

Sound design and auditory perception

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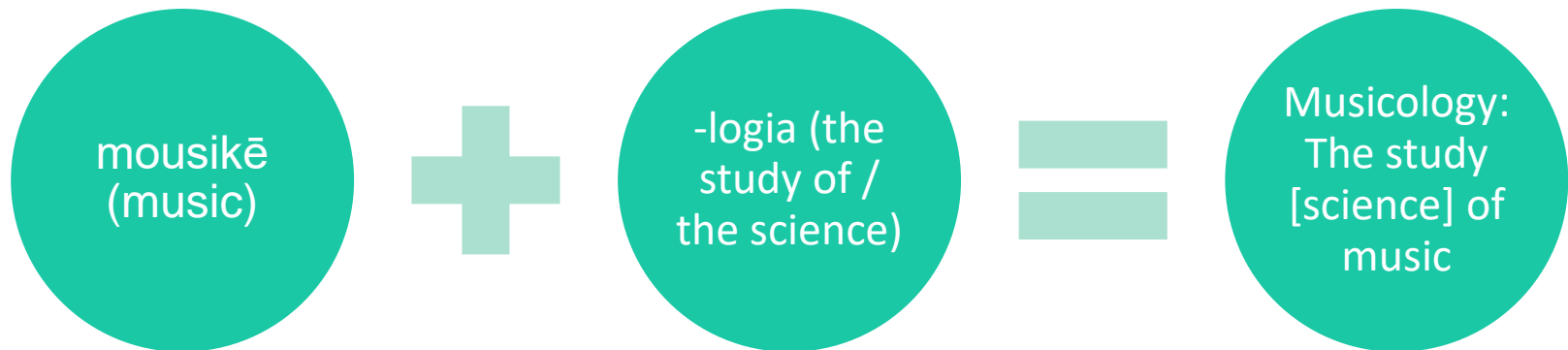
PhD candidate

IDA / IxS

Sound design

- Acoustic event is a sign carrier (Jekosch, 2005)
- Contributing fields: acoustics, engineering, psychology, *musicology*

Musicology defined



The Framework

HUMANITIES

Musicology
[Musikwissenschaft], Guido
Adler, 1885

Historical

Systematic

Ethnomusicology

History, Notation,
Instruments, Iconography,
Archivistic...

Acoustic, Music physiology,
psychology, sociology,
pedagogy, aesthetic and
philosophy, performance
practice...

World music, popular music,
film music, music and
religion, youth,
subcultures...

SOCIAL
SCIENCES ↔

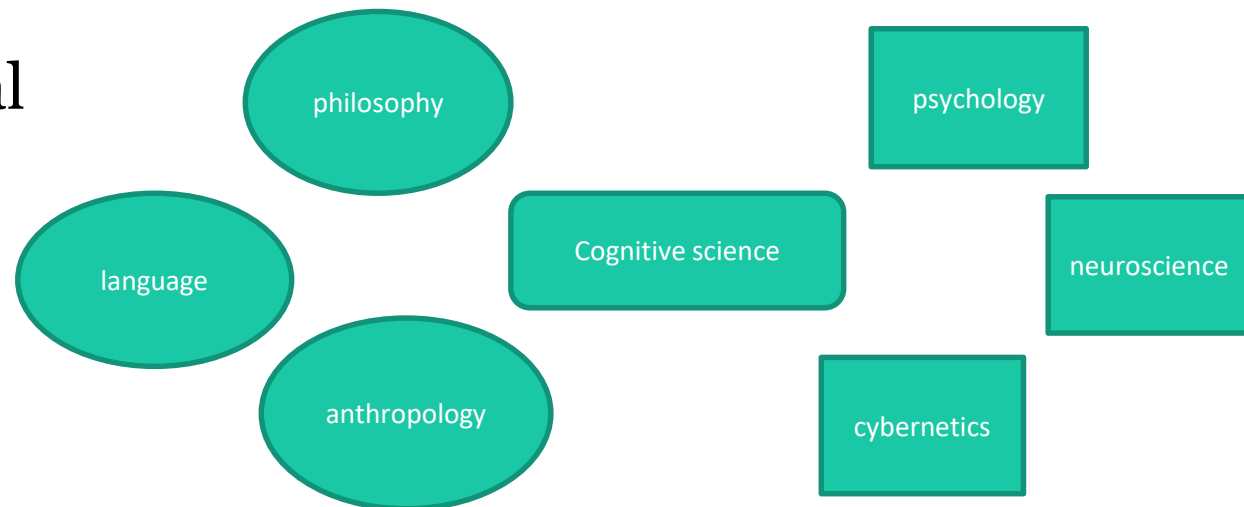
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From the musicology journals...

- Examples of topic explored by musicologists:
- “Automaticity and affective responses in valence transfer: Insights from the crossmodal auditory-visual paradigm”
- “The roles of music amongst musician Holocaust survivors before, during, and after the Holocaust”
- “Testing a spectral model of tonal affinity with microtonal melodies and inharmonic spectra”
- “Creativity beyond innovation: Musical performance and craft”
- “Psychological responses to recorded music as predictors of intentions to attend concerts: Emotions, liking, performance evaluations, and monetary value”

Cognitive science and musicology

- What is musical cognition?
- How is musical experience different?
- Music as a conceptual metaphor



Auditory experience

- Visual understanding of the environment is paradigmatic in understanding and studying perception, however, auditory, olfactory and tactile senses can extend, complement and challenge visual
 - Complementing with time, space, frequency, amplitude
- “An overemphasis on visual displays has constrained the development of interactive systems that are capable of making more appropriate use of the auditory modality.”(Rochesso et al., 2008)
- Complex and multifaceted, raises questions on what do we hear? What are the objects of hearing and differences of audition to other senses? (phenomenology of sound)
- Sounds are contextual and auditory experience- connected to the sound source, not just the sound

Properties of sound

- **Timbre** – sound color
 - interaction of sound production and physical construction of an “instrument” (Handel 1995)
- **Loudness** - volume and intensity of sound
- **Pitch** – the “height”, ordering dimension
- Duration, sonic texture, spatial location
- Silence?

Sound as a design dimension



Sound as a design dimension

- Significance of sound as a design dimension in our environment (auditory pollution)
- Relevance of sound for interaction on various levels. Between
 - Users
 - Artifacts
 - Services
 - Environments
- Sonic Interaction design (Rochesso et al., 2008)
 - Product sounds design
 - Art and Music (exploring interactive systems with embedded sounds, e.g. Alexa)
 - Sonification (e.g. sonar)

Sound design

- Complementary role of auditory experience to users' overall product experience (ergonomic and hedonic levels)
- ***sound as a property of interacting with the product***

Sound design elements

- **Consequential sounds** (e.g. hair dryer) vs. **Intentional sounds** (e.g. alarm)
- Importance of **context of usage** and **product type** (regular car vs. sports car)
- Auditory function as a **sign of “correct”/intended interaction**/feedback for functioning/not functioning
- **Congruence** of sound design to the product concept
- How is this reflected in users’ **expectations, values** and **experiences**

Therefore...

- Interacting with products produces sounds that are sensorially experienced and may result in attribution of meaning

Example

- Consequential / intentional sounds
 - Acoustic parameters → ascribed meaning
 - Functioning/not functioning related to sounds
 - Acoustic overload (i.e. irritation)
- Context of usage & product type
- Congruence of sound related to the product concept
- How is sound reflected in users' expectations, values and experiences



Considerations for the “artistic” exercise

- Music is a temporal and interactive experience- think about it more as an activity rather than an output
- Thinking about music, listening to music, making music (etc) combines working with and conceptualizing:
 1. Metaphors and non-auditory attributes ingrained in the musical idea
 2. Properties of music
 - these two work interchangeably together

1) Non-auditory attributes and metaphors

- Think about attributes of your systems;
 1. Is there a “common theme” and how would you characterize them? (e.g. controlled, rigid, flexible, time-efficient, complex, simple, systematic, low-tech) Is there a “metaphor” you could use to describe it ?
 2. What does such characterization mean (in terms of interactions, actors, context, experiences)?
 3. How does this characterization sound?
 - Use auditory attributes to describe it

2) Properties of music

- You can determine the sound of your system based on the following auditory attributes (this list is for your consideration, apply when you can):
 1. Pitch (high or low in an order sequence)
 2. Loudness/dynamics (high or low in volume, i.e. loud or soft)
 3. Timbre (sound “color”, i.e. tuba’s “color” is “deep” and “sturdy” while flute is light and bright)
 4. Tempo and rhythm (fast or slow, the regular/irregular, dense/dispersed “beat”)
 5. Texture (moving together in the same/different directions, not moving together etc.)
 - Texture is supported by the harmony; movement can be unison polyphonic, homophonic or cacophonic

Some resources:

- Sound library (CC)- <https://freesound.org/>
- Sam Fox Moving Pictures: music metaphors (examples) in the era of silent films <https://www.mont-alto.com/photoplaymusic/SamFoxMovingPictureVol1/SamFoxV1.html>
- BMW sound design:
<https://www.youtube.com/watch?v=tqZcSPXPhcc&list=PL7470479Do5639FFE>
- Music and meaning: music as a symbol of a culture:
<https://www.youtube.com/watch?v=dd5zuY4VHeM&list=PL2SOU6wxBotGvaMpGCoEnS2EI8GSlf2u>
- Sonification of scientific data:
<https://www.youtube.com/watch?v=2fP3G48ADno>

Some resources:

- Langeveld, L., van Egmond, R., Jansen, R., & Özcan, E. (2013). Product sound design: Intentional and consequential sounds. In *Advances in industrial design engineering*. IntechOpen.
- Rocchesso, D., Serafin, S., Behrendt, F., Bernardini, N., Bresin, R., Eckel, G., ... & Visell, Y. (2008, April). Sonic interaction design: sound, information and experience. In *CHI'08 Extended Abstracts on Human Factors in Computing Systems* (pp. 3969-3972). ACM.
- Samuels, D. W., Meintjes, L., Ochoa, A. M., & Porcello, T. (2010). Soundscapes: Toward a sounded anthropology. *Annual Review of Anthropology*, 39, 329-345.
- Zbikowski, L. M. (2008). Metaphor and music. *The Cambridge handbook of metaphor and thought*, 502-524.

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