INVENTION OF THE TOOL

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

2001, A Space Odyssey
INVENTION OF TOOLS

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

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

L’encyclopédie - Diderot & d’Alembert, 1751-1772
INTRODUCTION

TOOLS TO SHAPE OUR ENVIRONMENT
INTRODUCTION

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
A BIT OF PSYCHOLOGY

AFFORDANCES

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  James Gibson

Space affordances, P. Atmodiwirjo
PERCEPTUAL LEARNING

- Learning to recognize affordances

- “We perceive to learn, as well as learn to perceive”
  
  Eleanor Gibson
SIGNIFIERS

- Affordances as redefined by Don Norman
- To be perceived, an affordance must be visible
A BIT OF PSYCHOLOGY

SIGNIFIERS

- Affordances as redefined by Don Norman
- To be perceived, an affordance must be visible
THE POWER OF TOOLS

- We internalize the tool as a physical extension of our body
We internalize the tool as a physical extension of our body.
A BIT OF PSYCHOLOGY

TECHNICAL REASONING

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

François Osiurak
A BIT OF PSYCHOLOGY

APPROPRIATION

- A pen or a ruler?

- A mug or a compass?
A BIT OF PSYCHOLOGY

WHEN YOU HAVE A HAMMER. . .

- We create tools because we overestimate their capabilities

François Osiurak
WHAT ABOUT DIGITAL TOOLS?
SKETCHPAD
IVAN SUTHERLAND, 1963

GRAPHICAL INTERACTION
DIGITAL TOOLS

COMPUTER AS TOOL

“Computers are like a bicycle for our minds”
Steve Jobs
DIGITAL TOOLS

FROM PHYSICAL TOOLS . . .
DIGITAL TOOLS

... TO DIGITAL TOOLS
INSTRUMENTAL
INTERACTION
INSTRUMENTAL INTERACTION

INTERACTION IS MEDIATED BY A TOOL
INSTRUMENTAL INTERACTION

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INSTRUMENTAL INTERACTION

A DESCRIPTIVE MODEL

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

REIFICATION

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

- Transform a command into an object that can be directly manipulated
- Example: alignment
aligning an object to more than one StickyLine
The same tool can be used in different contexts

Example: color selector

Free the tools from the applications where they are trapped!
INSTRUMENTAL INTERACTION

REUSE

- Output reuse (objects)
- Example: copy-paste
INSTRUMENTAL INTERACTION

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)
INFORMATION
SUBSTRATES
SUBSTRATES

INSTRUMENTAL INTERFACES

- To create and edit content
INSTRUMENTAL INTERFACES

- BUT limited:
- How to use the pen from the “Paper” app to write on a photo in the “iPhoto” app?
Data does not exist in a vacuum
Data does not exist in a vacuum

Substrates provide context for interpreting data and constraints for presenting and interacting with it

Examples: musical score, spreadsheet, page layout, graph...
Support the music composition process by combining and interpreting notations in various ways.
Instruments can manipulate substrates

Instruments probe the substrate for specific properties or protocols to decide if they can operate

Instruments are themselves substrates

Instruments can be embedded in substrates
A substrate can represent data in another substrate

Instruments can modify the different substrates in the stack

Example:
A table substrate - edit a value
A graph substrate - set its type
A histogram - set its color
An image - paint on it
CONCLUSION
Reinventing interaction by separating tools from applications, and replacing applications with shareable and appropriable information substrates.
THANKS!

QUESTIONS?