



Music and the Mind

*Patrick Whelan MD PhD
Massachusetts General Hospital
and Harvard Medical School*

Course expectations

- 50% Assignments – all 2-page double-spaced papers on selected topics
 - Excellence in writing. Aim for perfection (spelling, grammar).
 - Reading scientific/medical literature critically
 - Due at 5pm Eastern Time on alternate Sundays, starting Feb 4
- 20% Midterm and 30% Final Exam
- Class Participation provides extra credit – whether in real time on Mondays, or in sections, or in correspondence with me/TFs, or in our YellowDig online forum (can only help you)
- For grad students, 40% of the grade will derive from an individual research project, due Sunday April 28. The 2p papers (30%), final (20%), and midterm (10%) will constitute the rest.

Student Expectations

Students are expected to conduct themselves responsibly, honestly, and with due consideration for others when engaging online.

Students should avoid doing the following during online class sessions:

- Driving, walking, or riding on public transportation
- Texting or talking on the phone
- Using inappropriate and/or harassing speech
- Using the chat feature for side and unrelated conversations

*deanofstudents.extension.
harvard.edu*



Contact:

Patrick Whelan MD PhD

jpatrickwhelan@mgh.harvard.edu

617-726-9381



Daniella Devarney

UCLA undergrad, doctoral student
Professional dancer and yoga/wellness teacher
ddevarney@gmail.com



Luis Vielma Jr

Teaches anatomy, physiology & microbiology
lhv314@g.harvard.edu



Sophia Penkrat

Writer, historian
sophie.penkrat@gmail.com

Heerraa Ravindran

Award-winning international
singer-songwriter, Co-founder of
Ascendance (youth organization),
Harvard Undergrad
her931@g.harvard.edu



Patrick Whelan MD PhD

- Lecturer in Pediatrics, *Harvard Medical School*
- Associate Physician, *MassGeneral Hospital for Children*
- Associate Clinical Professor of Pediatrics, *Geffen School of Medicine, UCLA*
- Clinical Assistant Prof., Dept of Molecular Microbiology & Immunology, *Keck School of Medicine at USC*
- Pre-med tutor, Harvard's Lowell House, since 1997

Patrick Whelan



Harvard Glee Club



Lowell House Opera

feel at home in opera



Harvard University Choir



Music in the news

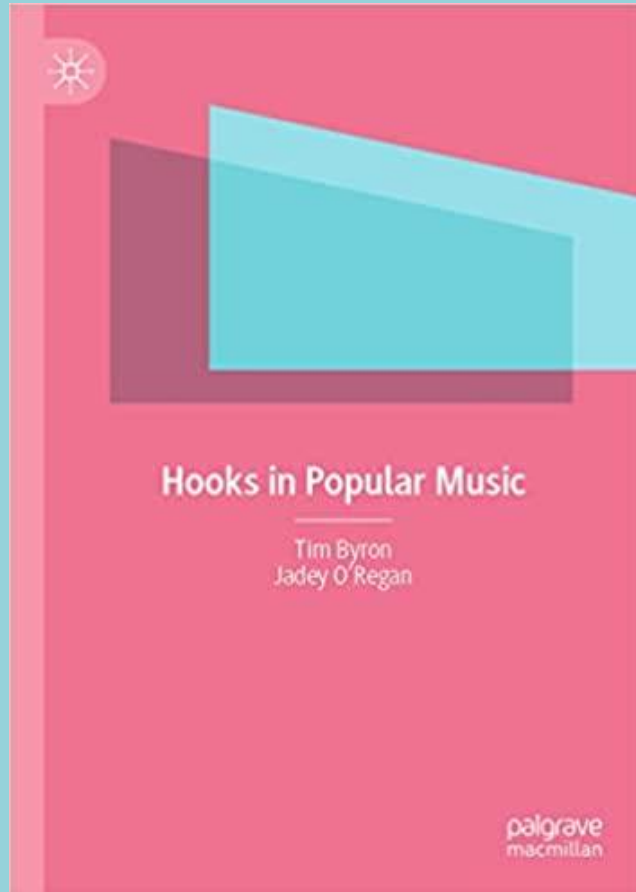
Key Facts:


- 1. Longitudinal Analysis of 40 Years of Music Lyrics:** The study conducted a comprehensive analysis of the top 40 songs from Billboard's Year-End Hot 100 single charts for every five years between 1971 and 2011. This approach, encompassing 360 songs over four decades, allowed for a longitudinal examination of changes in the prevalence and interrelation of lust and love themes in popular music lyrics.
- 2. Shift from Love to Lust Themes:** The study found a significant trend over time: a decrease in the proportion of songs with themes of romantic love and a combination of love and lust. In contrast, there was a notable increase in the proportion of songs focusing on themes of lust in the absence of love. This trend indicates a cultural shift in the portrayal and acceptance of sexuality outside traditional romantic relationships.
- 3. Genre-Specific Trends and Broader Implications:** The themes of lust in the absence of love were particularly prevalent in the hip-hop/rap genre. However, the changes in themes were not solely attributable to music genre, suggesting a broader cultural shift. The study also highlights the potential influence of these lyrical themes on the sexual attitudes and behaviors of young listeners, considering the significant role of music as a source of sexual information for adolescents and young adults.

Source: Neuroscience News



Music in the news





Neuroscience ▾ Neurology ▾ Psychology ▾ AI ▾ Robotics Genetics Neurotech ▾ About ▾

Home > Neuroscience > Auditory Neuroscience

Hooks and Earworms: What Makes Pop Songs So Catchy?

Auditory Neuroscience Featured Neuroscience Psychology · January 22, 2023

Summary: Researchers explore why some songs constantly get stuck in our heads and why these "hooks" are the guiding principle for modern popular music.


Source: University of Wollongong

"Hey, I just met you, and this is crazy... But here's my number, so call me, maybe."


These wise and catchy words are those of Canadian singer-songwriter Carly Rae Jepsen from her 2012 hit "Call Me Maybe." The song topped the music charts across the world, including in the United States, Canada and Australia.

But what was it about that song that made it so popular? Why, 10 years later, is it still so memorable? What makes any song stand out and be easily remembered?


Recent Neuroscience Research



In the Wake of a Wildfire, Embers of Change in Cognition and Brain Function Linger



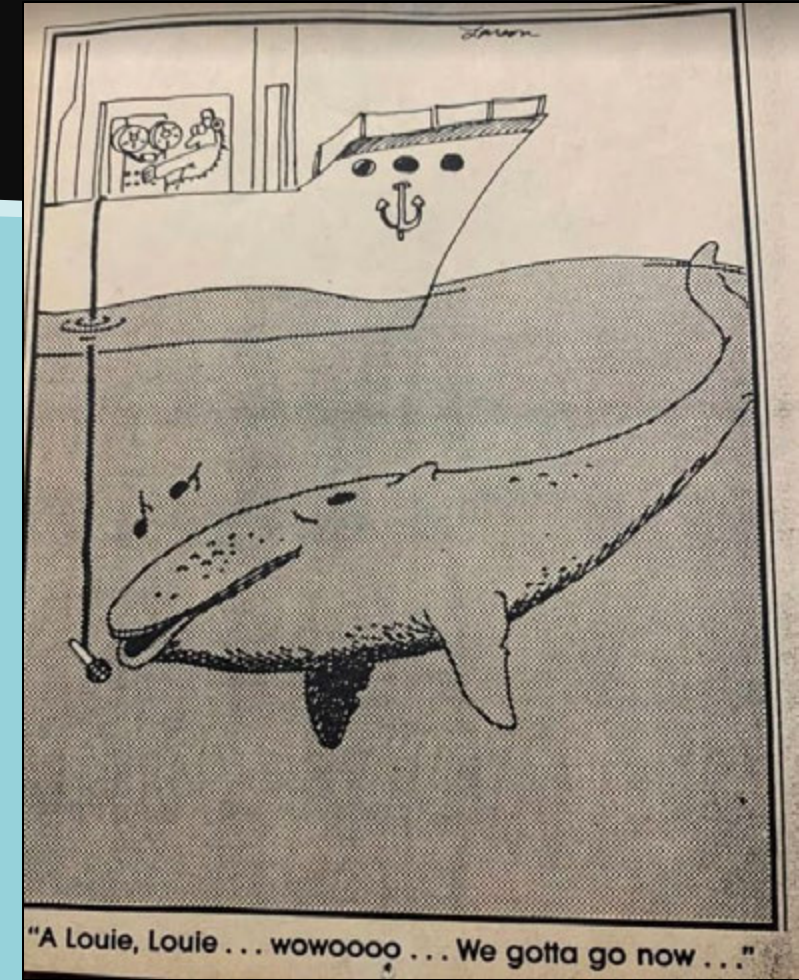
Wearable Tech and AI Combine to Track Progression of Movement Disorders



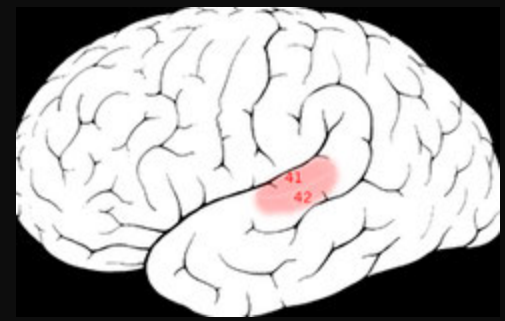
Hooks and Earworms: What Makes Pop Songs So Catchy?

The Great Questions

- Why do many people have music running through their brains all the time – “involuntary music”?
 - OCD predisposes to involuntary music, but virtually all humans experience bouts of obsessive music every week
 - Recently heard, familiarity, greater “singability”
- What role does music/rhythm play in brain function (“beat-based rhythmic processing”)?
- What can the relationship between music and neurologic diseases teach us about the brain?



The Great Questions: Musical Memory



- **How many songs/melodies are stored in our brains?**
 - Human memory estimated at 2.5 petabytes (a million gigabytes)
 - Memory is not non-specific (recalling everything): selective memory for faces and sounds
 - Short-term memory is more limited (like RAM)
 - “Muscle memory” (implicit memory) plays a part
 - Ties to emotion also play a big part
 - In dementia, music accesses brain areas through a back door to higher function
- **Why did we evolve the capacity to remember so many tunes, and in such detail?**

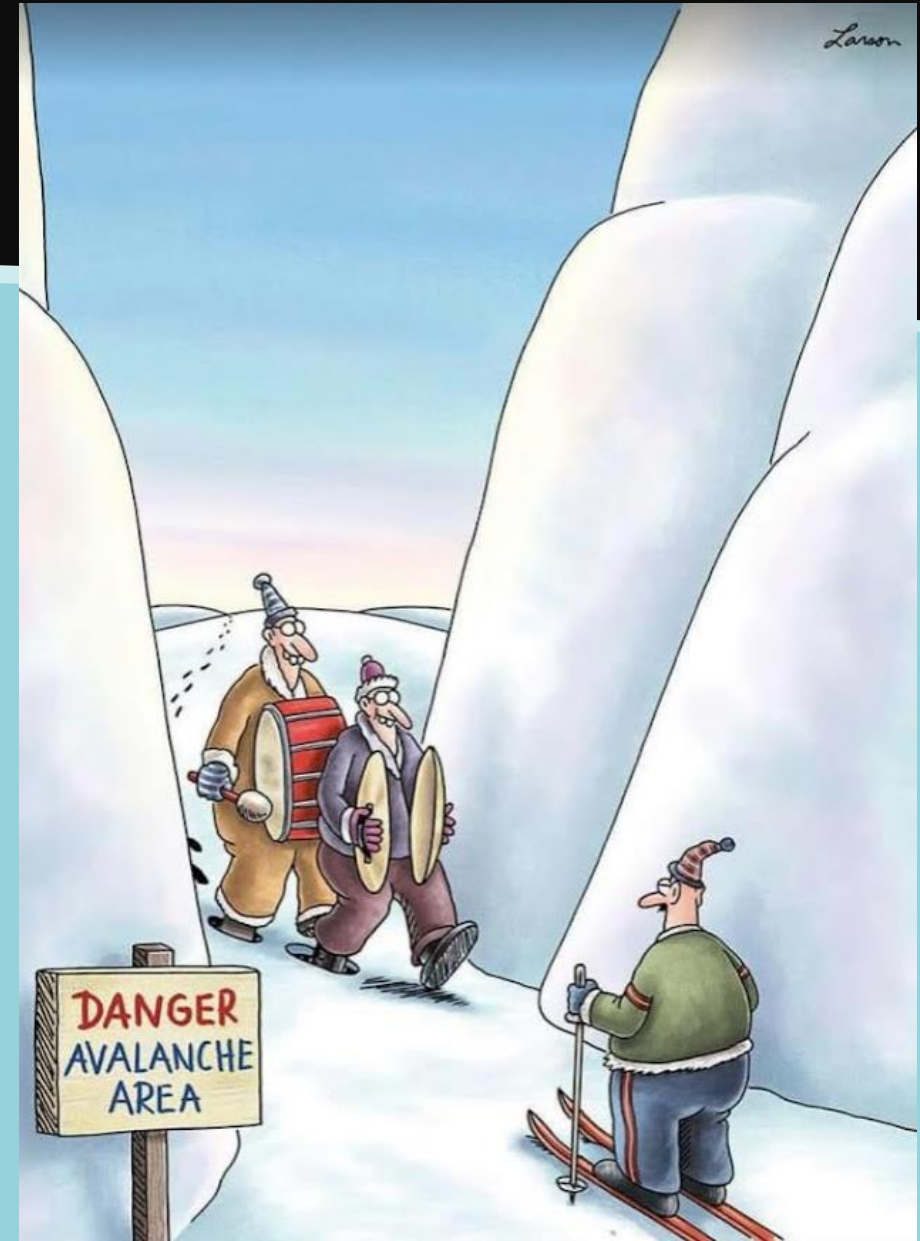
The Great Questions: Music and Language

- What is the relationship between music and language?
- Is there a universal musical grammar, akin to the innate capacity for language? (ala Noam Chomsky)
- Relationship between music and speech?
- Is the music sense an evolved capacity in humans?

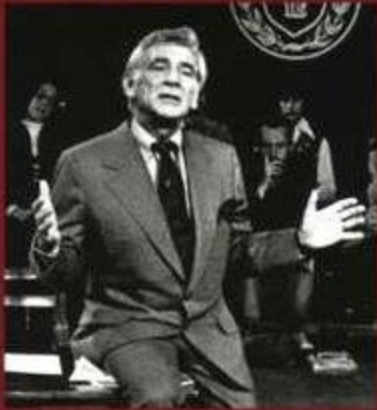
The Essential Question

What is the evolutionary origin of human musicality?

- If music is not an evolutionary adaptation, why is it universal?
- What does music awareness/capability in other primates tell us about its evolution?
- What other examples are there of “music” evolution in the natural world?



THE
UNANSWERED
QUESTION



SIX TALKS AT HARVARD BY
LEONARD BERNSTEIN

<https://www.youtube.com/watch?v=8fHi36dvTdE&t=200s>



“The Unanswered Question”

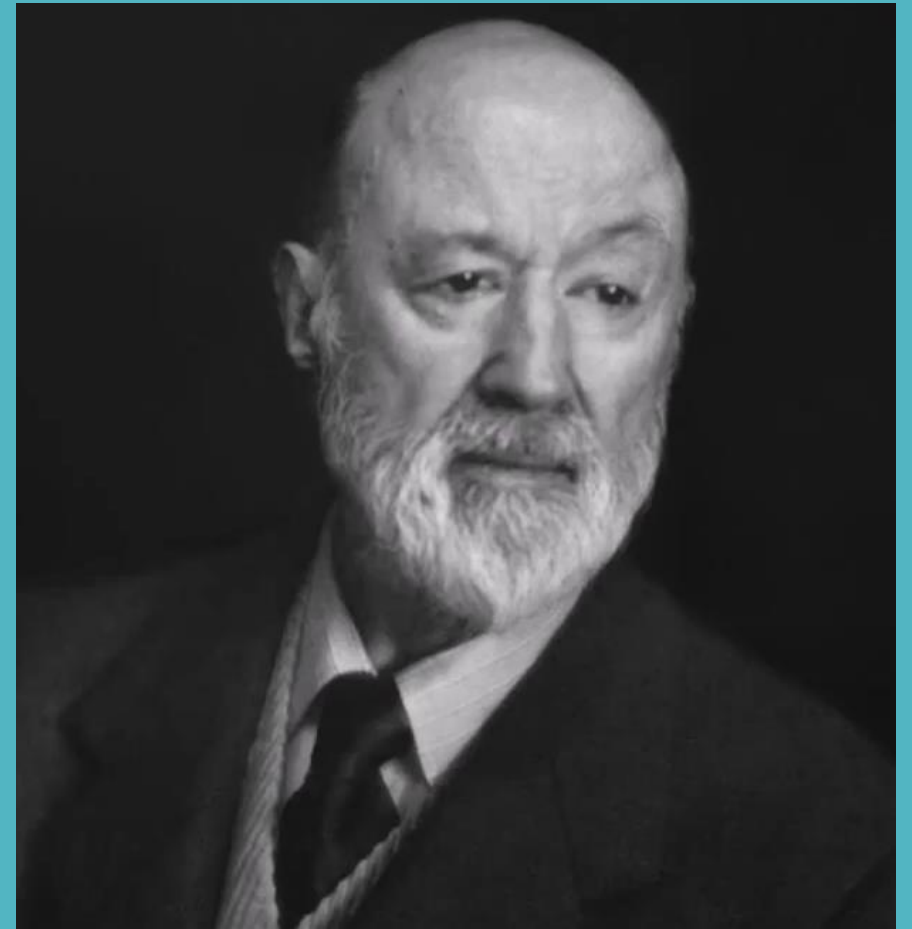
Charles Edward Ives (Oct 20, 1874 – May 19, 1954)



Charles Ives

- His father, George, was 16 at the start of the Civil War – but became a US Army band leader – prominent in the abolition movement in Danbury CT
- He played drums in the band of his father, who taught him music theory,
- Church organist at 14, writing hymns
- Captain of his high school baseball team, but his father died that year at age 49
- Music student at Yale
- Wrote a campaign song for William McKinley (1896)
- Varsity football team: his coach remarked it was “a crying shame” that he spent so much time at music at the expense of his athletics
- Ives’ Symphony #1 was his senior thesis

- Two contemplations
 - *A Contemplation of Nothing Serious or Central Park in the Dark in "The Good Old Summer Time"*
 - Scored for a player piano, a grand piano, and small orchestra
 - *A Contemplation of a Serious Matter or The Unanswered Perennial Question*
 - A chorus of strings plays a long motif of slow tonal triads from offstage: "The silence of the Druids – who know, see and hear nothing"
 - A solo trumpet poses "The Perennial Question of Existence"
 - A flute quartet of "Fighting Answerers" responds. They "realize a futility and begin to mock The Question, only to give up eventually"
 - He had in mind that each instrument cluster would play independent tempos, and may require separate conductors
 - At the end of the piece, the strings "hum softly in the distance, like the eternal music of the spheres."
 - The premiere was at Columbia Univ., May 11, 1946



A handwritten signature of Charles Ives in white ink on a black background. The signature is written in a cursive, flowing style and reads "Charles Ives".



The Unanswered Question

Elliott Carter *knew of the two works, and asked Ives' permission to perform a premier at Columbia – by a group of students from Juilliard in May 1946*

Aaron Copland, *a mentor to Leonard Bernstein, often conducted the piece and considered Ives to be one of the greatest American artists*

Leonard Bernstein in Massachusetts

- Born in Lawrence
- Graduate of Boston Latin School (1935)
- Harvard Class of '39, majoring in music
- Senior thesis on “The Absorption of Race Elements into American Music”; student of Walter Piston
- Met Aaron Copland by chance at a dance performance sophomore year
- Studied with Serge Koussevitzky at Tanglewood, summer 1940, and became his assistant
- Attended the Curtis Institute of Music in Philadelphia– piano, composition, conducting



On to New York

- Appointed assistant conductor to Artur Rodzinski of the NY Philharmonic 1943 (age 25)
- Conducting debut Nov 14, 1943, as substitute for Bruno Walter (who came down with flu) for a nationally-broadcast concert – with no rehearsal. Program of [Robert Schumann](#), [Miklós Rózsa](#), [Richard Wagner](#), and [Richard Strauss](#)
- New medium of television: Young People's Concerts
- Appointed conductor of the Philharmonic 1958





Leonard Bernstein – music
Arthur Laurents – book
Stephen Sondheim – lyrics
Jerome Robbins – choreography

- In 1949, Robbins proposed doing a musical version of “Romeo and Juliet”
- Contemporary slums on the Lower East Side, Jewish vs Italian Catholic gangs at Passover and Easter (Maria was Italian) – tritone motif

•

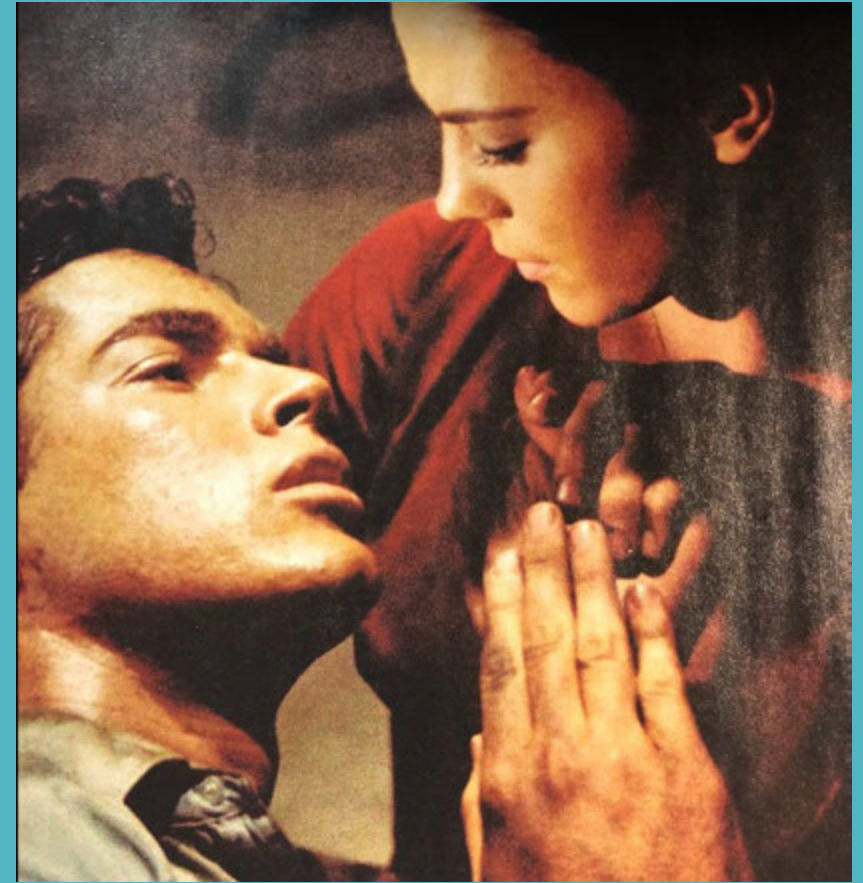


- Bernstein: “I had conceived an idea for a ballet when I was in Key West in 1941. I was crazy about Cuban music.” Also in that ballet was a tune that became “*America*.”
- They cut “a song introducing the Jets called *Mix*, a sort of militant, aggressive song that nobody could understand a word of because it was too fast and instrumental. That song wound up in *The Chichester Psalms* in Hebrew.”
- Laurents introduced Lenny to a young songwriter named Stephen Sondheim



- A few days before the opening, The NY Times recounted how the creators had held “one of the most notable casting marathons of modern theater,” an eight-month, coast-to-coast “dragnet” that scoured settlement houses, high schools, ballet companies, and college choirs
- Only two Puerto Ricans made the cut, including Chita Rivera (Anita)
- West Side Story opened on Broadway in 1957
- Tony Award nominee (Best Musical)

- Film released in 1961; Academy Award for Best Picture
- Marni Nixon, dubbing the singing of Maria, was completely left out of the credits
- Arthur Laurents managed a Broadway revival. In a 2011 interview, he described a Disney proposal for an animated version of “West Side Story” with ... cats? “Someplace I have a seven-minute reel that they made with white cats and black cats,” he said. “I remember the Maria cat came down the rope of a steamer illegally into the country. In the end I remember the Tony cat got run over. You can’t believe how terrible it was.”





“Leonard Bernstein was a charisma bomb from the moment he first seized the podium of the New York Philharmonic in 1943, subsequently diffusing his radioactive talent through the theaters of Broadway, the concert halls of Europe, the state occasions of Kennedys, the walls of the Ivy League, the treetops of Tanglewood and now, in what would be his centennial year, the endless purgatory of [YouTube](#).”

Alexandra Jacob, NYT review (2018) of Jamie Bernstein's book

“Phonology” is the study of the distribution and patterning of speech sounds in a language and of the rules governing pronunciation

- Bernstein borrowed this linguistic term and proceeded to develop what he called a theory of “musical phonology”
- Single common origin for all languages
- Introduces the idea of Noam Chomsky’s “innate grammatical competence” and postulates waysthe theory can be applied to music



Bernstein Lecture #1:

Musical Phonology

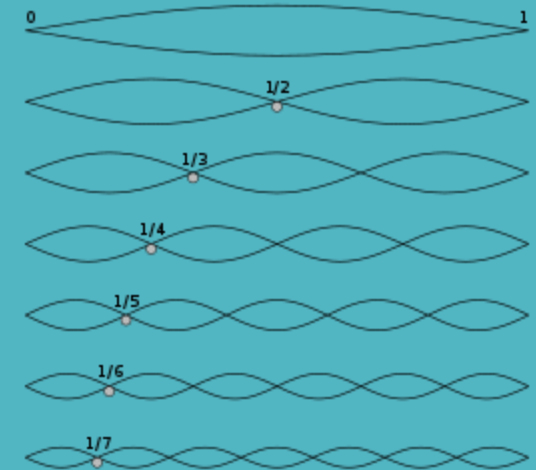
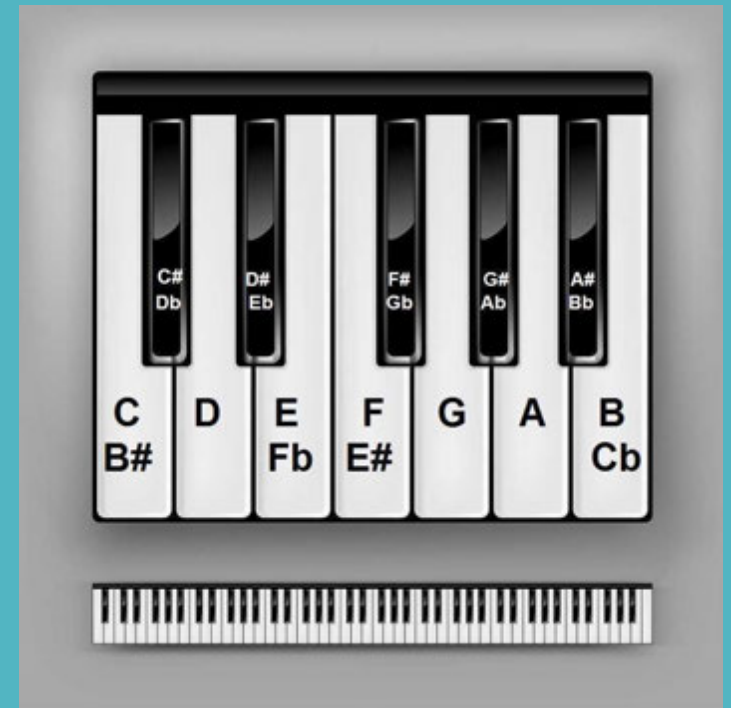
Lecture 1, Harvard Square Cinema, 9 Oct 1973

Set out to explore the aesthetic and metaphysical mysteries of music and creativity. Sitting at the piano, he presented a discussion of the overtone series, and the physics of musical expression. He introduced the idea of musical- linguistic analogues, and referred to linguistics as “mankind's newest key to self-awareness.”

Musical harmonics represent a natural tonal order "ruled by universal physical laws" that are characterized by mathematically resonating vibrations. From this stable tonal framework emerges the diatonic and chromatic scales that are the basis of Western music. Using these tonal building blocks, limitless musical combinations and modulations can be created.

Paradox of the universality of music, and its diversity: “Remember Montaigne's remark that the most universal quality of man is his diversity.”

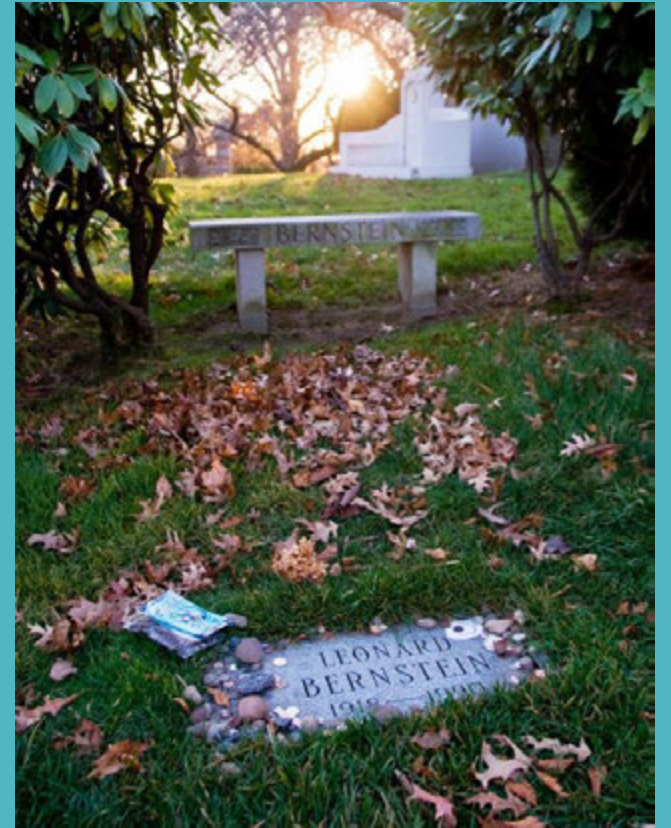
- Pentatonic scales were developed independently by many ancient cultures
- Pythagoras said the notes of the pentatonic scale occur naturally in the world
- Explored the mathematical properties of proportion and symmetry, and the idea of universal harmony
- In 2008 an Ice Age bone flute (40-60k) was discovered in a paleolithic cave in SW Germany. Made from a vulture bone with five holes, tuned to the pentatonic scale.
- *A string produces a sound based on the vibration of the whole string, but also halves, thirds, etc.*
- The scale appears in early Gregorian chant, West Africa, Native American music, Indonesian, Celtic, Chinese, and South American music





Leonard Bernstein

Aug 25, 1918 to Oct 14, 1990



“The Magic of Sound”

I’ve heard the soft whisper of wind in the pine trees,
The silvery ripple of brooklets at play;
I’ve heard the low voice of a sweet singing mother
As she sang to her child at the end of the day.

I’ve heard the faint rustle of sails in the sunset
And blue waves caressing the wild, rockbound shore;
The whistle of trains as they cross the green prairie
And mountains re-echo the cataract’s roar.

The notes of the organs in ancient cathedrals,
Where hearts of the faithful are lifted in song;
I’ve heard the gay laughter as children were playing,
The chatter and buzz of a large, happy throng.

*The earth has its music for those who will listen;
Its bright variations forever abound.
With all of the wonders that God has bequeathed us,
There’s nothing that thrills like the magic of sound.*

Reginald Holmes (1955)

Summary

1. Ralph Waldo Emerson and his devotee, Charles Ives, wrestled with the meaning of life
2. Leonard Bernstein amplified the question to get at the origins of our music sense
3. The brain hears music differently from speech, with ties from the auditory cortex to the primitive areas of the brain
4. Theories abound regarding the evolutionary origins of the music sense
5. What is the relationship between music and human identity?