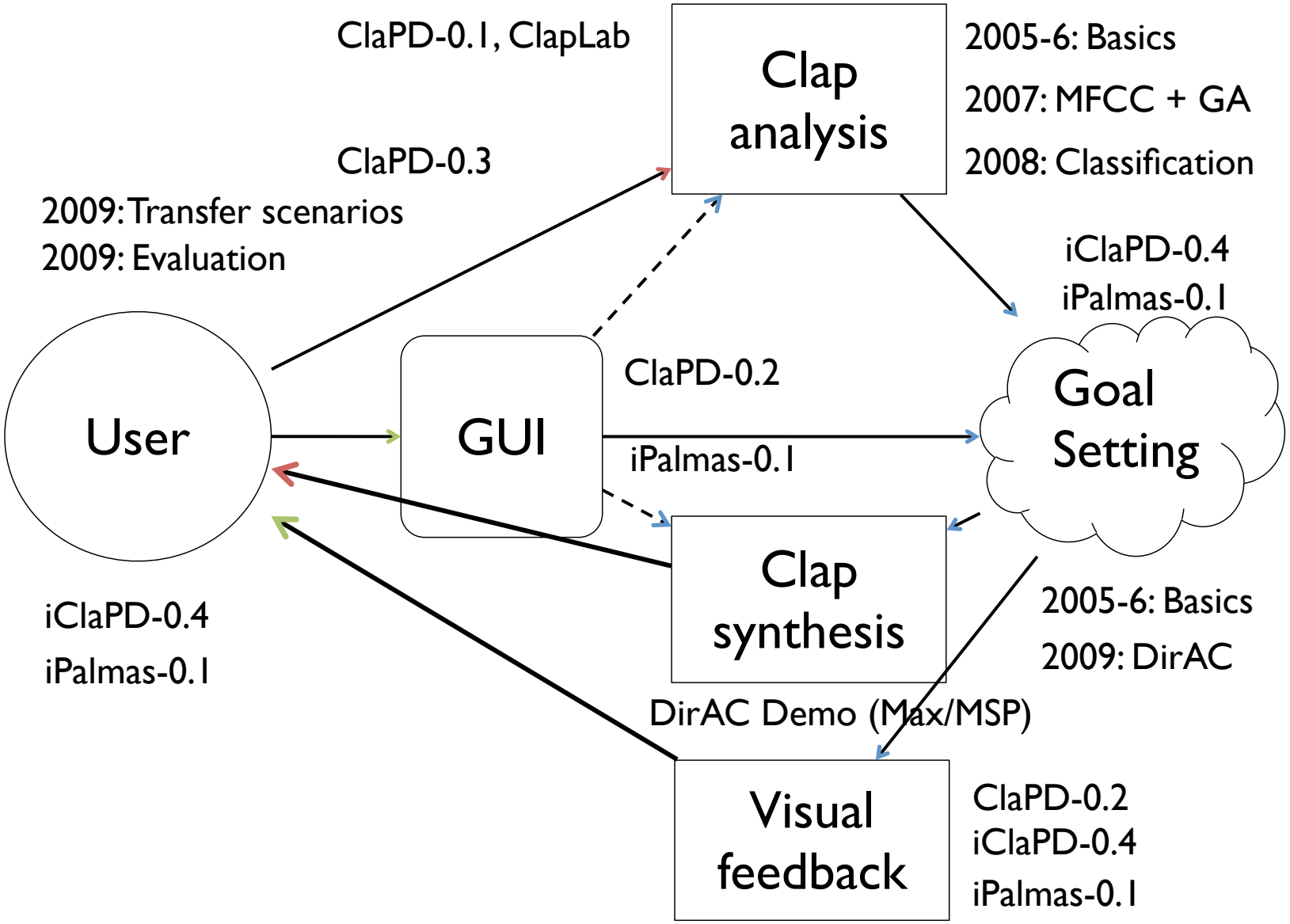
The sound of many real and virtual hands clapping

A research outline by

Cumhur Erkut
Academy Research Fellow
Department of Signal Processing and Acoustics
Aalto University School of Science and Technology

Framework of the talk



Outline

- Motivation
- From physics-based sound synthesis and control to interactive goal setting
- Towards rhythmic interaction design
- Reflections

Motivation

Time-sensitive crowded scenes

Why are they so problematic for sound design?

[Cölgecen1990:Movie]

The laws are simple ...

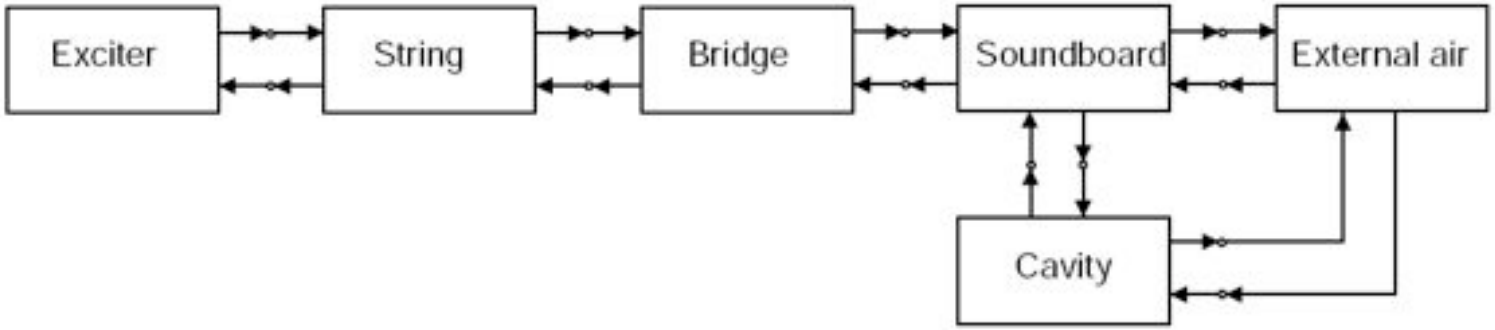
Can we make use of these in multimedia?

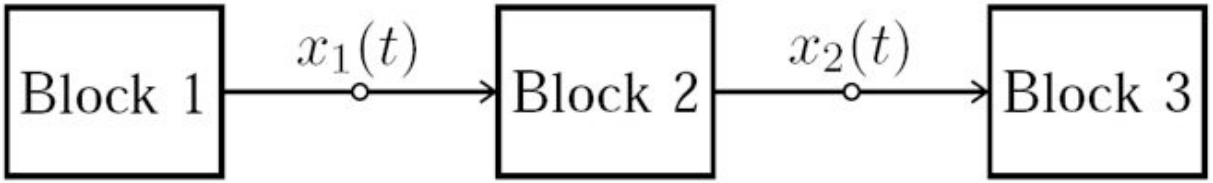
[Strogatz2003:Book]

Physics-based sound synthesis and control

Starting Point: Plucked Strings

Bidirectional interactions, block-based physical models





Focus on Sound Generation

How do we interact with the SGM?

This slide contained visual material from Mulder98 for framing the research in sound generation and modeling. Please refer to the original reference for more info.

After [Mulder98]

A cosmogony of synthetic sounds

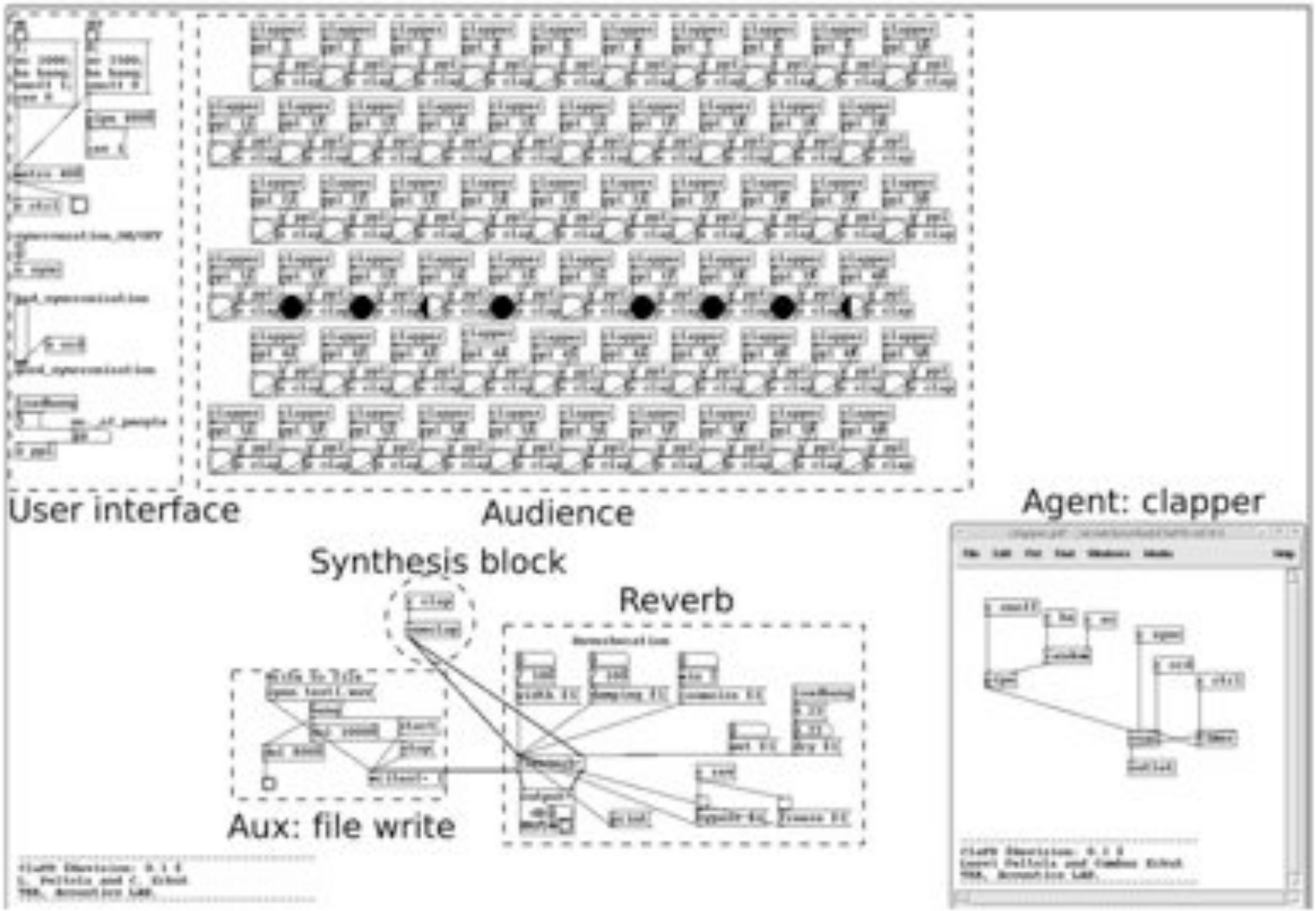
Physics-based sound synthesis models for natural interaction

This slide contained visual material from Rocchesso07 for framing SOb research. Please refer to http://www.soundobject.org/ for more info.

[Rocchesso07, Repp87]

Analysis, synthesis, control

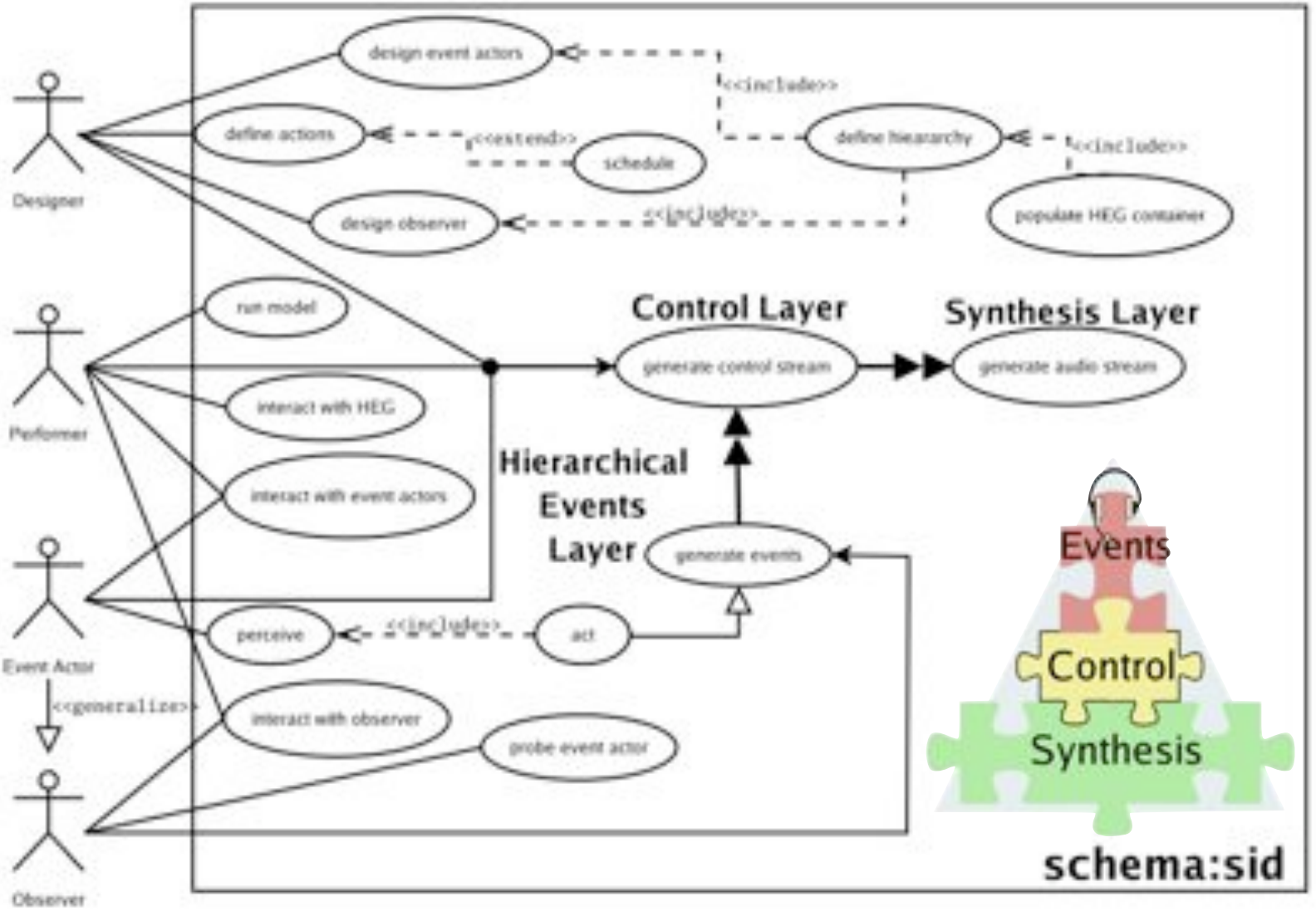
ClaPD-0.1



[Peltola 2006]

Synthesis, Control, and Events

A toolset for sonic interaction design



[Academy of Finland Project # 120583]

Adding a bit interactivity and motion

What we wanted

Simple controls

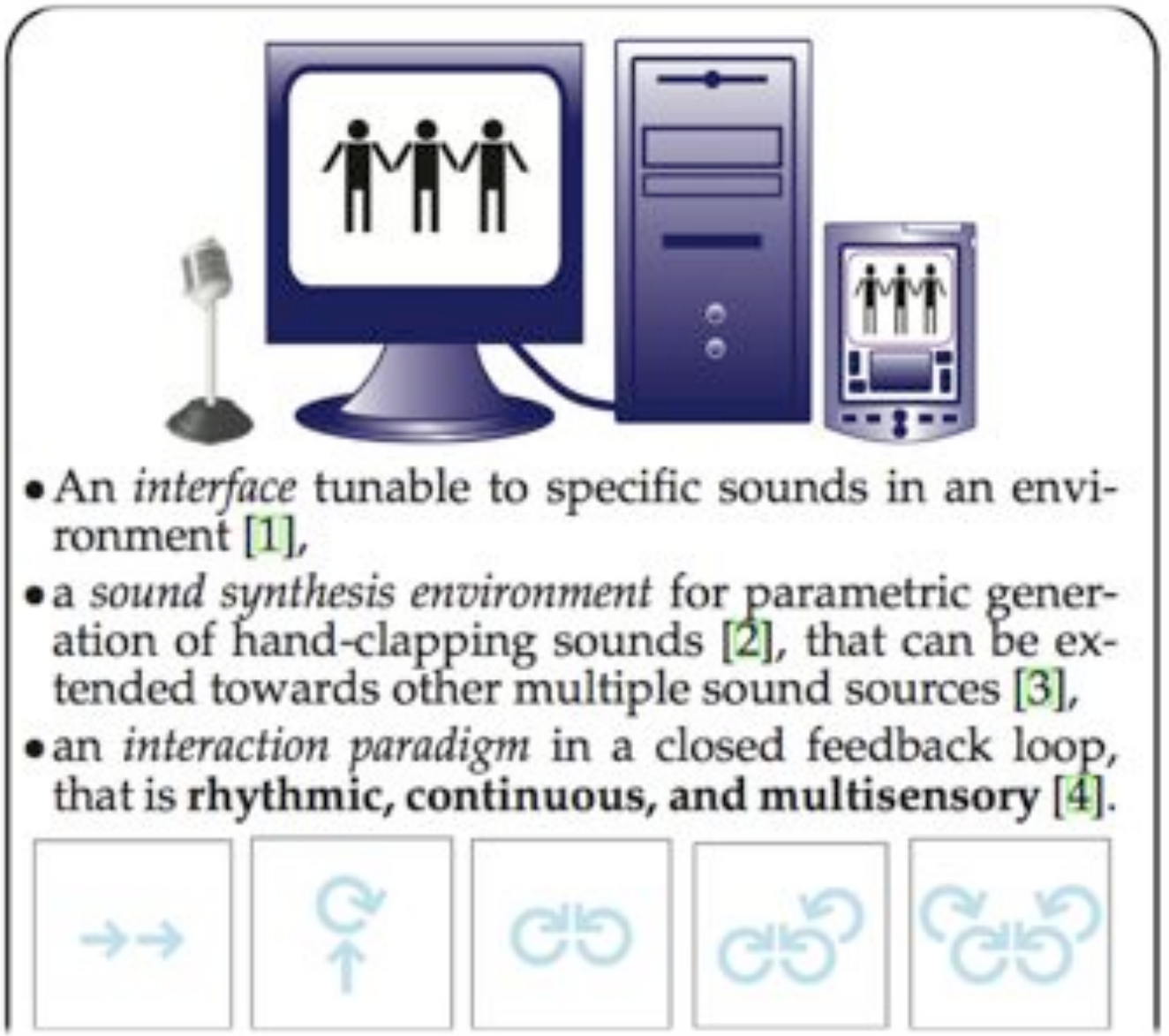
Hand clapping

The computer
capable of capturing
and reproducing sound

[Jylhä:2008]

What happened

Many different interaction possibilities ...



- An *interface* tunable to specific sounds in an environment [1],
- a *sound synthesis environment* for parametric generation of hand-clapping sounds [2], that can be extended towards other multiple sound sources [3],
- an *interaction paradigm* in a closed feedback loop, that is **rhythmic, continuous, and multisensory** [4].

[Erkut:2009]

Demo

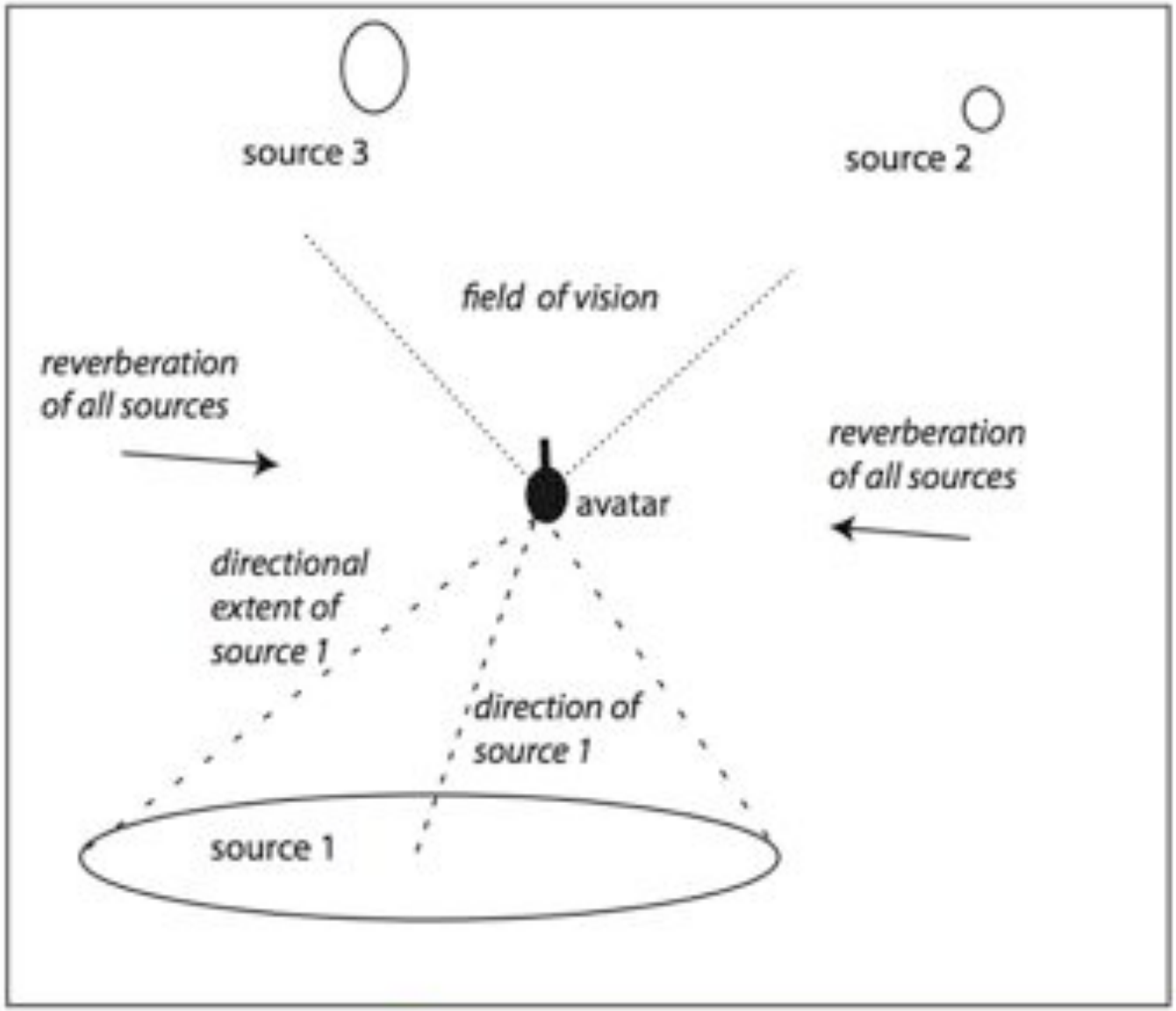

SONIC INTERACTIONS
WITH HAND CLAP SOUNDS
ANTTI JYLHÄ AND CUMHUR ERKUT
HELSINKI UNIVERSITY OF TECHNOLOGY

More demos

YouTube - AaltoUnivASPteam's Channel

Integration with DirAC

Efficient spatial sound synthesis for virtual worlds



[Pulkki09]

Towards multimodal interaction

with application to virtuality

This slide contained visual material from Welbergen: 2007 for framing the MoCap of the hand clap gestures. Please refer to the original reference for more info.

[Welbergen:2007]

Their research Questions

- Does the phonological synchrony rule for gestures also hold for clapping?
- Are slow claps larger in amplitude, and fast ones smaller?
- Does the motion path depend on tempo?
- What are the individual differences?
- (How is rhythmic counting synchronized with the motion?)

[Welbergen:2007]

Results: coupled oscillators again

Linear relationship between movement path length and tempo

This slide contained visual material from Welbergen: 2007 for outlining their results. Please refer to the original reference for more info.

[Welbergen:2007]

But what is happening at dance?

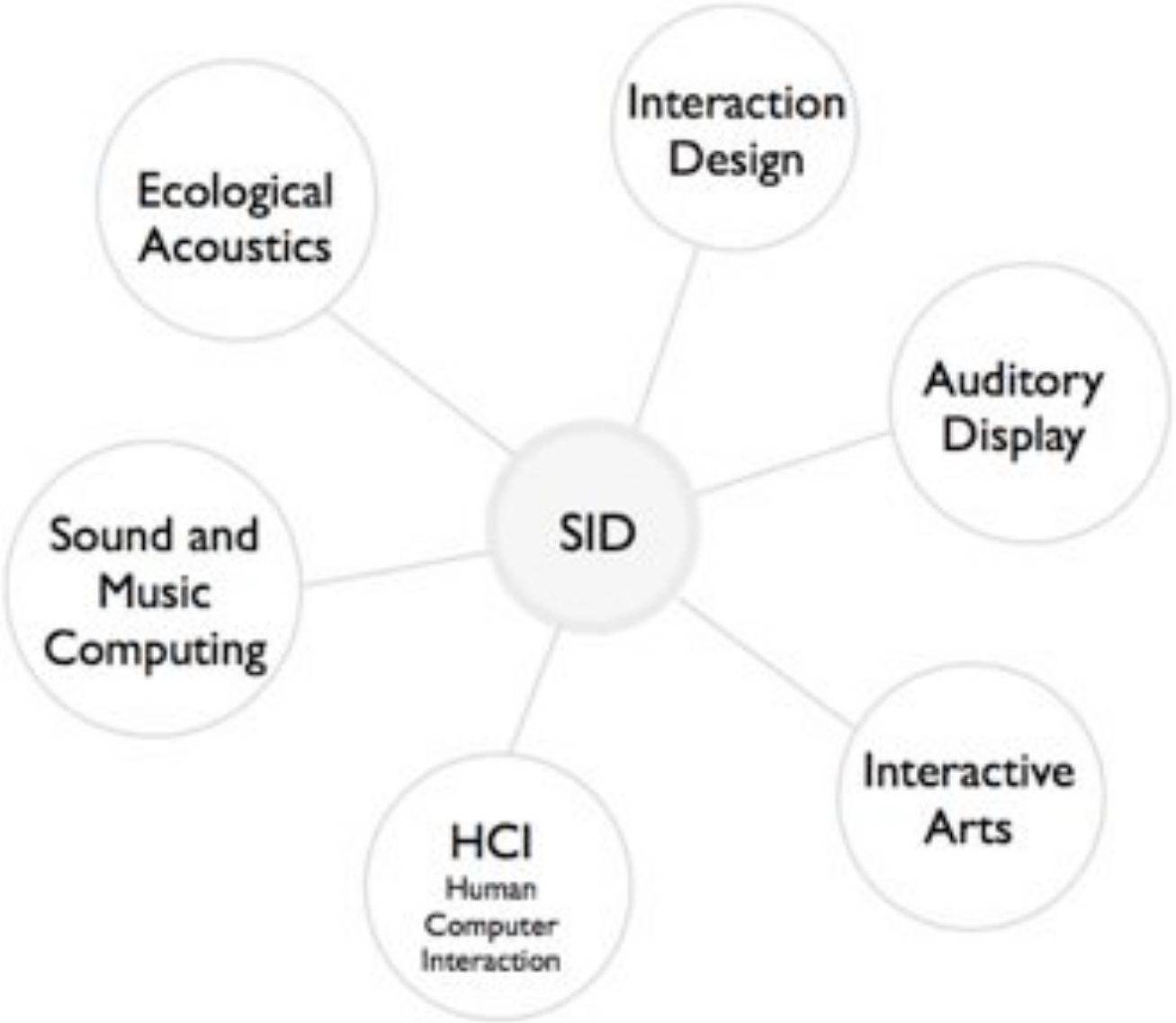
Functions of sonic gestures ...

[Erkut:2009]

Towards rhythmic interaction design

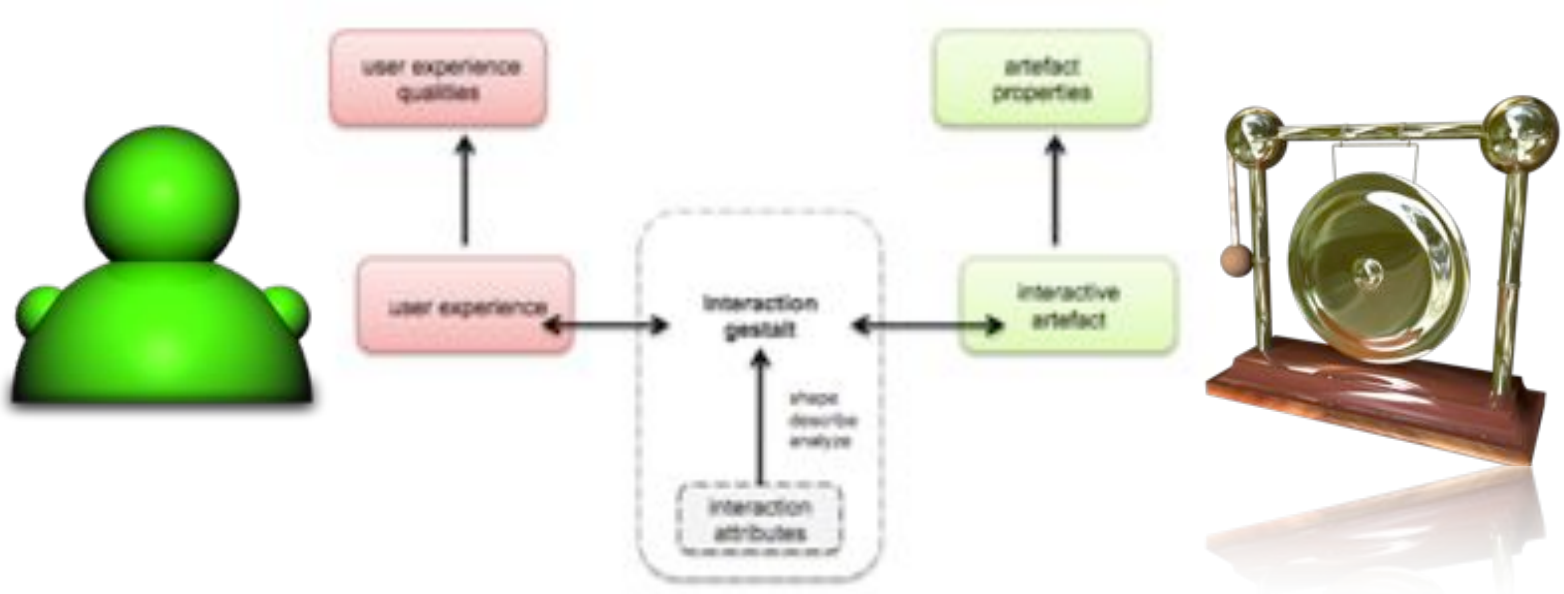
The SID activity zone

Many guidances



Interaction gestalts and attributes

Temporality there, but underemphasized



[Lim et al, 2009]

Towards new basic design

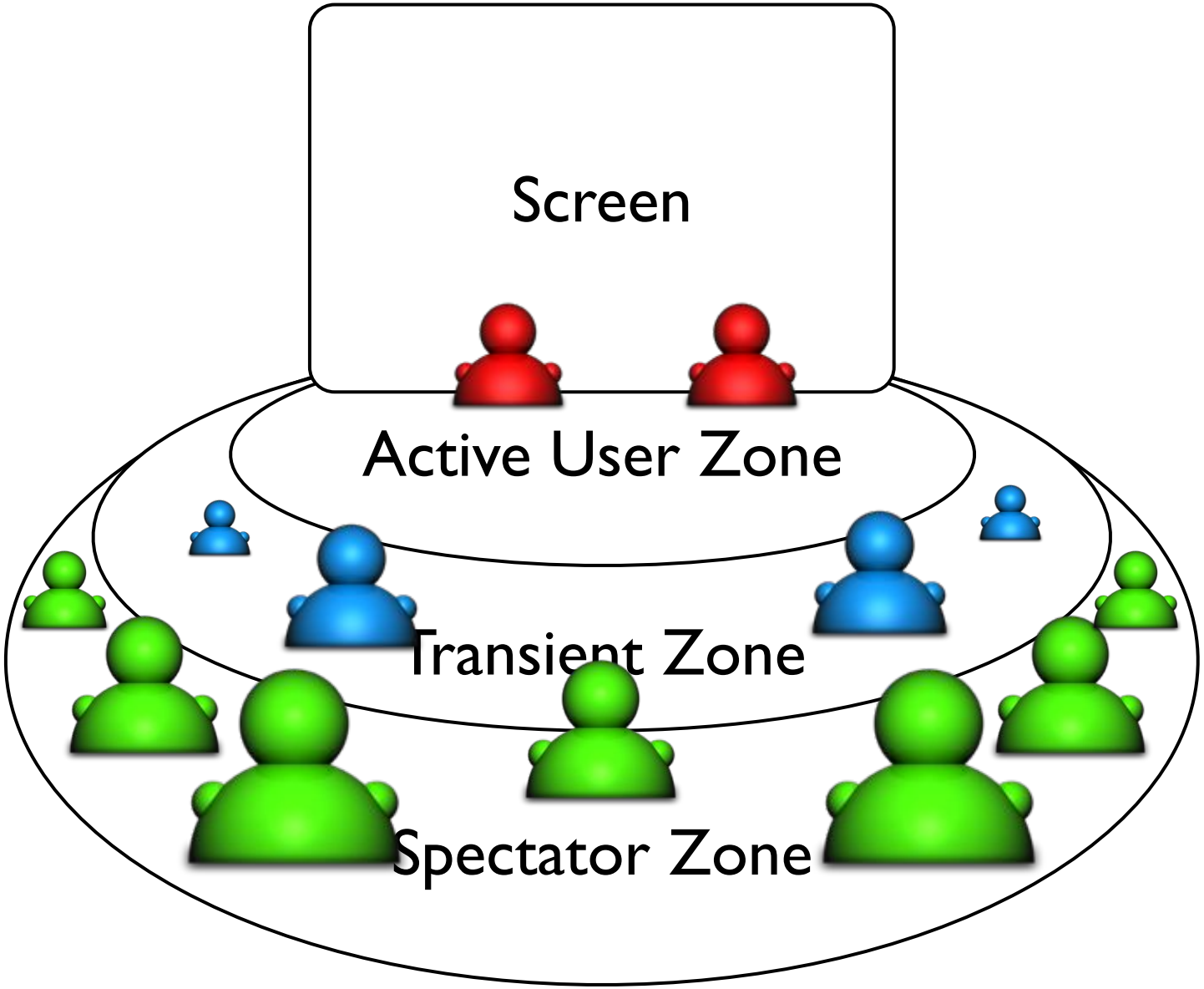
Remapping interaction attributes

This slide contained visual material from an unpublished report written by Stefano Delle Monache, 2009. Please contact the author at stefano.dellemonache@gmail.com for more info.

[Delle Monache, 2009]

Example: Interactive screens

Facilitator of social interaction



Reflections

- Despite the limitation, the area is not exhausted.
- We'd be happy to collaborate with interested parties to explore this fundamental capability
- ... and transfer it to the technical development, design, and evaluation of rhythmic interactive systems.

References

- Delle Monache. Unpublished research plan (2009).
- Erkut et al. Recent advances in exploring self-induced sonic interactions in the context of performing arts. Proc. HAID (2009)
- Jylhä and Erkut. Sonic interactions with hand clap sounds. Proc. Audio Mostly (2008)
- Lim et al. Interactivity attributes: a new way of thinking and describing interactivity. Proc. Intl. Conf. Human factors in computing systems (2009) pp. 105-108
- Mulder AG. Design of Virtual Three-dimensional Instruments for Sound Control. PhD Thesis, Simon Fraser Unv (1998)
- Peltola et al. Synthesis of hand clapping sounds. IEEE Transactions on Audio, Speech and Language Processing (2007)
- Pulkki et al. Efficient spatial sound synthesis for virtual worlds. (2009) pp. 10
- Repp, B. The sound of two hands clapping: an exploratory study. J. Acoust. Soc. Am., 81(4): 1100–1109 (1987).
- Rocchesso, D. Sonic Interaction Design. Lecture in Audio Signal Processing Seminar (2007)
- Welbergen and Ruttkay. On the Parametrization of Clapping. Proc. Intl. Workshop on Gesture in HCI and Simulation (2007)
- Strogatz. Sync: The Emerging Science of Spontaneous Order. Book (2003)