What's Tonic in a Snare Drum Sonata?

Art Samplaski

Cornell University
Dept. Chemistry &
Chemical Biology (dayjob)

SCSMT 2019
Louisiana State University
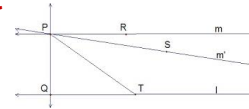**Baton Rouge, LA**

"Lightbulb Moment"

Expansion of Scientia
(= "Whoops, Picture More Complex Than We Thought...")

Ex. 1: Geometry

≤ 19th c., ~~"Geometry" = Euclid's Principles~~ *bzzzt*

"Euclidean Geometry":   **1 parallel line**

"Hyperbolic Geometry":   **∞ parallel lines**
(Lobachevsky/Boylai)
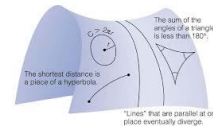
"Elliptical Geometry":   **0 parallel lines**
(Riemann [no relation])
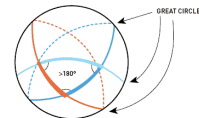
Poincaré: Non-Euclidean geoms.
***logically equivalent* to Euclidean**

Expansion of Scientia
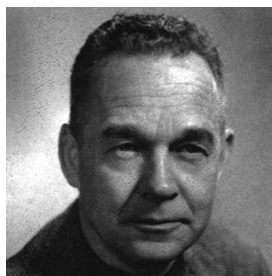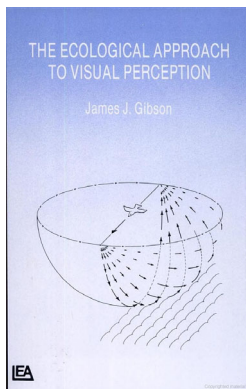### (= "Whoops, More Complex Picture Than We Thought...")

Ex. 2: Astronomy
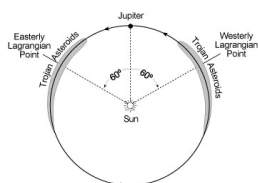
The Basic Solution for Music (almost)
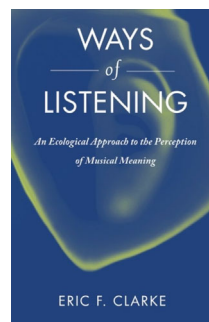
Tovey (1956, 51 [orig. 1944]):

Tonality is the ***element*** which groups a succession of musical sounds intelligibly round some centre.

James J. Gibson
(1904-79)

Ecological Model
Of Cognition

Eric F. Clarke
(1955-)

The ecological approach

"Ask not what's inside your head but what your head is inside of"
James J Gibson

<u>Main point</u>: sensory signals come from real things in the world, and therefore are tightly constrained by the laws of physics. Perceiving is about grasping sensory laws, the "invariant structure" of sensory signals (or sensorimotor laws).

<u>Example, pitch:</u>
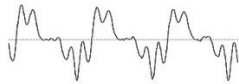
This acoustical wave elicits a pitch percept (musical note)

This other wave elicits the same pitch (same note), but the pattern is different.

However, the structure is the same (=periodicity)

James J Gibson (1979). The ecological approach to visual perception.
JK O'Regan & A. Noë. A sensorimotor account of vision and visual consciousness.

slide by Romain Brette, Ecole Normale Supérieure

Ecological Embeddedness of Perception 101:
The Visual Cliff

(ossia, You Too Can Feel Like Wile E. Coyote)

from EJ Gibson & RD Walk,
***Sci. Amer.* (1960, Apr.) 64-71**

Virtual (i.e., logical) Machines
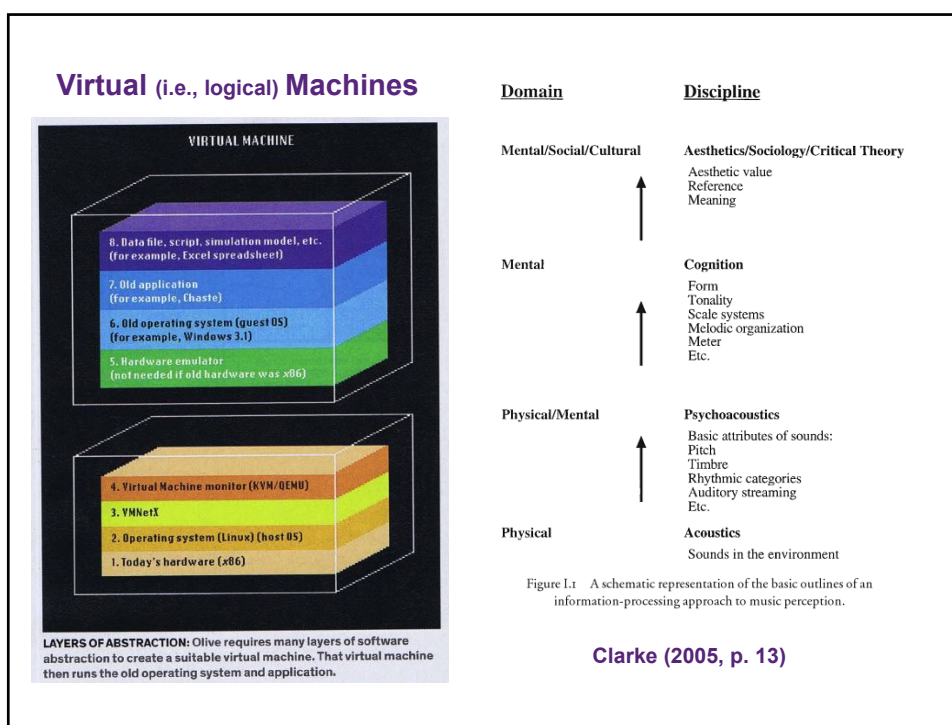

LAYERS OF ABSTRACTION: Olive requires many layers of software abstraction to create a suitable virtual machine. That virtual machine then runs the old operating system and application.

Domain	Discipline
Mental/Social/Cultural	Aesthetics/Sociology/Critical Theory
	Aesthetic value / Reference / Meaning
Mental	Cognition
	Form / Tonality / Scale systems / Melodic organization / Meter / Etc.
Physical/Mental	Psychoacoustics
	Basic attributes of sounds: / Pitch / Timbre / Rhythmic categories / Auditory streaming / Etc.
Physical	Acoustics
	Sounds in the environment

Figure I.1   A schematic representation of the basic outlines of an information-processing approach to music perception.

Clarke (2005, p. 13)

"Information-processing" model of music cognition, simplified from Clarke (2005)

Psycho-cultural layer(s) Aesthetic valuations of musical phenomena
(shimmering quality of *slendro* in Bali;
major/minor triads in Western music; etc.)
Statistical learning experience
(e.g., tonic inference cues)
Style/form/genre preferences
...

Psychoacoustic layer(s) Low level cognitive processes that implement
Gestalt principles, most notably **closure** (tonic)
and good continuation (e.g., linear polyphony)
Acoustic dissonance (*slendro*, ic-1, etc.)
Auditory stream segregation (timbre, etc.)
...

Physical layer(s)   Waveform characteristics
Physiology and biophysics of the auditory system
...

N.B.: non-linear interactions can (and almost certainly do) occur between layers

Different Layers Can Create Possibly Radically Competing Meanings for the Same Phenomenon

"Dissonance" = Two DIFFERENT things

At a psychophysical layer, **SENSORY** Dissonance
- Overlapping responses in inner ear cause signal interference
- Creates sense of "roughness"
- Innate to all humans—end-product of 500+ million years of evolution shaping organisms' auditory systems interacting w. objective external environment

At "psycho-cultural" layer(s), **MUSICAL** Dissonance: variable culturally-developed interpretations

gamelan *slendro* scale:
- Western-trained listeners: tend to think "*waaay* out of tune, dude!"
- Balinese-trained listeners: aesthetically desirable "shimmering" quality

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Tonic: An element (pitch[-class], sonority, timbre, rhythmic pattern, etc.) in a piece (or repertoire) of music that creates a sense of psychological closure, of "having returned to baseline," and against which most or all other like elements (pitches, rhythms, etc.) arrange in some system of functional relations.
        (N.B.: not all other elements need have clear-cut, or even any, functional relations to a tonic.)

Dominant: An element in a piece (or repertoire) of music that creates a sense of being one step away from baseline (tonic) and which generates an expectation of imminent return to tonic.

Tovey corrected:

Tonality: *Any* system of functional relations in a piece (or repertoire) of music which has a(t least one) tonic present.
    Corollary: Classical Tonality—the particular system of tonality used in European
                music during ca. 1630–1830.

"But This Will Cause Semantic Chaos!!"

(won't it?)

No.

In computer programming since ALGOL 68:

"Operator Overloading"

**Semantic meaning of operators ("+", etc.) dependent
on semantic type of their operands.**

(N.B.: some operator properties need not hold for certain operand types.)

Operator Overloading

**Semantic meaning of operators ("+", etc.) dependent
on the semantic type of their operands.**

operation: "+"

operand type	meaning	example
numbers	**addition**	**3 + 4.2 = 7.2**
strings	**concatenation[†]**	**"Ron" + "Hermione" = "RonHermione"**
sets	**set union[†]**	**[ostrich, owl] + [puppy, owl, mouse] = [ostrich, owl, puppy, mouse]**

[†] **"+" not commutative for strings;
"commutativity" not meaningful for set union**

Example of Clear but Nonclassical Dominant

Copland, Symphony 3: Scherzo

Movement is "in F" at this moment

Music builds to climactic [057] = "start of a suspension..."

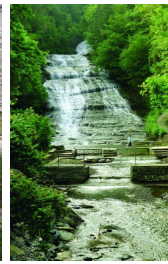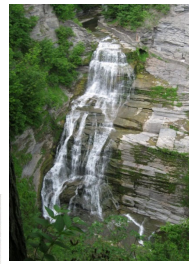**...but directly goes back to home base w/o "resolving"...**

AND—pitches are {G, C, D}, so chord is "[057] built on II"

ATONAL Tonality???!?!!??!

Schoenberg (1954/1969, 194-95):

One day there will be a theory which abstracts rules from these [12-tone] compositions. Certainly, the structural evaluation of these sounds will again be based on their functional potentialities.

Grateful thanks for assistance with sound excerpts to Eric Feinstein,
Sidney Cox Library of Music and Dance, Cornell