what is timbre realism?

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**timbre:** *that feature of a sound which distinguishes it other than its pitch, volume, or duration.*

Most familiar examples: musical instrument families—timbre is what distinguishes the strings from the brass.
realism (about a perceptual quality): the view that quality is a human-independent property in the world.

Our question today: what sort of human-independent property might timbre be?
plan of the talk

① The Color Realism Debate

② Timbre
   – The Science
   – The Philosophy

③ Morals
color
Color Realism: Are colors properties in the world?

**Realism:**
Yes!
But which properties?

**Relationalism:**
Yes, but . . .
Jonathan Cohen

**Eliminativism:**
No!
C. L. Hardin

**Physicalism**
Byrne & Hilbert
Paul Churchland

**Ecological Approaches**

**Enactivism**
Alva Noë
Mohan Matthen?
Justin Broakes?

**Structuralism**
Gary Hatfield
Kathleen Akins
me

**Primitivism**
John Campbell
Joshua Gert
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color facts
datum 1: **constancy**

- The light entering our eyes is a function of both (i) the object’s surface properties, *and* (ii) properties of the light source.

- Nevertheless, we assign “the same” color to the object’s surface across changes of lighting and context (**color constancy**)

- **Intuition:** there are *objective surface properties* that *correlate* with our attributions of color.
datum II: similarities

• Colors stand in various relations to each other:

• Orange is more similar to red than to blue.

• Red and green are opposites (in the sense that they cannot be simultaneously experienced as a single percept—"reddish green" is impossible).

• Color relations may be represented by a color solid.
color solids

(representing color similarity distances)

The Munsell Renotations, 1943

Munsell Renotations remapped into CIELAB, 1976 (Regier, et al., 2007)
shared commitments

Physicalist and Ecological realists share some basic commitments:

1. **Color constancy** motivates **realism**
2. External correlates are **candidates** for a realist analysis of color
3. Color similarities are **evidence**: they must be explained or explained away

They differ in which external correlates they identify with the colors.
**color physicalism**

**Color physicalism:** color = surface spectral reflectance

Surface Spectral Reflectance (SSR): the percentile of light reflected from the surface at each wavelength
Color physicalism: color = surface spectral reflectance

Surface Spectral Reflectance (SSR) is:

- **Objective**
- **Distal**
- **Reductive** (it is “the physicist’s analysis of color”)

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(color physicalism: color = surface spectral reflectance)
Ecological Color: color = contingent features of the environment of relevance to the organism (on an evolutionary timescale?) detected by color vision
Ecological Color:

- **Objective**
- **Distal**
- **Not reductive**
  (at least not to categories of the physicist)
Why call these theories “ecological”? 

J. J. Gibson pioneered the “ecological” theory of perception
- *The Senses Considered as Perceptual Systems*, 1966
- *The Ecological Approach to Visual Perception*, 1979

Explicitly contrasted “ecological optics” with “physical optics”
- *Dynamic interaction* between organism and environment
- *Ambient information* of evolutionary importance to organism

James J. Gibson
1904 – 1979
problem: color similarities

- **Hardin**: similarities do not obtain for reflectance properties, hence eliminativism

- **Churchland**: transform reflectance space to recover similarities

- **Byrne & Hilbert**: physicalist about colors, but primitivist about similarities

- **Noë**: similarities explained by similar sensorimotor expectations

- **Matthen**: similarities explained as similar grounds for conditioning

- **Hatfield**: only brute difference between colors is content bearing
Taking stock: color morals

- Constancy and similarities are evidence

- Constancy motivates realism

- Realist analyses identify different external correlates of color:
  - Physicalist — SSR
  - Ecological — sensorimotor contingencies; structure

- A successful theory explains (away) similarities
timbre science
**timbre:** that feature of a sound which distinguishes it other than its pitch, volume, or duration.

Most familiar examples: musical instrument families—timbre is what distinguishes the strings from the brass
timbre facts

• **Datum 1:** timbre constancy — we (often) assign “the same” timbre to a sound source across radical changes in context.

• **Datum 2:** timbre similarities – we make consistent categorization and similarity judgments about timbres that can be precisely measured.

• There are two main scientific theories of timbre:
  – *Helmholtz*
  – *Gibson*
helmholtz (1877)

- **Wave theory of sound**: sounds are *disturbances* (waves) in a medium (e.g. air).

- **Helmholtz theory of timbre**: timbres are *functions* of the *Fourier transform* (component sine waves) of a sound.
gibson (1966)

- **Ecological theory of sound**: sounds *convey information* about (“are”?) *distal events* (nature of event + location).

- **Gibson theory of timbre**: timbres are *ecologically important features* of the *distal mechanical disturbance* (which produced the sound).
a timbre solid?

EH = English Horn
FH = French Horn
FL = Flute
TM = Trombone
TP = Trumpet
C's = Clarinets
O's = Oboes
S's = Strings
X's = saxophones

Axes
I = brightness (?)
II = synchronicity of harmonics
III = spread of attack inharmonicity

Timbre similarity space of Grey, 1977.
timbre physicalism ?
Many arguments in the philosophy of timbre share the basic structure of the color realism debate:

1. **Timbre constancy** motivates **realism**
2. External correlates are **candidates** for a realist analysis of **timbre**
3. **Timbre similarities** are **evidence**: they must be **explained** or **explained away**

The main difference is that the similarity structure of timbre and the external correlates of timbre are scientifically much more poorly understood.
a standard view?

There seems to be a fairly broad consensus amongst philosophers of sound:

Reject the Helmholtz analysis of timbre as it fails to account for timbre constancy.

Identify timbre with distal resonant events.
In defending the event type view of timbre, O’Callaghan quotes Handel: “no known acoustic invariants can be said to underlie timbre”. . .

. . . and observes timbre “is constant across changes to frequency, intensity, attack, decay, . . .,” concluding that “timbre quality . . . depends . . . upon features of the source and the characteristic manner in which it disturbs a medium” because “That is . . . what remains constant across changes to its determinate audible qualities. The uniformity of timbre across sounds and circumstances is best explained by constancy in factors beyond the attributes of waves.” (89)
o’callaghan (2007)

• One example:

In defending the event type view of timbre, O’Callaghan quotes Handel: “no known acoustic invariants can be said to underlie timbre” . . .

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timbre as event type

• **O’Callaghan:** sounds are *events which disturb a medium* and timbres are the “characteristic manner” of the disturbance.

• **Roden:** timbres are “variable sets of physical features” of a “sound generation mechanism.”

• **Davies:** timbre is *not* a property of sounds (disturbances in a medium), but of “musical instrument types and…voices.”

• **Casati & Dokic:** sounds are *event types* and timbres correlate with differences in the vibrating object’s internal structure.

• **Kulvicki:** sounds (and timbres) are properties of objects revealed when they are induced to vibrate.
Many who accept an event-type theory of timbre call it “physicalism”:
- Casati & Dokic (1994)
- O’Callaghan & Nudds (2009)
- Roden (2010)

However, this mischaracterizes the view in two crucial ways:
1. It abandons the heritage of this view in Gibson. (Gritten, 2012)
2. It misidentifies the view as reductive.

[Physicists characterize the timbre stimulus as a function of the Fourier transform of the wave. Thus, the Helmholtz view is the physicalist one by the reductive criterion.]
You might think:

"Just because the physicist studying sound describes timbre in the Helmholtz way doesn’t mean there isn’t a reductive physical account of resonant event types adequate for a physicalist theory of timbre!"

My answer, either:

1. We identify timbres with just mechanical resonant event types, but then we fail to provide a basis for reducing all timbres, or
2. We include a sufficiently broad category of events to reduce all timbres, but it does not form a well-defined physical category (nor does it ensure distality).
tacoma narrows bridge

https://youtu.be/XggxeuFDaDU
“event types” not a natural kind

Tacoma Narrows Bridge (1940) illustrates role of dynamic coupling between vibrating body and medium in producing overall vibratory event.

- Musical instruments: sound is result of interaction between mechanical resonant processes and vibratory properties of medium.

- Physically, no sharp distinction (in causal role) between distal vibratory process, disturbances in medium, and proximal wave.
<table>
<thead>
<tr>
<th>Event Type</th>
<th>Color Physicalism</th>
<th>Ecological Color</th>
<th>Helmholtz Timbre</th>
<th>Gibson Timbre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Distal</td>
<td>X</td>
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<tr>
<td>Reductive</td>
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<td>(to physics)</td>
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morals
philosophy

① Terminology of “physicalism” misleading

② Take advantage of the Gibson / ecological legacy!

③ Better concepts for a multimodal realism debate?

– **Invariance** identifies external candidates for realism

– **Simplicity** in accounting for sensory similarities *weighs in favor of* a candidate.
① Phenomenology of timbre experience:
   – What are the basic qualities of timbre experience?
   – Timbre solid

② The ecological project:
   – Needs a systematic analysis of the stimuli in ecological terms:
     • Characterization of different vibratory process types
     • (Ecological) analysis of similarities between them
thank you!
pitch similarities

Roger Shepard’s pitch torus (1982)
odor similarities

Henning odor prism (1915)

Koulakov, et al. (2011) “potato-chip” odor space based on PCA of Dravniek’s 1985 data set
Henning taste tetrahedron (1916) contrasted with empirical data of taste similarity judgments (Schiffman, 2000)
violin modes