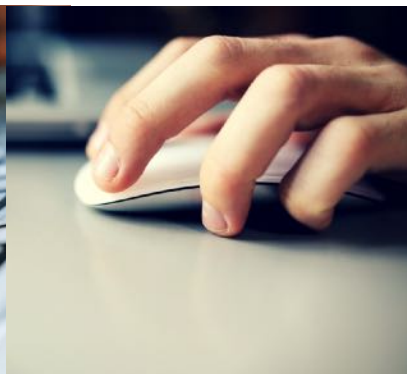




# Interaction styles

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[mb1@lisn.fr](mailto:mb1@lisn.fr)



# What is an interaction style?

The interaction loop:

Human: perceive/think/act

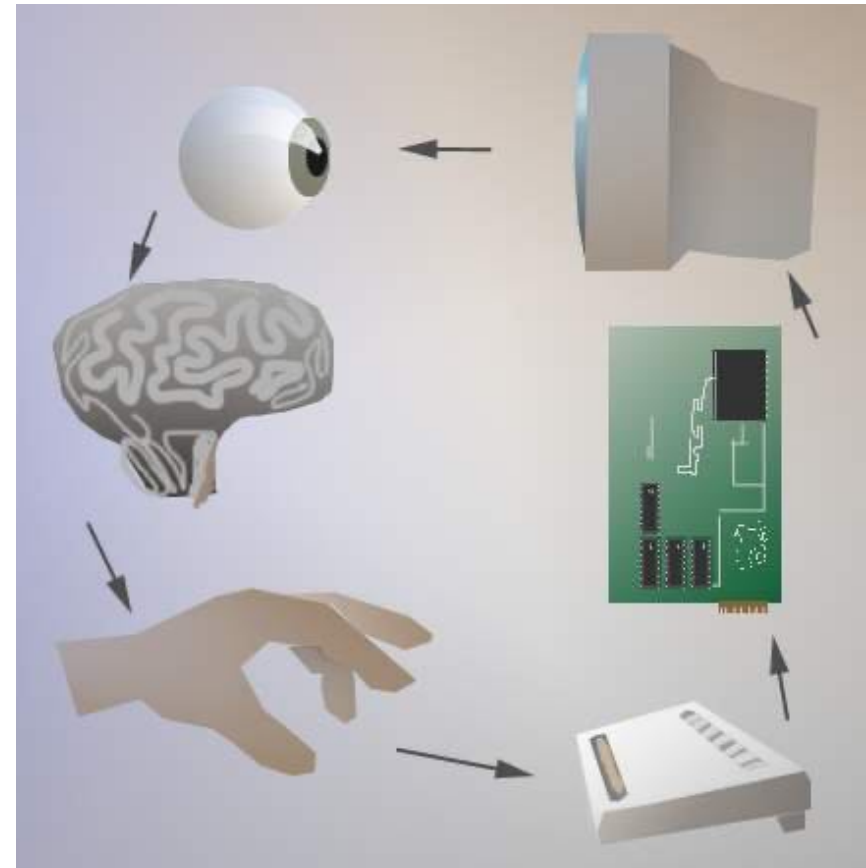
Computer: input/compute/output

Interaction style:

What input is captured?

How is output presented?

What are the internal objects  
referenced by input  
and presented in the output?



# Interaction style: Conversational interaction

## Command line interface

Input: Command language

Output: Text

Objects are referenced by name

## Example

```
grep -i HCI class.txt | sort | uniq
```

## Advantages

Powerful (create new commands)

Fast for experts

## Drawbacks

Hard to learn

Dialog imposed by the system



Teletype model 33  
(Computer Museum)

# Conversational interaction

## Renewed interest with natural language interfaces



How are you today, ChatGPT?



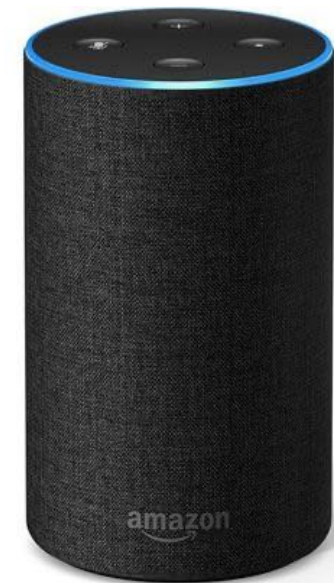
As a language model trained by OpenAI, I don't have the ability to experience emotions like a human would. I am designed to assist with providing information and answering questions to the best of my ability. Is there something specific you would like to know?



What is the Capital of the Klingon homeworld, Qo'noS?



In the fictional Star Trek universe, the Klingon homeworld is called Qo'noS and its capital is called First City. It is the political and cultural center of the Klingon Empire and the location of the Klingon High Council. It is a city of great size and importance in Klingon society.



Alexa

# Interaction style: Menus and forms

## Guided interaction

Input: select items, enter data in fields

Output: result of command (or other form)

Objects are selectable items  
or the results of queries

Most often used to query a large database

## Advantages

Guides the user  
Easy data entry

## Drawbacks

Dialog imposed by the system  
Repetitive entry

The screenshot shows a dark-themed train ticket booking interface. At the top, there are two input fields: 'From' with the placeholder 'Enter origin station...' and 'To' with 'Enter destination station...'. Below these is a 'Via / Avoid' section with a small icon and text. The next section contains three radio buttons for 'One Way', 'Return', and 'Open Return', with 'One Way' selected. Below the radio buttons are two columns: 'OUT' and 'RETURN'. Under 'OUT', there are four dropdown menus: 'Today' (11-Sep-23), 'Tomorrow' (empty), 'Same day' (empty), and 'Next day' (empty). Under 'RETURN', there are four dropdown menus: 'Leaving at' (empty), 'Leaving at' (empty), '23' (empty), and '15' (empty). Below the dropdown menus is a section for '1 adult (16+)' with a dropdown arrow and the text 'Add railcards'. At the bottom is a large green button with the text 'Get cheapest tickets' and a right-pointing arrow.

[trainline.com](https://www.trainline.com)

# Interaction style: Navigation

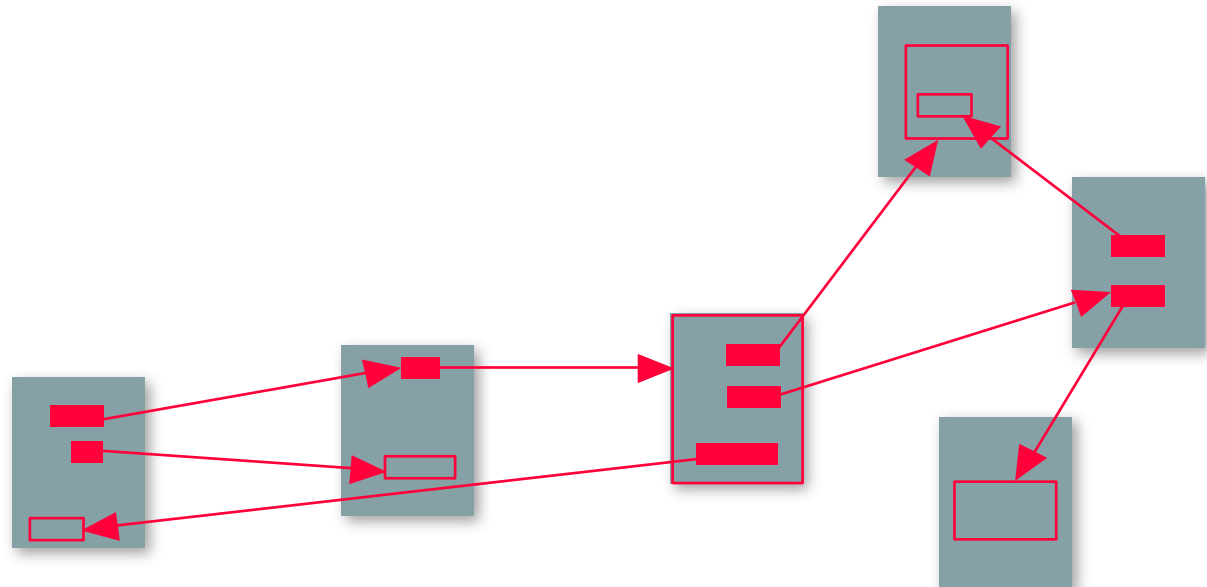
## Hypertext / Hypermedia

Input: select link anchor

Output: node (or page)

Objects are the nodes

Example: the Web!



## Advantages

Progressive access to large amount of information

Information organized into nodes

## Drawbacks

Lost in hyperspace

Where am I? What have I missed?

# Navigation

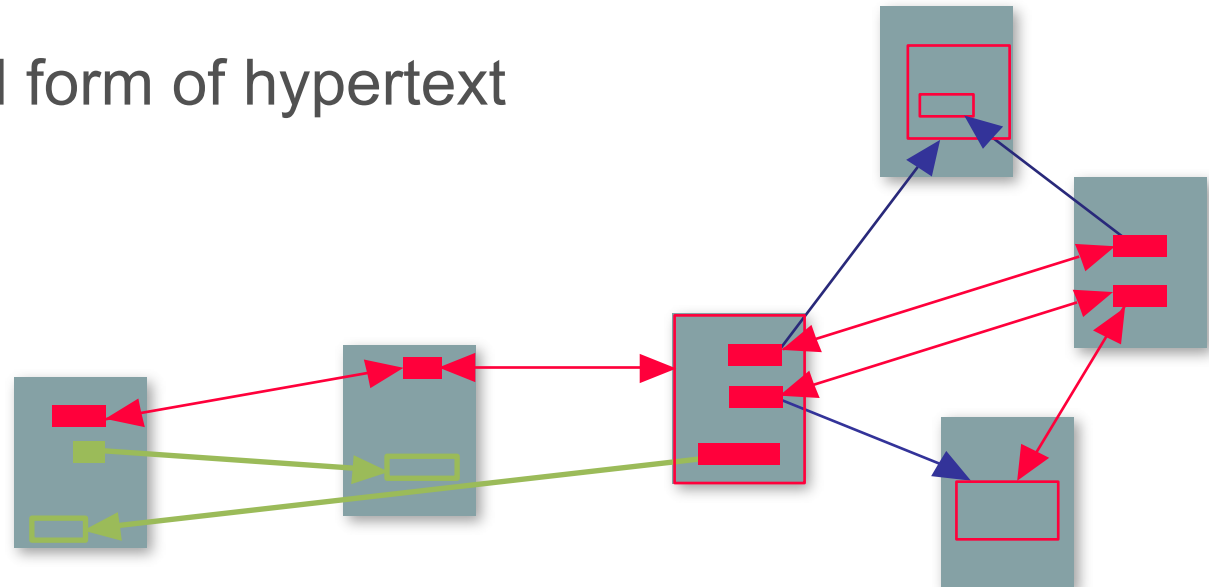
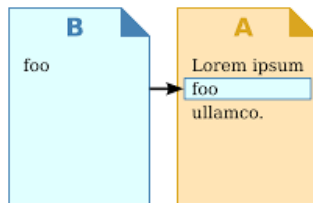
The web is a very limited form of hypertext

Single type of link

Links are unidirectional

No transclusion:

include the content of the target node in the source node



Many interfaces combine Menus, Forms and Navigation

Menus and forms to specify a query

Navigation to browse the results

# Interaction style: Direct manipulation

## Direct manipulation

Input: point-and-click, drag-and-drop objects

Output: objects change state

Objects are represented graphically



The dominant form of interaction

## Advantages

User is in control

Builds on physical skills

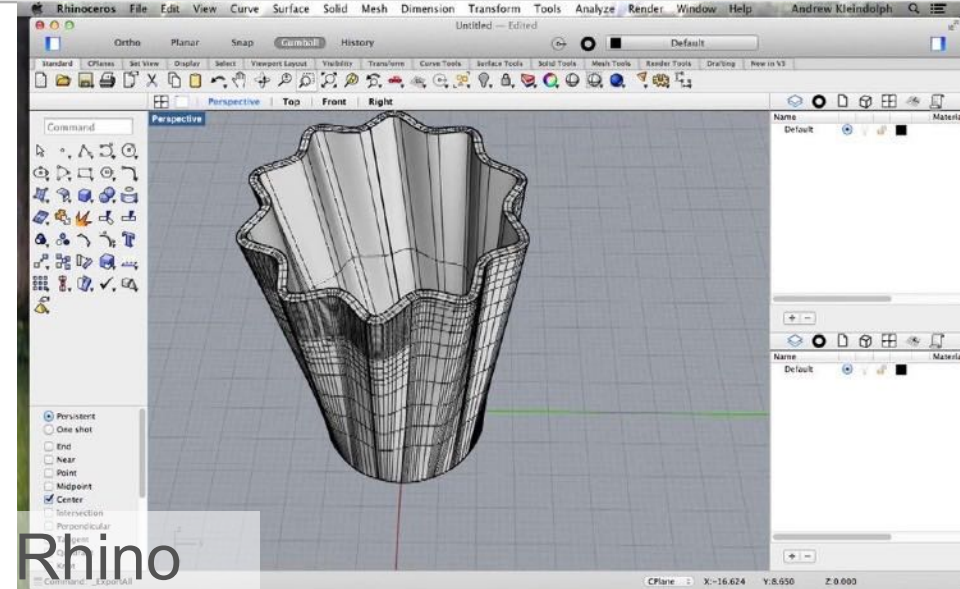
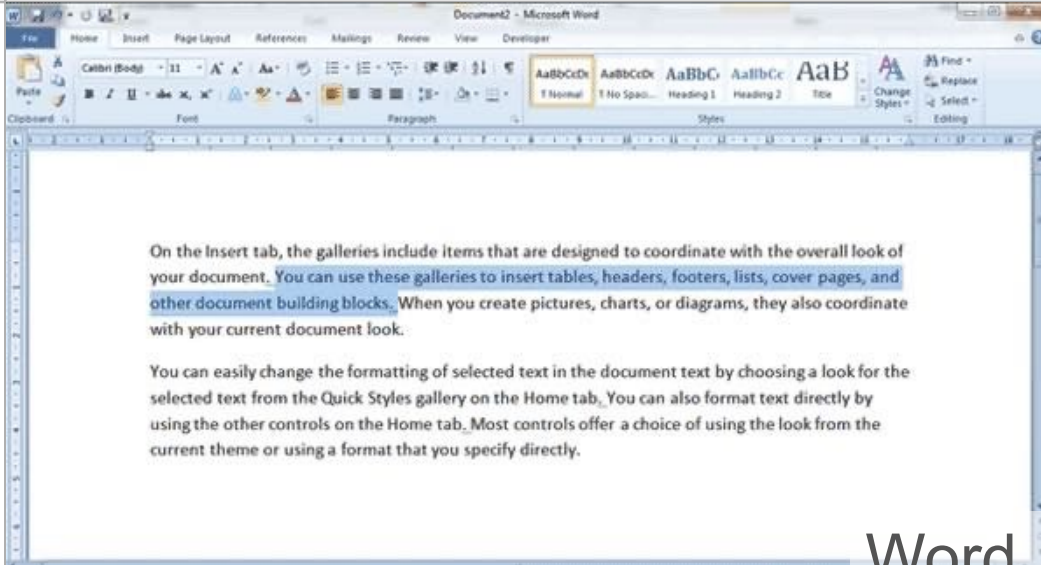
## Drawbacks

Can be slow

No power of abstraction



# Direct manipulation



Word  
Rhino  
Finale  
Resolve

# Direct manipulation

## Document editing

Interaction controlled by the user



WYSIWYG

What  
You  
See  
Is  
What  
You  
Get

# Direct manipulation

## Iconic interaction

Generic interface

Metaphorical approach

Drag-and-drop



# Direct manipulation

Shneiderman (1983)

## Four principles

1. Continuous representation of the objects of interest
2. Physical actions rather than complex syntax
3. Quick, incremental, reversible operations whose effect on the objects of interest is immediately visible
4. Layered approach to facilitate learning

# WIMP interfaces: the current standard

## Presentation

**W**indows

**I**cons (and other graphical representations)

## Interaction

**M**enus,

Dialog boxes, Input fields, Scrollbars, etc.

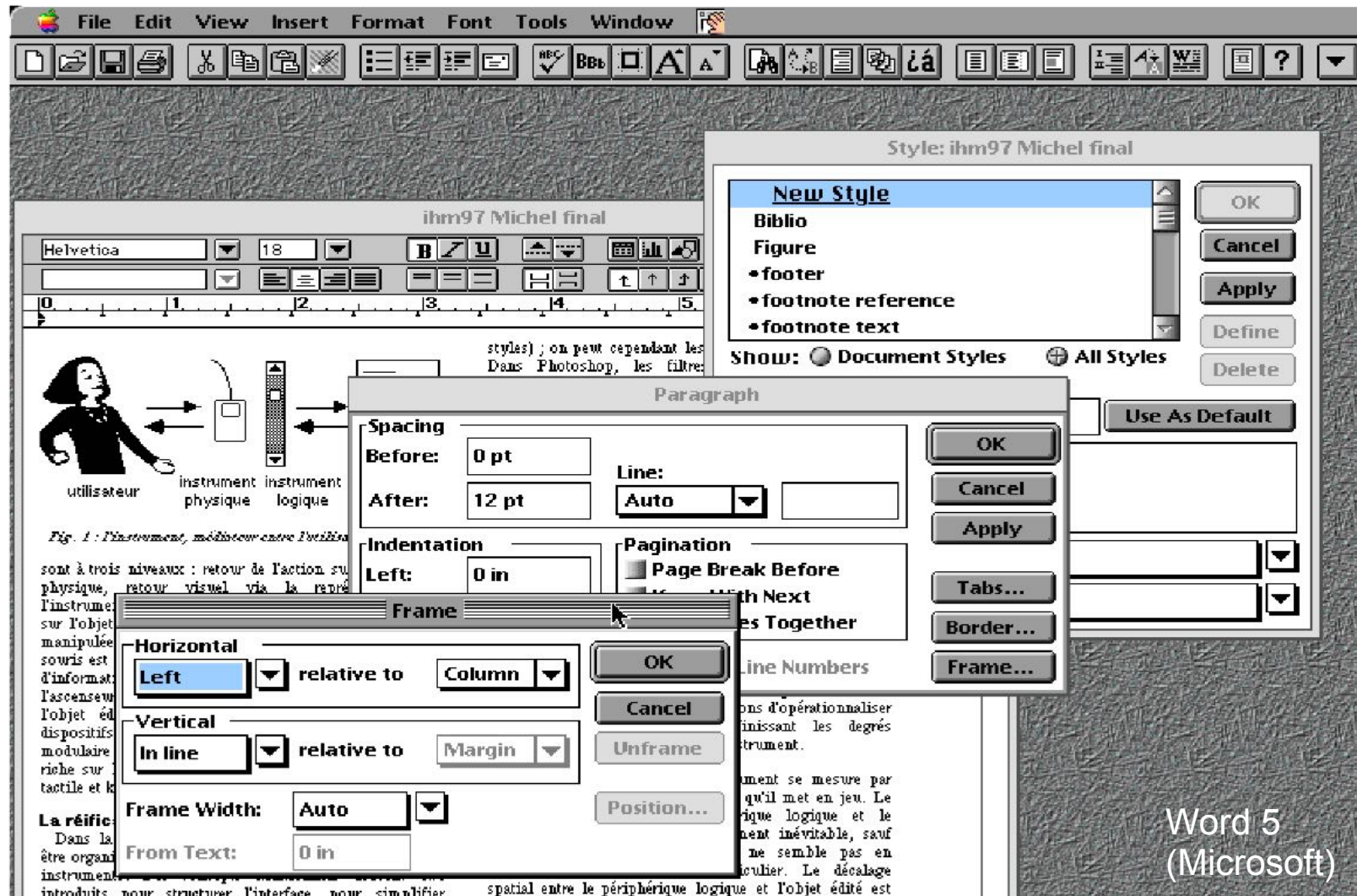
## Input

**P**ointing, Selection, Gestures

## **GUI** - Graphical User Interface

Menus + Forms + Navigation + Direct Manipulation

# WIMP interface: direct + indirect manipulation



Word 5  
(Microsoft)

# Gesture input

## Richer input for direct manipulation

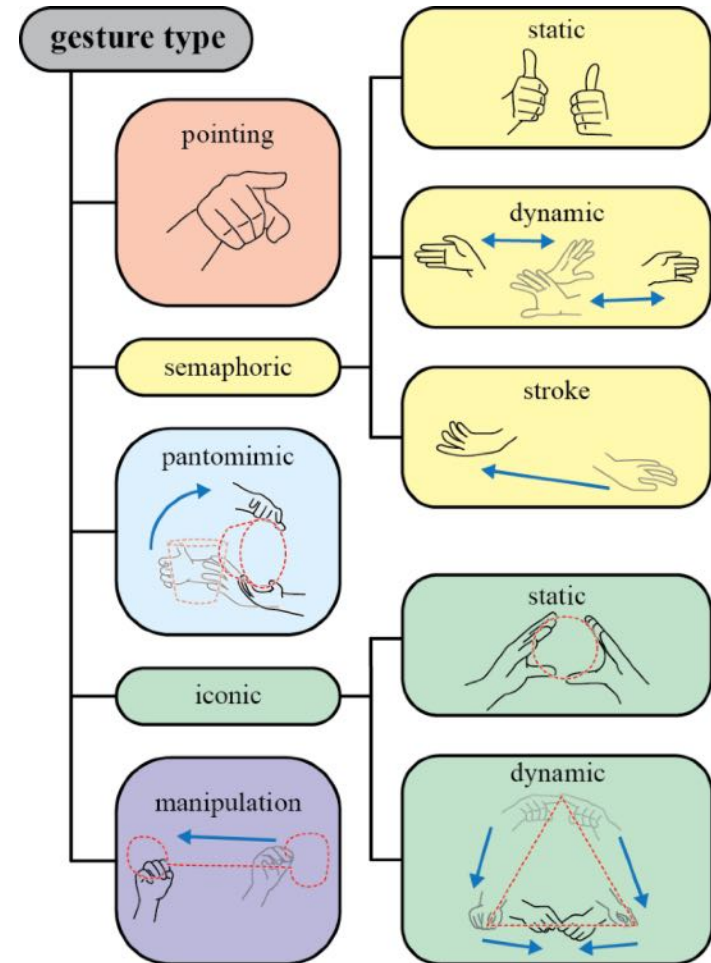
Marks traced on a surface vs. mid-air gestures  
Literal input (a drawing) vs. interpreted symbol  
Different types of gestures

## Advantages

Fast  
Expressive

## Drawbacks

Hard to discover  
Can be ambiguous



Aigner et al.

# Interaction style: Gesture-based interaction

## Pen-based



PDA (Palm Pilot)



TabletPC (HP)



Whiteboard(Smart)

## Touch-based



PLATO (CDC, 1972)



Multitouch (Jeff Han)



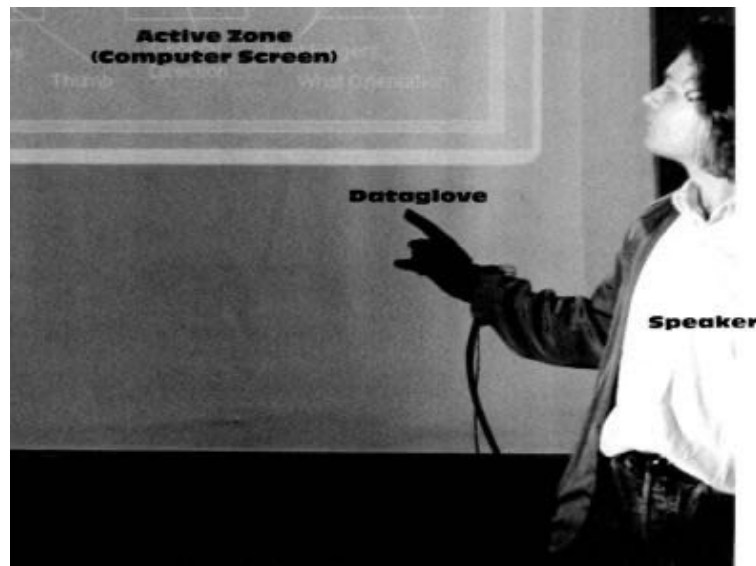
iPad (Apple)

# Gesture-based interaction

## 3D or mid-air gestures



VideoPlace (Krueger, 1983)



Charade (Baudel, 1993)



Kinect (Microsoft)

# VideoPlace (Krueger, 1983)



# Recognition vs. Recall

## **Recognition-based interface:**

Provides information (feed-forward) about available commands, so the user can recognize them

Example : menus, icons, toolbars, ...

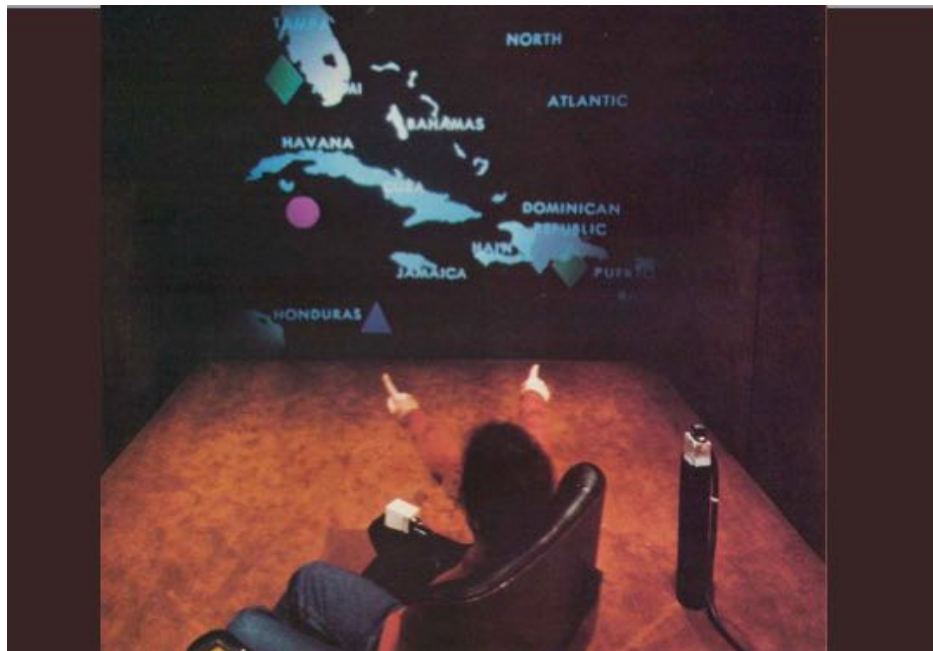
## **Recall-based interface:**

Relies on the user having learned and memorized the commands and/or how to input them

Example : gesture-based interface, language-based interface (speech, natural language, command language)

# Interaction style: Multimodal interaction

Combine speech + gesture

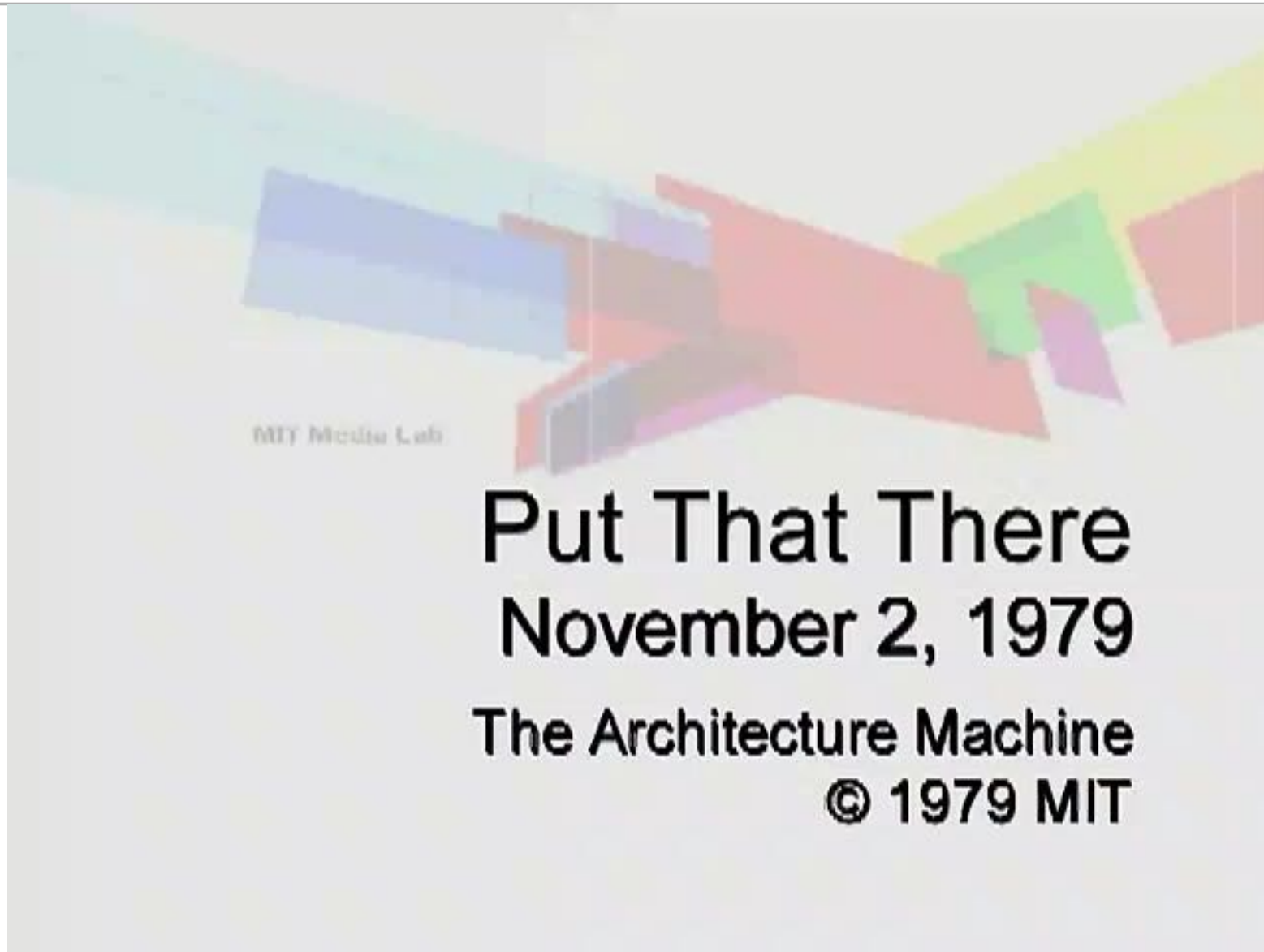


Put-that-there (Bolt, 1980)



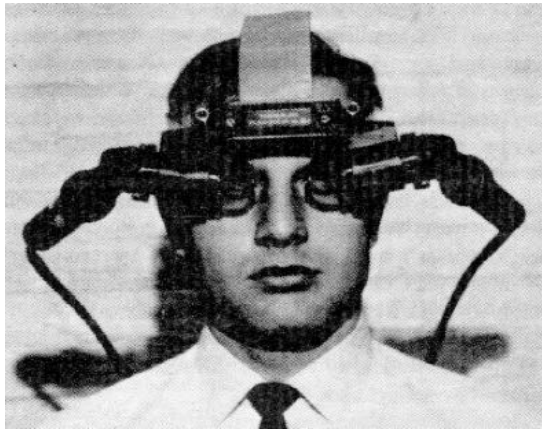
Minority Report (movie)

# Put-that-there (Bolt, 1980)

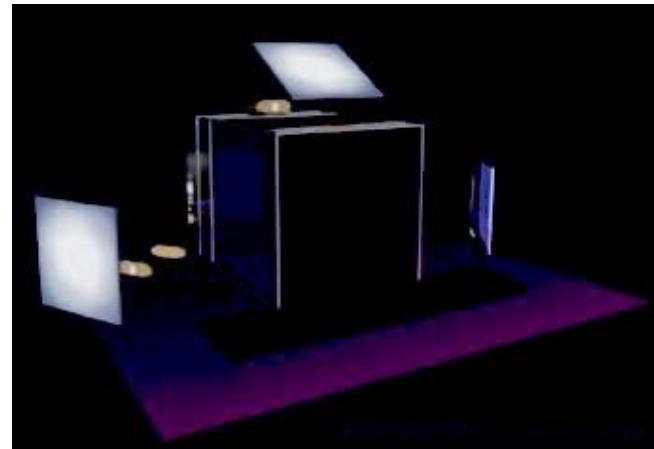


# Interaction style: Virtual reality

## Immersion of the user



Sutherland (1968)



HTC Vive



CAVE

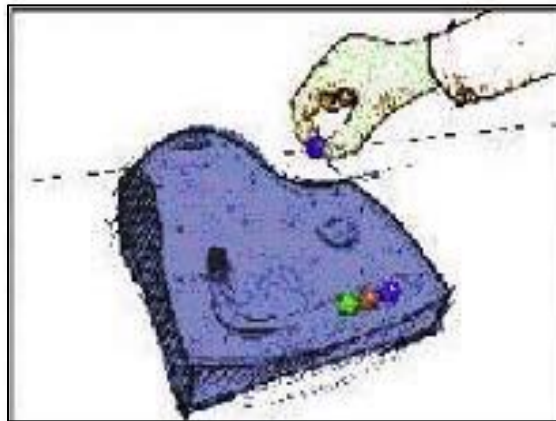
# Interaction style: Mixed and augmented reality

## Tangible interaction:

Use physical objects for interaction

## Augmented reality (later renamed Mixed reality):

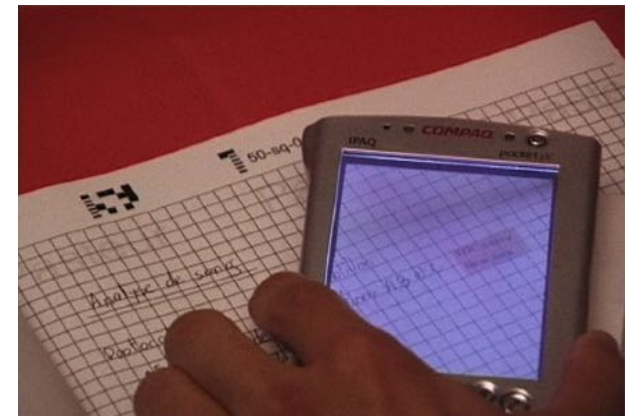
Augment physical object with computational capabilities



Marble answering machine  
Durrell Bishop




Digital Desk  
Pierre Wellner



A-book  
Wendy Mackay

# Marble answering machine (Bishop, 1992)



SIMON & IMOGEN'S HOUSE

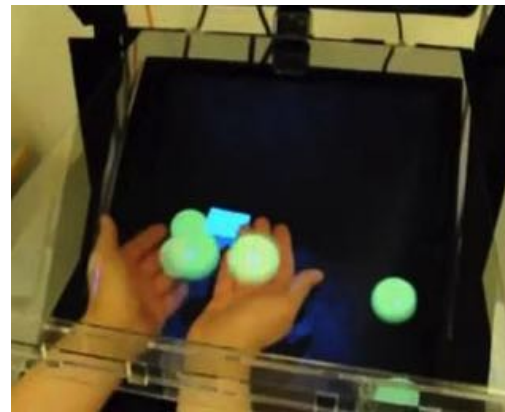
# DigitalDesk (Wellner, 1993)



# Augmented Reality / Mixed Reality



Wearable group / Thad Starner (1995, MIT)



Holodesk (2012, Microsoft)



ARKit (2017, Apple)

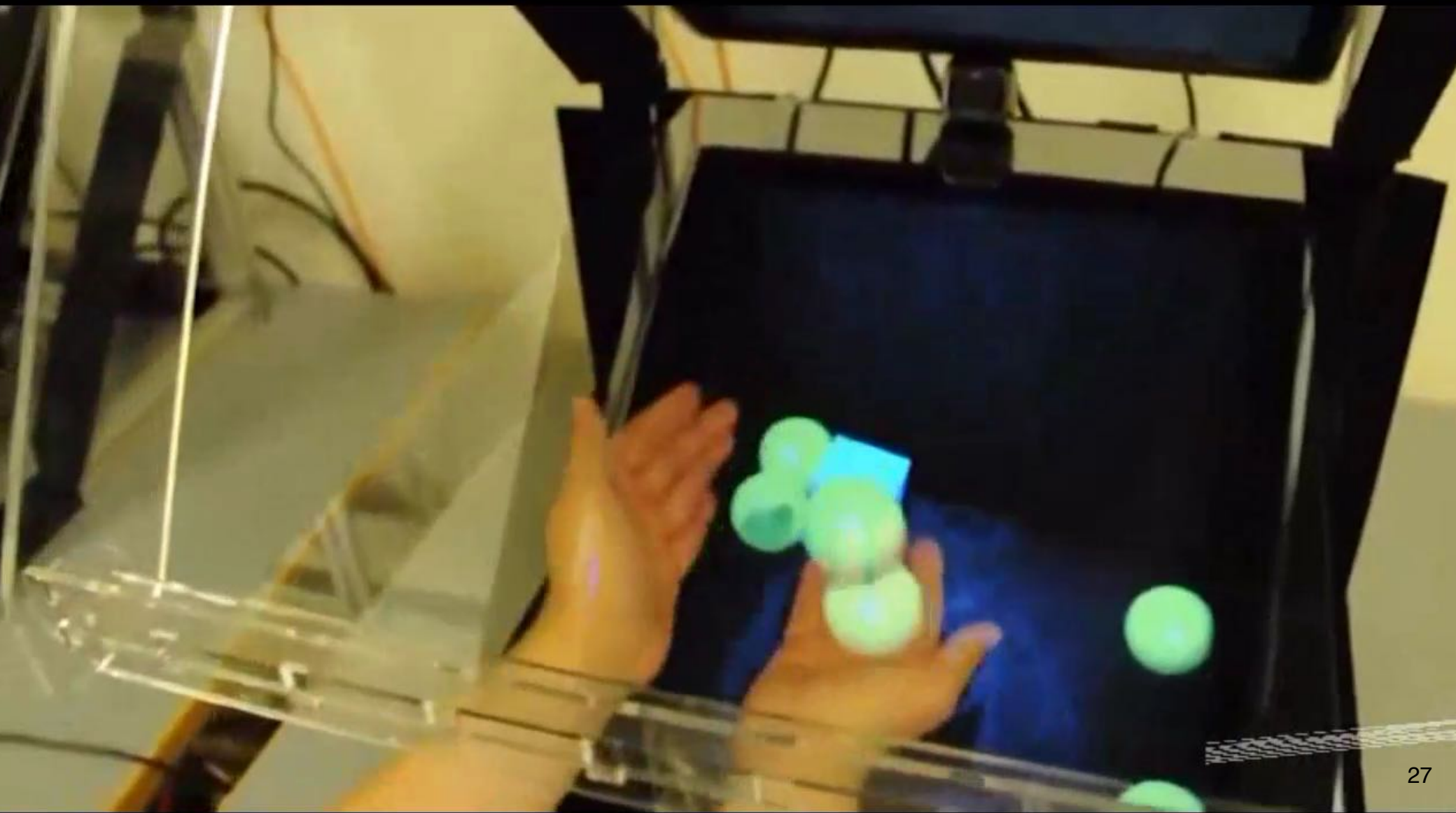


Google Glass (2010)



Hololens (2015, Microsoft)

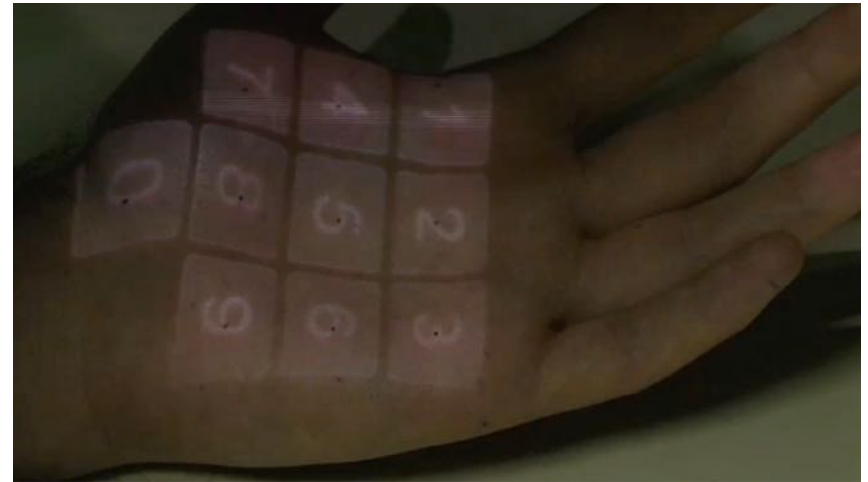
# Holodesk (Microsoft, 2012)



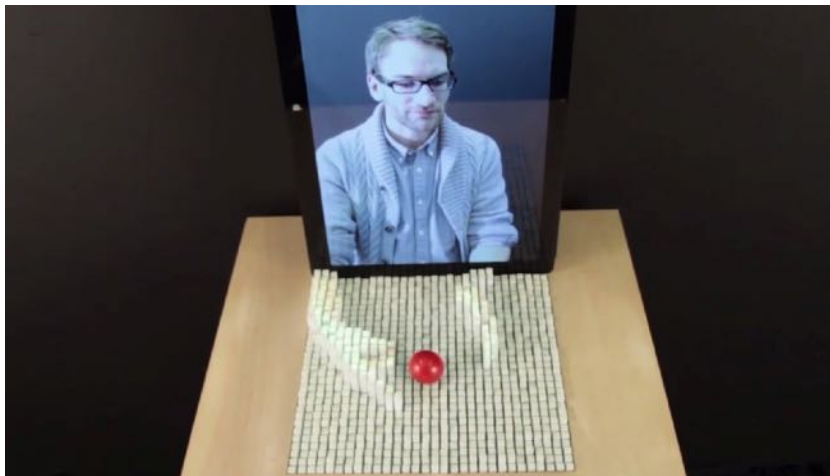
# Embodied and Physical interaction



RomAlive (2014, Microsoft)



Skinput (2016, CMU)



InForm (2013, MIT)



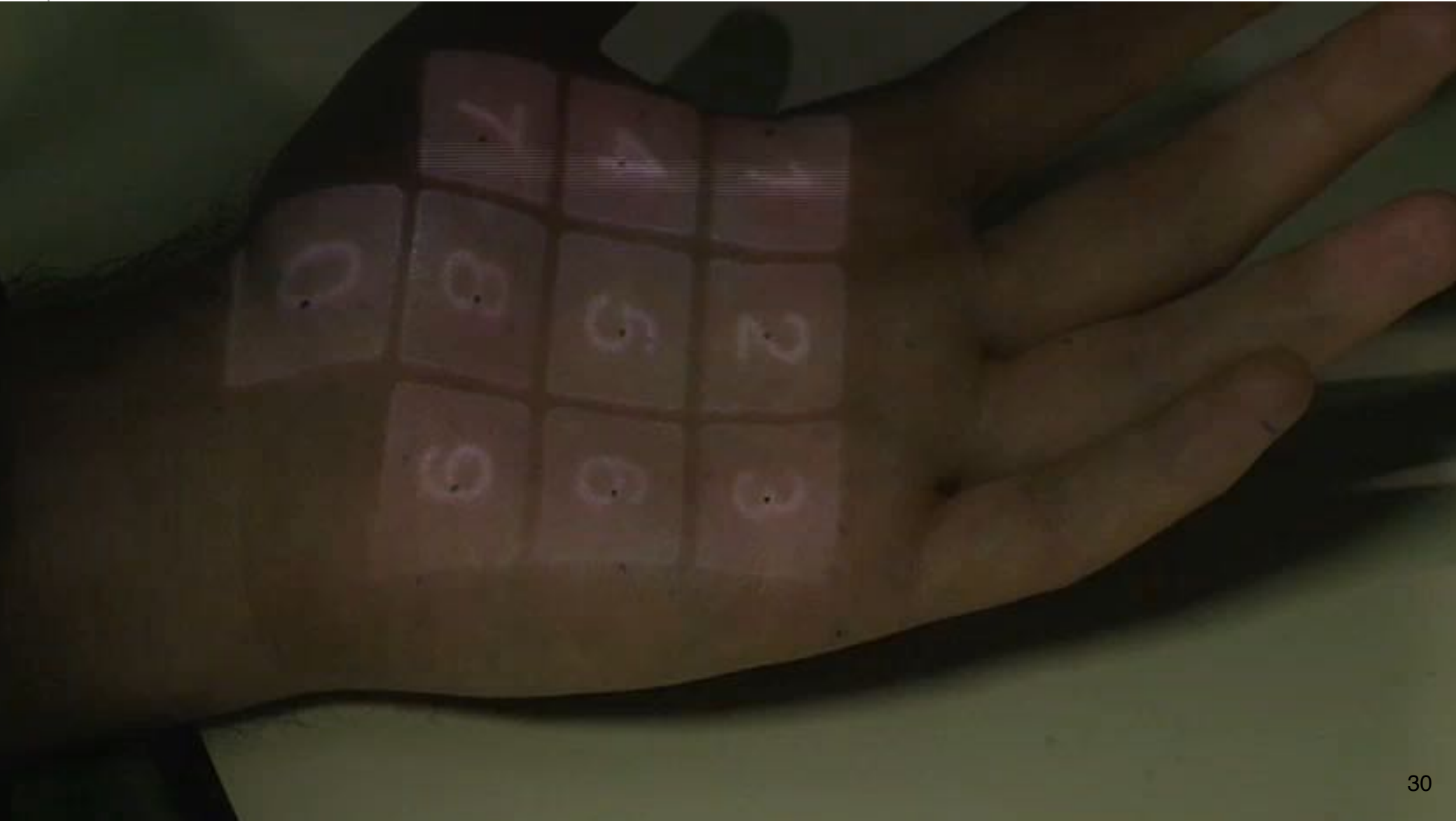
Zoids (2017, Inria)

## RoomAlive (Microsoft, 2014)



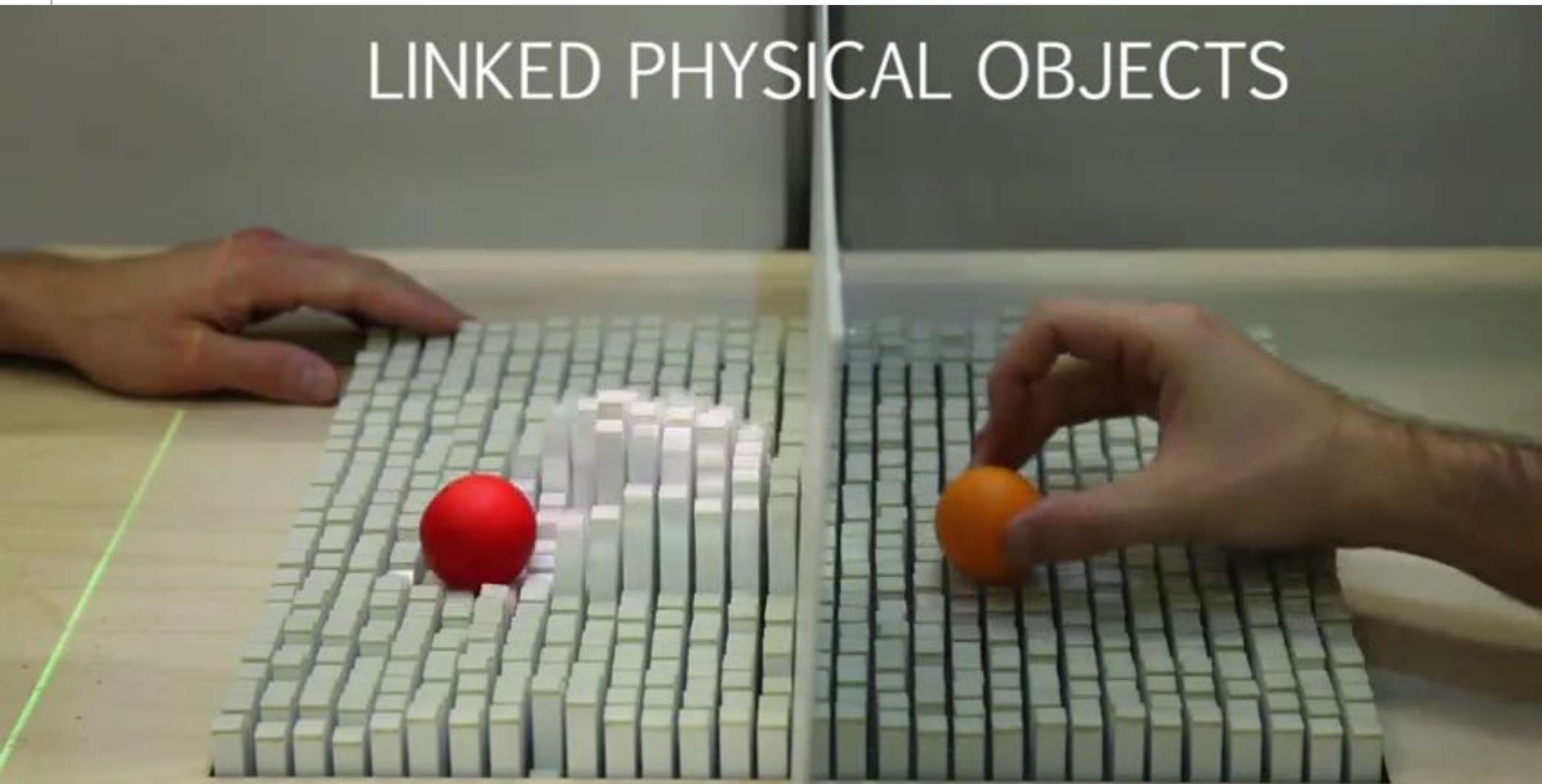
**With RoomAlive, users can touch, shoot, and dodge augmented content.**

# Skinput (CMU, 2016)



# InForm (MIT, 2013)

## LINKED PHYSICAL OBJECTS



# Zooids (Inria, 2017)



## Zooids: Building Blocks for Swarm User Interfaces

*Mathieu Le Goc<sup>1,3,4</sup>, Lawrence H. Kim<sup>2</sup>, Ali Parsaei<sup>2</sup>, Jean-Daniel Fekete<sup>1,4</sup>, Pierre Dragicevic<sup>1,4</sup>, Sean Follmer<sup>2</sup>*

<sup>1</sup> Inria, <sup>2</sup> Stanford University, <sup>3</sup> Université Paris-Sud, <sup>4</sup> Université Paris-Saclay

# What next?

Brain-computer interfaces?



Emotional agents



Robots



Your idea?

# What future do you want?



# What future do you want?

