

# week 02



# Activity Theory and HCI

---

Implications for user interfaces

# Lecture Outline

---

- Historical development of HCI (from Dourish)
- Activity theory in a nutshell (from Kaptelinin & Nardi)
- Activity theory and design implications for HCI

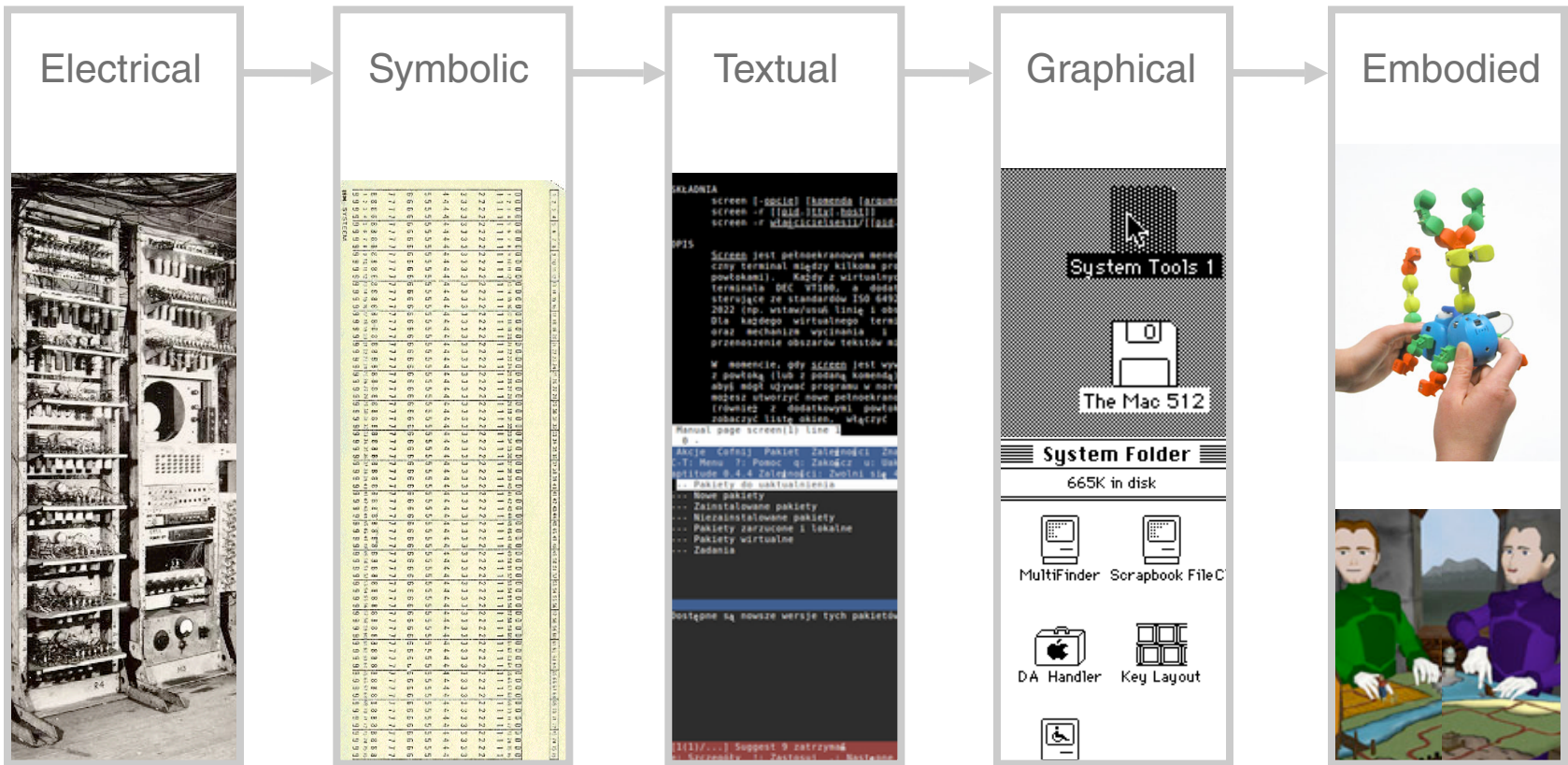
# Historical Development of User Interfaces

From electrical to embodied interactions

---

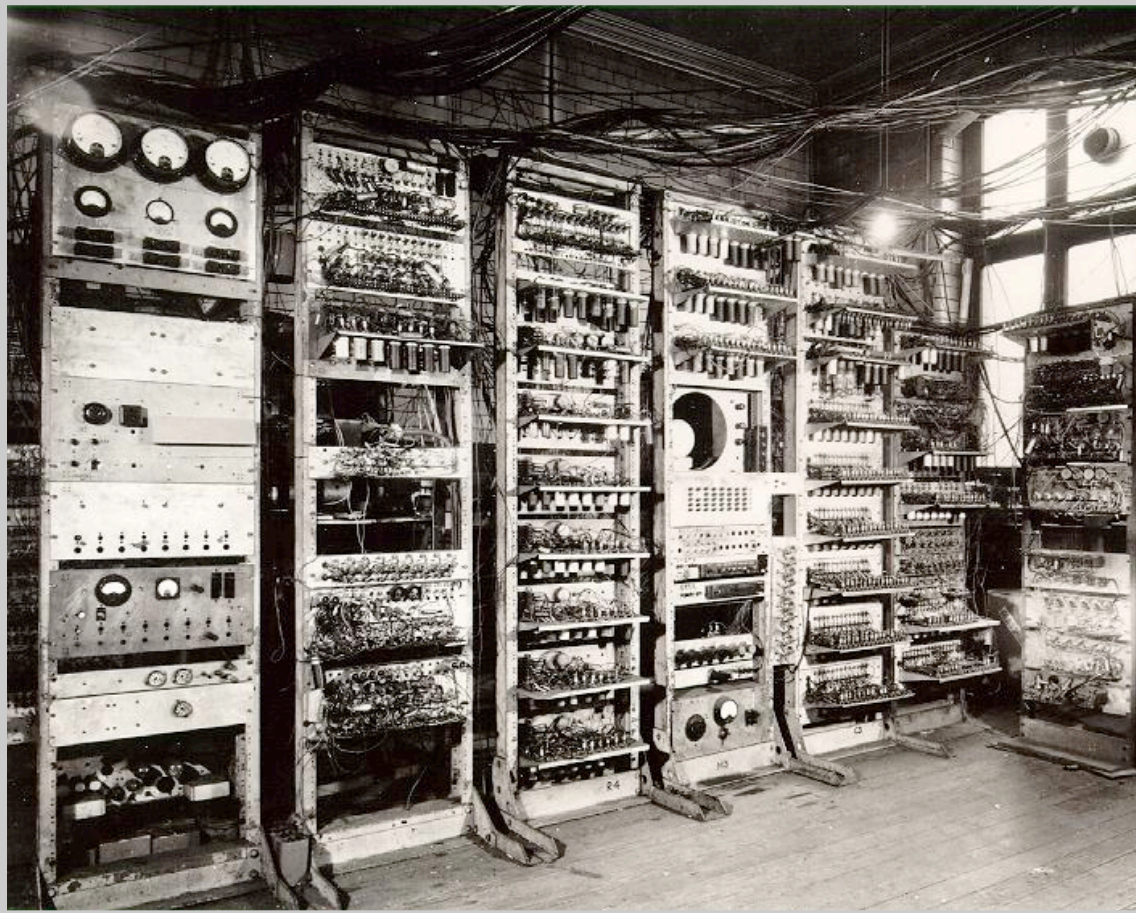
“Our experience using computers reflects a tradeoff made more than 50 years ago. We are now in a position to reconsider the trade-off.”  
From *Where the Action Is* (Dourish, 2001)

# Historical Development of UI



## Historical Development of HCI

# Electrical

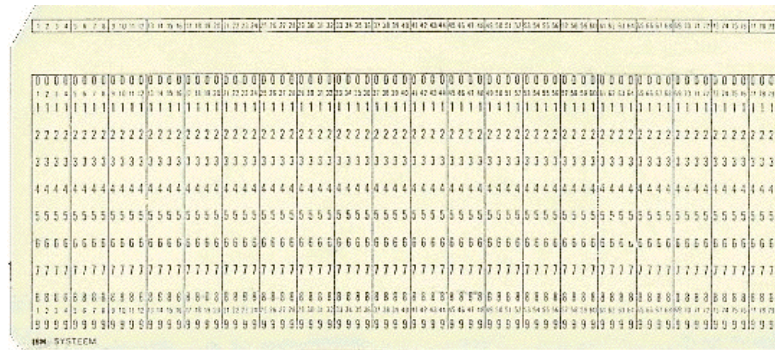


The Small Scale Experimental Machine, AKA “Baby” built at Manchester University in 1948.

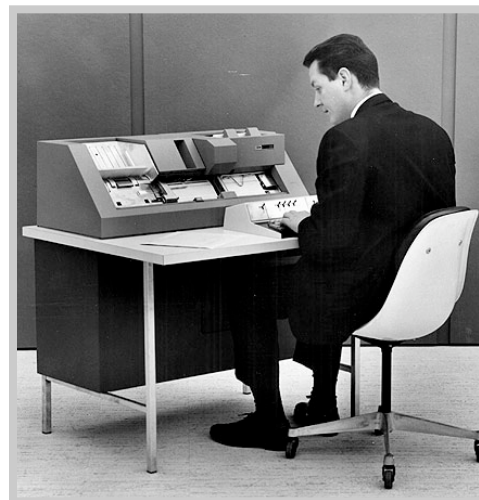
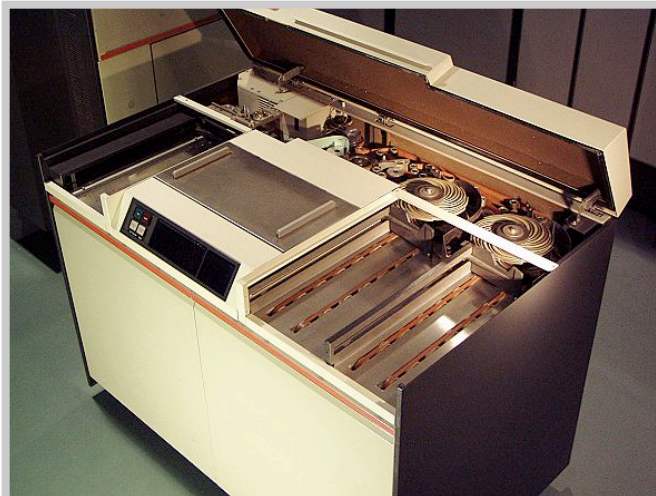
- Special purpose devices (e.g., automatic calculation of missile trajectories, patterns in coded messages)
- To program the machine for different tasks, electrical circuits need to be changed
- Interacting with the system required a thorough understanding of the electronic design

## Historical Development of HCI

# Symbolic



- Introduction of programming systems
- Symbolic forms of interaction is not textual (e.g., punched cards)
- More regularized instructions available across a wider range of machines



IBM 29 card punch (circa 1950's)

## Historical Development of HCI

# Textual

```

SCREEN[1]                               SCREEN[1] 09:12 owala 15 zostało
09:12 -- Asia/9675929 --- --
09:12 -- aha...
09:12 --
09:13 -- Asia/9675929 --- --
09:13 a ja zaczynam juz sprzatac..
09:13 --
09:14 -- oflara/8647675 --- --
09:14 ok
09:14 --
09:14 -- oflara/8647675 --- --
09:14 a ja nie wiem, czy bede mogl przyjsc...
09:14 --
09:14 -- Asia/9675929 --- --
09:14 --
09:16 -- Asia/9675929 --- --
09:16 a spytasz sie..
09:16 --
09:16 -- oflara/8647675 --- --
09:16 no
09:16 --
09:16 -- Asia/9675929 --- --
09:16 wez sie umniecniej tak radnie:)
09:16 --
09:17 [oflara/8647675: wskaz/2:Asia]
[Asia]
@ kkg

PREFIX=(ovj)+ STATUSMSG=+ TOPICLEN=390 NETWORK=OPIC
MAXLIST=bel:100 MAXTARGETS=4 CHANTYPES=#& :are supported by
this server
1: CHANLIMIT=#:50 CHANNELLEN=50 CHANMODES=eIob,k,l,impqMRS
AMAYLEN=160 KNOCK ELIST=CMTU SAFELIST EXCEPTS=e INVEK=I
:are supported by this server
2: 18GAAAGCN user unique 00
3: local users on irc 251 : 64
4: global users on irc 18 : 04
5: invisible users on irc 4328 : 1004
6: ircops on irc 33 : 14
7: total users on irc 4328 :
8: unknown connections 1
9: total servers on irc 23 : avg. 188 users per server:
10: total channels created 1355 : avg. 3 users per channel
11: Current local users: 251 Max: 337
12: Current global users: 4328 Max: 4851
13: Highest client connection count 338 : 337
14:
15: The new BitChX help system from EPIC is available by typing
16: /ehelp.
17: The old BitChX help files are available as /bhelp.
18: ircII help files are available as /help.
19:
20: Mode change +l for user lukasz
21: Mode change +su for user lukasz
09:17as[[lukasz(-isw)](Mail: 62) |]
[Log ??]
@)

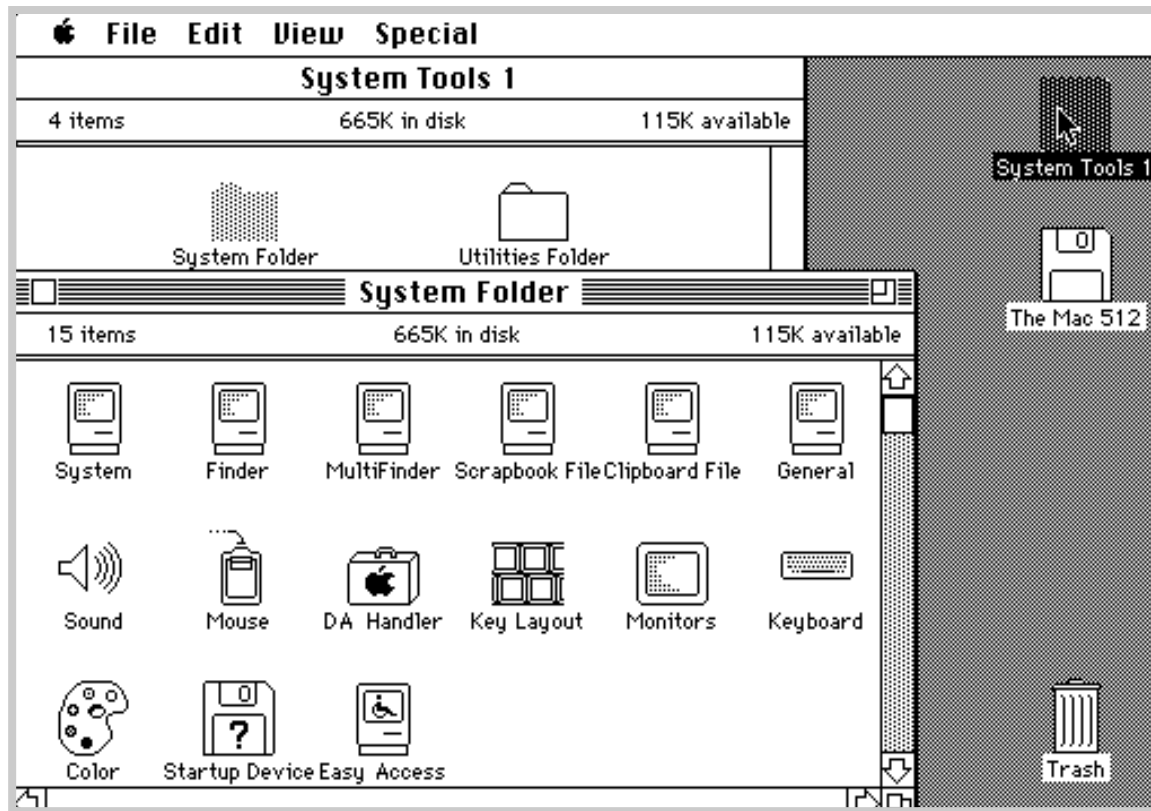
```

- Takes advantage of the best-developed form of symbolic interaction: written language
- More like a “dialog”

E.g., early UNIX, DOS

## Historical Development of HCI

# Graphical



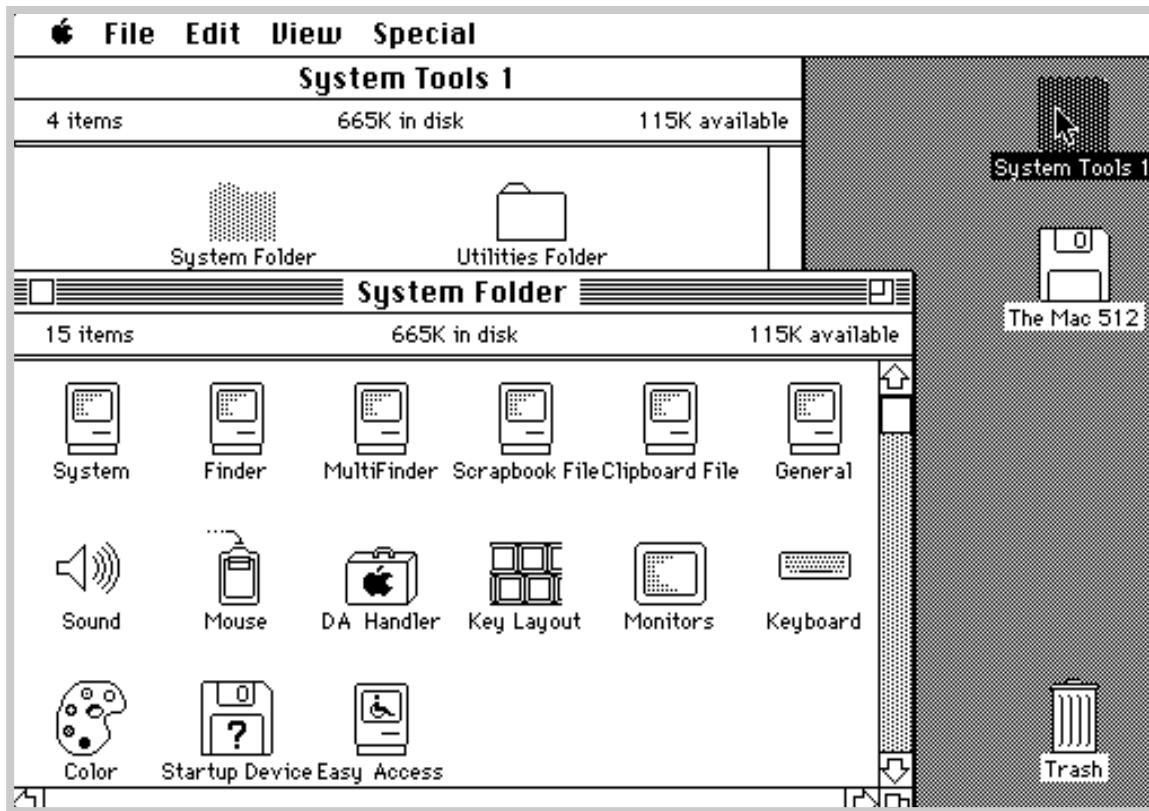
Turning interaction into two-dimensional space rather than a one-dimensional stream of characters

Macintosh System 4.2, 1987



## Historical Development of HCI

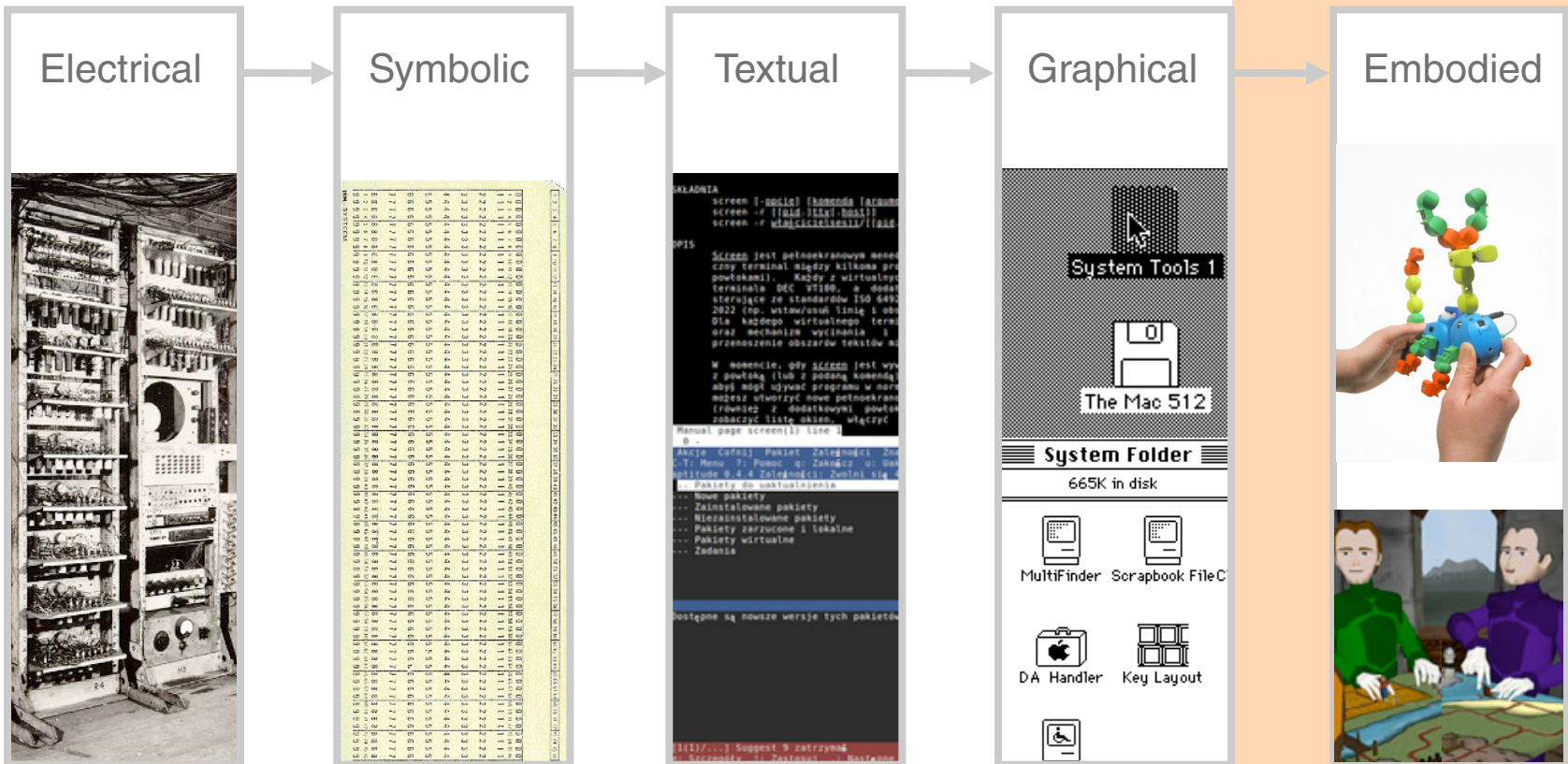
# Graphical



Macintosh System 4.2, 1987

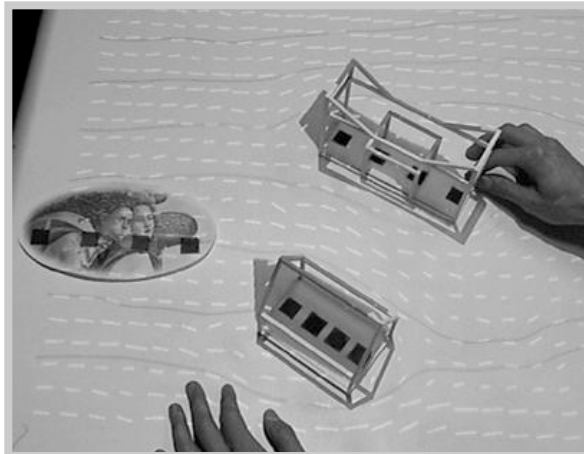
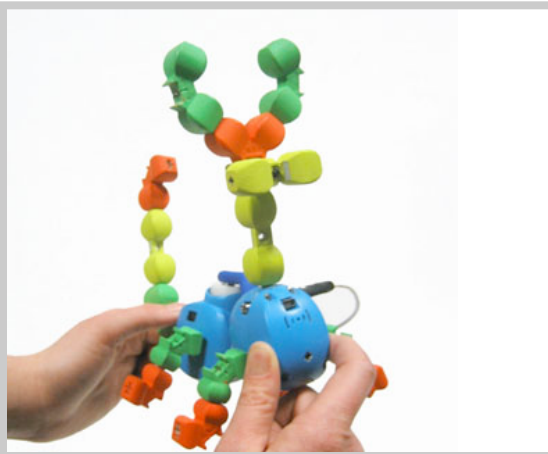
- **Peripheral Attention**  
Primary space, secondary space (e.g., windows and dashboards)
- **Pattern recognition and spatial reasoning**  
Opportunities to arrange data spatially
- **Information density**  
A picture really can be worth a thousand words (e.g., diagrams)
- **Visual metaphors**  
File cabinets, trashcans, desktop tools

# Embodied Interaction



## Historical Development of HCI

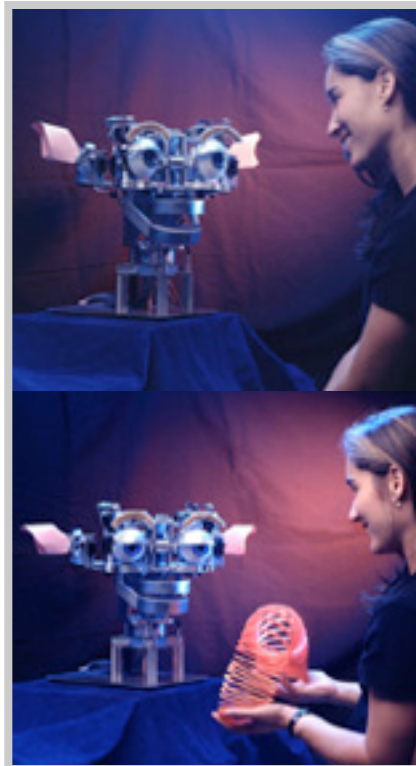
# Tangible Interaction



- Computation that moves beyond desktop
- Interaction is incorporated more richly in our daily experience of the physical world
- Trend 1: Distribute computation across a variety of devices
- Trend 2: Augment the everyday world with computational power

## Historical Development of HCI

# Social Computing



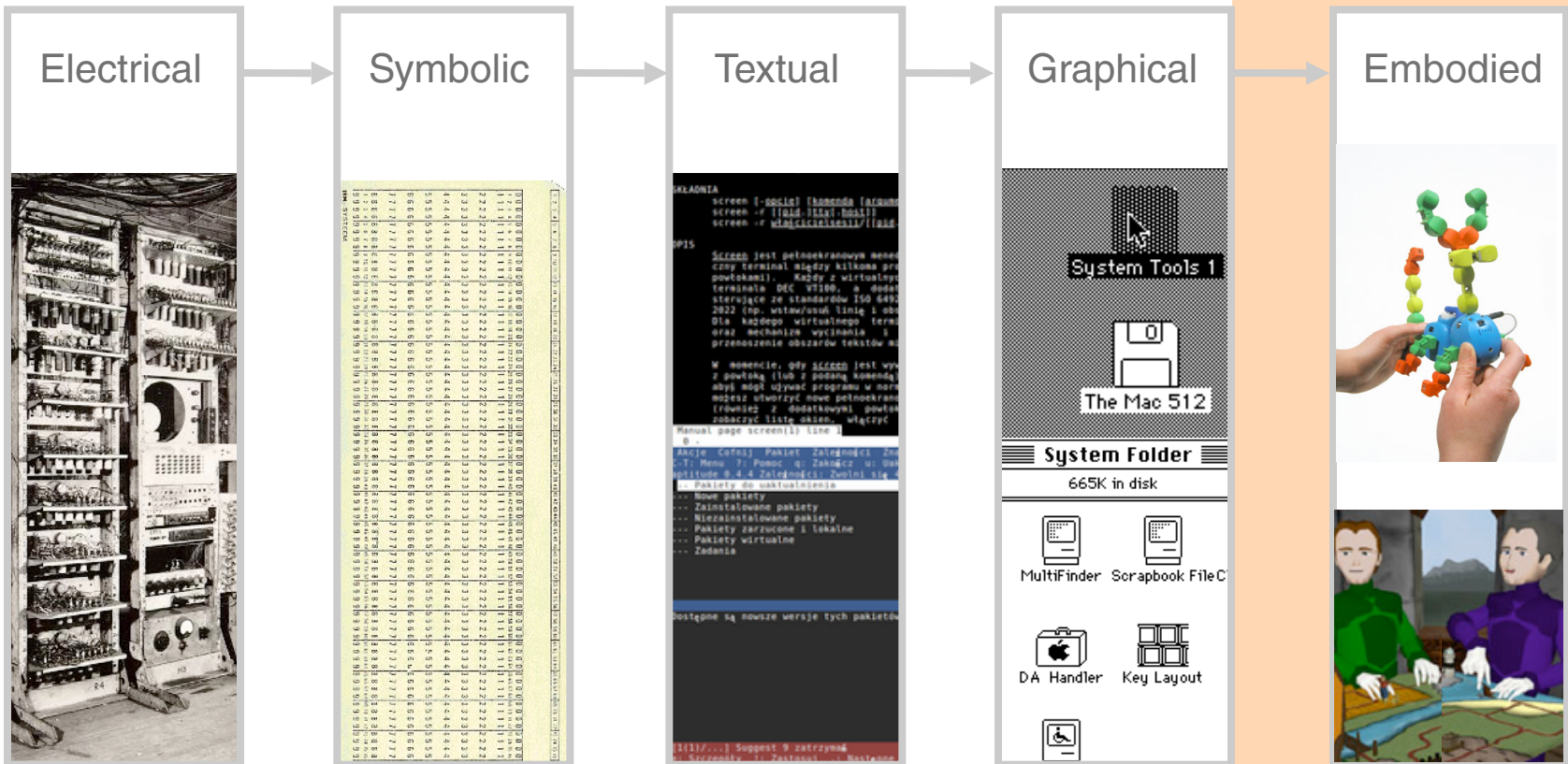
Kismet (Breaseal, 2000)



Spark (Vilhjálmsón, 2004)

- The application of sociological understanding to the design of interactive systems

# Embodied Interaction



# “Computer reaching out”

---

Interaction moves from being directly focused on the physical machine to incorporating more and more of the **user’s world** and the **social setting** in which the user is embedded. The scope of human-computer interaction is expanding to include larger-scale, longer-term phenomena of computer use. (Dourish, 2004)

# Activity Theory and HCI

From human factors to human actors

---

Attempts to incorporate human activity in interaction design have led to ideas of “activity-based,” “activity-centered,” or “activity-centric” computing. How people actually use technology at work and play.

# Activity Theory

---

Aims to understand individual human beings, as well as the social entities they compose, in their natural everyday life circumstances, through an analysis of the genesis, structure, and processes of their activities.



## Activity Theory

# Brief Background

---



Behaviorist (circa 1930's)  
Observable behaviors

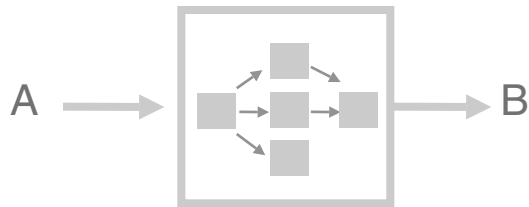
## Activity Theory

# Brief Background

---



Behaviorist (circa 1930's)  
Observable behaviors



Cognitivist (circa 1950's – 1990's)  
Mental models

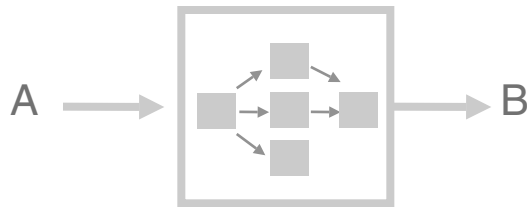
## Activity Theory

# Brief Background

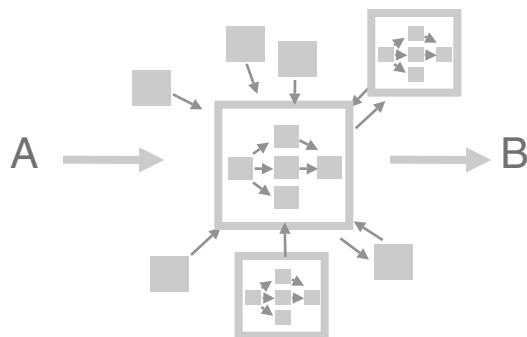
---



Behaviorist (circa 1930's)  
Observable behaviors



Cognitivist (circa 1950's – 1990's)  
Mental models

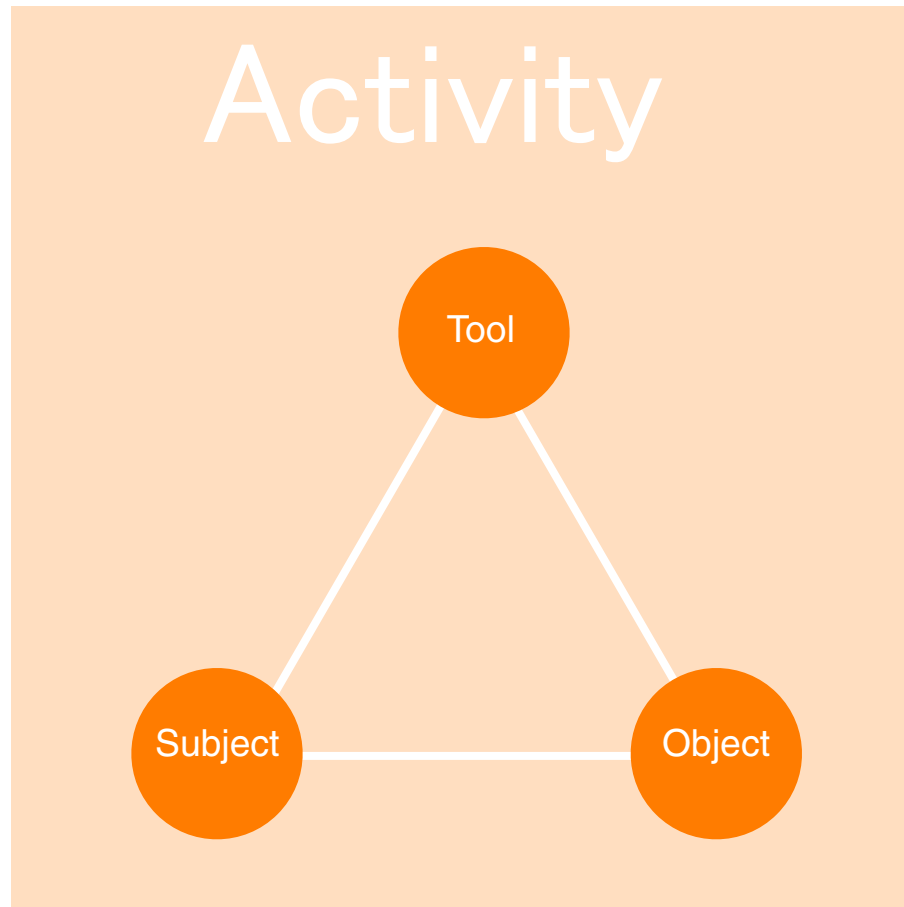


Social Constructivist (circa 1950's – 1990's)  
Activities and context

## Activity Theory

# Unit of Analysis

---

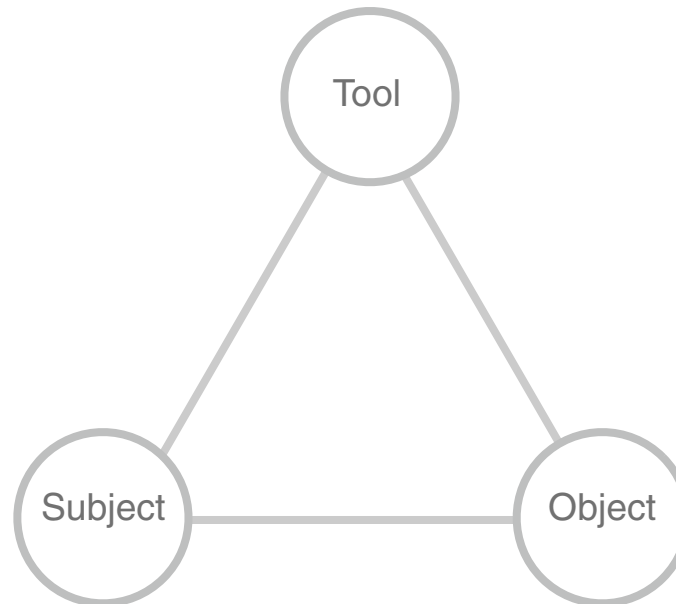


## Activity Theory

# Unit of Analysis

---

People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.

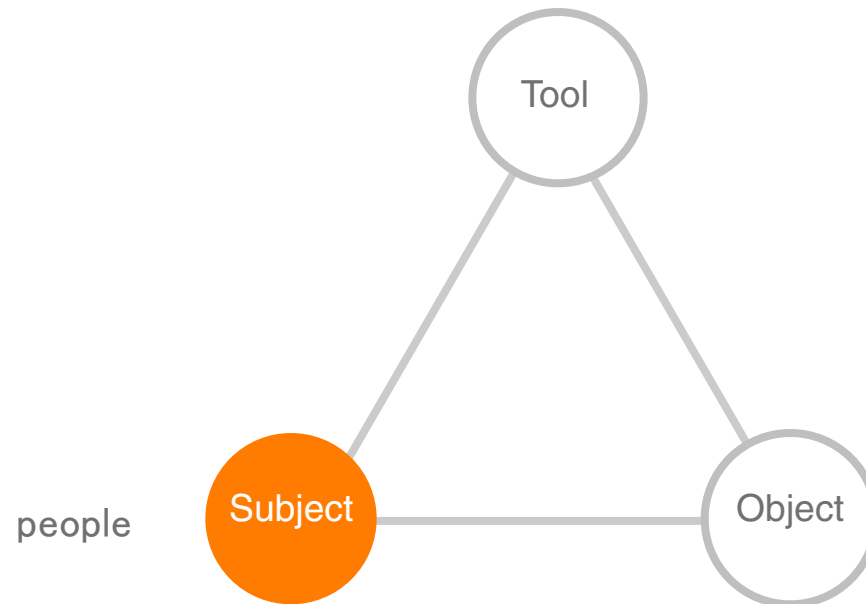


## Activity Theory

# Unit of Analysis

---

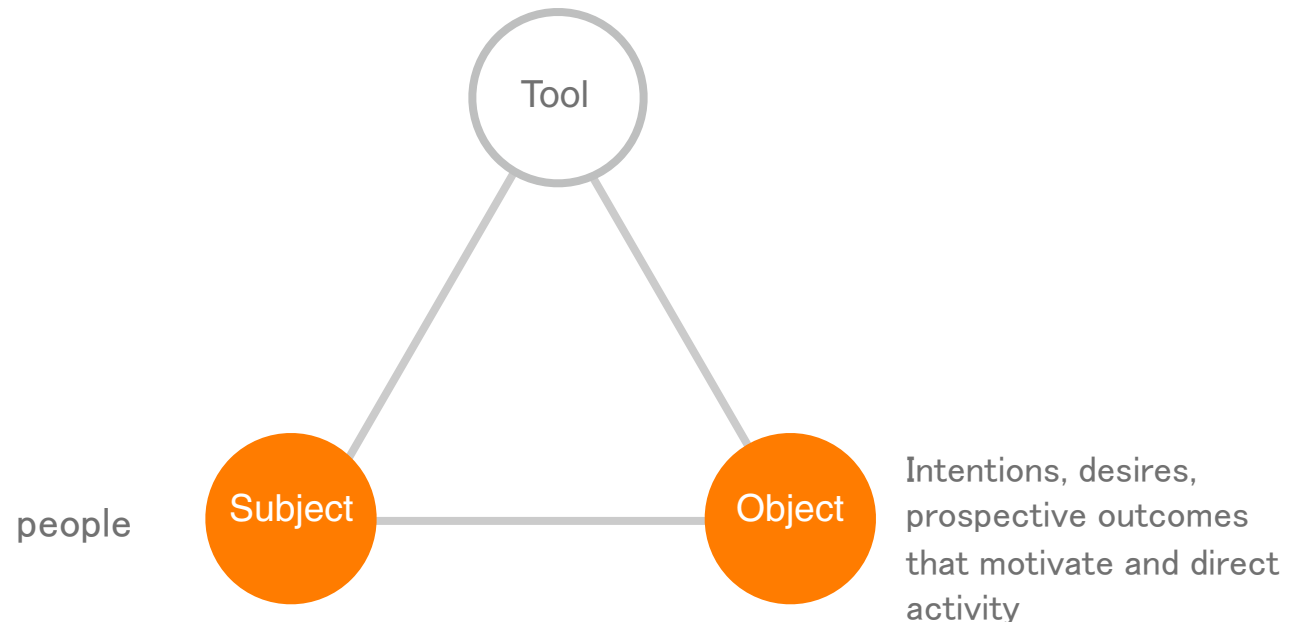
People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.



## Activity Theory

# Unit of Analysis

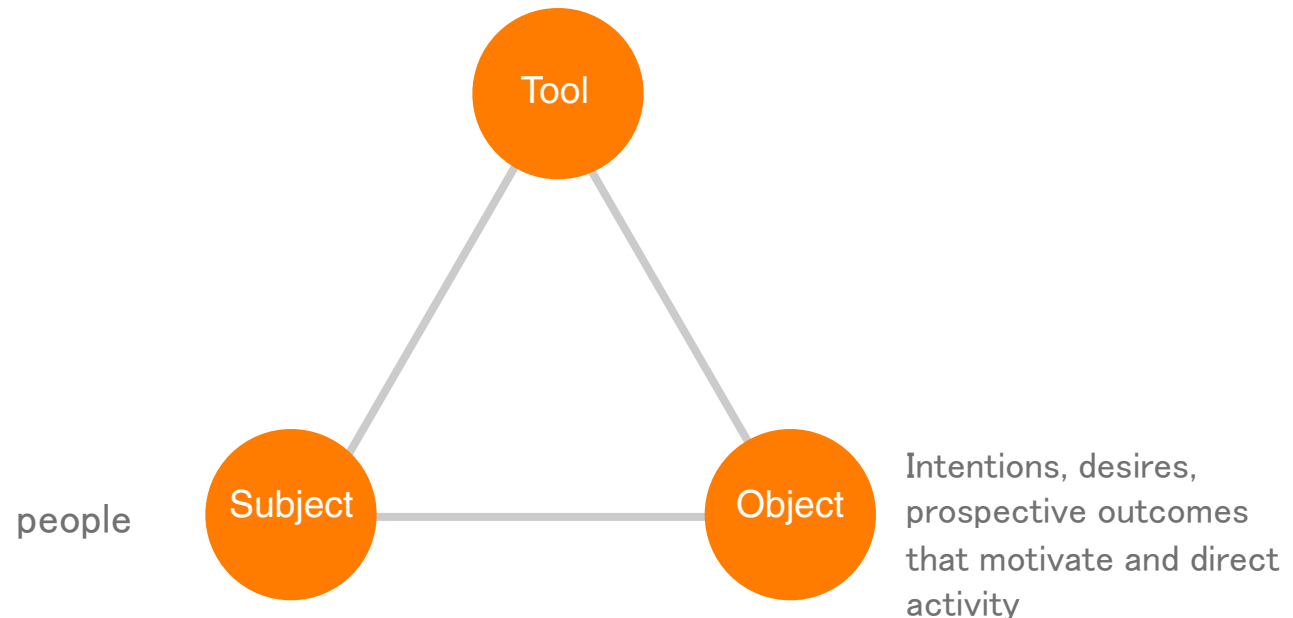
People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.



## Activity Theory

# Unit of Analysis

Tools mediate between people and the world. Activity theory casts the relationship between people and tools as one of **mediation**.

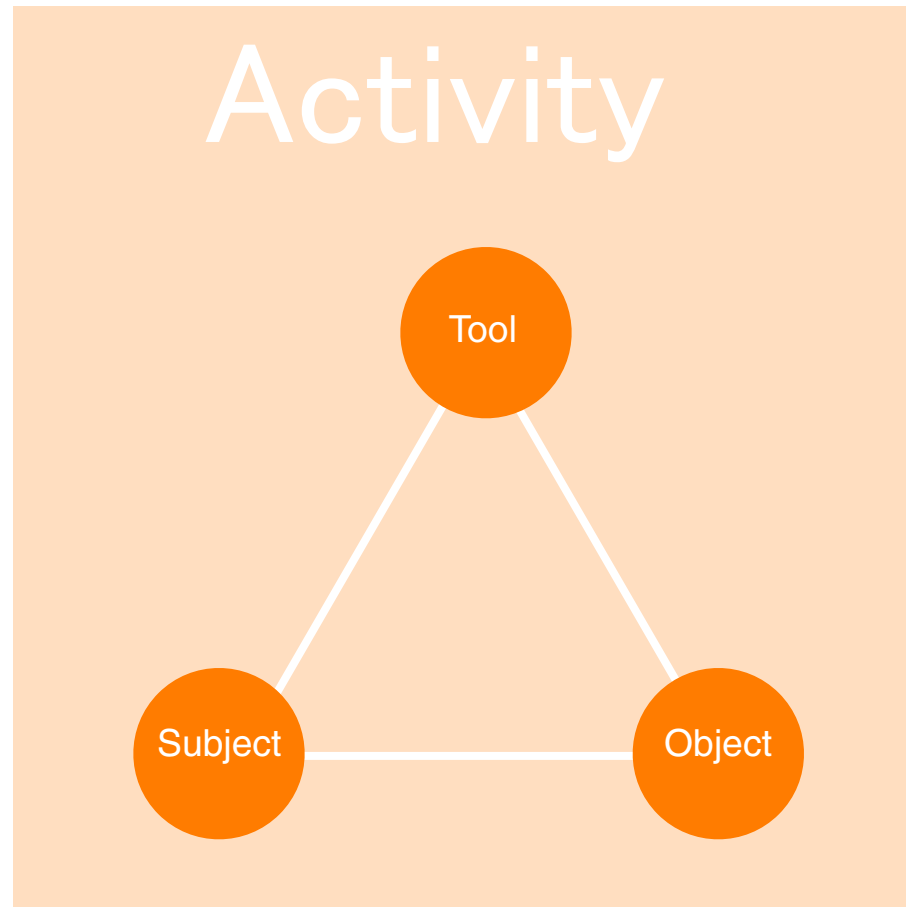




## Activity Theory

# Unit of Analysis

---

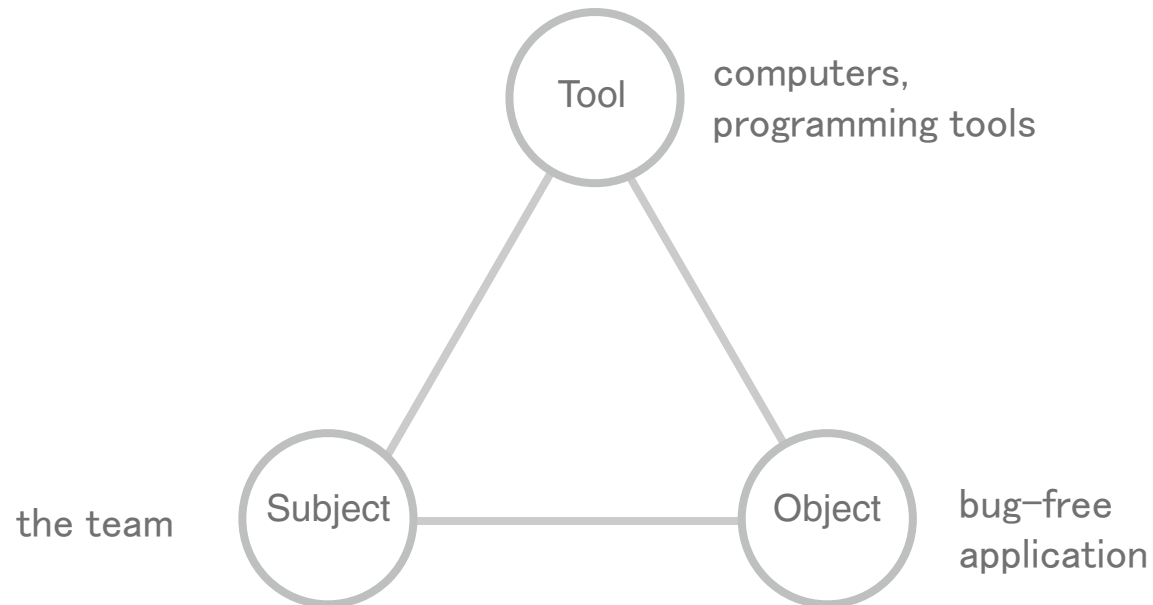


## Activity Theory

# Example 1

---

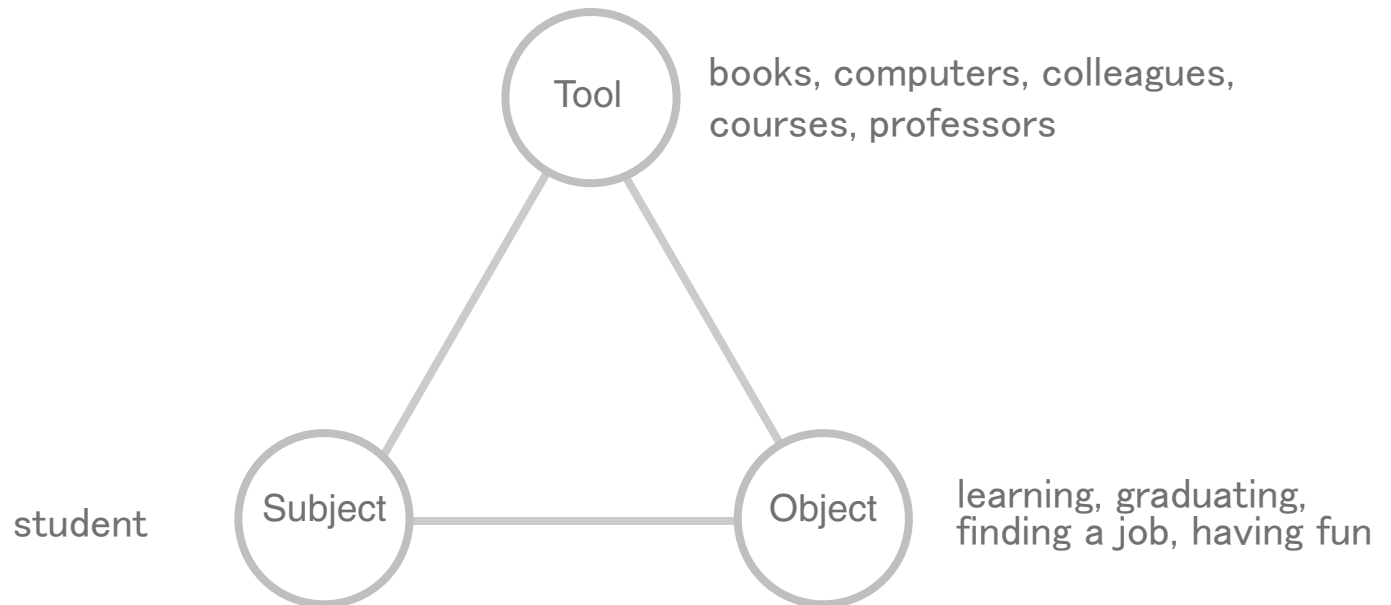
A software team programming a system for a client



## Activity Theory

# Example 2

Being a graduate student at UC Berkeley



# Activity Theory Concepts

---

- Hierarchical structure of activity
- Object-oriented
- Internalization and Externalization
- Tool mediation
- Development

## Activity Theory

# Hierarchical Structure

---



Activity



Actions

conscious  
goal-oriented



Operations

automatic,  
unconscious

## Activity Theory

# Hierarchical Structure

---

## Example 1



Activity

Building  
a house



Actions

Putting the roof  
up, transporting  
bricks by truck



Operations

Hammering,  
changing gears  
when driving

## Activity Theory

# Hierarchical Structure

---

## Example 2



**Activity**

Completing a software project



**Actions**

Programming a module, arranging meetings



**Operations**

Using OS

## Activity Theory

# Hierarchical Structure

---

## Example 3



Activity

Being a  
grad student



Actions

Passing exams



Operations

???

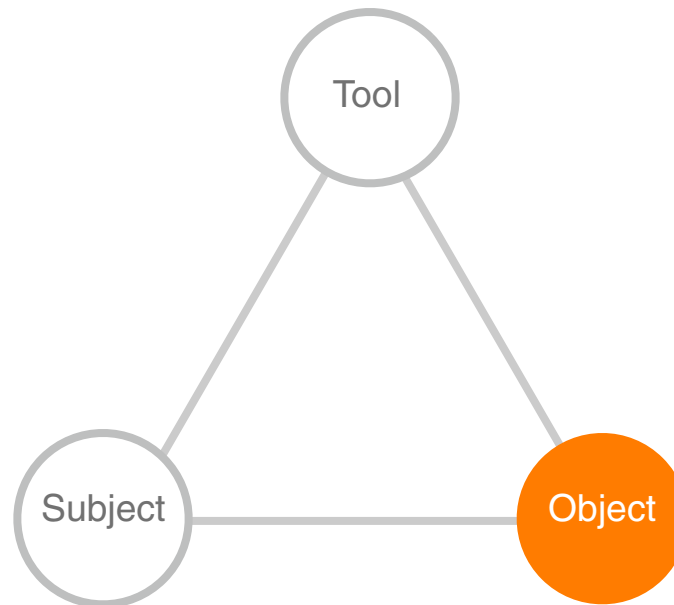


## Activity Theory

# Object

---

**Object** gives meaning to what people do.  
Objects separate one activity from another.

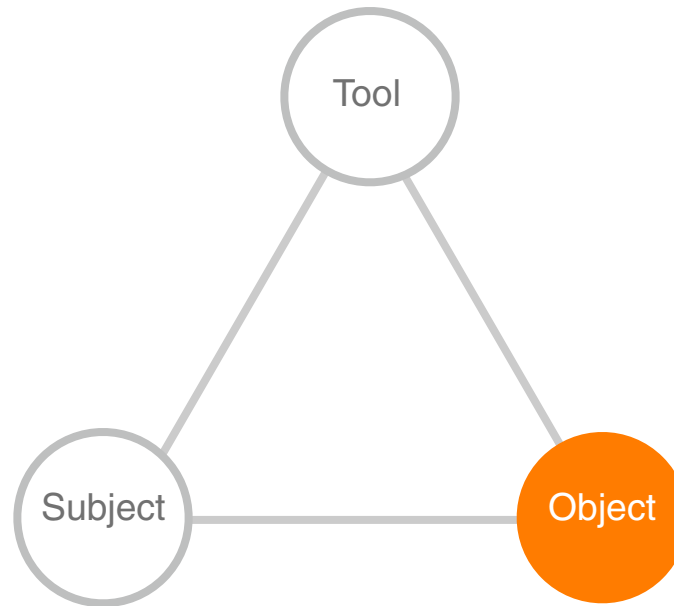


Intentions, desires,  
prospective outcomes  
that motivate and direct  
activity

## Activity Theory

# Object

Can be physical thing or ideal object



[www.boltonmuseums.org.uk](http://www.boltonmuseums.org.uk)

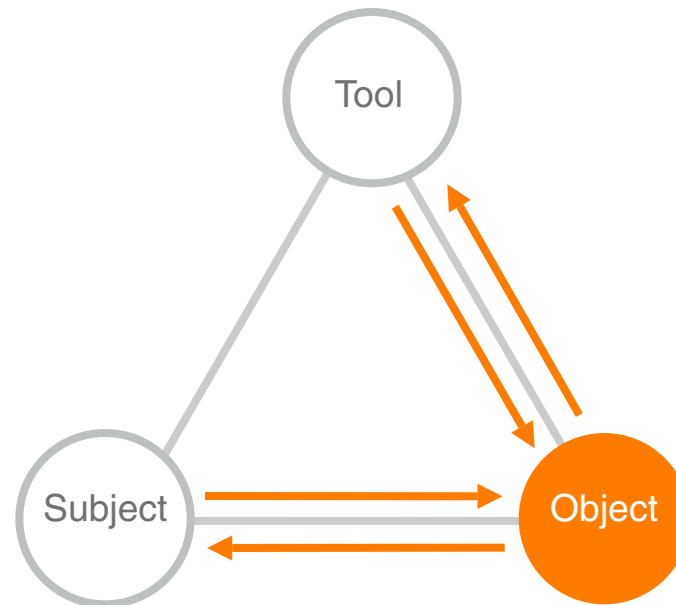


Intentions, desires, prospective outcomes that motivate and direct activity

## Activity Theory

# Object

Object is shaped by explicit and implicit rules, norms, and requirements existing in the local and the wider community



[www.boltonmuseums.org.uk](http://www.boltonmuseums.org.uk)

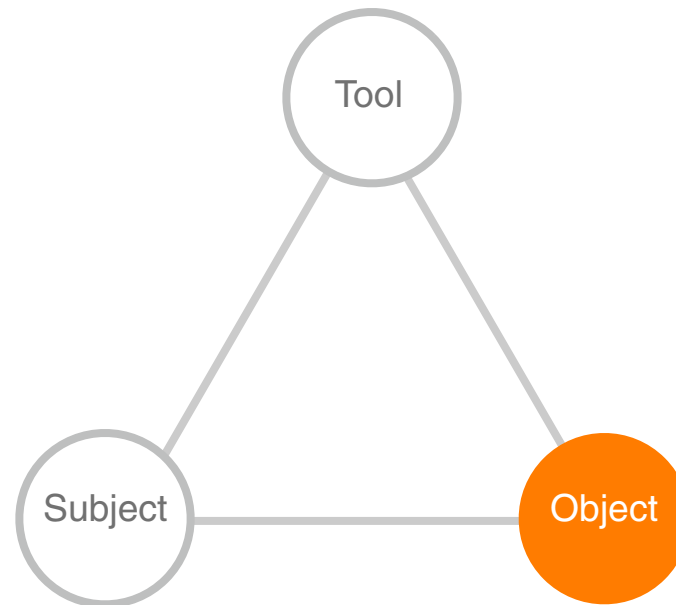


Intentions, desires, prospective outcomes that motivate and direct activity

## Activity Theory

# Object

The world provides **resistance** and **affordances** to our attempts to reach the object of our activities



[www.boltonmuseums.org.uk](http://www.boltonmuseums.org.uk)



Intentions, desires, prospective outcomes that motivate and direct activity

## Activity Theory

# Internal and External Activity

---

**Internal activity:** e.g., counting numbers in your head

**External activity:** e.g., counting numbers with your fingers

Activity Theory: Internalization / Externalization

# Internalization

---

Transformation of external activities into internal ones. Means for people to try potential interactions with reality without performing actual manipulation with real objects (mental simulations, imaginings, considering alternative plans, etc.).



Activity Theory: Internalization / Externalization

# Externalization

---

Transforms internal activities into external ones. It is important when a collaboration between several people requires their activities to be performed externally in order to be coordinated.

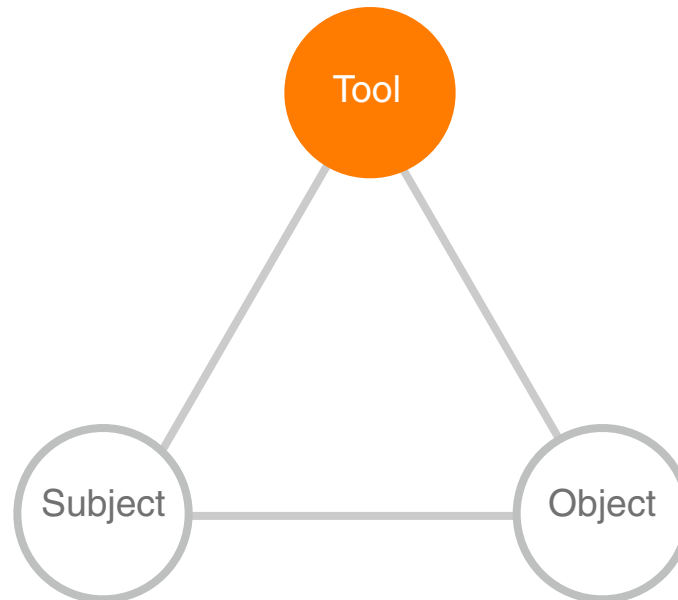


## Activity Theory

# Tools and Mediation

---

Tools shape the way human beings interact with reality. The shaping of external activities eventually results in the shaping of internal ones, and vice versa.



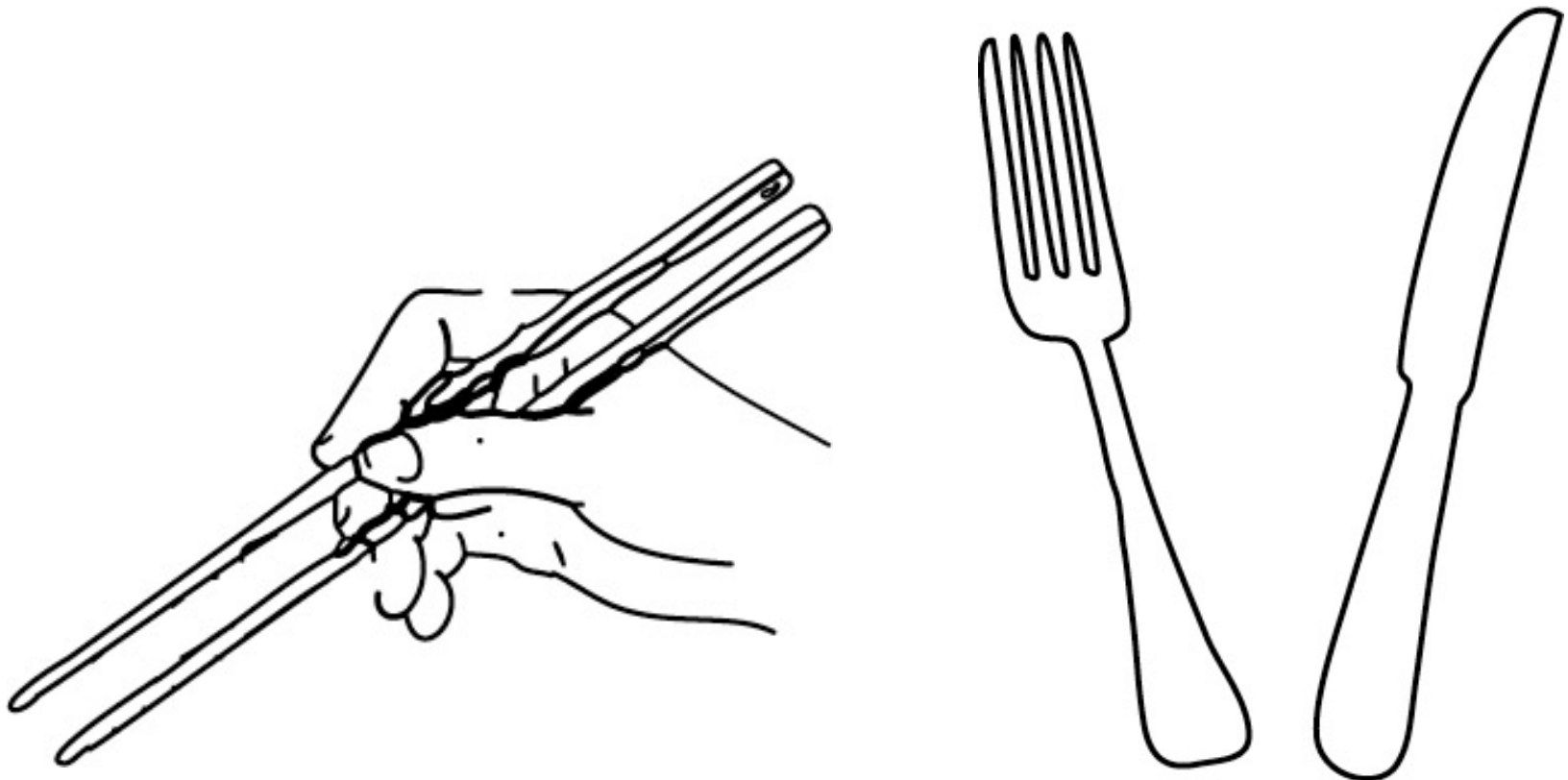


## Activity Theory

# Tools and Mediation

---

Use of tools is an accumulation and transmission of social knowledge.



Activity Theory

# Development

---

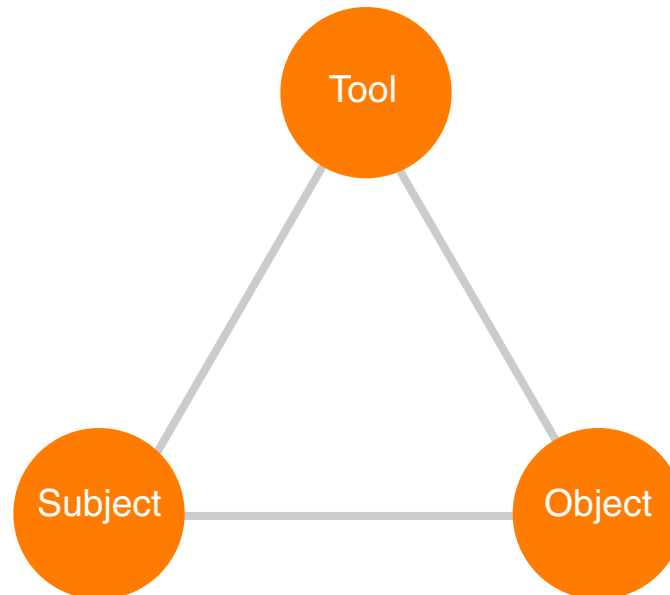
Human activity unfolds over time in a historical frame.

The long view: we cannot understand activity if we do not watch it cycle, grow, change. It would be desirable to establish a practice of design in which the development of users – their ability to grow and change with technology.

# Activity Theory: Summary

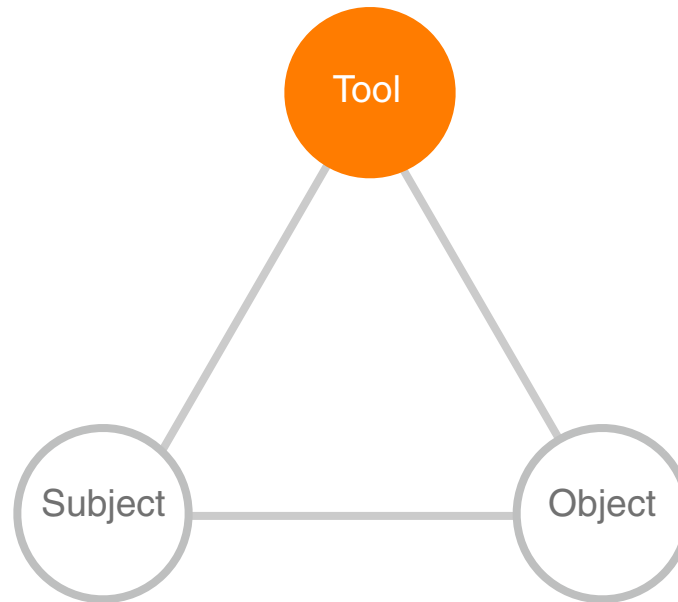
---

- Hierarchical structure of activity
- Object-oriented
- Internalization and Externalization
- Tool mediation
- Development



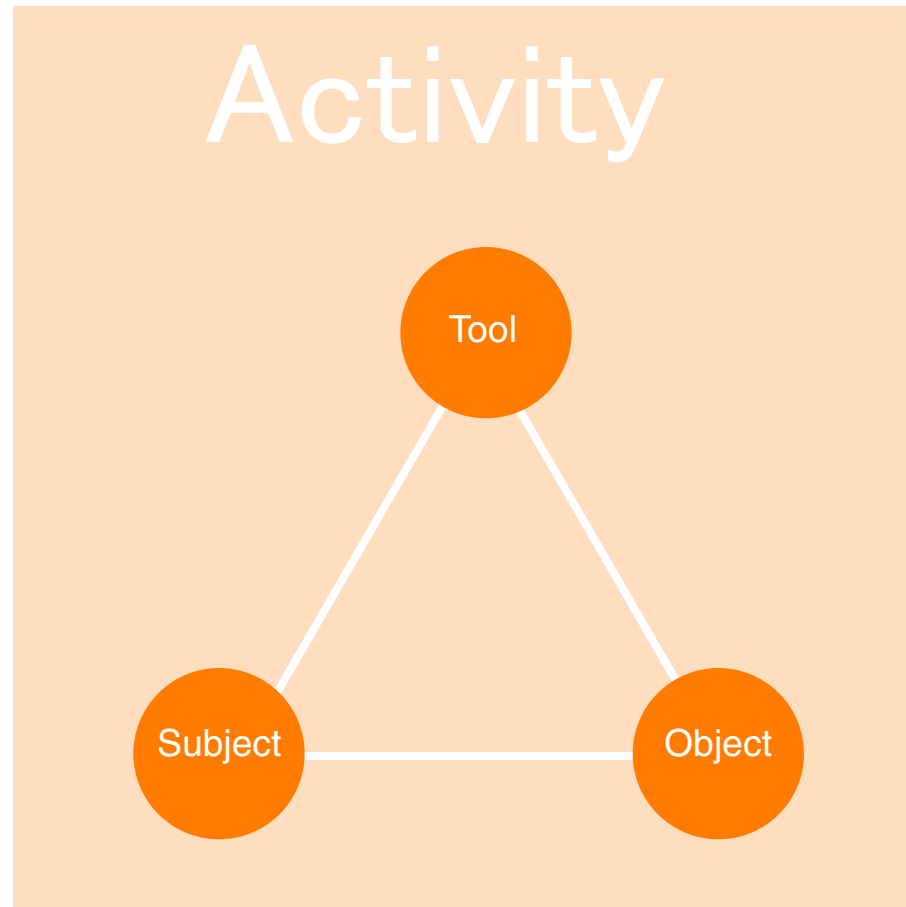
# Why Should We Care about Activity Theory?

---



# Designing Human Activities, Not Just Tools

---



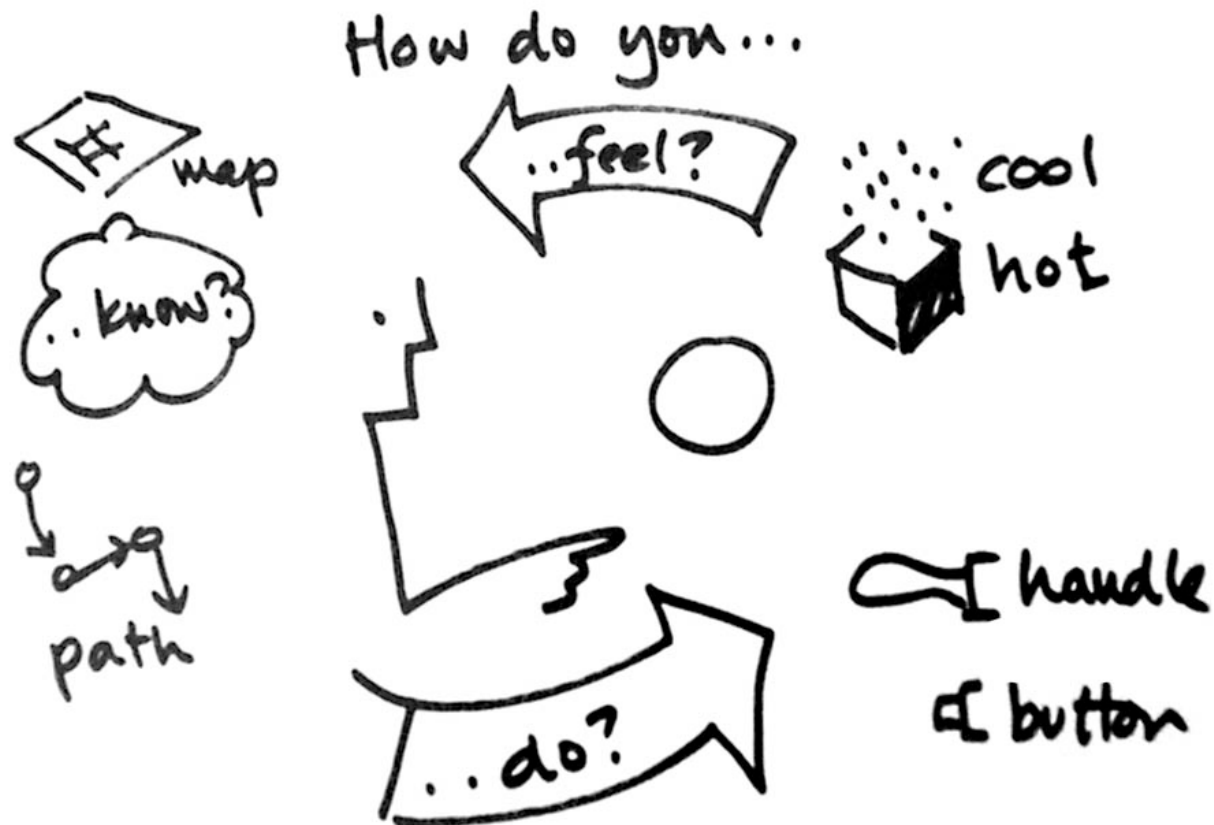
# Designing Interactions

From designers' perspective

---

The term “interaction design” was coined by Moggridge in late 1980’s. A new design discipline, dedicated to creating imaginative and attractive solutions in a virtual world, where one could design behaviors, animations, and sounds as well as shapes.

# Designing Interactions



# For Thursday, September 4

---

- Get the Physical Computing book
- Read the Intro, Chapters 1, 2, & 3 of Physical Computing book
- On Thursday, bring \$75 for the lab kit (cash or check)



# Thanks!