

FUNDAMENTALS OF SITUATED INTERACTION - 7 JANUARY 2021

MICHEL BEAUDOUIN-LAFON

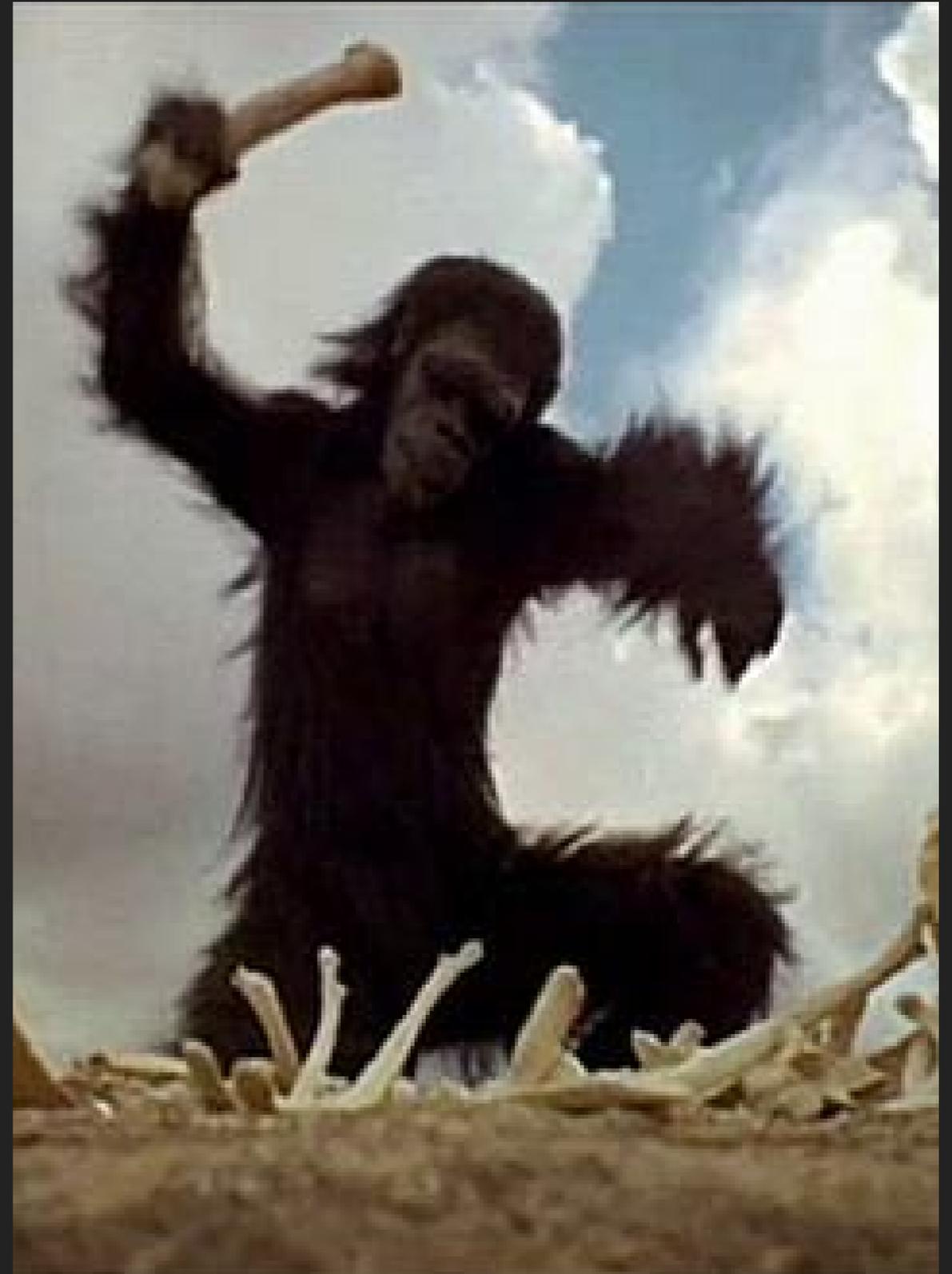
UNIVERSITÉ PARIS-SACLAY & INSTITUT UNIVERSITAIRE DE FRANCE

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# OF TOOLS AND INSTRUMENTS

# INVENTION OF THE TOOL

- ▶ Humans are the only species that creates tools to shape their environment



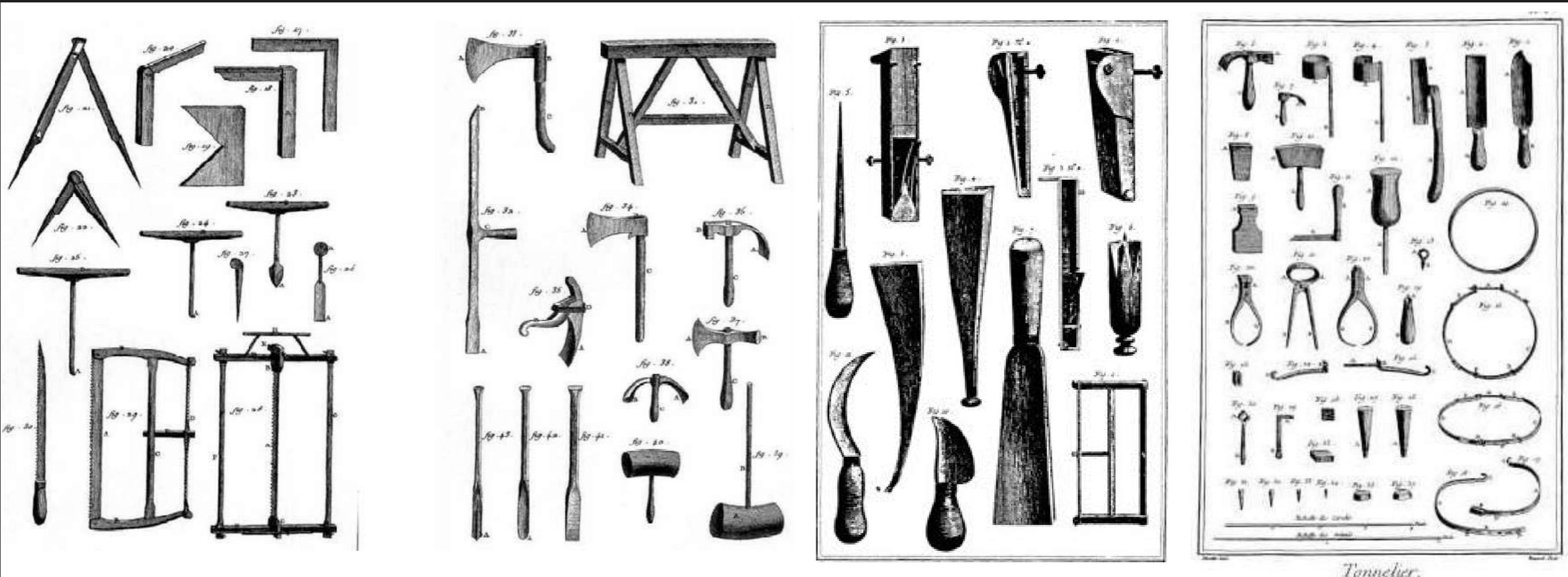
# INVENTION OF TOOLS

- ▶ Traces of tools have been found as far back as 3.3 million years



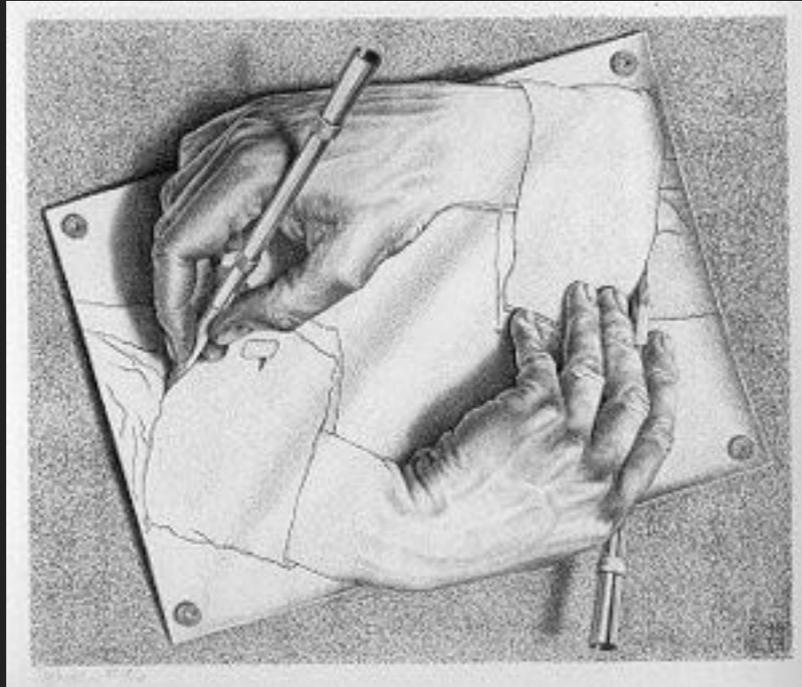
Sonia Harmand, anthropologist

# MOST OF OUR INTERACTIONS WITH THE REAL WORLD ARE MEDIATED BY TOOLS AND INSTRUMENTS



Tonnellerie.

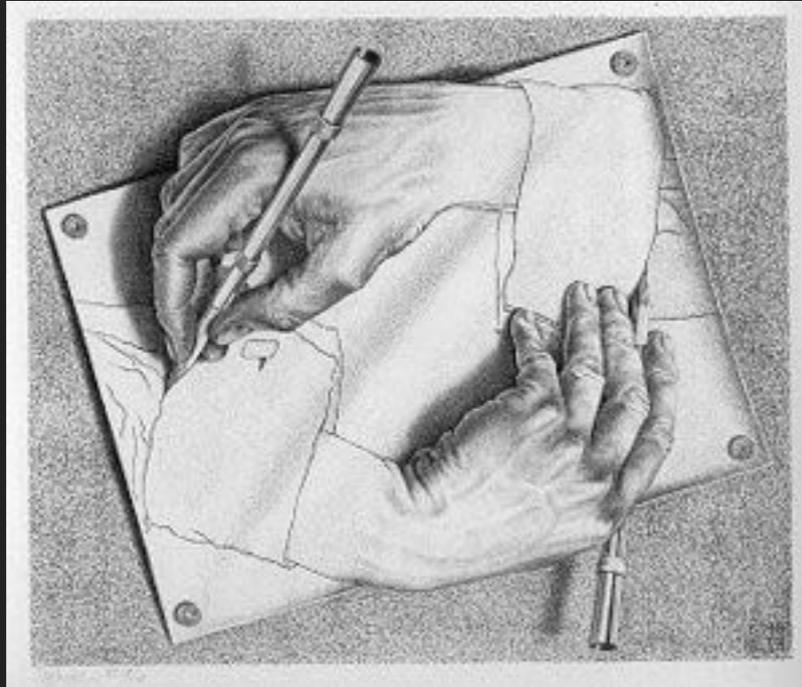
# TOOLS TO SHAPE OUR ENVIRONMENT



# INTRODUCTION

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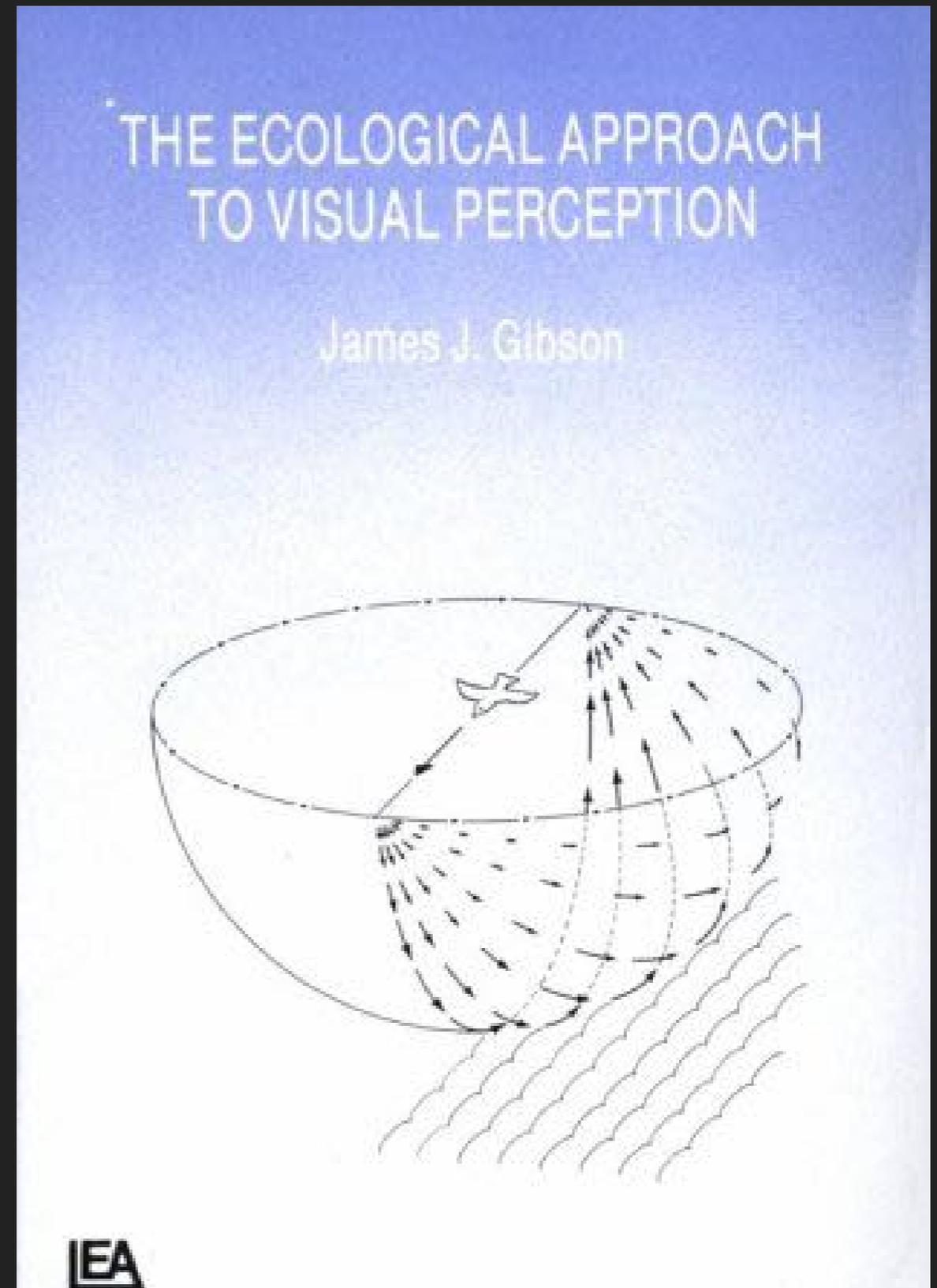
## BUT NOT ALWAYS EASY TO LEARN



# A BIT OF PSYCHOLOGY

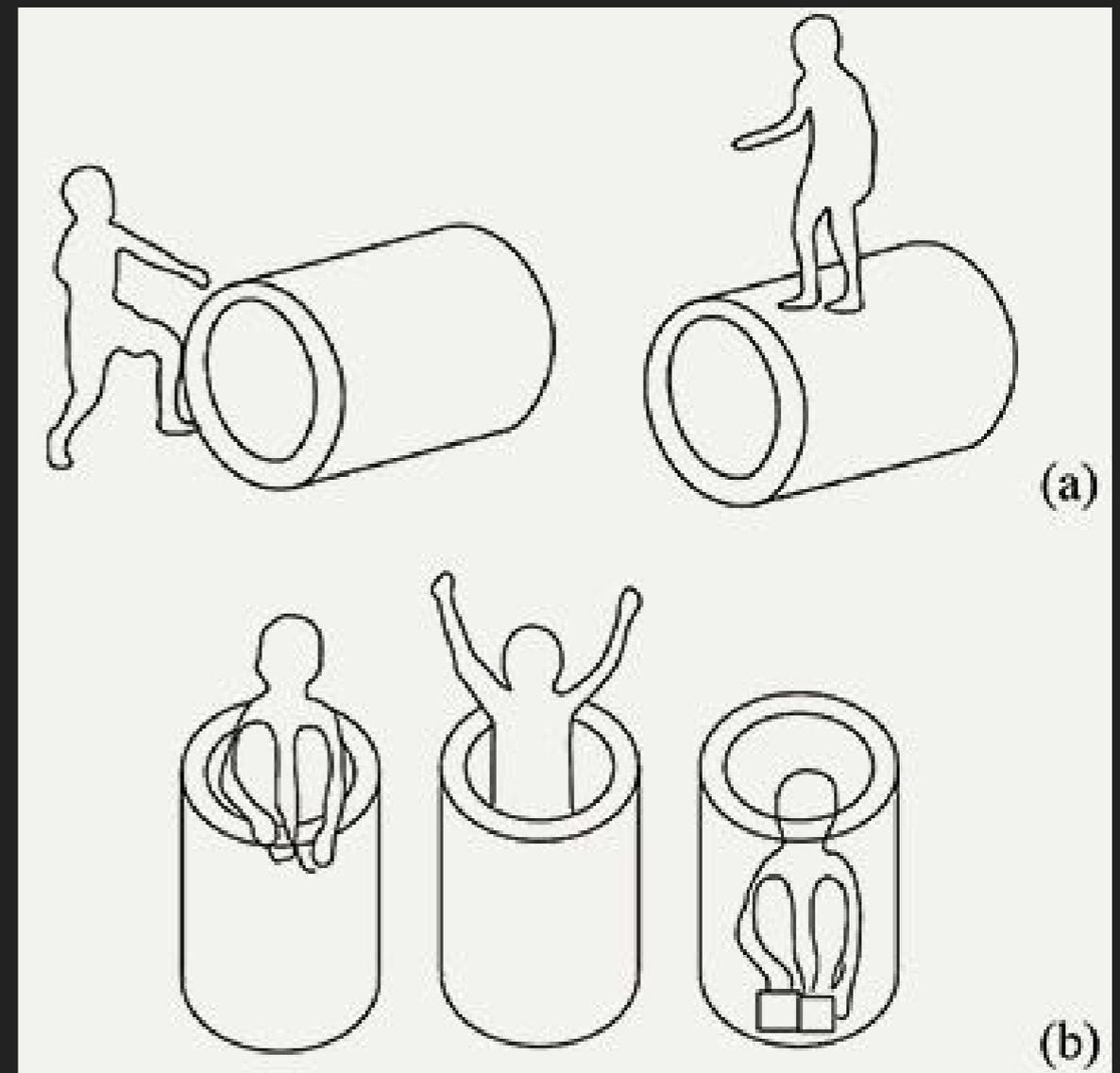
# AFFORDANCES

- ▶ We directly perceive the capabilities for action of an object
- ▶ "... the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill..."  
James Gibson



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## PERCEPTUAL LEARNING

- ▶ Learning to recognize affordances
  
- ▶ “We perceive to learn, as well as learn to perceive”  
Eleanor Gibson

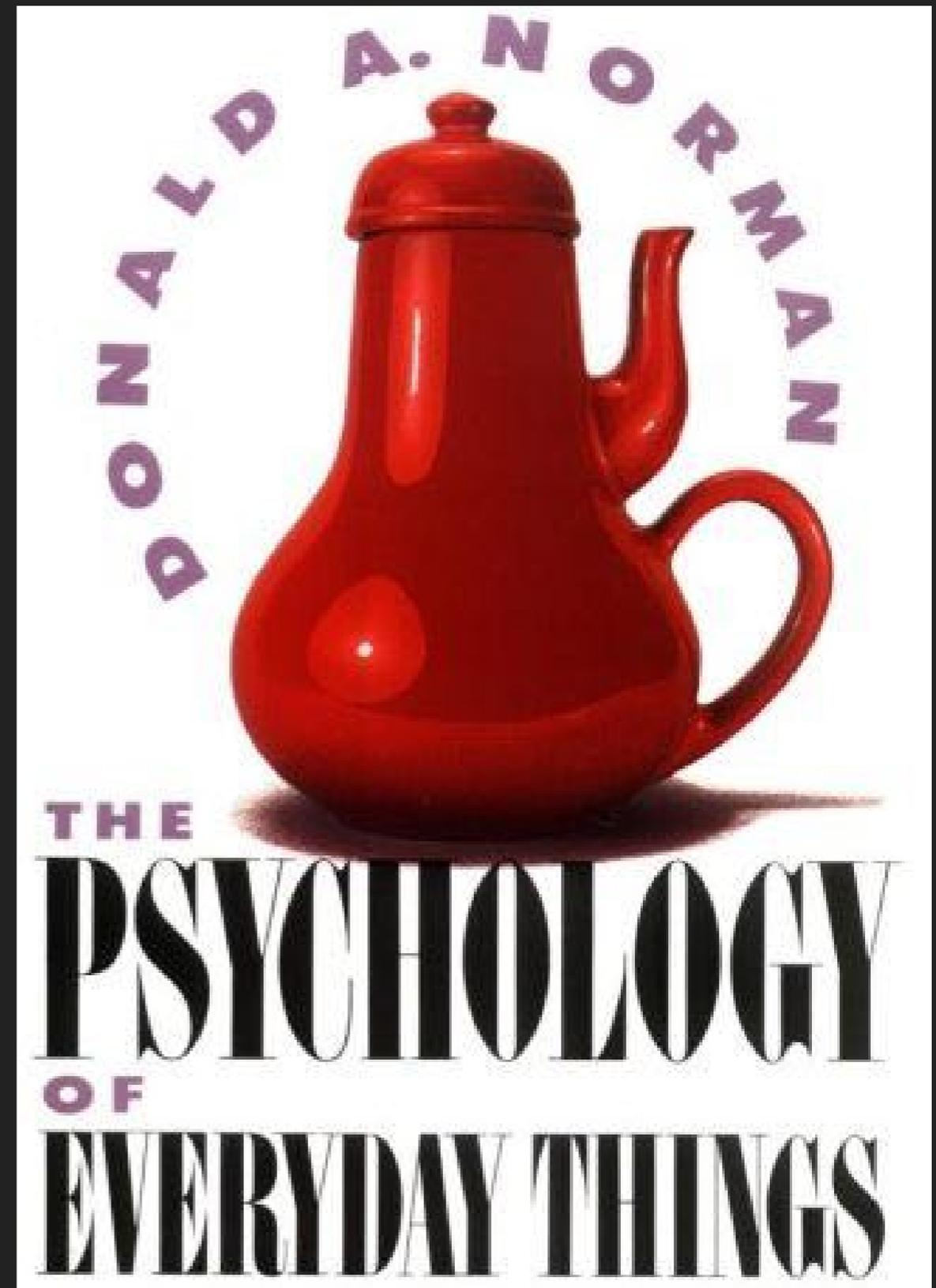




**JAMES & ELEANOR GIBSON**

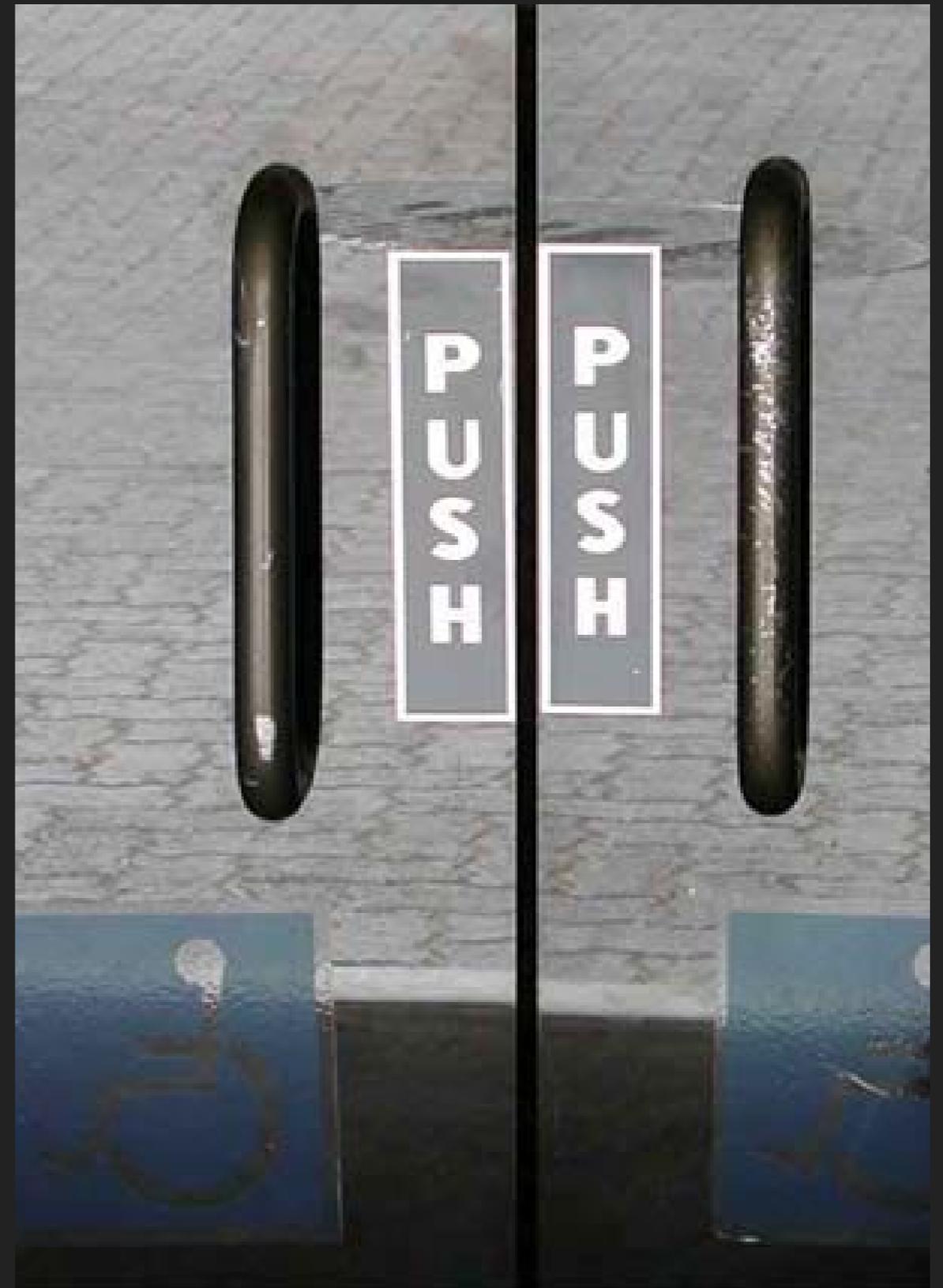
## SIGNIFIERS

- ▶ Affordances as redefined by Don Norman
- ▶ To be perceived, an affordance must be visible



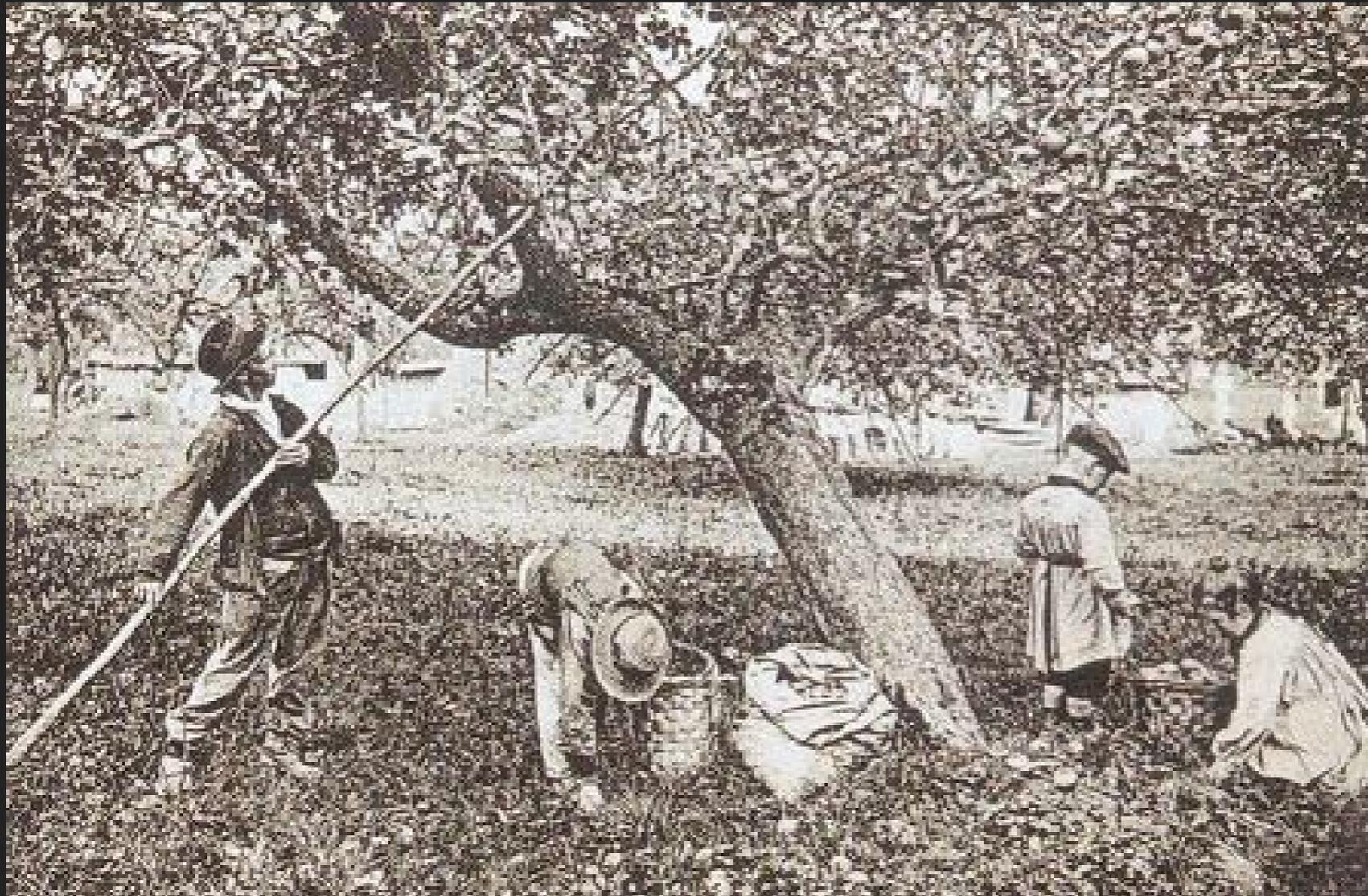
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## THE POWER OF TOOLS

- ▶ We internalize the tool as a physical extension of our body



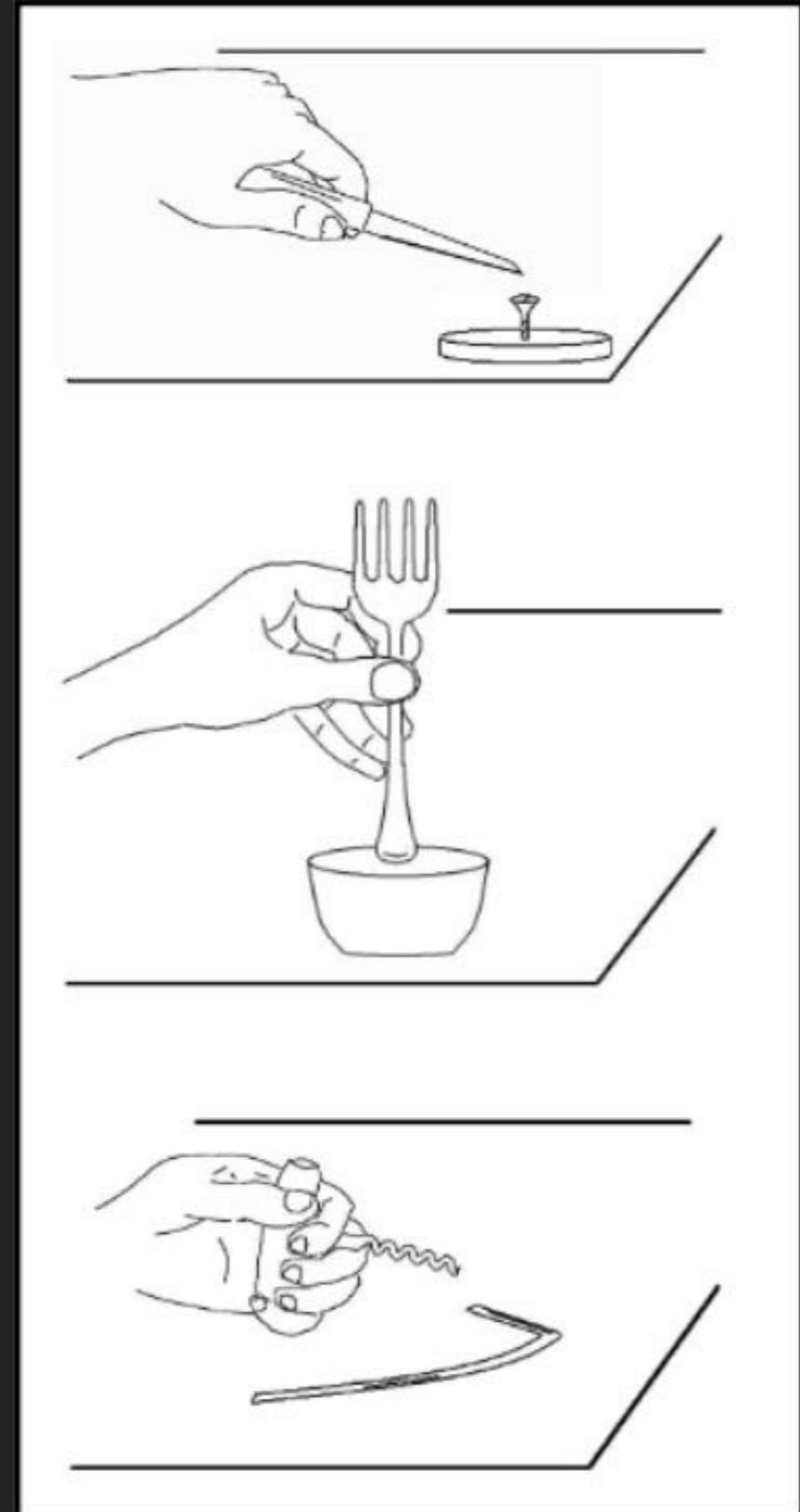
## THE POWER OF TOOLS

- ▶ We internalize the tool as a physical extension of our body



## TECHNICAL REASONING

- ▶ We simulate in our head the physical mechanism to solve a problem
- ▶ We appropriate the objects at hands



# APPROPRIATION

- ▶ A pen or a ruler?
  
- ▶ A mug or a compass?



## WHEN YOU HAVE A HAMMER...

François Osiurak

- ▶ We create tools because we overestimate their capabilities



**WHAT ABOUT  
DIGITAL TOOLS?**

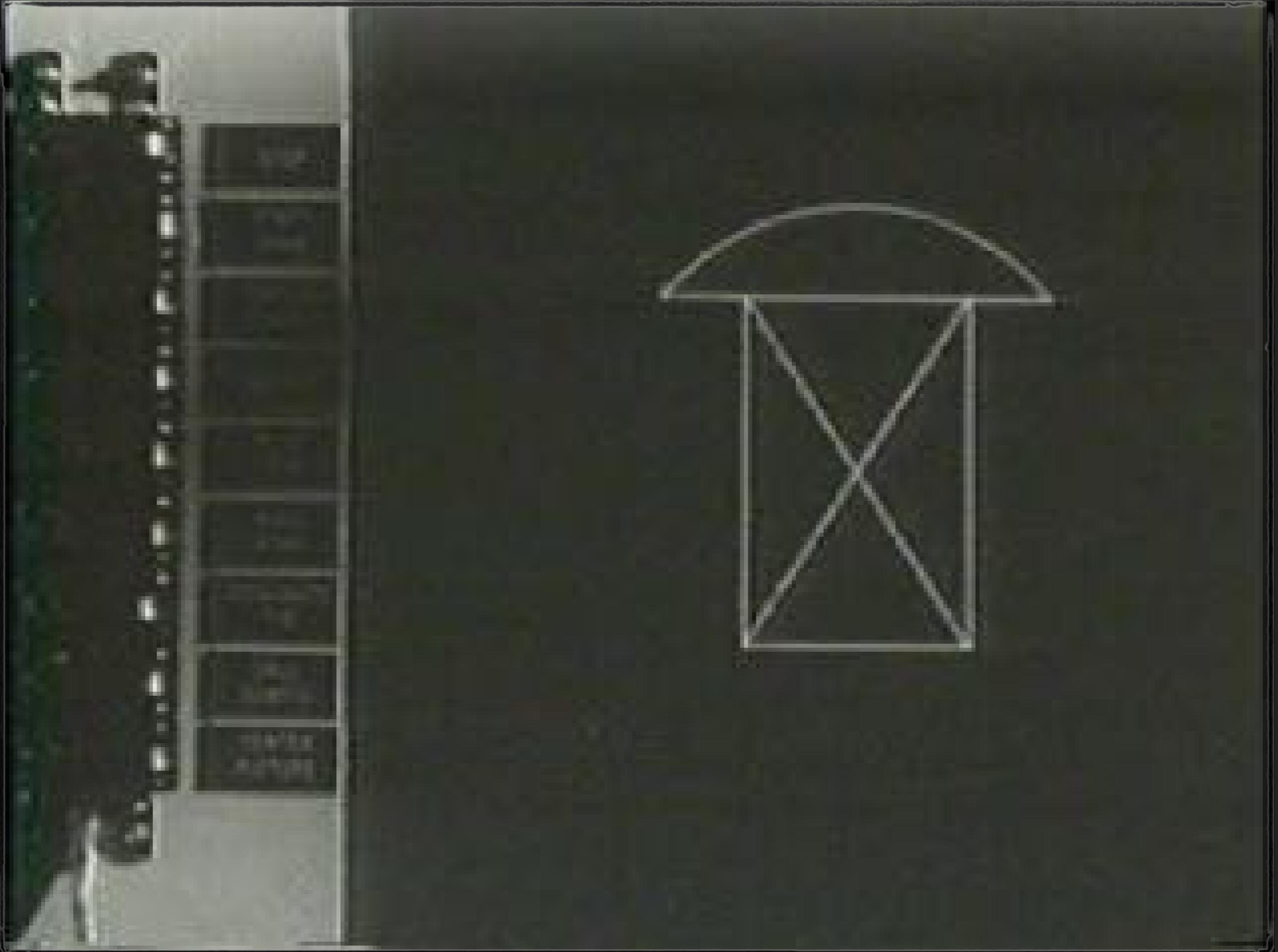


SKETCHPAD

IVAN SUTHERLAND, 1963

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**GRAPHICAL  
INTERACTION**



## COMPUTER AS TOOL

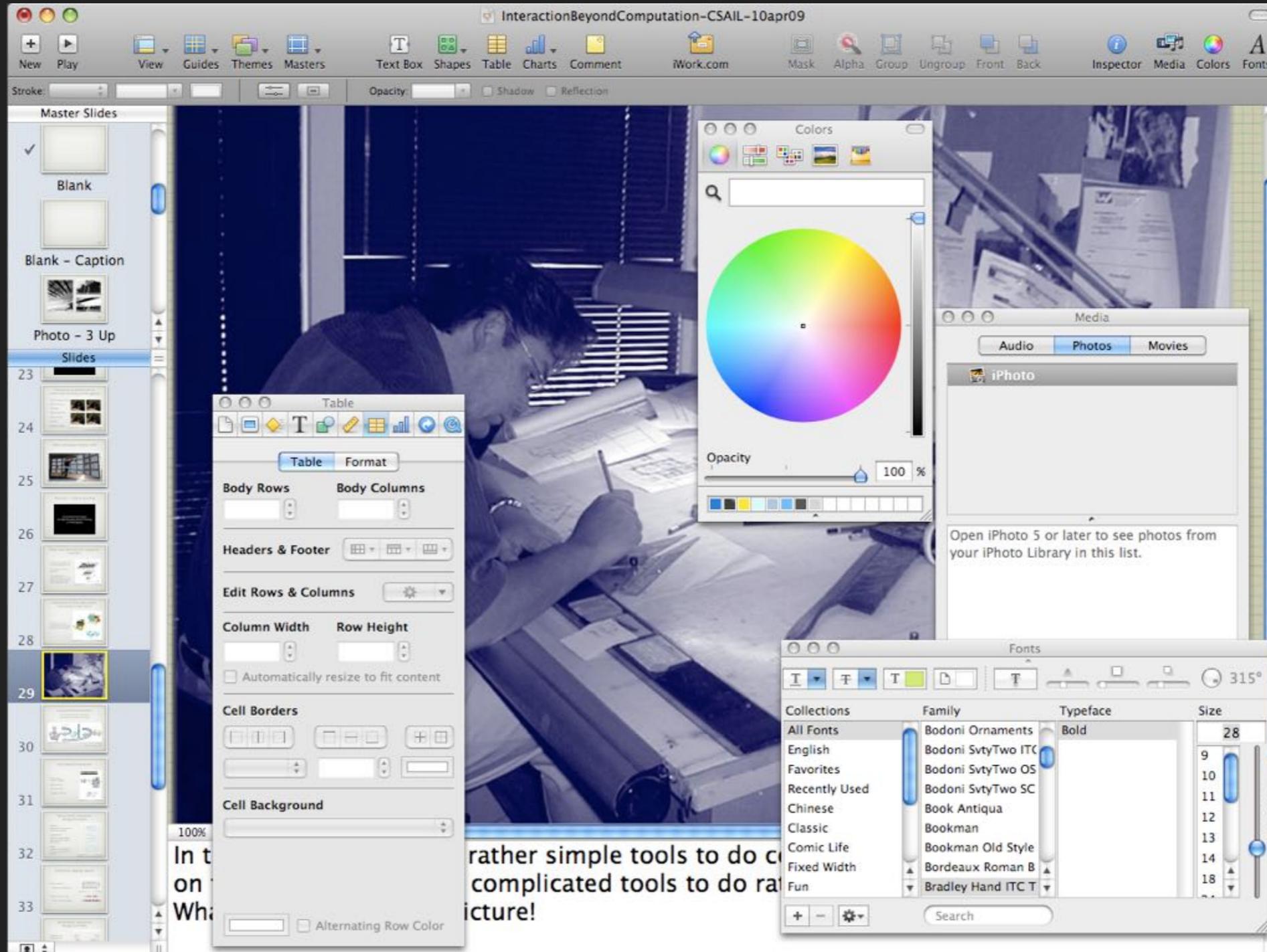
- ▶ “Computers are like a bicycle for our minds”  
Steve Jobs



# FROM PHYSICAL TOOLS ...



# ... TO DIGITAL TOOLS

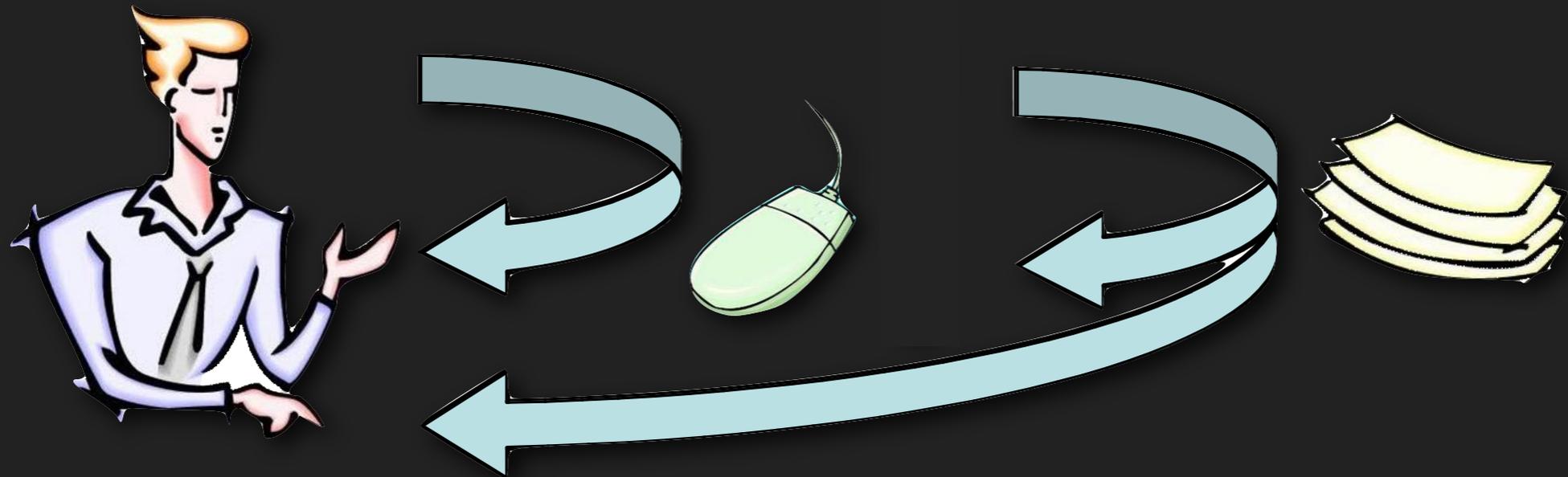


# **INSTRUMENTAL INTERACTION**

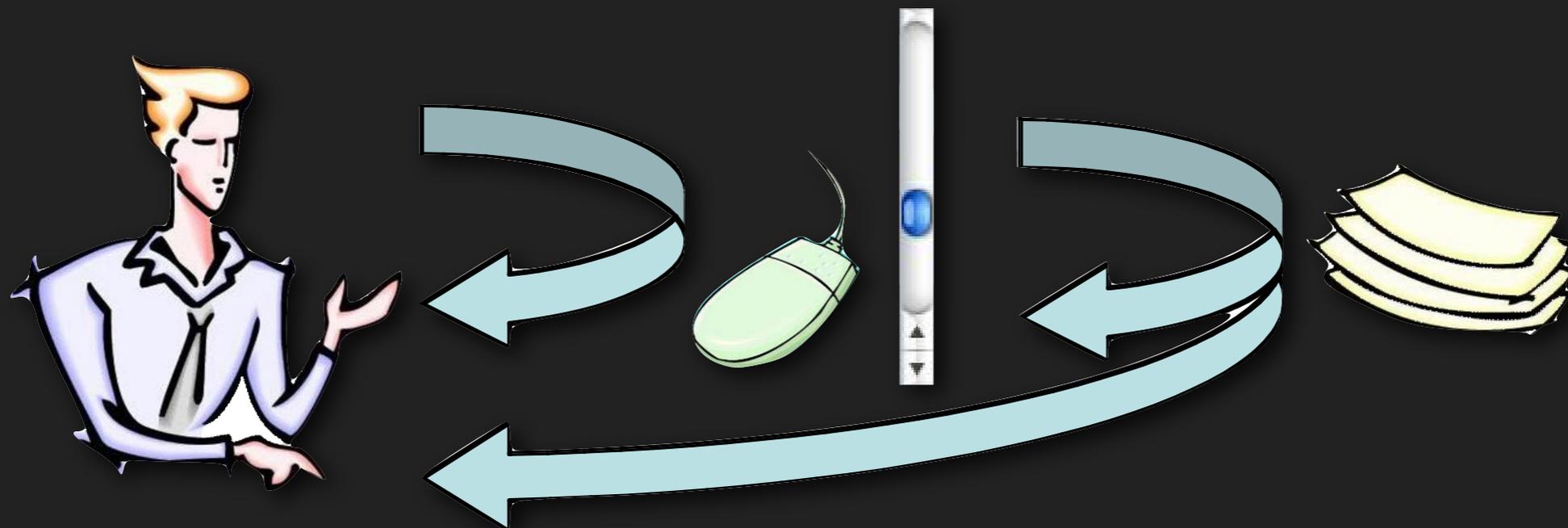
# INTERACTION IS MEDIATED BY A TOOL



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# INTERACTION IS MEDIATED BY A TOOL



## A DESCRIPTIVE MODEL

- ▶ From direct manipulation
- ▶ To tangible interaction
  
- ▶ But not universal:
- ▶ Voice-based interaction?
- ▶ Gesture-based interaction?



# INSTRUMENTAL INTERACTION

## CPN2000

**CPN Editor**

- Toolbox
  - Style Tools
  - Editing Tools
  - Simulation Tools
  - Page Tools
- CPN
  - Top
  - Receiver(1)
  - Receiver(2)
  - Network
  - Sender

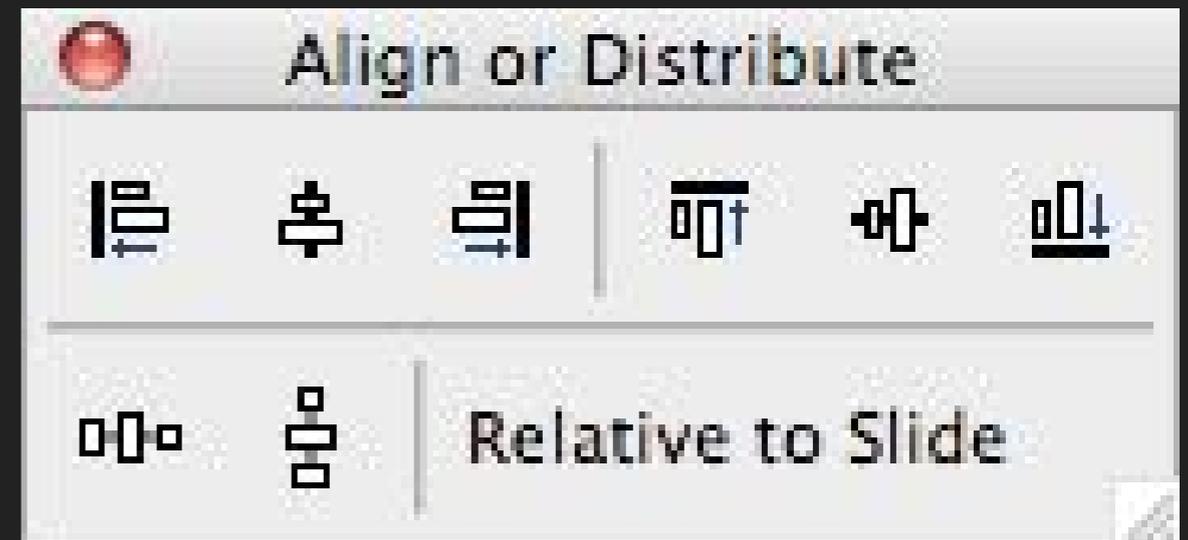
Receiver(1) Receiver(2)

Receiver(1)

Top Network Sender

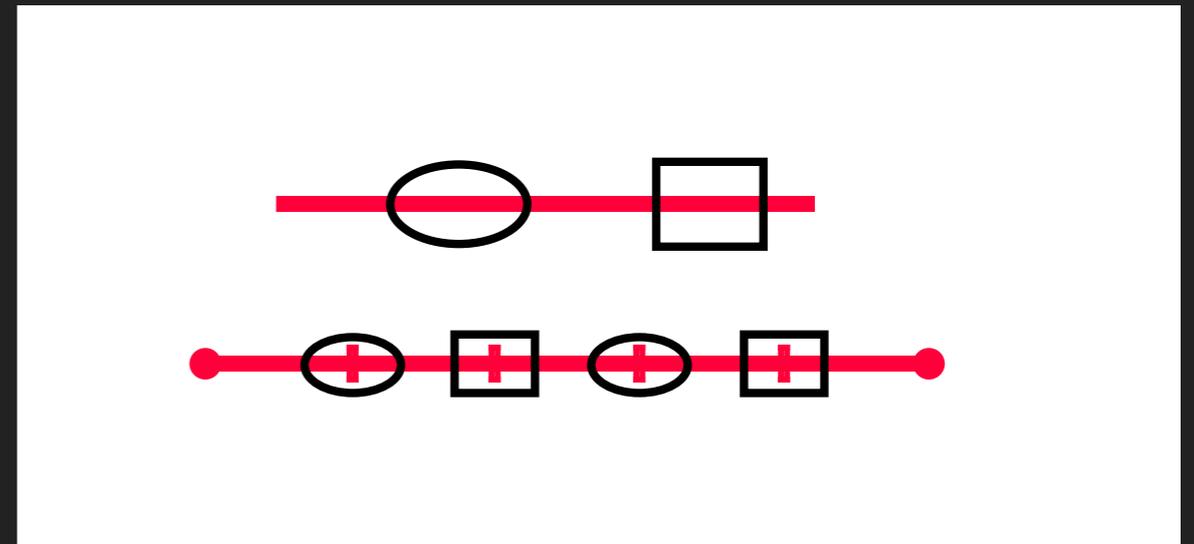
## REIFICATION

- ▶ Transform a command into an object that can be directly manipulated
- ▶ Example : alignment



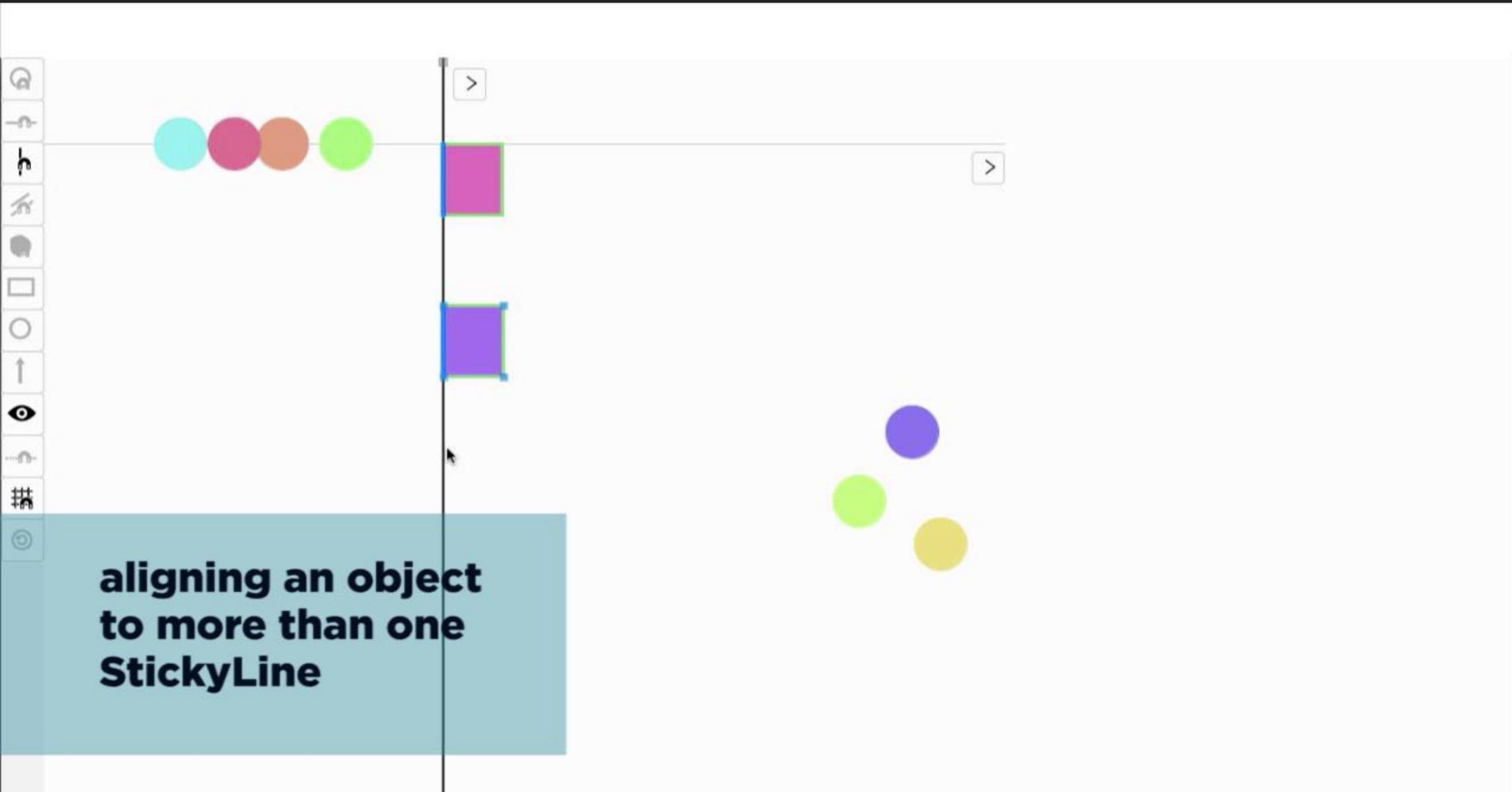
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# STICKYLINES

M. Ciolfi, N. Maudet, W. Mackay, M. Beaudouin-Lafon  
[Video](#)



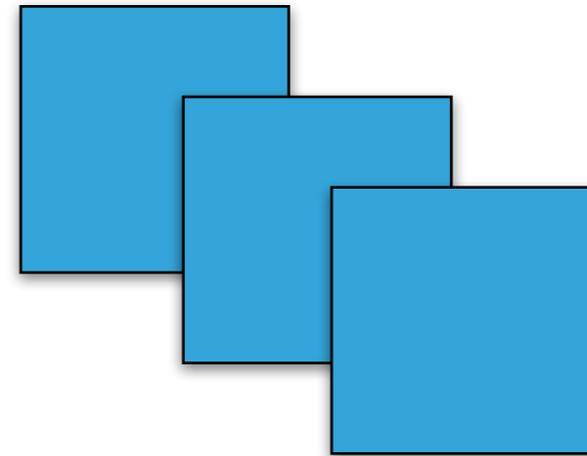
## POLYMORPHISM

- ▶ The same tool can be used in different contexts
- ▶ Example : color selector
- ▶ Free the tools from the applications where they are trapped!



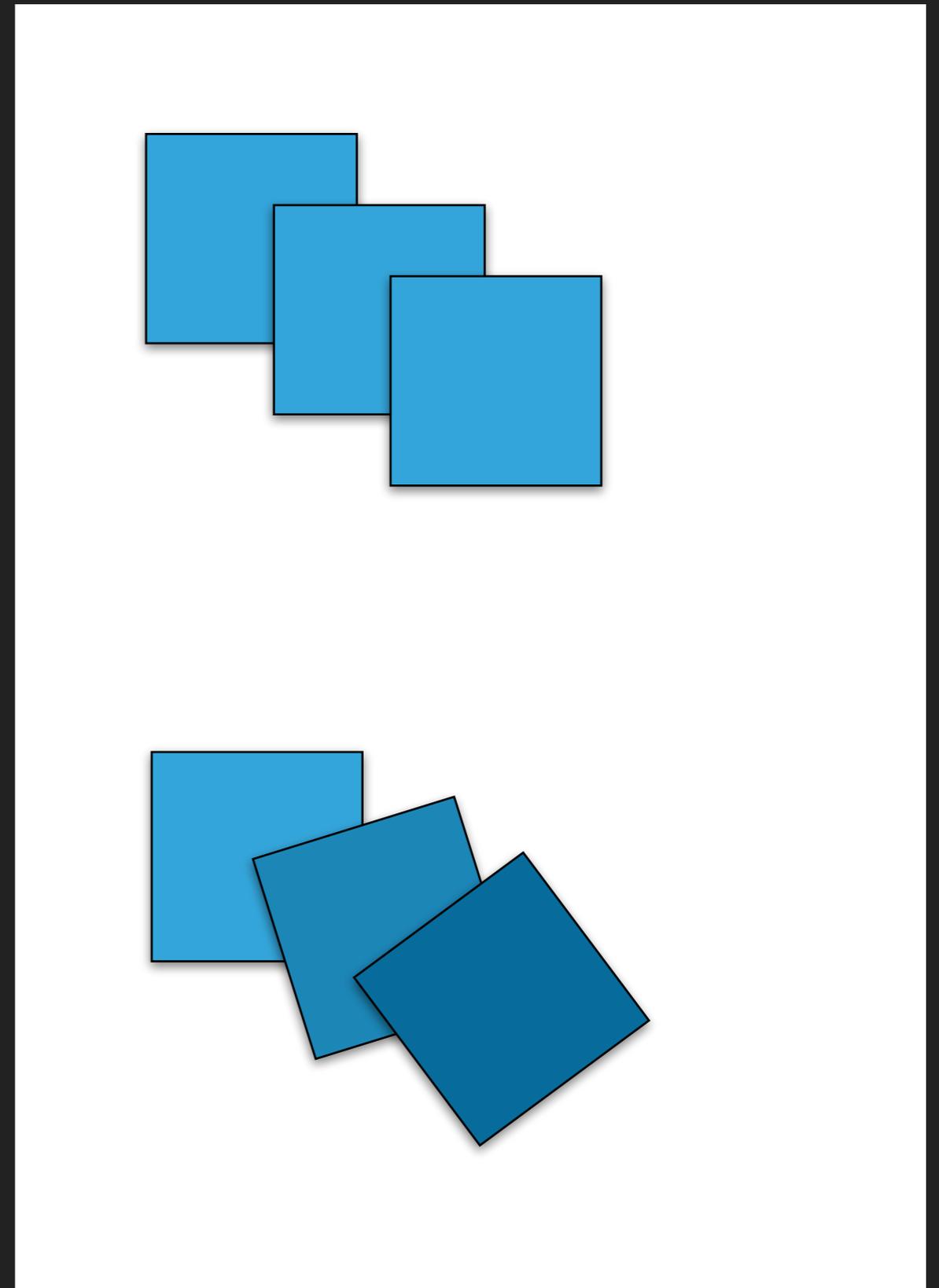
## REUSE

- ▶ Output reuse (objects)
- ▶ Example : copy-paste



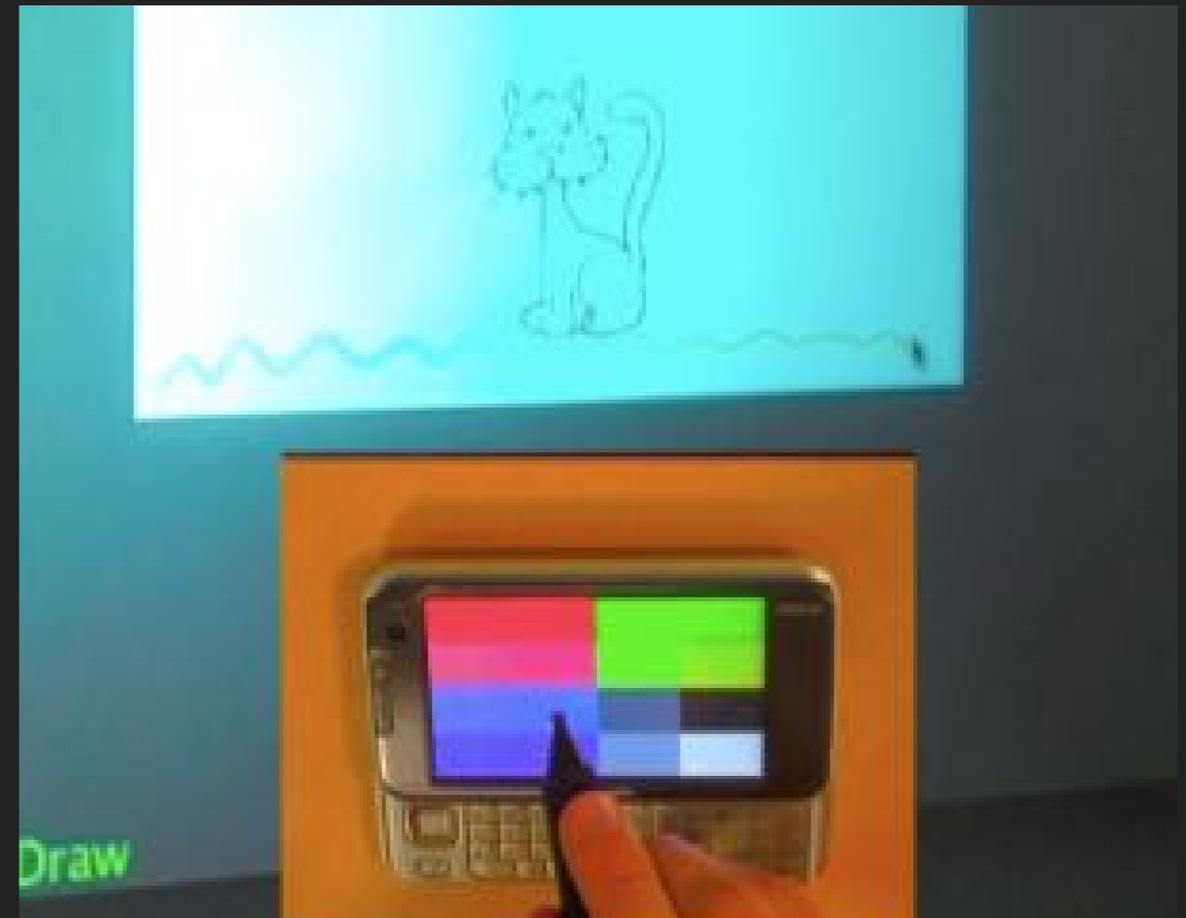
## REUSE

- ▶ Output reuse (objects)
- ▶ Example : copy-paste
  
- ▶ Input reuse (commands)
- ▶ Example : redo, macros



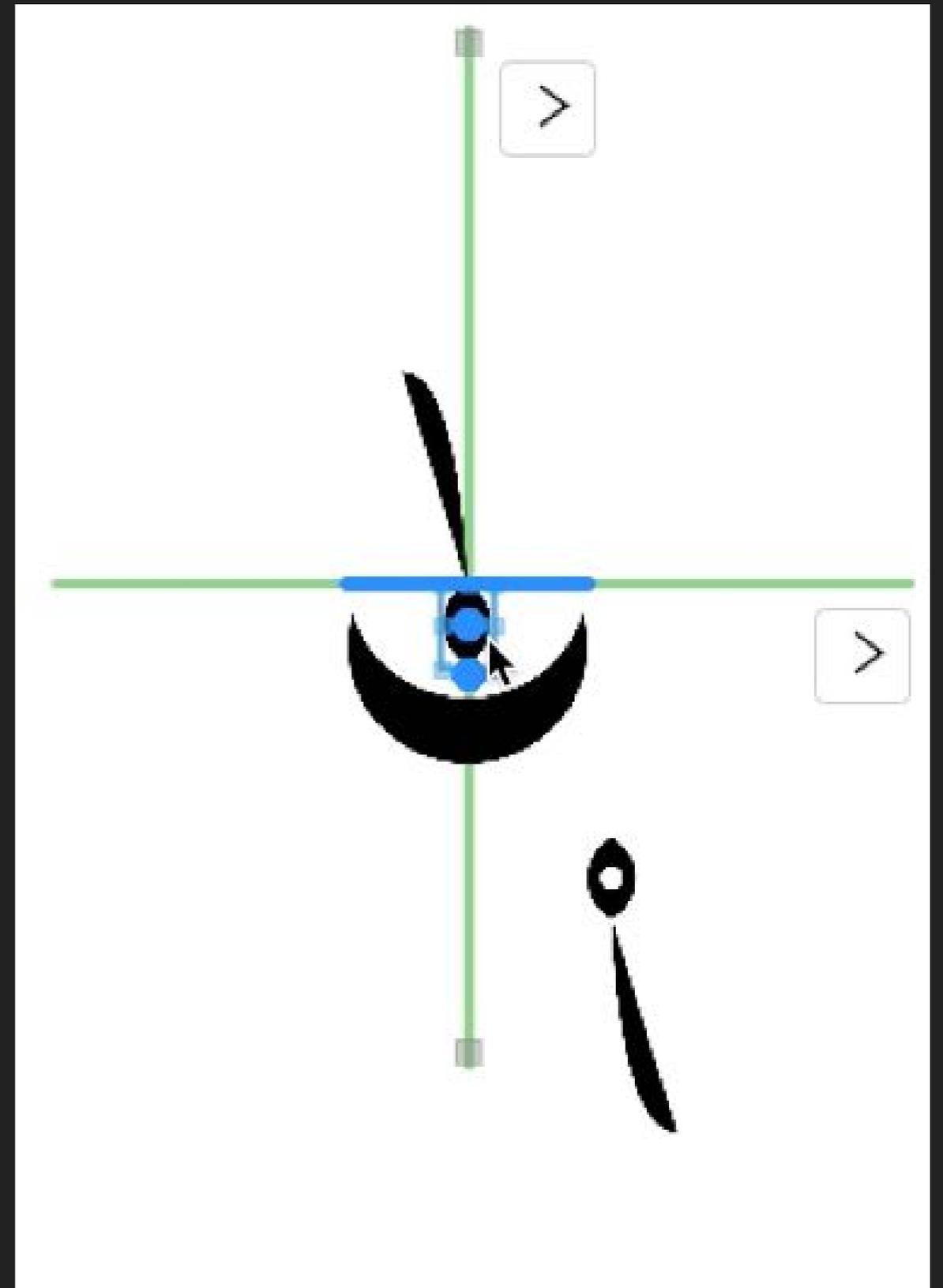
## UBICOMP INSTRUMENTS

- ▶ Instruments spanning multiple interaction surfaces
- ▶ Multi surface interaction
- ▶ VIGO (CHI'09)



## ANALYZING STICKYLINES

- ▶ Reification of alignment
- ▶ Polymorphic
  - ▶ Align objects of different types
  - ▶ Move command adds/removes object to/from StickyLines
- ▶ Reusable
  - ▶ Copy StickyLine (with objects)
  - ▶ Copy tweaks



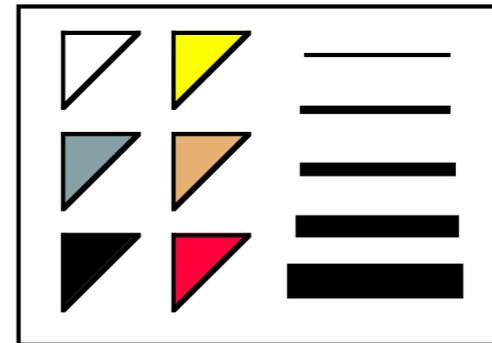
# INTEGRATING THE PRINCIPLES

- ▶ Reification and polymorphism:
  - ▶ More objects and fewer commands
- ▶ Reification facilitates output reuse:
  - ▶ More first-class objects can be reused
- ▶ Polymorphism facilitates input reuse:
  - ▶ Increases the scope of commands

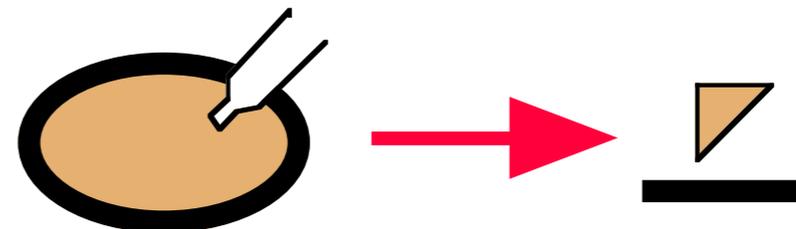
## STYLES

- ▶ Reification of a collection of attributes
- ▶ Polymorphism
  - ▶ Apply style to different objects
- ▶ Reuse
  - ▶ Extract style from object
  - ▶ Apply to other objects

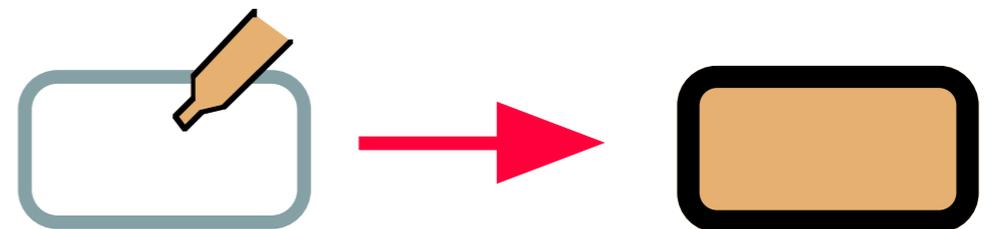
Style



Style picker

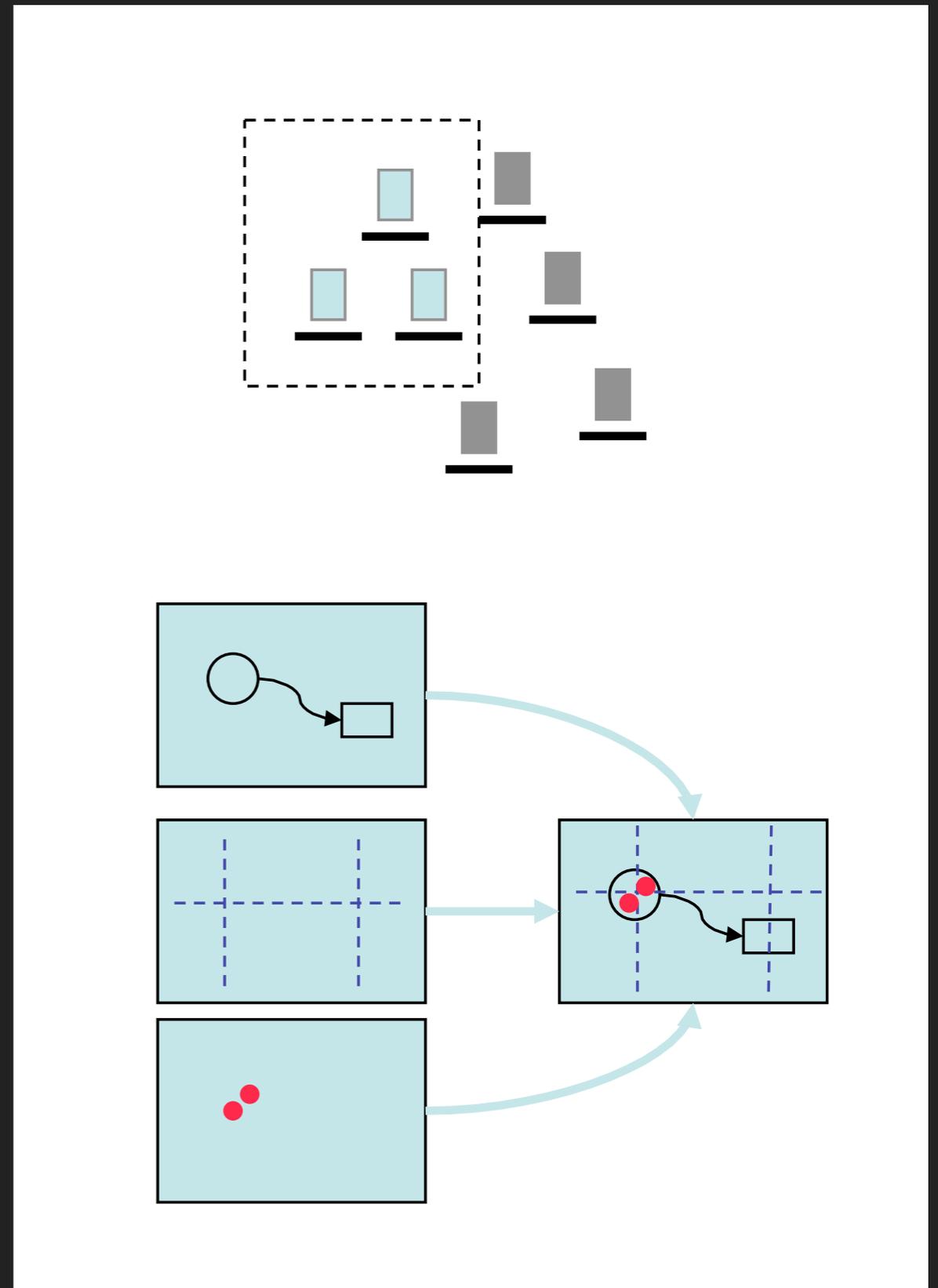


Style dropper



## OTHER EXAMPLES

- ▶ Groups
  - ▶ Reify a selection
  - ▶ Support polymorphism
- ▶ Layers
  - ▶ Reify modes
- ▶ Macros
  - ▶ Reify sequences of commands



# OBJECT-ORIENTED DRAWING

H. Xia, B. Araujo, T. Grossman, D. Wigdor  
[Video](#)

## Object-Oriented Drawing

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