SID Grid

Collaborative Experimentation in a Sensor-Rich Laboratory

WACE 2005
Seattle, WA

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University of Chicago
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Social Informatics Data Grid

- Multimodal data
  - Collection and archiving
  - Collaborative annotation
  - Analysis
- Wide application
  - Social and behavioral studies at many scales
  - Computer science
    - HCI, dB, pattern recognition, MM, Grid

Research Project Areas

- Advanced Display Evaluation
- Analysis & Synthesis of Biological Motion
- Cognitive and Social Neuroscience
- Collaborative Environments
- Computational Linguistics
- Database Design
- Interpersonal Relationships
- Multimodal Communication
- Neurobiology of Social Behavior
- Pattern Recognition

	Today	Tomorrow with SID Grid
Theories & Models	Static Single cause Linear Component processes Symbolic models	Dynamic Multiple causes Nonlinear Systems or networks Embodied models
Collaboration	Single labs Annotations by single investigators Local access only	Community of collaborators Collaborative annotation Remote & distributed access
Query and Analysis	Standard statistical analyses Single stream Non-standard formats & coarse alignment Single location Stand alone application	Automated query, exploration, and analysis services Multiple streams Tools to acquire, transform & align multiple data streams Multiple locations Extensible SID Grid application
Measurement & Annotation	Single measure Uni-modal Single time scale Manual coding	Multiple measures Multimodal Multiple time scales Automated coding
Data Collection	Single investigator populating database on single workstation	Community of collaborators creating SID Grid data resources on grid

Goals

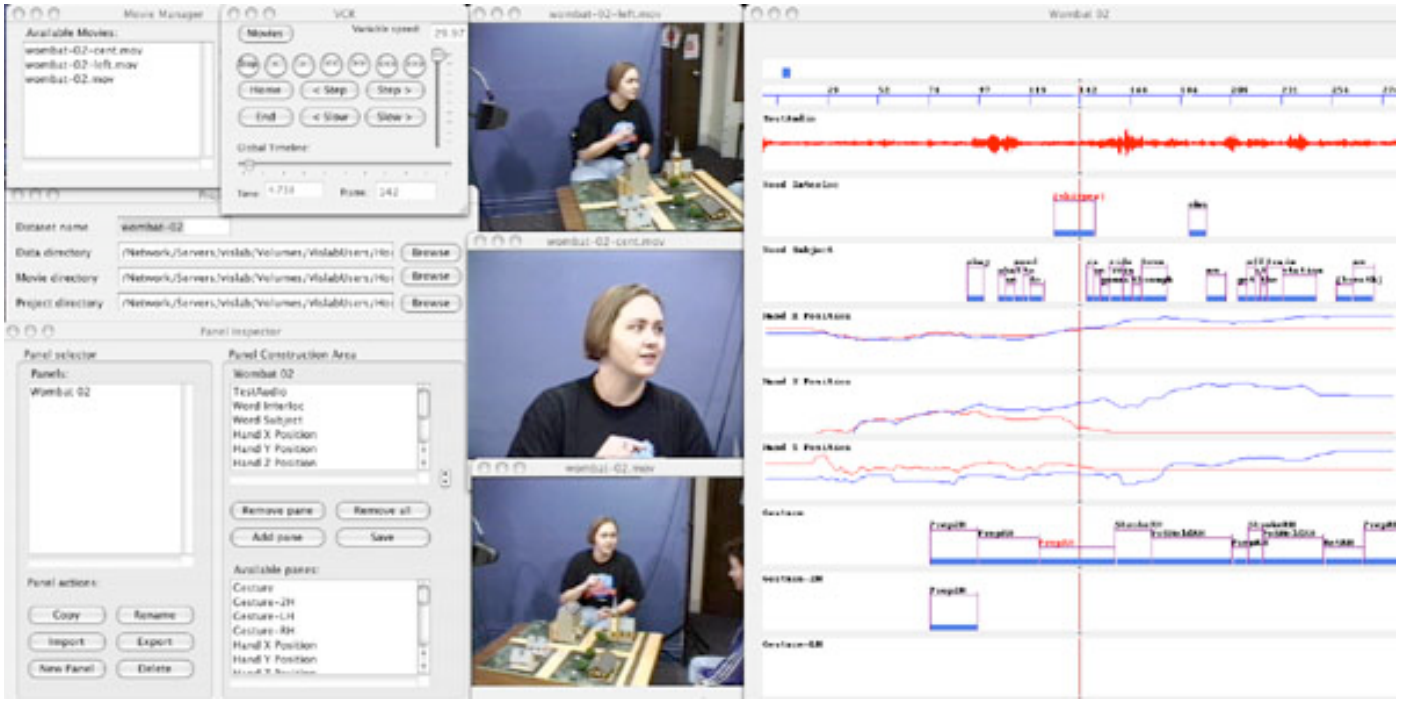
- Fundamentally change the kind of experiments that can be attempted
- Enable new class of virtual experiments
- Redefine Social Informatics
- Promote collaboration in creation and analysis of complex multimodal data archives

Existing Resources

- Public Databases
  - TalkBank, CHILDES
    - Transcript, media
- Annotation and Analysis Tools
  - VisSTA, CLAN
    - Transcription, coding, analysis
  - PRAAT
    - Speech analysis

VisSTA

Visualization for Situated Temporal Analysis”



- annotation and analysis of multi-modal meeting streams

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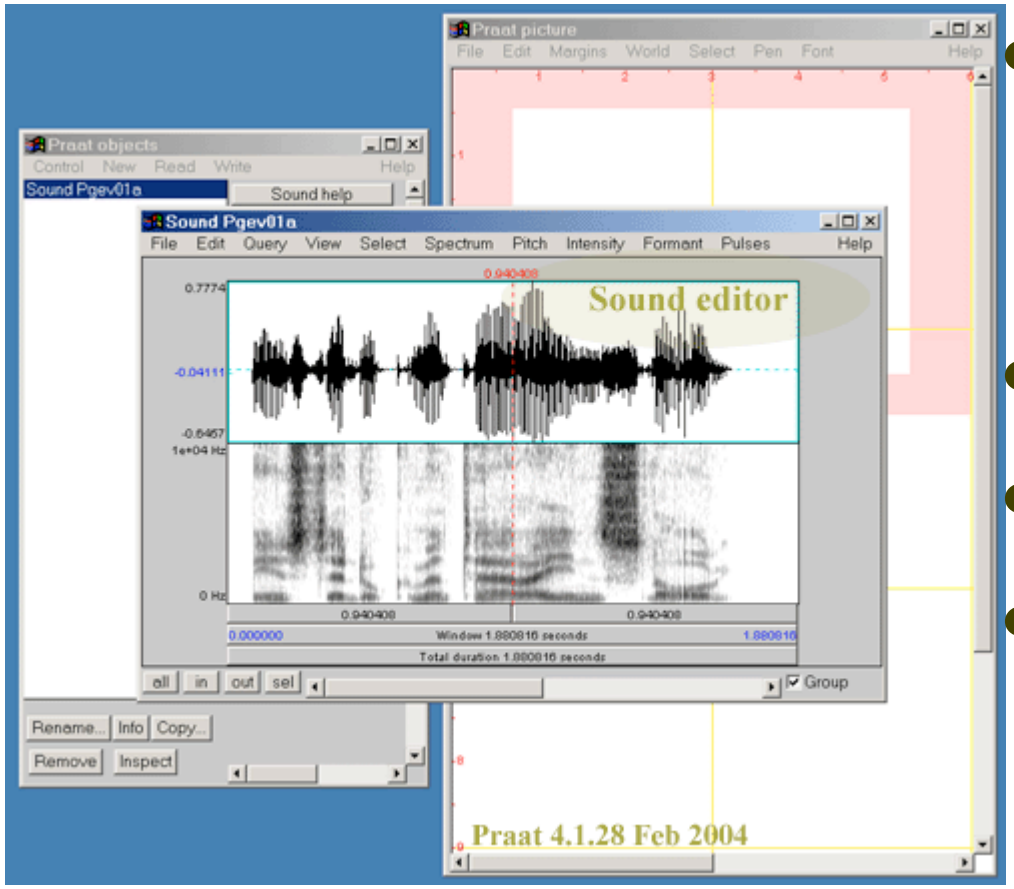
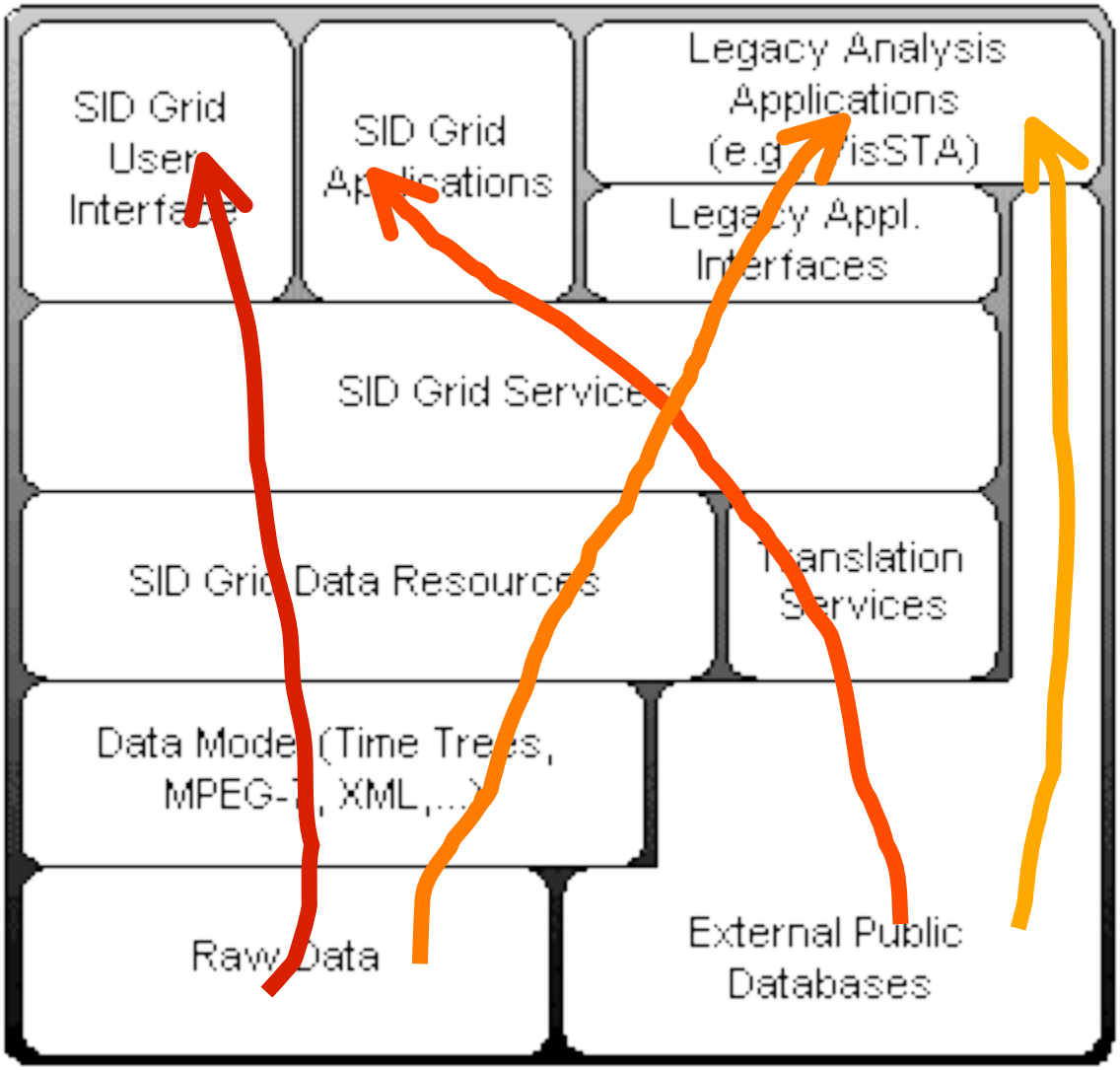
Praat



- Speech analysis
  - Spectral, pitch, formant, intensity,…
- Synthesis
- Manipulation
- Labeling

SID Grid


SID Grid
User
Interface
SID Grid
Applications
Legacy Analysis
Applications
(e.g. VisSTA)
Legacy Appl.
Interfaces
SID Grid Services
SID Grid Data Resources
Translation
Services
Data Model (Time Trees,
MPEG-7, XML,...)
Raw Data
External Public
Databases

Sensor and Stimulus Systems

- Stimulus Display
  - Multi-projector wall
  - Transparent display
  - High density display
- Audio Stimuli
  - Audio feedback
  - Spatialization
- Video Recording
- Audio Recording
- Eye Tracking
- Motion Analysis
- IR Thermography
- Physiological Recording
- EEG

Sensor and Stimulus Systems

- Stimulus Display
- Audio Stimuli
- Video Recording
- Audio Recording
- Eye Tracking
- Motion Analysis
- IR Thermography
- Physiological Recording
- EEG

- Scene
- Face
- Full body

- Ambient array
- Personal boom mic

Sensor and Stimulus Systems

- Stimulus Display
- Audio Stimuli
- Video Recording
- Audio Recording
- Eye Tracking
- Motion Analysis
- IR Thermography
- Physiological Recording
- EEG

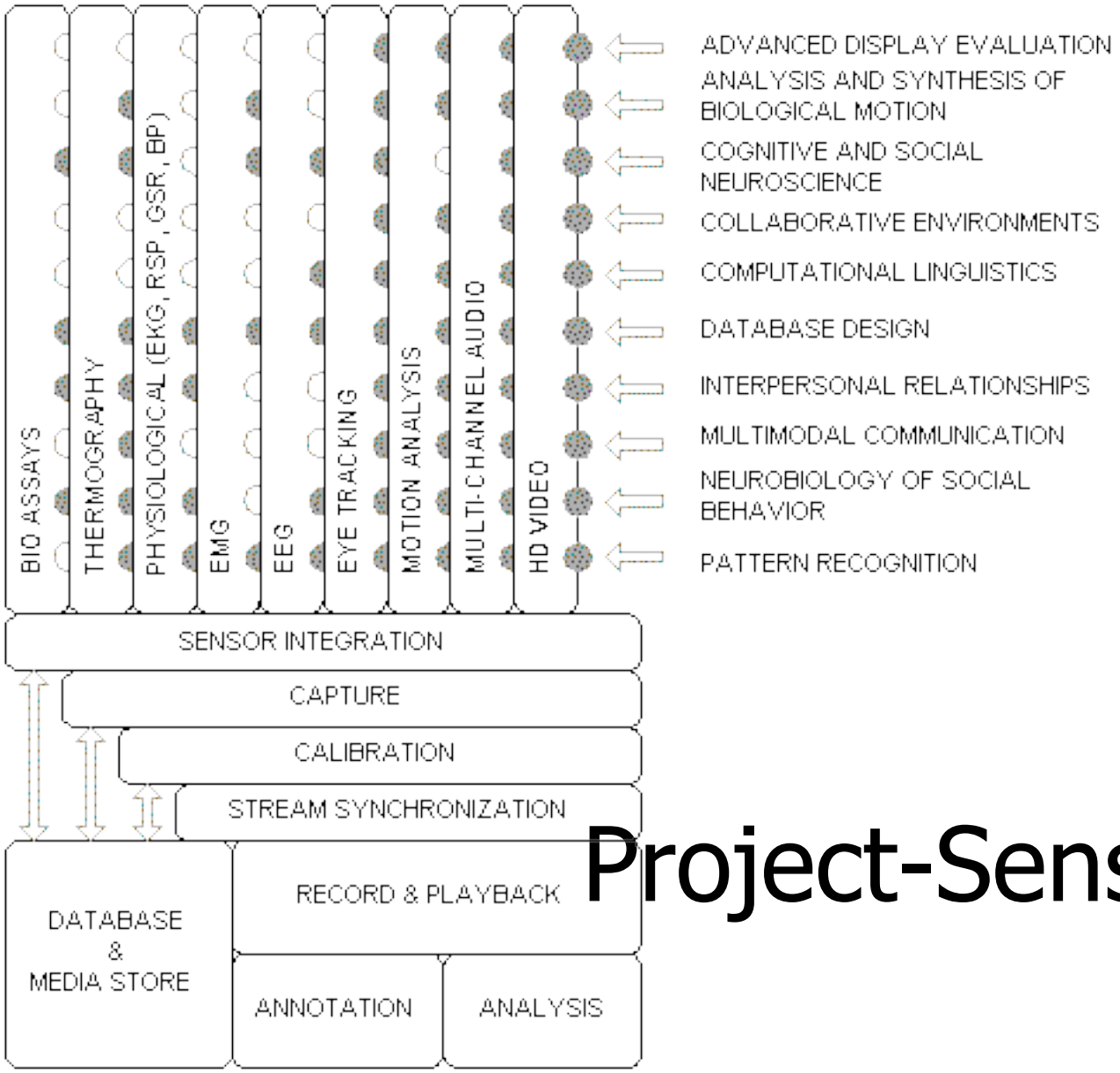
- Head mounted
- "Remote optics"
- Visualeyez
  - 512 active markers
- Mid-infrared 320x240 NTSC

Sensor and Stimulus Systems

- Stimulus Display
- Audio Stimuli
- Video Recording
- Audio Recording
- Eye Tracking
- Motion Analysis
- IR Thermography
- Physiological Recording
- EEG

- electrocardiogram
- electromyogram
- galvanic skin response
- respiration
- blood pressure

- High density electroencephalogram



Project-Sensor Matrix

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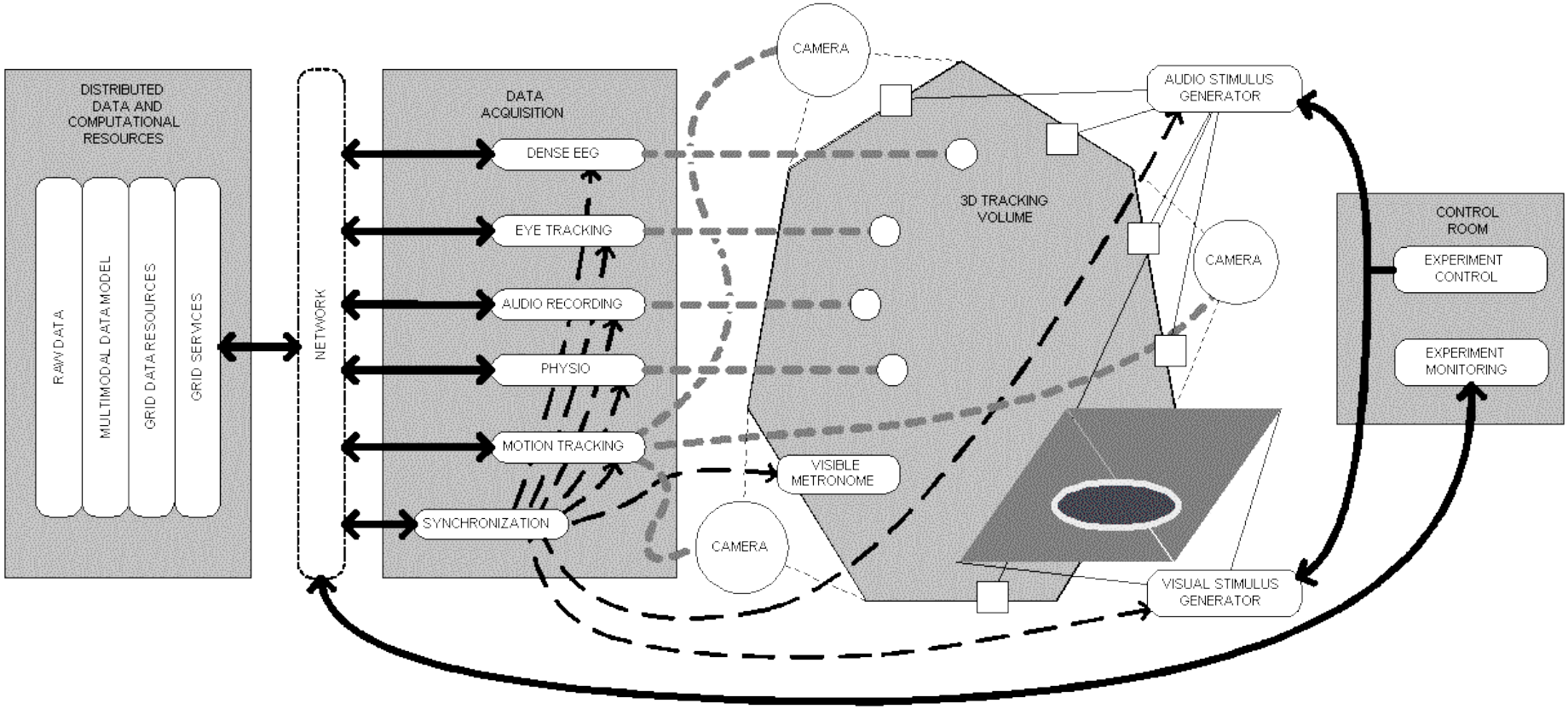
SuperLab



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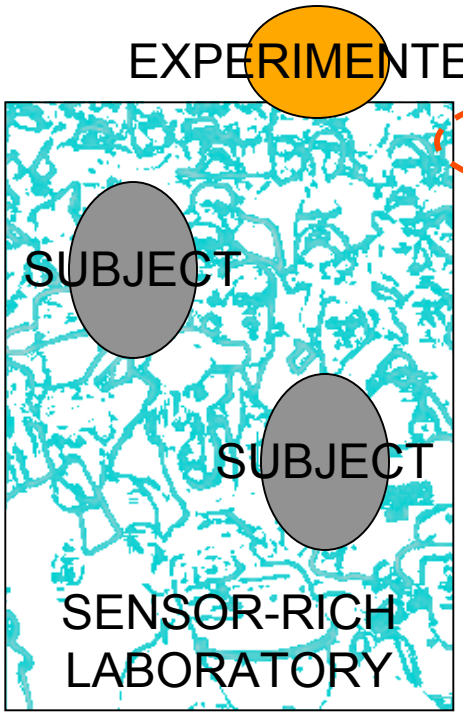
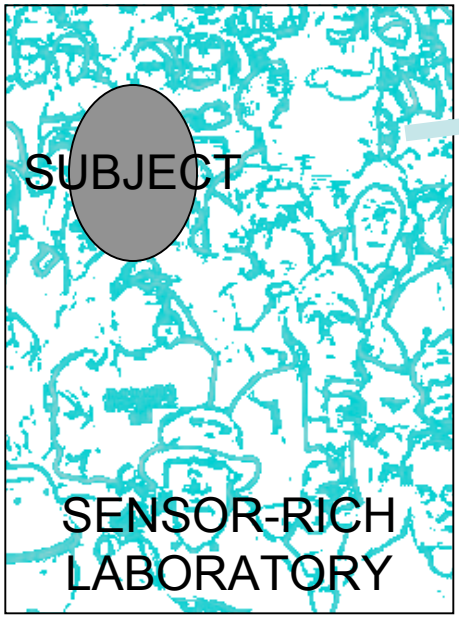
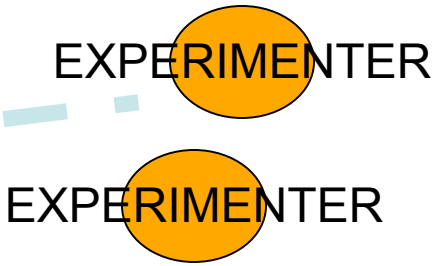
Here Now



- Co-located people & sensors
- Control
- Monitoring
- Annotation
- Analysis
- Archiving

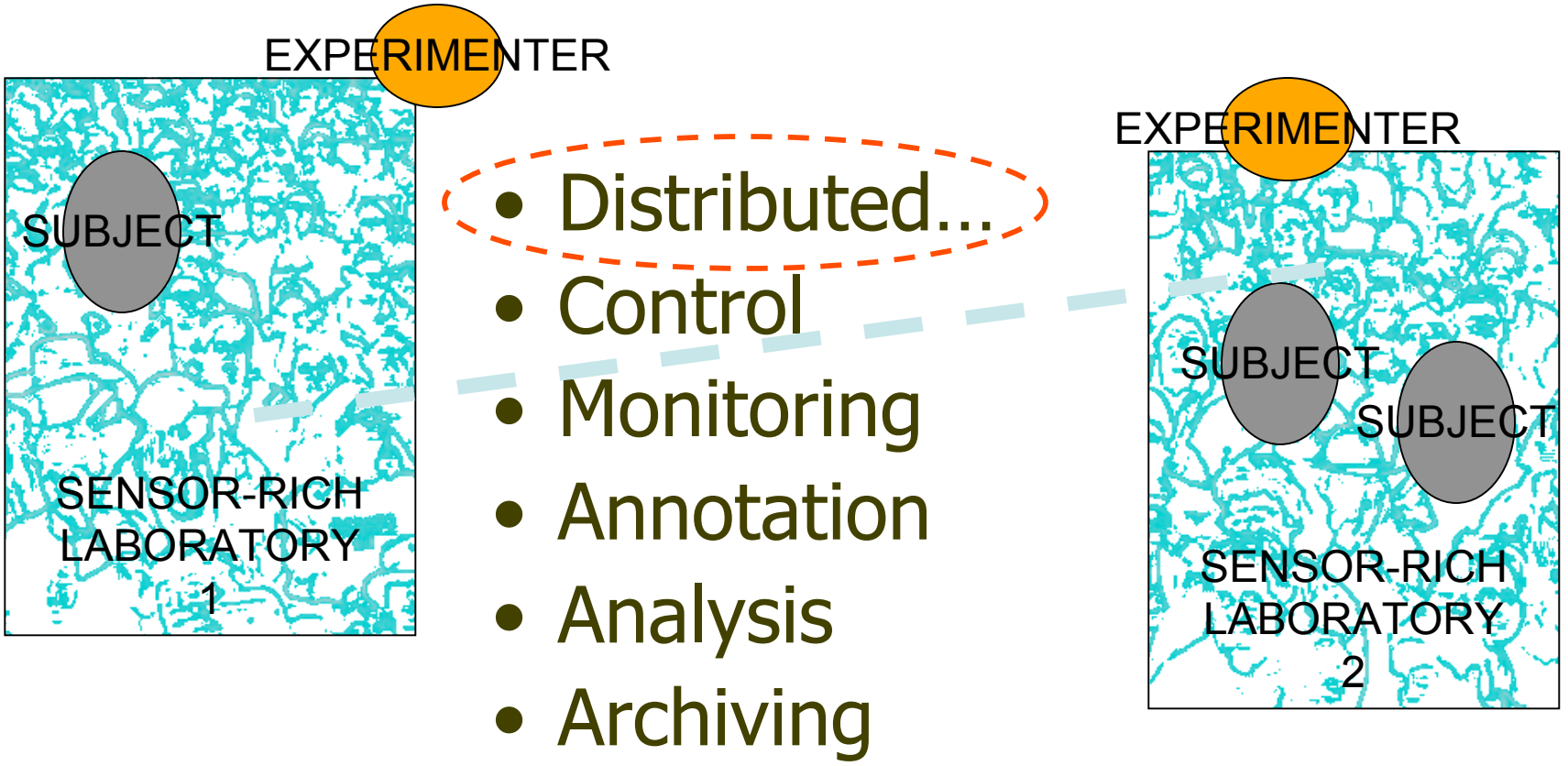
Remote Now



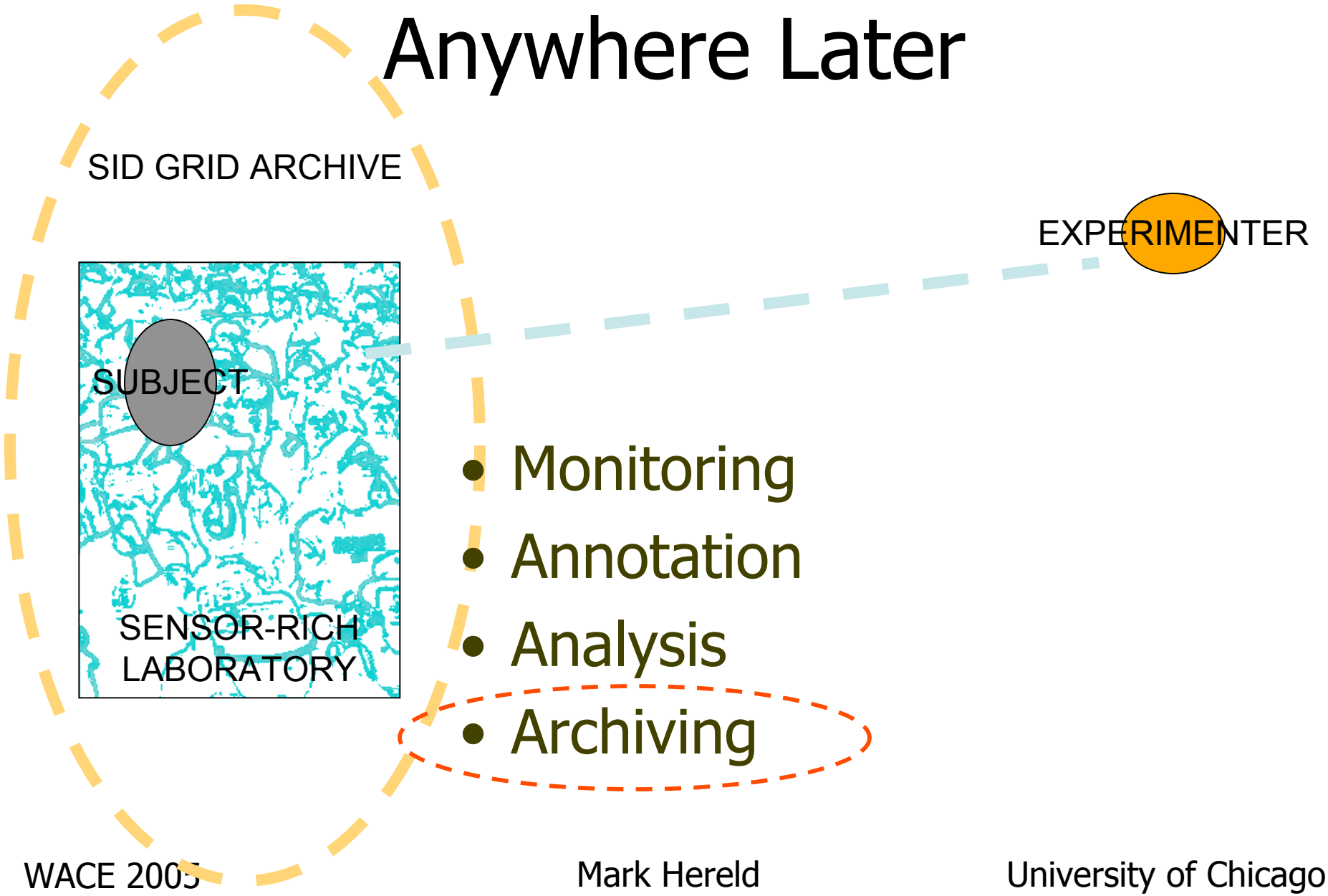


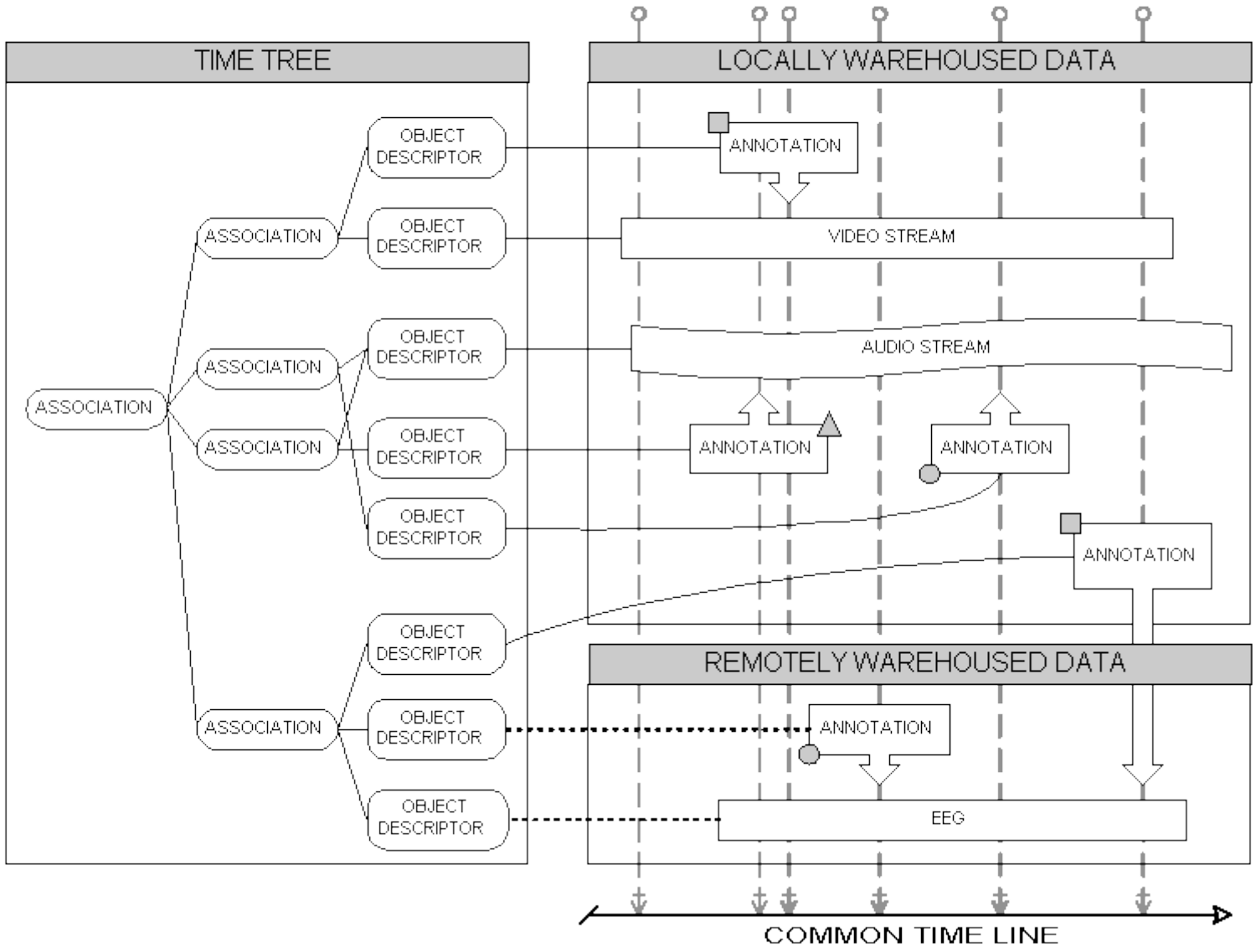
- Control
- Monitoring
- Annotation
- Analysis
- Archiving

Distributed Now



Anywhere Later




TIME TREE
LOCALLY WAREHOUSED DATA
REMOTELY WAREHOUSED DATA
ASSOCIATION
ASSOCIATION
ASSOCIATION
ASSOCIATION
ASSOCIATION
OBJECT DESCRIPTOR
OBJECT DESCRIPTOR
OBJECT DESCRIPTOR
OBJECT DESCRIPTOR
OBJECT DESCRIPTOR
OBJECT DESCRIPTOR
OBJECT DESCRIPTOR
ANNOTATION
VIDEO STREAM
AUDIO STREAM
ANNOTATION
ANNOTATION
ANNOTATION
ANNOTATION
EEG
COMMON TIME LINE

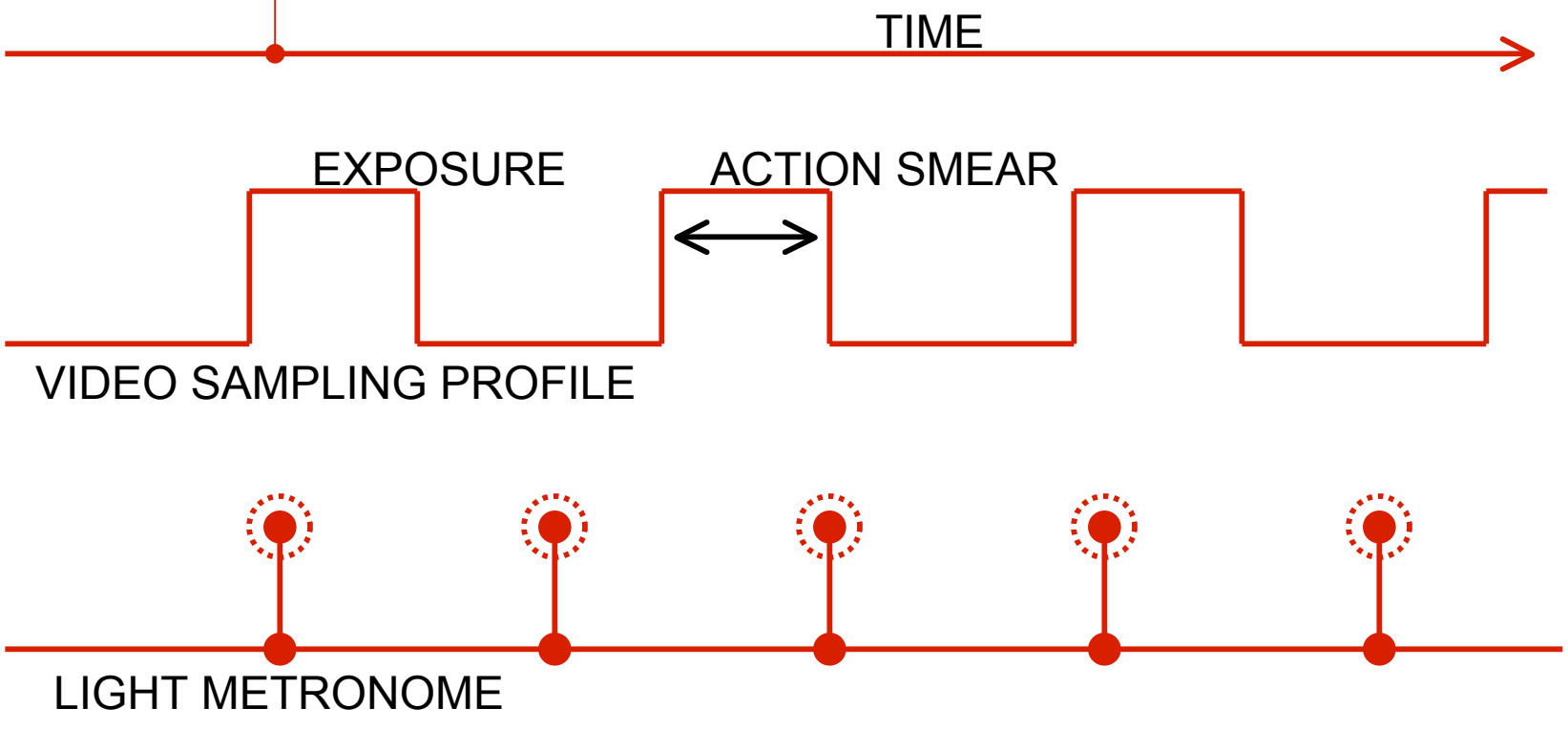
Time

- Device sampling properties
  - Signal integration interval (duty cycle)
  - Sample rate
- Data acquisition
  - D/A conversion
  - Direct memory access
  - System interrupts
- Timestamping
  - Where in the processing pipeline?
- Streaming
  - Network latency

BIOLOGICAL TIME SCALE 1 ms

TicTalk

INSTANTANEOUS
SCENE



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Multimode Stream Synchronization

- Genlock and other exposed triggers
  - coordinated by the SuperLab synchronization control system
- Characterize sampling parameters of each sensor
  - a one-time cost in test and measurement for each device type
- Generate unobtrusive environmental sync
  - blinking lights, audible metronome, etc.
  - sensible by the recording devices
- Provide global electrical time track over wire
  - co-recorded with multi-wire sensors such as high-density EEG

Social Informatics Data Grid

- Multimodal data
  - Collection and archiving
  - Collaborative annotation
  - Analysis
- Wide application
  - Social and behavioral studies at many scales
  - Other application domains…
  - Computer science
    - HCI, dB, pattern recognition, MM, Grid

Collaborators

- Bennett Bertenthal (UC, psychology)
- David McNeill (UC, linguistics)
- Robert Grossman (UIC, databases)
- Mark Hereld (UC/ANL, cs)
- Gina Levow (UC, cs)
- Michael E. Papka (UC/ANL, cs)
- Steve Porges (UIC, psychology)
- Rick Stevens (UC/ANL, cs

Questions?

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