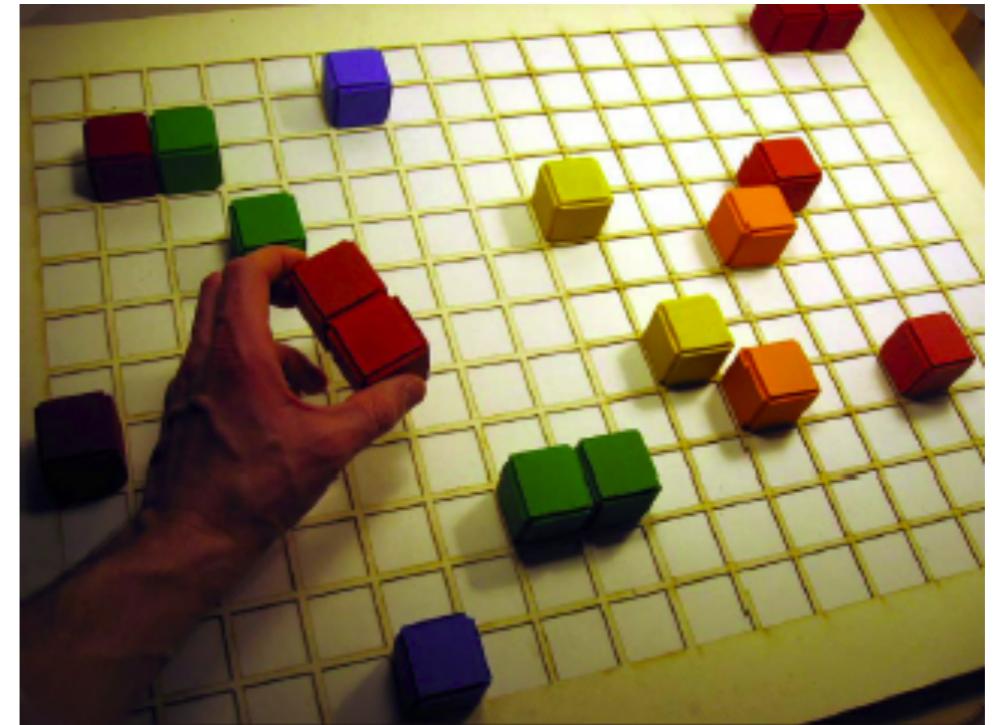


# From Design Computing to Creating Unique Technology for Everyone



**Ellen Yi-Luen Do**

**University of Colorado Boulder & National University of Singapore**

[ellendo@acm.org](mailto:ellendo@acm.org)

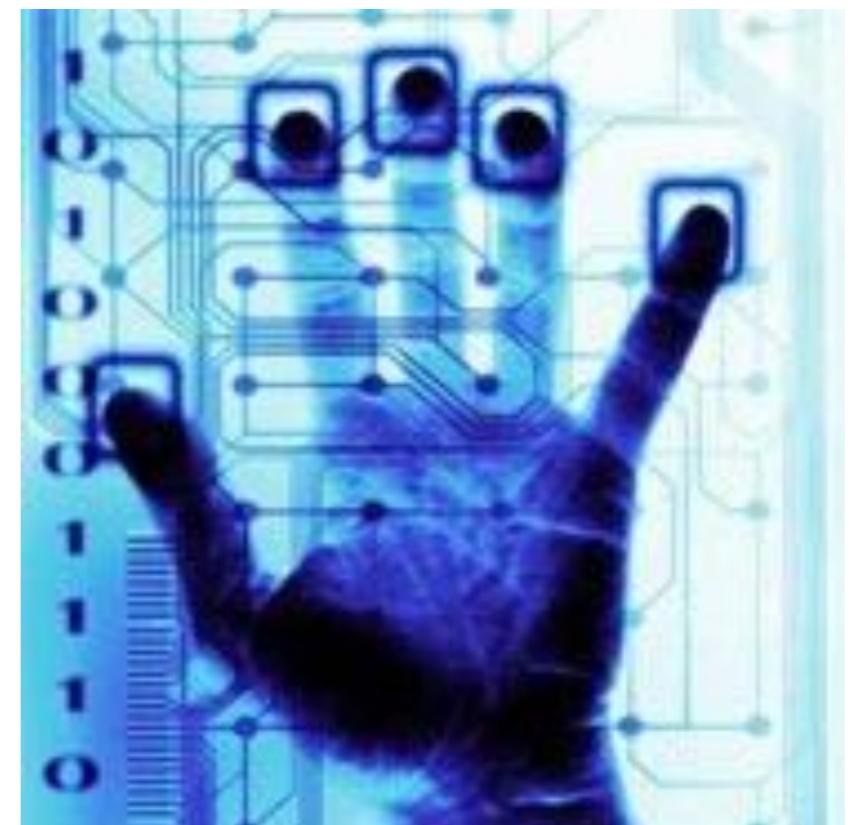
# Design Computing?

CSCW activities Building Modelling Spatial Intelligence Computer-Aided namely studies Cooperative Architecture Supported Expert term practice umbrella Modeling creativity Knowledge-based number Computing techniques Analog morphogenesis development Digital recent years Work Support research areas Computer novel BIM grouped Visual concepts Automated education application

Systems Artificial design computing Computational Design

We build things...  
physical & computational artifacts ...

- **objects** to think with
- ways of working
- **methods & tools** to make **things**



**1**

# **Smart Objects**

**2**

**CUTE**

**3**

**ATLAS**

**1**

## **Smart Objects**

**2**

**Creating Unique Tech for Everyone**

**3**

**ATLAS**

# 1. Smart Objects

# Smart Objects - Smart **Living** Environment



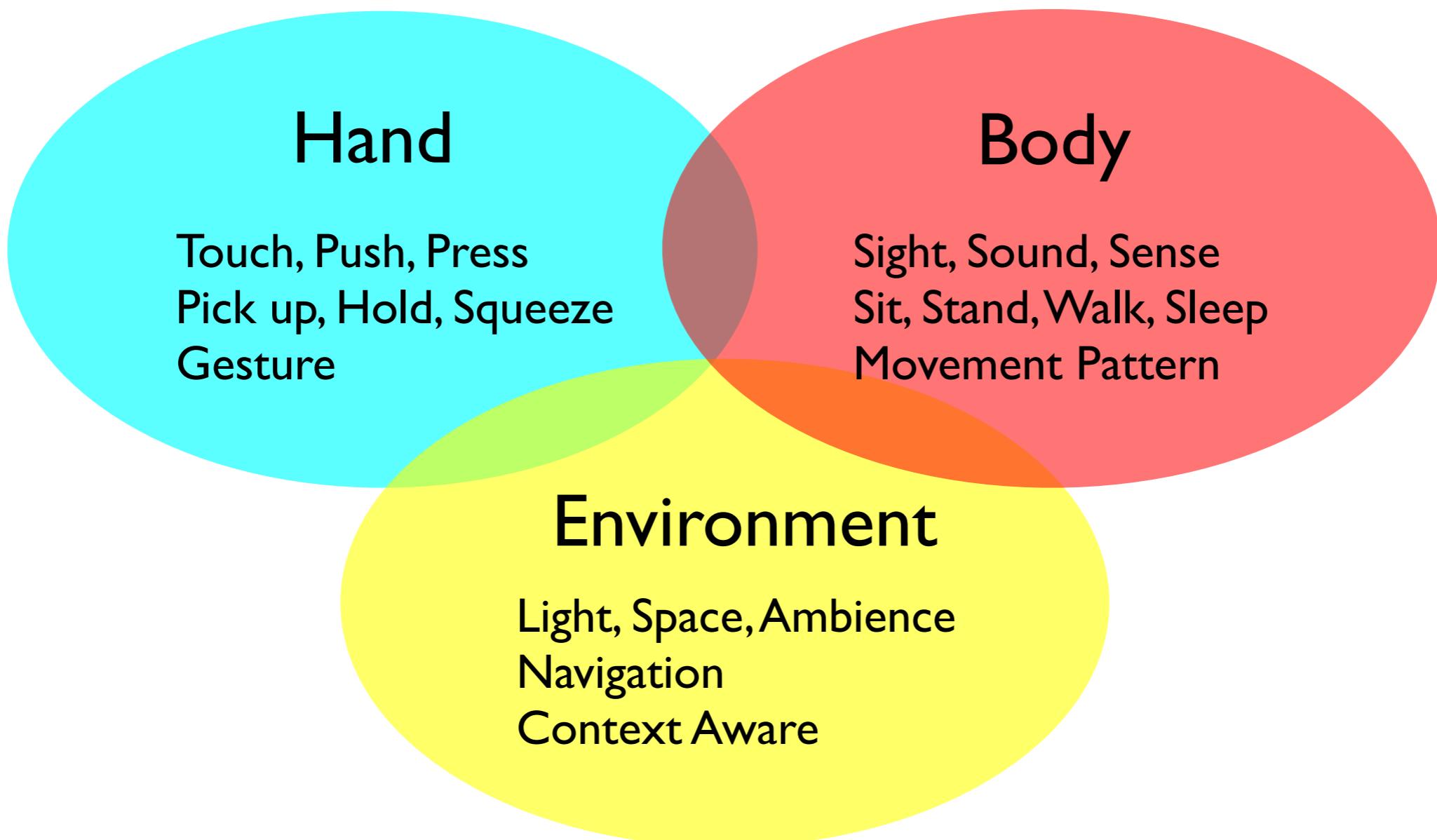
Physically & Computationally Enhanced Environment

# Built Environment as an Interface



Integrating Design, Computation & Physical Environment

# A Human Centric View of Smart Objects



# Computing Smart Environments



Intelligent Objects



Responsive Furniture



Interactive Environments

# Computing Smart Environments



Intelligent Objects



Health



Responsive Furniture



Awareness



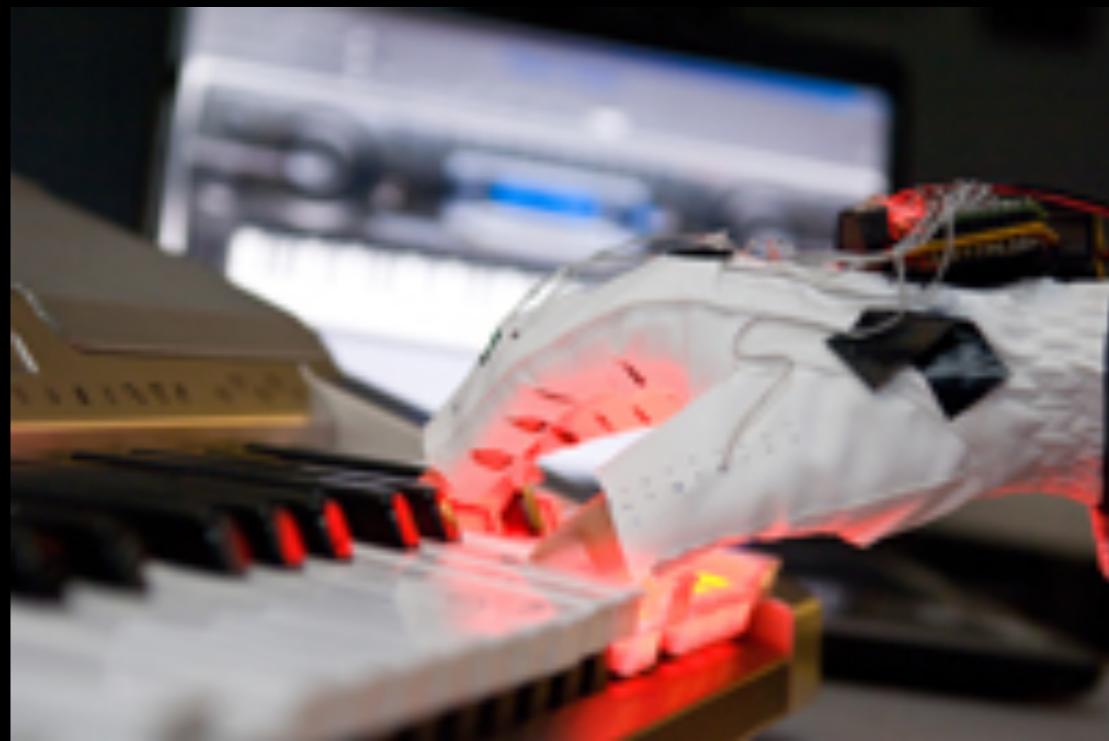
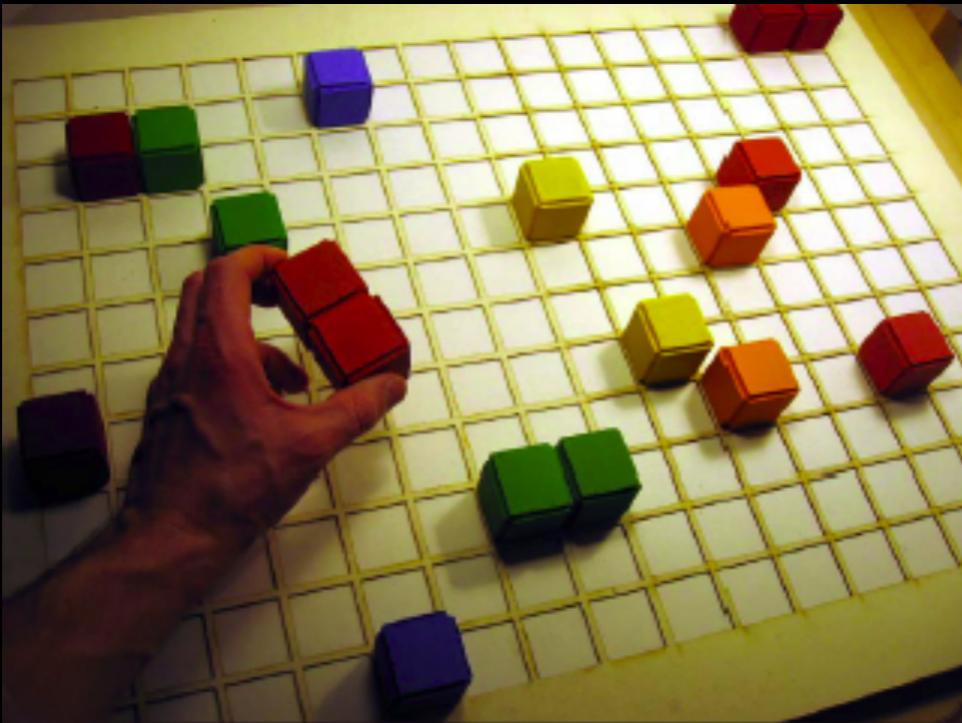
Interactive Environments



Entertainment

Designing Interactive Computing for Happy Healthy Life

# Intelligent Objects



Everyday Object as Interface

# Responsive Furniture



Chairware, Tableware, Everyware

# Computationally Enhanced Environments



Sensing and Actuating

# Navigational Blocks



tangible navigation of digital information

<https://dl.acm.org/citation.cfm?id=502725>

# Posey

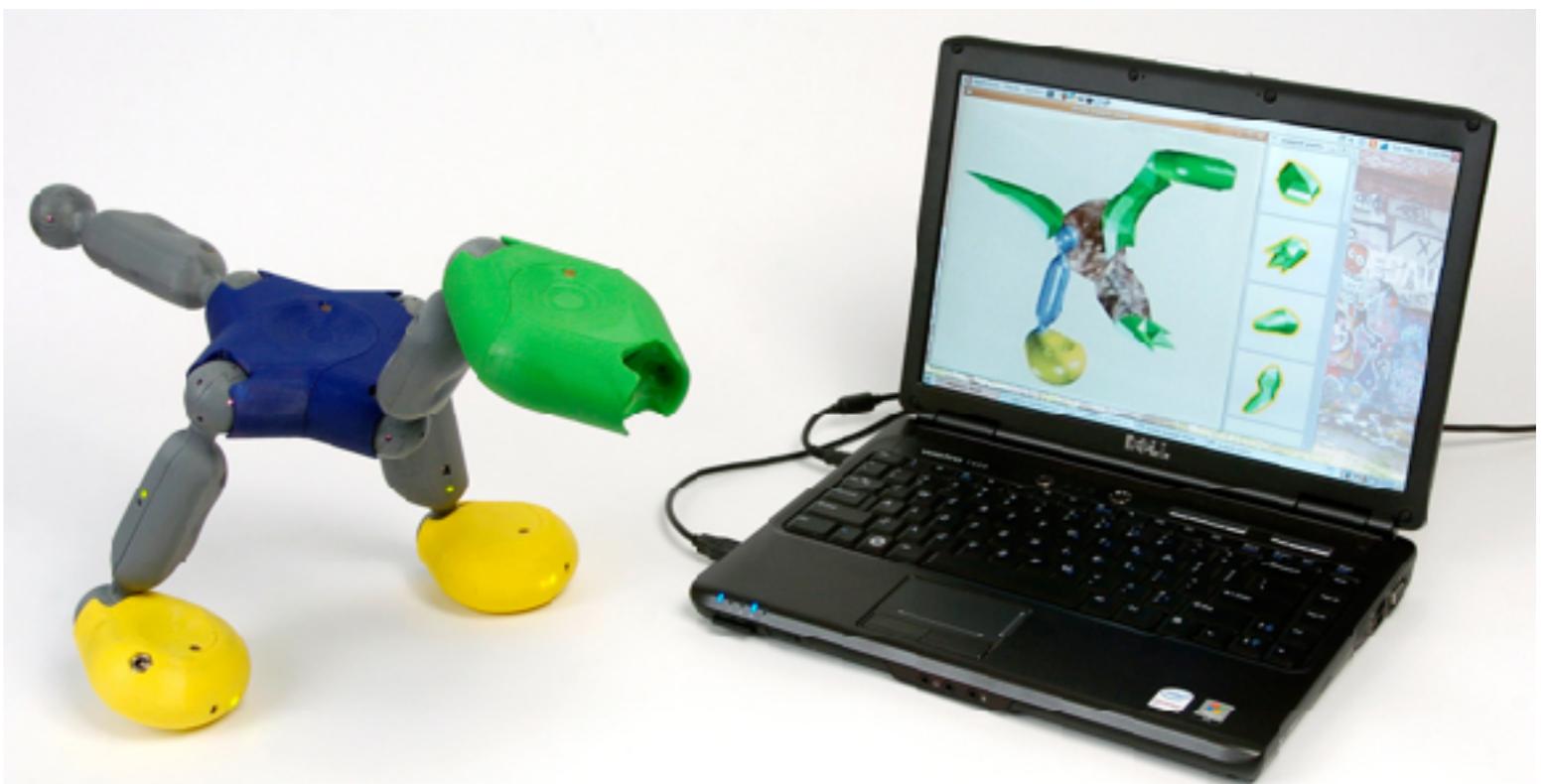
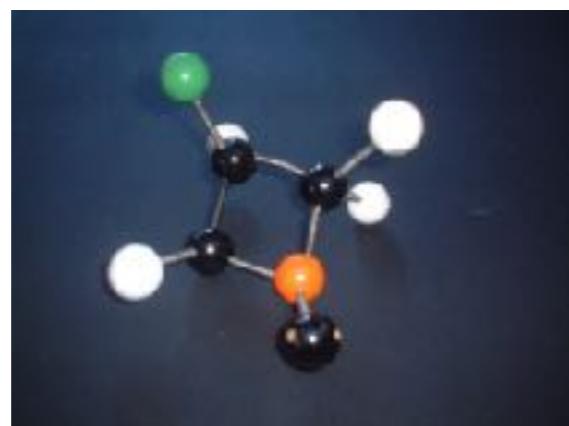
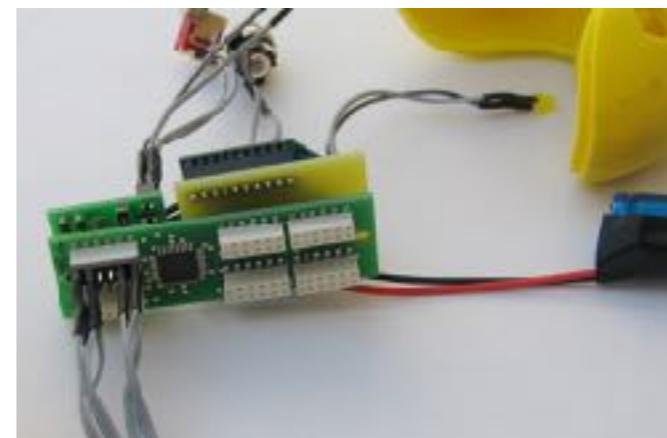
tangible sketching API

Puppet Show



<https://dl.acm.org/citation.cfm?doid=1347390.1347402>

# Posey



hub-and-strut geometry construction kit  
that senses connections and angles

# Piano Touch



<https://ieeexplore.ieee.org/document/4911582/>

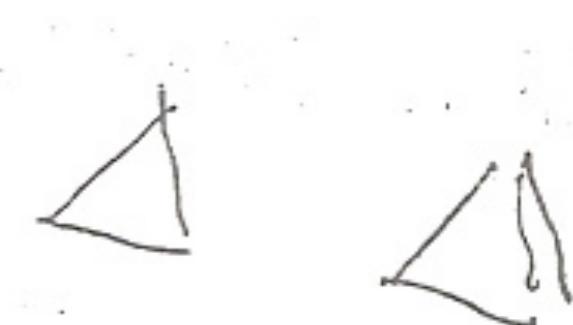
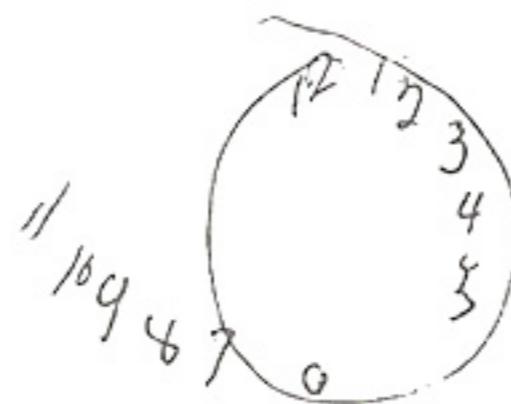
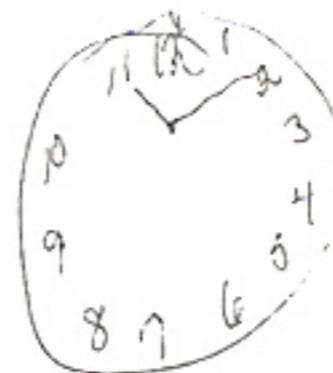
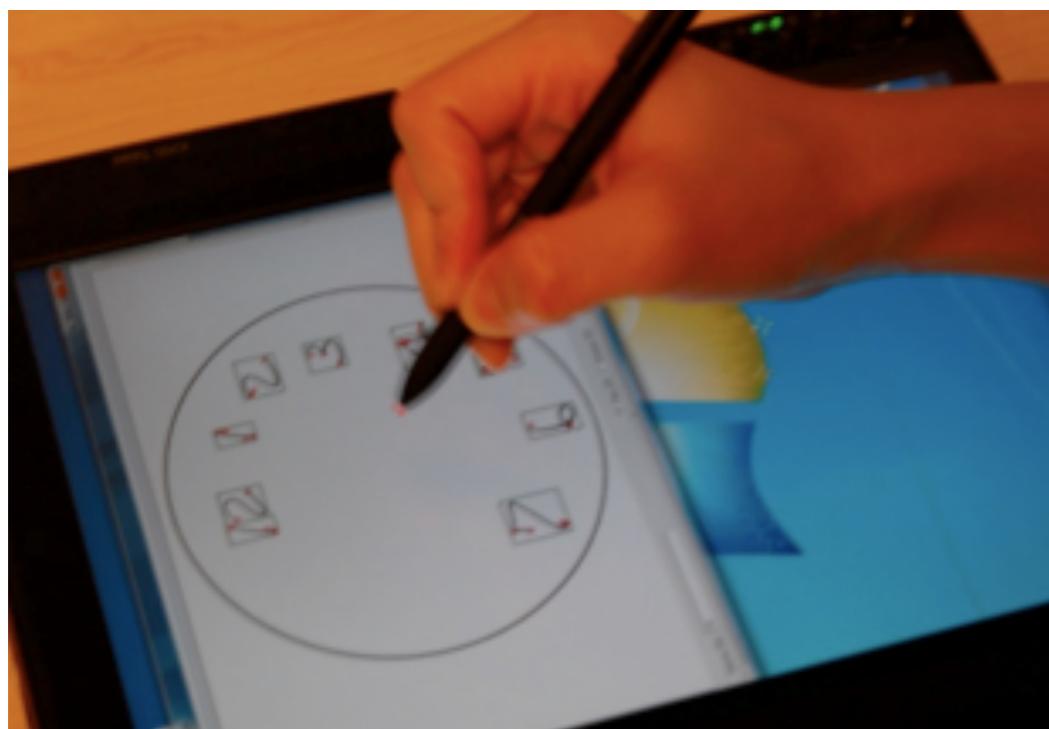
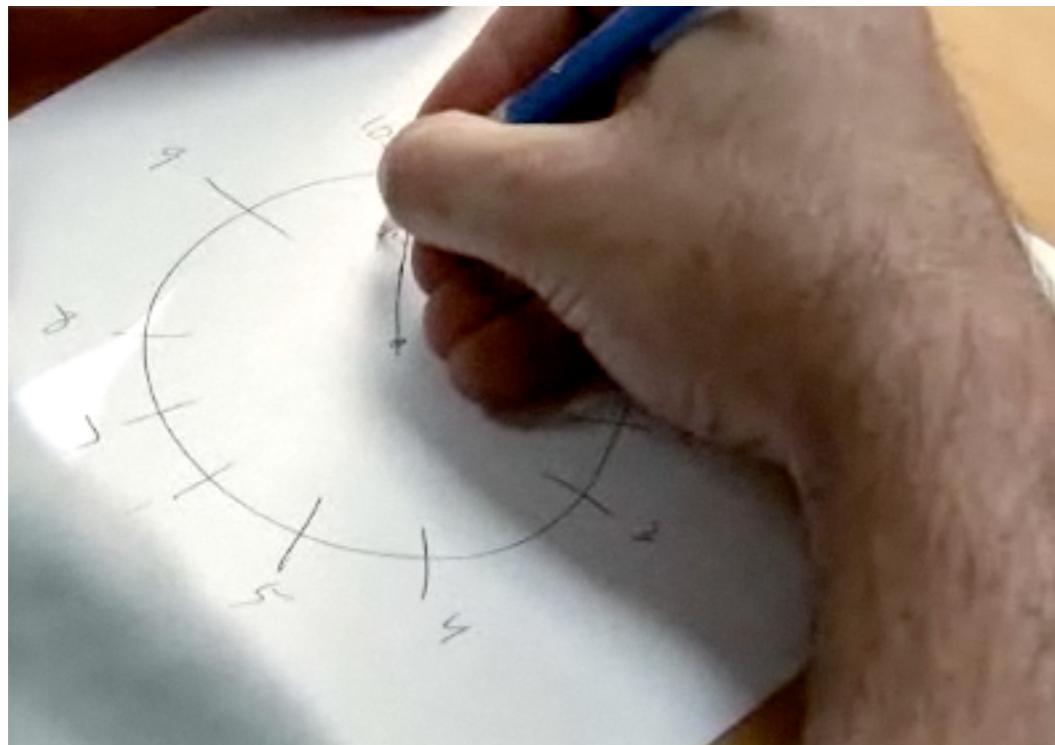
# Piano Touch / Mobile Music Touch



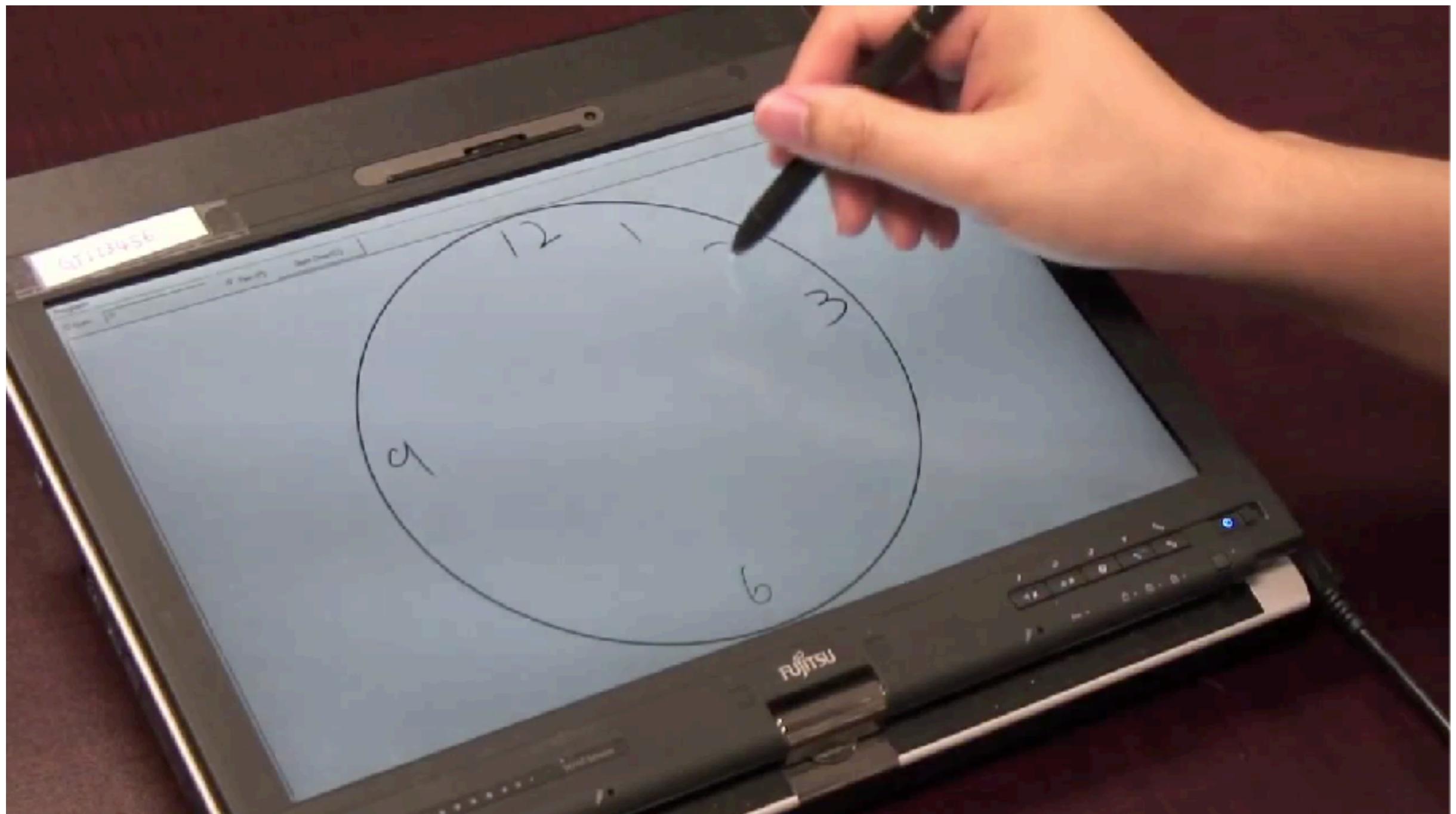
<https://dl.acm.org/citation.cfm?id=1753443>

<https://www.youtube.com/watch?v=xqlkZX0f7KA>

# Automatic Clock Drawing Test for Cognitive Impairment Screening

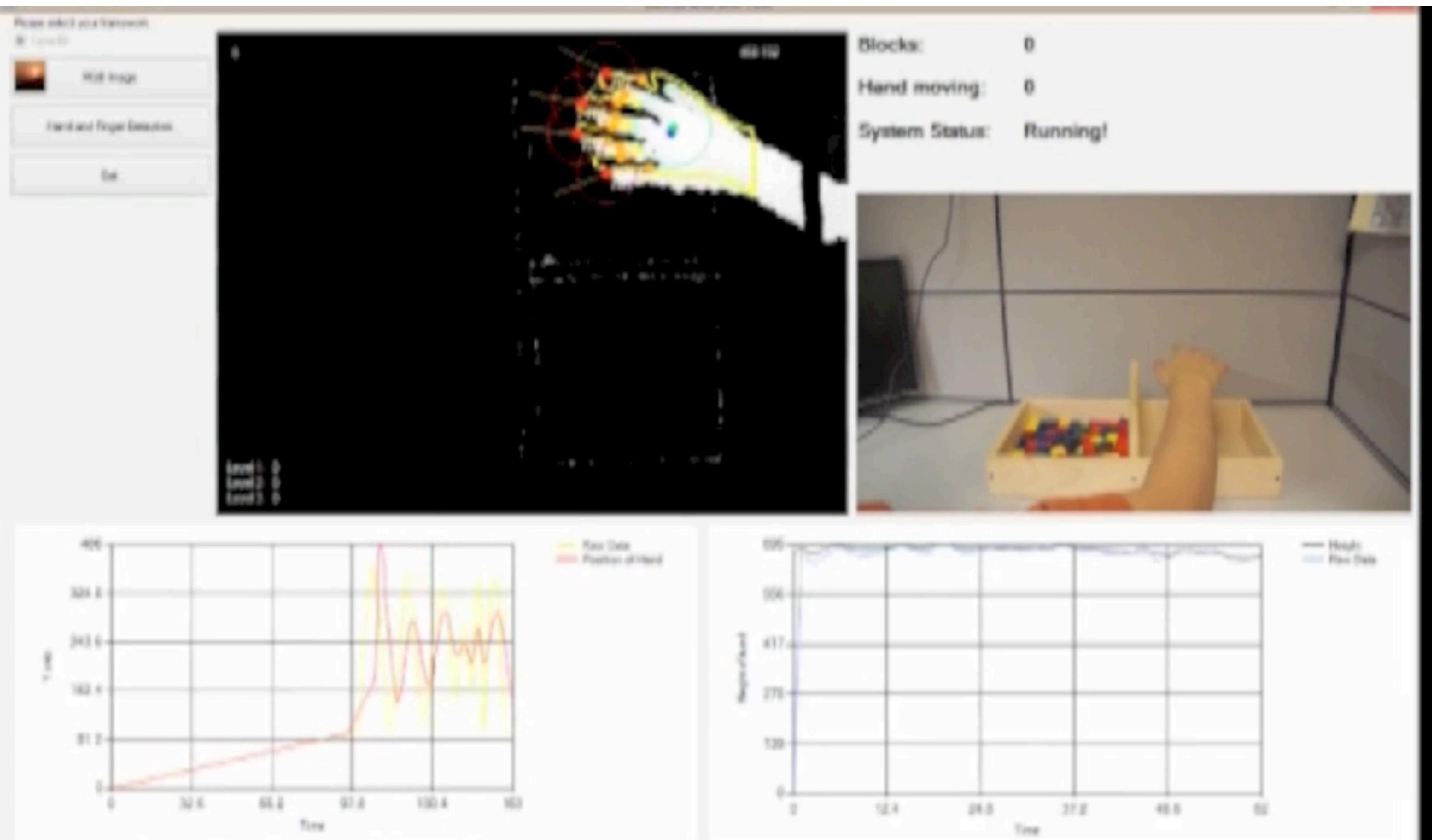


# Clock Drawing Test for Cognitive Impairment



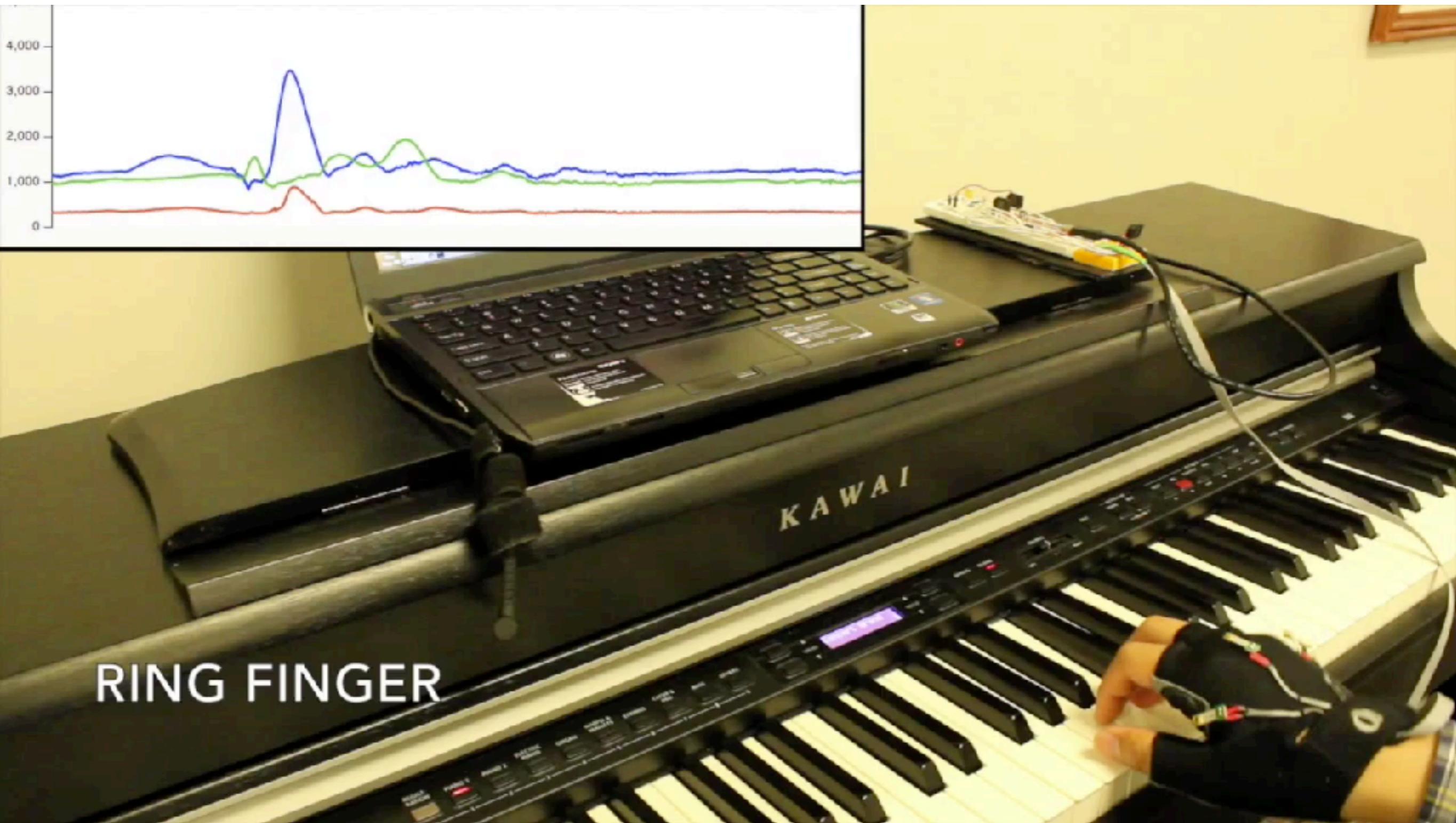
<https://www.news.gatech.edu/2012/10/01/home-based-assessment-tool-dementia-screening>

# Digital Box and Block Test



<https://ieeexplore.ieee.org/document/6529516/>

# Tactile Teacher



RING FINGER

<https://dl.acm.org/citation.cfm?doid=2818052.2869133>

# Acknowledgement

Several research projects presented here were supported in part by the National Science Foundation under Grants IIS-96-19856, IIS-00-96138, DUE-0127579 and ITR-0326054. The views and findings contained in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.



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## 2. Creating Unique Technology for Everyone

# Creating Unique Technology for Everyone



Ellen Yi-Luen Do  
Keio-NUS **CUTE** Center  
**N**ational **U**niversity of **S**ingapore

[ellendo@nus.edu.sg](mailto:ellendo@nus.edu.sg)



# KEIO-NUS Connective Ubiquitous Technology for Embodiments (CUTE) Center



[cutecenter.nus.edu.sg](http://cutecenter.nus.edu.sg)



## Keio-NUS CUTE Center

Connective Ubiquitous Technology for Embodiments

**C**reating  
**U**nique  
**T**echnology for  
**E**veryone!



<http://cutecenter.nus.edu.sg>



# Organisation of CUTE Projects

## EXPERIENCE MEDIA

**Multi-sensory connection technology to engage millions of people for playful, creative and affective interactive**

**New Frontiers  
(Blue Sky)**

**Enrichment through Travel & Wellness**

**Continuing  
Research**

**Tangible Interaction**

- Catapy
- Paper Interaction
- Digital Taste
- Ninja Track
- Tangible Tokens

**Augmented Learning**

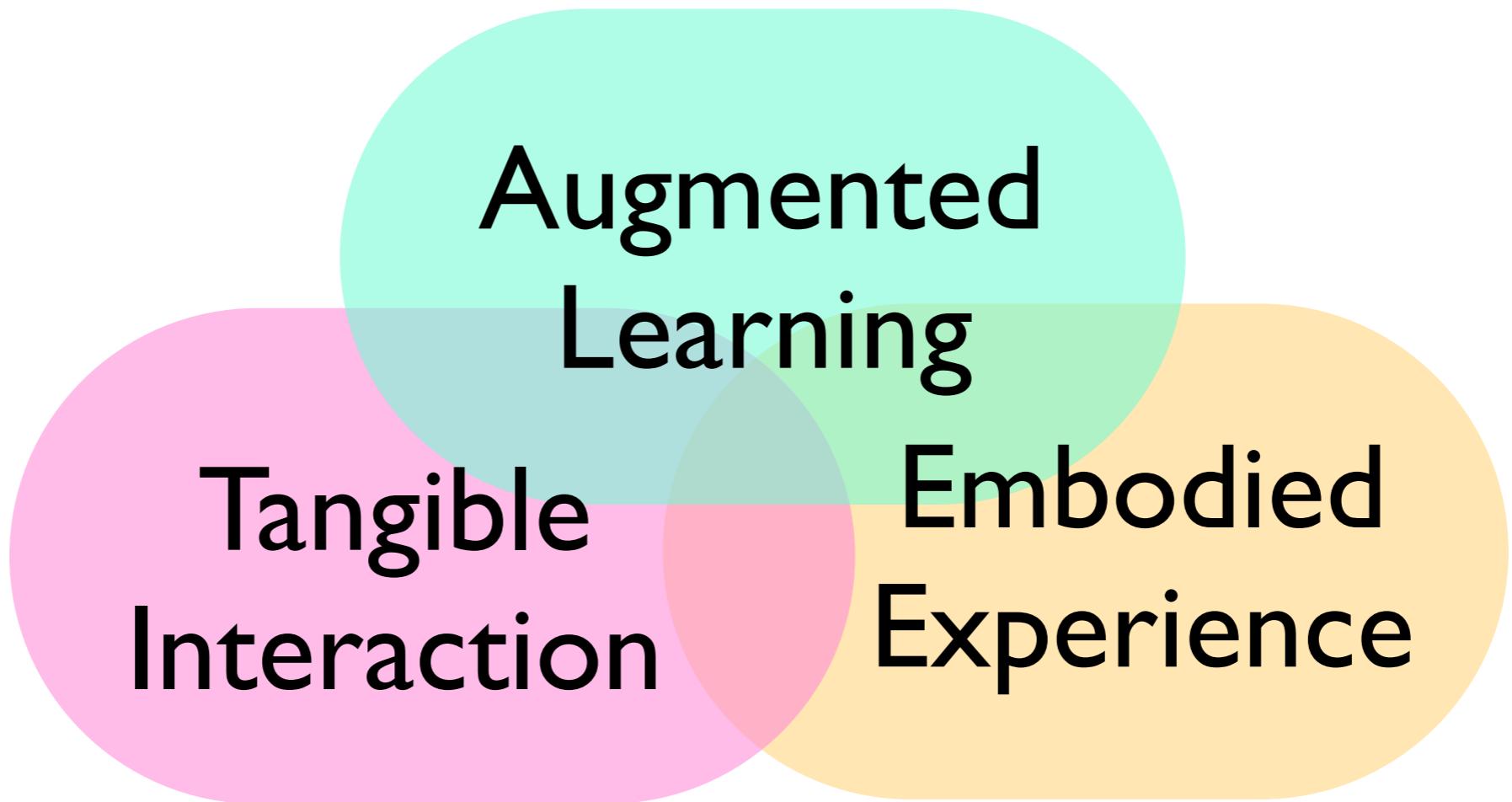
- DoDo Game
- Jackson Plan
- AR Muse
- Wild AVR
- VR Med Sim

**Embodied Experience**

- Crowd Trail
- CITIUS
- 3RD Eye
- Cozy Map
- 3D Food Printing

**To Market**

T Jacket, Catapy, Crowd Trails, Sensorendipity  
Ninja Track, Smart Sail, AR Muse



We seek to **advance** the sciences and practices of experience media design, with special attention to how they may be **augmented** by **technology**.



# **Embodied Experience**

# 3RD EYE

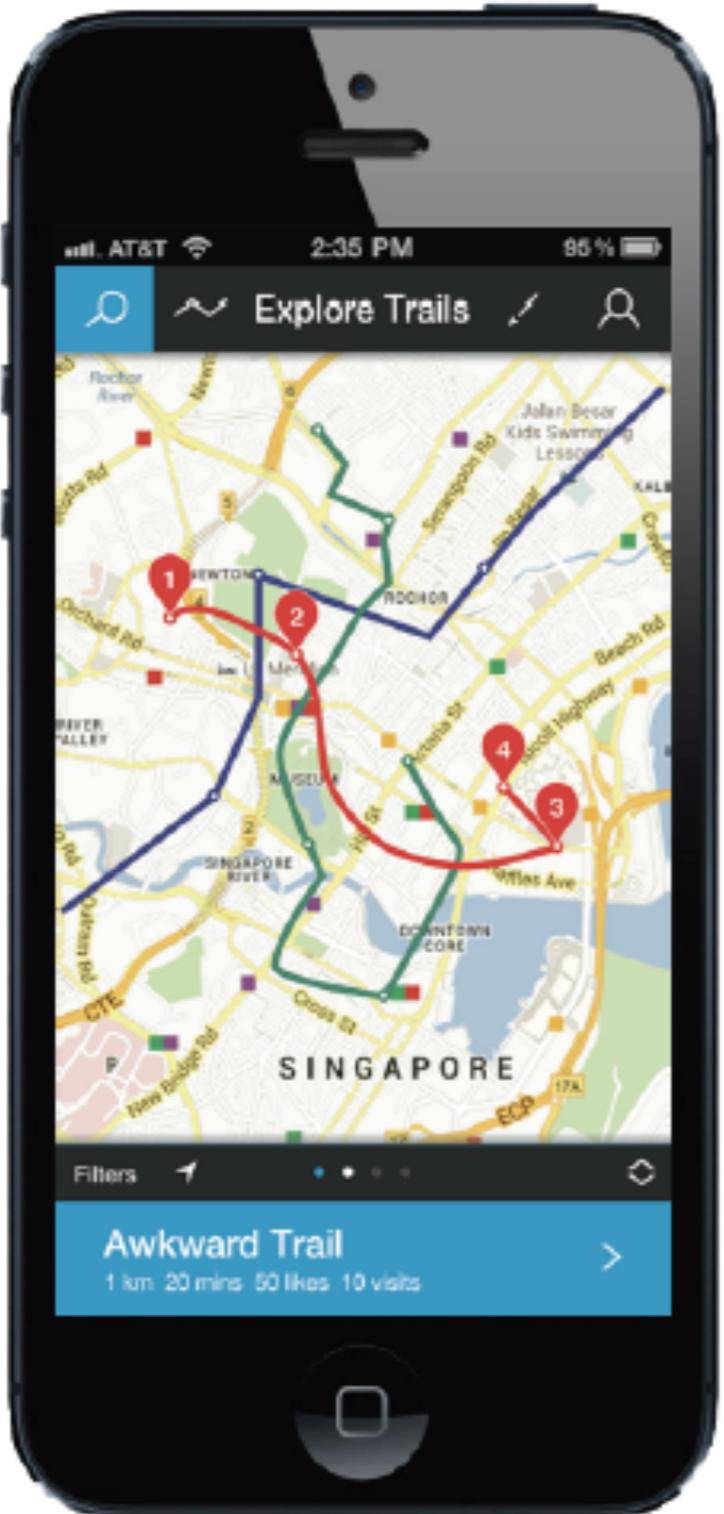
## Vehicle to Vehicle (V2V) communication



collision prevention system in a motorbike helmet

# Crowd Trails App

## crowd trail creation to share experience of places



**CrowdTrails A Digital Memory Project**

**Explore Trails**

- Awkward Trail
- Be Active Trail
- Chicken Rice Trail
- Do or Die Trail with Long...
- Example Trail

**Explore Trails**

auto iure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat

**1 Marina Park**

Lorum ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in

**2 Marina Bay Sands**

Lorum ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt

**Shoutouts**

User 1 6/6/2013 Hi, this is my first time posting. Awesome, great and special.

User 2 6/6/2013

User 4 6/6/2013 The above picture was taken somewhere cool. Come visit it is so awesome and cool. Especially MBS and the chicken rice

**Trail Editor**

Spot Number: 1

Use current location

Locate on map

+ Name

+ Description

+ Photo

Save Delete Spot

Add New Spot

<https://crowdtrails.org/>

# Crowd Trails App

crowd trail creation to share experience of places

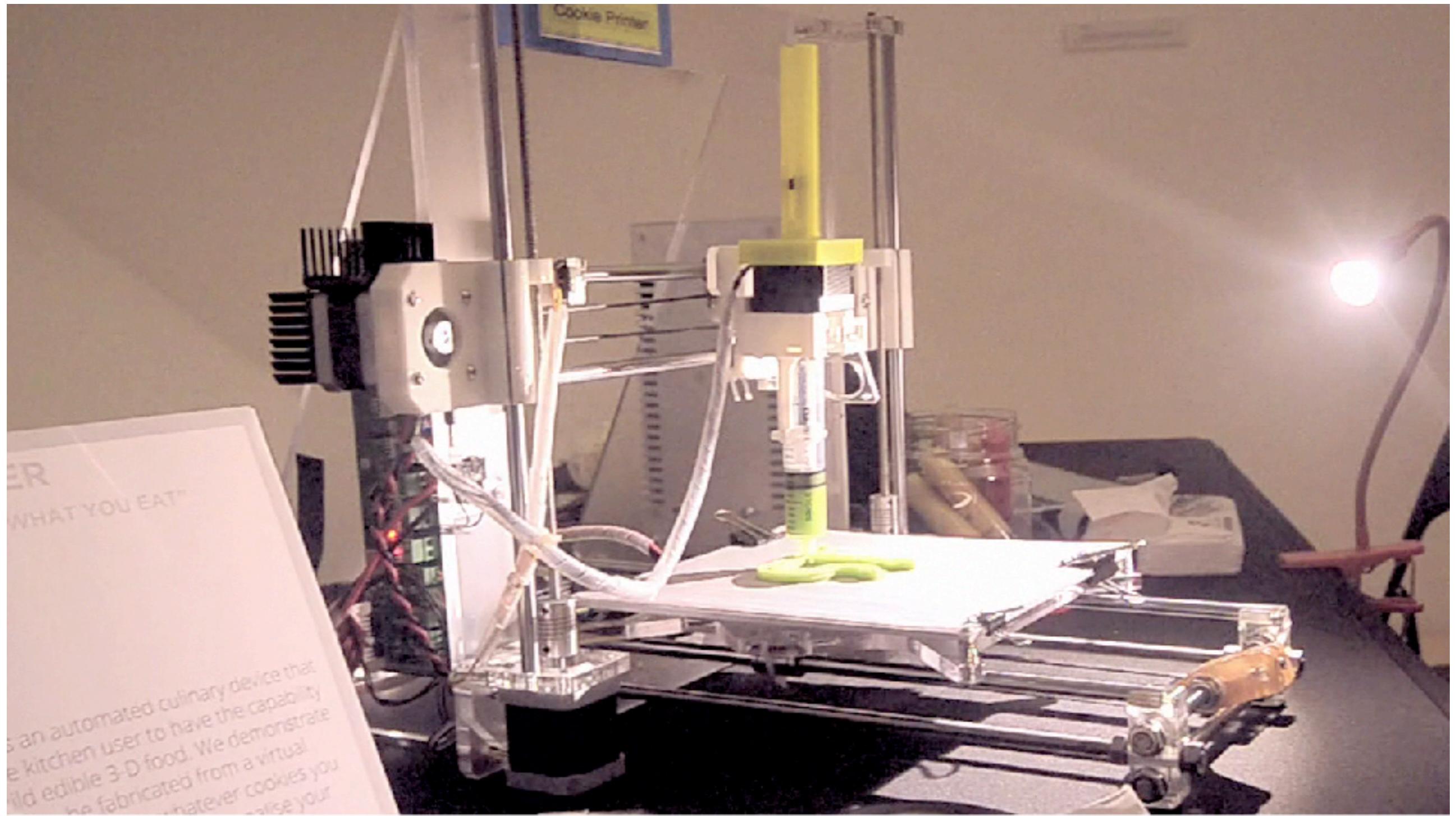


# 3D Cookie Printer



<https://www.sciencedirect.com/science/article/pii/S2351978915010574>

# 3D Cookie Printer



nutrition and shape design customization

# inSight



**kick-starting communications for elders aging in place**

<https://dl.acm.org/citation.cfm?id=2726954>

# Augmented Learning

# E Museum

Augmented Reality renders artwork in different moods



# AR-muse: Augmented Reality for Art Museums

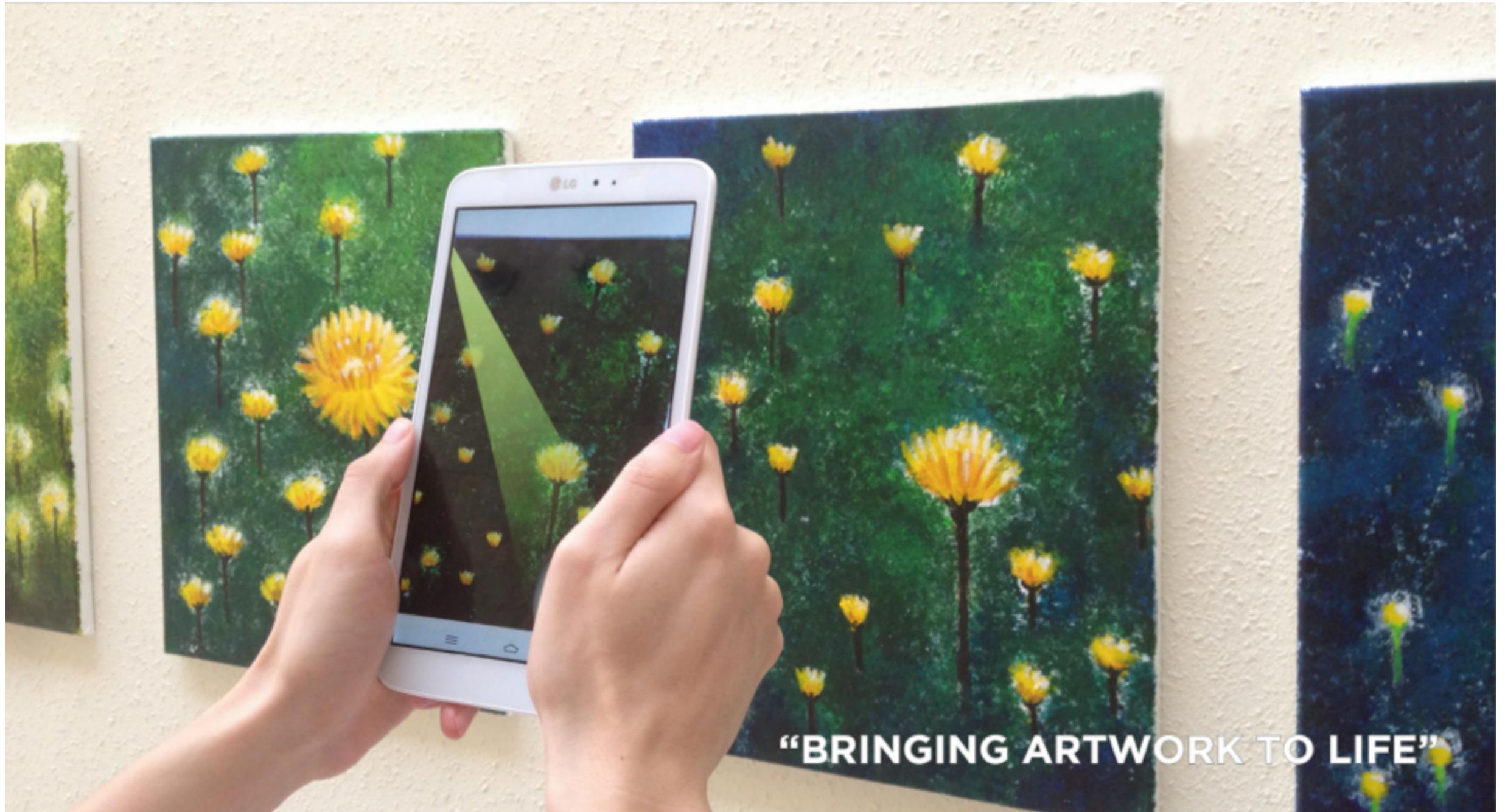


Augmented Reality makes the paintings come alive

<https://www.youtube.com/watch?v=t3IEIWT6NYo>

# AR Muse

## Augmented Reality for Learning in the Museum Context

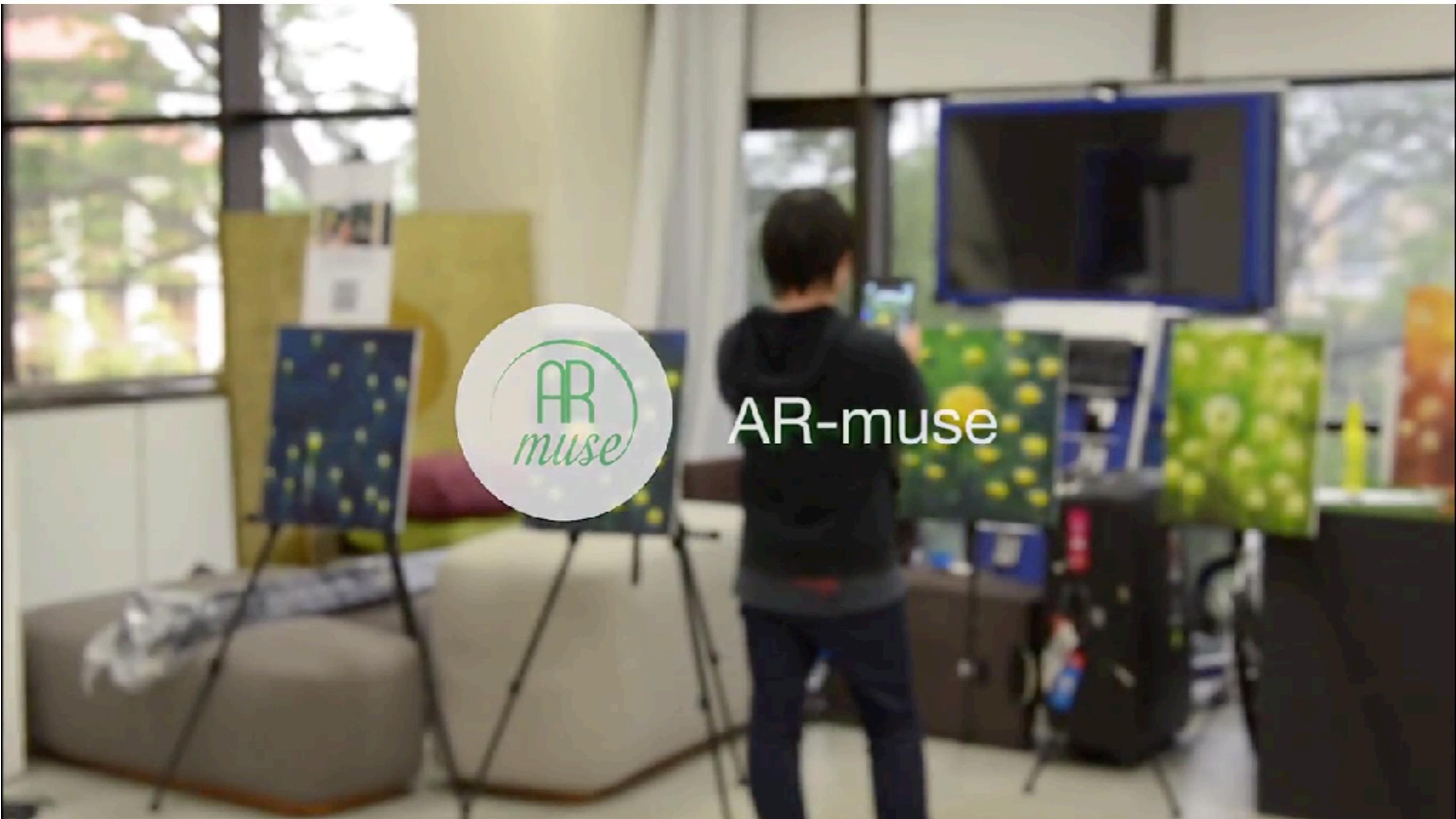


<https://ieeexplore.ieee.org/document/6935432/>

# AR Muse



# AR Muse

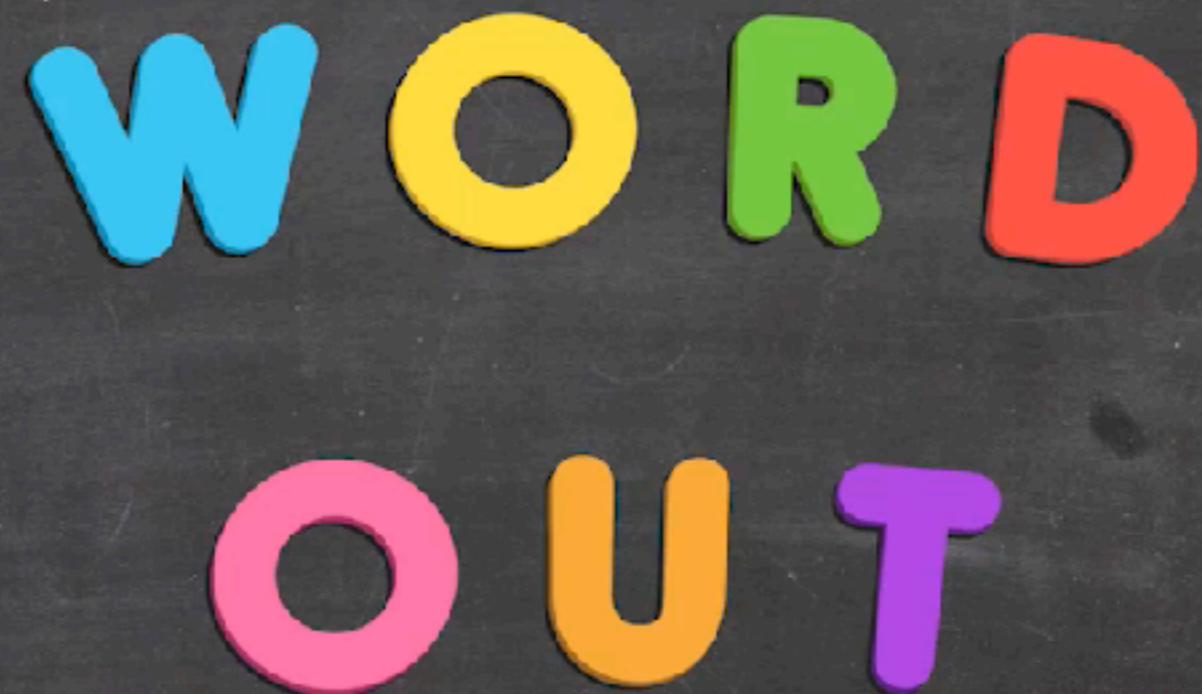


<https://www.youtube.com/watch?v=ZfSQLTltycw>

# AR-muse @ Science Center Singapore ArtScience Museum



# Word Out!



WORD  
OUT

The word "WORD" is stacked above the word "OUT" on a dark, textured surface. The letters are large, 3D-style, and colored: W is blue, O is yellow, R is green, D is red; the second O is pink, U is orange, T is purple.

Learning the Alphabet through Full Body Interactions

<http://delivery.acm.org/10.1145/2730000/2728657/supp/sgc0109-file3.mp4?>

# Word Out!



Learning the Alphabet through Full Body Interactions

<https://dl.acm.org/citation.cfm?id=2728657>

# Virtual Reality Simulation Systems

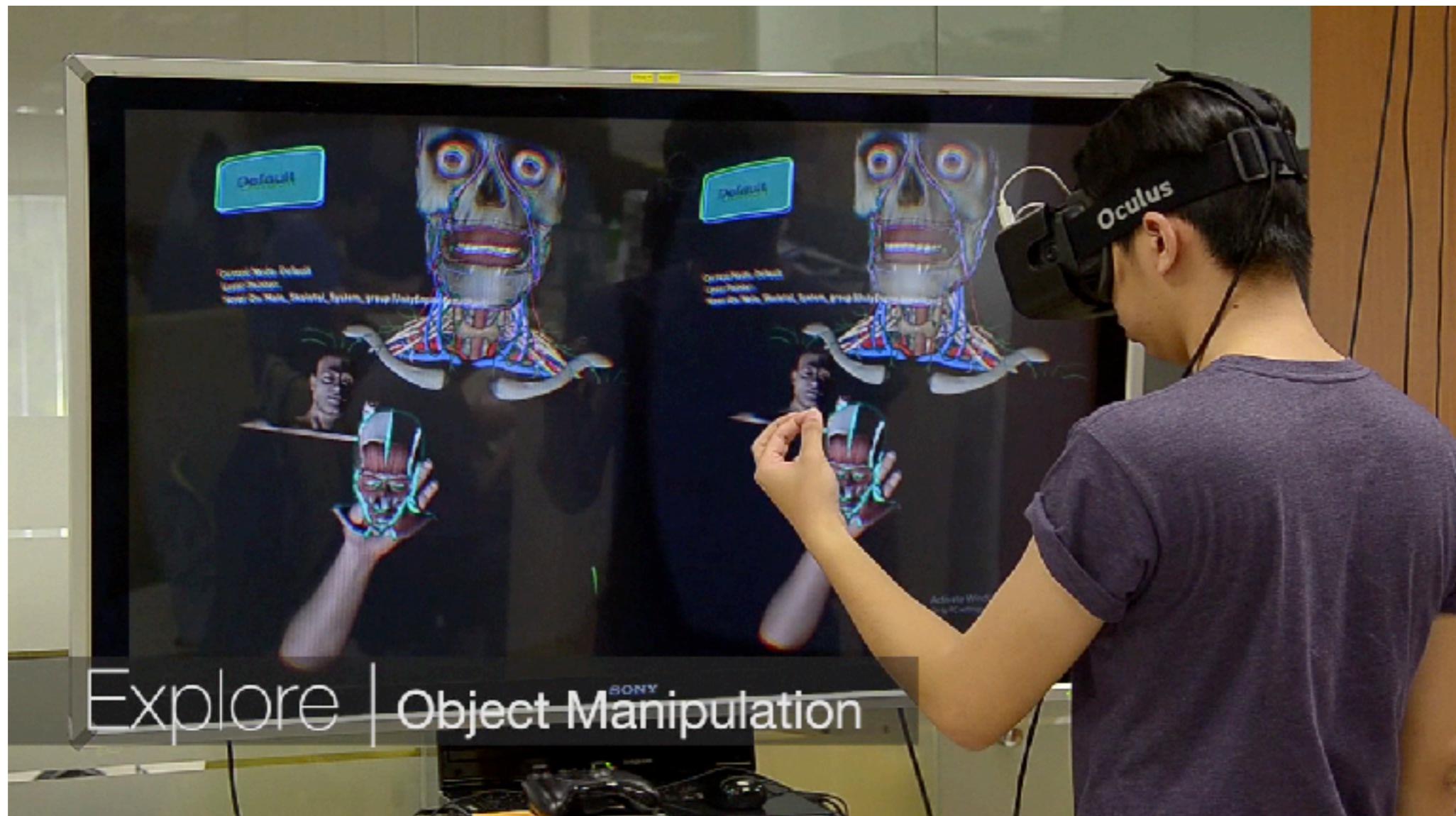
Centre for Healthcare Simulation



Yong Loo Lin  
School of Medicine



# Virtual Interactive Human Anatomy



LeapMotion virtual-contact-based

<https://www.youtube.com/watch?v=exYjVbM5XEA>

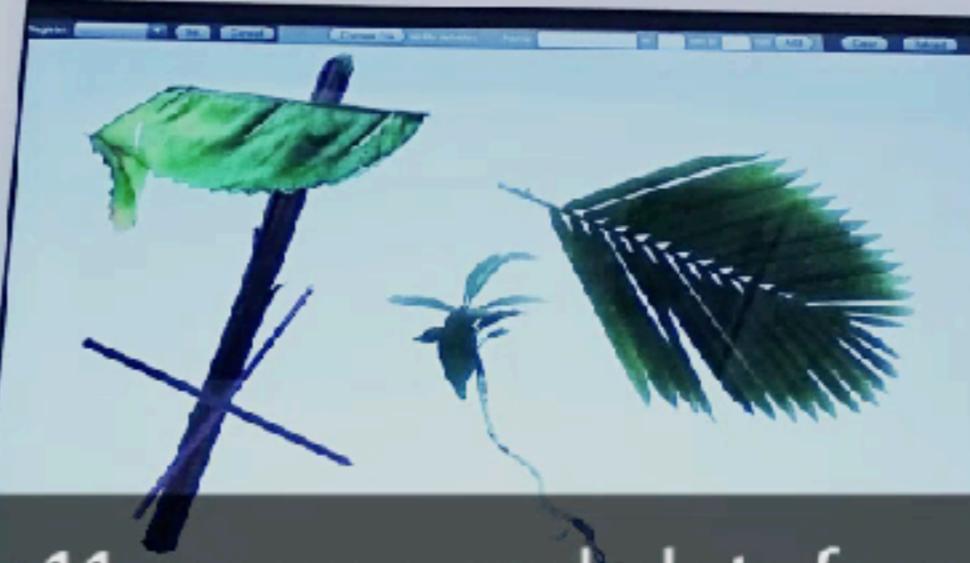
# **Virtual Interactive Simulation Environment**



**HTC Vive - training tutorial and quiz**

# Tangible Interaction

# Tangible Tokens



We build Tangibles for 11 common symbols to form the default set, using conductive tips, laser cut bases, conductive clay and symbols.

natural/digital object tokens to preserve an old language

<https://dl.acm.org/citation.cfm?id=2702339>

# D'Licious Vessel / Digital Taste



stimulating different taste sensation to promote healthy lifestyle

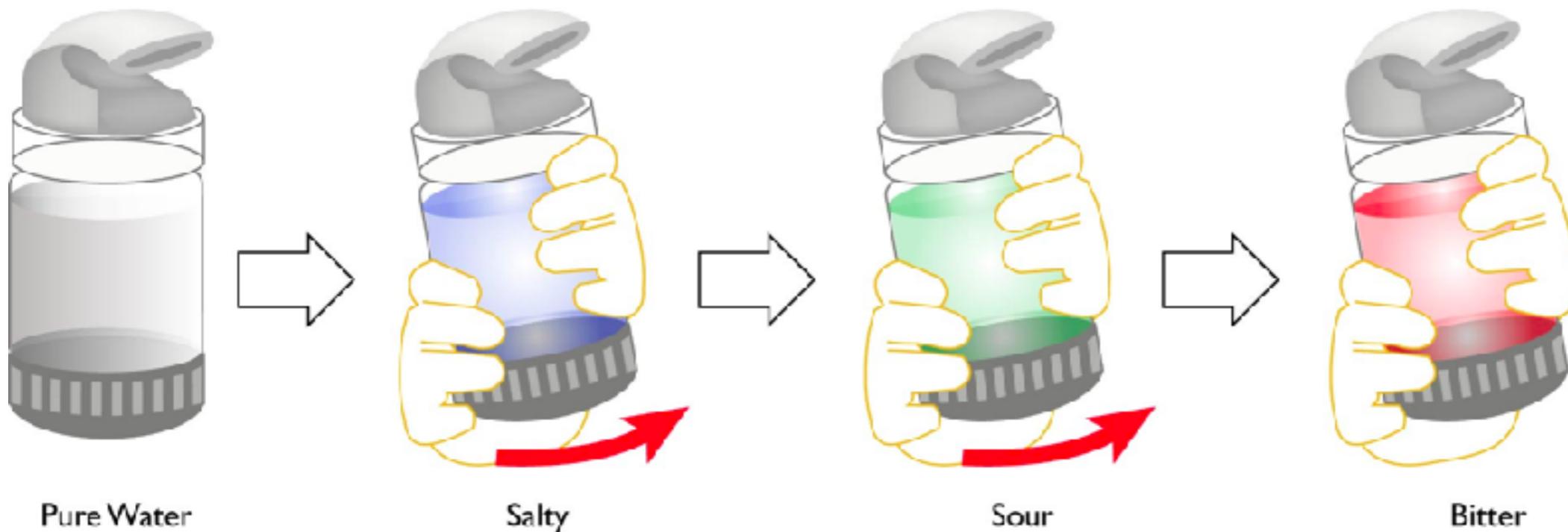
# Digital Taste & Virtual Cocktail



stimulating different taste sensation to promote healthy lifestyle

<https://www.sciencedirect.com/science/article/pii/S0963996918303983>

# Fun Rasa Bottle (Digital Taste) ..

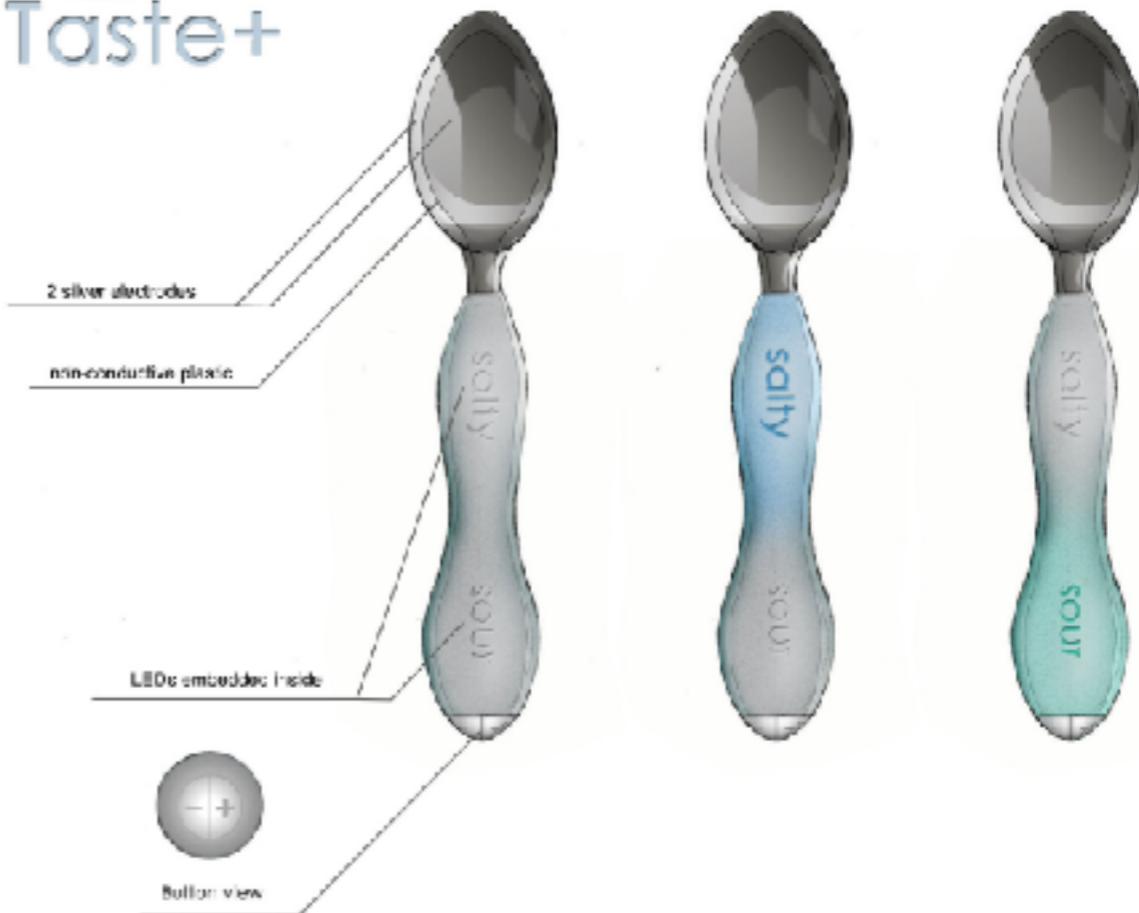


# Taste +

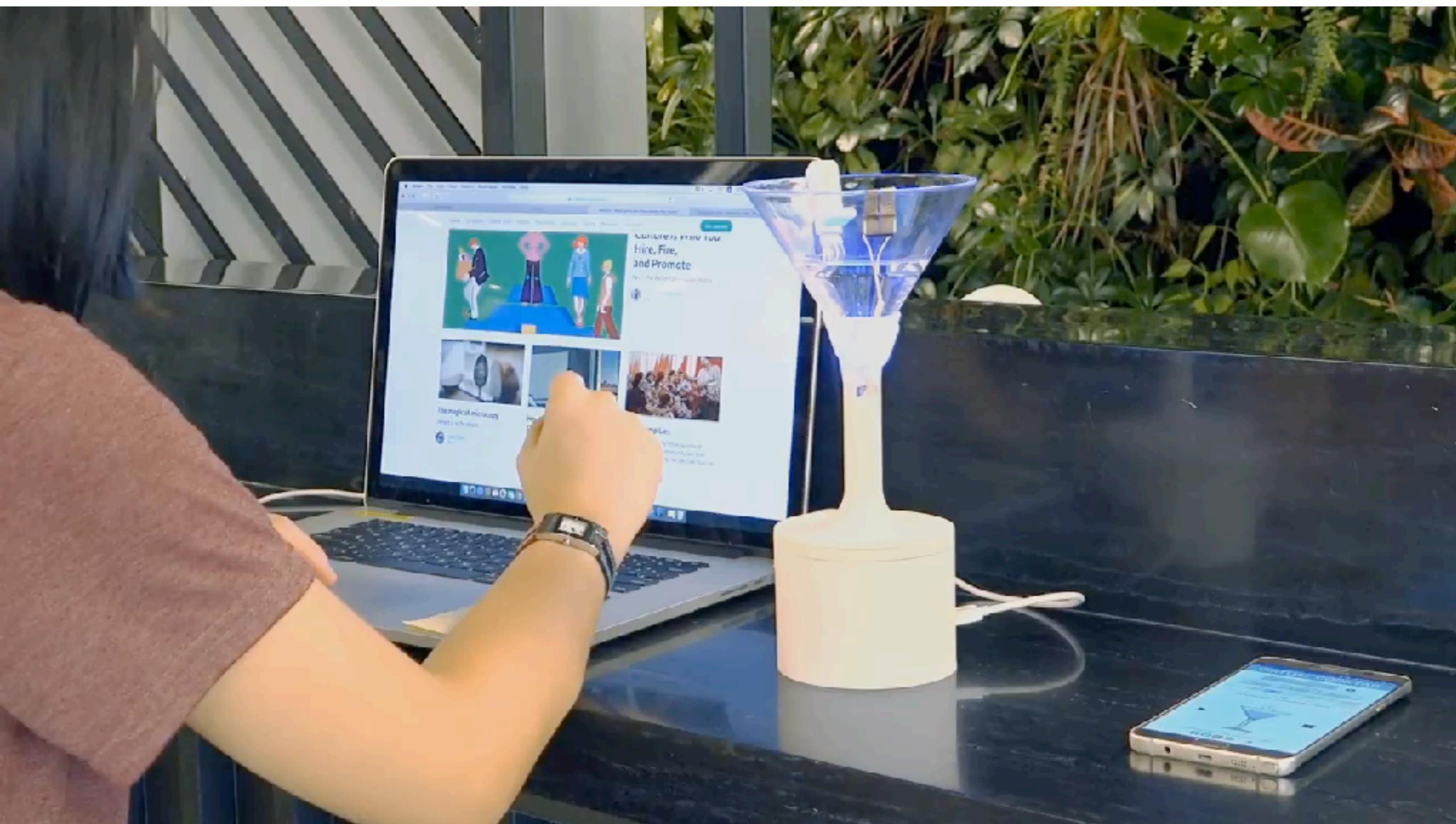
A spoon that electrically stimulates the taste buds



Taste+



# Virtual Cocktail



<https://www.youtube.com/watch?v=RQI6UDP1kOQ>

# Scented Pebbles



dynamic multi-sensory ambience of light and smell  
<https://dl.acm.org/citation.cfm?id=2690873>

# Scented Pebbles



active objects that allow users to create unique ambience of smell and lighting bas

dynamic multi-sensory ambience of light and smell

<https://vimeo.com/110558914>

# Season Traveller



Season Traveller is a wearable VR system that integrates

<https://dl.acm.org/citation.cfm?id=3174151>

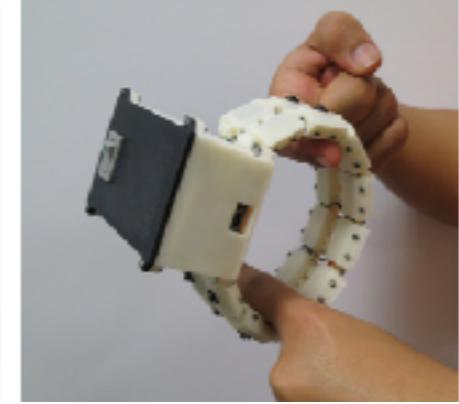
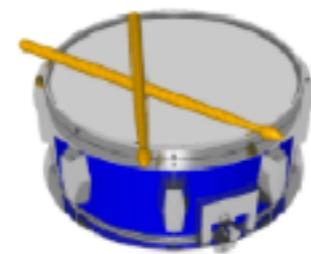
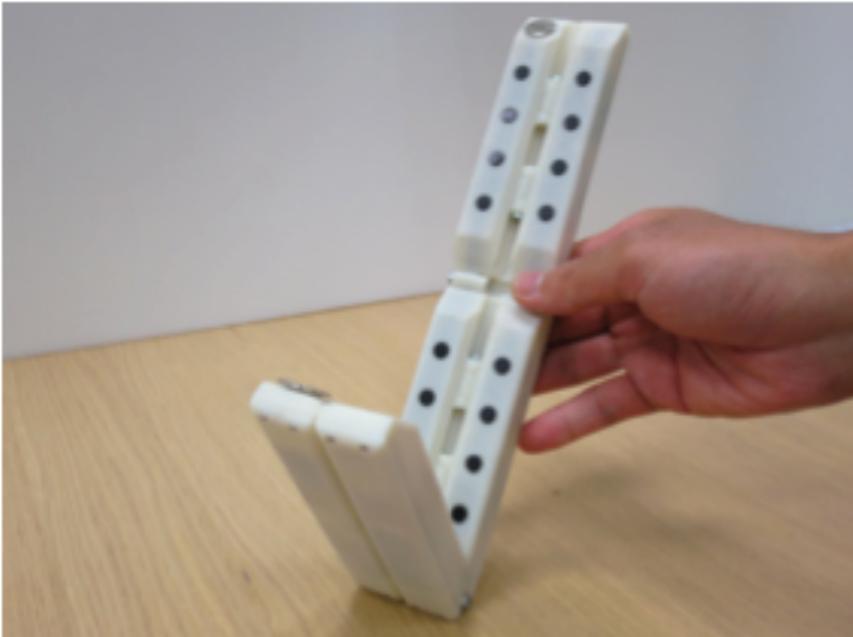
# Ninja Track



**Playful Toy  
Interface**

<https://dl.acm.org/citation.cfm?id=2460628>

# Silver Tune



smart music toy for individual and group music therapies



<http://bit.ly/reelblade>



## Keio-NUS CUTE Center

Connective Ubiquitous Technology for Embodiments

**C**reating  
**U**nique  
**T**echnology for  
**E**veryone!



Keio University

<http://cutecenter.nus.edu.sg>

# Acknowledgement

This research is supported by the Singapore National Research Foundation under its International Research Center Keio-NUS CUTE Center @ Singapore Funding Initiative and administered by the IDM Program Office.





Lee Kong Chian  
Natural History Museum

**P&G**



Singapore  
History  
Consultants

**DENSO**



ArtScienceMuseum  
MARINA BAY SANDS



Unilever

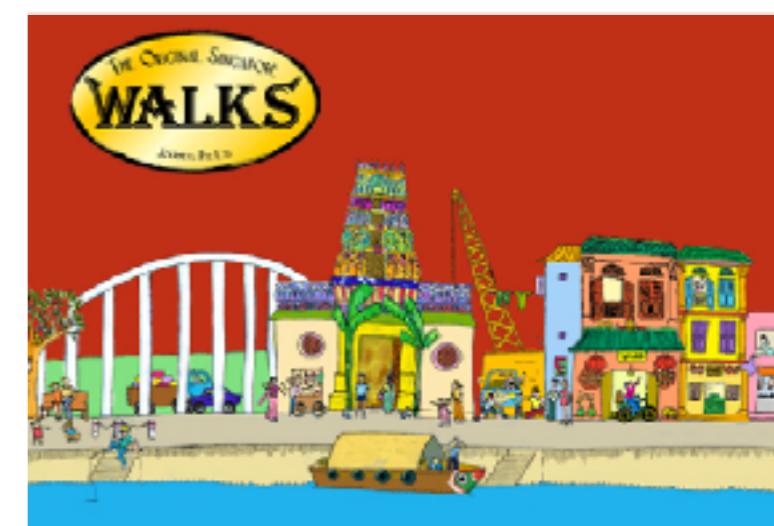


Children's Centre for Creativity

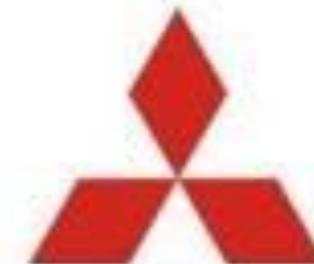


Yong Loo Lin School of Medicine

**TOSHIBA**



People's Association



**MITSUBISHI**  
HEAVY INDUSTRIES, LTD.



National  
Heritage  
Board

# Open Lab



# Stanford University

iDA

INFOCOMM  
DEVELOPMENT  
AUTHORITY OF  
SINGAPORE



Ryerson  
University

Georgia  
Tech



# 3. ATLAS



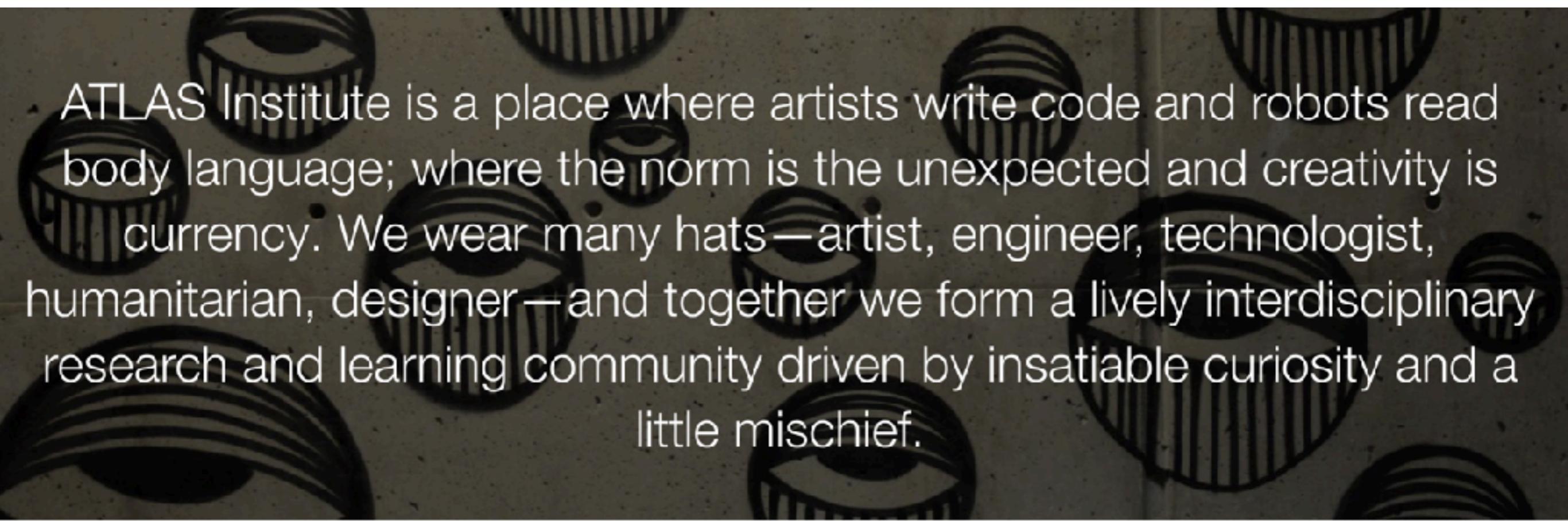
University of Colorado **Boulder**

<http://atlas.colorado.edu>



**ATLAS:**  
an  
interdisciplinary  
institute for  
radical  
creativity and  
invention.

We inspire critical thinking, research and experimentation that turn ingenious ideas into reality.



ATLAS Institute is a place where artists write code and robots read body language; where the norm is the unexpected and creativity is currency. We wear many hats—artist, engineer, technologist, humanitarian, designer—and together we form a lively interdisciplinary research and learning community driven by insatiable curiosity and a little mischief.

**The best way to predict the future is  
to invent it.**

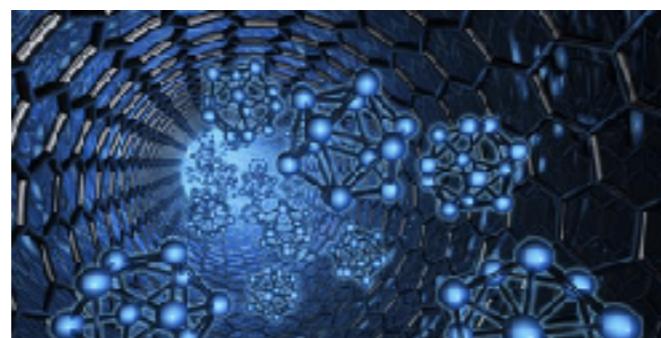
- Alan Kay

**Any sufficiently advanced technology  
is indistinguishable from magic.**

- Arthur C. Clarke

# LABS & STUDIOS

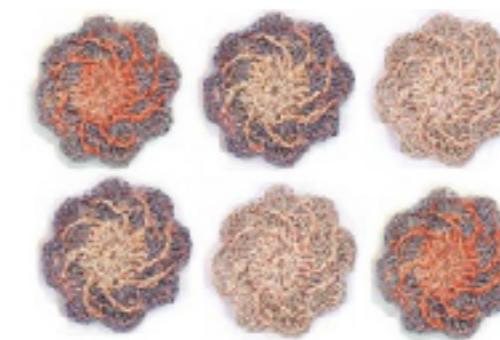
Emergent  
Nanomaterials



Playful  
Computation



Interactive  
Robotics  
& Novel  
Technologies



Unstable  
Design

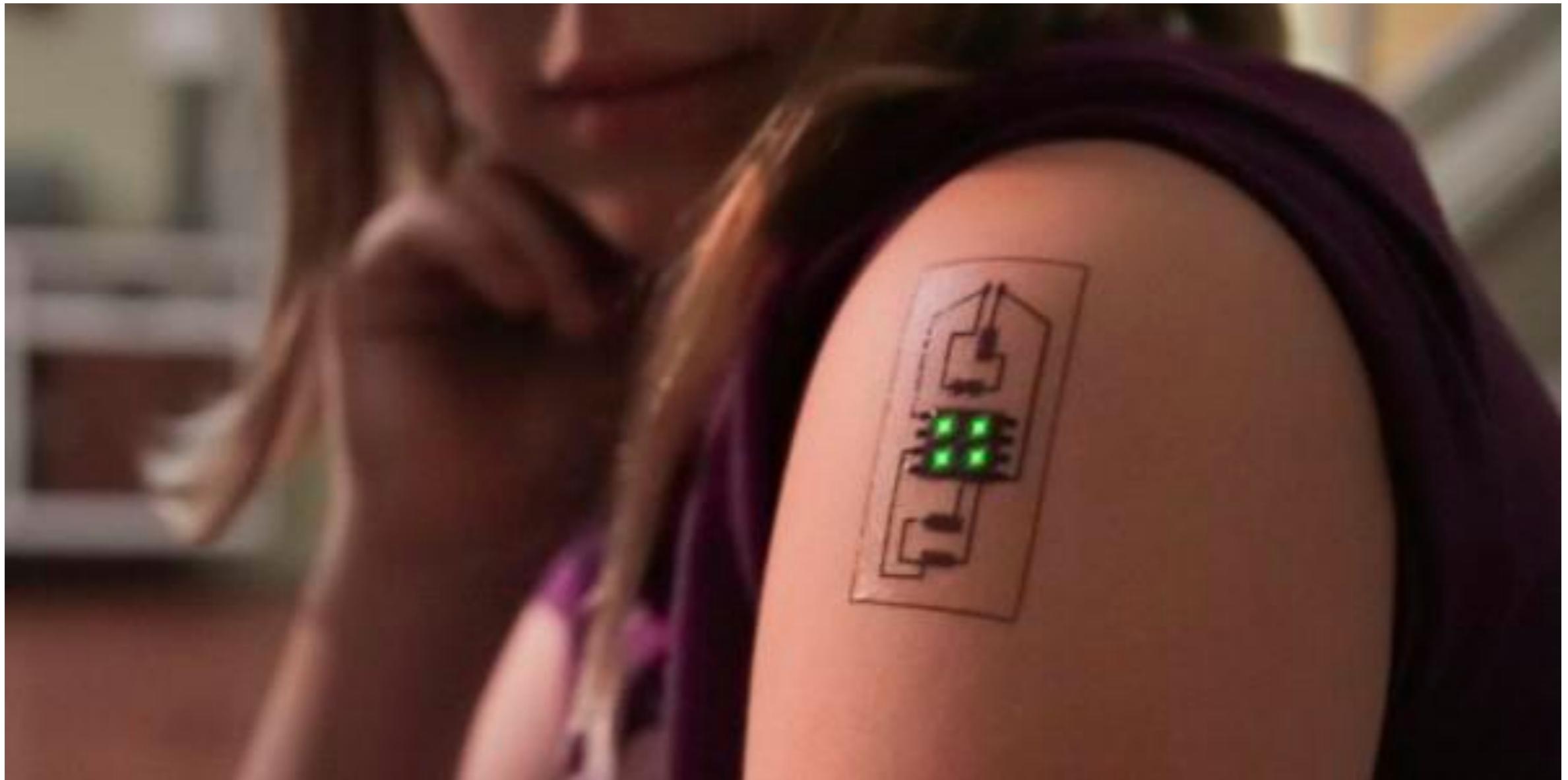


ACME



THING

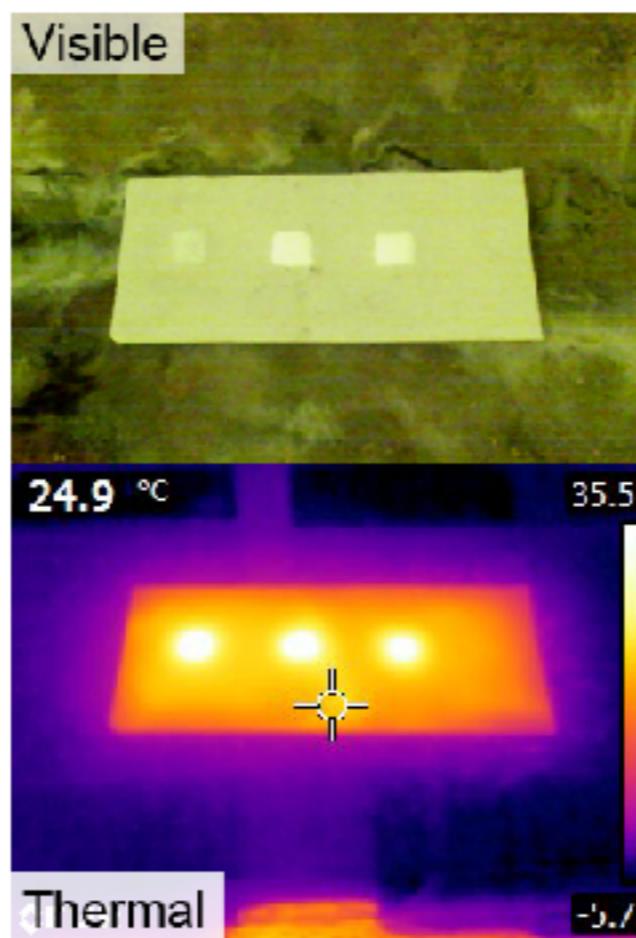
# Emergent Nanomaterials Lab



**inventing the future of materials**

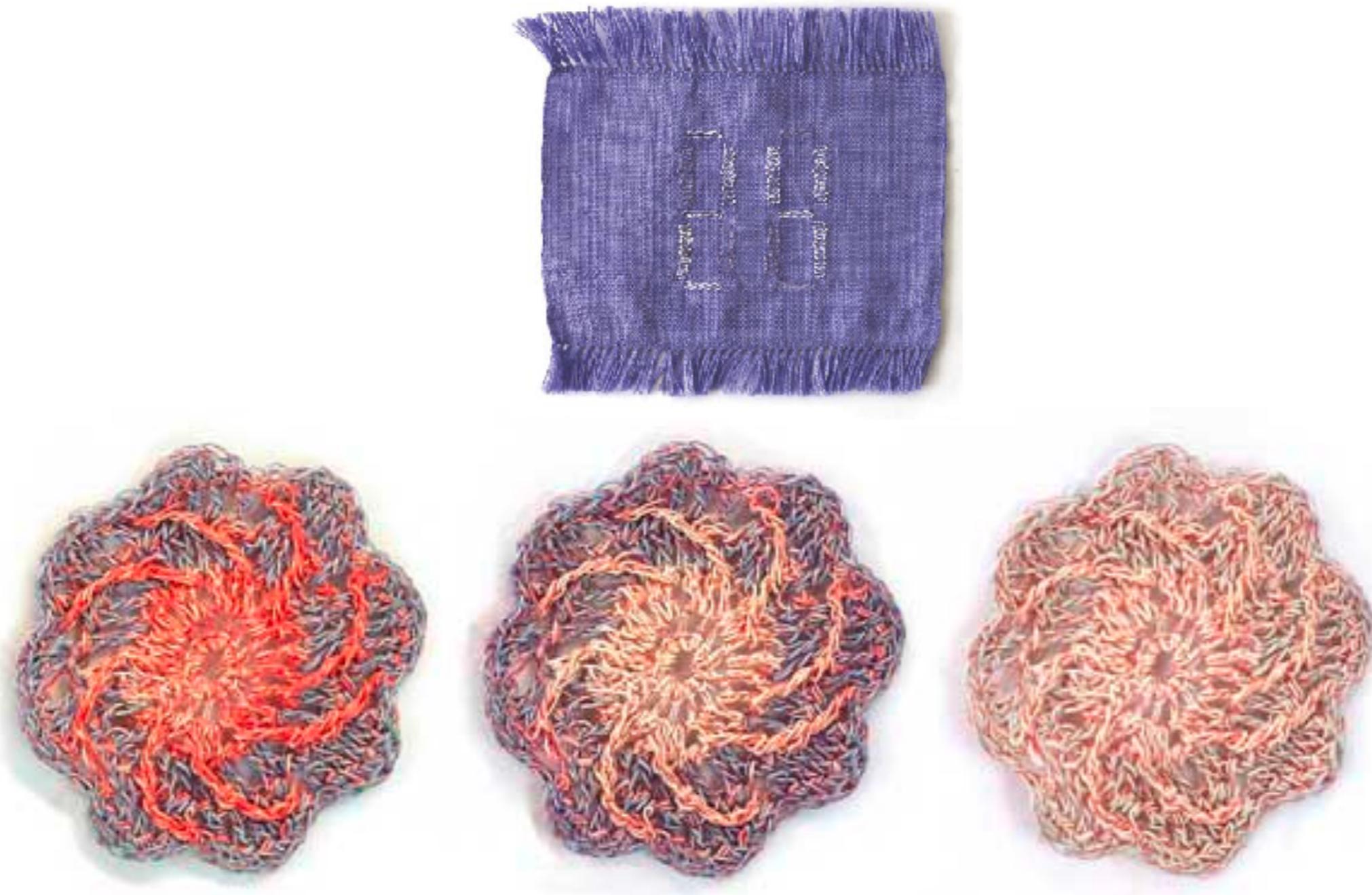


"solar powered" tattoo visible only under ultra-violet light



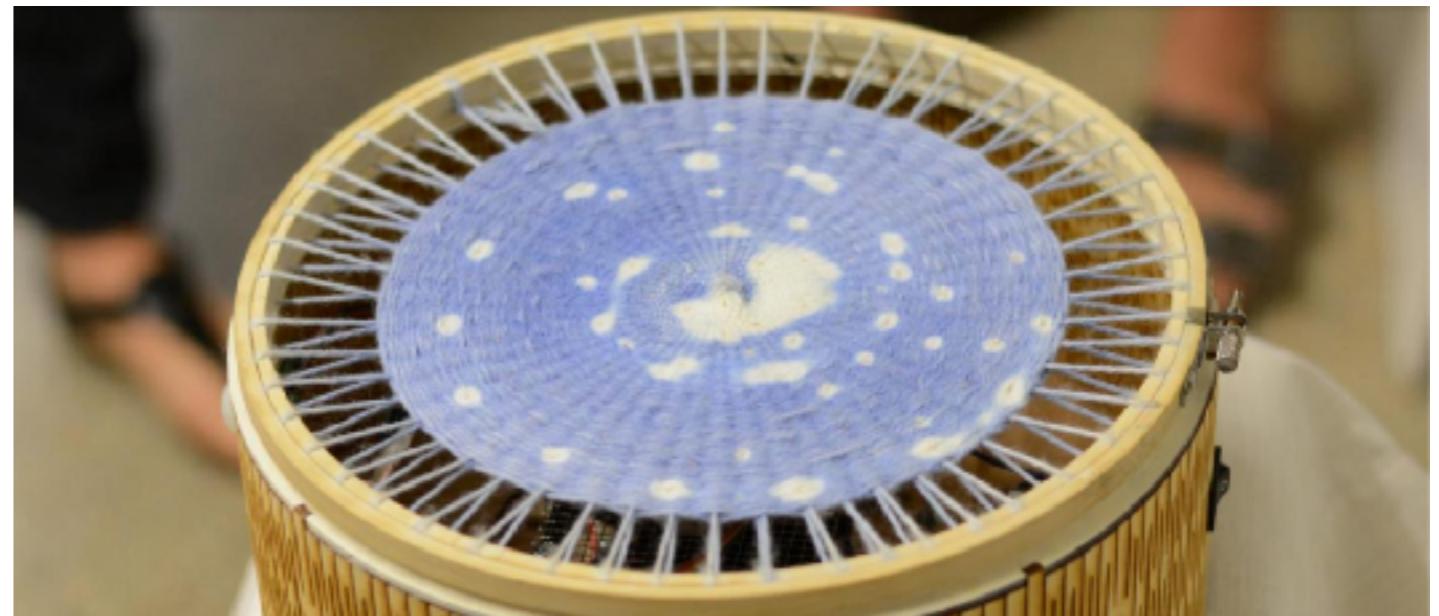
IR image of a "thermal storage" tattoo  
that stays warm in the cold

# Unstable Design Lab

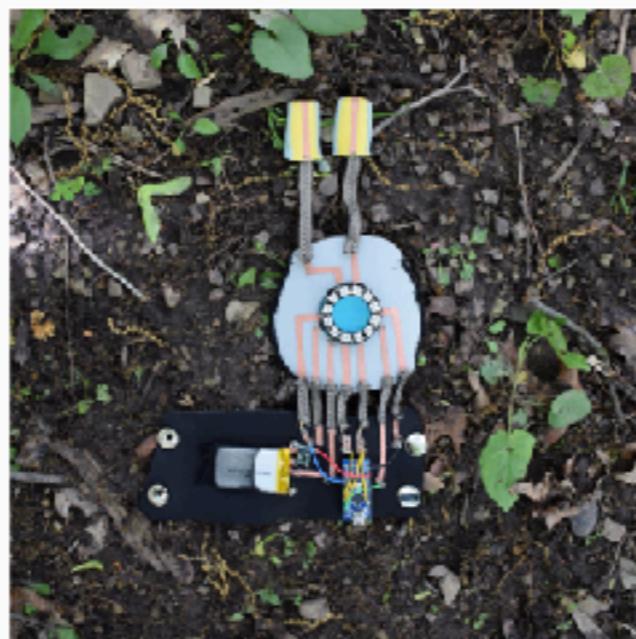


**inventing the future of textile fabrication**

# Field Computing



DATA HARVEST



HAND-SUBSTRATE INTERFACE



SPORE STEPPER

Smart Textile

# ACME Lab (A Creative Machine Environment)



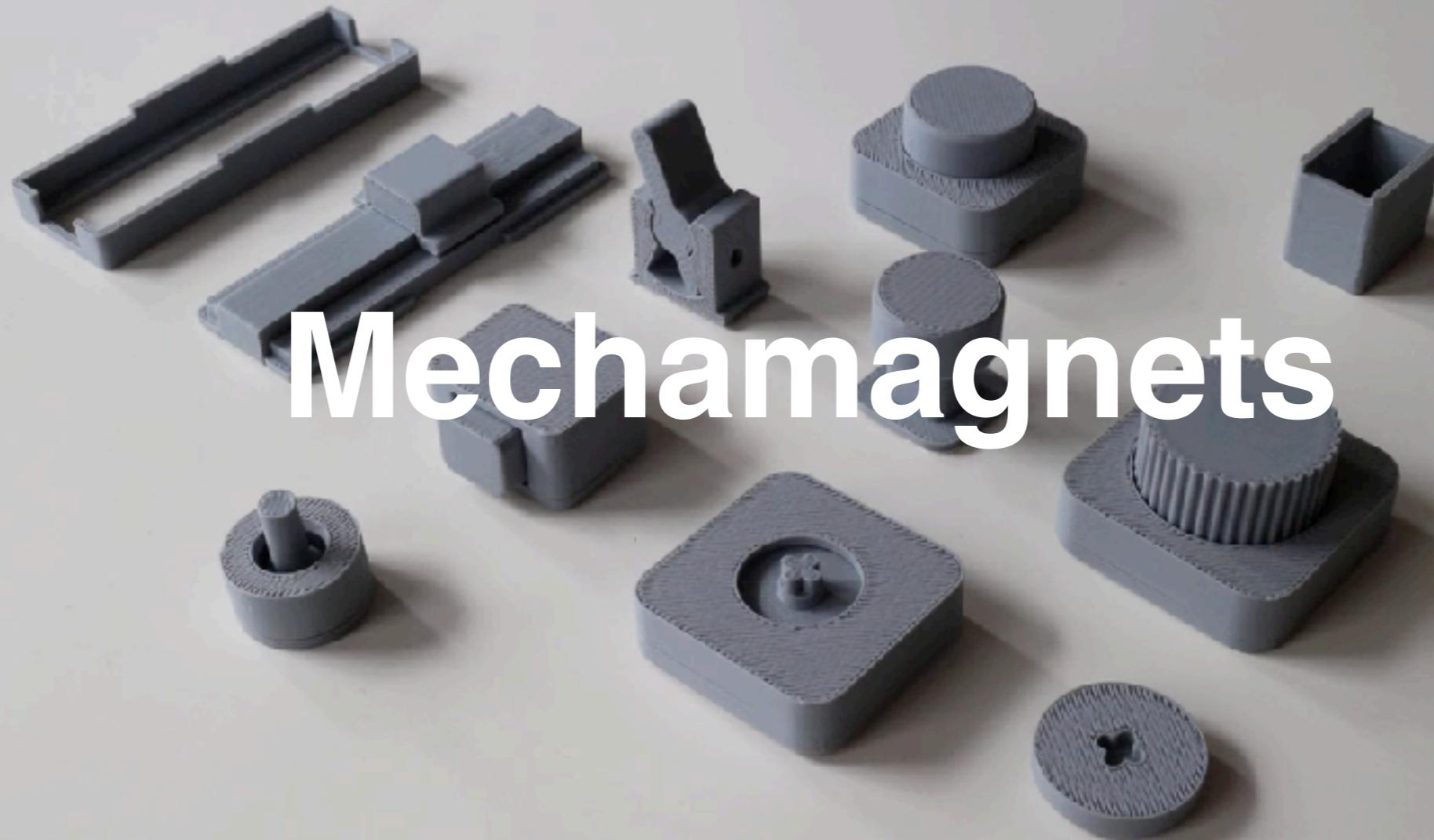
**inventing the future of tangible interaction**



the light orchard



# Mechamagnets



# Lab for Playful Computation



**inventing the future of children & computing**



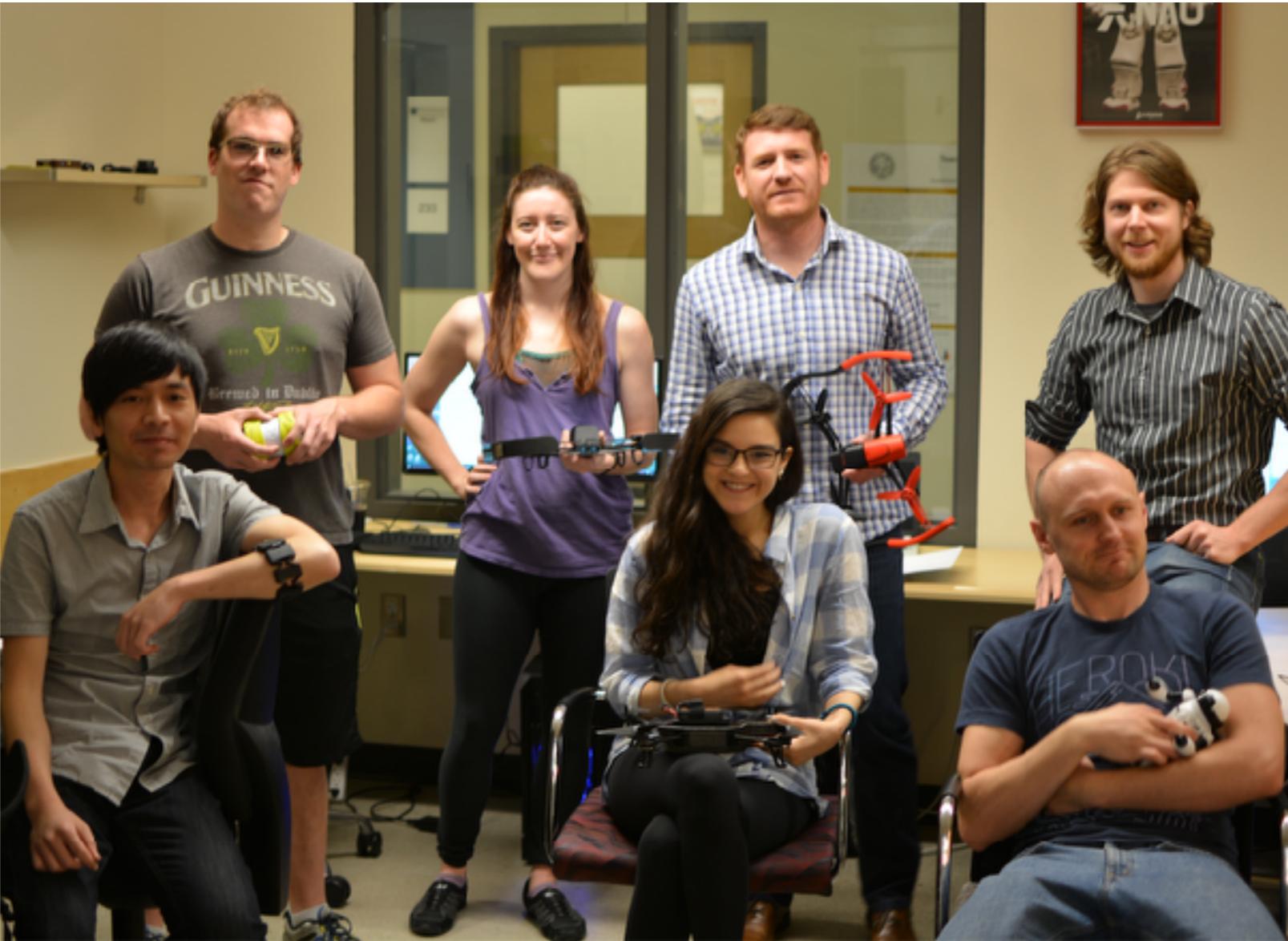
**Luminous Science:**  
learning biochemistry of a garden  
through art-making.





**ARCADIA**  
A RAPID PROTOTYPING PLATFORM  
FOR REAL-TIME TANGIBLE  
INTERFACES

# IRON (Interactive Robotics and Novel Technologies) Lab

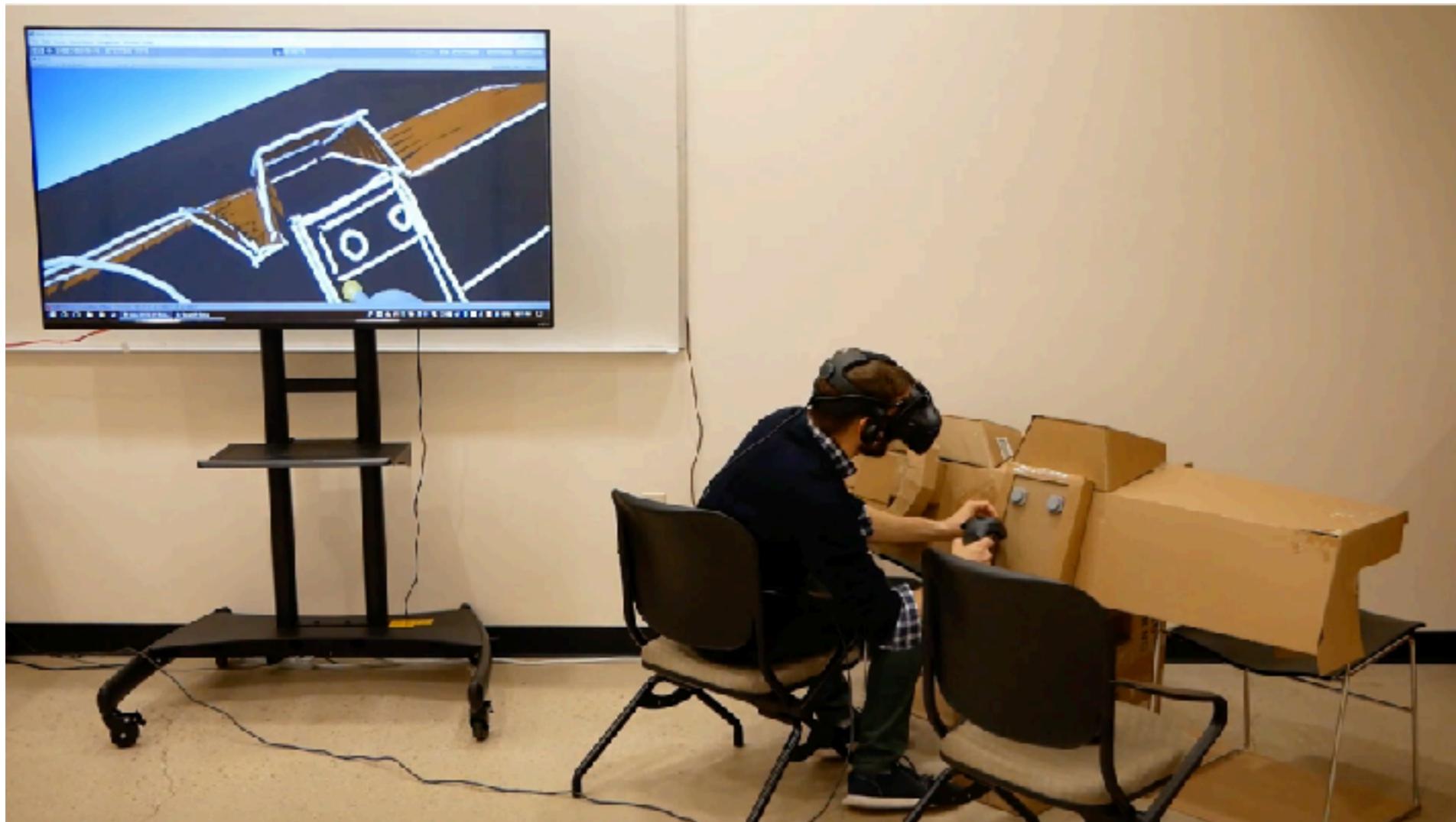


**inventing the future of work & play with robots**

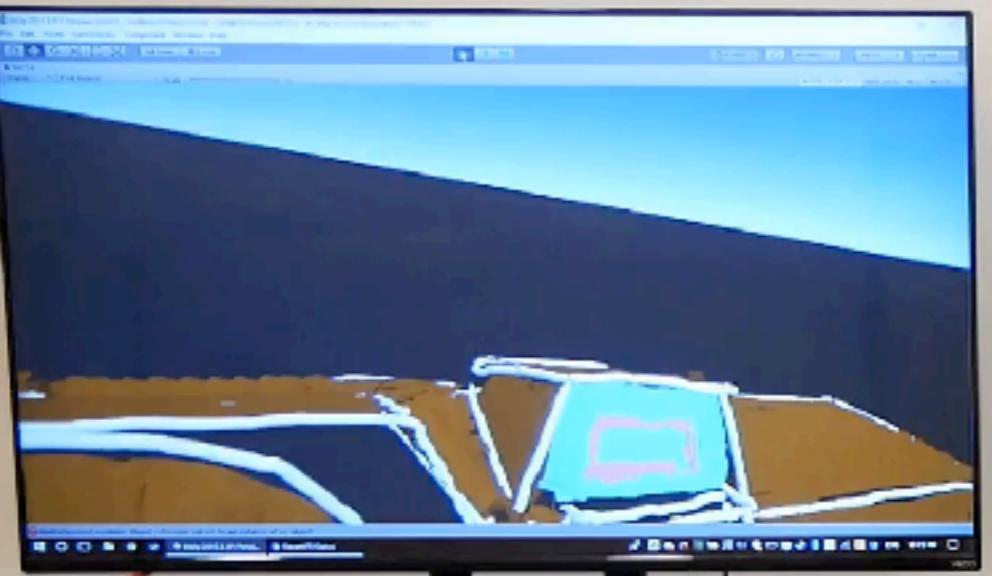
# Teleoperation with Augmented Reality



# **THING Lab (Transformative Human Interfaces for the Next Generation)**



**inventing the future of everyday interactions**



# Haptic Wizard of OZ Prototyping in VR



Create your own machine. Start with paper.  
Share your creative machines with others.

Try Your  
Machine Design

Learn How to  
Prototype

Explore What  
Others Made

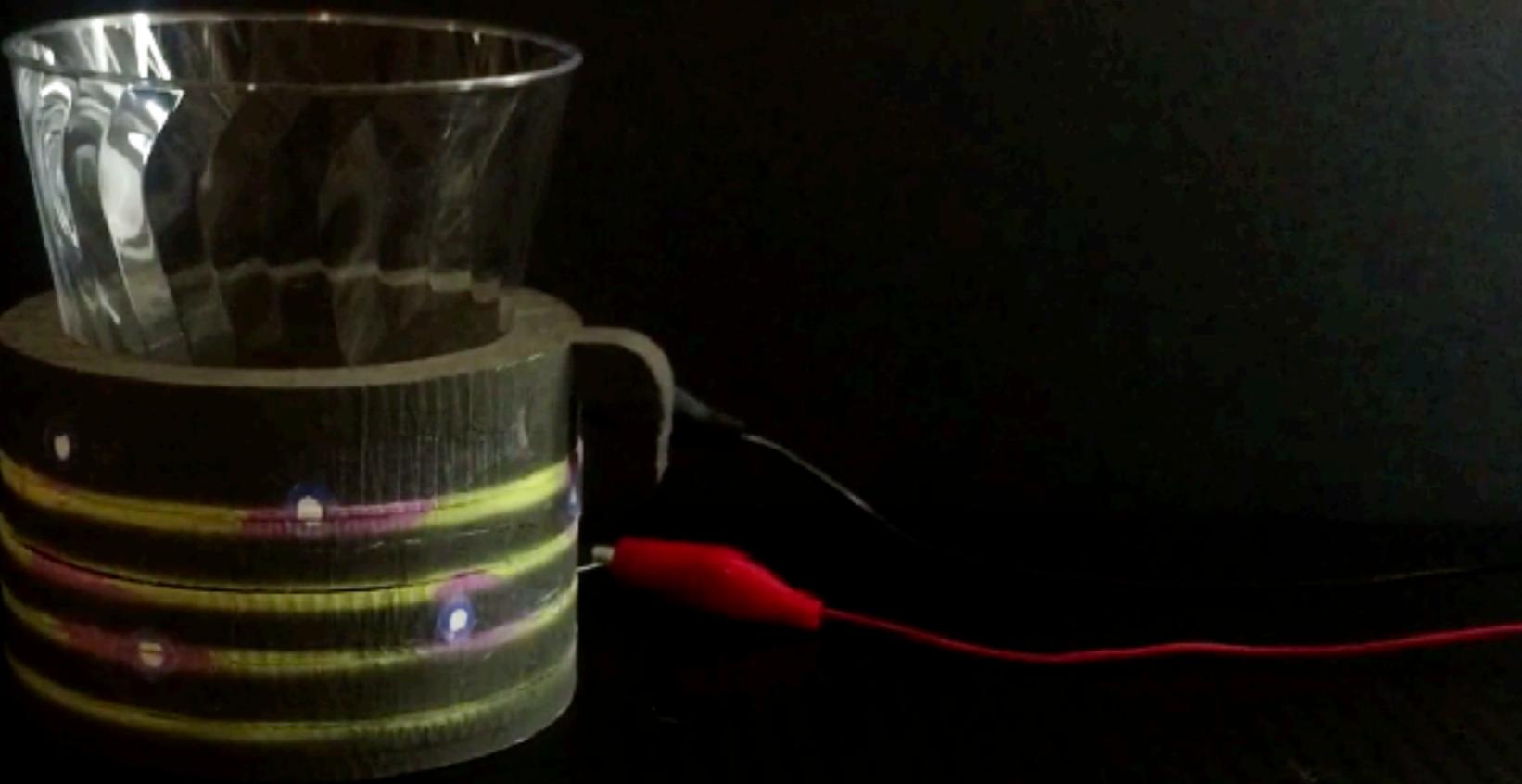
Read About  
Paper Mech



## Featured Tutorials

Learn More





# PEP (3D Printed Electronic Papercrafts)

## An Integrated Approach for 3D Sculpting Paper-Based Electronic Devices

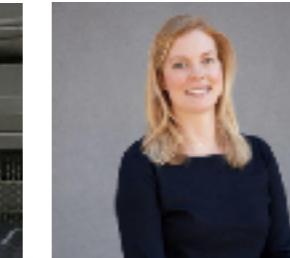
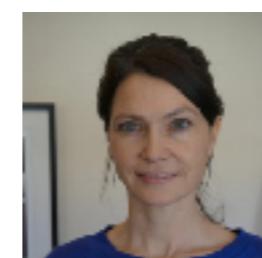
Hyunjoo Oh<sup>1</sup> Tung D. Ta<sup>2</sup> Ryo Suzuki<sup>1</sup> Mark D. Gross<sup>1</sup> Yoshihiro Kawahara<sup>2</sup> Lining Yao<sup>3</sup>

<sup>1</sup>University of Colorado Boulder    <sup>2</sup>University of Tokyo    <sup>3</sup>Carnegie Mellon University

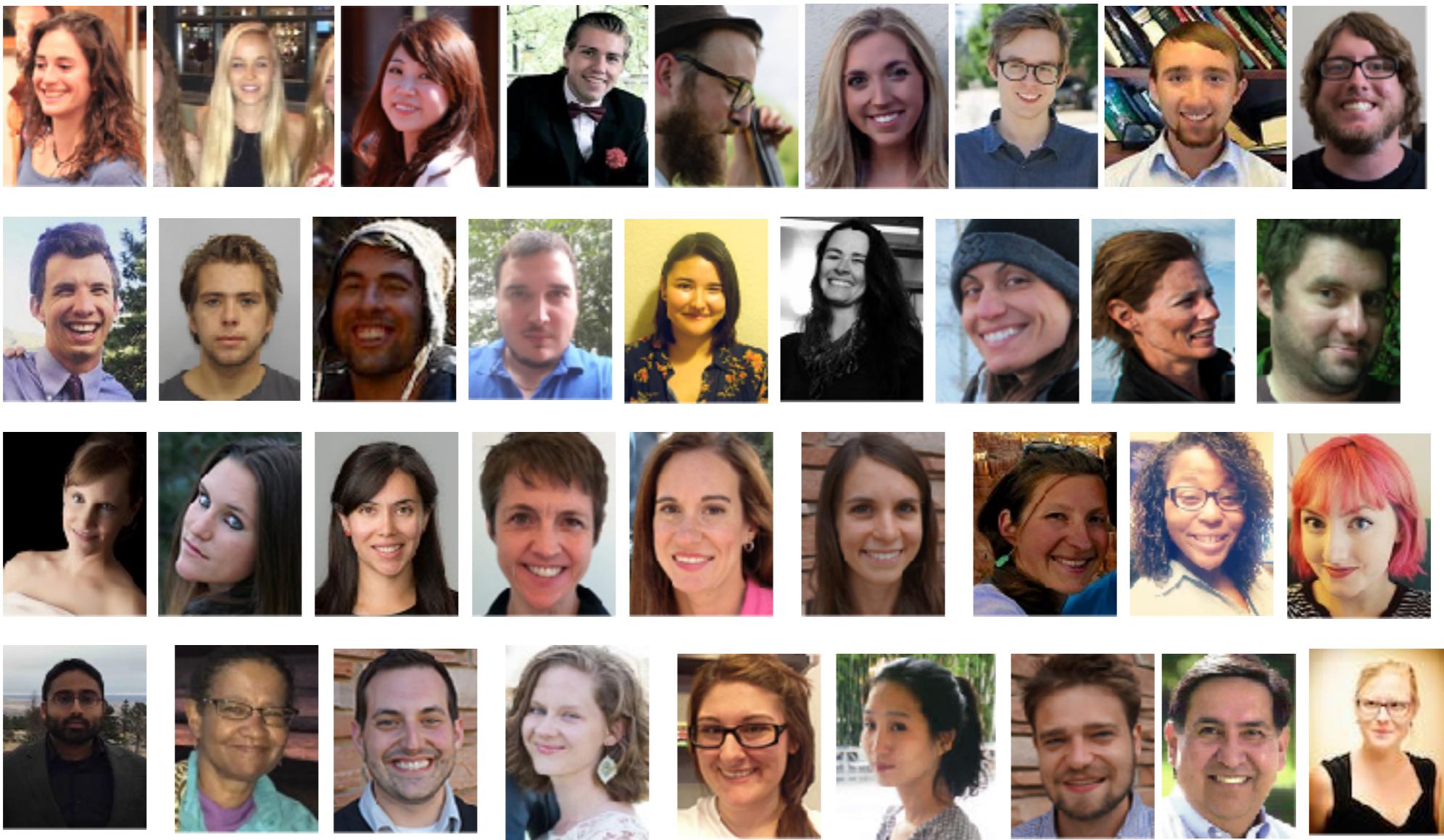
<https://dl.acm.org/citation.cfm?id=3174015>

**people – technology – design**

# ATLAS FACULTY



# ATLAS GRADUATE STUDENTS



# RESEARCH PARTNERS (2017-18)





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an  
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creativity and  
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**ATLAS**  
INSTITUTE



University of Colorado **Boulder**



University of Colorado **Boulder**

**atlas.colorado.edu**

杜宜倫

**Ellen Yi-Luen Do**

Director of Partnerships & Innovation

**[ellen.do@colorado.edu](mailto:ellen.do@colorado.edu)**

