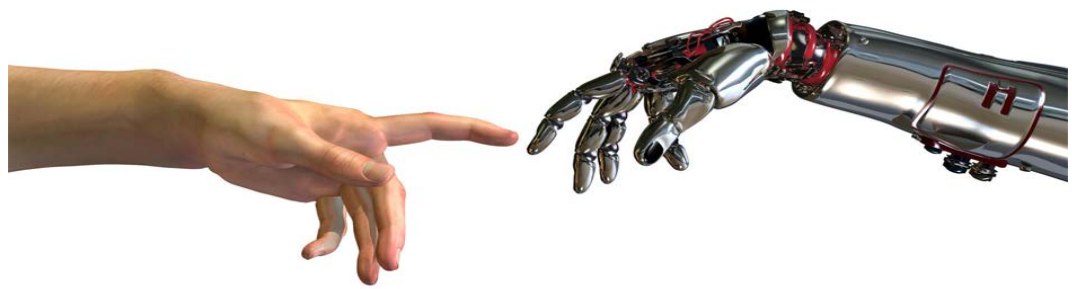
Human-Computer Interaction



Myounghoon “Philart” Jeon

Mind Music Machine Lab

Center of Cyber-Human Systems

Cognitive Science, Computer Science

CS 1000 – October 13, 2015

Philart's Personal…

Mind Music Machine

MIND MUSIC MACHINE LAB

Background & Teaching

Experience wrt HCI

1. HCI Researcher @Daum Comm., UX/UI Designer & Sound Designer @LG Elec.
2. Co-work with SS, H/K Motors, Toyota, GE, Panasonic, etc.
3. Best Papers (HFES, HCII), Ergonomic Design Award, IF Comm. Design Award
4. HFES, CHI, HCII, MobileHCI, ASSETS, CSUN, ICAD, AutomotiveUI, UbiComp, etc.

Educational Background

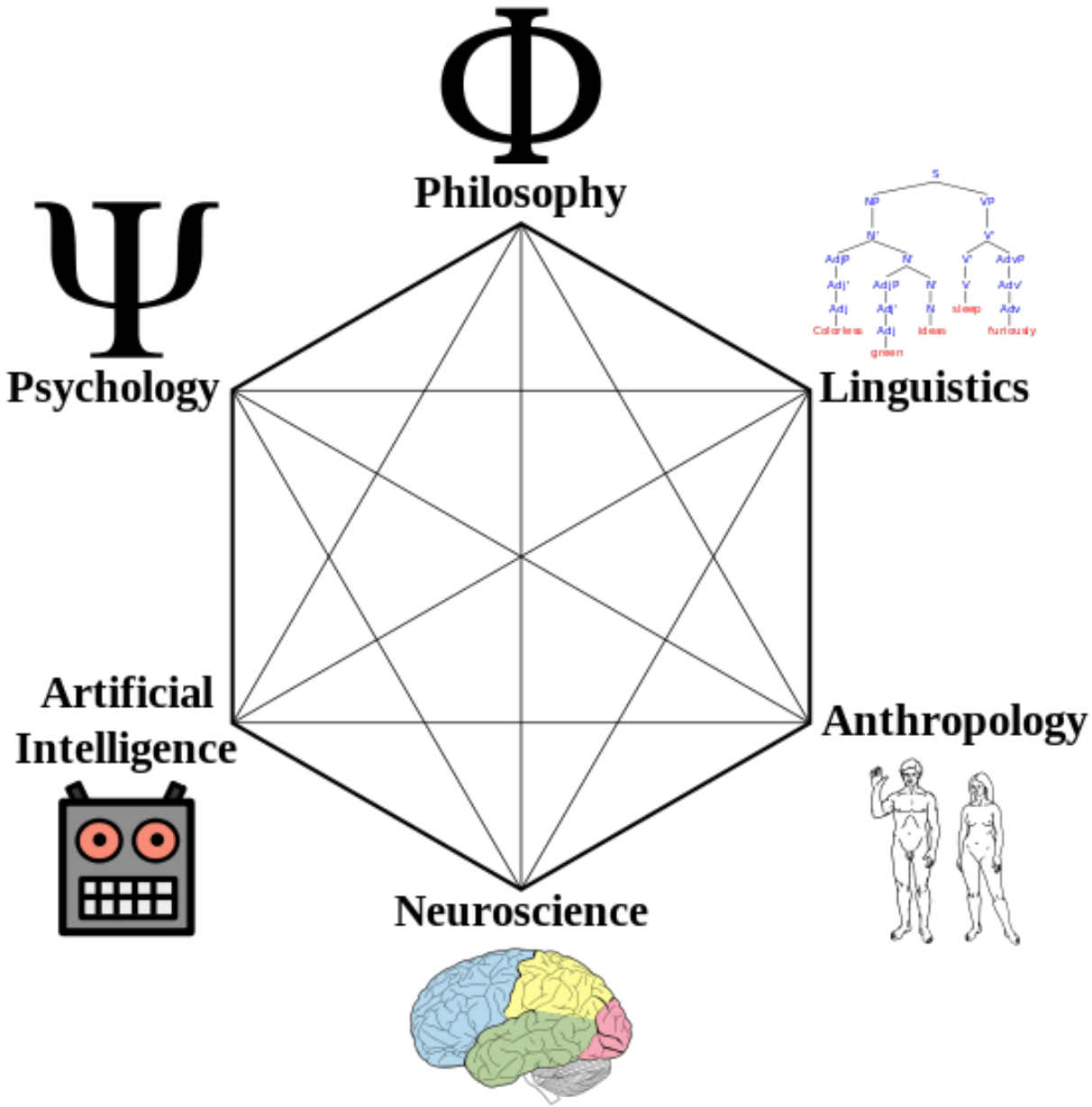
- **PhD Engineering Psychology (HCI), Georgia Institute of Technology (2012)**
- **M.S. Engineering Psychology, Georgia Institute of Technology (2010)**
- **M.S. Cognitive Science, Yonsei University in Korea (2004)**
- **B.A. Sociology, Yonsei University in Korea (2000)**
- **B.A. Psychology, Yonsei University in Korea (2000)**
- **Film Scoring Expert Institute, Yonsei University in Korea (2007)**

Teaching

- **Human-Computer Interaction/ HCD**
- **Affective Design and Computing**
- **Human Factors**
- **Human Factors II: Multimodal Design & Measure Studio**

What type of produ[je]cts?

Academic Origin: Cognitive Sciences (Cognitive Engineering)

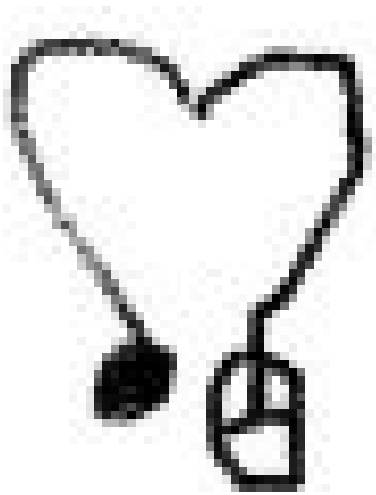


In fact, Affective Sciences

The tri-M Lab

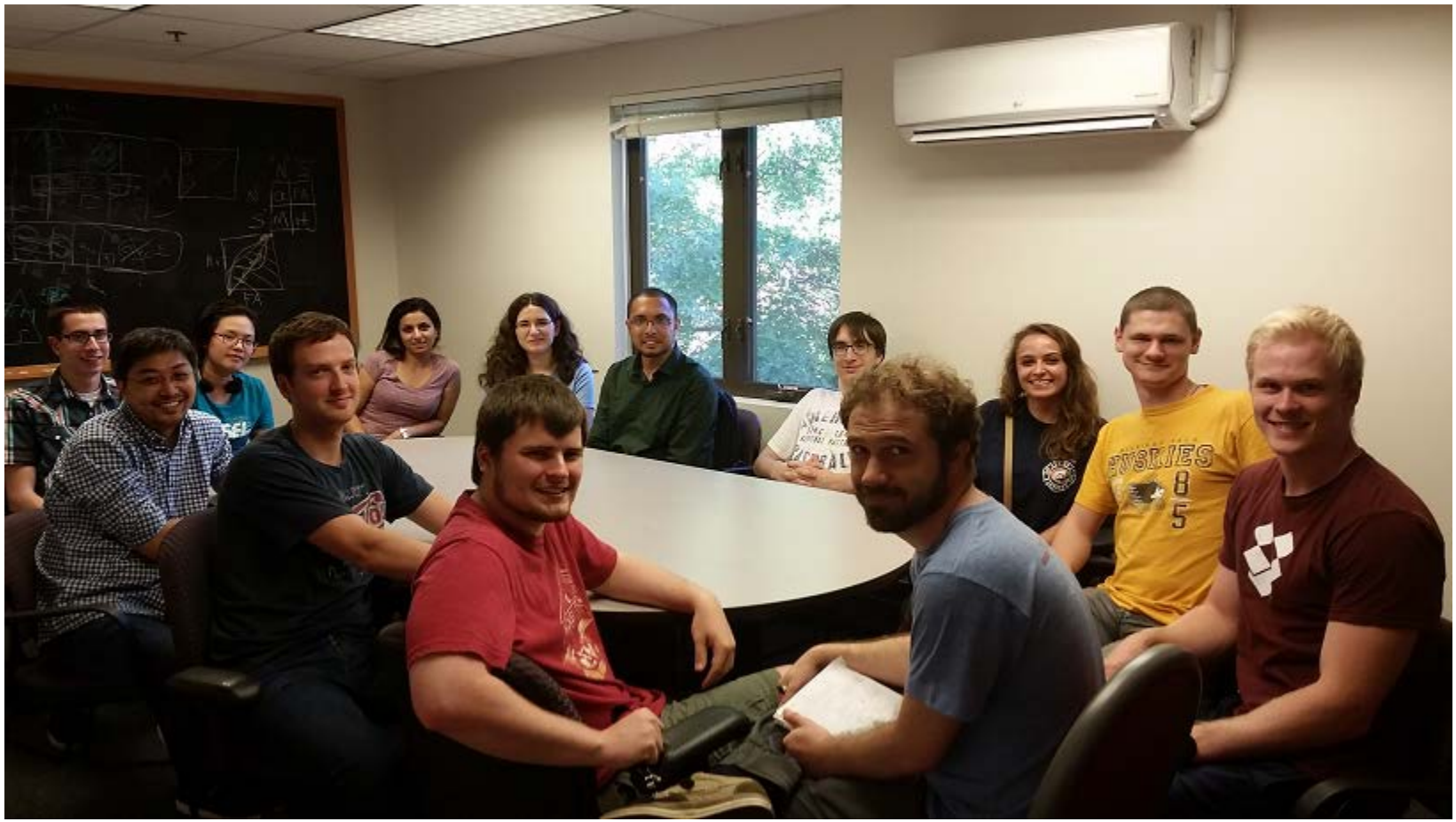
Mind

Music



Machine

The tri-M Lab



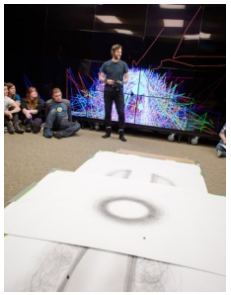
6 + 2 Graduates (Human Factors + Computer Science)
8 Undergraduates (CS, CE, Psy, Sound Design, ME)

Center of Cyber-Human Systems, Institute of Computing and Cybersystems

Human-Centered Design: Designing systems of the users, by the users, and for the users.
We are interested in People, Art, Design, Technology, & eXperiences

AUDITORY DISPLAYS & SONIFICATION


AUGMENTED & VIRTUAL REALITY




AFFECTIVE COMPUTING


Human-Centered Computing

AUTOMOTIVE UI

ASSISTIVE TECHNOLOGY

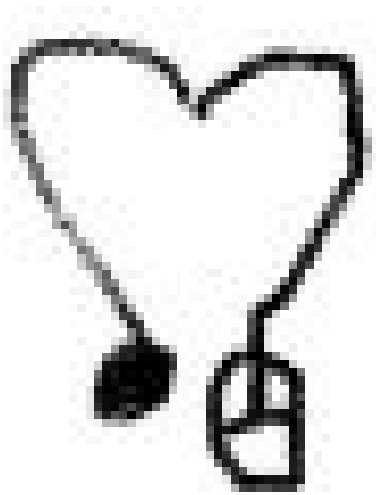

Mind Music Machine

The tri-M Lab

Google “mind music machine lab”
Or email philart@gmail.com or mjeon@mtu.edu

Mind

Music



Machine

Sonification in VR

Goal

Expand artists' emotional expressions and aesthetic dimensions
using visualization and sonification at the immersive virtual environment

System Configuration

- Vicon Tracker – 12 infrared cameras
  - 120 Hz
  - Sub-millimeter precision
- Display Wall – 24, 42’’ Monitors
- OpenGL (C++)
- JFugue Library for audio output
- ISML – GUI interface for customizing sonification par ameters

System Configuration

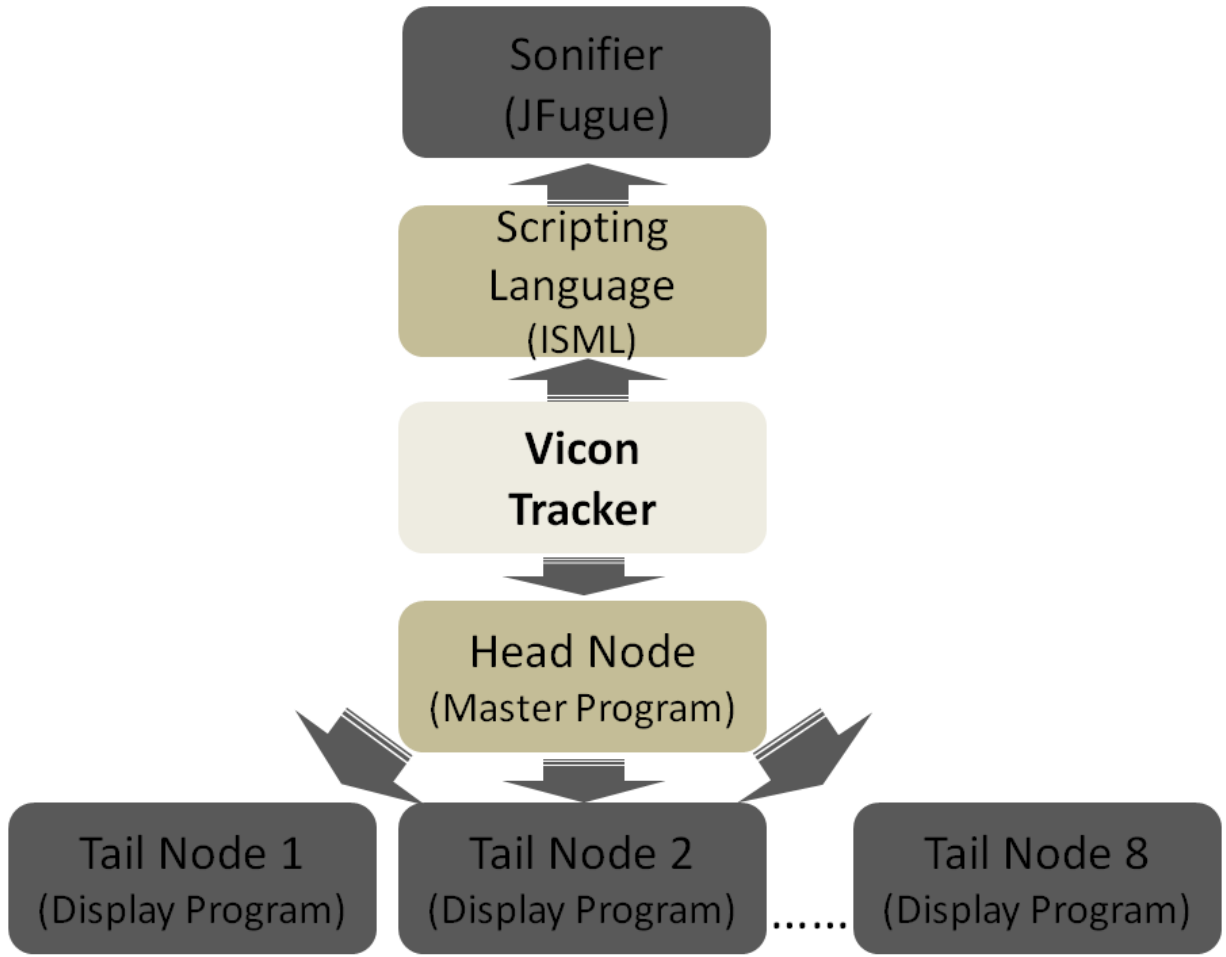


Fig. 1. The Vicon tracker sends the signal to (1) the visualizer (head node), which distributes it to 8 tail nodes, each of which is connected to 3 multivisions; and (2) the sonifier via the scripting language.

Interactive Map

Virtual Instrument

Tony Orrico...

Tony Orrico, 8 circles | *Photo by Michael Hart*

Based in Chicago, creates large geometric pieces,

"Penwald Drawings"

Embodied Penwald Drawings

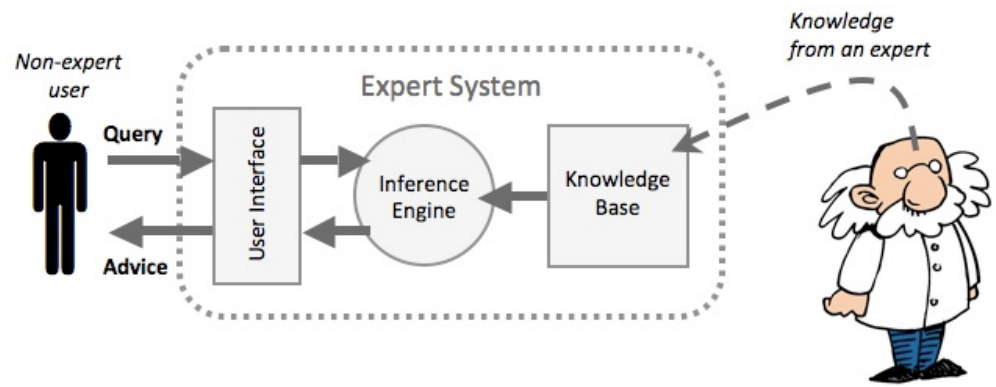
"Orrico laid face down on a piece of paper holding graphite pencils in both hands. He pushed off a wall, jetting himself forward on top of the piece. He dragged his graphite pencils along with him; as he writhed his way back to the starting position over and over again, he left behind himself a pictorial history of his motion."

"He knelt on a large sheet of paper,
striking it with graphite as he swung his arms in a pendular motion, and slowly revolved atop the mat."

Multiple Layers of Outcomes

The outcomes of our collaboration and Tony's works were displayed in the Finnish American Heritage Center in Hancock, MI.

Research in Progress



Creativity & Intentionality

Automotive User Interfaces & ITS

01. Warning Design

02. Social Car

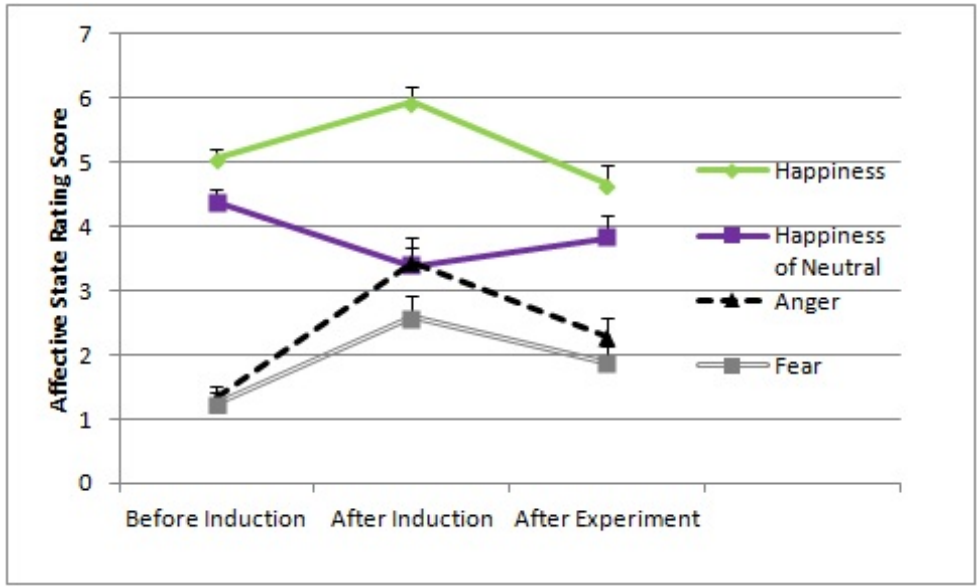
03. Emotional Driving

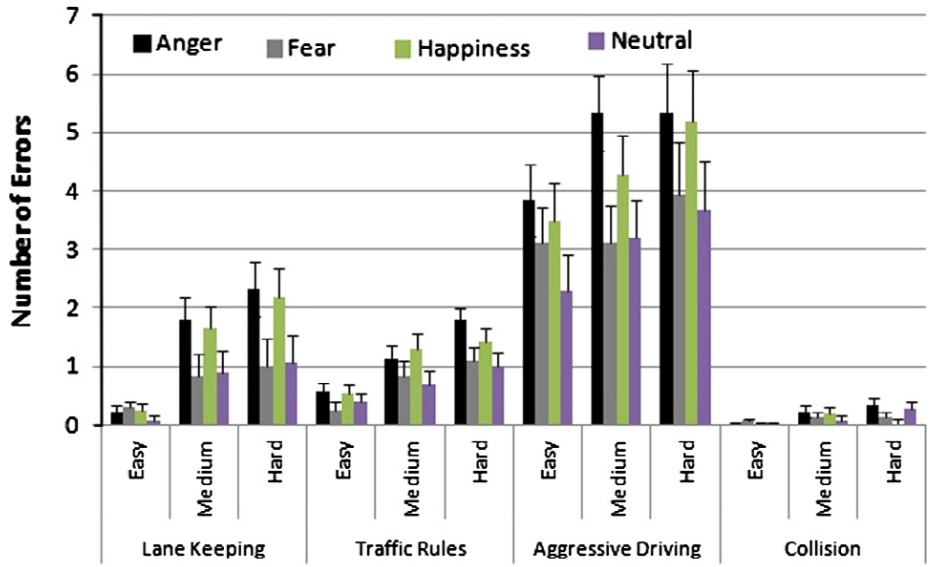
Goal

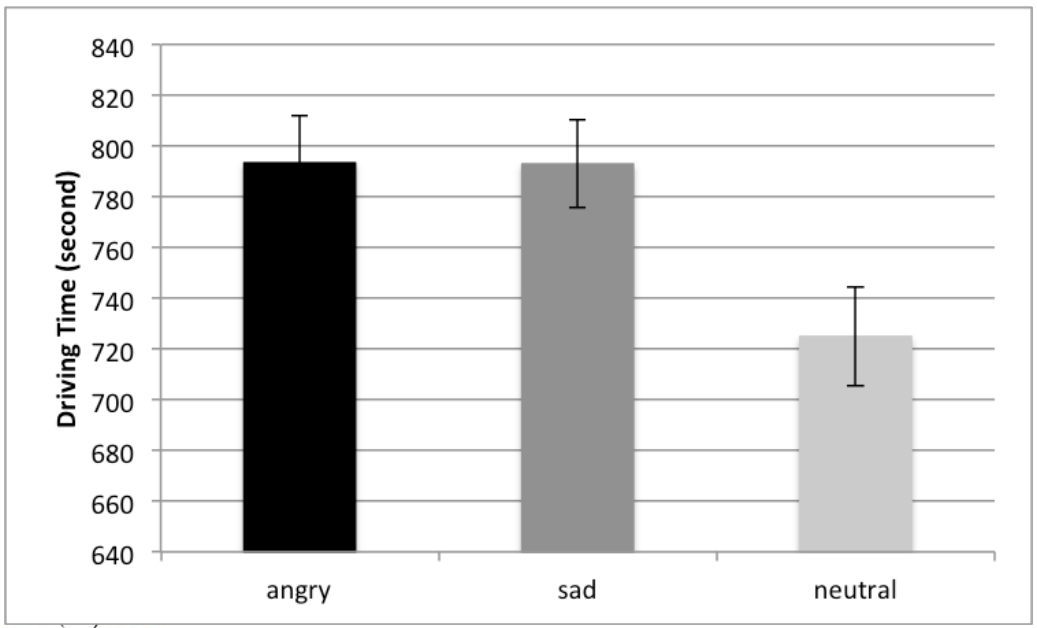
Taking drivers' emotions and affect into account,
improve road safety by estimating a driver's affective states and intervening with dynamic technologies

Driving Simulators in tri-M Lab

Results from 8 Experiments



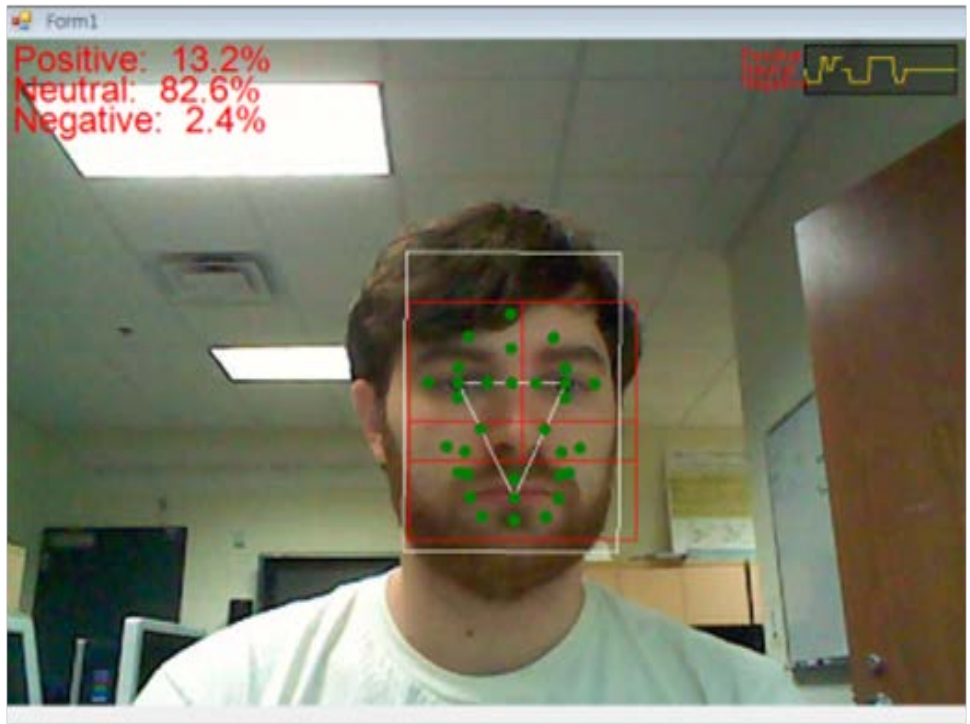




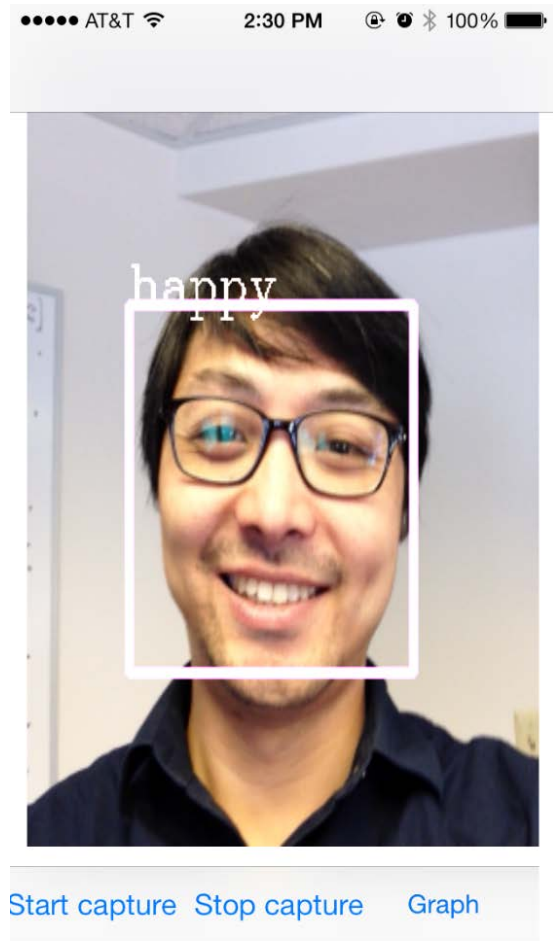
Music Machine

MIND MUSIC MACHINE LAB

Facial Expression Detection Systems



Our first system uses the Support-Vector Machines (SVMs) algorithm, which could detect positive, negative, and neutral affective states. Our second system uses the Viola-Jones object detection framework, which could detect more specific affective states, including anger, happiness, and surprise.



Research in Progress

Table 2. Mapping variables for observation states and sonification parameters

Observation States		Sonification Parameters (SP)
Affective States (AS)	**Driving Behaviors (DB)**	
- FacialExpression: s_{FEX}	- LaneDeviation: s_{LD}	Musical Parameters (MP)
- FacialEMG: s_{FEMG}	- SteeringWheelAngle: s_{SWA}	- Genre: c_{GE}
- EyeMovementPattern: s_{EMP}	- Speed: s_{SP}	- Key: c_{KEY}
- HeartRate: s_{HR}	- Pedal Force: s_{PF}	- Tempo: c_{TE}
- Respiration: s_{RE}	- Collision: s_{CO}	Human Factors (HF)
- SkinConductance: s_{SC}		- Familiarity: c_{FA}
- BrainWaves: s_{EEG}		- Preference: c_{PR}
		- Expectation: c_{EX}
		System Factors (SF)
		- Timing: c_{TI}
		- Duration: c_{DU}
		- Regularity: c_{RE}
		- Interference: c_{IN}

$$ObservationStates = AS(s_{FEX}, s_{FEMG}, s_{EMP}, s_{HR}, s_{RE}, s_{SC}, s_{EEG}) \times DB(s_{LD}, s_{SWA}, s_{SP}, s_{PF}, s_{CO})$$

$$SonificationParameters = MP(c_{GE}, c_{KEY}, c_{TE}) \times HF(c_{FA}, c_{PR}, c_{EX}) \times SF(c_{TI}, c_{DU}, c_{RE}, c_{IN})$$

$$SonificationOutputs = f(ObservationStates \times SonificationParameters)$$

Intermittent sonification based on driver affective states and behaviors

Continuous sonification using multistream soundscapes

Mind Music Machine

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Assistive Technologies & Accessible Computing

01. Navigation for Blind

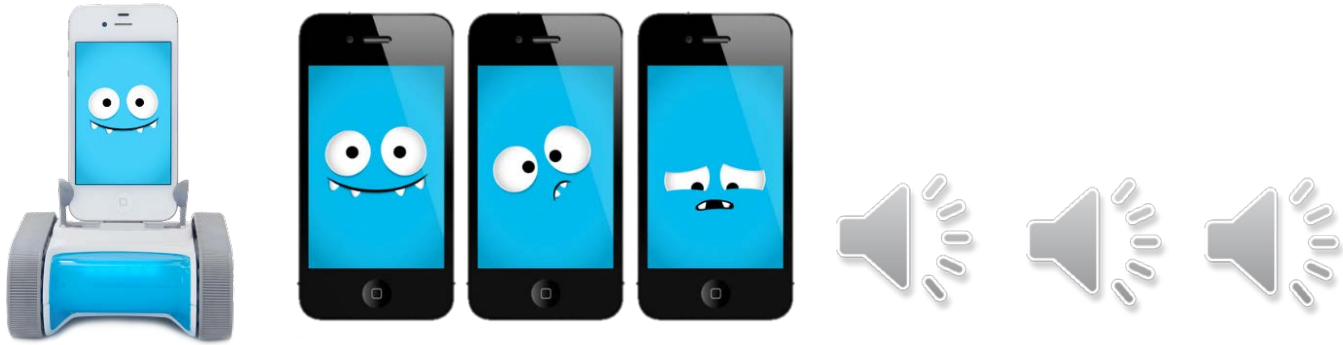
02. Digital Literacy for OAs

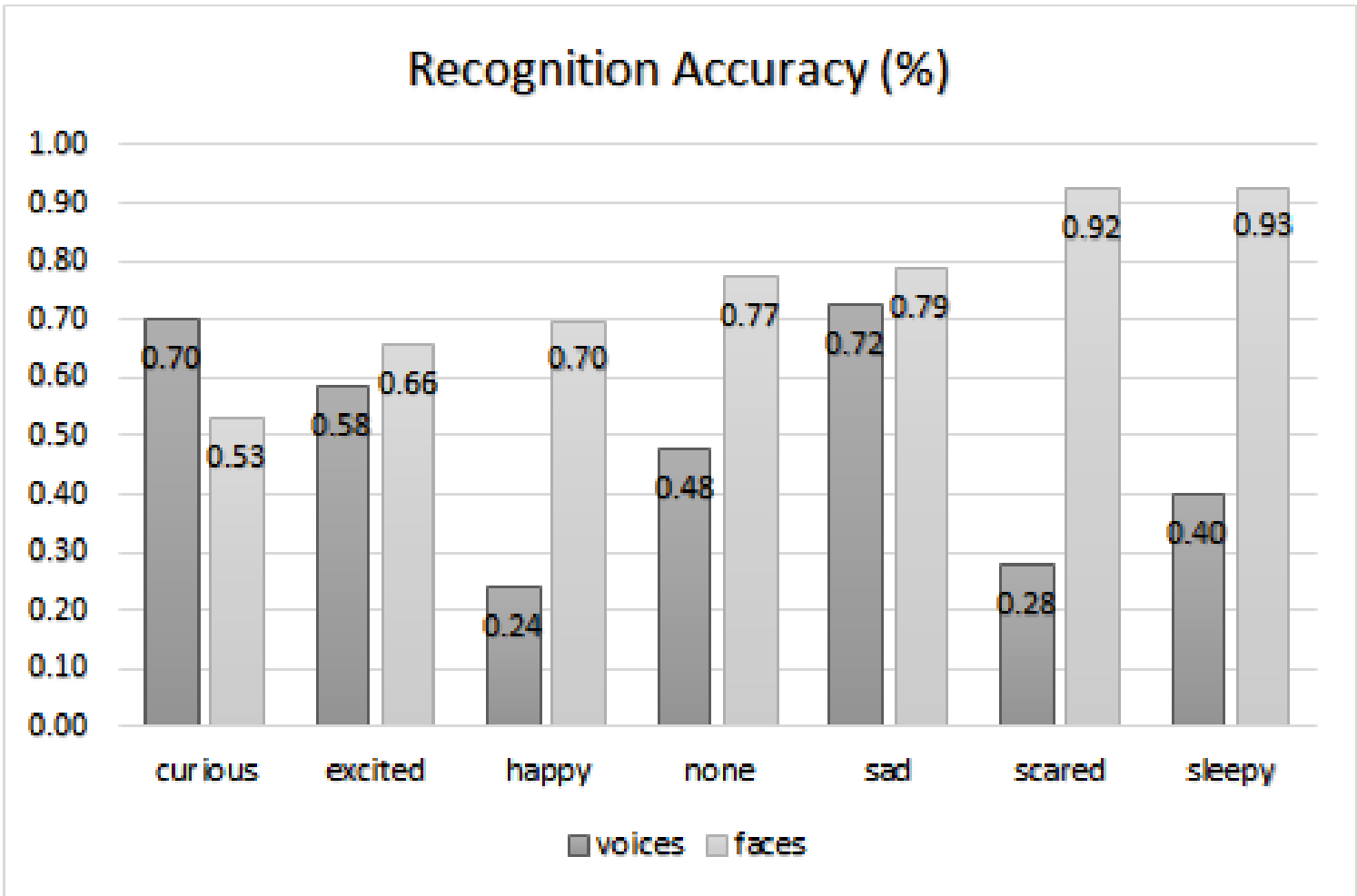
03. SocialBot for Autism

Goal

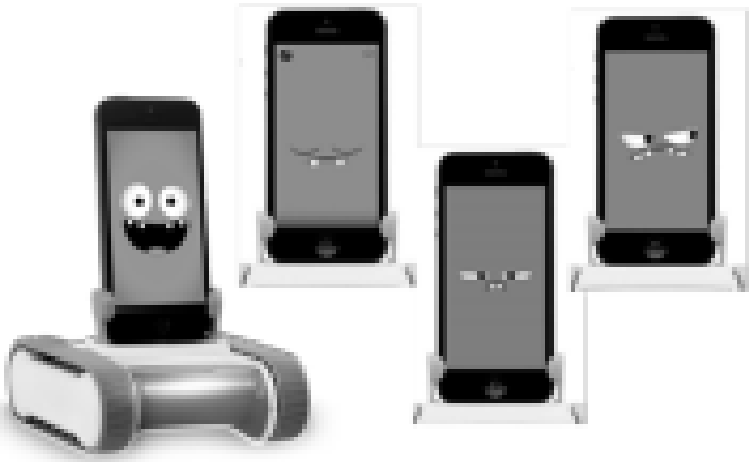
Facilitate social and emotional interaction of children with ASD using physical and musical stimuli

Emotion Recognition Research

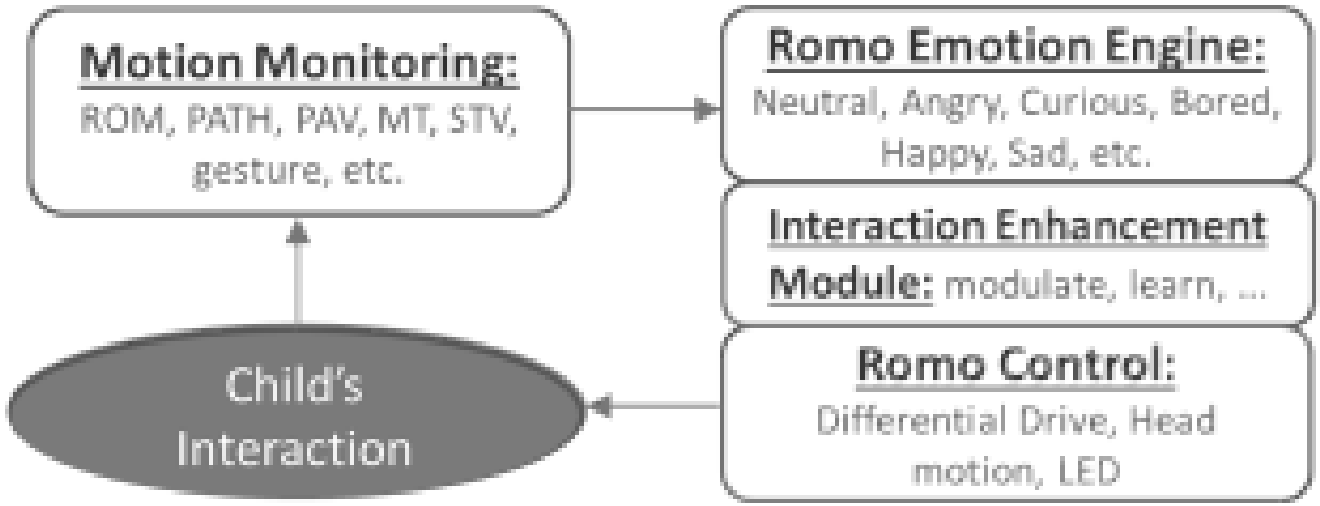




Research Concept Diagram



(a) Romo robot



(b) Interaction Framework

Research Aspects

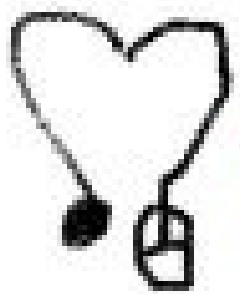
- Platform-free sonification server
- Estimation a child's affective sates and overall interaction patterns with a robot
- Robotic learning of human behaviors for increasing the engagement

Research in Progress

Research:
Robot Acceptance
Human-Robot Team Interaction

Thank You

Mind

Music  Machine