

## Research in Multimedia Engineering

- Stephen Travis Pope
  - Graduate Program in Media Arts and Technology (MAT)
  - Center for Research in Electronic Art Technology (CREATE)
  - University of California, Santa Barbara (UCSB)
  - [stp@create.mat.ucsb.edu](mailto:stp@create.mat.ucsb.edu)
  - June, 2004

CREATE      MAT Media Arts and Technology Graduate Program

## R&D Areas of Interest

- Models/Representations for Media Data
- Digital Audio Signal Processing
- Distributed Real-time Applications
- Music Information Retrieval
- Sensors and UIs for Interaction

CREATE      MAT Media Arts and Technology Graduate Program

## Models/Representations for Media Data

- Keywords: Knowledge representation / AI, OO design patterns, modeling dynamic data, state machines, data-flow, Petri nets
- StateOfTheArt: Declarative and procedural languages for describing structured event sequences for animation and music
- Accomplishments: Smoke Music Representation Language and derivatives (Dmix, SuperCollider, CHARM, OSC, etc.)

CREATE      MAT Media Arts and Technology Graduate Program

## R&D Topics: Media Data Models

- Models of multi-level transformations of functions of time
- Graphical rendering and animation of dynamic network structures
- Efficient execution of logic-marked Petri nets for simulation and sequencing
- Rule extraction, machine learning of "performance" in speech and music
- Gesture capture / mapping for control

CREATE      MAT Media Arts and Technology Graduate Program

## Digital Audio Signal Processing

- Keywords: Digital audio analysis / synthesis techniques, surround and spatial sound representation and processing, head-related transfer functions (HRTF), distributed high-performance DASP
- StateOfTheArt: wavelet/pulsar processing, VR-based spatial auralizers,
- Accomplishments: CSL, MixViews, Siren, NOLib, ATON and CSL auralizers, LLCH model, CloudGenerator, PulsarGenerator

CREATE      MAT Media Arts and Technology Graduate Program

## R&D Topics: DASP

- Compression and transfer of multi-channel high-resolution audio
- IFFT-based synthesis techniques
- Distributed spatial rendering
- Data reduced HRTF (head-related transfer function) processing
- Intermingling of bursty control and streaming data in networks

CREATE      MAT Media Arts and Technology Graduate Program

## Distributed Real-time Applications

- Keywords: Distributed processing environments (DPEs), cluster management, CORBA/TAO, fault-tolerant systems, load-balancing, heterogeneous server farms
- StateOfTheArt: Cluster mgmnt, TelComm DPEs, reliable computing
- Accomplishments: HPDM/ ATON (1999-2001), Yellow (2001-3), and CRAM (2003)DPE systems

CREATE Modeling and Learning  
Distributed Programs MIAT Modeling and Learning  
Distributed Programs

## R&D Topics: Cluster DPEs

- Expert systems (rules, nets, constraints) for planning and configuration of distributed applications
- Run-time monitoring of distributed systems (HW & apps)
- Run-time low-latency load-balancing
- Fault detection and recovery in real-time systems

CREATE Modeling and Learning  
Distributed Programs MIAT Modeling and Learning  
Distributed Programs

## Music Information Retrieval

- Keywords: Databases for sound/music, musical structure, score, and performance meta-data, clustering in immense databases, clustering with complex feature vectors, stored procedures for distance metrics, visualization of clusterer operation
- Accomplishments: Paleo, CSL, NOLib, FASTLab 1, FMAK music feature extraction/database systems

CREATE Modeling and Learning  
Distributed Programs MIAT Modeling and Learning  
Distributed Programs

## R&D Topics: Sound/Music Databases

- Detailed signal analysis processing for feature extraction
- New analysis techniques (wavelets, multi-time-scale, tracking)
- Advanced (AI-based) media data segmentation and indexing
- Managing large media and meta-data storage

CREATE Modeling and Learning  
Distributed Programs MIAT Modeling and Learning  
Distributed Programs

## Sensors and UIs for Interaction

- Keywords: multi-modal gesture sensors, HCI, haptic sensing, computer vision, VR systems, immersive UIs, aware spaces, multi-level gesture mapping
- Accomplishments: ATON VE system, RIDL gestural controllers, OSC networking interfaces, *Sensing/Speaking Space*

CREATE Modeling and Learning  
Distributed Programs MIAT Modeling and Learning  
Distributed Programs

## R&D Topics: Sensors and Control

- Multi-sensor gesture recognition and control mapping
- Specifying and controlling dynamic 3-D gesture maps
- Multi-camera and multi-microphone input processing & feature extraction
- Physical sensors for control and performance
- Aware/Sensing spaces

CREATE Modeling and Learning  
Distributed Programs MIAT Modeling and Learning  
Distributed Programs