tenure presentation

Sha Xin Wei
Associate Professor, Canada Research Chair
Computer Science & Software Engineering
Concordia University

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Menu

- Past
- Present
  - Teaching, Research, Service
- Future
  - Teaching, Research, Service

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Past

3

continuous models of morphogenesis

Single body of work.

Multiple perspectives:
Philosophy & Critical Studies
Computer Science & Art

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biography

1984 - 1994

Scientific simulation & visualization, Stanford (Apple+IBM, NeXT)

1994 - 1997

Human-computer Systems, Stanford (Research Apple, Xerox PARC, Sun, Taligent, Kaleida, etc.)

Interaction and Media Group Faculty Seminar

1997 - 1998

Pliant Research (J Harris, A Henderson, N Damiris, H Wild, B Smith, P Dourish)

Interval Research (M Slaney T Bell, machine learning)

1999 - 2001

Computer Science, Mathematics, History of Science, Stanford

T Winograd, R Mazzeo, T Lenoir

2001 - 2004

Georgia Tech, LCC, Graphics, Visualization and Usability Center

2004 - 2005

Harvard University

MIT

2005-present

Concordia University

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Mathematics

Differential Geometry

- Total mean curvature

Geometric Measure Theory

PDE's Analysis on Manifolds

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Scientific modeling and visualization

Computational Physics

- Microworld Simulations, B Cabrera
- Quantum Inflationary Cosmology, A Linde

Mathematica

- Wolfram Research Mathematics Advisory Board
- Differential Geometry: symbolic algebra + numerical pdes
- Structured 2D Editor

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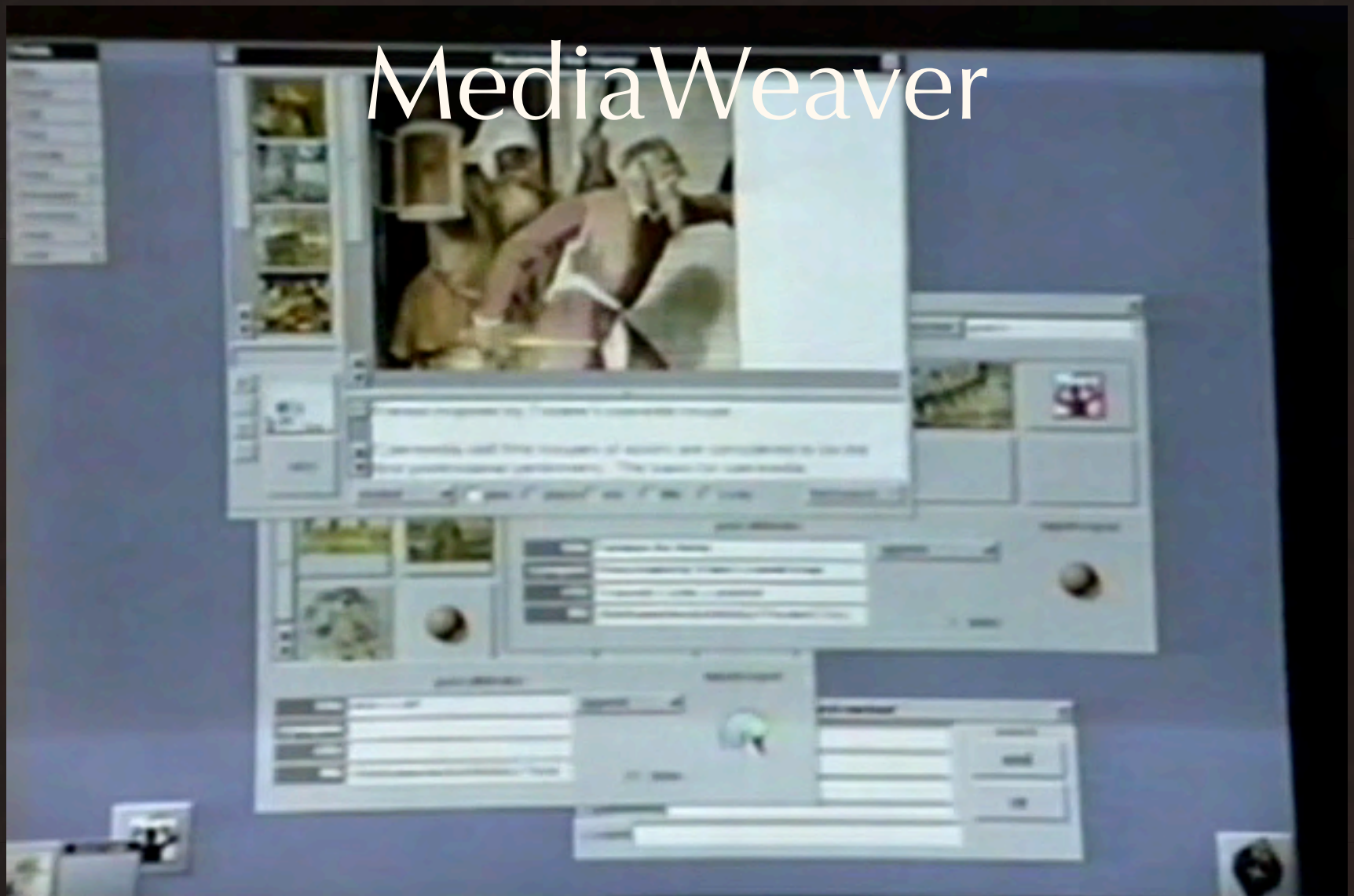
MediaWeaver



Stanford, Berkeley, + 4 other US universities; Digital Libraries Initiative, 1994-1996

Distributed multimedia database

Object-oriented frameworks

Storage, Meta-data, Search engine abstraction, Services, Front ends

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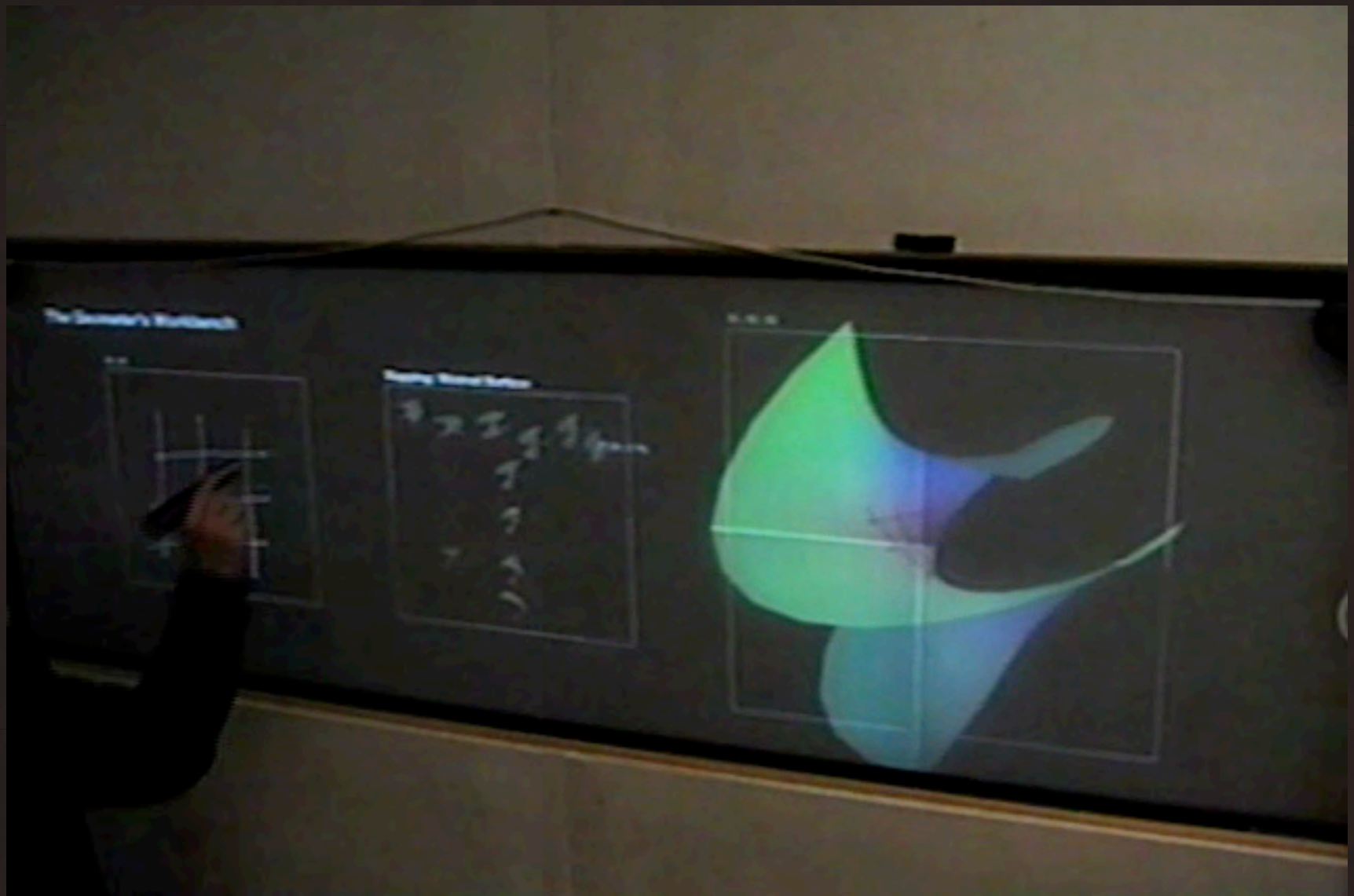
Geometer's Workbench



w/ F Guimbretiere

Winograd, Hanrahan InfoMural Group, Stanford 2000

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Present

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Teaching

Computer Science
Atelier - Laboratory

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Course Load

Each term:

{Undergrad, Grad} x {CSE, DCART}

{Supervised Readings: Undergrad, MA, MFA, PhD}

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COMP

COMP 691: Alchemy (history of chemistry), computational physics, realtime video

COMP 471: Computer graphics, computational video

COMP 498: Real-time computational video

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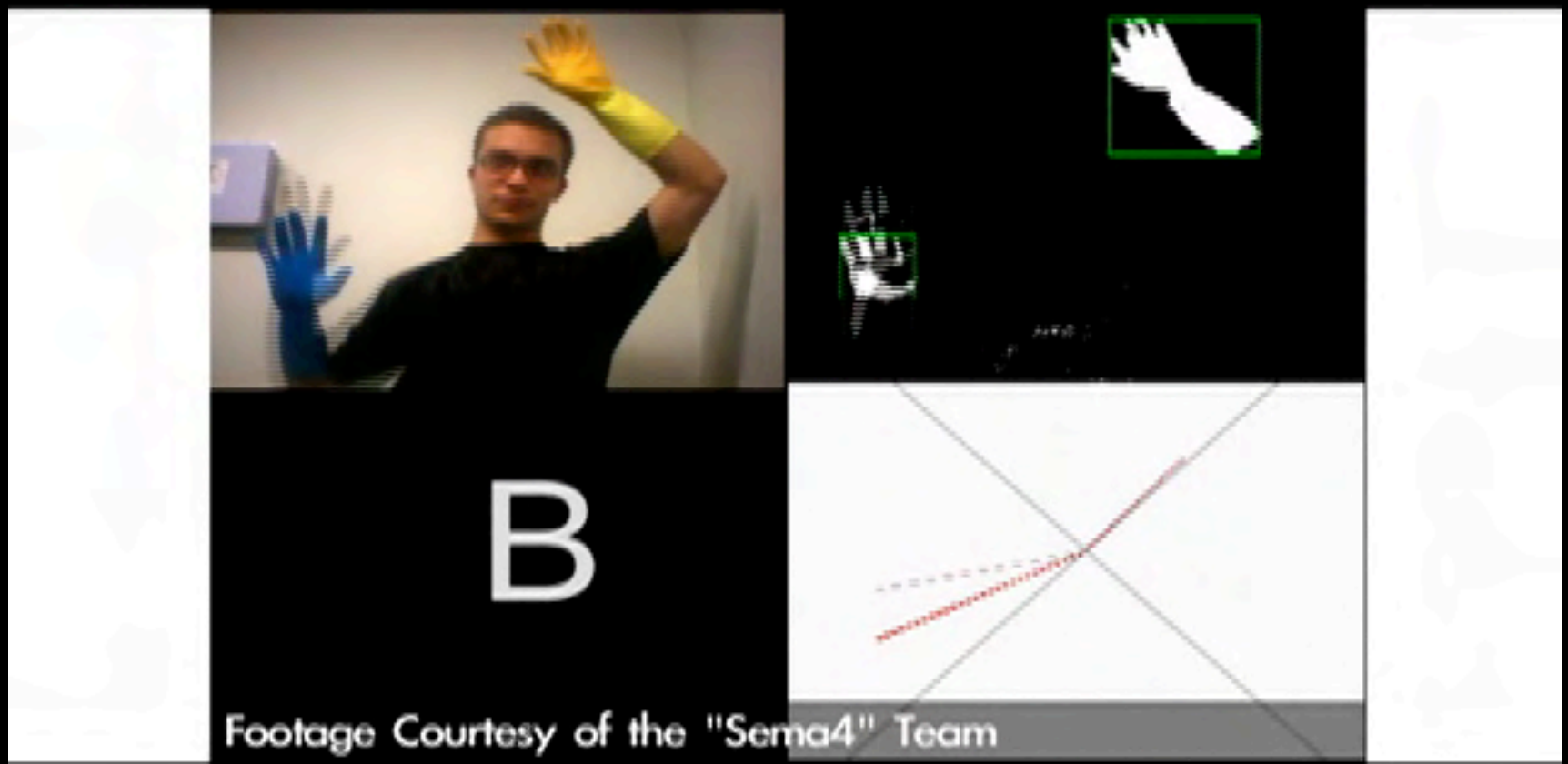
COMP 471 (CART 498)



Scene crime; Sema4 pattern recognition

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COMP 691 + CART 498X

Y Assogba: background & movement detection

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COMP 691 + CART 498X

Triface: gesture tracking, continuous mapping to stroke

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Doctoral

HUMA 888, Doctoral Seminar in Interdisciplinary Studies I, Critical Studies of Media Arts and Sciences: Subjectification, Process, and Performance

SIP 825, Critical Studies of Media Arts and Science, Graduate Seminar / Supervised Readings

Currently Supervised:

- H Smoak, Structured Light
- E Conrad, Art: Phenomenology and Perception
- V Lamontagne, Performance & Ubiquitous Technologies
- S Y Park (Interactive Art and Reception)
- P Harrop (Architecture & CS)
- + J Willet, D J Johnston, T Rhoades, ...

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Atelier Workshops

Summer Workshop 2005

Soft Architecture 2006

Nataraja Movement 2006

Ouija Movement Experiments 2007

Grotesque Perturbations Soft Architecture Workshop with Dedale Studio, Summer 2007

Movement+Sensors+Media, May-June 2008

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Visiting Artists & Researchers

Some Guests:

Benoit Maubrey, Die Audio Gruppe, 2005

Erin Manning & Brian Massumi, SenseLab, 2005-2007

Niklas Damiris and Helga Wild: Capital Practices and the Co-Production of Values, March 2007

Toni Dove: Spectroscopia interactive cinema, April 2007

N Damiris + Doug McDavid: Eco-economics, April 2008

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Research:
Topological Media Lab

= atelier + studio + laboratory
materiality, phenomenology of events, gesture & intention

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Strategy

Create works in public, cultural domain
Derive questions from these public projects
Develop conceptual approaches
Design & build laboratory
Create new works in public, cultural domain

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Context: Events in Public

What's an event: A game, theater, dance, festival... athletic event, climbing a mountain, a dinner, speech, ...

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How can we build a world that's not complicated, but rich?

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design spaces and **events** as architectural phenomenological experiments

arakawa and gins, ubiquitous site, nagi

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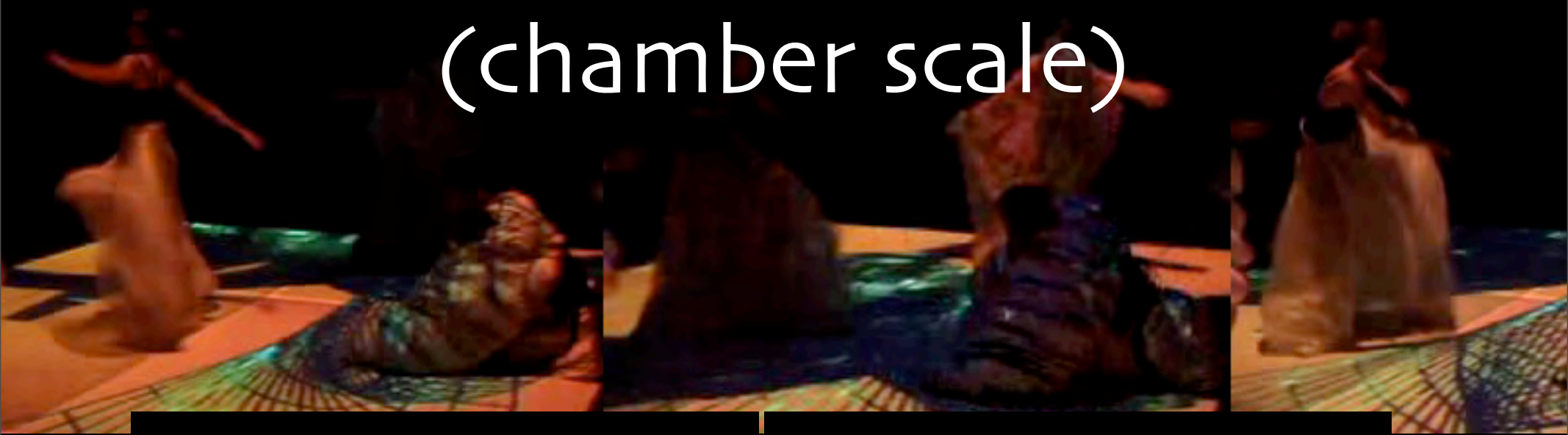
events in responsive spaces (chamber scale)



tgardens 2000-2001 sponge + foam

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events in responsive spaces (building scale)

Research Program

distributed materiality, agency, gesture
responsive environments
gestural sound
calligraphic video
sensate/animate textiles
media choreography
movement arts and architecture

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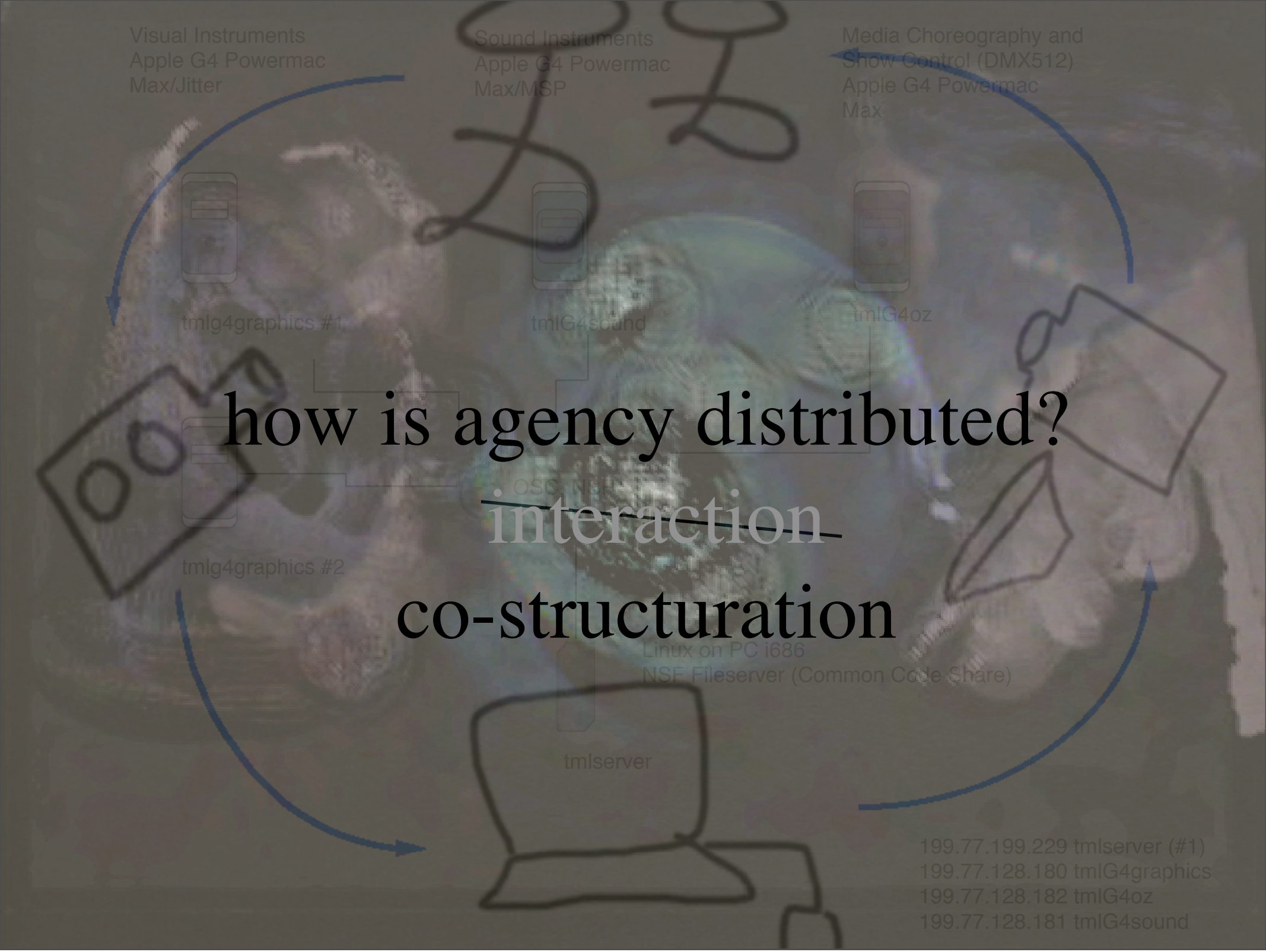
what makes something tangible?
tg2001 sponge foam

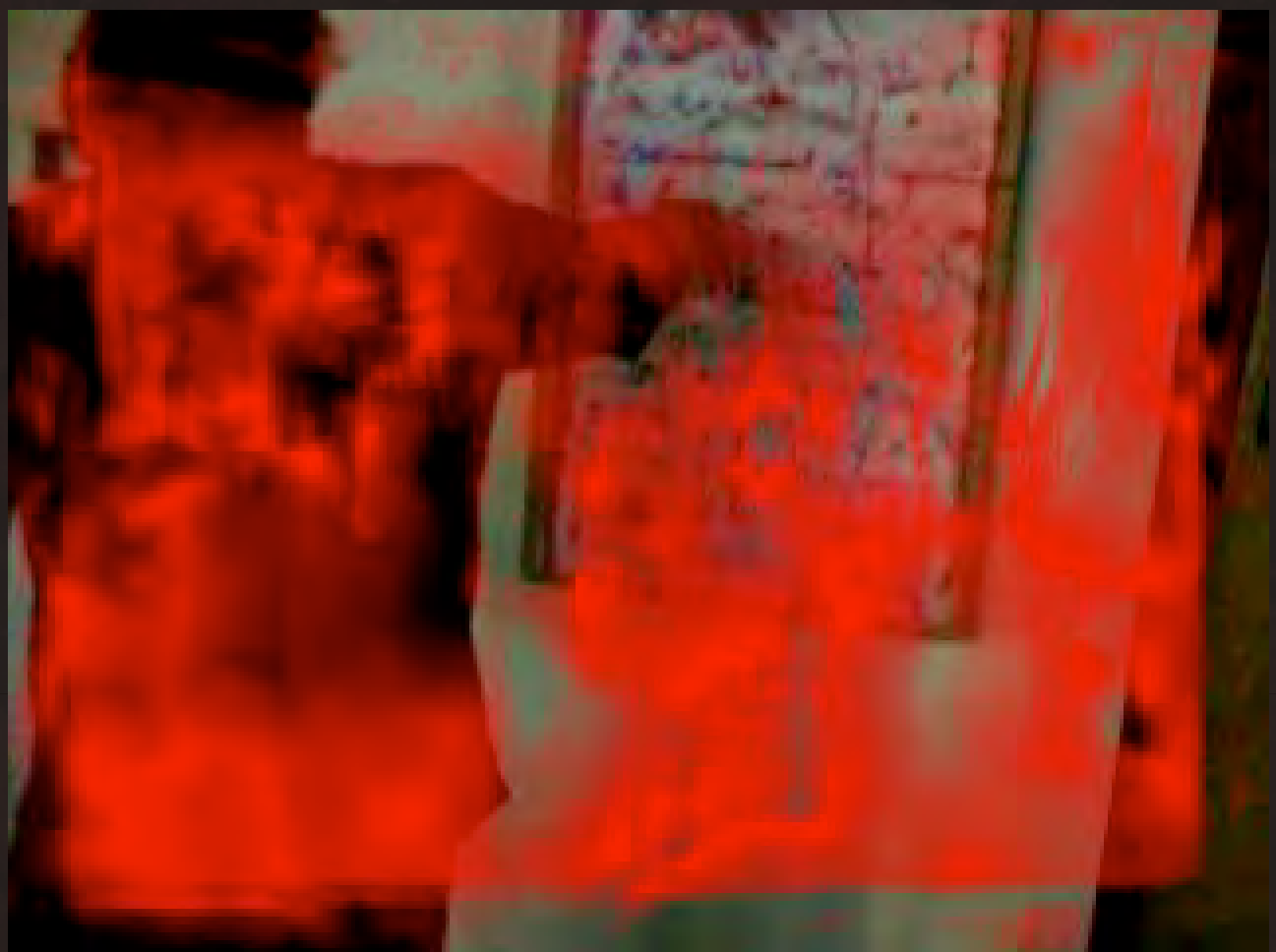


how is agency distributed?

~~interaction~~

co-structuration

what (when) is a gesture?



Craig Dongoski, Atlanta 2004.

Satinder Gill, Cambridge, musicality and rhythm in collective gesture, 2005-2009.

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intentional gesture

Search for correlates, not certificates, of intentional gestures.

Candidates:

Periodicity (Auto-correlation)

Synchrony (Correlation)

Breaks from prediction (Kalman filter as discrepancy measure)

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how can someone inhabit a
dense responsive environment?
tg2001 sponge+foam

Research Results

7 PhD's

24 Masters and Undergrads

12 Affiliate Artists and Researchers

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calligraphic video: leverage embodied knowledge

fire, smoke / Yoichiro Serita et al. TML 2003

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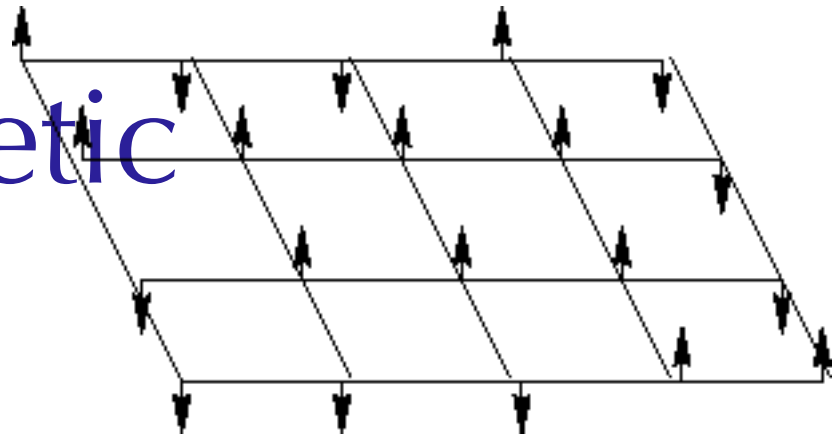
Ising Model magnetic domains



spin up or down of a magnetic domain

$$\sigma_i = \begin{cases} 1, & \text{“up”} \\ -1, & \text{“down”} \end{cases}$$

J > 0 encodes energy favoring aligned spins

$$E = -H \sum_i \sigma_i - \frac{J}{2} \sum_{(i,j)} \sigma_i \sigma_j$$

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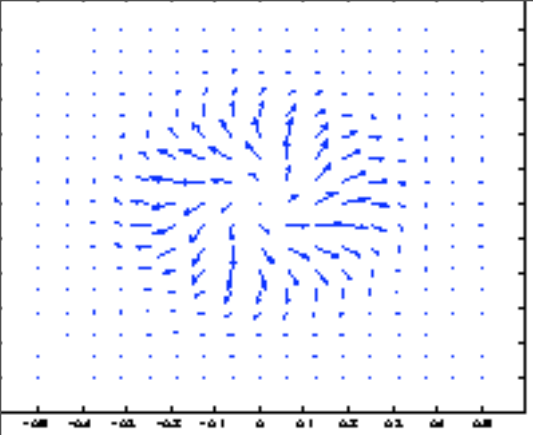

Ginsburg-Landau spin glass

Generalization of Ising model
from discrete range {0,1} to
continuous range S^1

$$\iota u_t^\epsilon + \Delta u^\epsilon = \frac{1}{\epsilon^2}(|u^\epsilon|^2 - 1)u^\epsilon$$

$$\epsilon \to 0.$$

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Ising video operator

Yannick Assogba, 2006

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lattice-field works gracefully with lots of people

Navier-Stokes & Wave Blackbox Inaugural May 2006

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Gestural sound & Wearable computing

gestural sound: wysiwyg

Blackbox test • November 2006

+ Marcelo Wanderley, McGill, IDMIL

F. Abtan, D. Birbaum, D. Gauthier, E. Singyor, D. van Nort, + E. Conrad, R. Koehly • November 2006

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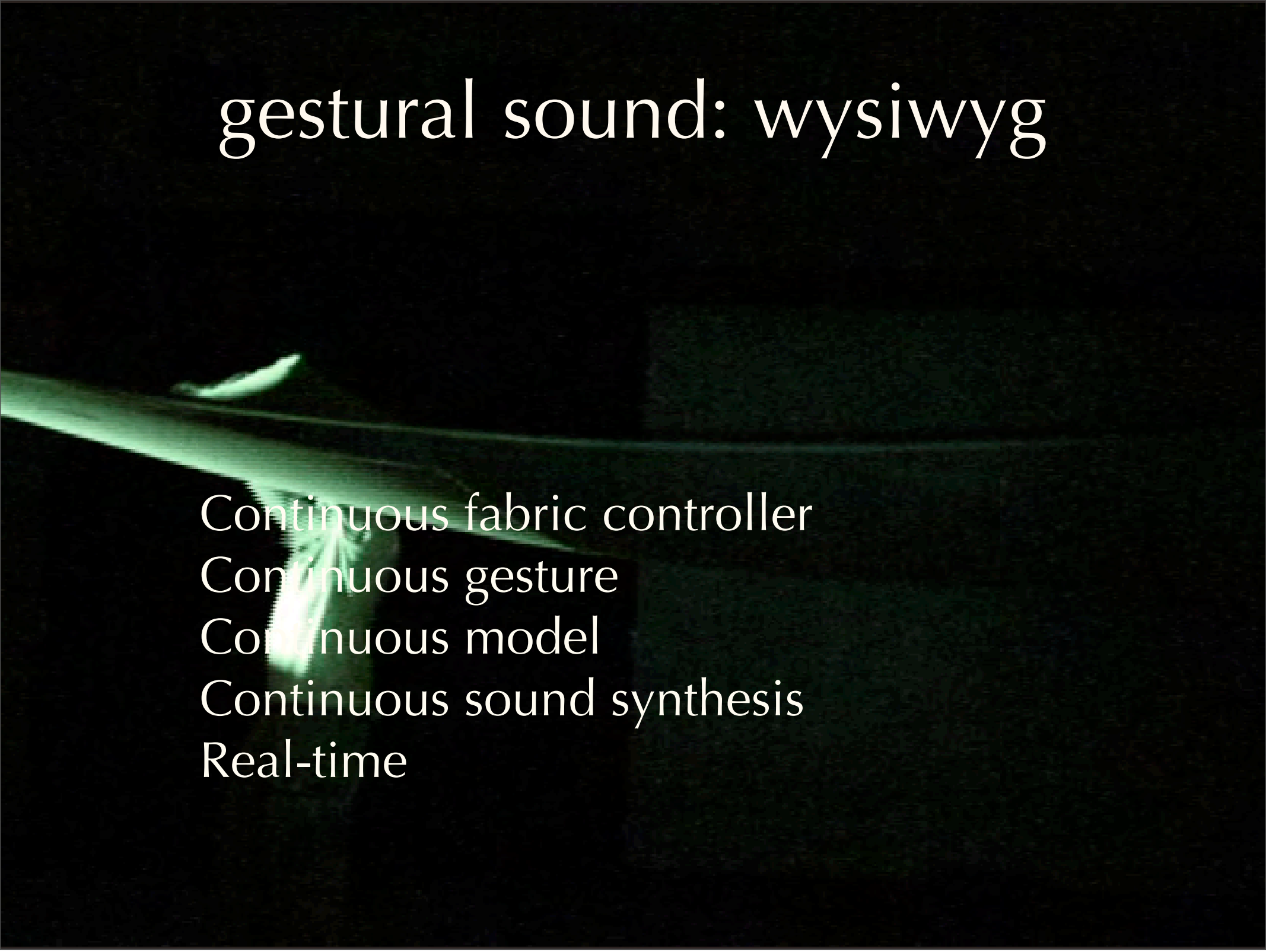
gestural sound: wysiwyg



Continuous fabric controller
Continuous gesture
Continuous model
Continuous sound synthesis
Real-time

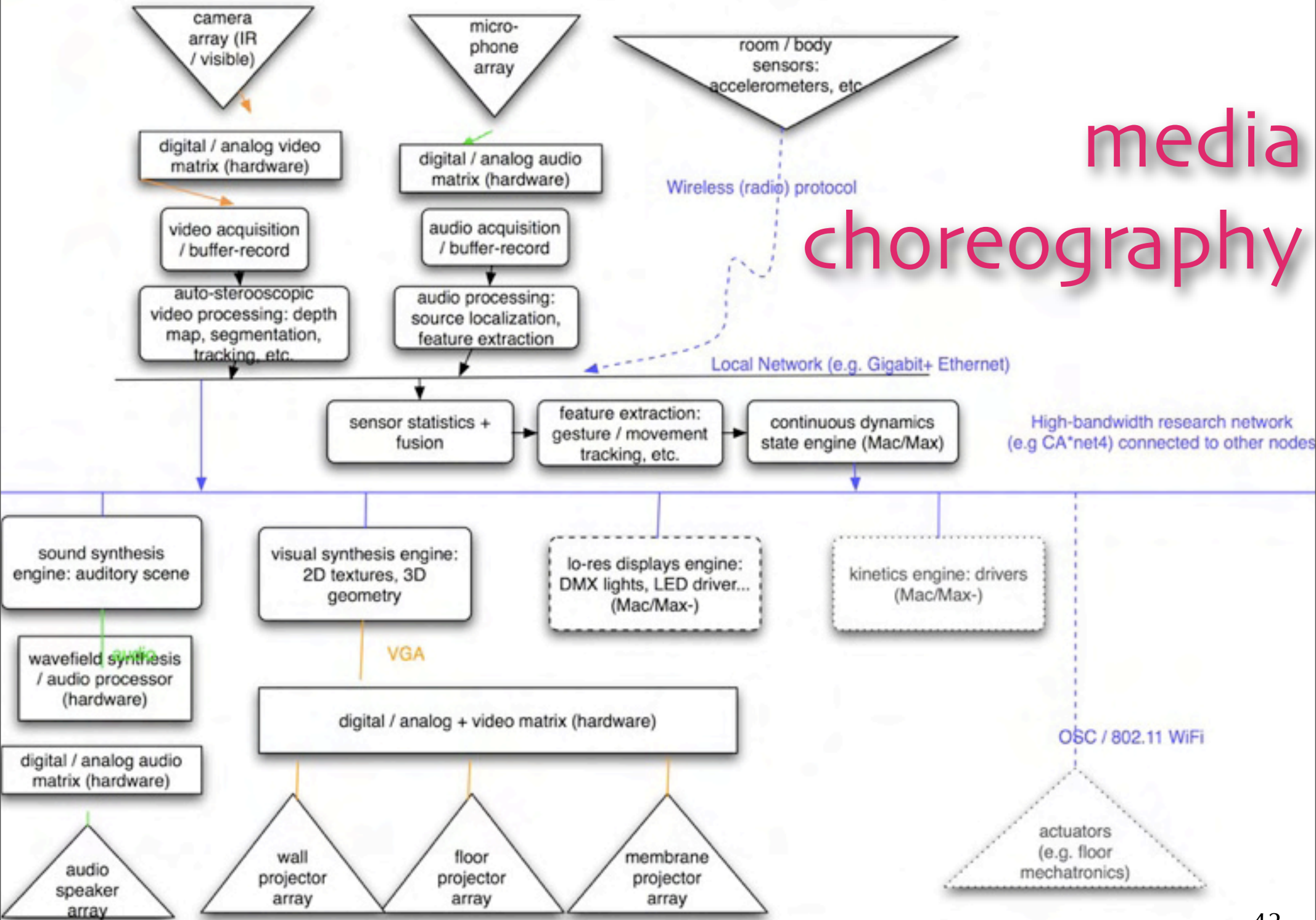
wearables: softwear

Hexagram Active Textiles and Wearable Computing Axis

Profs. J. Berzowska, B. Layne, I. Bachman (Fine Arts)

WYSIWYG 2006, Prof. M. Wanderley + 6 (Concordia-McGill)

TML 2002-2004: J. Fantauzza, S. Park,Y. Caravia, S. Lee, G. Semeco,++



media choreography

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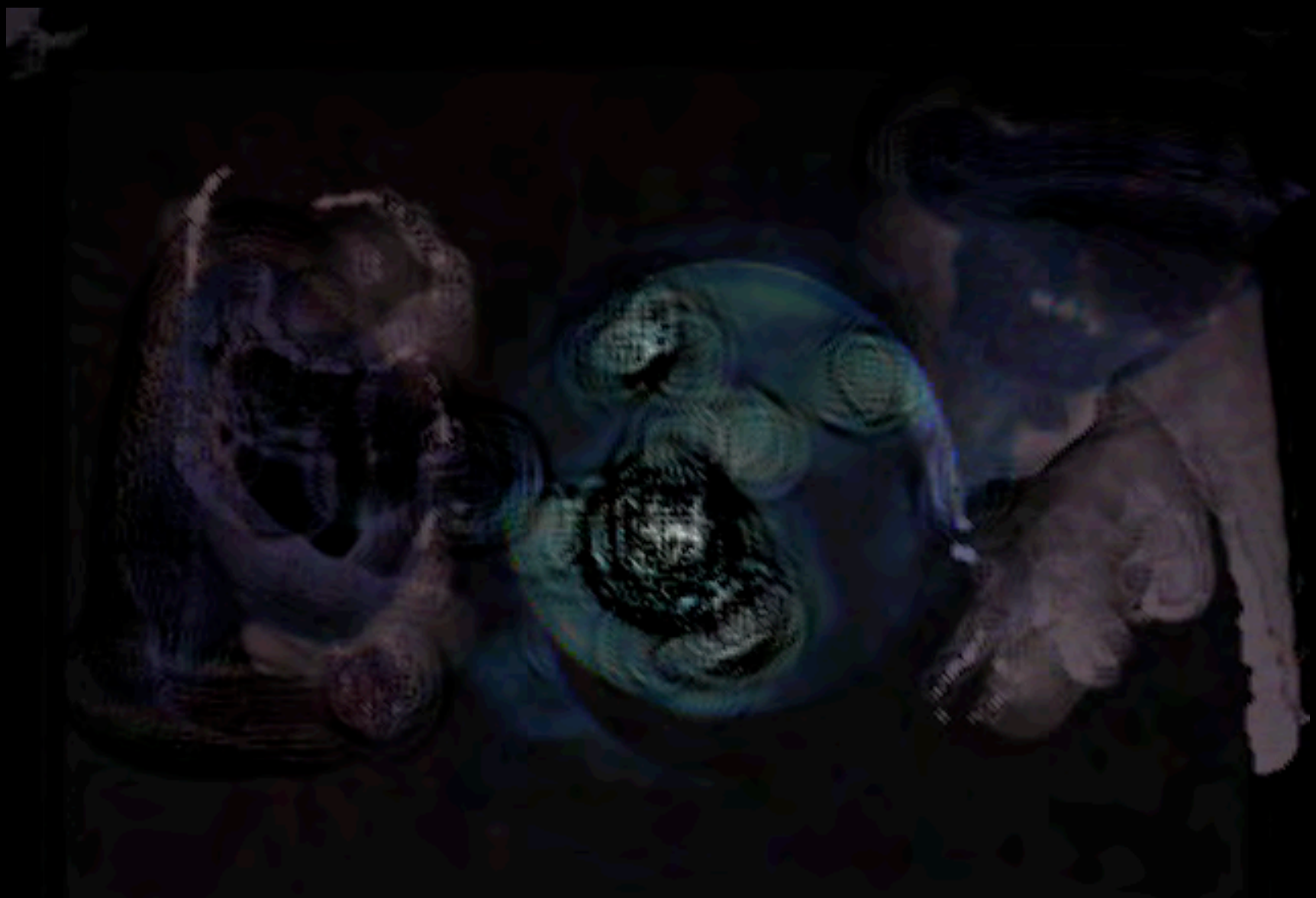
e pur si muove

Continuous state evolution in four dimensions. Yon Visell (physics), Harry Smoak + Kevin Stamper (construction and physical computing), Chris Salter + Matthew Warne (sound instruments) TML 2004

Thick/N media choreography



phase change induced by speech and movement energy
Harry Smoak, Matthew Warne, Kevin Stamper TML 2004

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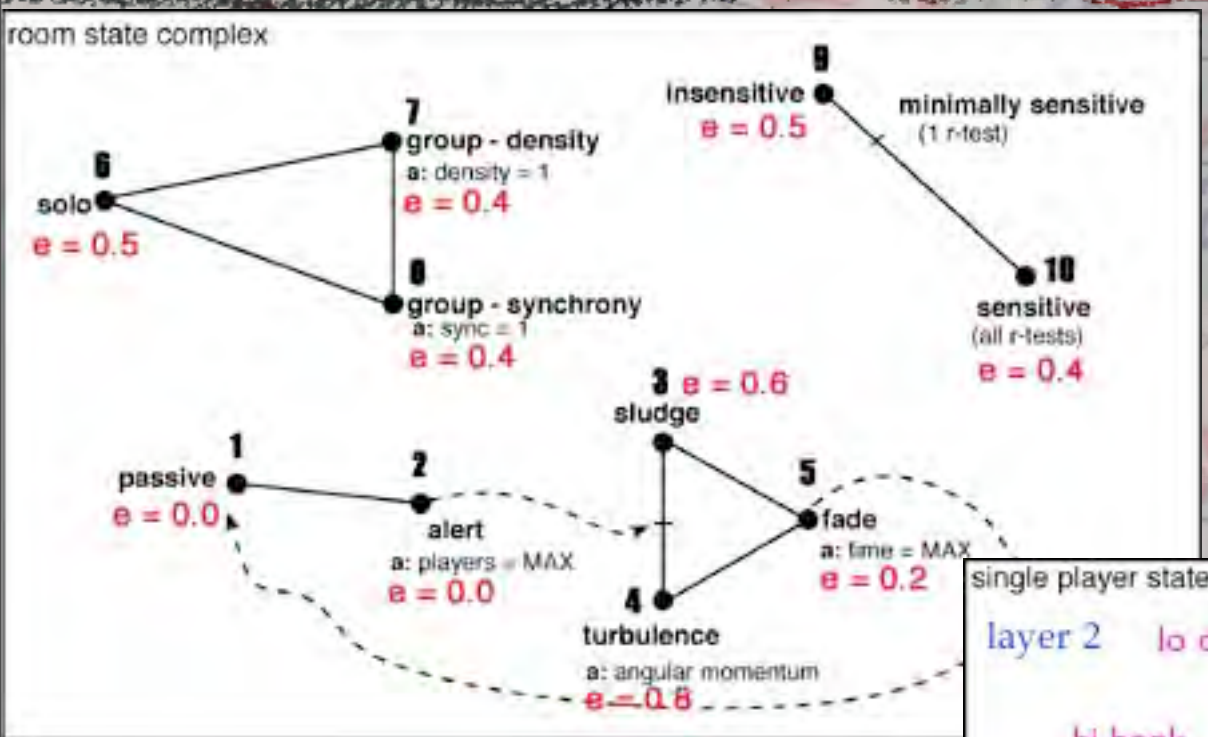
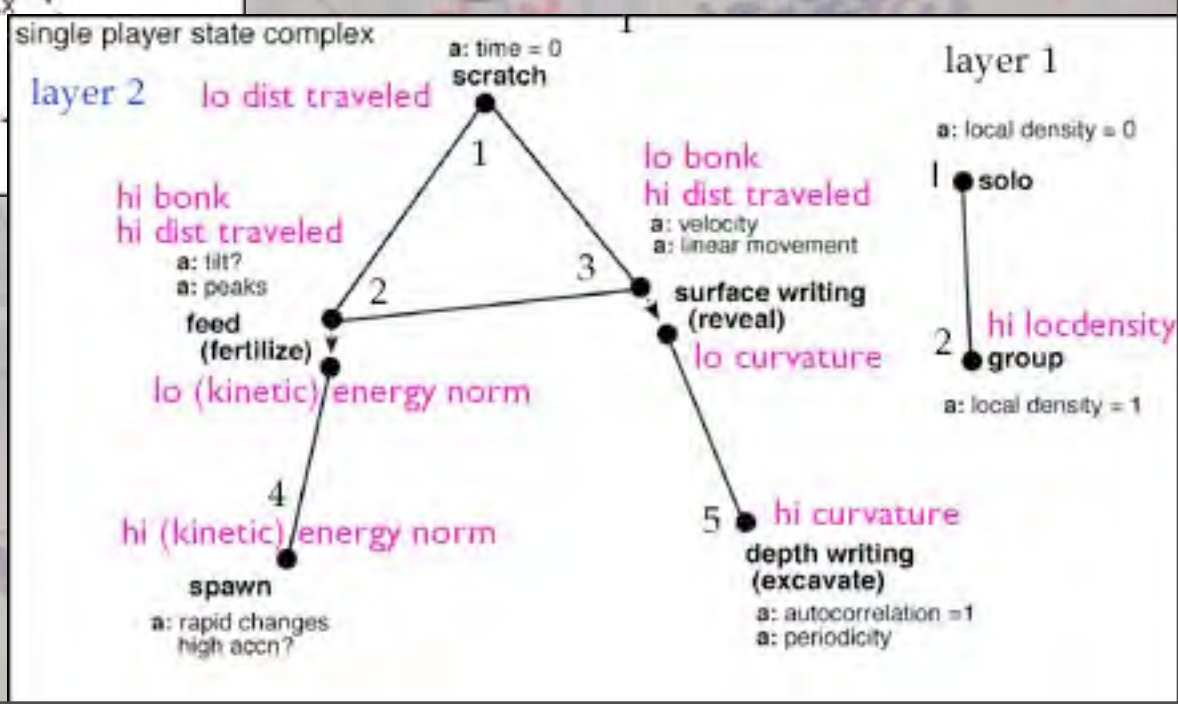
media choreography



continuous state topologies for room and each person



metaphorical labels
superposed states
continuous evolution

dynamics on manifolds

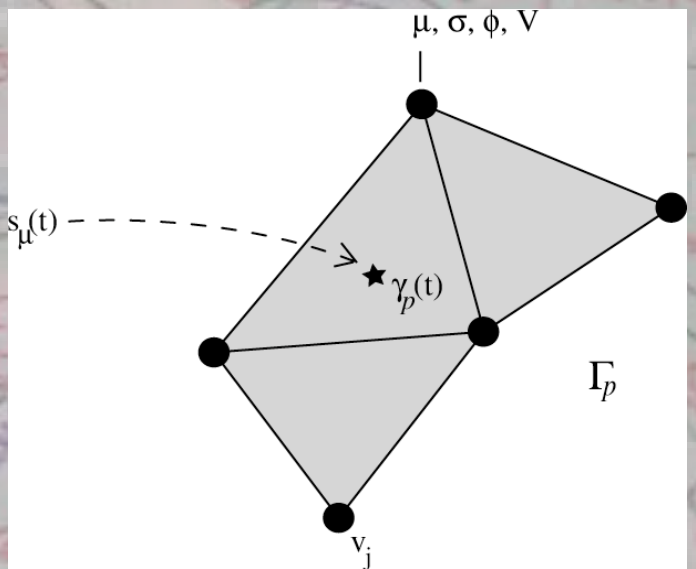
Total manifold = Metaphorical State x Observables

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

State is a convex combination of elementary states

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

dynamical system on simplicial complex



Metaphor space: meaningful experience, manifold

State: (convex) combination of pure states

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

Kinetics: F = -Grad[U] / mass

applications

Architecture & responsive environments

Movement arts & responsive environments

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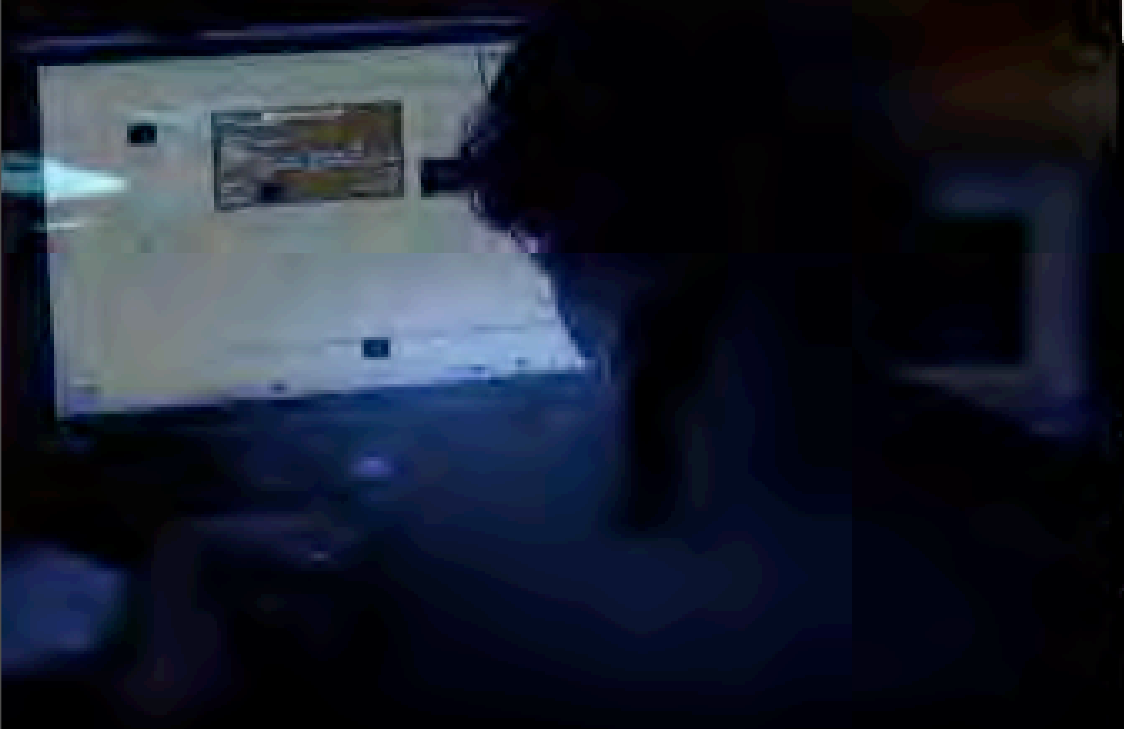
ARTAUDIAN lighting



camera-based tracking
mapping movement to
theatrical, structured
light

theatrical light

real-time, responsive projected lightfields
M. Montanaro, H. Smoak, et al. Nov. 2006

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Meteor Shower

Jean-Sebastien Rousseau, Tim Sutton, Emmanuel Thivierge, + TML

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movement experiments

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Dance Moves: Virtual Puppetry

Ex Centris, HEXAGRAM

Using game controllers to articulate bodies in VR worlds (e.g. Sony Home, Second Life)

New genres of multi-player movement games.

Work with high profile choreographers, and artists. Local virtuosi.

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Ouija: entrainment

Ouija Experiment on Collective Gesture in Responsive Media Spaces, June-July 2007

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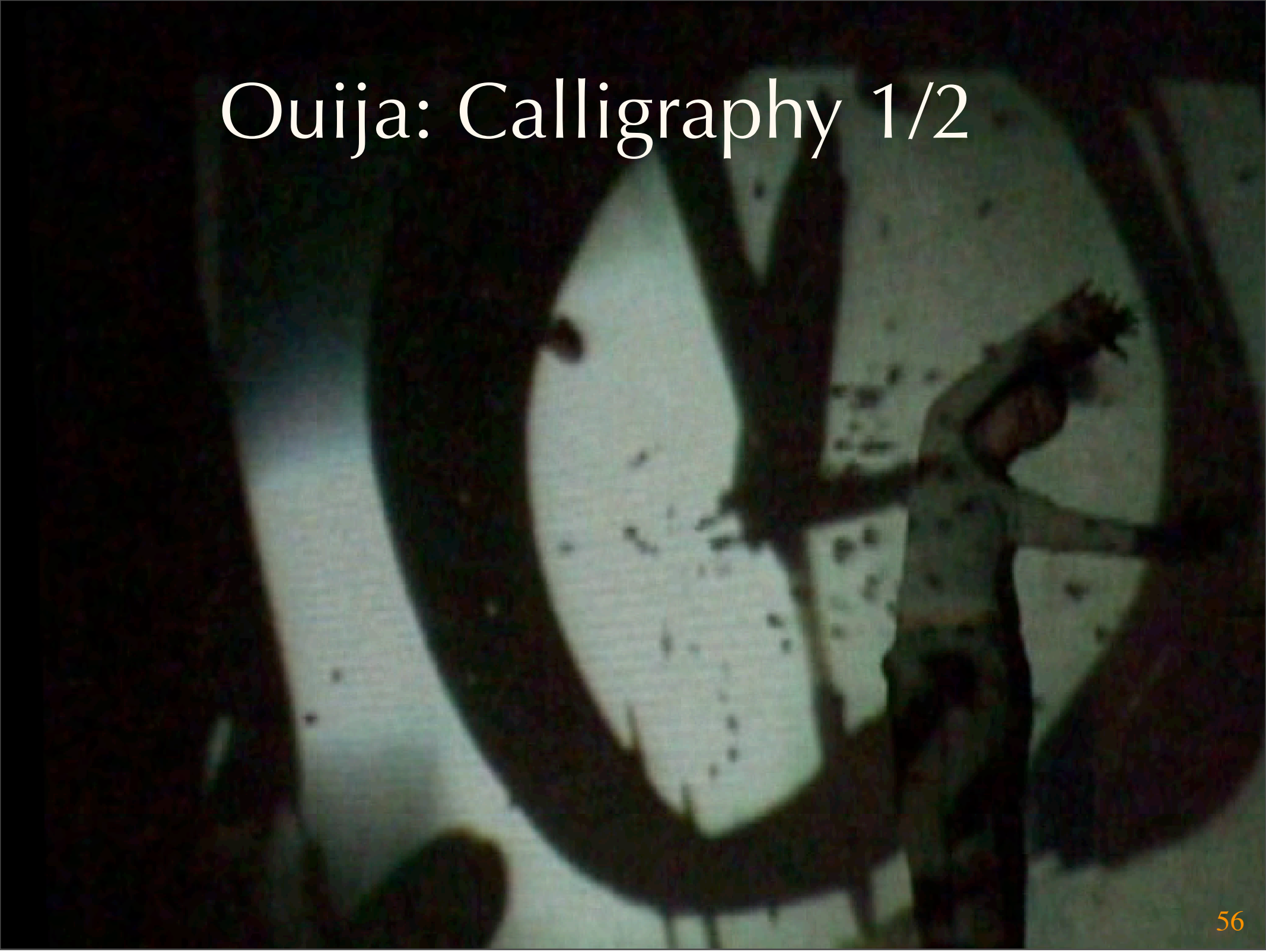
Ouija: Calligraphy 1/2



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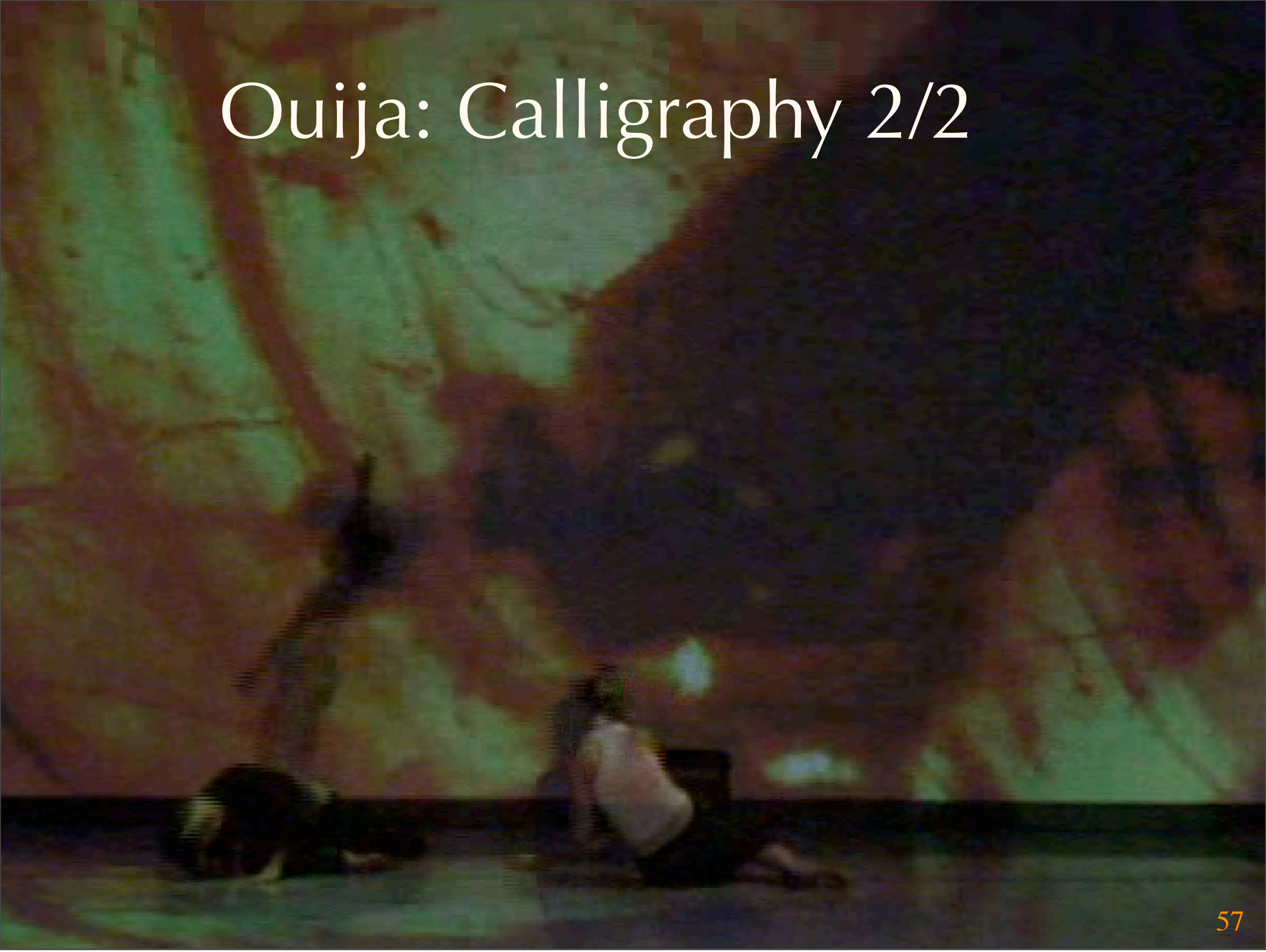
Ouija: Calligraphy 2/2



TML's institutional setting

SUPPORTING FOUNDATIONS & CORPORATIONS
AFFILIATE STUDENTS, ARTISTS & RESEARCHERS

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foundation support ...

Canada Research Chairs

Canada Fund for Innovation (CFI): Topological Media Lab

Rockefeller Foundation: Boundary Crossings

Langlois Foundation: Wearable Sound Instruments

Hexagram: WYSIWYG Gestural Sound

FQRNT: Team Grant for SRE Research (Media Choreography)

FQRSC: "Il Y A" Calligraphic Video

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foundation support

Creative Work Fund: Sauna
Rockefeller Foundation: TGarden; Boundary Crossings
Langlois Foundation: TGarden
LEF ++ TGarden

$1,751,891 since June 2005

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pending

NSERC, Tracking Continuous Gestures for Continuous Instruments

SSHRC, Soft Architecture (creation / research)

Hexagram, Ozone Continuous Dynamics Media Choreography (awarded Feb 2008)

Pending: $320,341

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industrial support

Sony: researcher (2 years)

Intel Research: TinyOS motes

Intel: wearable computing fund

IBM: deep computing consultation

Apple: equipment subsidy

Solotech: technical consultation

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industrial contacts

IDEO Design

Gensler Associates

Steelcase design research

IBM research

Sony

Langlois

Electronic Arts

Maxis

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research advisory network

Stanford University: Winograd (Computer Science)

Duke University: Lenoir (History of Science)

Harvard University: Biagioli (History of Science)

University of California Irvine: Philip (Women's Studies, Post-colonial Studies)

Georgia Institute of Technology: MacIntyre, Essa, Bobick, Mynatt (Computer Science)

University of Paris 1 Sorbonne: Formis (Philosophy & Art), University of Paris 8: Abrioux (Philosophy & Art)

Cambridge University: Gill (Psychology & Linguistics)

University of Toronto / Lancashire: Suchman (Social Studies of Technology)

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Future

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Future Teaching

three courses:

macro

micro

meta

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Field-Tested

Architecture of Responsive Spaces
(systems, HCI)

Realtime computation
Media choreography
Architecture (rigorous crit)
Urban | Domestic environments
Team-based installation projects

*(**macro** course)*

Designed

Ubiquitous Computing: Sensing, Gesture, Movement

wireless sensor platforms

realtime pattern recognition

continuous & low frequency time series

rhythmanalysis

phenomenology, ethnography, embodied interaction

*(**micro** course qv. Tangible Bits in Fine Arts)*

Social Impact and Ethics of Information Technologies (Science and Technology Studies) *(**meta** course)*

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Future Research

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Theory

- Book project: Poiesis and Topological Media
  - Berkeley Deleuze conference 2006
  - Stanford Heidegger conference 2007
  - Harvard Critical Digital April 2008
  - Aberdeen UK April 2008
  - MIT / Duke / Stanford
- PhD Seminar

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Scientific Agenda

Continuous models for machine perception

Signal level vs semantic analysis

What is a gesture?

Correlates to intentionality

- WYSIWYG (Hexagram 2006-2007, Sha Wanderley et al. SMC, ICMC)
- NSERC proposal

What is an object?

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Scientific-Philosophic Agenda

What is an object?

- E Husserl Phenomenology of consciousness
- R Thom Morphogenesis
- A Connes Invariants and consciousness
- J Petitot Morphogenesis & phenomenology

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Engineering

- Machine Perception (eg CVPR)
  - O'Regan et al. Lie groups & computer vision
- Ubiquitous computing
  - Ethnography, HCI
- Human-in-the-loop, Realtime Systems
  - Ozone Media Choreography (Hexagram 2008)

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Engineering Applications

Movement

(Ouija June-July 2007)

Architecture

(Dedale November 2007)

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Future Service

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Institution Concordia

Bridging with Fine Arts & Humanities curricula. (E.g. Center for Interdisciplinary Studies)

Cross-faculty consortium on performance and technology.

- Recruitment: researchers, students, funding

(Already: CU, UQaM, McGill; USA, UK, India)

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Scholarly Community

Editorial work

AI & Society

Springer-Verlag

Experimental Practices Book Series

Rodopi Press

(Critical Studies of Media Arts and Sciences)

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Disciplinary Bridges

Science and Technology Studies

Philosophy

Human-Computer Interaction

Systems & Machine perception

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credits

Students, Scholars, Artists
Who have passed through or
worked with the Topological Media Lab

Georgia Tech 2001-2005
Concordia University 2005 - 2007

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