Human-Sound Interaction (HSI)

current and future directions

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Foundation of this work

- Sonic Interaction Design
- Music affordances
- Aural Diversity

Sonic Interaction Design

Sound at the centre of the design [27] and reflects on several aspects of sonic interaction: perceptual, cognitive, emotional, product sound design, auditory display and sonification.

SID aims to explore “ways in which sound can be used to convey information, meaning, and aesthetics and emotional qualities in an interactive context” [10] that can vary from critical functionalities of a product that relies on auditory feedback to communicate to its users, to artistic musical works such as performances or installations.

[10] Franinovića, K., and Serafin, S. 2013. Sonic interaction design. Mit Press.
[27] Rocchesso, D., Serafin, S., Behrendt, F., Bernardini, N., Bresin, R., Eckel, G., Franinovic, K., Hermann, T., Pauletto, S., Susini, P., and Visell. 2008. Sonic Interaction Design: Sound, Information and Experience. In CHI ’08 Extended Abstracts on Human Factors in Computing Systems (CHI EA ’08). Association for Computing Machinery, New York, NY, USA, 3969–3972. https://doi.org/10.1145/1358628.1358969

Music Affordances

Music can invite gestures that are often evoked by:

- Timbral and dynamic qualities of the sound [15]
- Musical aspects [15]
- Causality of the sound [3]
- Affordances of the instrument or interface [33]

[3] Caramiaux, B., Susini, P., Bianco, T. et al.2011. Gestural Embodiment of Environmental Sounds: an Experimental Study. InProc. of the International Conference on New Interfaces for Musical Expression (NIME '11). Oslo, Norway, 144–148.
[15] Godøy, R. I,. 2010. Gestural affordances of musical sound. In Musical Gestures: Sound, Movement, and Meaning, Rolf Inge Godøy and Marc Leman (Eds.). Routledge, New York, New York, 115–137.
[33] Tanaka, A., Altavilla, A., and Spowage, N. 2012. Gestural Musical Affordances. In Proceedings of the 9th International Conference on Sound and Music Computing. Copenhagen, Denmark.

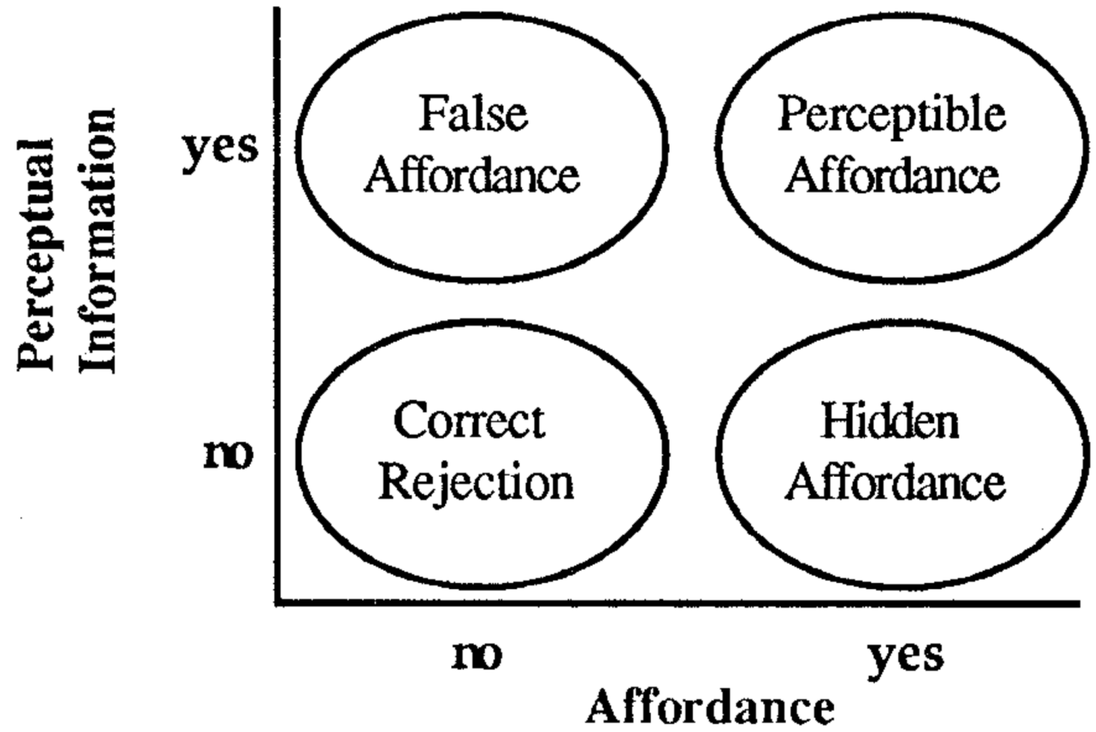
Sound tracing

Video source: https://youtu.be/lK9LyUOsIXs
Caramiaux, B., Bevilacqua, F., Schnell, N., (2009) Towards a gesture-sound cross-modal analysis, GW'09 Proceedings of the 8th international conference on Gesture in Embodied Communication and Human-Computer Interaction, Bielefeld, Germany, pp 158-170.

Perception of affordances

Gaver [12] categorised affordances upon their perceptibly:

- correct rejections, when there is no affordance and it is not perceived;
- perceived, the affordance is present and perceived;
- hidden, the affordance is present but it is not perceived
- false affordances an affordance is perceived but it does not exist



[12] William W. Gaver Technology Affordances. In Proc. of the SIGCHI Conference on Human Factors in Computing Systems (CHI '91). ACM, New York, NY, USA, 79–84. https://doi.org/10.1145/108844.108856ver. 1991

Perception of affordances

Diversity of human-factors that can affect the perception of affordances

- Auditory
- Vision
- Haptic feedback
- Cultural Background




Human-Sound Interaction

Direct, engaging, natural and embodied interaction with sound that takes into account one's abilities to perceive the world.

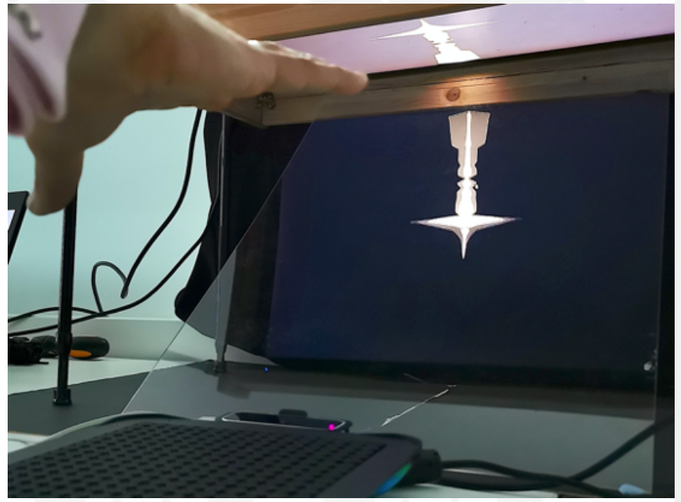
- ***direct*** as the impression or a feeling about an interface capable of being described in terms of concrete actions [22]
- ***engaging*** as fostering the "feeling of directly manipulating the objects of interest", where "the world of interest is explicitly represented and there is no intermediary between user and world" [22]
- ***natural*** "as being marked by spontaneity" [17]
- ***embodied*** as an extension and incorporation of human skills and abilities within the interaction design of a system [8]

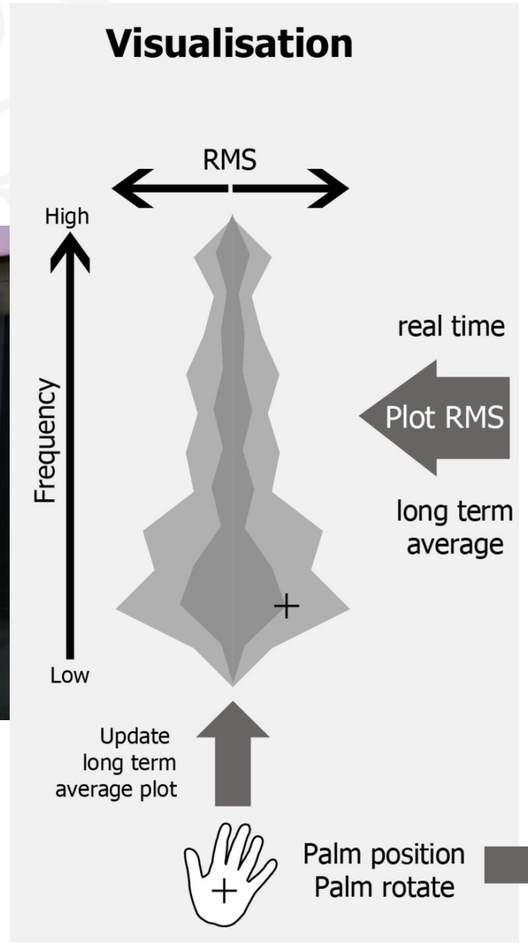
[8] Dourish P.,. 2001. Where The Action Is: The Foundations of Embodied Interaction. MIT Press.
[17] GinaJoue, SAG., and Mittelberg, I., 2011. Understandingnaturalness and intuitiveness in gesture production. In Proc. of the SIGCHI Conference on Human Factors in Computing Systems (CHI). Vancouver, BC, Canada, 821–824.
[22] Norman D.A. and Draper, S.W., 1986. User Centered System Design: New Perspectives on Human-computer Interaction. Lawrence Erlbaum Associates, Hillsdale, New Jersey.

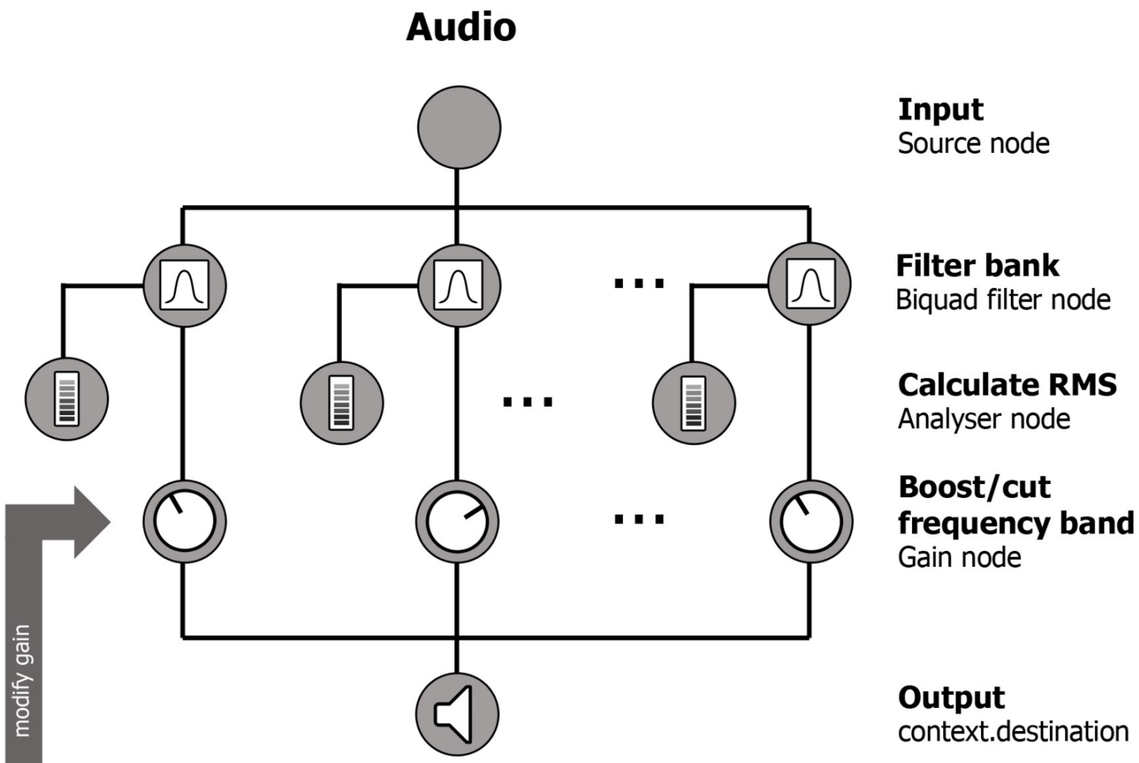
SoundSculpt

Di Donato, B., Dewey, C., and Michailidis, T. (2020) Human-Sound Interaction: Towards a Human-Centred Sonic Interaction Design approach. In 7th International Conference on Movement and Computing (MOCO '20), July 15–17, 2020, Jersey City/ Virtual, NJ, USA.ACM, New York, NY, USA, 4 pages. DOI: 10.1145/3401956.3404233.

SoundSculpt







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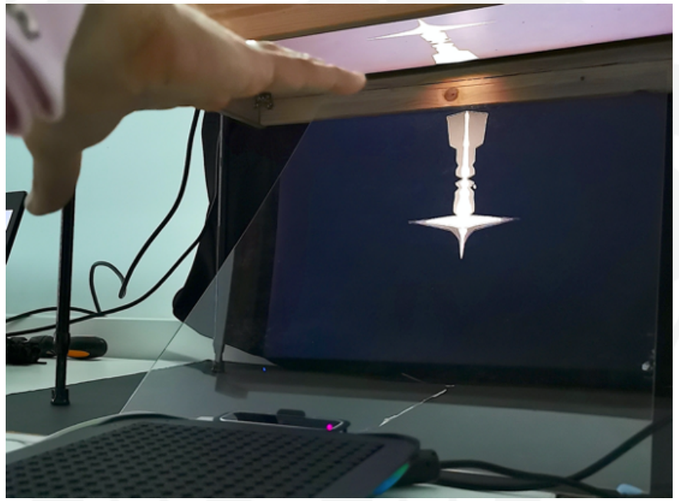


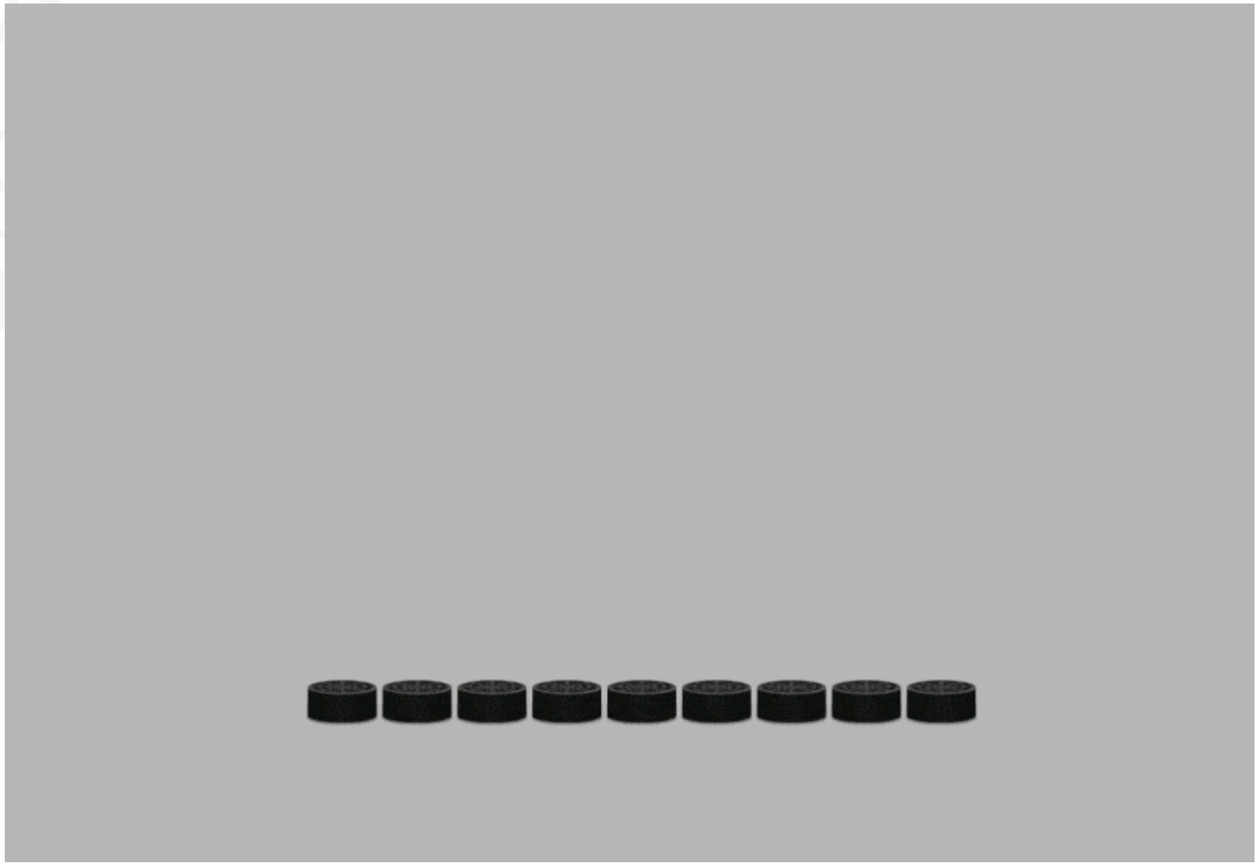


Image source: https://www.ultraleap.com/haptics/

HSI & Aural Diversity

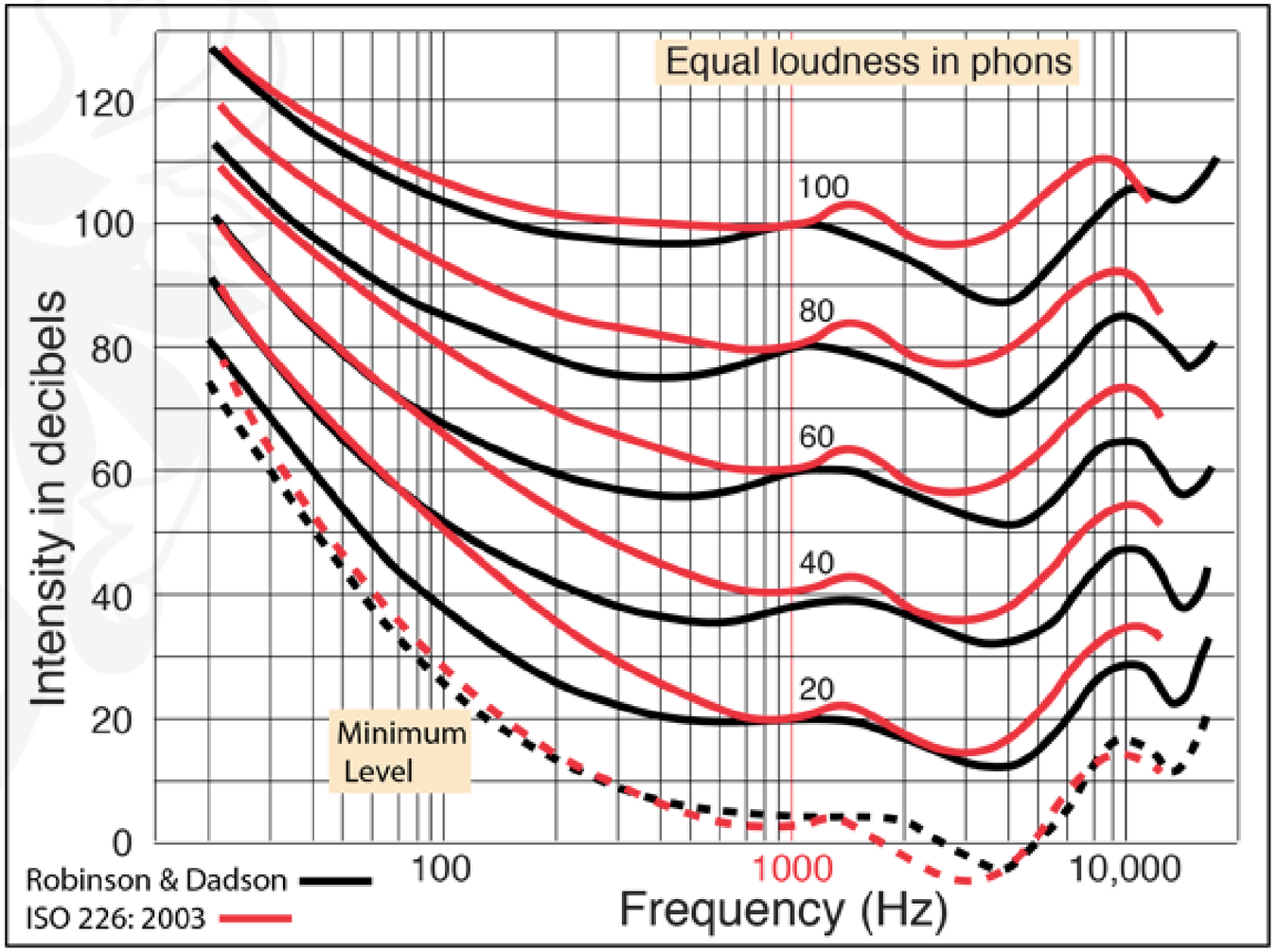


Image source: http://hyperphysics.phy-astr.gsu.edu/hbase/Sound/eqloud.html#c1

HSI & Aural Diversity

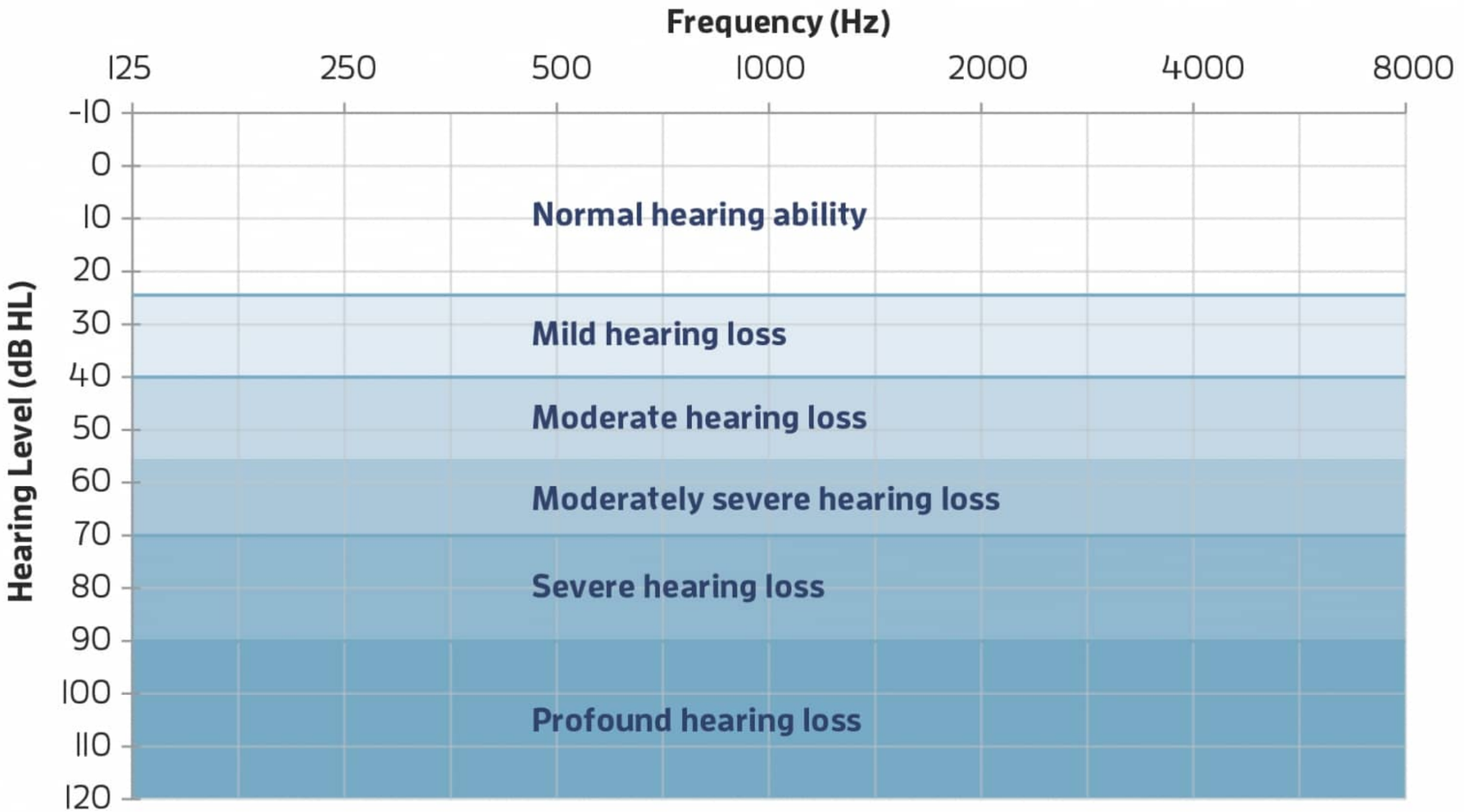
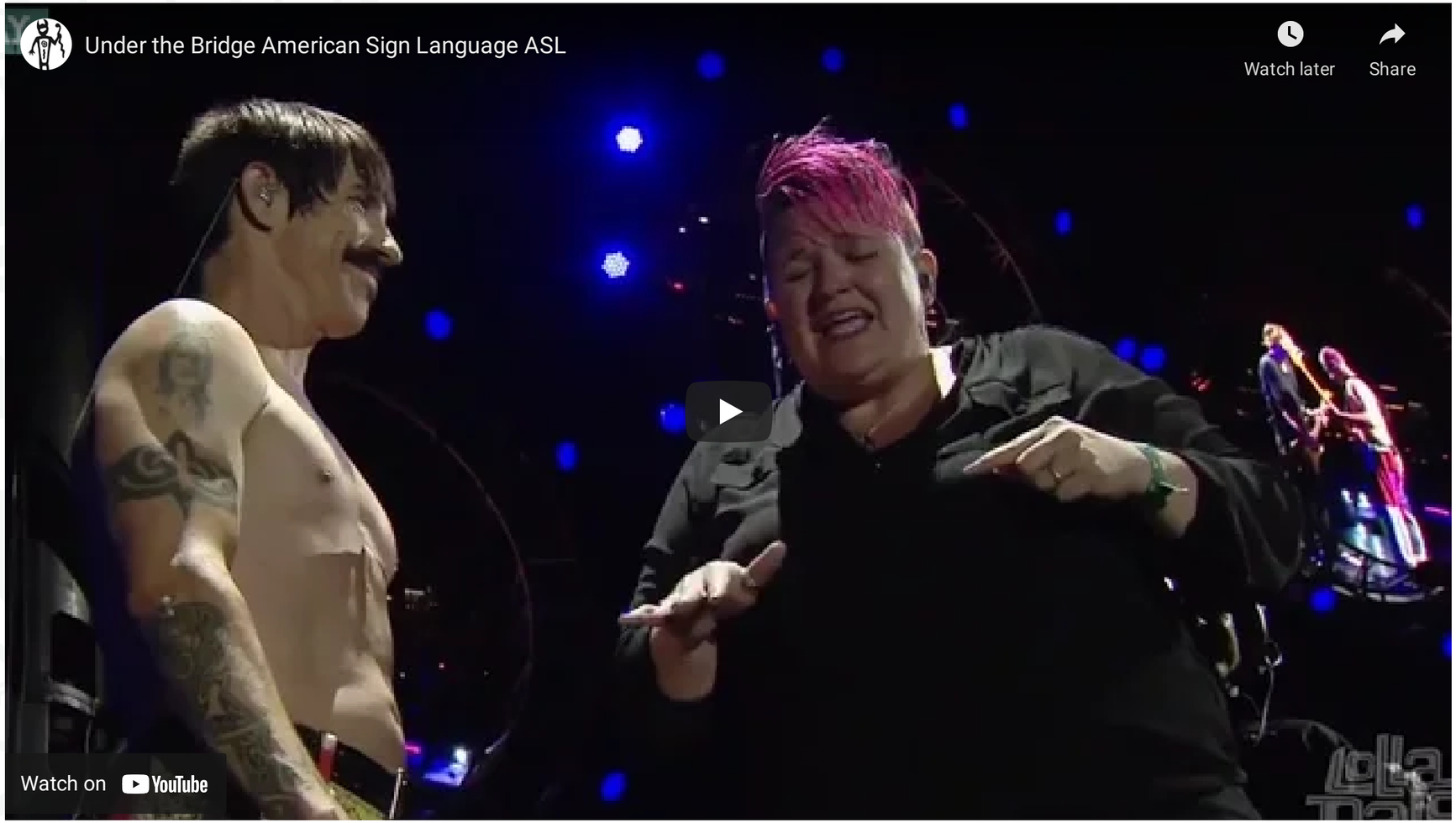


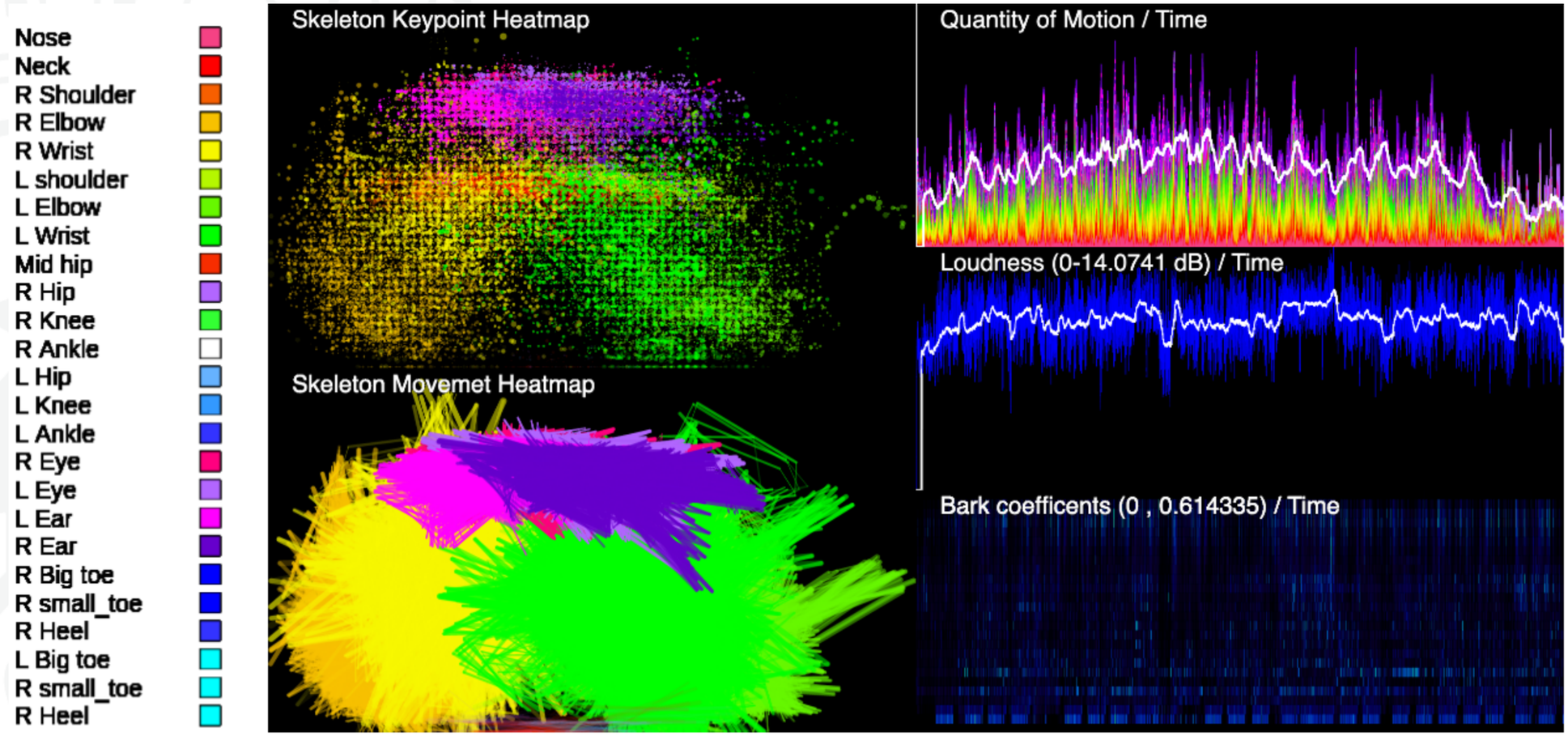
Image source: https://www.healthyhearing.com/report/41775-Degrees-of-hearing-loss

HSI & Aural Diversity



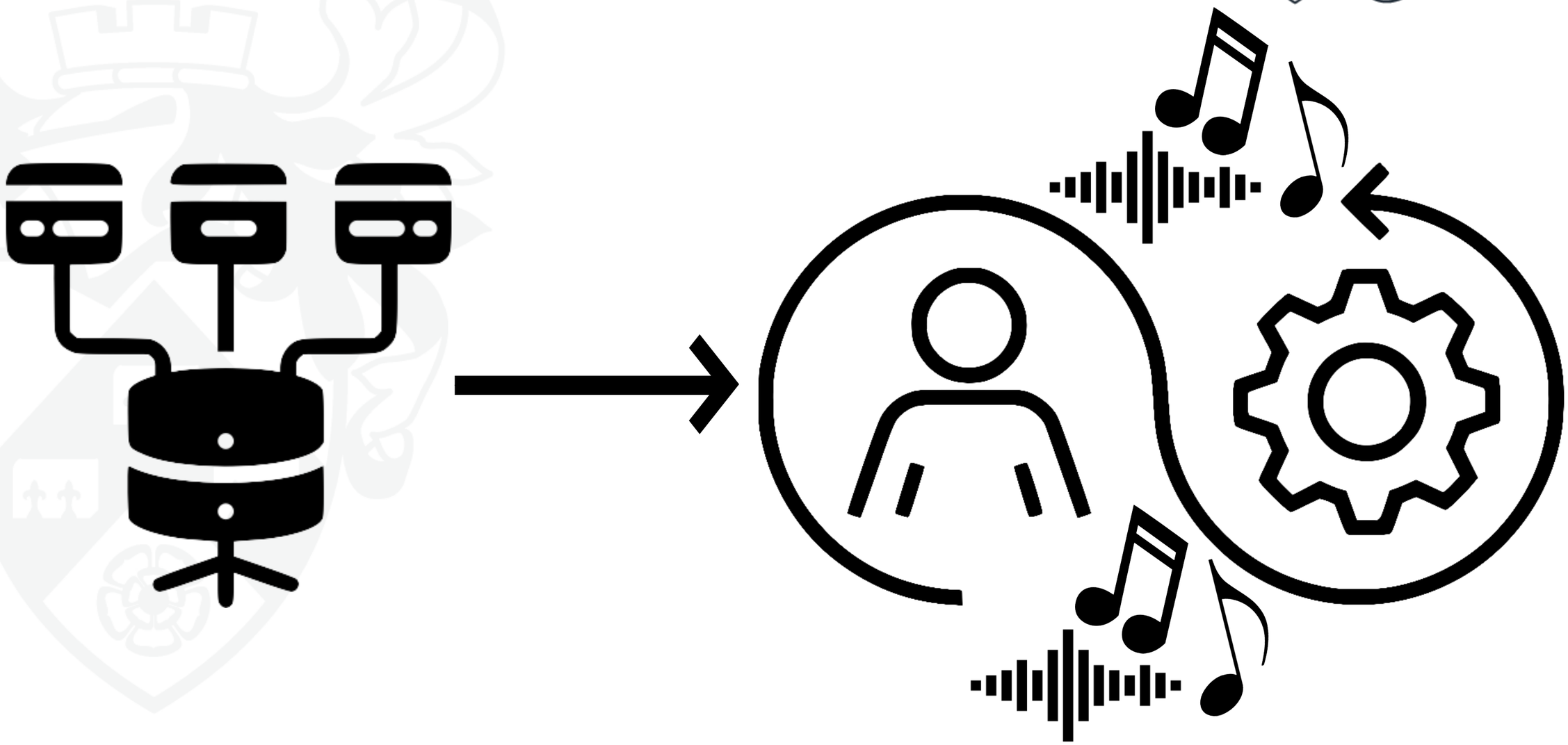
Video source: https://youtu.be/MGRWeKeh9NE?t=150

the HSI-data repository



Repository link: https://github.com/balandinodidonato/HSI-data

what's next



HSI at MSTRC

The HSI project will

- Study music perception and cognition, musical behaviour and music experience using scientific methods and emerging technologies within the HSI framework
- Develop technology for musical application based on the artistic, scientific and engineering knowledge created by the project
- Study the application of HSI principles and interfaces in music composition, performance, recording, reproduction, dissemination and consumption
- Critically examin HSI between technology, culture, business, and creativity

HSI at MSTRC

HSI project will use on the …

- MSTRC Listening Lab: for perception sound studies and soundtracing studies
- Audience Response System: to gather accurate and reliable data that will enrich the HSI-data repository, and subsequently the model which will then inform the design of musical interfaces
- Studio facilities: to design and analyse and audio and conduct sound studies
- Performance venues: to test and evaluate with musicians the interfaces informed by HSI research

Thank you for listening

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