

# Tangible Interaction

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# Objectives

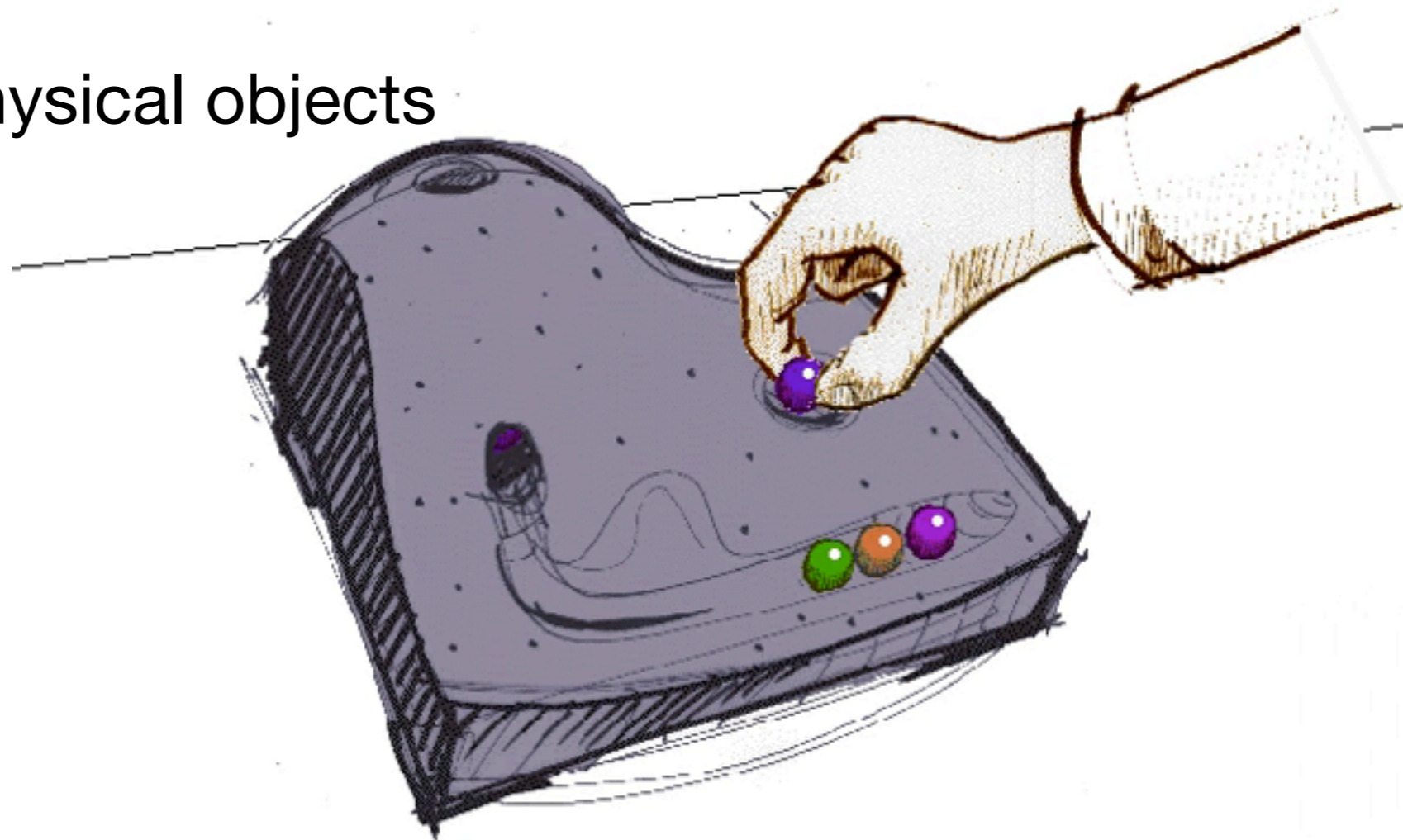
Answering basic questions, i.e.:

- What are TUI?
- What is their story?
- What are they good for?
- What are their limitations?
- What is their future?
- How to make them?

# **Tangible User Interfaces: What are they?**

# Tangible User Interfaces: What are they?

Interfaces involving physical objects  
that can be grasped



Example:  
Durrell Bishop's  
Answering Machine

# Tangible User Interfaces: What are they?



## Graphical User Interfaces

interfaces usually limited  
to standard screen+keyboard+mouse

# Tangible User Interfaces: What are they?



## Virtual Reality Interfaces

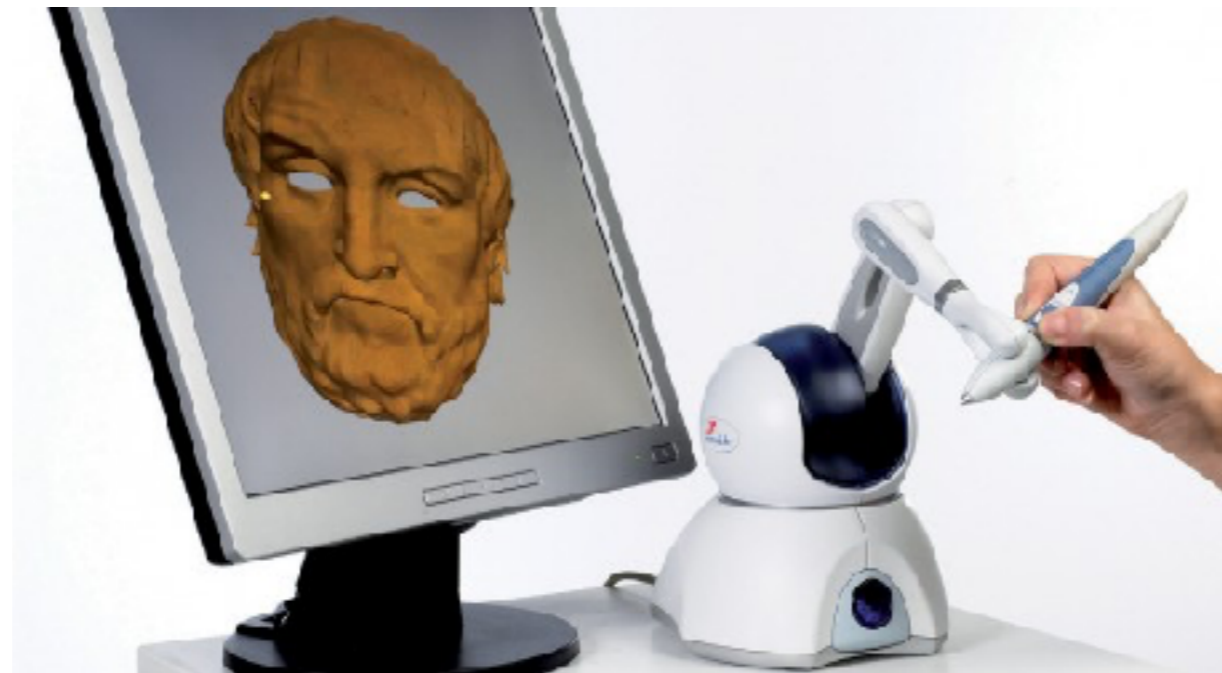
interfaces to immerse the user in a digitally generated world

# Tangible User Interfaces: What are they?



**Augmented Reality (AR) and Augmented Virtuality (AV)**  
Tangible Interfaces belong to AR+AV

# Tangible User Interfaces: What are they?



## Haptic Interaction

Tangible Interfaces belong to Haptic:  
Both involve touch and manipulation,  
but haptic usually not passive



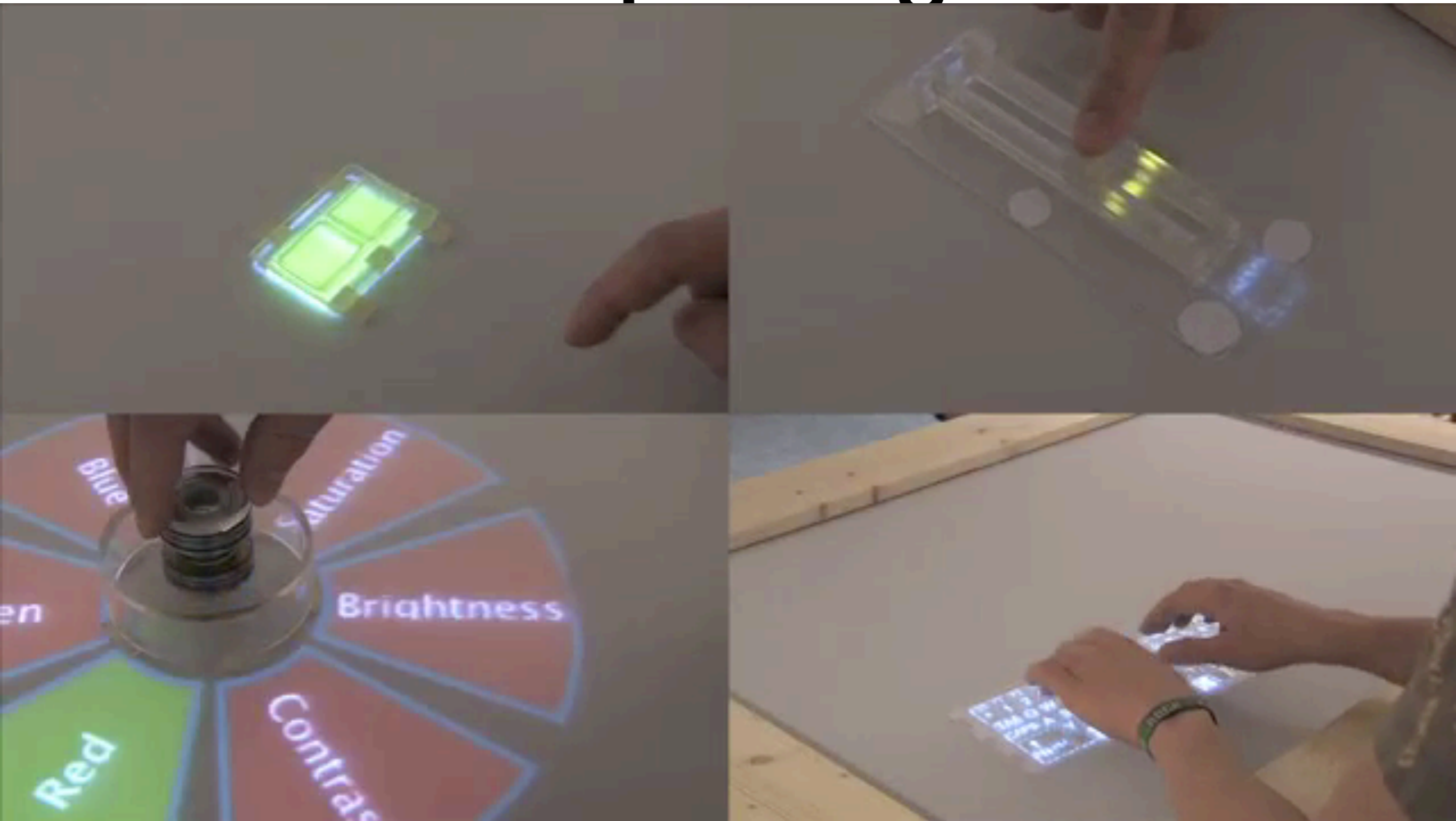
# Tangible User Interfaces: What are they?



## Internet of Things

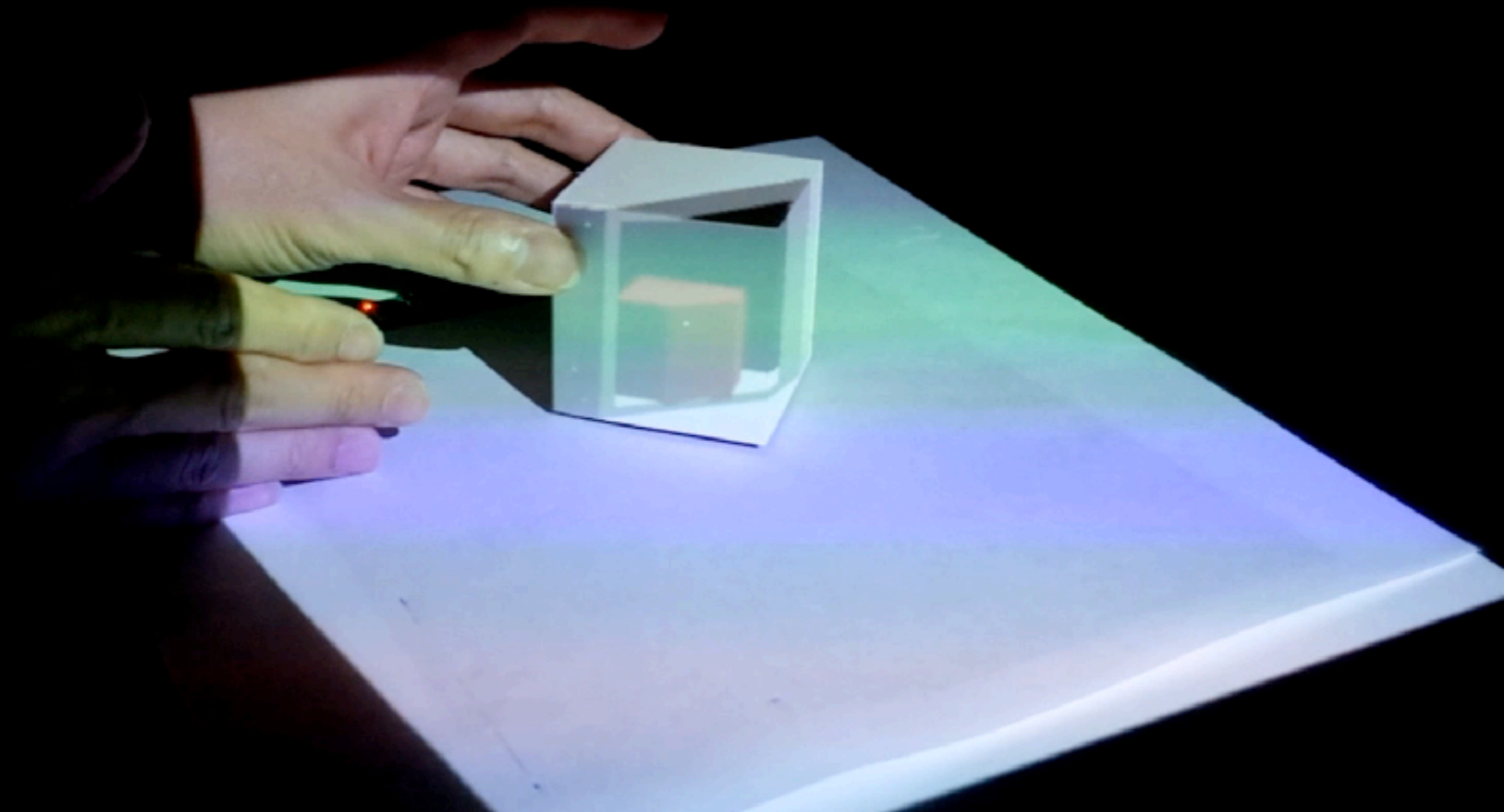
TUI not necessarily connected to Internet  
If so, can be through a computer

# Spread: GUI paradigm



# Spread: Augmented Reality paradigm

Section Cut to See Inside

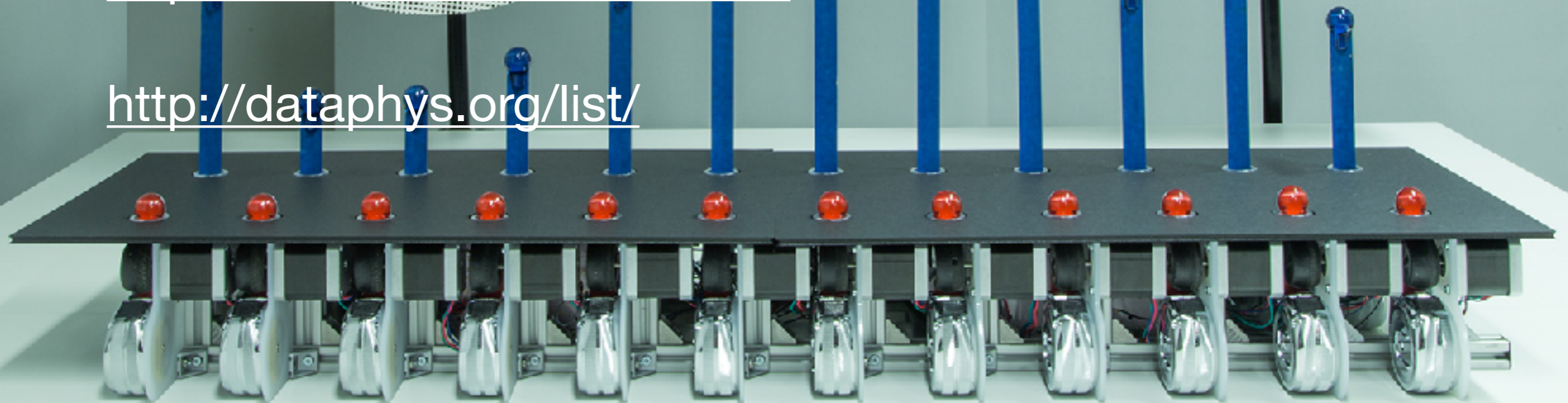


# Spread: visualisation tasks

<https://vimeo.com/106053696>

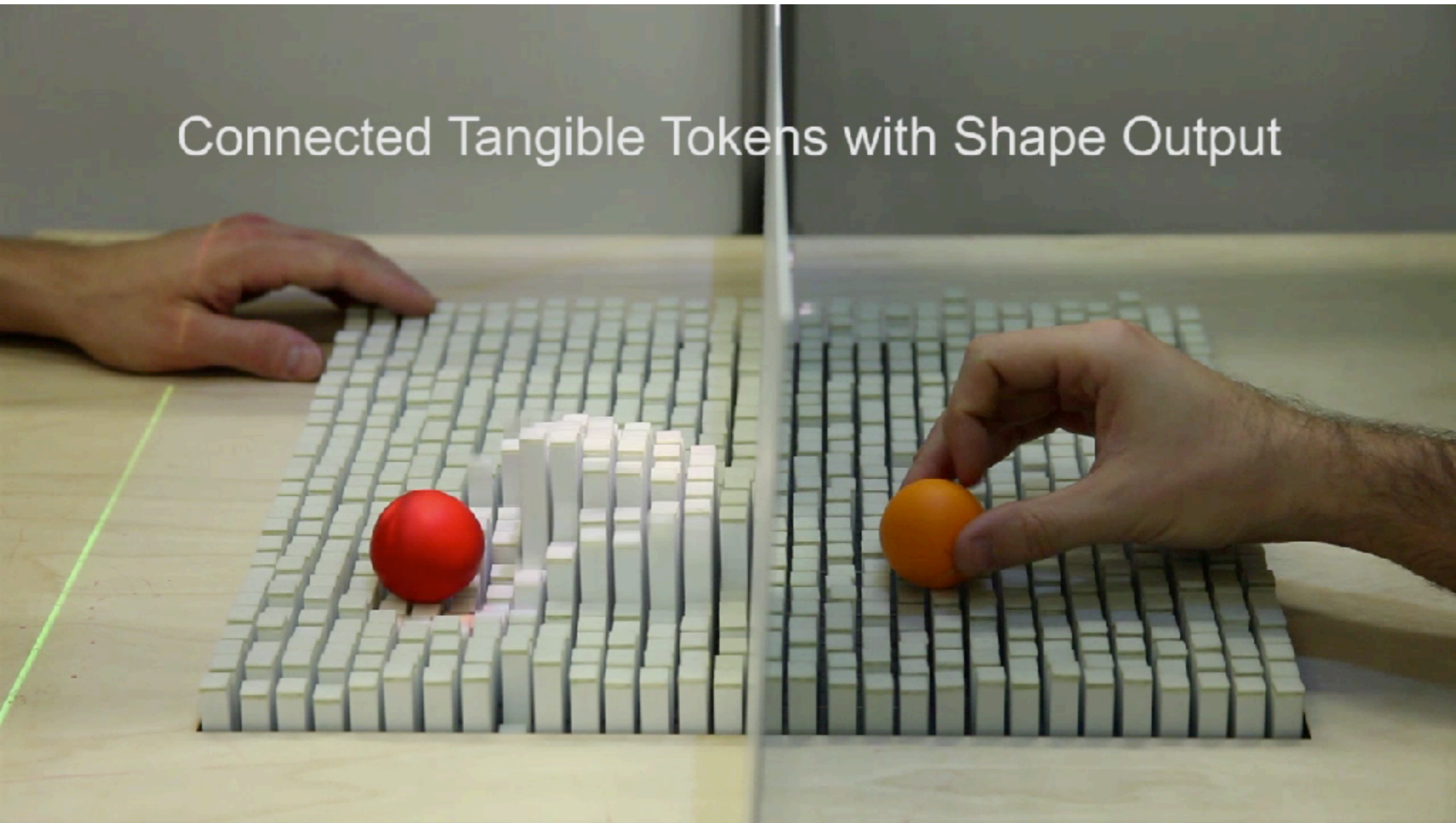
<https://vimeo.com/106053695>

<http://dataphys.org/list/>



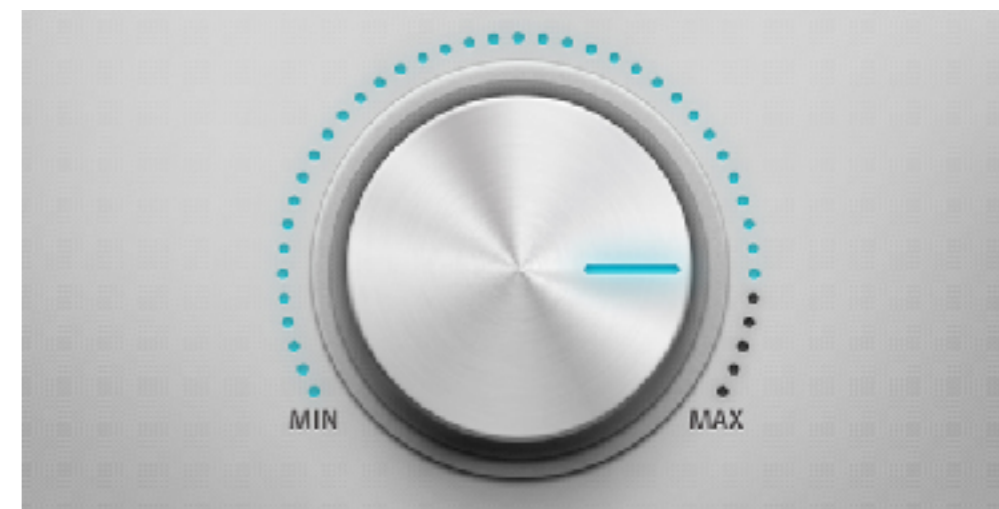
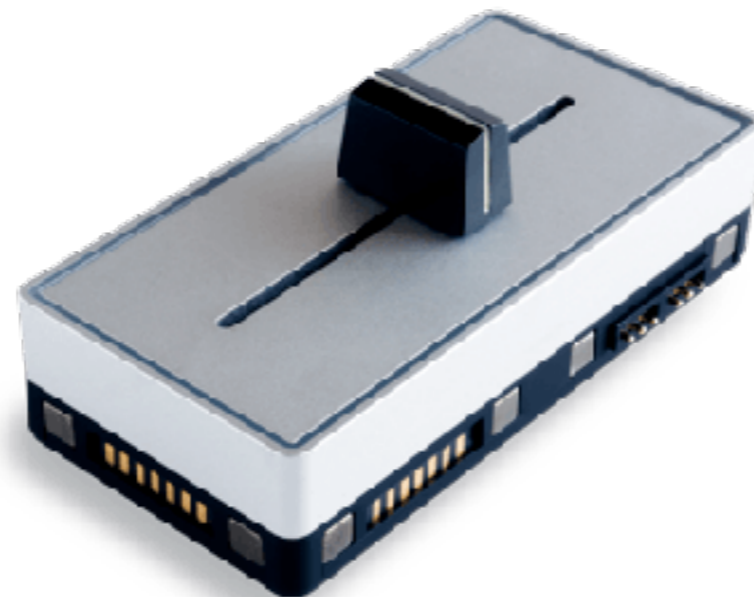
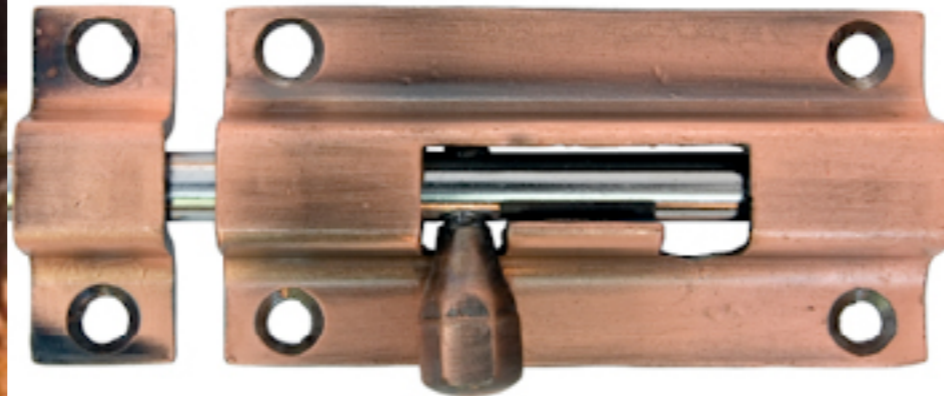
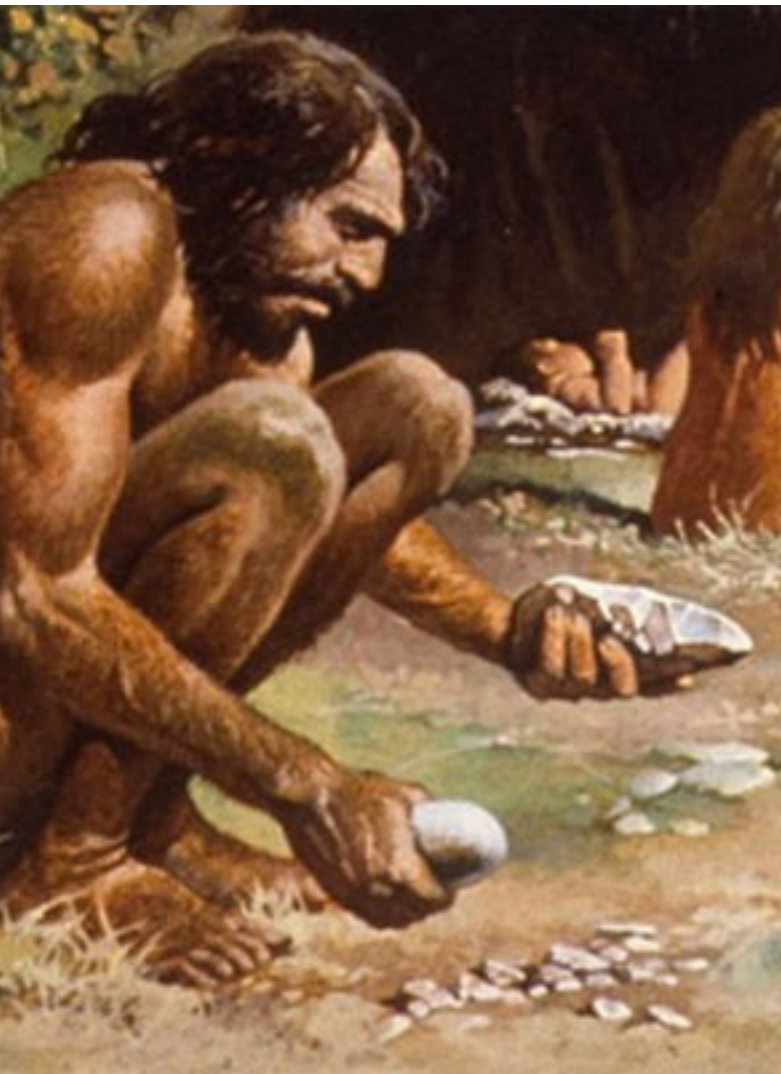
# Spread: Remote collaboration tasks

Connected Tangible Tokens with Shape Output



**What is their story?**

# Manipulation of tangible tools has always been here...

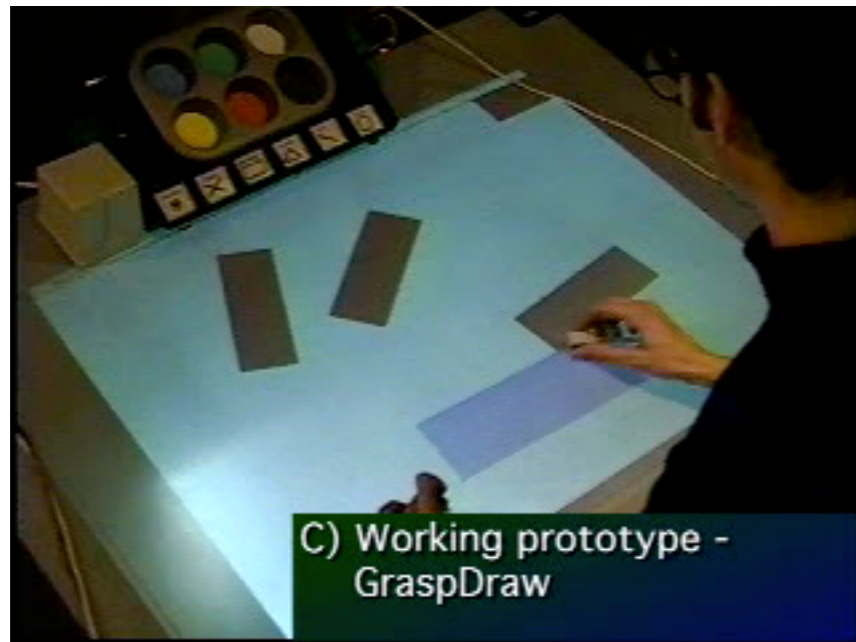


**... and is still here**





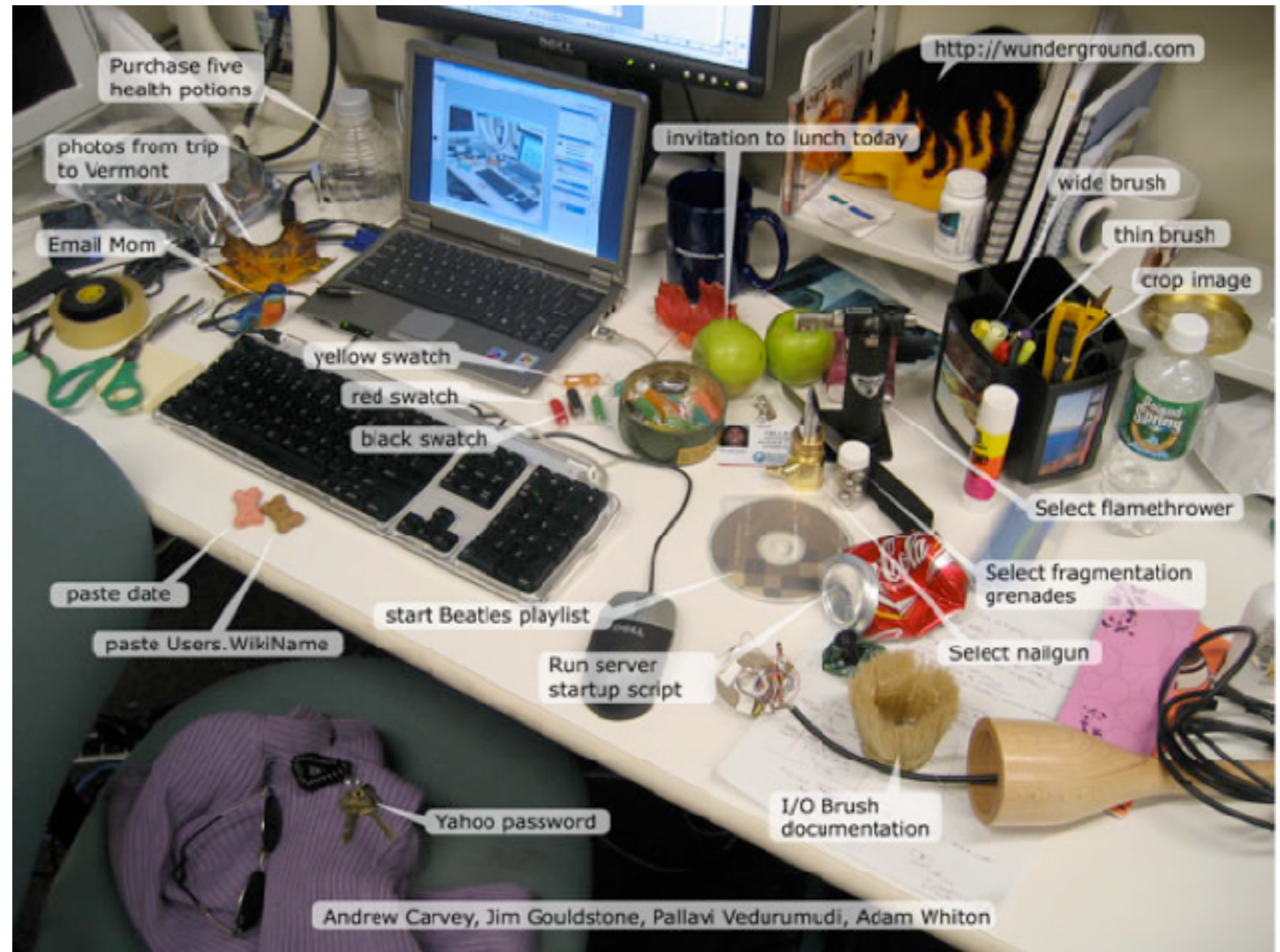
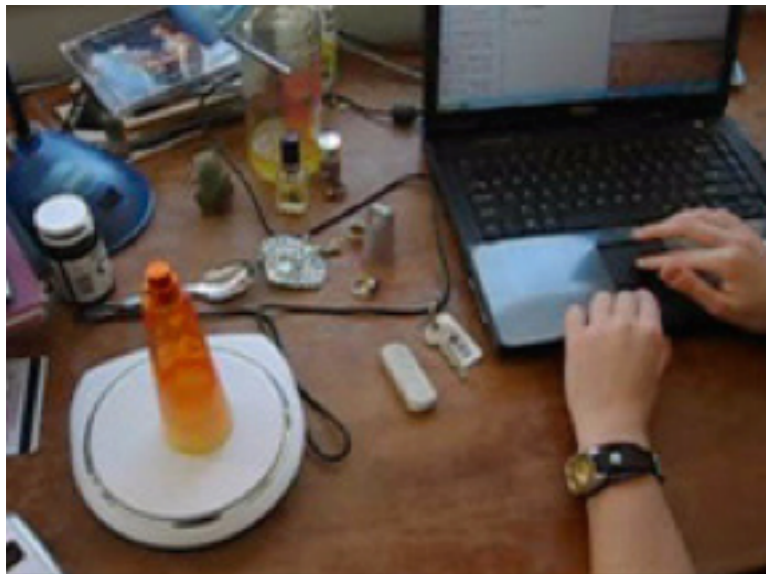
# Seminal papers



# Early works on Tangible User Interfaces

- DataTiles: Tangible overlay mixing Tangible and Graphical Interaction  
<https://www.youtube.com/watch?v=cmD8EKWxD4M>
- Containers: mediaBlocks  
<http://vimeo.com/48827402>
- metaDesk  
<http://vimeo.com/44545109>
- 3D animation with tangible sliders (1996)  
<https://www.youtube.com/watch?v=SnDHjY5aD5c>

# Example of Tangible User Interfaces



<http://dl.acm.org/citation.cfm?doid=1125451.1125582>

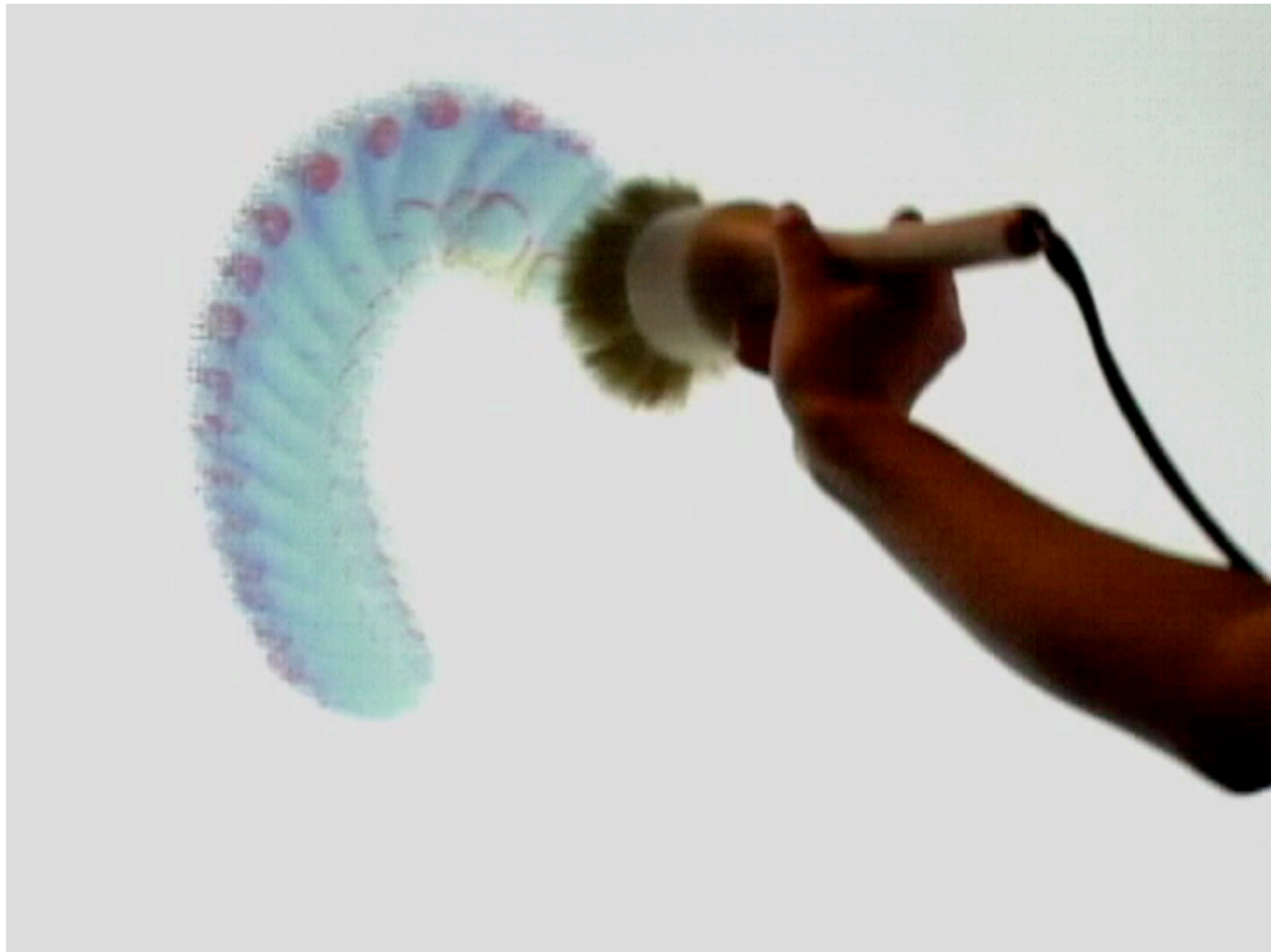
# Example of Tangible User Interfaces



<https://www.youtube.com/watch?v=0h-RhyopUmc>

<https://www.youtube.com/watch?v=MPG-LYoW27E>

# Example of Tangible User Interfaces



**I/O Brush**

# **Tangible User Interfaces**

## **What are they good for?**

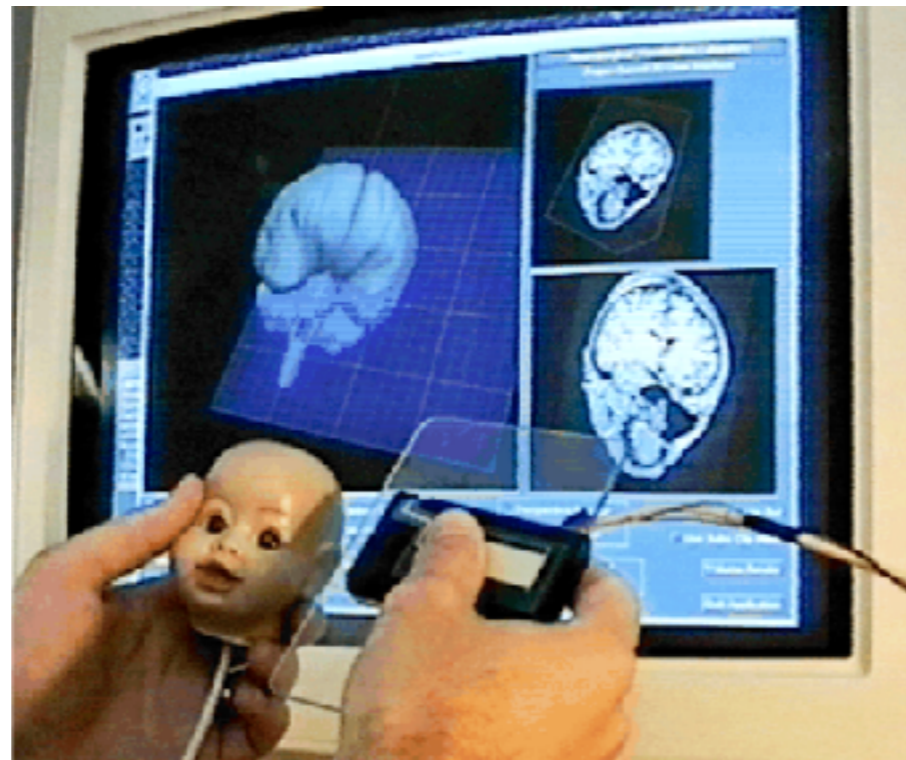
# Tangible User Interfaces

## What are they good for?

- **Interaction embodied  
in the physical world of the user:**  
Physical User & Physical Interface
- **Performance:**  
Passive haptic feedback

# Embodied interaction

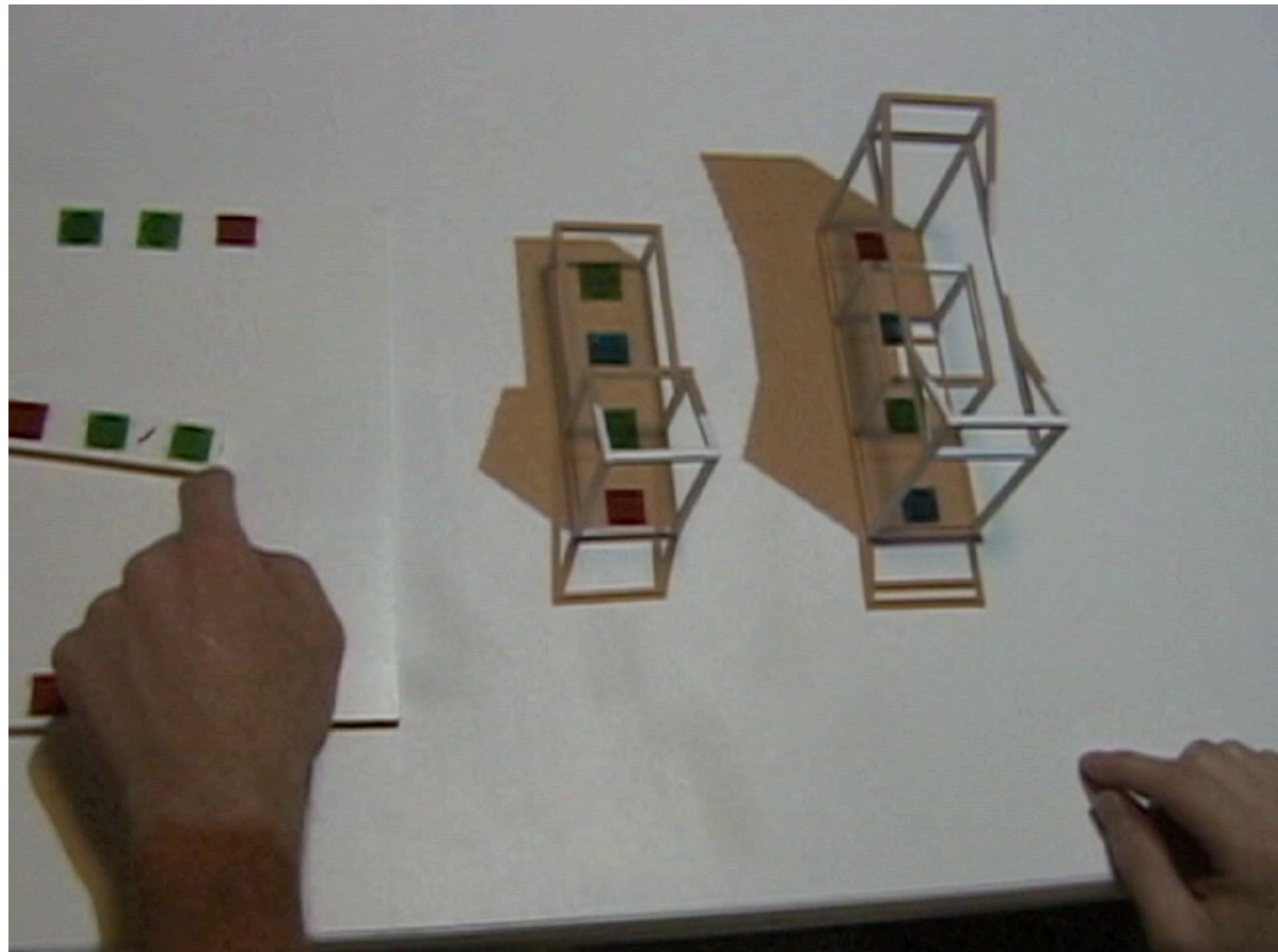
Object (prop) to interact at a distance with GUI





# Embodied interaction

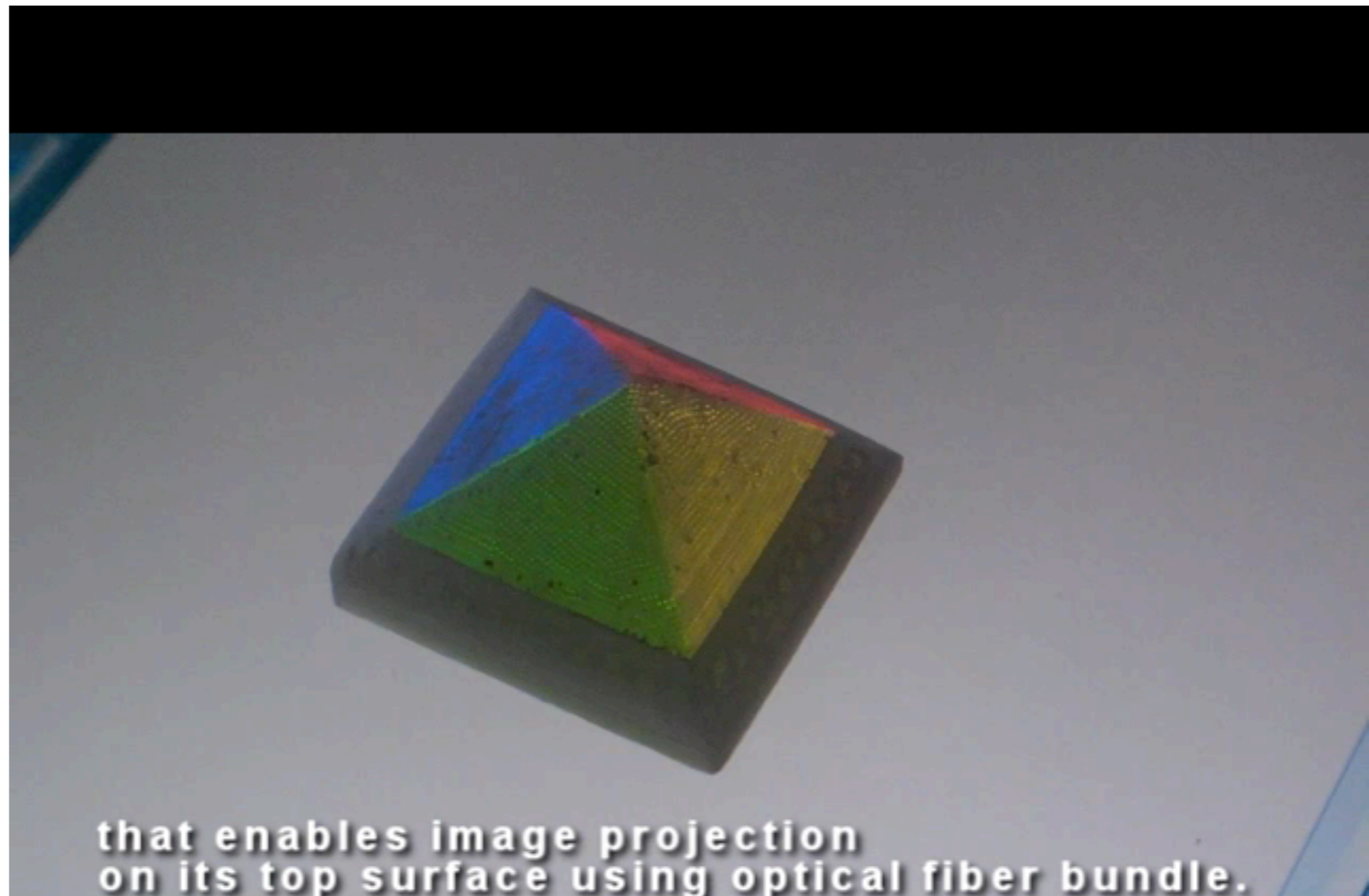
Tangible and overlaid projection



Example: URP

# Embodied interaction

Rear-projection and optical fibers

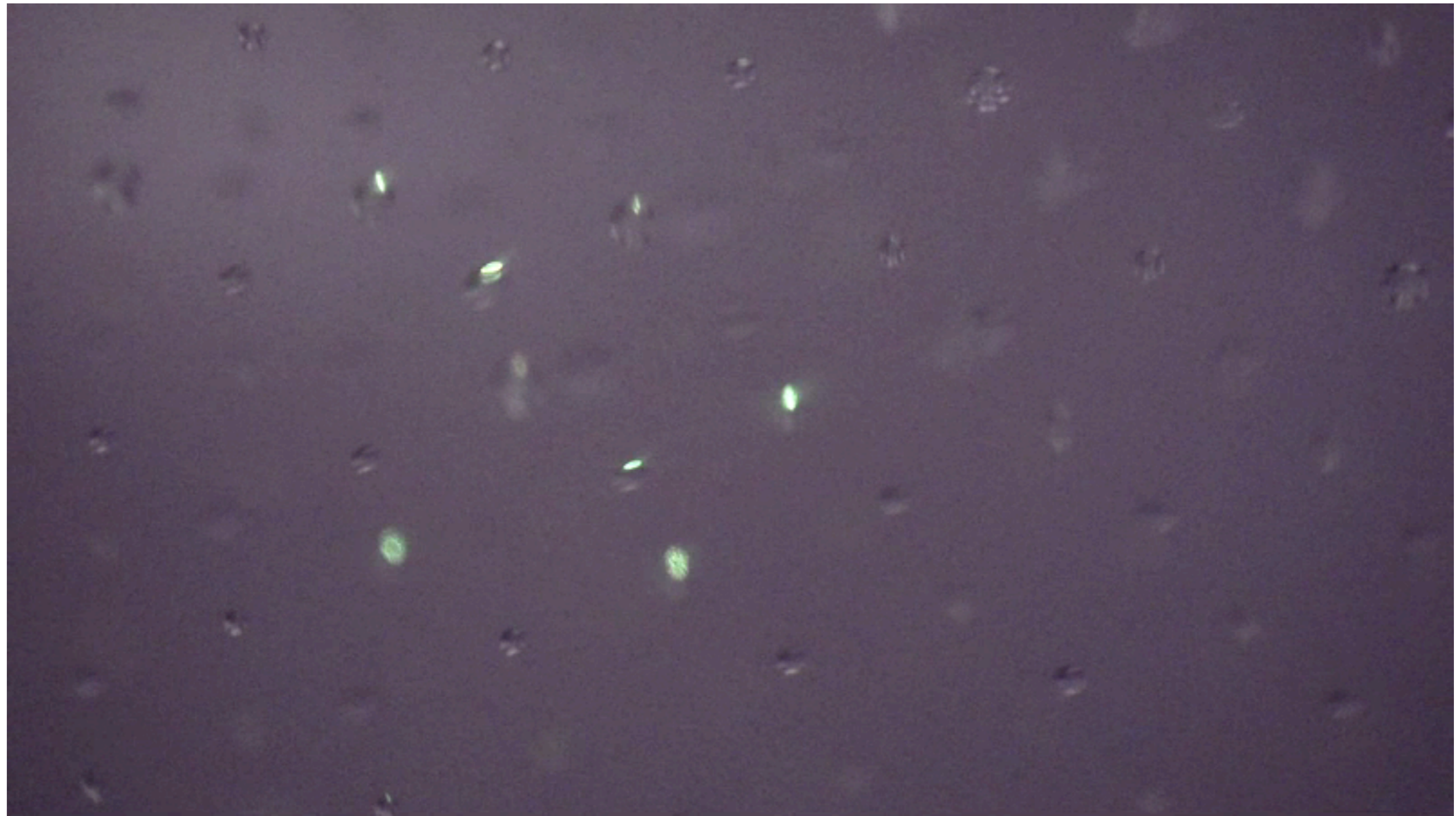


that enables image projection  
on its top surface using optical fiber bundle.

**Example: Ficon**

# Embodied interaction

## Printed Optics



# Fishkin's metaphors

**Analogy** between  
the **system** effect of a user action  
to the **real-world** effect of similar actions

# No metaphor

No analogy between action and result

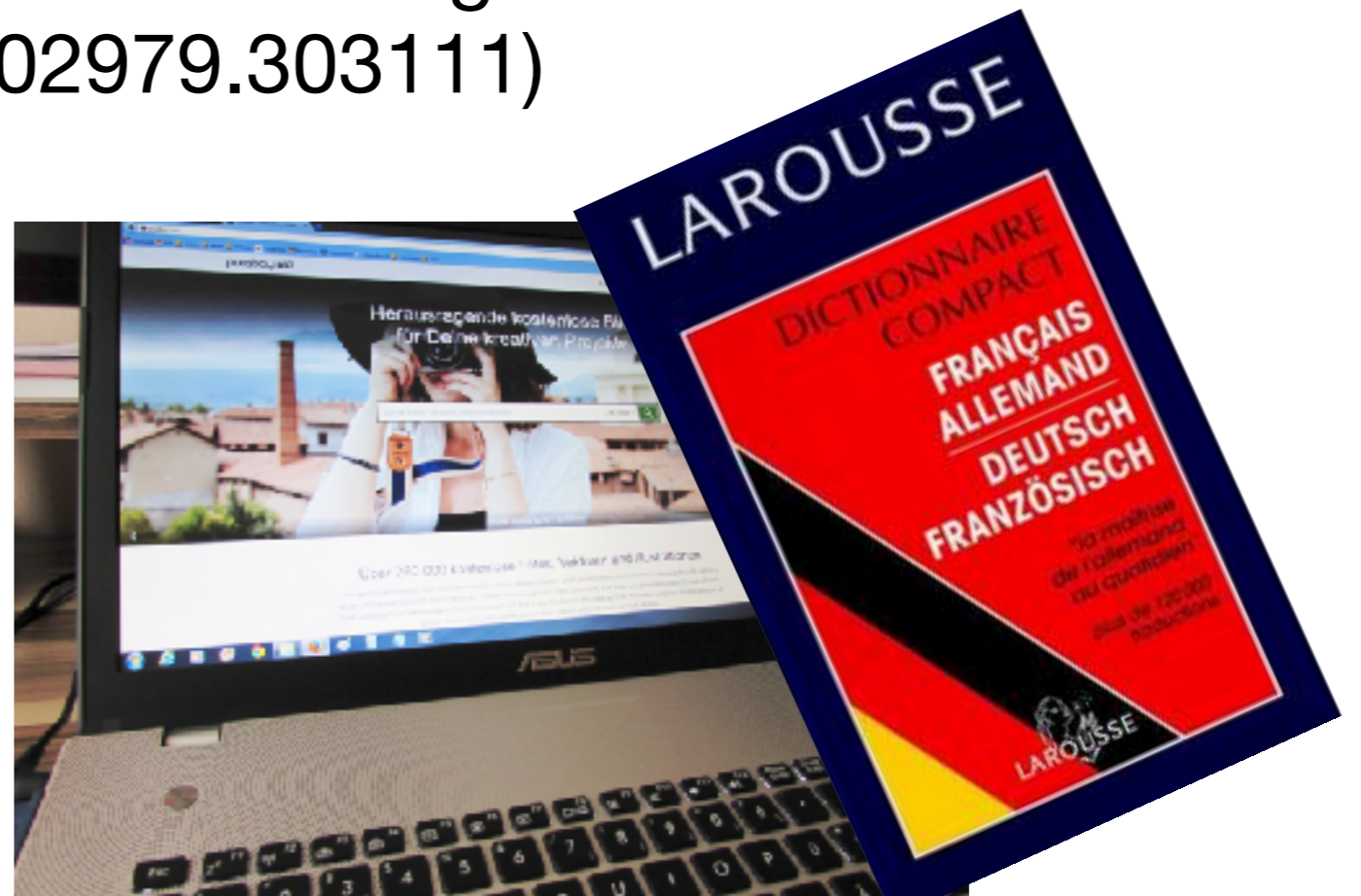
E.g., command-line UI, clock in URP

# Noun

Shape-related

“an <X> in the system is like  
an <X> in the real world”

E.g., dictionary (<http://dl.acm.org/citation.cfm?doid=302979.303111>)



# Verb

Motion-related

“<X>-ing in our system is like  
<X>-ing in the real world”

E.g., NAVRNA



# Noun & Verb

“<X>-ing an <A> in our system is like  
<X>-ing something <A>-ish in the real world”

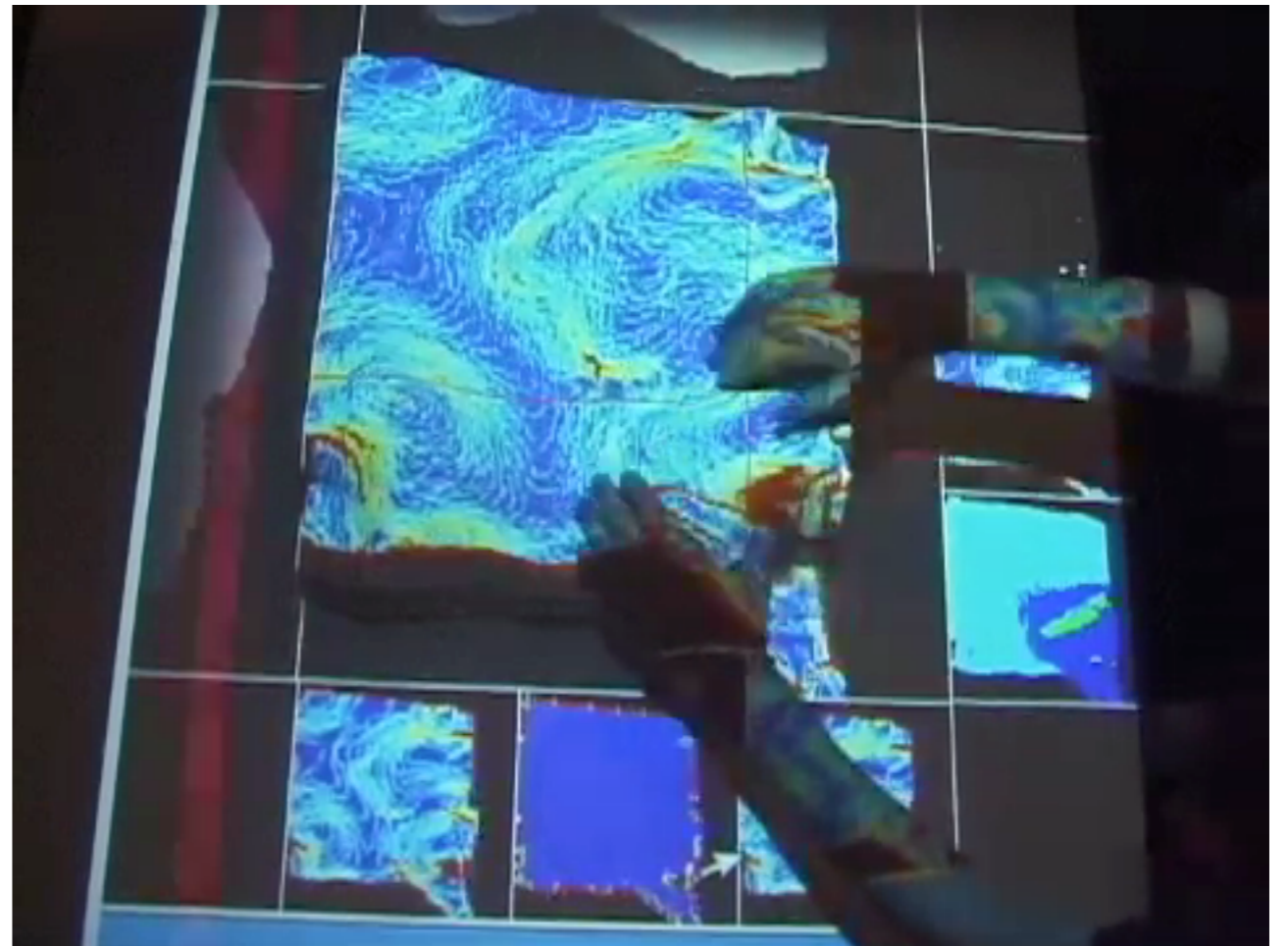
E.g., eraser in Digital Desk, building in URP



# Full

In user's mind, there is no system

E.g., Illuminating Clay



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