Melody & Harmony: combinations and sequences of pitches unfolding in time
Melody (Wikipedia)

In **music**, a **melody** (from **Greek** μελῳδία - *melōidía*, "singing, chanting"[1]), also **tune**, **voice**, or **line**, is a **linear** succession of musical tones which is perceived as a single entity. In its most literal sense a melody is a sequence of **pitches** and **durations**, while more figuratively the term has occasionally been extended to include successions of other musical elements such as tone color.
Melody: note sequences unfolding over time

- Melody: sequences of sounds, vertical dim.
- Tonality: relating to a tonic (pitch)
- Existence region: tone durations
- Intervals vs. contour vs. absolute pitch vs. scale
- Tonal vs. atonal sequences
- Invariance over key transpositions
- Multiple melodic lines: polyphony
- Hierarchical structure: phrases
- Repetition & change
- Formation of expectation & its violation
- Melodic memory
- Musical preferences: personality, style

Ivor Cutler “Go and sit upon the grass”
Style analysis (La Rue, Guidelines for Style Analysis)

• Sound (texture)
  – timbre, combination, contrast
  – range, gaps, special effects, idiom

• Harmony (functions: color & tension)
  – tonal structure: linear & modal, unified, polycentric, atonal, serial, etc
  – Movement relationships: progressions, modulations
  – Part exchange, counterpoint, imitation

• Melody
  Range, mode, vocal/instrumental
  Motion: stepwise, skipping, leaping, chromatic, active/stable, articulated/continuous
  Patterns: rising, falling, sawtooth, undulating, etc.
  Peaks and lows
Style analysis, cont. (La Rue)

• **Rhythm**
  – Surface rhythm, vocabulary & frequency of patterns
  – Meter, tempo, module (fraction, pulse, motive, phrase, sentence, larger groupings)
  – Patterns of change: stress, lull, transition
  – Fabrics: homorhythmic, polyrhythmic, variant rhythmic density

• **Growth**
  – systematic movements in musical dimensions, tempos, dynamics, meters, etc
  – Movement: structural/ornamental

• **Text influence (lyrics, lyric functions)**
• Don’t Fence Me In (Cole Porter)

  Fred Hersch

  Willy Nelson/Leon Russell

  Greatest Cowboy Songs

  Louie Armstrong

  David Byrne
Composing melodies

Melody first: Note trajectories
Key: From a set of notes in a scale
Phrases & phrase structure
  (pattern, similarity/proximity, timing)
Chords first: From chord progressions
Melody is said to result where there are interacting patterns of changing events occurring in time.\[1\] Change is necessary for events "to be understood as related or unrelated." Melodies often consist of one or more musical phrases, motifs, and are usually repeated throughout a song or piece in various forms.

Melodies may also be described by their melodic motion or the pitches or the intervals between pitches..., pitch range, tension and release, continuity and coherence, cadence, and shape. "Many extant explanations [of melody] confine us [sic] to specific stylistic models, and they are too exclusive."\[1\]
Establishment of the tonic (tonal system, tonality induction)

- 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?
Tonal hierarchy of notes within the key of C

Ranking: similarity to the tonic

Notion of distance from tonic in pitch-similarity space

Melody as trajectory away from and toward the tonic and/or other points in space

Figure by MIT OpenCourseWare.
Music Animation Machine
HARMONIC COMPASS

Figure by MIT OpenCourseWare.

Courtesy of Stephen Malinowski. Used with permission.
Tonal system

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

from Bigand chapter

For Melody
Tonic
Dominant
Third
Other degrees

For Harmony
I
V
IV
VI
II
III
VII

Figure by MIT OpenCourseWare.
For Melody

Tonic
Dominant
Third
Other degrees

Figure by MIT OpenCourseWare.
What makes a melody a recognizable pattern?

What is the representational essence of melody such that it can be recognized

1) if notes are transposed (all shifted by the same frequency ratio)?
2) if notes are played faster or slower (tempo invariant)

is it contour?: up/down changes in pitch
does it depend on musical intervals?: as relative distances in pitch space
absolute pitches?: note
scale position?: re tonic
Melody

What is the representational essence of melody such that it can be recognized under note deletions and transformation?

tempo invariant

contour : up/down
interval: rel. pitch dist.
absolute pitch: note
scale position: re tonic

Figure 10.14
Properties of melodic sequences. Passages can be characterized in terms of the melodic contour, the size of the interval, the actual note, and the position of that note within the key. The first six notes of “Three Blind Mice” are shown in (a). A transformation that maintains the identical contour (______) while altering the interval, note, and scale position is shown in (b). A transformation that does not maintain the identical contour is shown in (c).

Courtesy of MIT Press. Used with permission. Source: Handel, S.
Melody:

contour
interval
note
scale position

Figure 10.14
Properties of melodic sequences. Passages can be characterized in terms of the melodic contour, the size of the interval, the actual note, and the position of that note within the key. The first six notes of “Three Blind Mice” are shown in (a). A transformation that maintains the identical contour (---+) while altering the interval, note, and scale position is shown in (b). A transformation that does not maintain the identical contour is shown in (c).

Courtesy of MIT Press. Used with permission.
Melody and Note Durations

Too short: Weak Pitches

Too long: Lack of interaction between pitches

From *Thinking in Sound* McAdams, Bigand eds.
What makes a "good" or memorable melody?

Coherence of pattern

Balance between order & chaos (surprise)

U-shaped preference curve

Related physiological assumptions:

Relations (Gestaltists) ~ correlation-based representations

vs.

Local features (associationists)

Atomistic feature detectors, machine vision
Tension-relaxation
Implication-realization (implication-expectation)
(from Meyer, 1956, Emotion & Meaning in music)
cf. Namour's application to melody
Distance from tonic, patterns of stress and relaxation

A Primer of Visual Literacy
Donis Dondis, MIT Press, 1973
Gestaltist principles
Relations rather than perceptual atoms
Intervals (relations between notes, re: tonic) as relations
Notion of strong vs. weak organization

Principles of simplicity, similarity, proximity, inclusiveness, common fate, closure
Gestalt principles (Jay Dowling, in Aiello)

Figure by MIT OpenCourseWare.
Figure 10.13
Identification of notes within tonal and atonal contexts. On each trial, subjects were presented the standard (S), a short eight-note passage, and then one of the three possible comparison notes (C). The comparison was either the same as the standard (a correct match) or was one semitone higher or lower (an incorrect match). The four variations of the standard note (diatonic vs. nondiatonic) and interpolated passage (tonal vs. atonal) are illustrated in (a)–(d). In addition, the three possible comparison stimuli are displayed (adapted from Krumhansl 1979).
Strong vs. weak organization

Patterns Illustrating Gestalt Organization

Courtesy of MIT Press. Used with permission.
Figure 3.3
Melodic and rhythmic grouping.

Source: Synder, B. *Music and Memory.*
Courtesy of MIT Press. Used with permission.
Congruence of temporal proximity and melodic leap.

Conflict between temporal proximity and melodic leap. (Proximity dominates.)

Figure 3.2
Conflict of grouping forces.

Courtesy of MIT Press. Used with permission.
Deep structure of melodies

Even if the surface structure is altered quite a bit (as is common in jazz or any variations on a theme), the melody is recognizable. Part of this may be the result of chord progressions, and aspect of the deep intervallic harmonic and melodic structure.

Schenker pioneered a method of reducing a melody to its essentials, stripping off successive layers of ornament.
Schenkarian time-span reduction of melody (Lerdahl)

Images removed due to copyright restrictions.
Schenkarian time-span reduction of melody (Lerdahl)

Images removed due to copyright restrictions.
Fig. 1.3 in Lerdahl, F. *Tonal Pitch Space*.
Preview in Google Books.
Chord progression &
harmonic groupings

Image removed due to copyright restrictions.
See Fig. 8.2 in Bigand, E., and S. McAdams. 
Tonality and harmony

- Harmony: concurrent sounds, vertical dim.
- Tonality: relating to a tonic (pitch center, “home”)
- 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
- Harmonic tension-relaxation dynamics:
  - pitch stability (multiplicity of alt. organizations)
  - movement to & away from tonic (confirmation of 1 pitch framework)
Triads: 3-note chords made up of thirds
Major: root + major third + fifth
Minor: root + minor third + fifth

Image removed due to copyright restrictions.
Chord notation: scale degrees

Chords are also distinguished and notated by the scale degree of their root note or bass note. For example, since the first scale degree of the C major scale is the note C, a triad built on top of the note C would be called the one chord, which might be notated 1, I, or even C, in which case the assumption would be made that the key signature of the particular piece of music in question would indicate to the musician what function a C major triad was fulfilling, and that any special role of the chord outside of its normal diatonic function would be inferred from the context.

Roman numerals indicate the root of the chord as a scale degree within a particular key as follows:
I tonic
ii supertonic
iii mediant
IV subdominant
V dominant
vi submediant
vii subtonic/leading tone

Many analysts use lower-case Roman numerals to indicate minor triads and upper-case for major ones, with degree and plus signs (♭ and ‡) to indicate diminished and augmented triads, respectively.
Probe-melody studies

Listeners can use both contour (pitch height, pitch direction changes) and the interval/scale degree structure for melodic recognition.

For well-formed coherent easily remembered melodic patterns, (STRONG PATTERNS) interval alterations are highly noticable.

For ill-formed, hard-to-remember melodies (WEAK PATTERNS), contour is used more for
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

How much of the structure of tonal pitch space – perceptual distances between notes and keys and between keys and other keys – falls out of the structure of basic auditory representations?

How much of it is acquired through associative learning (culture) of pitch combinations?
Note-chord

Krumhansl probe tone study

Correlations of simulated PIDs
Probe tone profiles for related keys

Context effects: relatedness of chords within & across keys

Figure 1. Multidimensional scaling solutions of fourteen chords—seven from the key of C major and seven from the key of F# major. All ordered pairs of chords were judged (a) with no context (top), (b) in a C major context (left), and (c) in an F# major context (right). Chords separate according to key membership. A tonal context shrinks distances between chords in the context key, and stretches distances between chords out of the context key.

Similarity relations between chords in the key of C

Images removed due to copyright restrictions.
See Figs. 1 and 4 in Leman, M. and F. Carreras.
"Schema and Gestalt: Testing the Hypothesis of Psychoneural Isomorphism by Computer Simulation."
Chord progressions, "cadences"

sequences of chords

tension & relaxation
instability-stability

One of the self-conscious aims of 20th c. “atonal” music (e.g. Schoenberg) is the avoidance of tonal centers and expectations

http://www.musictheory.net/load.php?id=55

Courtesy of MIT Press. Used with permission.
Common progressions

"The most common chord progressions, in the common practice period and in popular music, are based on the first, fourth, and fifth scale degrees (tonic, subdominant and dominant); see three chord song, eight bar blues, and twelve bar blues.

The chord based on the second scale degree is used in the most common chord progression in Jazz, II-V-I.

The circle of fifths progression is generally regarded as the most common progression of the common practice period (1600-1900), involving a series of descending perfect fifths that often occur as ascending perfect fourths. The circle of fifths makes up many of the most commonly used progressions, such as II6, V, I in major."

-- Wikipedia
Common progressions used in contemporary popular music

- **Twelve-bar blues** - I - vi - IV - V

- **50s progression** - I - V - vi - IV

For example, 'Dammit' (Blink-182), 'With or Without You' (U2), 'Let It Be' (The Beatles). This progression uses the same chords as the 50s progression, in a different order.

- I - I - IV - V

  For example the verse of 'Good Riddance (Time of Your Life)' by Green Day.
Three chord song

A three-chord song is a song whose music is built around three chords that are played in a certain sequence. Perhaps the most prevalent type of three-chord song is the simple twelve bar blues used in blues and rock and roll.

Typically, the three chords used are the chords on the tonic, subdominant, and dominant (scale degrees I, IV and V): in the key of C, these would be the C, F and G chords. Sometimes the V7 chord is used instead of V, for greater tension.

Three-chord songs are easy for the listener to remember, which can make them effective in pop music. Some of the most famous songs to use three-chord patterns are "Louie Louie" by The Kingsmen and "Wild Thing" by The Troggs. Three-chord songs like these are also easier to learn than other, more complicated songs. Among others, country singer Hank Williams and folk singer Bob Dylan have written large numbers of such songs. Denis Leary's song "Asshole" uses a three chord progression. Punk music very often features three-chord songs - sometimes called a 'three chord trash' (cf. The Ramones)."
Common progressions used in the **common practice period** (roughly 1600-1900)

I, i May progress to any other triad. May interrupt any progression.

<table>
<thead>
<tr>
<th>Major keys</th>
<th>Minor keys</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>ii-V, ii-vii6°</td>
</tr>
<tr>
<td>iii-iI6</td>
<td>iii-Iv, iii-V, iii-vi</td>
</tr>
<tr>
<td>IV</td>
<td>IV-I, IV-Iv, IV-V, IV-vii6°</td>
</tr>
<tr>
<td>V</td>
<td>V-I, V-vi</td>
</tr>
<tr>
<td>vi</td>
<td>vi-Iv, vi-V, vi-iii-Iv</td>
</tr>
<tr>
<td>vii6°</td>
<td>vii6</td>
</tr>
</tbody>
</table>

* ii and IV in minor used with an ascending #6; v in minor used with a descending 7.

See Chord (music)#Quality and Triads for a brief explanation of the notation used in this table.
"In music, modulation is most commonly the act or process of changing from one key (tonic, or tonal center) to another. This may or may not be accompanied by a change in key signature. Modulations articulate or create the structure or form of many pieces, as well as add interest.

There are several different types of modulation -- (these) modulations may be prepared or unprepared, smooth or abrupt. It is smoother to modulate to more closely related keys than to keys further away. Closeness is determined by the number of notes in common between keys, which provides more possible pivot chords, and their closeness on the circle of fifths. A modulation is often completed by a cadence in the new key, which helps to establish it. Brief modulations are often considered tonicizations."

-- Wikipedia, music modulation.

Types of modulation (different ways of bridging the transition): common chord, common tone, chromatic, enharmonic, phrase (direct, abrupt, “truck driver’s gear change”, sequential.
Music Animation Machine (Triads, LATTICE)

Courtesy of Stephen Malinowski. Used with permission.
Tonal hierarchy of chords. The tree diagram indicates the relative hierarchical importance among the chord degrees. The horizontal arrows show the conventional listener interpretation of tension (T) and release (R).

Figure by MIT OpenCourseWare.
Hierarchies of organization

Qualities - similarity relations
• Tonal hierarchies
  – Proximity to tonic (key, scale-relations)
• Chord hierarchies
  – Proximity to major or minor triad

Events grouped in time
• Melodic hierarchies (time)
  – Phrases, themes
• Rhythmic hierarchies
• Harmonic movements -
Tonal system

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

Alphabet = 12 pitches of chromatic scale
C  C#  D  D#  E  F  F#  G  G#  A  A#  B

Scales = subgroups of 7 pitches

24 Scales: 12 Major + 12 Minor

Intra-key hierarchies
Inter-key hierarchies

For Melody
Tonic
Dominant
Third
Other degrees

For Harmony
I
V
IV
VI
II
III
VII

Circle of fifths

Figure by MIT OpenCourseWare.
Chord Hierarchies

Distance relations

Greater distance from tonic creates greater tension
Smaller distance resolves tension


Tonal hierarchies: trees, nestings, and neighborhoods

Tonal hierarchy of chords. The tree diagram indicates the relative hierarchical importance among the chord degrees. The horizontal arrows show the conventional listener interpretation of tension (T) and release (R).

Tonal hierarchy of chords. The tree diagram indicates the relative hierarchical importance among the chord degrees. The horizontal arrows show the conventional listener interpretation of tension (T) and release (R).

Figure by MIT OpenCourseWare.
Katz (in Musical Networks)

Attempt to develop computer models that behave in a manner like human listeners in their evaluation of melodies

Key relations through bottom-up and top-down associations

Connectionist nets
