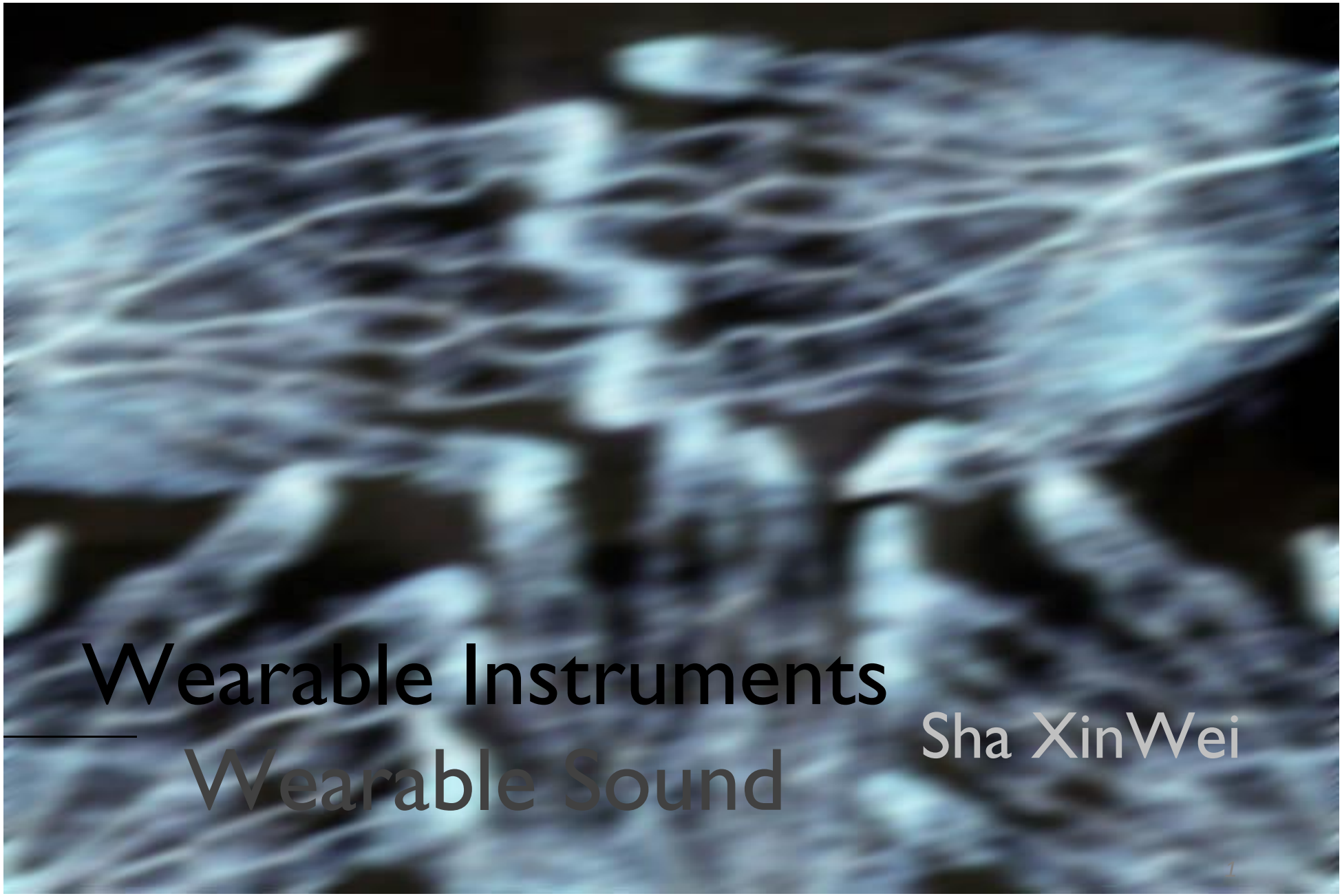

Wearable Instruments
Wearable Sound
Sha XinWei

Responsive Spaces

IN THE WILD • 2001

Thick in-vivo Experiments

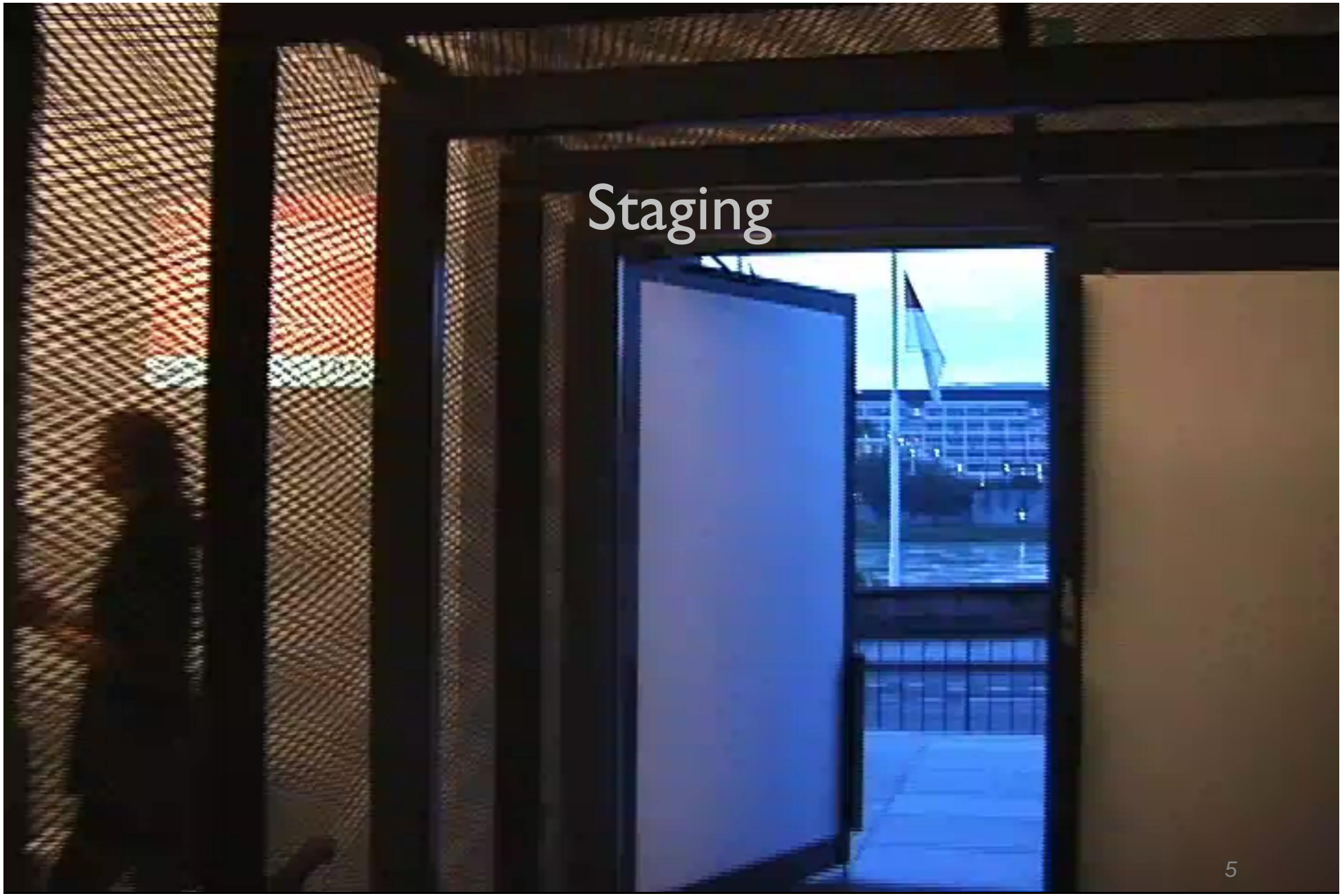
In a continuous, responsive, dense, living space –

How do we coordinate action without explicit language?

How do we improvise gestures ?

What makes something palpable ?

How we become more adept playing ? Virtuosity.

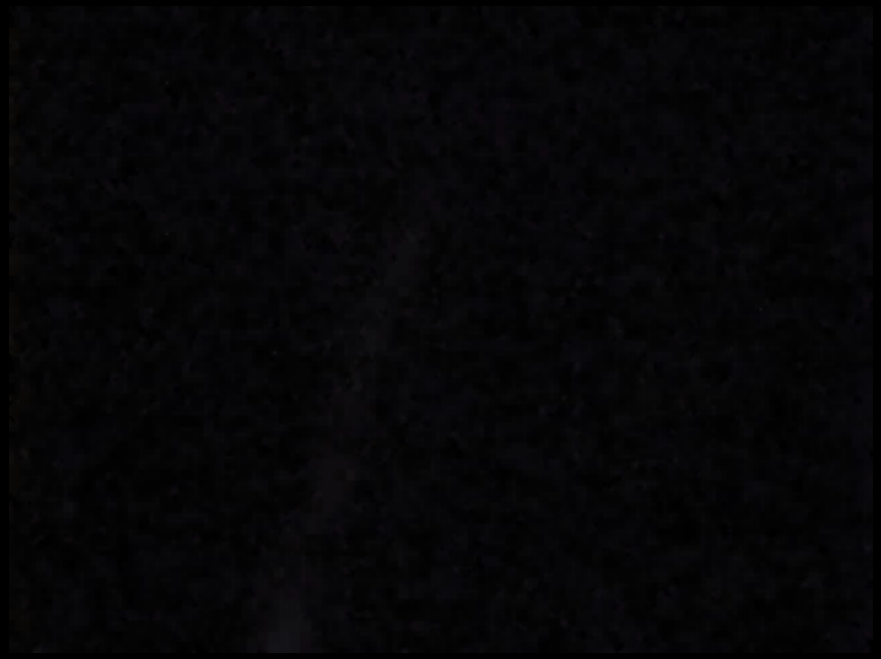

Staging

Two Phenomena

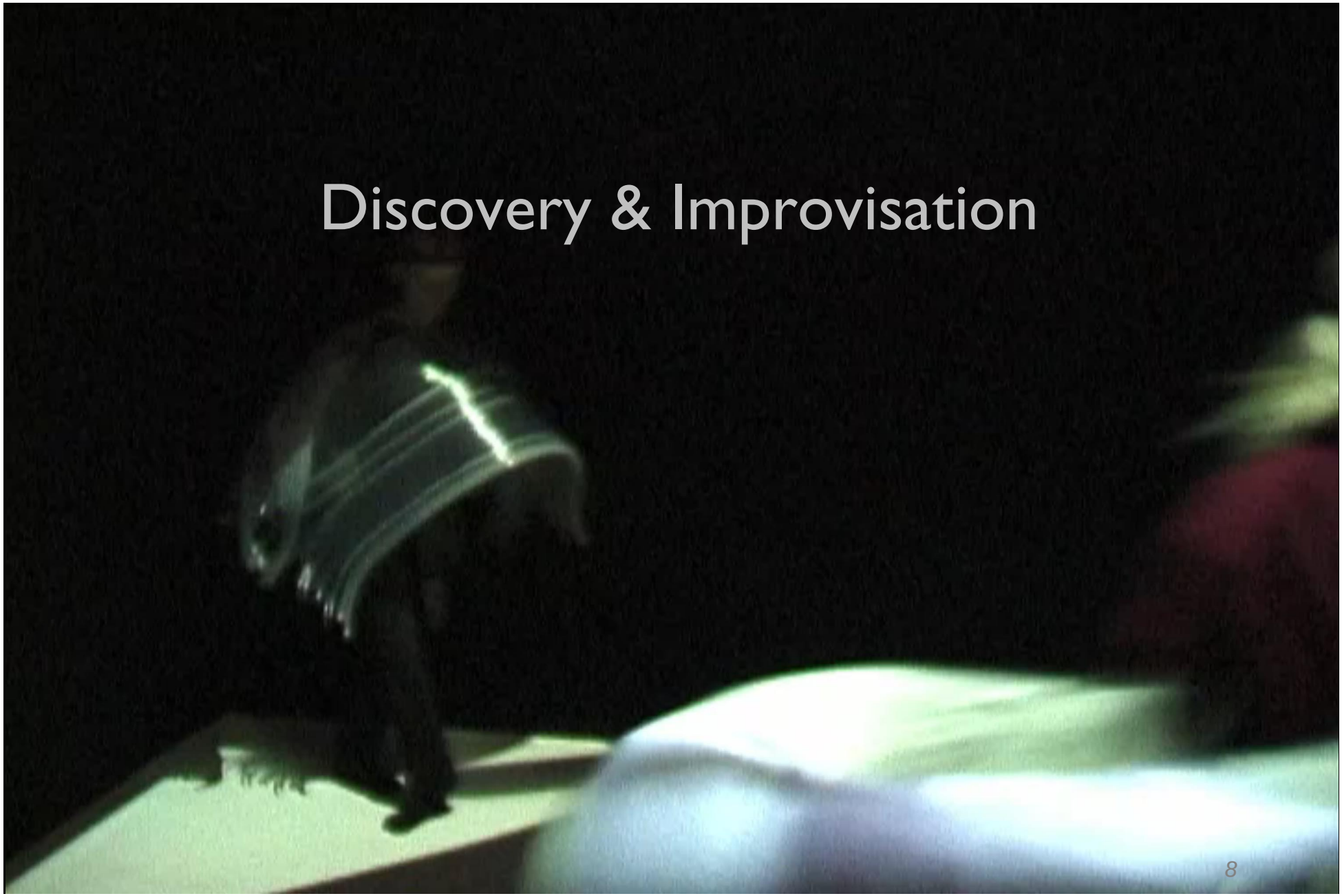
Induced tangibility

A-linguistic learning & articulation

Induced tangibility



(play hopskip) Ars Electronica 2001


Discovery & Improvisation

Responsive Media Spaces

IN THE LAB • 2001-2003

Blair MacIntyre
Erik Conrad
Junko Tsumuji
James Hsu
Yon Visell
Kat Tejavanija
Jehan Moghazy
David Demumbrum
Jim Ransone
Yoichiro Serita
Yvonne Caravia
Sunderesan Jayaraman
Sungmee Park
Wolfgang Reitberger
Vinny Fiano ...

* Topological Media Lab

School of Literature, Communication and Culture

New Media Center

Graphics and Visualization Lab

Georgia Institute of Technology

Topological Media Lab

Gesture & Materiality

micro

Hybrid computational / physical material

Tangibility and materiality

Temporal textures

Gesture

Domestic spaces

Design and inhabit rich, responsive, dense media

Urban spaces

macro

Wearable Computing

Body-borne and Environmental Sensors

Wireless

- TinyOS, motes (UC Berkeley, Intel; Dey, Paulos)

Active Fabrics, Softwear

- Softwear collaborations (Jayaraman, Park; Tejavanija; Berzowska)

Applied Pattern/Signal Analysis

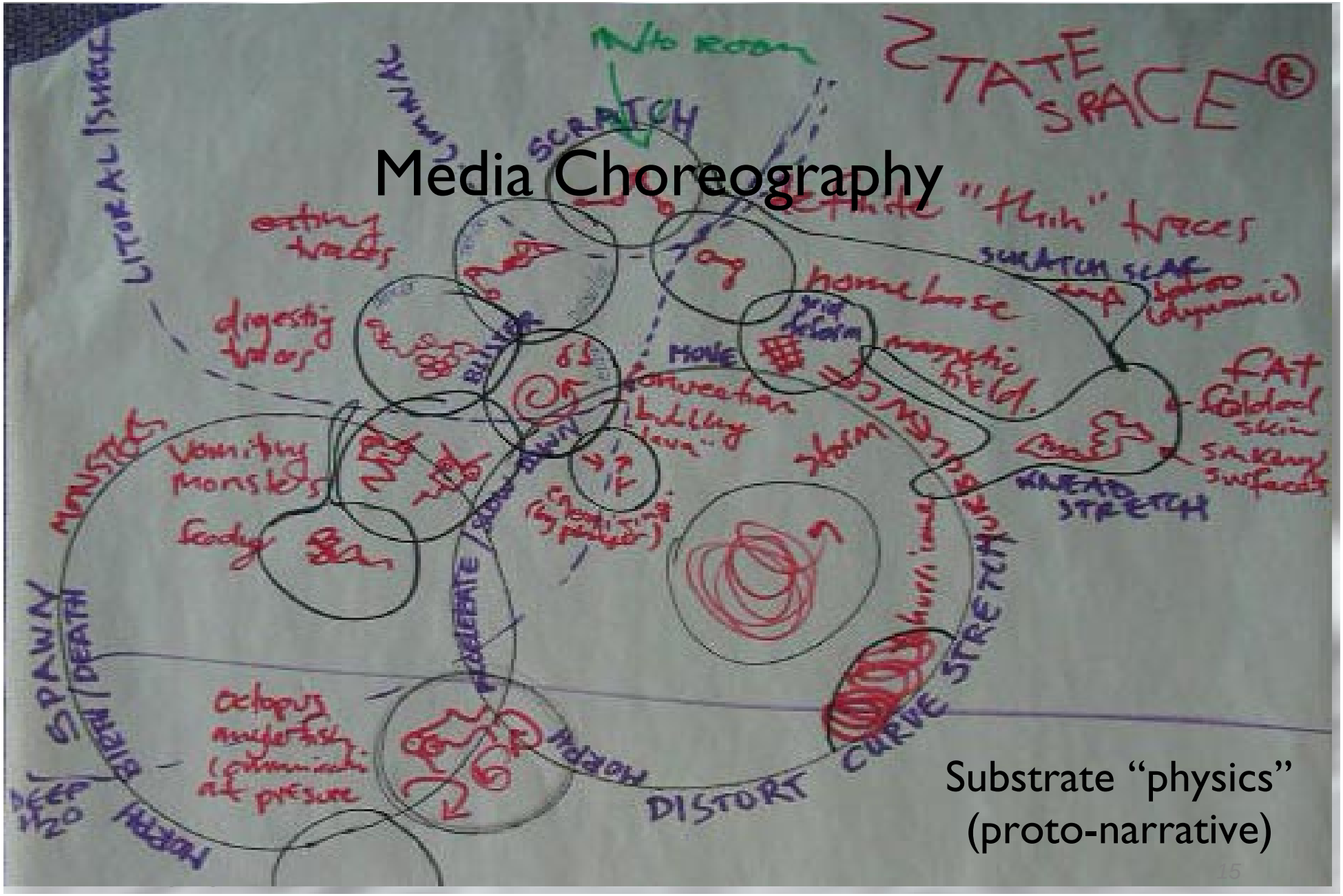
Vision tracking

Gesture tracking

Speech tracking

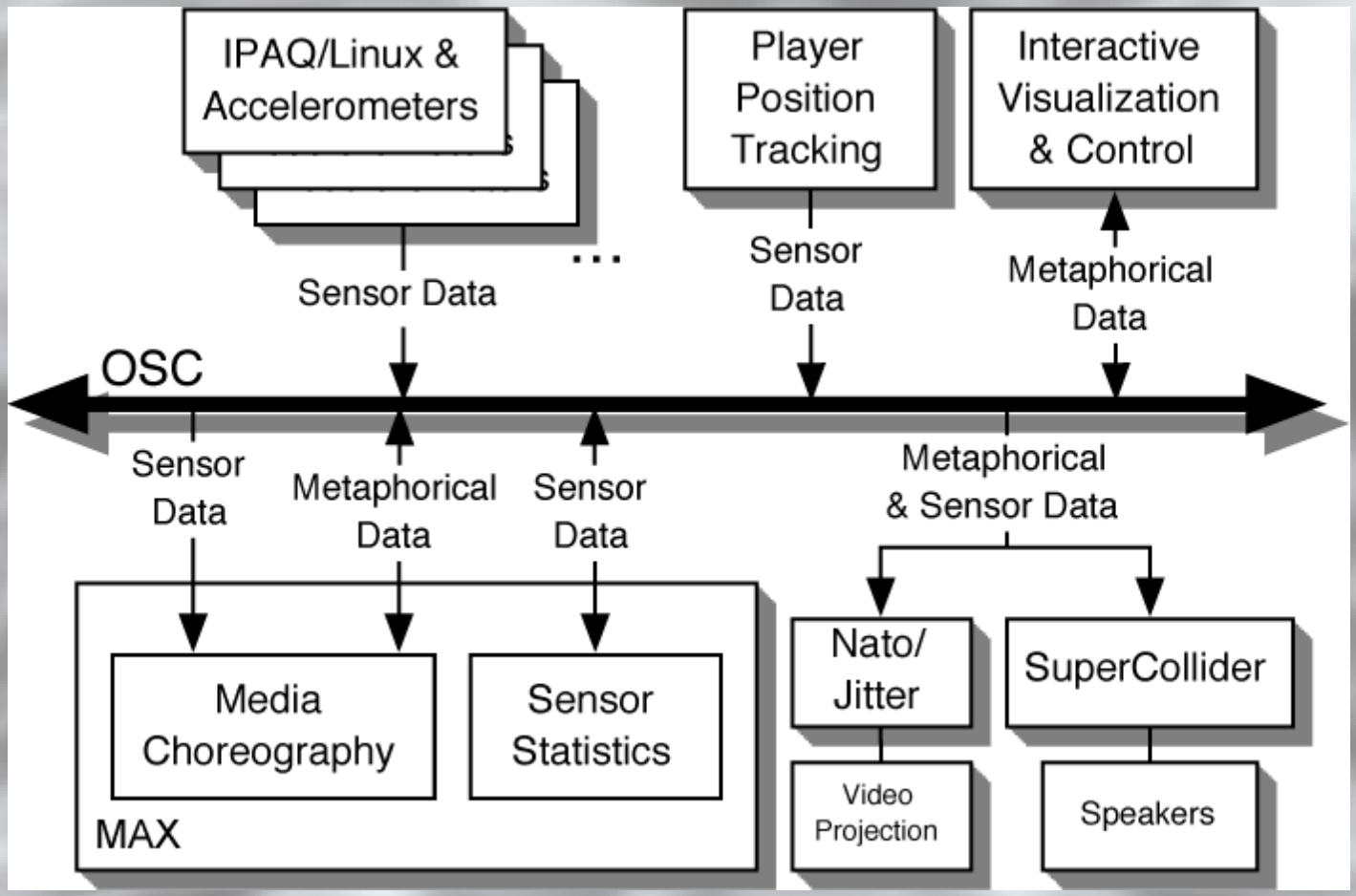

Media Choreography
Realtime video and sound synthesis
Responsive Media Authoring Systems
Continuous Time State-Evolution

Media Choreography



Substrate “physics”
(proto-narrative)

Architecture



Statistics

"Intention" and "Learning"

Preliminaries

- Calibration (accelerometers and IR)
- Data throttling

Scalar vs 1d or 2d array

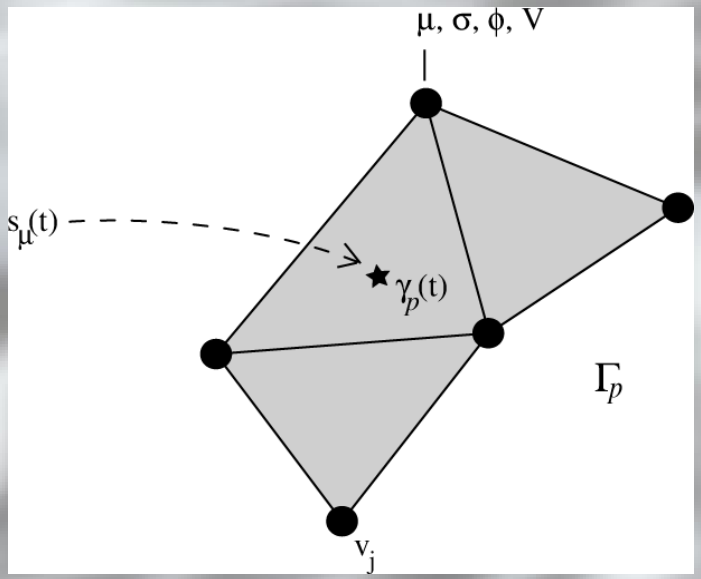
Instantaneous or integral

Integration over time or sample

- Application: Leaky accumulator for slewing

Dynamical System on Simplicial Complex

Statistical Physics



States Manifold: meaningful experience, as metaphors

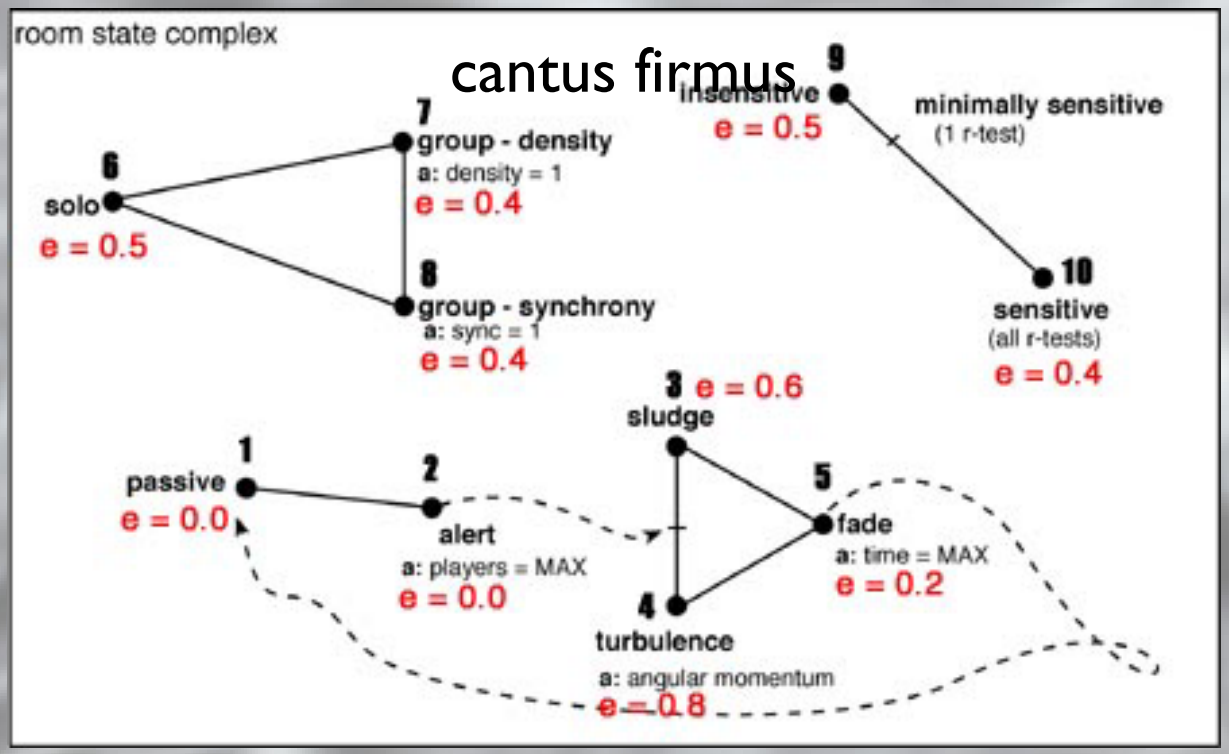
State: (convex) combination of pure states

Potential energy U = E(sensor) + E(static)

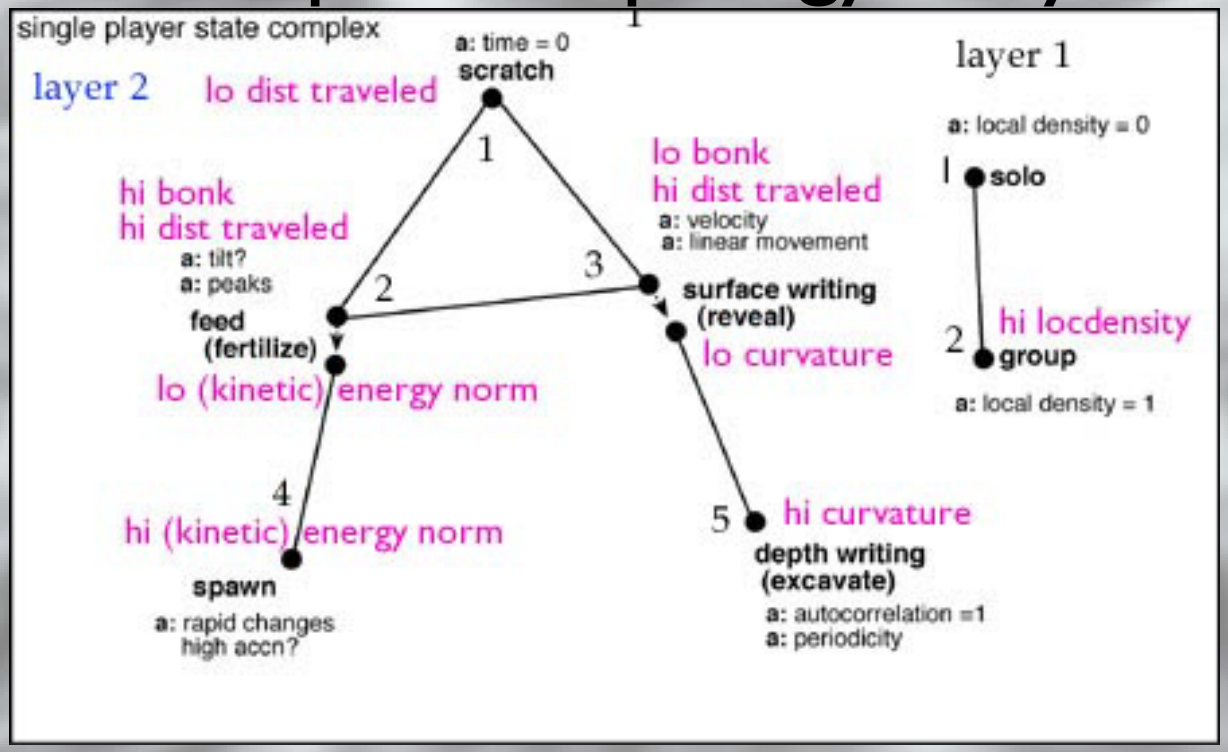
Kinetics: F = -Grad[U]

Arnold, Classical Mechanics
Itzykson & Drouffe, Statistical Field Theory
Jordan, Learning in Graphical Models

Phase Space Topology: Room



Phase Space Topology: Player



Dynamical System Overview

Total manifold = Metaphorical State x Observables

$$M = \prod_{p=0}^{N_p} M_p = \prod_{p=0}^{N_p} \Gamma_p \times S_p.$$

$$\gamma_p(t) = \sum_{j=1}^{N} \lambda_j(t) v_j$$

$$\sum_{j=1}^{N} \lambda_j(t) \equiv 1 \ .$$

Energetic Model

$$U[\gamma_p(t)] = \sum_{v_i \in \sigma(\gamma_p(t))} f(\lambda_i) \left\{ e^{-\beta E_k[s_{\alpha\_p}(t)] + g_s \phi_k} + g_V V_k \right\}$$

$$E_k[s_{\alpha;p}(t)] = \sum_{\alpha\beta=1}^{N_s} (\mu_{\alpha k} - s_{\alpha;p}(t))(\mu_{k\beta} - s_{\beta;p}(t)) / \sigma_{\alpha\beta}$$

Dynamics

$$F[\gamma_p(t)] = -\nabla U - \xi \dot{\gamma}_p(t)$$

In convex coordinates

$$F_k = \frac{-dU}{d\lambda_k} - \xi \dot{\lambda}_k$$

Discrete states and discrete transitions are special case
Good framework to handle noise, hysteresis.

Equation of Motion

∇U on phase space

The evolution is given by

$$\dot{x}_m \rightarrow \dot{x}_m + \frac{1}{m} F_m^t \ \mathrm{dt}$$

$$x_m \rightarrow x_m + \dot{x}_m \ \mathrm{dt}$$

where

dt = integration timestep

m = mass of particle

Calligraphic Video May 2002

Resonance Response May 2002

Spectral Methods (Kac)

Wearable Instruments: Wearable Sound

Phenomenological Experiments

Experimental Phenomenology

Softwear: Body + Garment

Matter, Poetry and Poiesis

Patterns: tattoos, (virus), resonance

Gesture instrument

Material as memory, amplification

Thick space

Fabric Media

S. Jayaraman and S. Park @ Georgia Tech

J. Berzowska; E. Kusaite, M. Kuzmanovic et al.; S. Diamond et al.

K. Tejavanija, Y. Caravia, J. Fantauzza @ TML

Research Agenda

Experimental

- Gesture, Movement
- Tracking, Feature Extraction
- Continuous Media Choreography
- Softwear, Wireless Sensors, Fabric

Design

- Realtime Video Synthesis
- Realtime Sound Synthesis

Applications

- Softwear: wearable sound
- Responsive Media Spaces