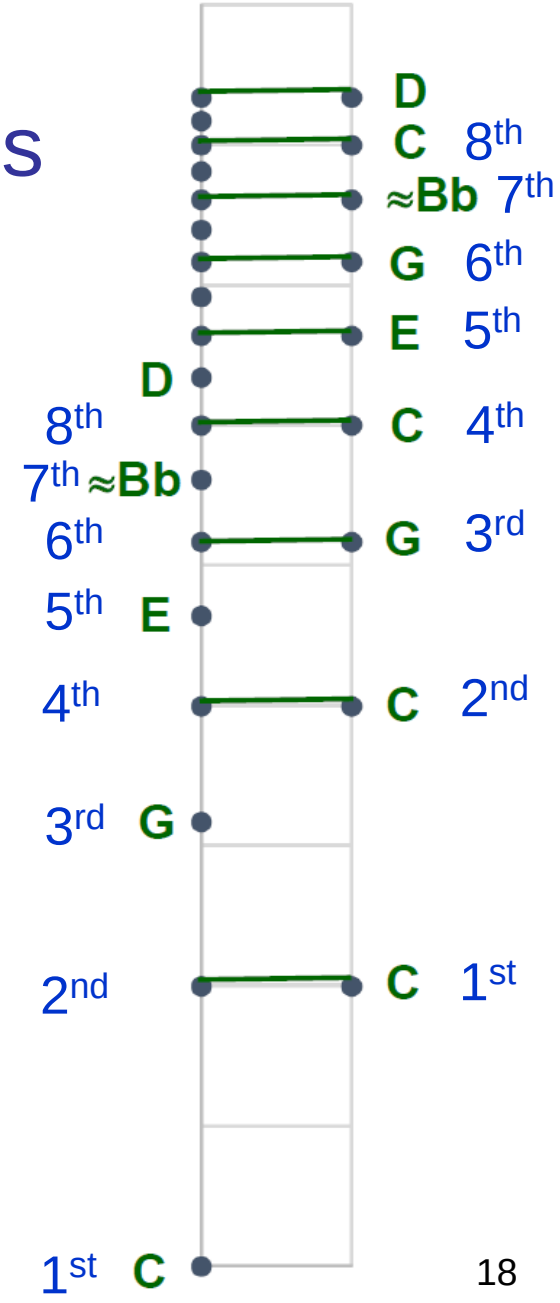
- It is easy to recognize intervals whose frequencies have simple ratios.
  - They have many harmonics in common.
    - For example, a **perfect fifth**…



Harmonics of C and G,
which have frequency ratio 2:3

Harmonious Intervals

- It is easy to recognize intervals whose frequencies have simple ratios.
  - They have many harmonics in common.
    - For example, an **octave**…

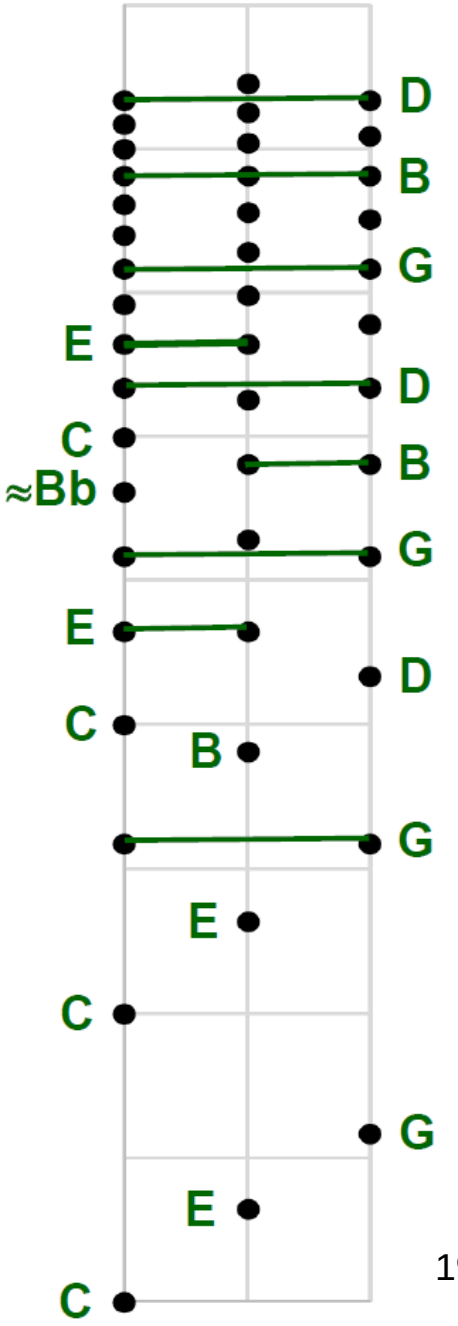


Harmonics of C and C octave, which have frequency ratio 1:2

Harmonious Intervals

- It is easy to recognize intervals whose frequencies have simple ratios.
  - They have many harmonics in common.
    - For example, a **major triad**…

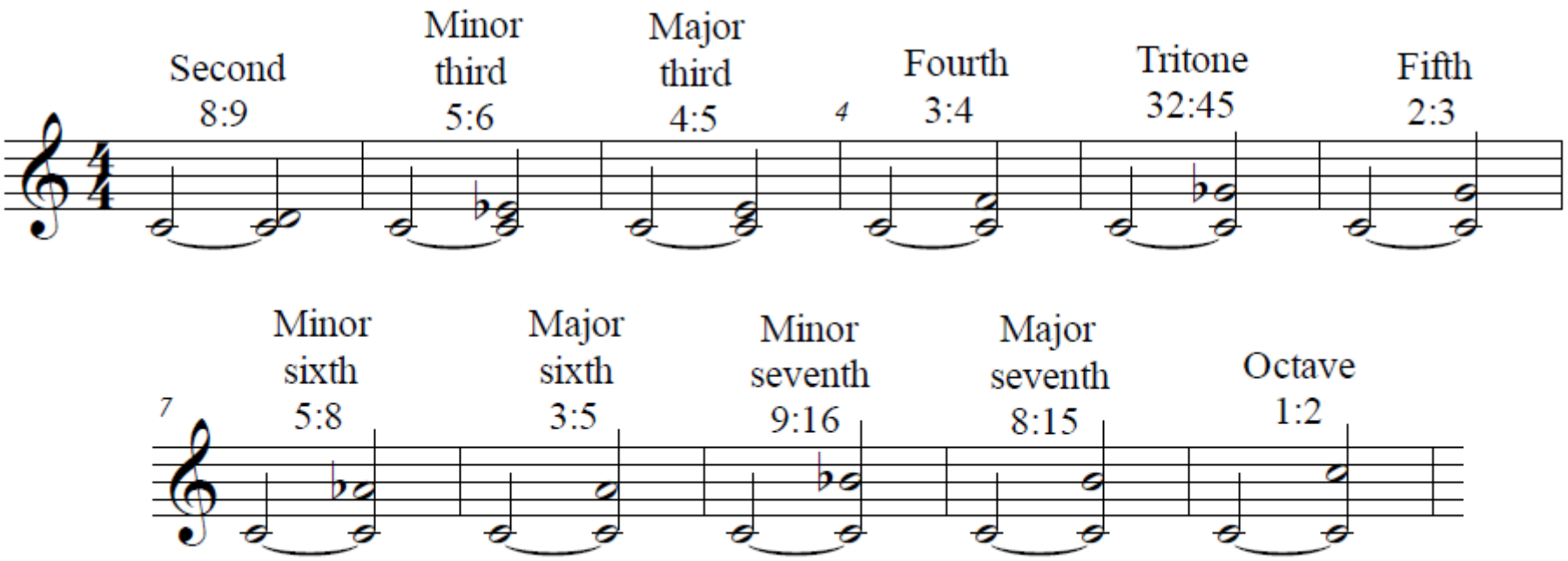
Harmonics of C, E and G,
which have frequency ratios 3:4:5



Intervals

Ratios with smaller numbers indicate greater consonance

Audio file

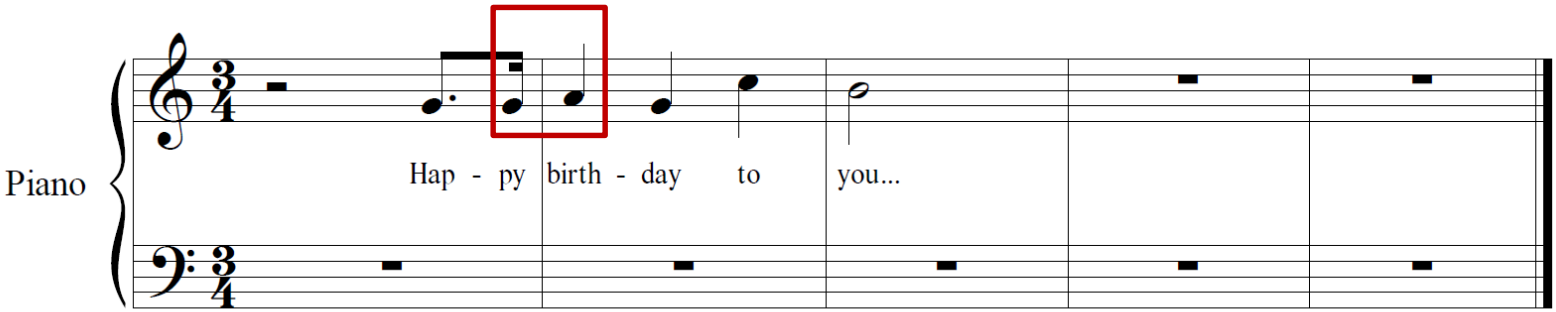


Intervals

Major second 8:9

Audio file

Happy Birthday

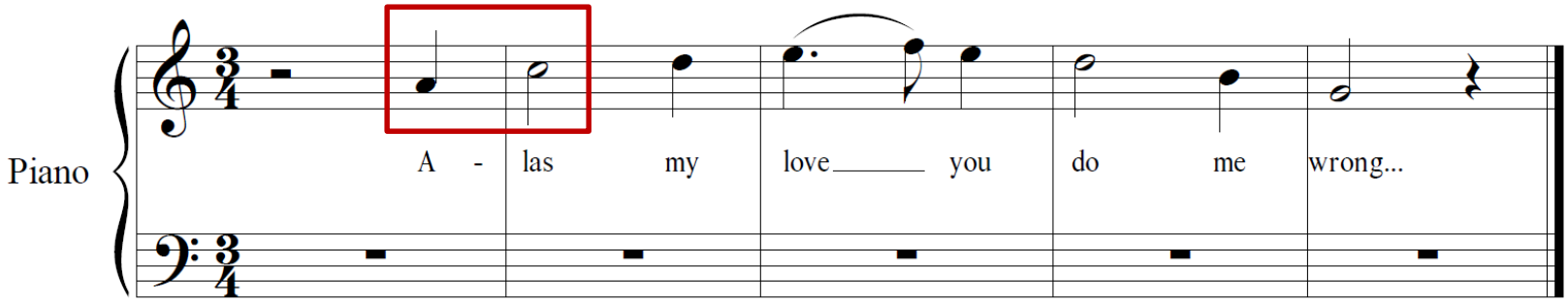


Intervals

Minor third 4:5

Audio file

Greensleeves



Intervals

Major third 5:6

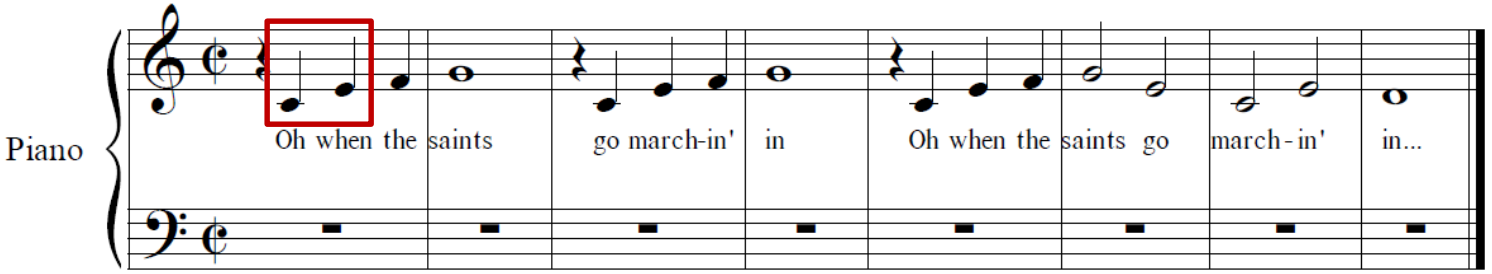
Audio file

Careful: Not all doorbells ring a major 3rd!

Cukoos? They sing a minor 3rd, major 3rd, or 4th, depending on the time of year.

Audio file

When the Saints Go Marching In

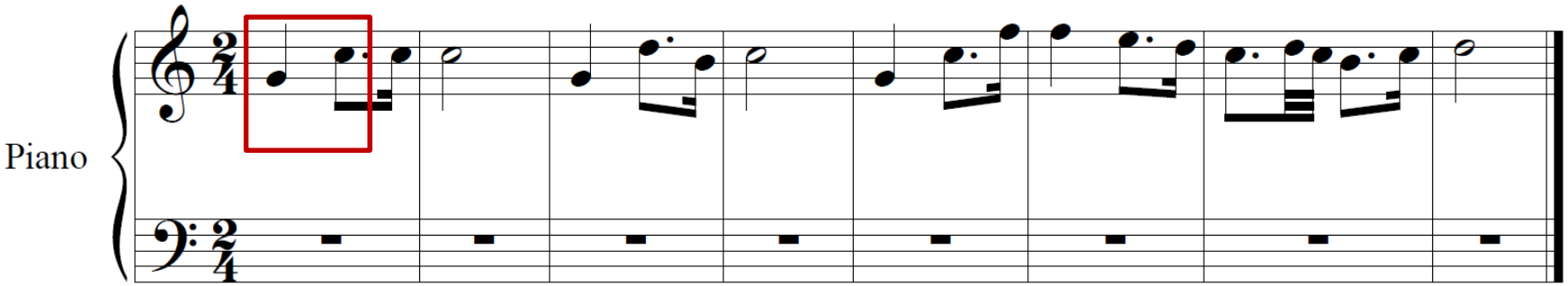


Intervals

Fourth 3:4

Audio file

Wedding March (Wagner)

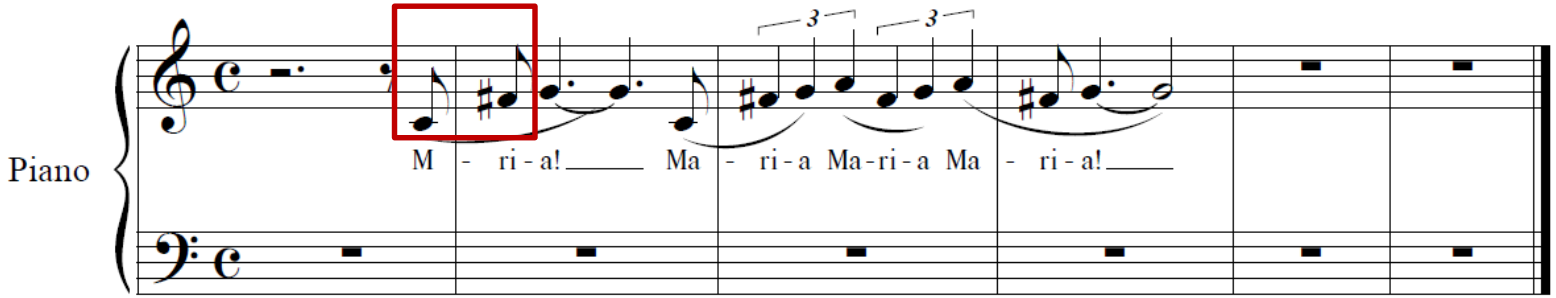


Intervals

Tritone 32:45

Audio file

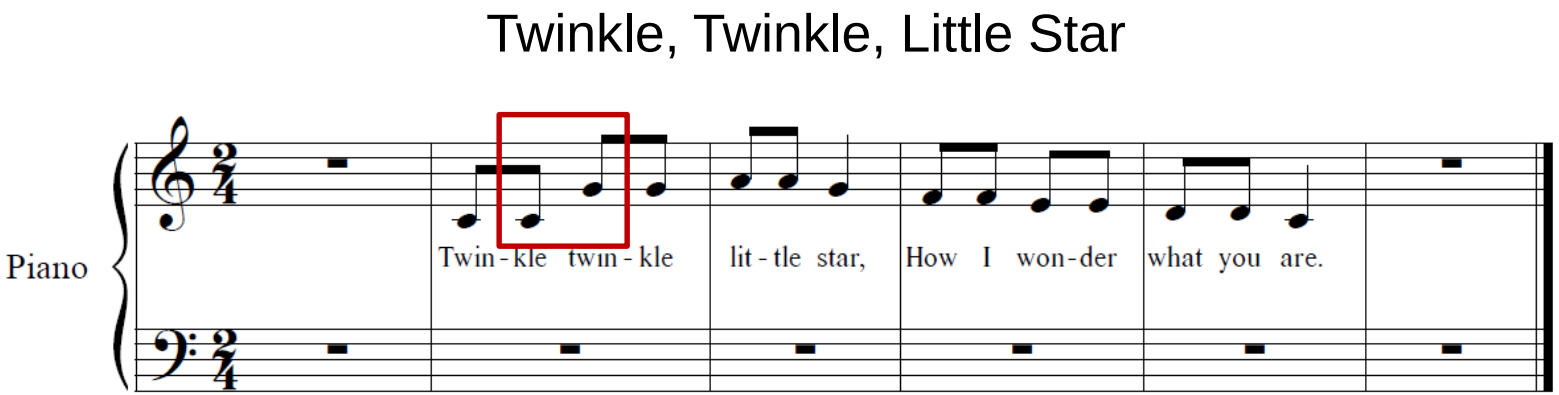
Maria (Bernstein/Sondheim)



Intervals

Fifth 2:3

Audio file

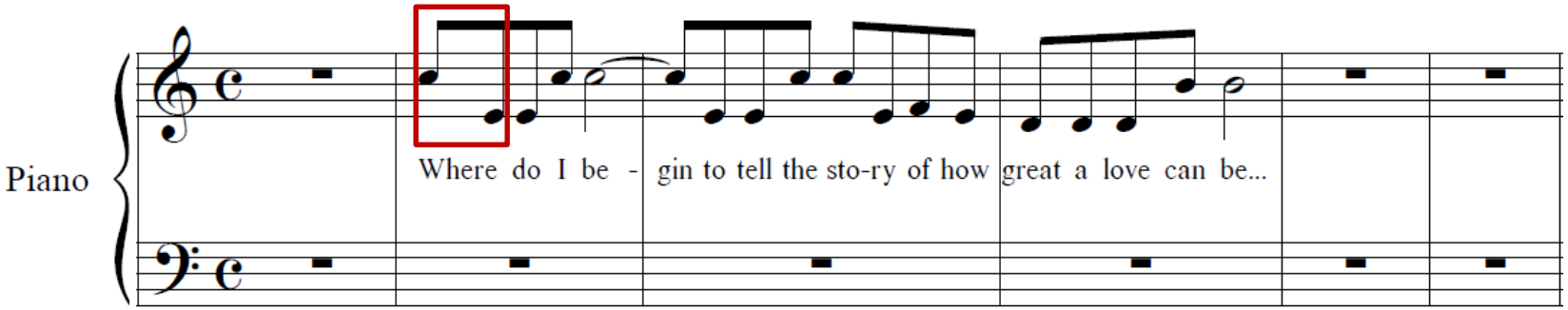


Intervals

Minor sixth 5:8

Audio file

Love Story (Taylor Swift)



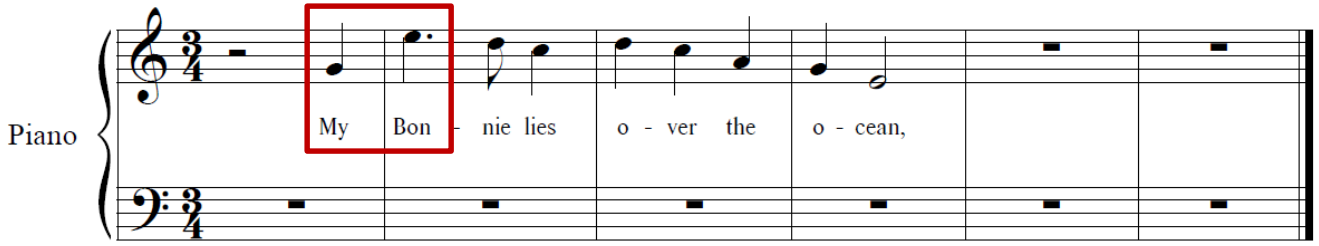
Intervals

Major sixth 3:5

Audio file

Audio file

My Bonnie Lies Over the Ocean

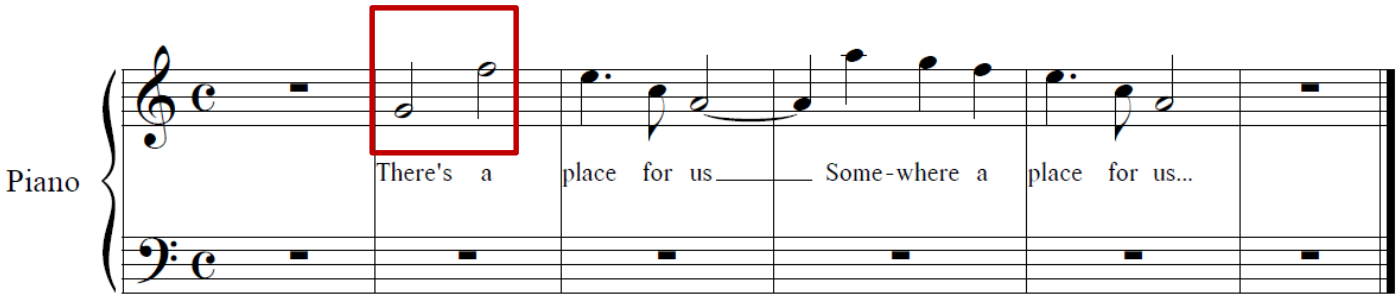


Intervals

Minor seventh 9:16

Audio file

Somewhere (Bernstein/Sondheim)

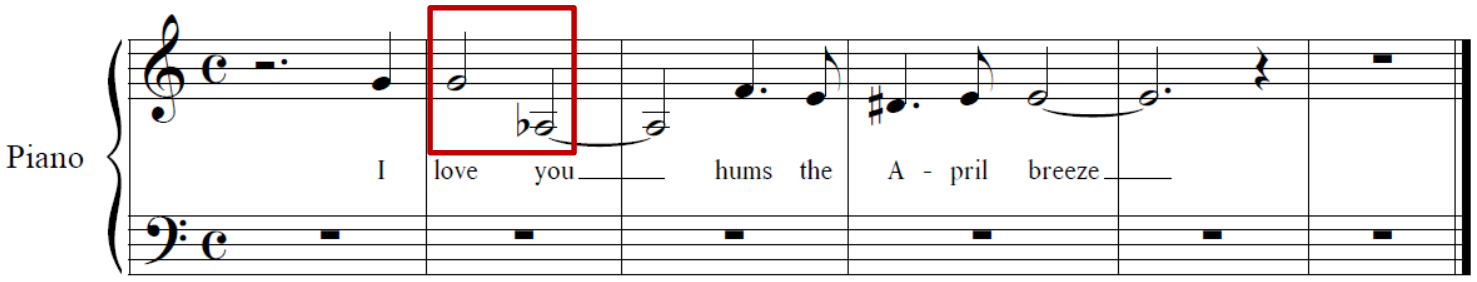


Intervals

Major seventh 8:15

Audio file

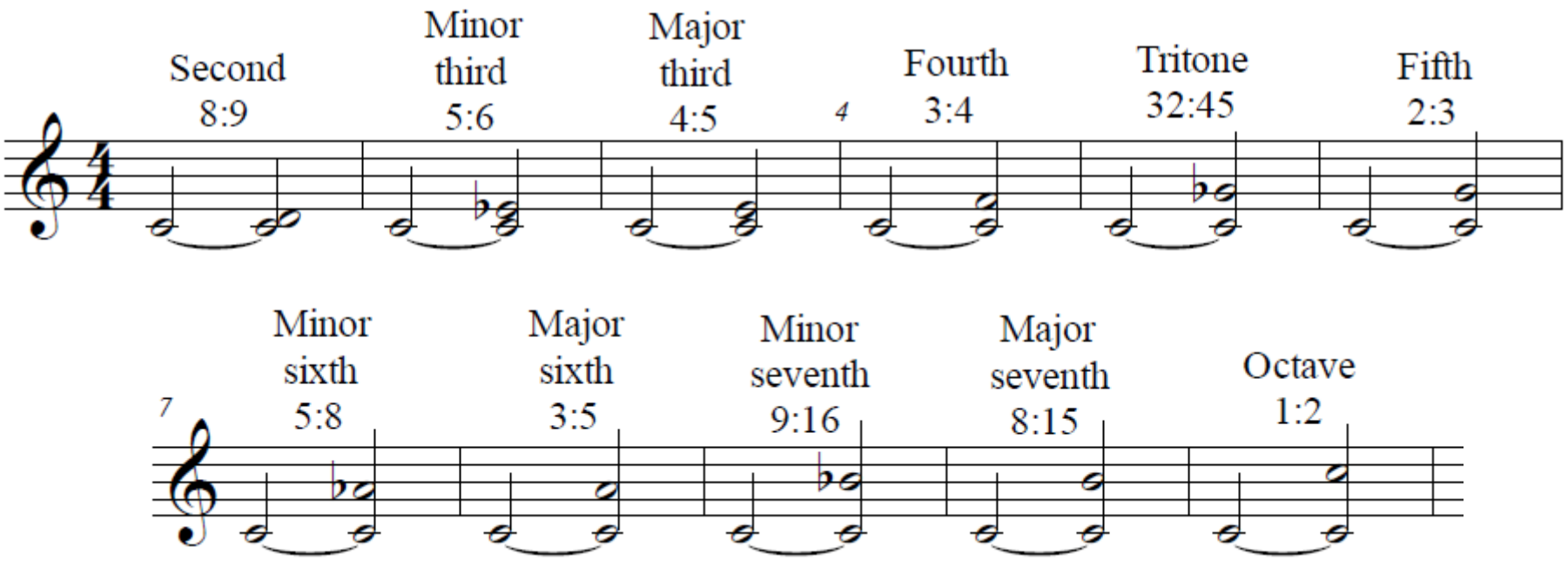
I Love You (Cole Porter)



Intervals

Ratios with smaller numbers indicate greater consonance

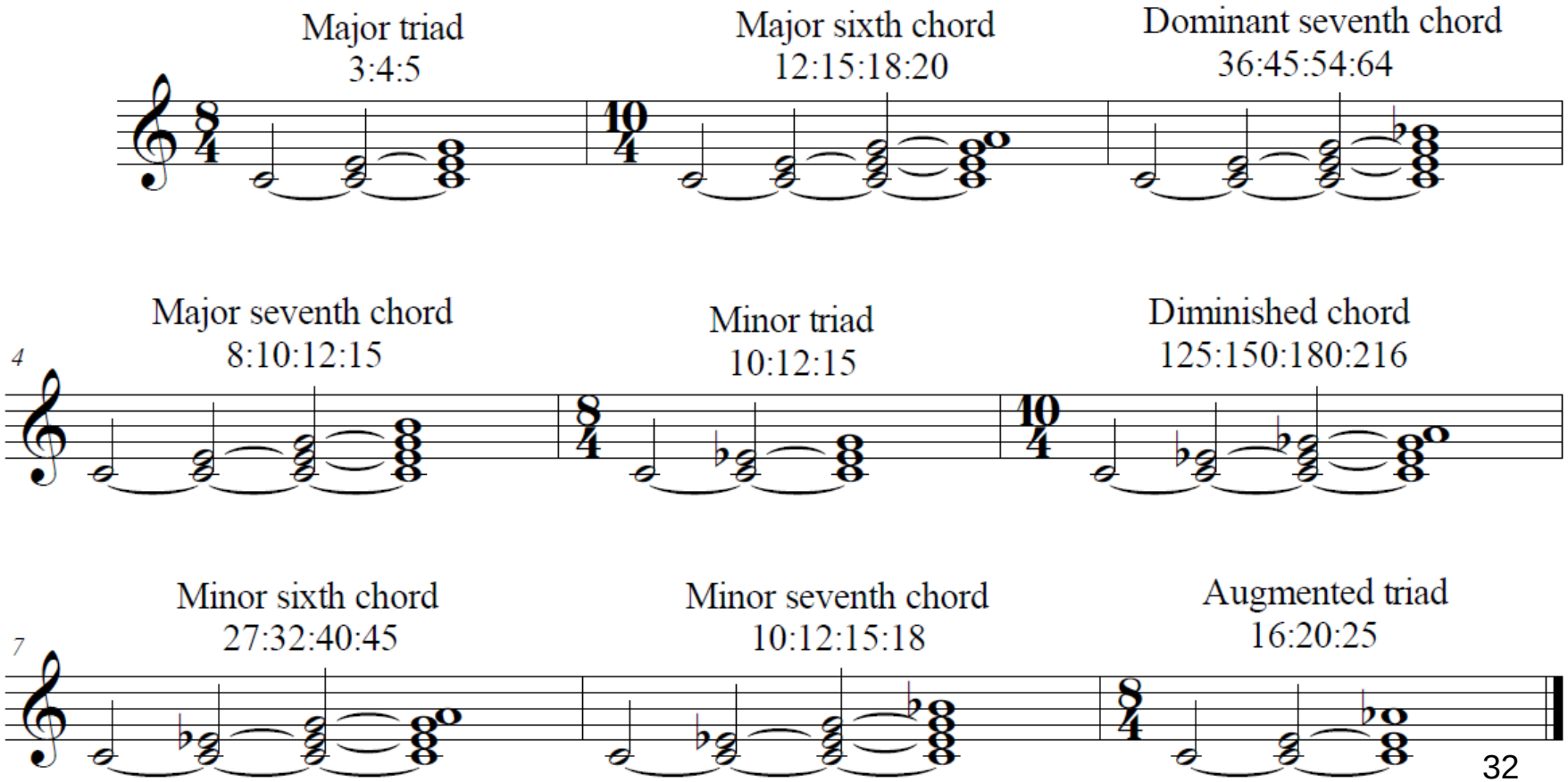
Audio file



Common chords

Ratios with smaller numbers indicate greater consonance

Audio file



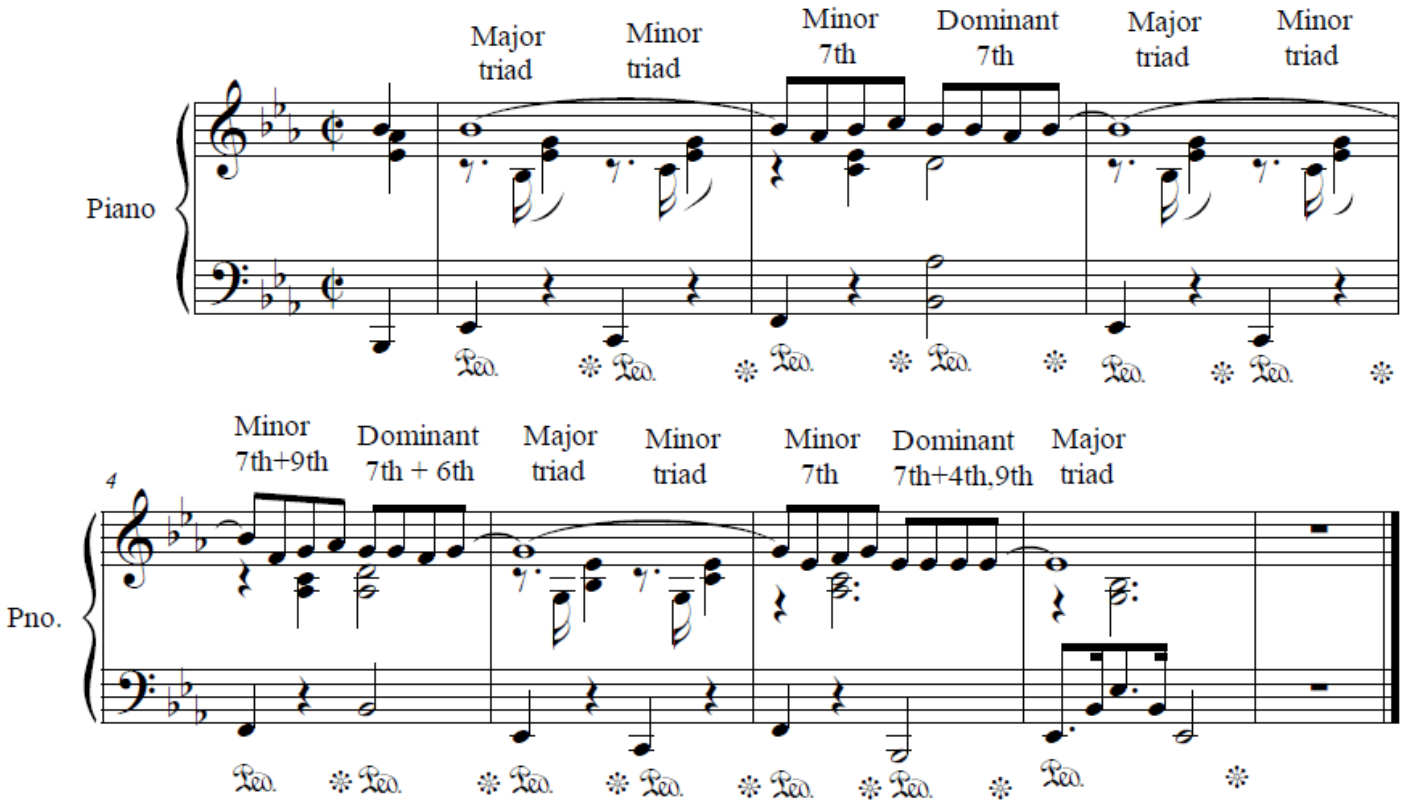
Chords

Example: “Blue Moon” (1933)

Richard Rogers (music) and Lorenz Hart (lyrics)

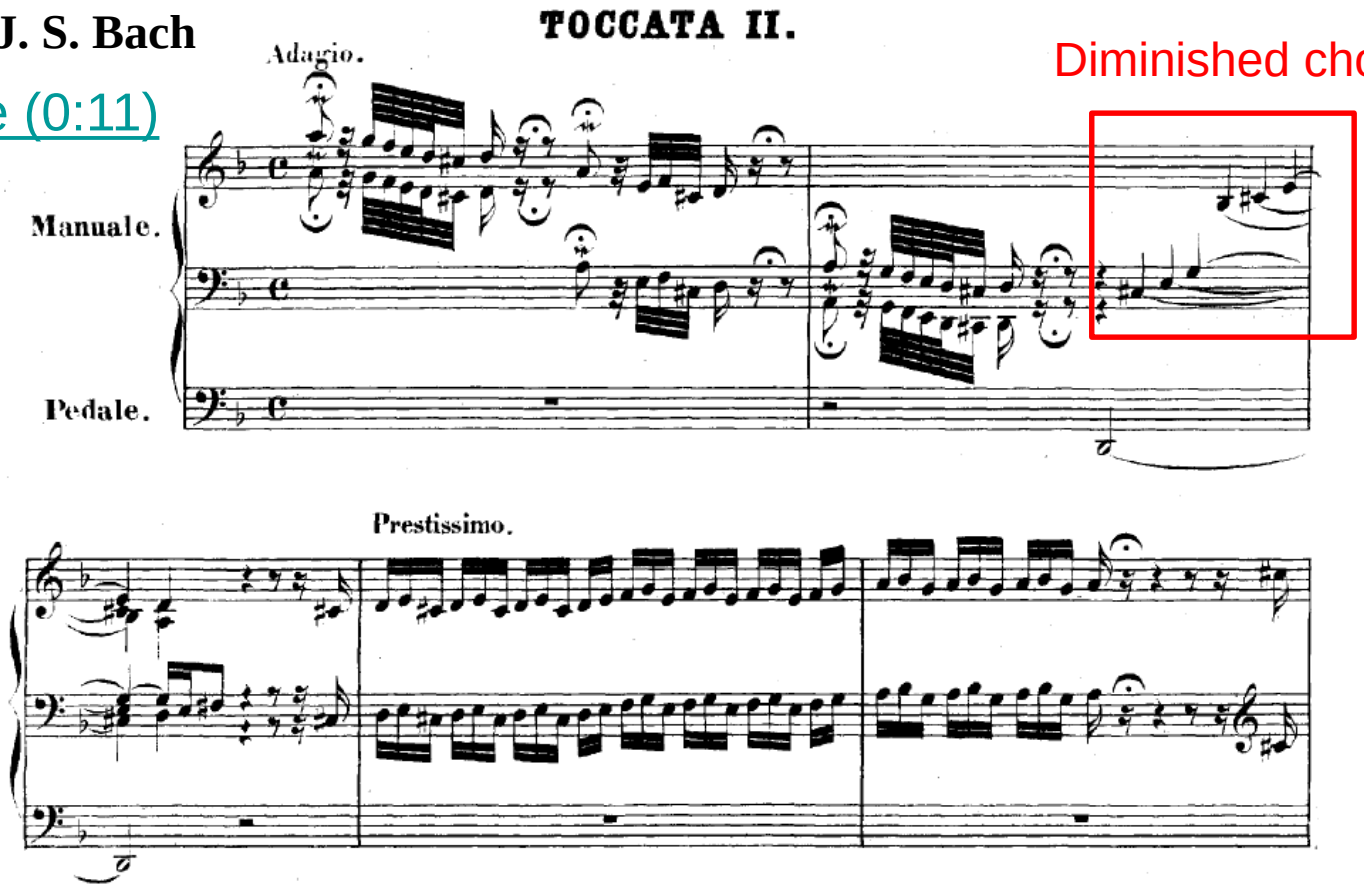
[Audio file from *Manhattan Melodrama* (1934) 0:06]

[Audio file of the excerpt below]



Chords

Example: Diminished chord 125:150:180:216



Diminished chord

Audio file (0:11)

Chords

Example: Minor 6 chord 27:32:40:45

Most popular sound for US freight trains

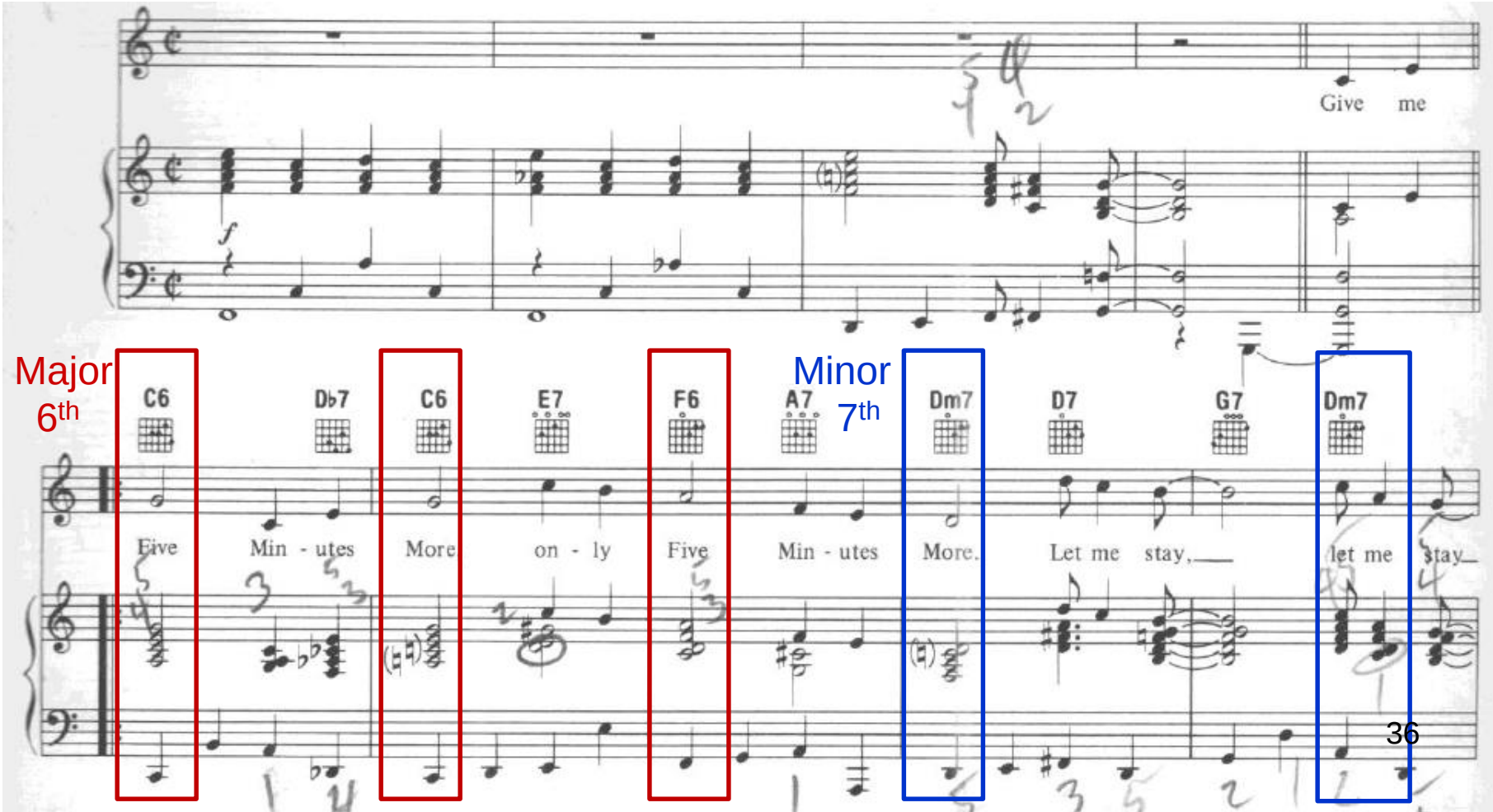
Audio file (0:08)

Chords

Example: “Five Minutes More” (1946)

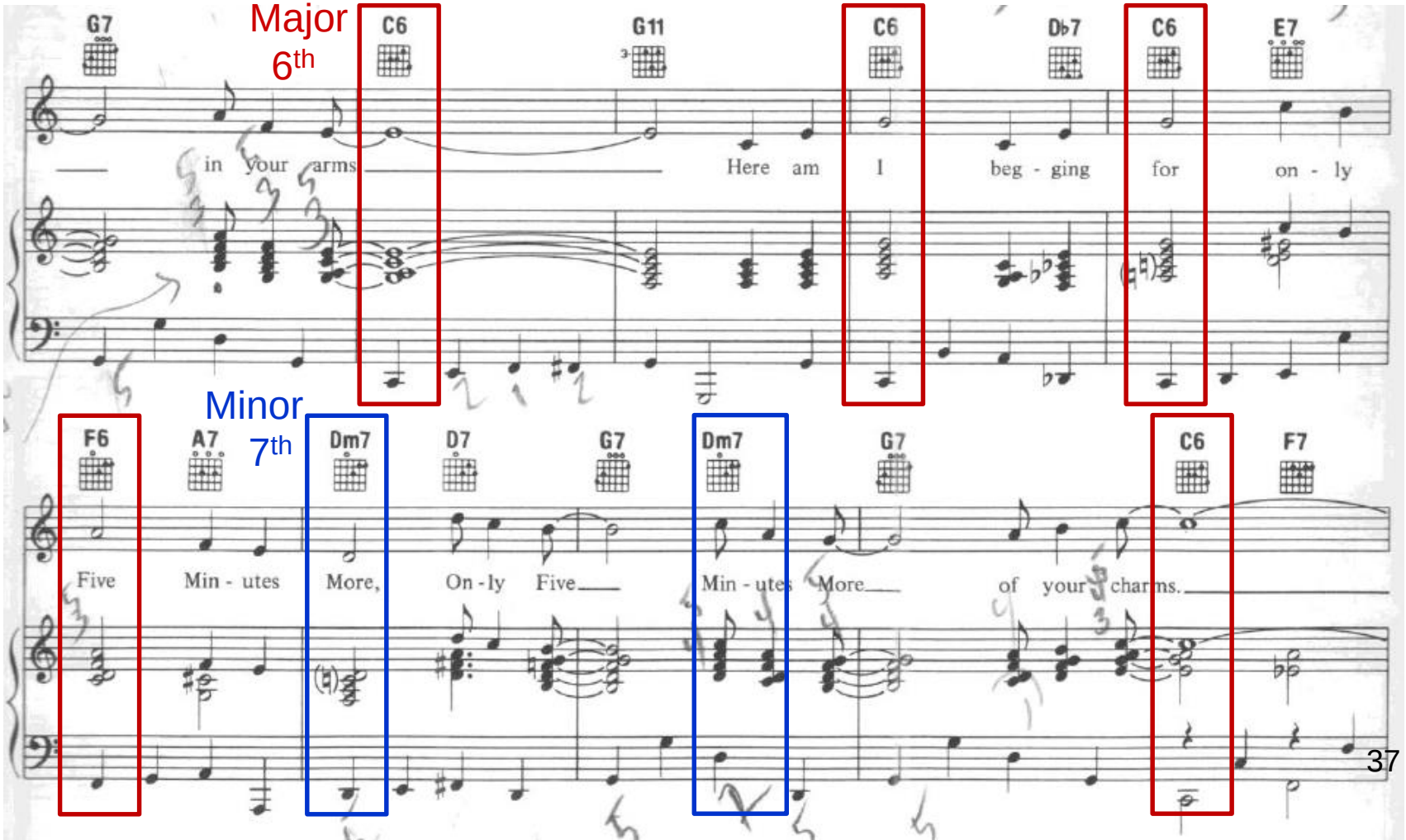
Jule Styne (music) and Sammy Cahn (lyrics)

Audio file



Chords

Example: “Five Minutes More” (1946)

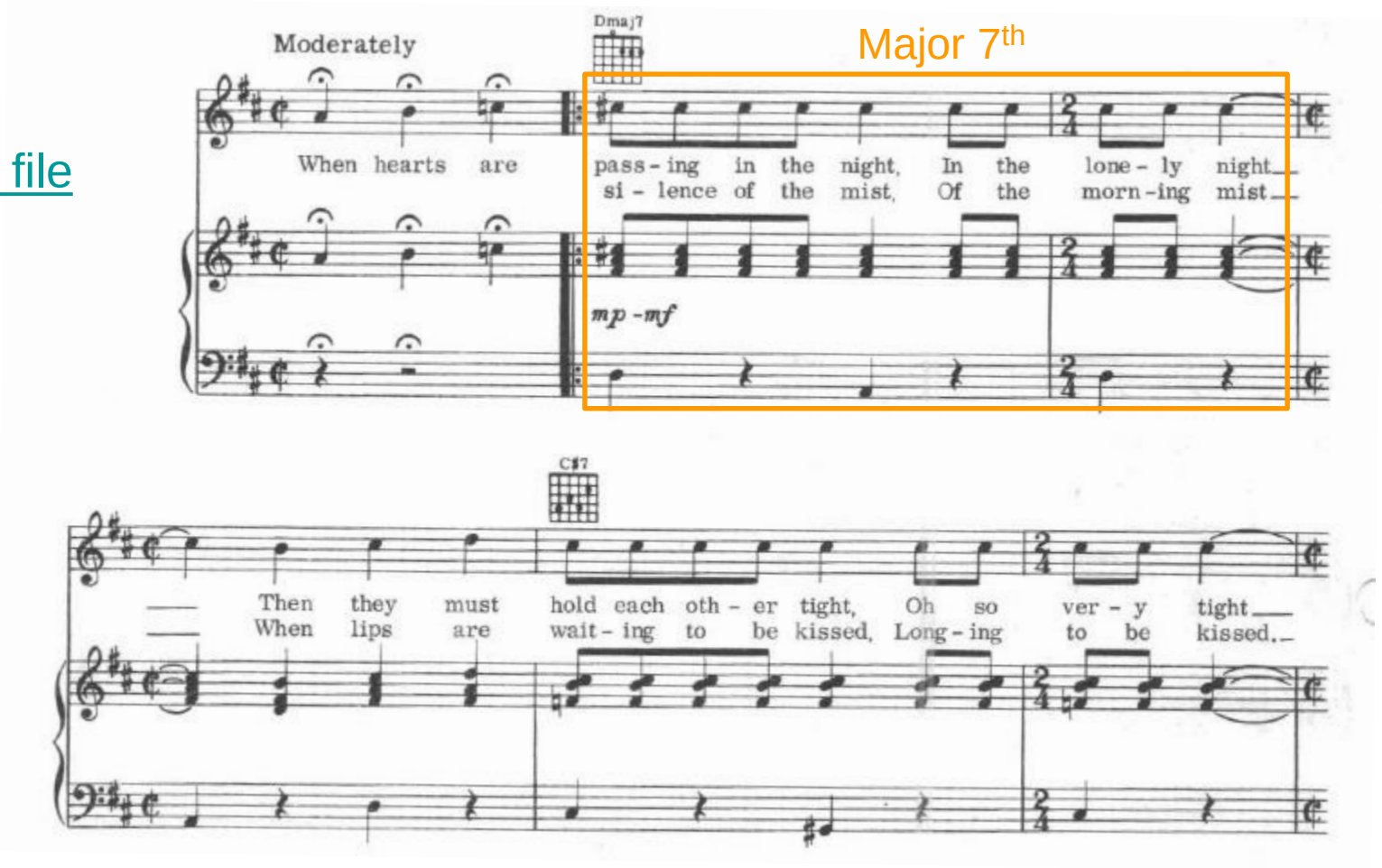


Chords

Example: “A Man and a Woman” (1946)

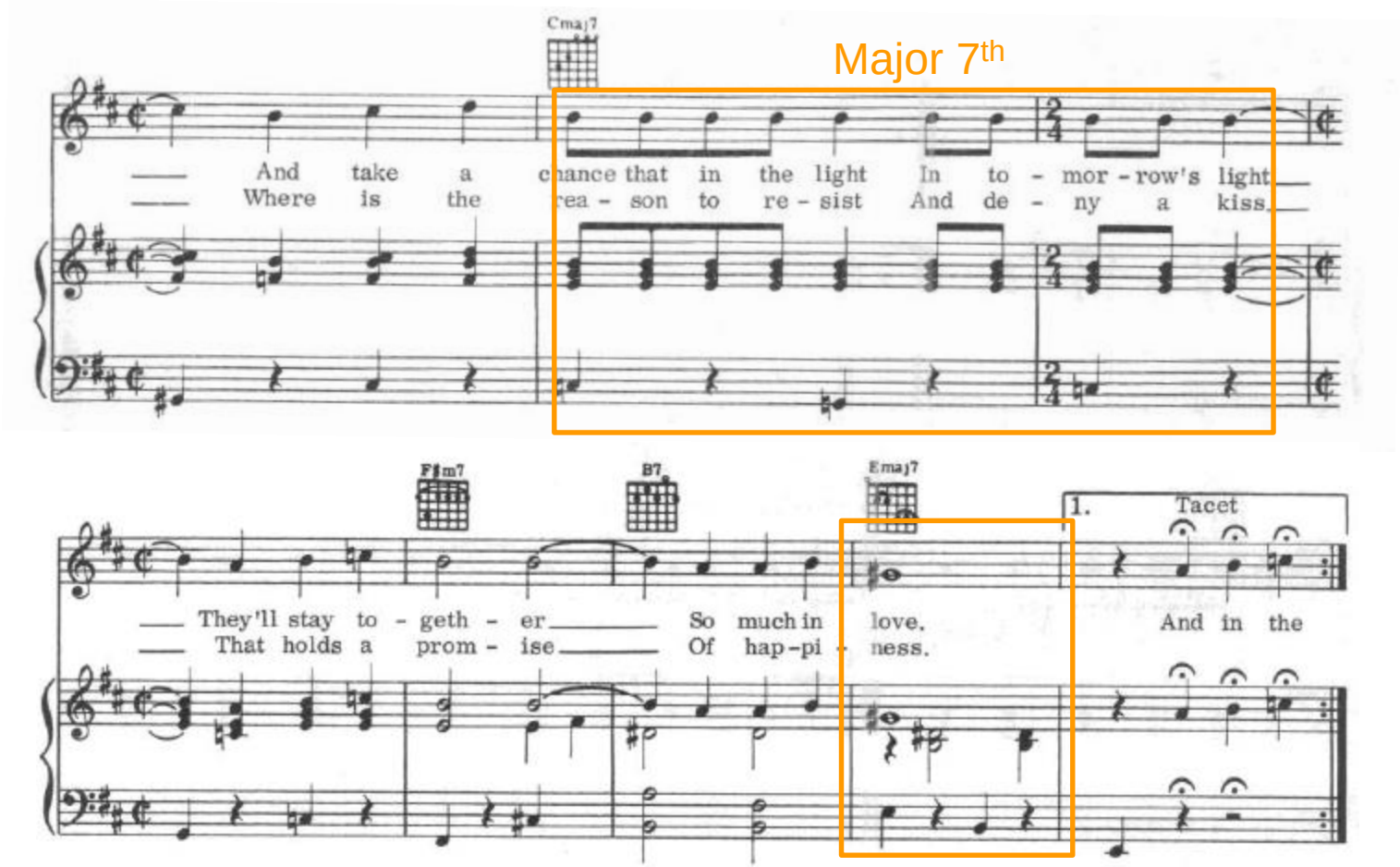
Francis Lai (music) and Pierre Barouh (lyrics)

Audio file



Chords

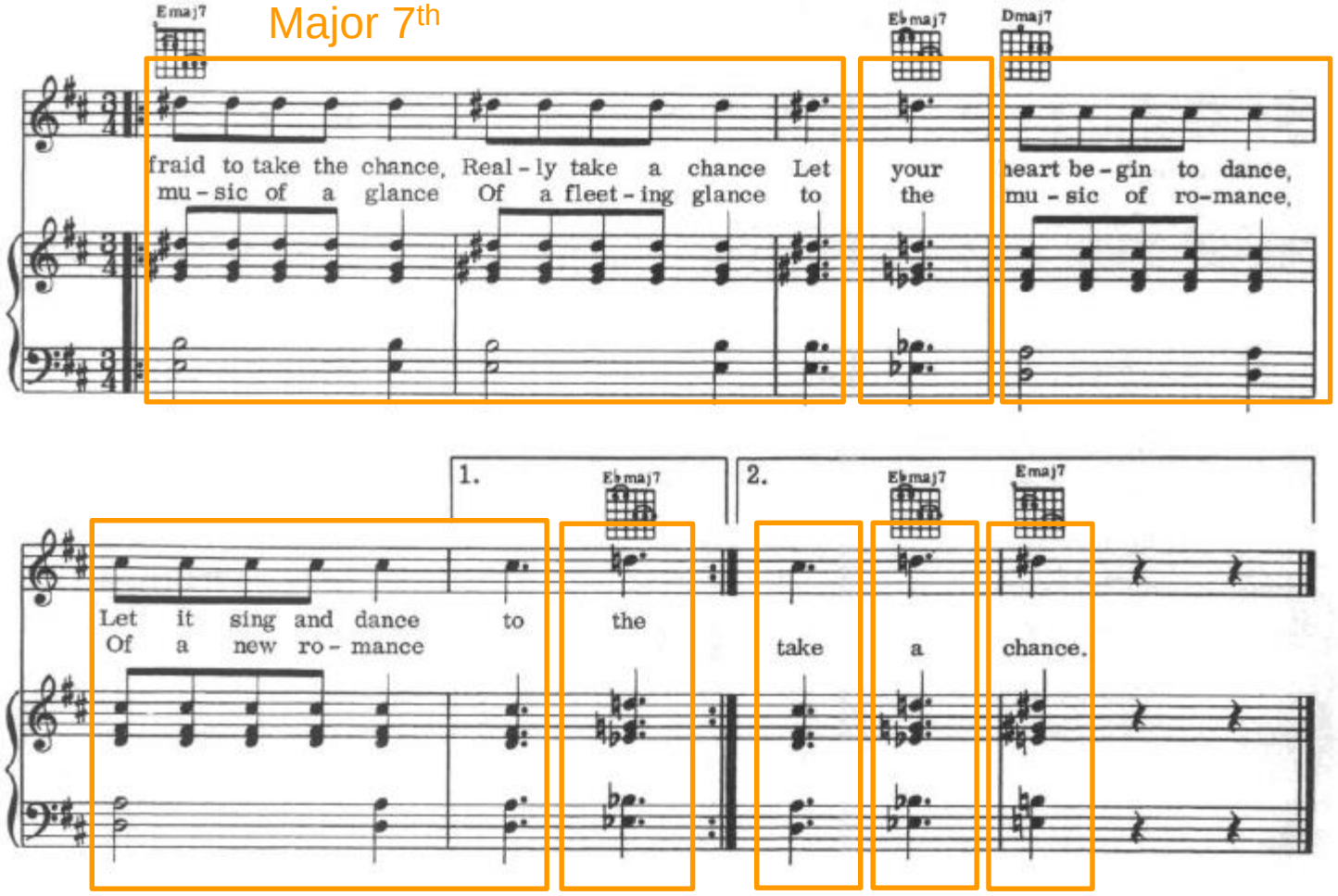
Example: “A Man and a Woman” (1946)



Chords

Example: “A Man and a Woman” (1946)

Skipping to the end of the song…



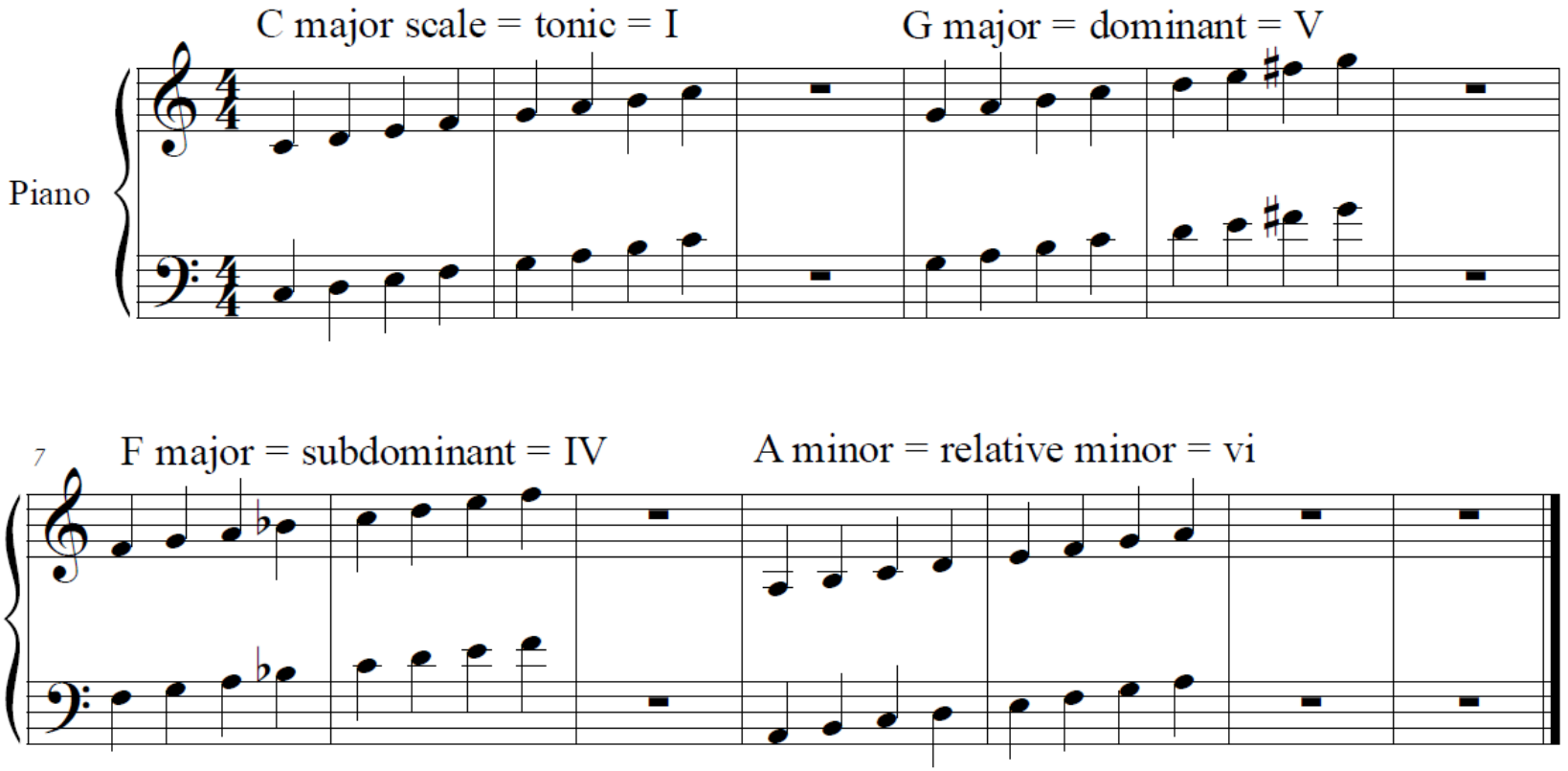
Keys

- One can start a scale on any one of the 12 chromatic notes.
  - This produces the 12 **keys**.
- Some keys are more **distant** from the **tonic** key
  - Tonic key = the one we start the music in.
  - More distant keys have **fewer notes in common**.

Keys

Some closely related keys

Audio file

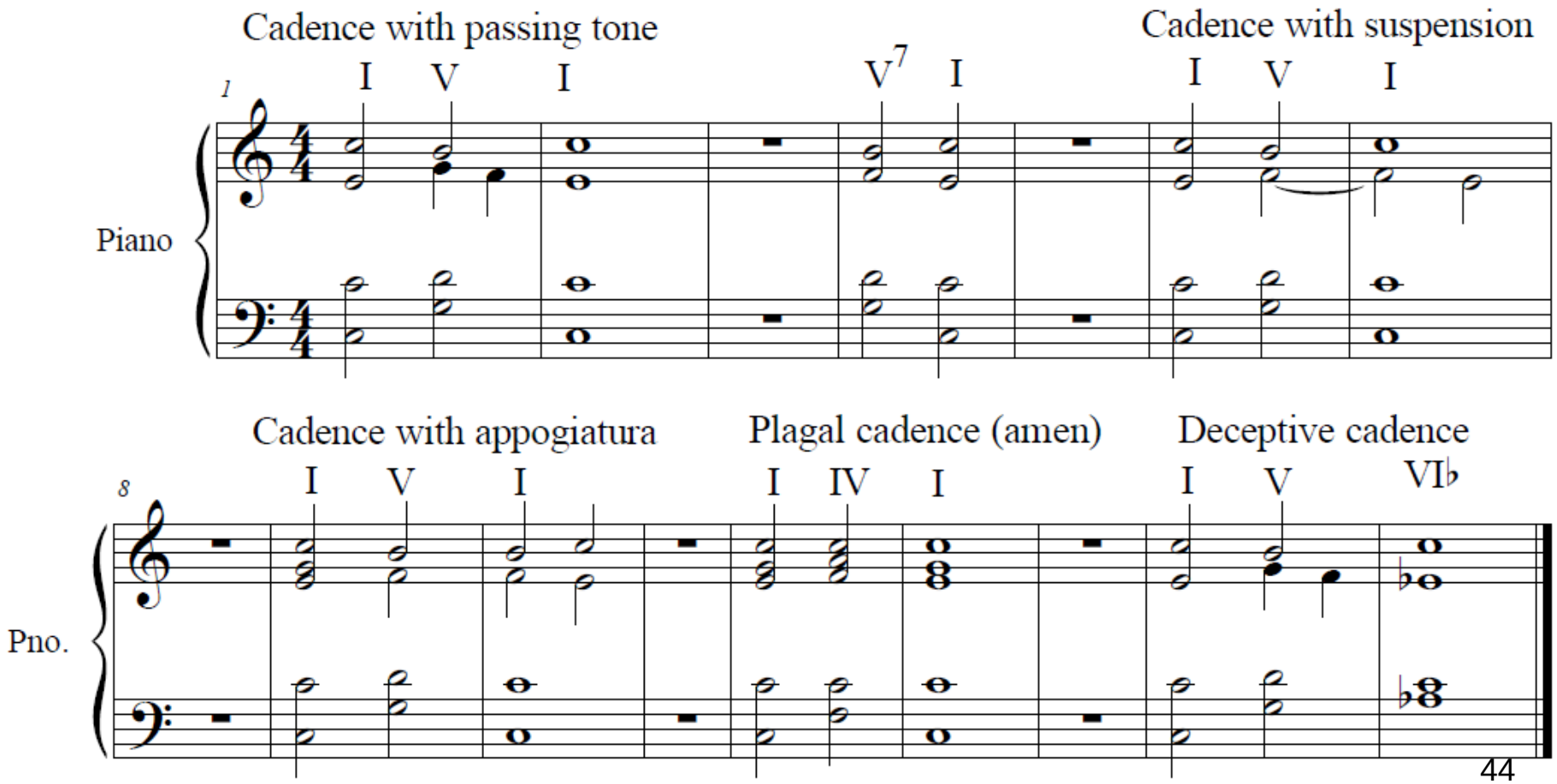


Keys

- Western music likes travel & adventure…
  - Start at home (tonic)
  - Travel to other lands (other keys)
  - Return home (tonic)
- Much music moves from tonic to dominant to tonic (I-V-I)
  - The return to the tonic is a **cadence**.

Cadences

Audio file

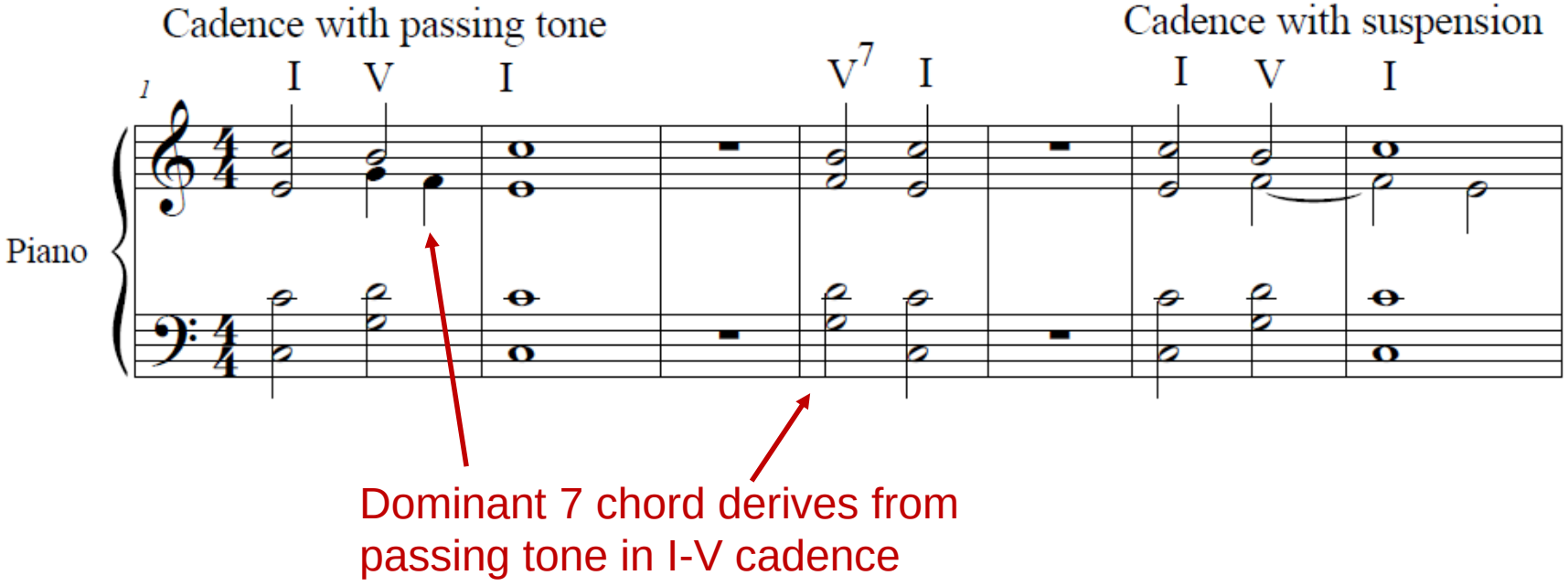


Cadences

Audio file

Audio file

Audio file

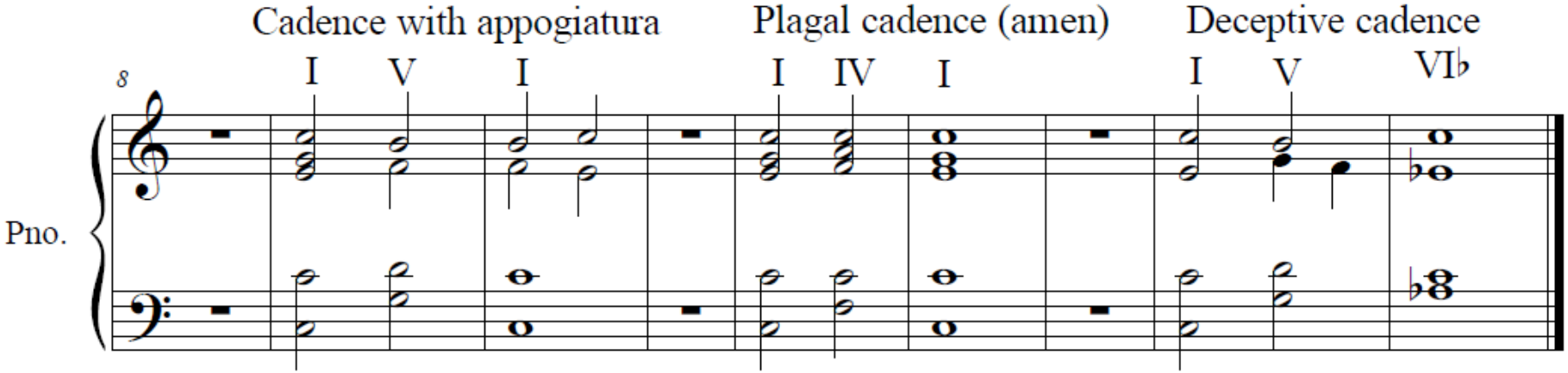


Cadences

Audio file

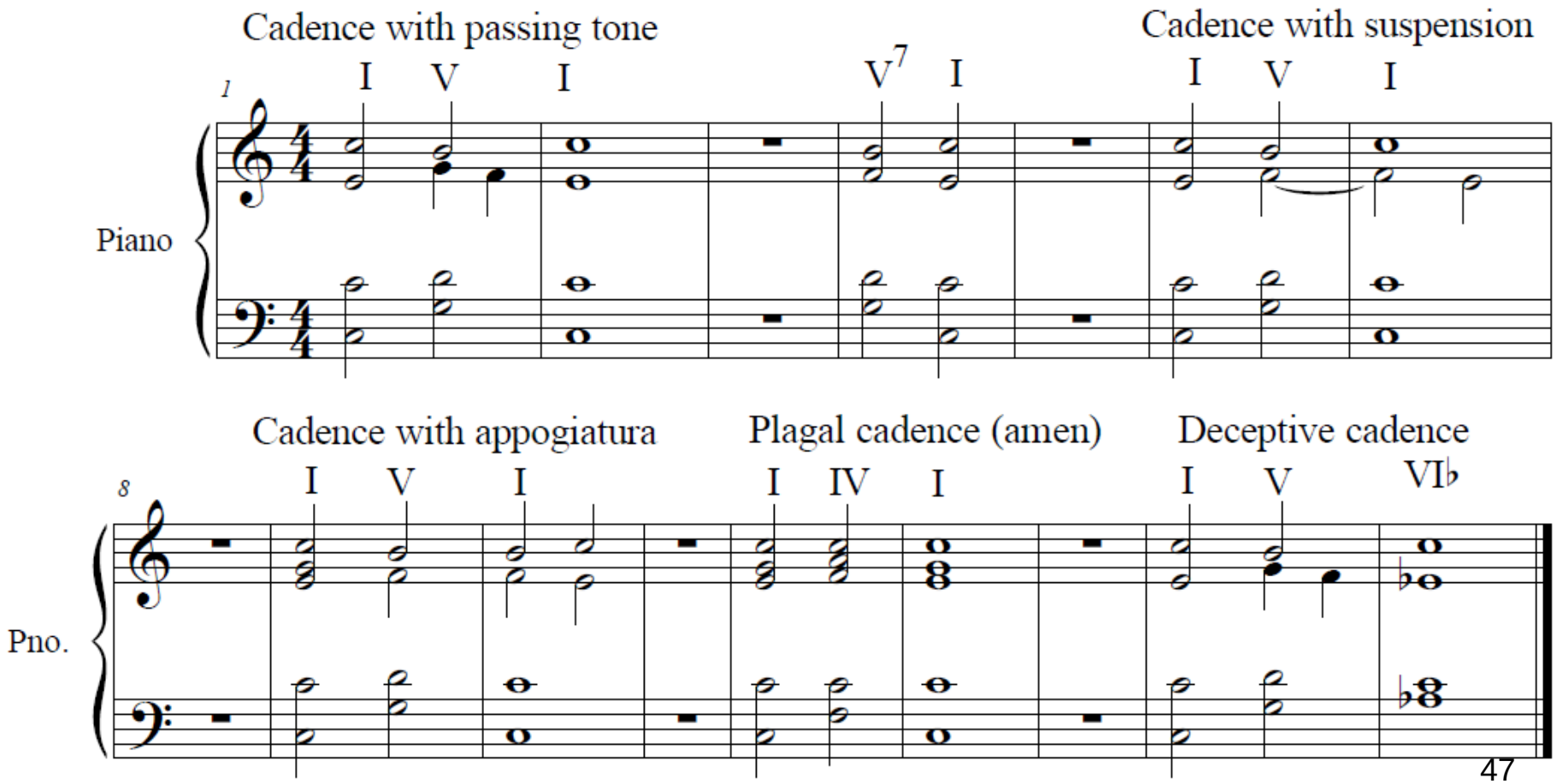
Audio file

Audio file



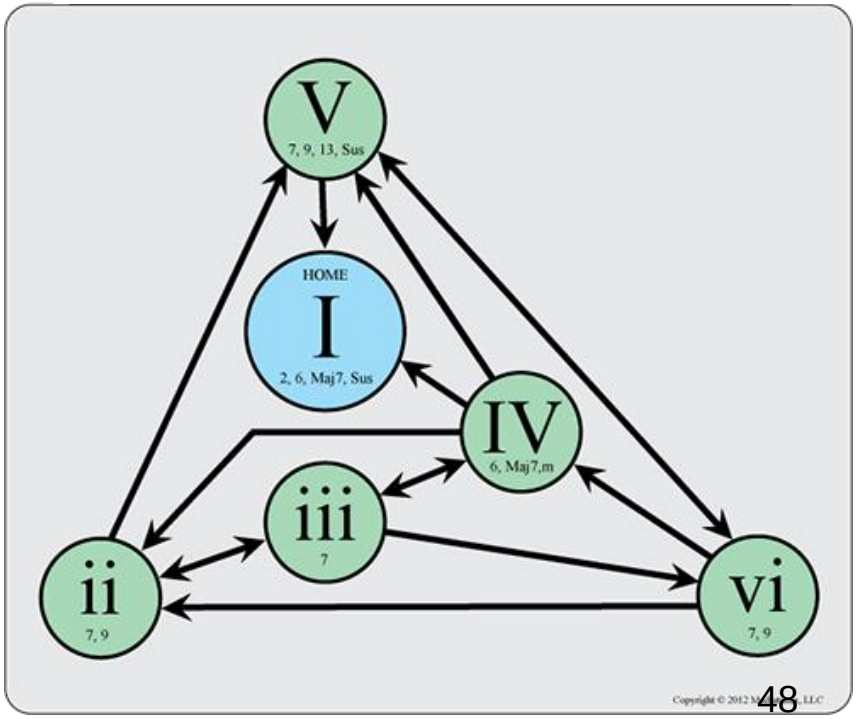
Cadences

Audio file



Cadences

- Dominant 7th chord is from V-I cadence
  - Passing tone creates 7th chord
  - Dominant 7th chord does not "lead to" tonic
- Harmony should flow organically from the music
  - Not be imposed from outside as a "standard" chord progression.



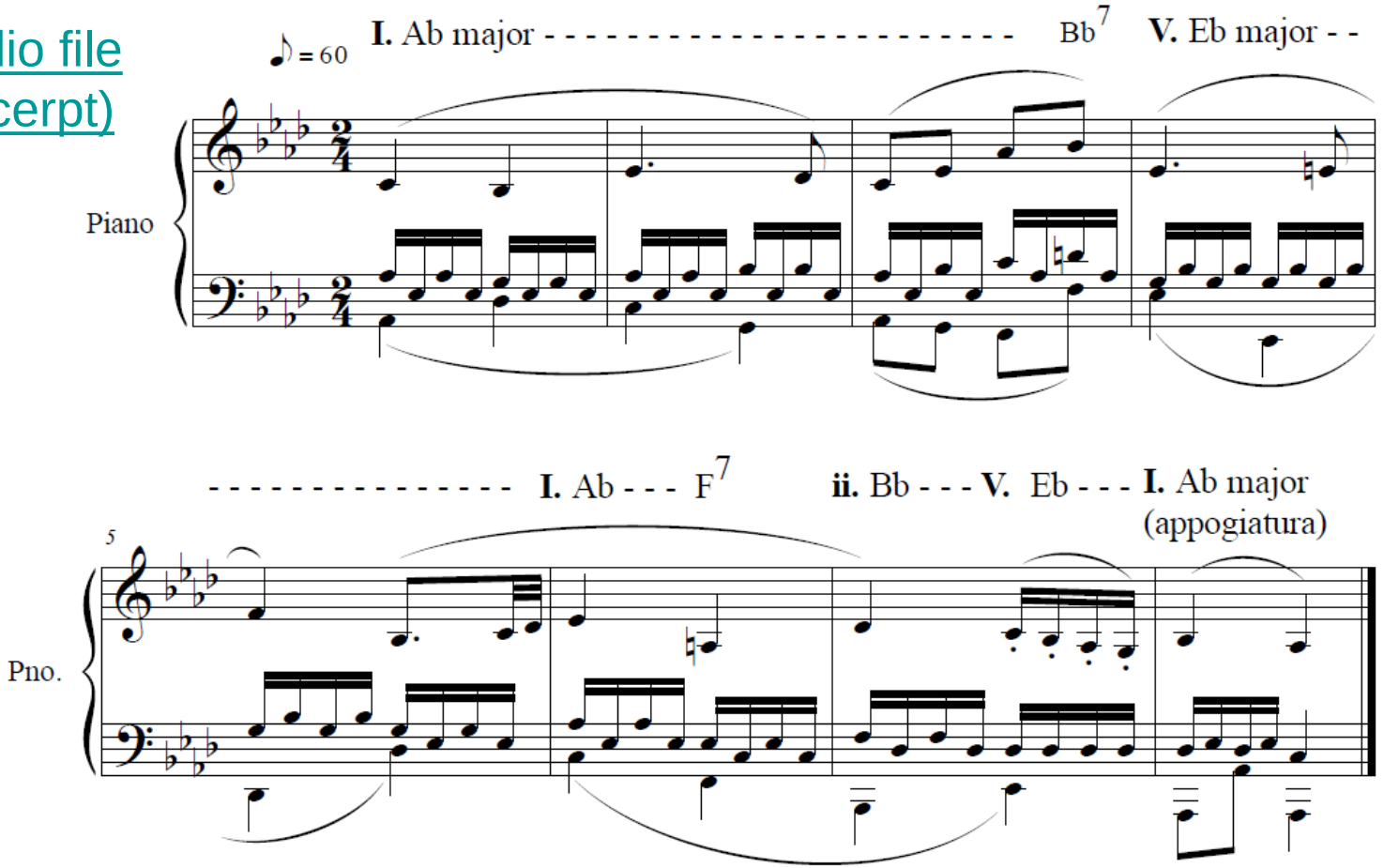
Cadences

Example: Adagio Cantabile from Pathetique Sonata

L. van Beethoven (1798)

Audio file (performance)

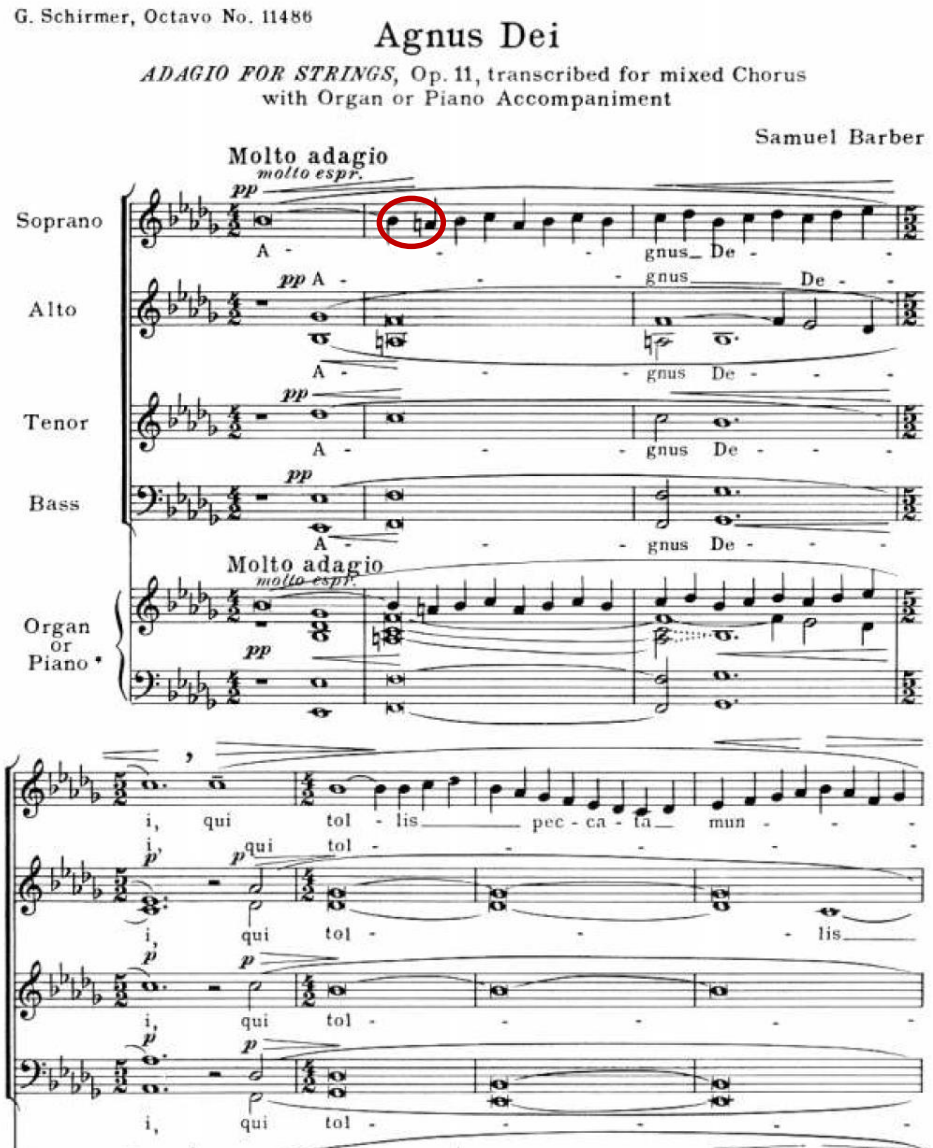
Audio file (excerpt)



Suspension

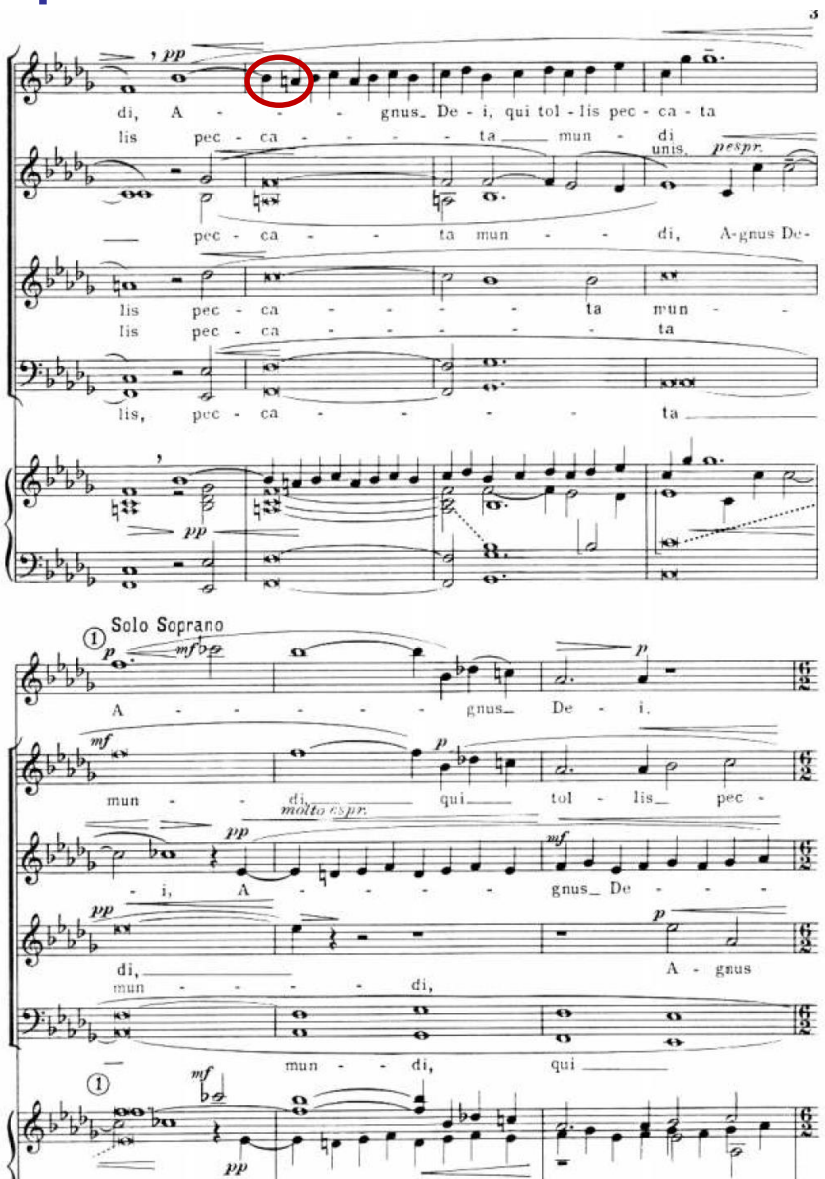
Example:
Agnus Dei
(from Adagio
or Strings)
Samuel Barber

Audio file (performance)



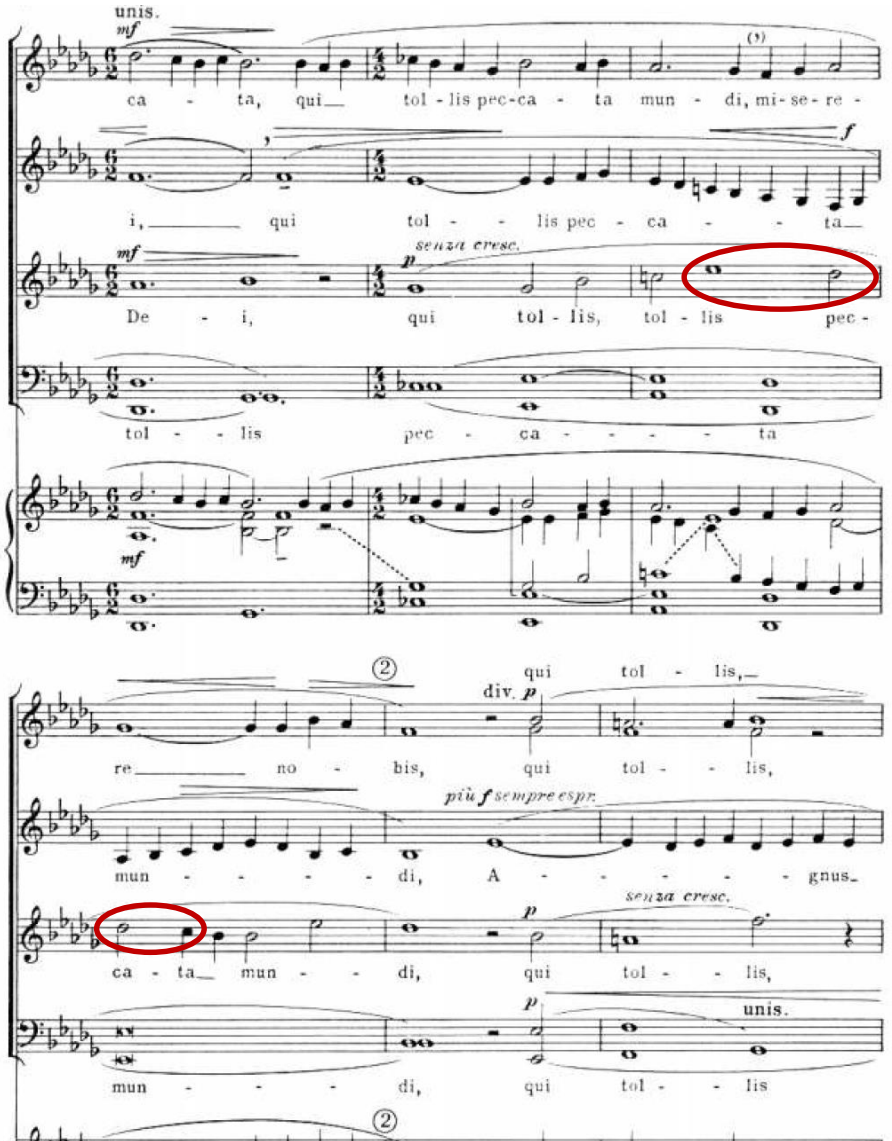
Suspension

Example:
Agnus Dei
(from Adagio
or Strings)
Samuel Barber



Suspension

Example:
Agnus Dei
(from Adagio
or Strings)
Samuel Barber



Temperament

- There is a problem with playing all the keys with only 12 different notes.
  - The harmonic intervals are not exactly right.
- The pitches are adjusted so that every key is slightly out of tune.
  - The errors are the same in every key
  - **This is equal temperament**.

Temperament

Interval	Error
C-D (second)	Slightly flat
C-E (major third)	Sharp
C-F (fourth)	Slightly sharp
C-G (fifth)	Slightly flat
C-A (sixth)	Sharp
C-B (seventh)	Sharp

Alternative Scales

- Are the traditional scales the best choice?
  - They are the **second best** choice!

Alternative Scales

- Are the traditional scales the best choice?
  - They are the **second best** choice!
- The 19-tone chromatic is a better choice.
  - Based on a complete combinatorial search.
  - Provides a larger set of consonant chords.
  - Basis for many interesting scales.

Alternative Scales

- Are the traditional scales the best choice?
  - They are the **second best** choice!
- The 19-tone chromatic is a better choice.
  - Based on a complete combinatorial search.
  - Provides a larger set of consonant chords.
  - Basis for many interesting scales.
- Why didn't someone discover the 19-note chromatic?

Alternative Scales

- Are the traditional scales the best choice?
  - They are the **second best** choice!
- The 19-tone chromatic is a better choice.
  - Based on a complete combinatorial search.
  - Provides a larger set of consonant chords.
  - Basis for many interesting scales.
- Why didn't someone discover the 19-note chromatic?
  - **Someone did!**

Alternative Scales

- Advantages of 19-note chromatic were discovered during the Renaissance.
  - By Spanish organist and music theorist **Francisco de Salinas** (1530-1590).
  - Didn't catch on…

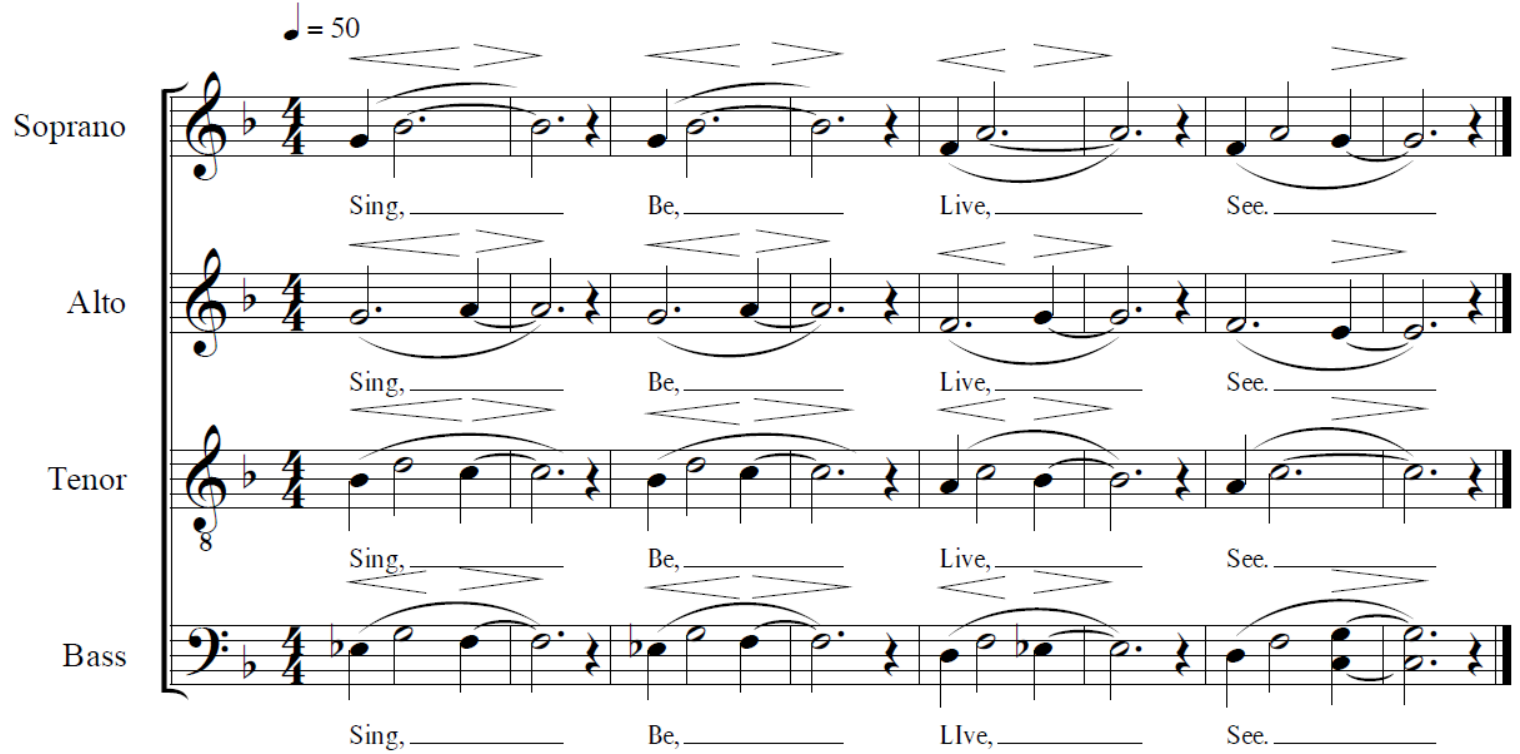
Just Tuning

Example: “Earth Song” for SATB

Frank Ticheli (2006)

Audio file (choral performance)

Audio file (excerpt below)



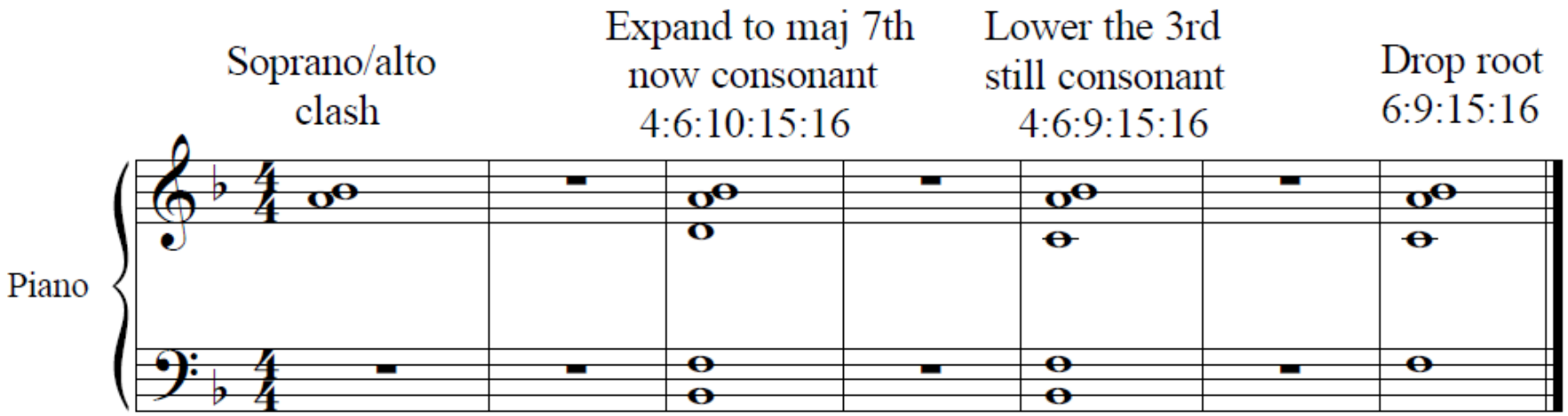
Just Tuning

Example: “Earth Song” for SATB

Frank Ticheli (2006)

Ticheli’s chord

Audio file



- The chord is **consonant** when performed with just tuning.
- Also, the A-B*b* clash produces a **beat note** that is exactly 2 octaves below the root Bb.

Just Tuning

Example: “Alleluia” for SATB
Randall Thompson (1940)

Audio file

- Entire text consists of 2 words from Hebrew – *Alleluia, Amen*
- Performed by Octarium.
- Written for opening of Berkshire Music Center (Tanglewood)
- An example of how beautiful harmonious voices can be.
- Note major 6th chords (3 different inversions) just after climax (4:54, 5:08, 5:18)

Ozawa Hall, Tanglewood