

# week

# 02



# Activity Theory and HCI

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Implications for user interfaces

# Outline

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

# Historical Development of User Interfaces

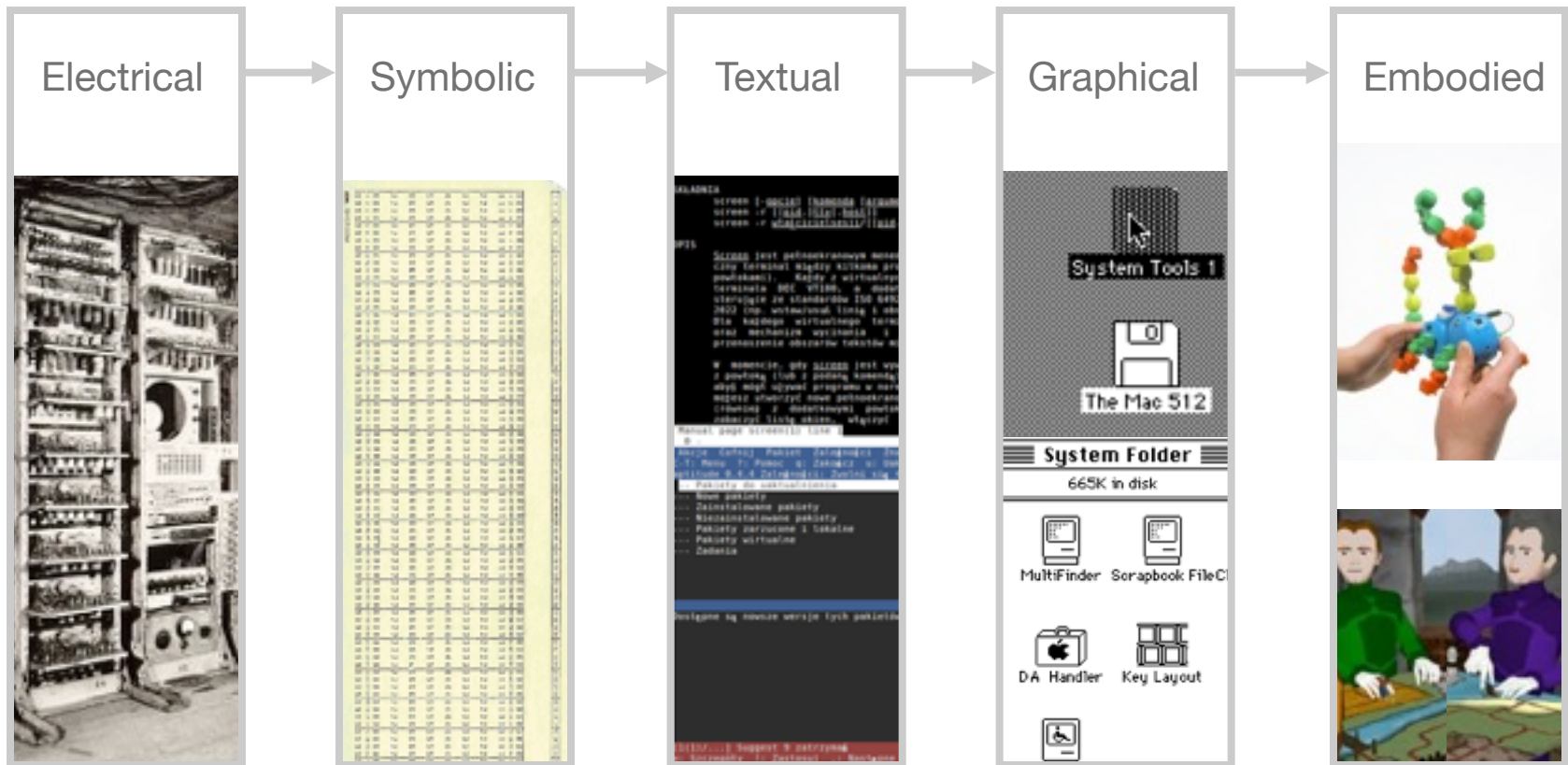
From electrical to embodied interactions

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“Our experience using computers reflects a tradeoff made more than 50 years ago. We are now in a position to reconsider the trade-off.”

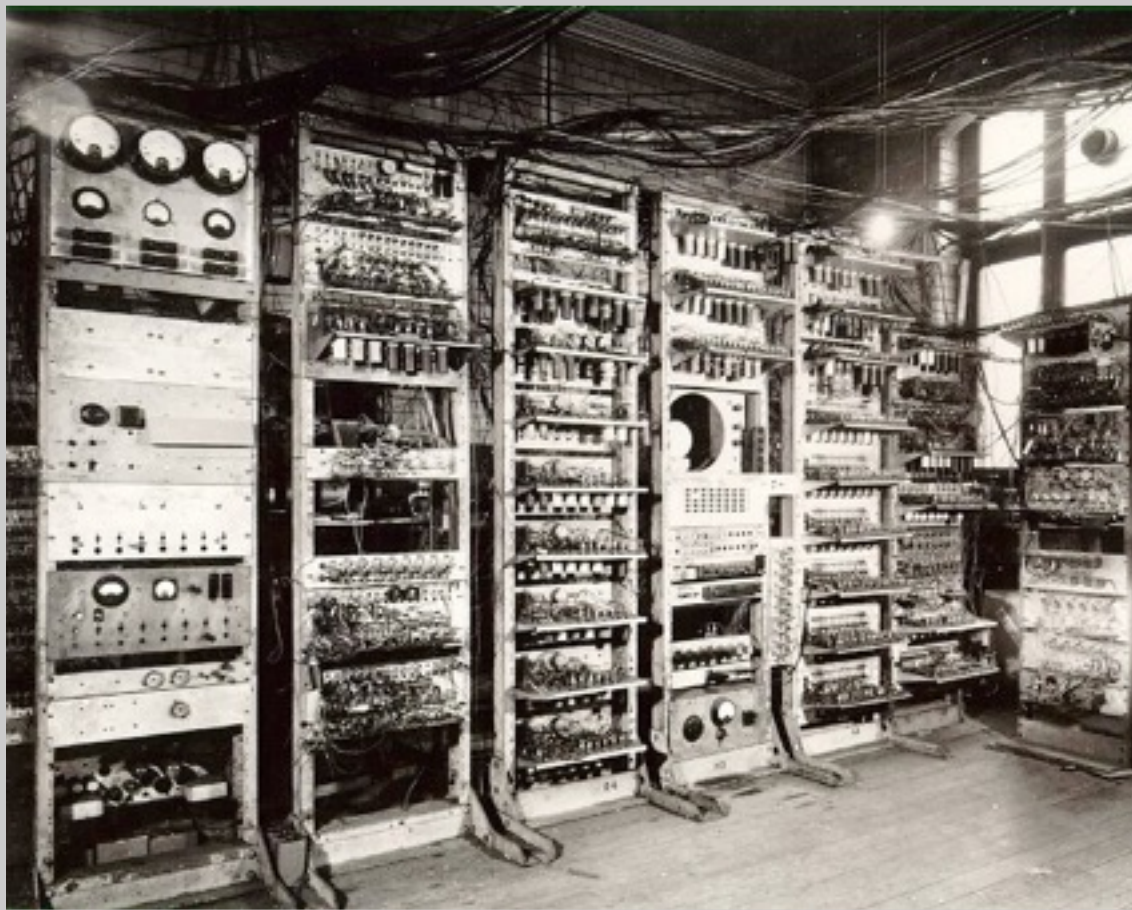
From *Where the Action Is* (Dourish, 2001)

# Historical Development of UIs



## Historical Development of HCI

# Electrical

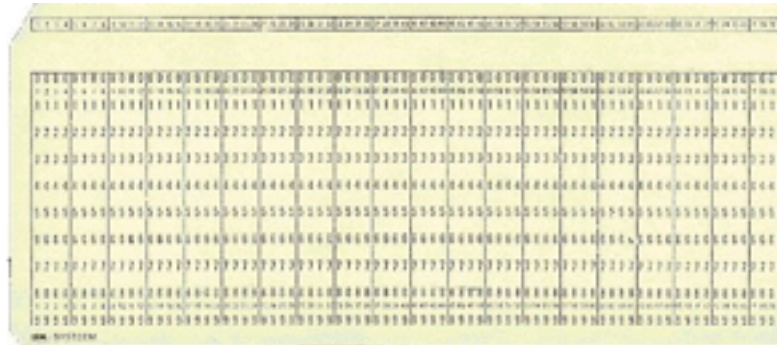


The Small Scale Experimental Machine, AKA “Baby” built at Manchester University in 1948.

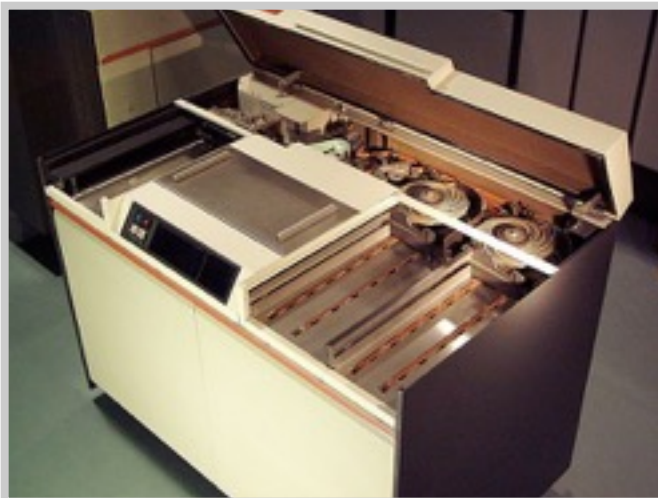
- Special purpose devices (e.g., automatic calculation of missile trajectories, patterns in coded messages)
- Held a sequence of instructions in its memory.
- To program the machine for different tasks, electrical circuits need to be changed
- Interacting with the system required a thorough understanding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

## Historical Development of HCI

# Symbolic



- Introduction of programming systems (e.g., assemblers)
- 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)
MANUAL
screen - menedzer okien z emulacją VT100/ANSI

SKŁADKA
screen [-qqc] [termina [argumenty]]
screen -f [nazwa] [nazwa]
screen -f [nazwa] [nazwa] [nazwa]

OPIS
Screen jest pełnoskranowym menedżerem okien, który dzieli fizy-
czny terminal między kilkoma procesami (zwykle interaktywnymi
powłokami). Każdy z wirtualnych terminali daje funkcjonalność
terminala DEC VT100, a dodatkowo również pewne funkcje
sterujące ze standardów ISO 6492 (ECMA 48, ANSI X3.64) oraz ISO
2022 (np. wstawienie linii i obsługa wielu zestawów znaków).
Dla każdego wirtualnego terminala istnieje bufor przewijania
oraz mechanizm wycinania i wklejania, który umożliwia
przenoszenie obszarów tekstów między oknami.

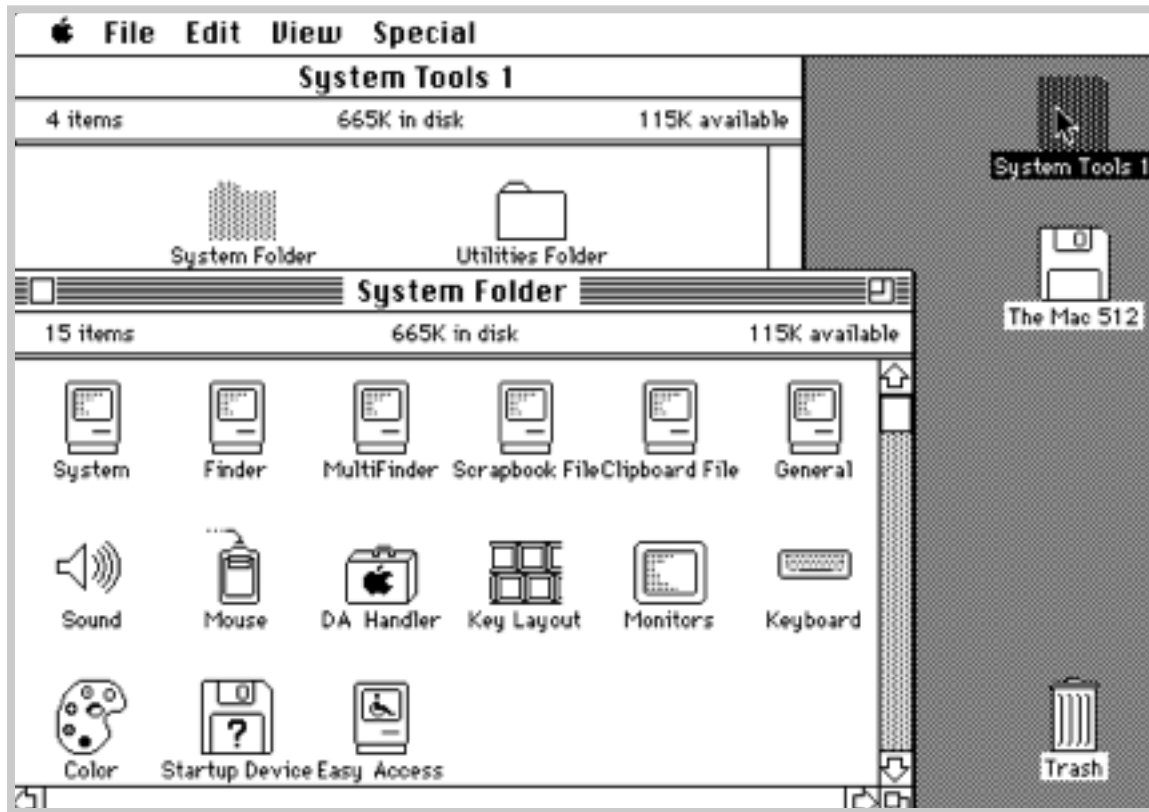
W momencie, gdy ekran jest wywołany, tworzy pojedyncze okno
z powłoką (lub z podaną komendą), a następnie czeka z dopy-
kaniem, aby mógł używać programu w normalny sposób. W dowolnej chwili
można stworzyć nowe pełnoskranowe okno z innymi programami
(również z dodatkowymi powłokami), zabić istniejące okna,
zmniejszyć liczbę okien, włączyć raportowanie wyjścia, wklejać
Manual page screen(1) line 1
@ -
Akcje: Cofnąć: Pakiet: Zakończ: Znajdź: Opisz: Wskaz: Pomoc
C-T: Menu: ? : Pomoc: q: Zakończ: w: Wirtualizuj: g: Instaluj/Usuń: pakiet
Kodowanie: 0-4:4: Zakończ: Znajdź: 495000 na dysku
Pakiety do zainstalowania:
--- Nowe pakiety
--- Zainstalowane pakiety
--- Niezainstalowane pakiety
--- Pakiety zarchiwizowane i lokalne
--- Pakiety wirtualne
--- Zadania
Dostępane są najnowsze wersje tych pakietów.
[[1]]... Suggest 9 zatrzymać
g: Skreślony: 0: Zakończ: ... Następnie: ...
@ -
PREFIX=evjg+ STATUS=+g+ TOPICLEN=390 NETWORK=OPTC
MAXLIST=be1:100 MAXTARGETS=4 CHANTYPES=+M :are supported by
this server
- CHANNELIT=+6:50 CHANNELLEN=50 CHANNELS=+e1g.w.t.lampstms
MAXLEN=100 KNOCK (LIST=CMNU SAFELIST EXCEPTS=+ INVEX=I
lare supported by this server
- 18GAAACM your unique ID
- local users on irc 251 : 0%
- global users on irc 10 : 0%
- invisible users on irc 4310 : 100%
- ircops on irc 33 : 1%
- total users on irc 4328 :
- unknown connections 1
- total servers on irc 23 : avg. 188 users per server:
- total channels created 1355 : avg. 3 users per channel
- Current local users: 251 Max: 337
- Current global users: 4328 Max: 4051
- Highest client connection count 310 : 337
- The new BitchX help system from EPIC is available by typing
/help.
- The old BitchX help files are available as /bhelp.
- ircII help files are available as /help.
- Mode change +1: for user lukasz
- Mode change +ou for user lukasz
[09:17:00][lukasz@-10w][Mail: 62] []
[Log ff]
@)
  
```

- 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



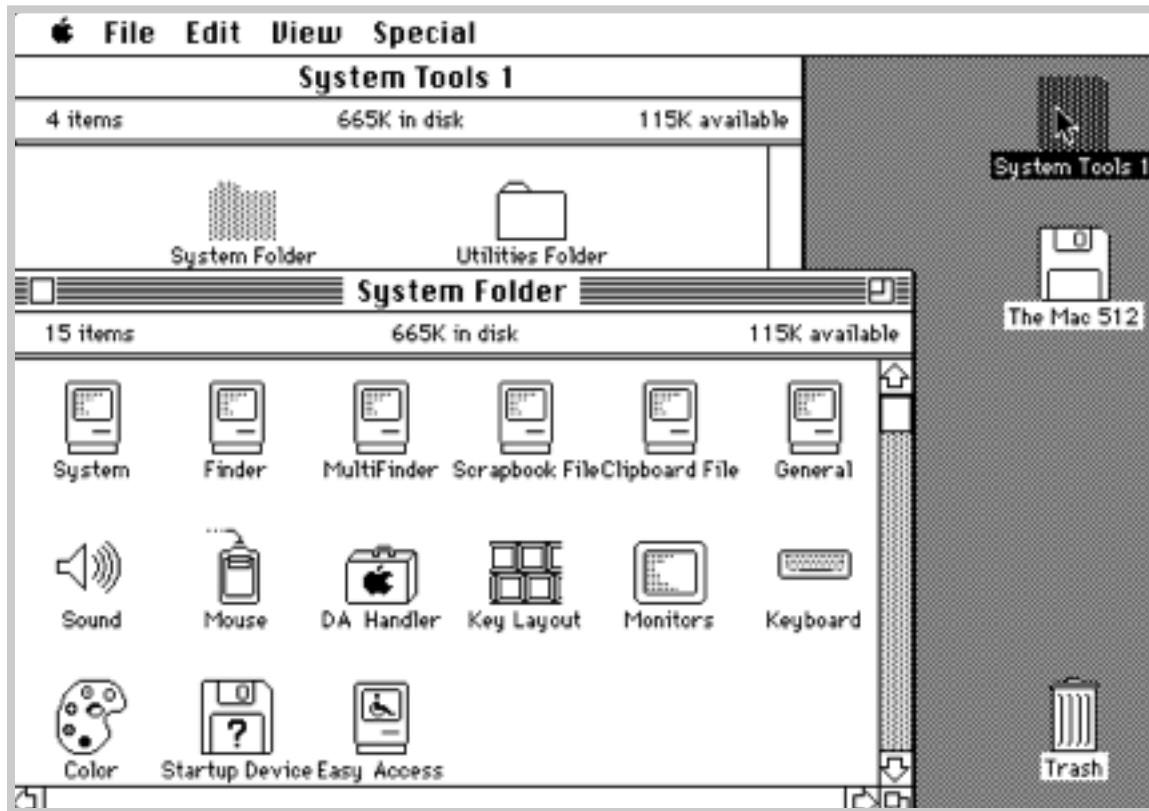
Turning interaction into two-dimensional space rather than a one-dimensional stream of characters

Macintosh System 4.2, 1987



## Historical Development of HCI

# Graphical

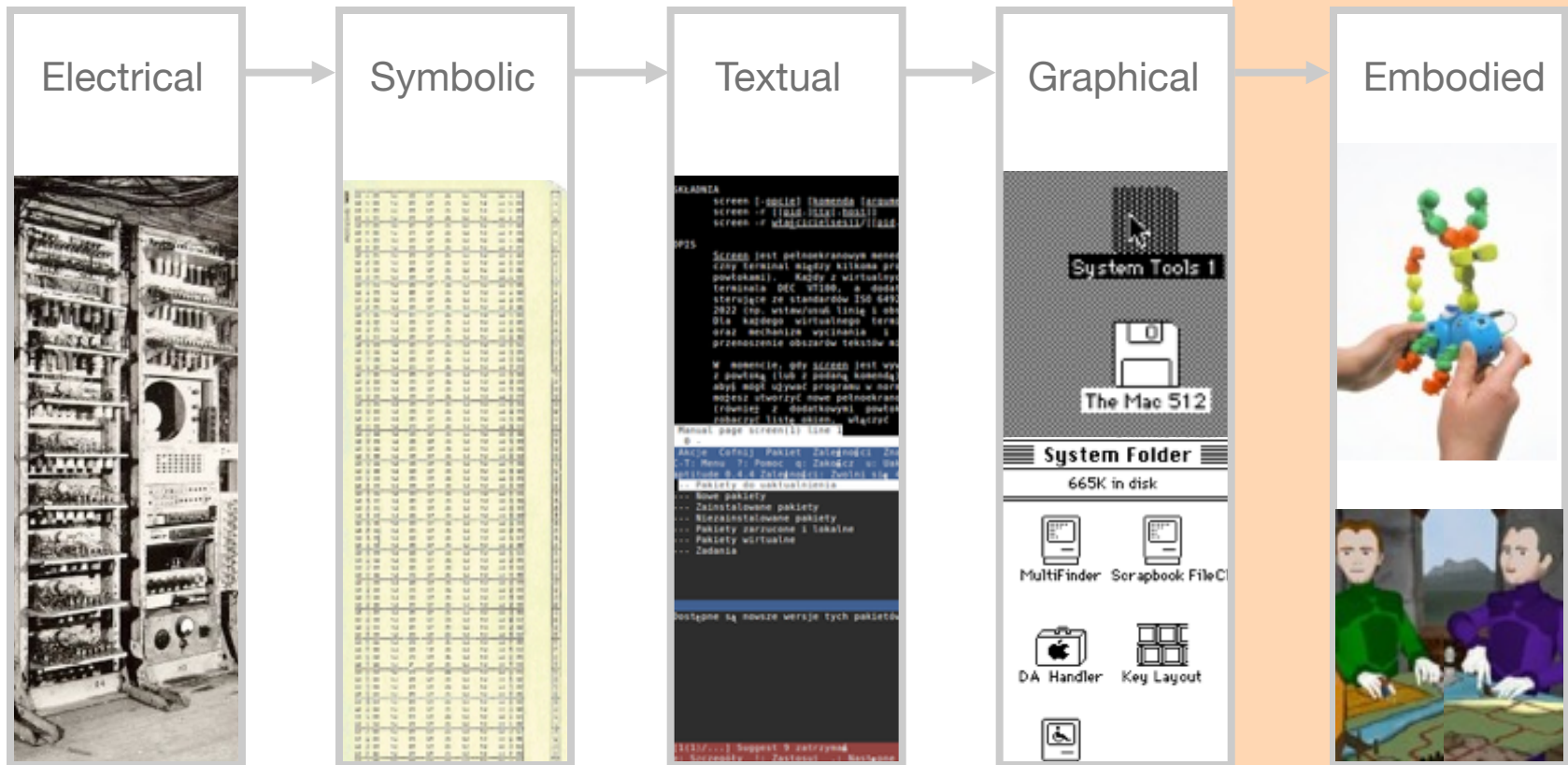


Macintosh System 4.2, 1987

Exploit more sets of human skills:

- **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

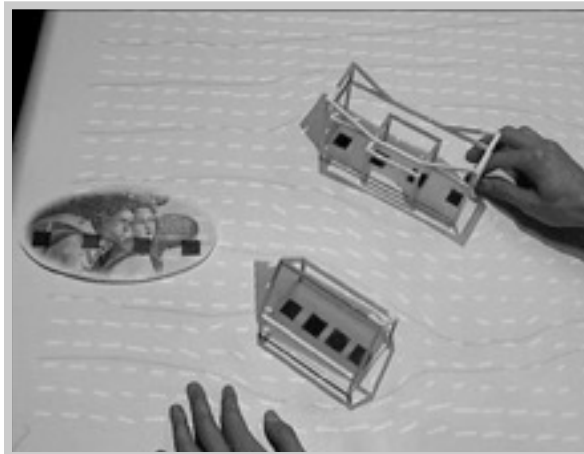


## Historical Development of HCI

# Tangible Interaction



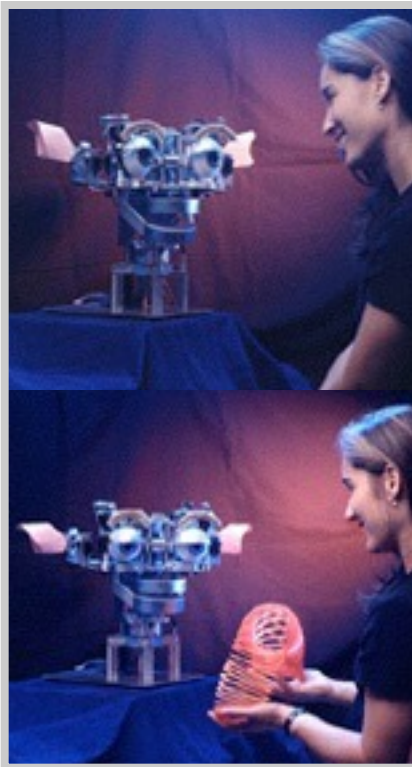
- Computation that moves beyond desktop
- Interaction is incorporated more richly in our daily experience of the physical world
- Trend 1: Distribute computation across a variety of devices
- Trend 2: Augment the everyday world with computational power



## Historical Development of HCI

# Social Computing

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



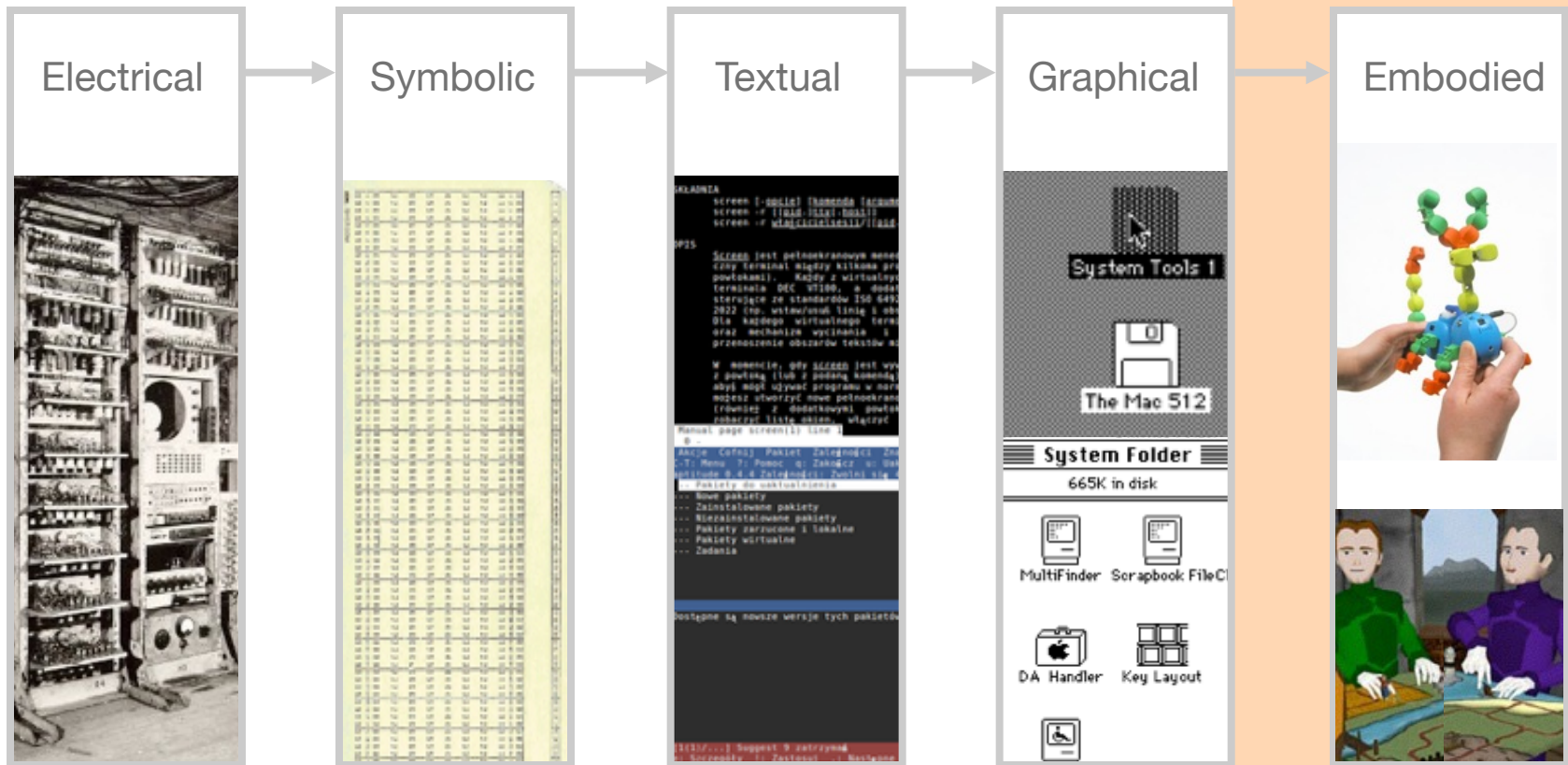
Kismet (Breaseal, 2000)



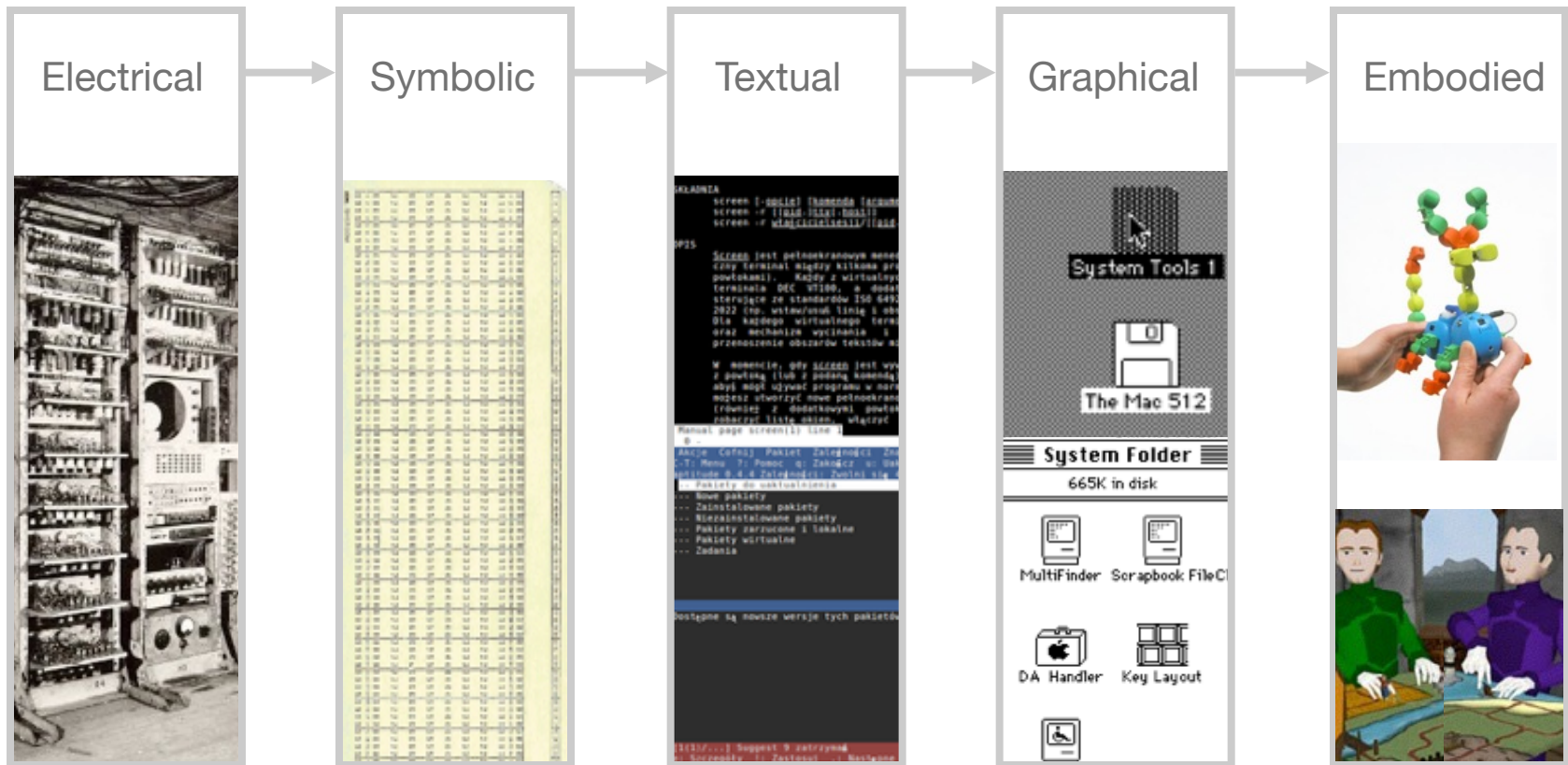
Spark (Vilhjálmsón, 2004)



# Embodied Interaction



# Embodied Interaction





# “Computer reaching out”

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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

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Understand technology as part of the larger scope of human activities.  
How people actually use technology at work and play.

# Activity Theory

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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

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Behaviorist (circa 1930's)  
Observable behaviors

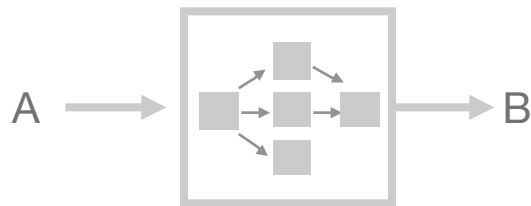
## Activity Theory

# Brief Background

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Behaviorist (circa 1930's)  
Observable behaviors



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

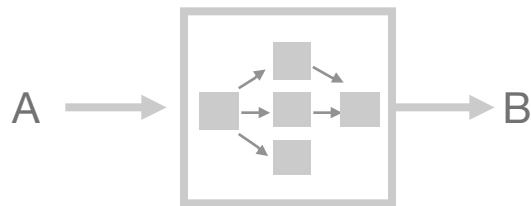
## Activity Theory

# Brief Background

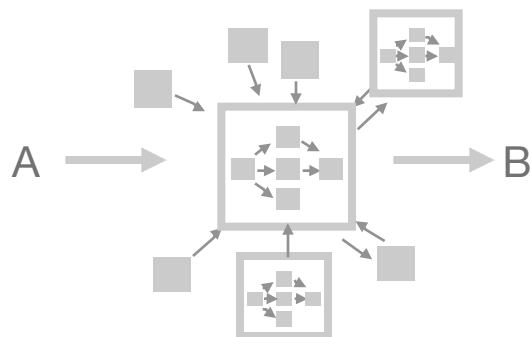
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Behaviorist (circa 1930's)  
Observable behaviors



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



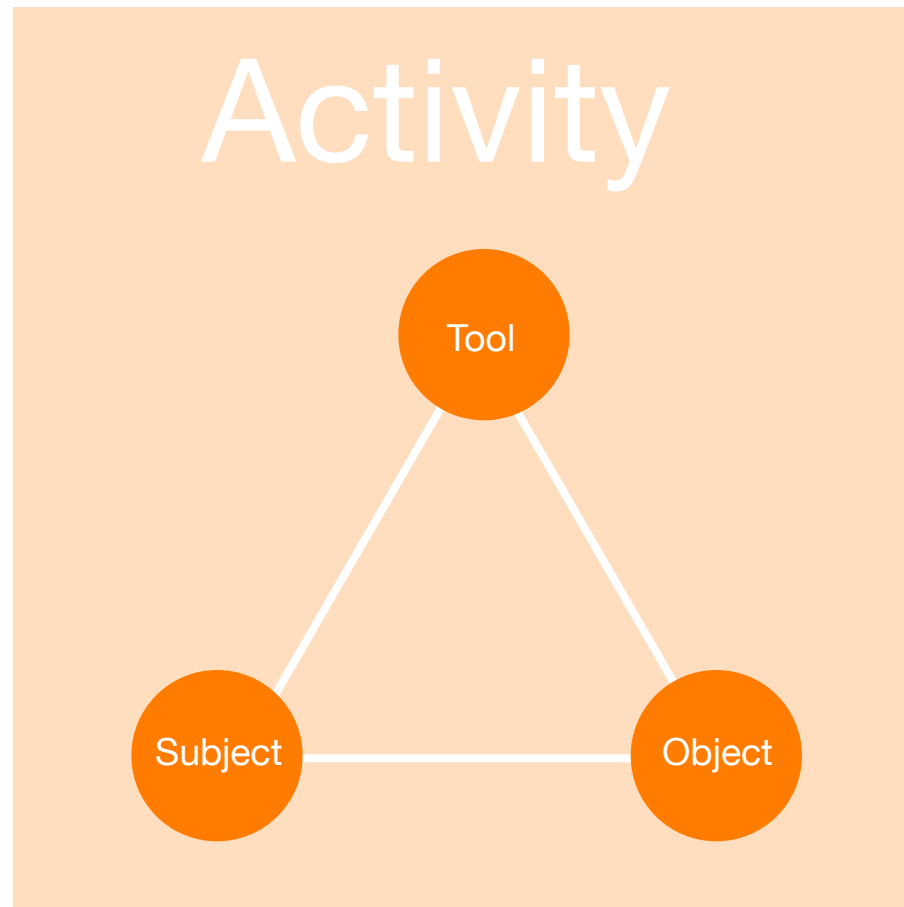
Social Constructivist (circa 1950's – 1990's)  
Activities and context



## Activity Theory

# Unit of Analysis

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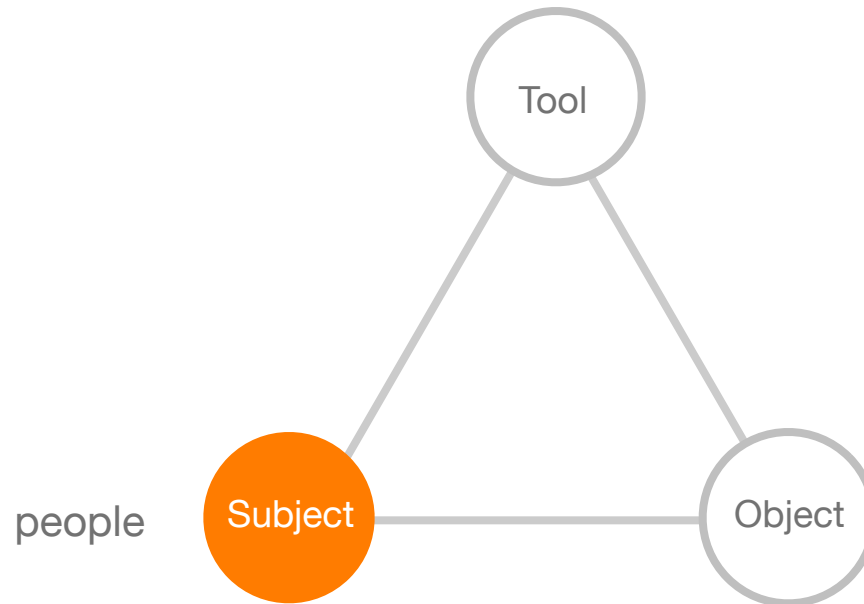


## Activity Theory

# Unit of Analysis

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People act as **subjects** in the world

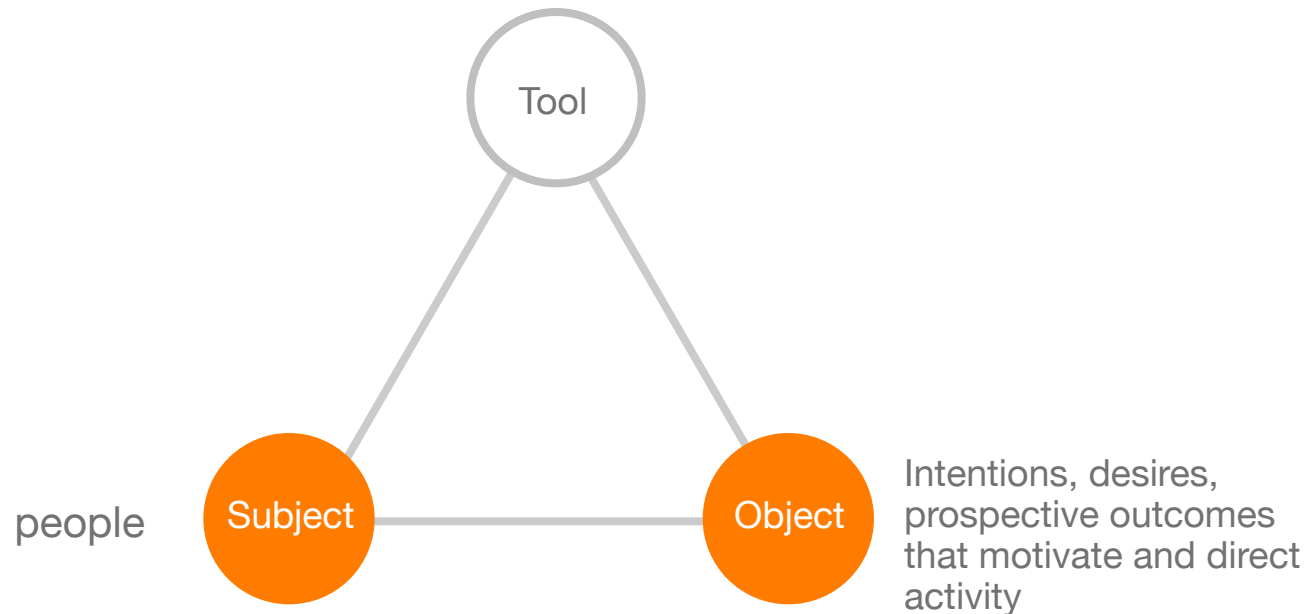


## Activity Theory

# Unit of Analysis

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

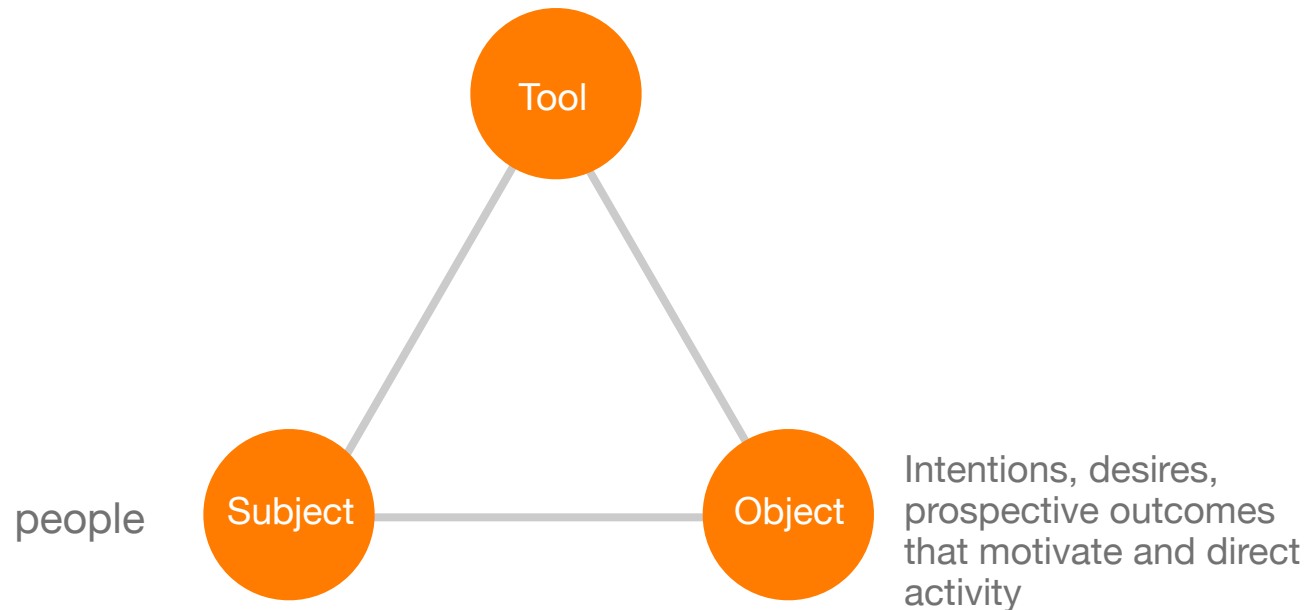


## Activity Theory

# Unit of Analysis

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

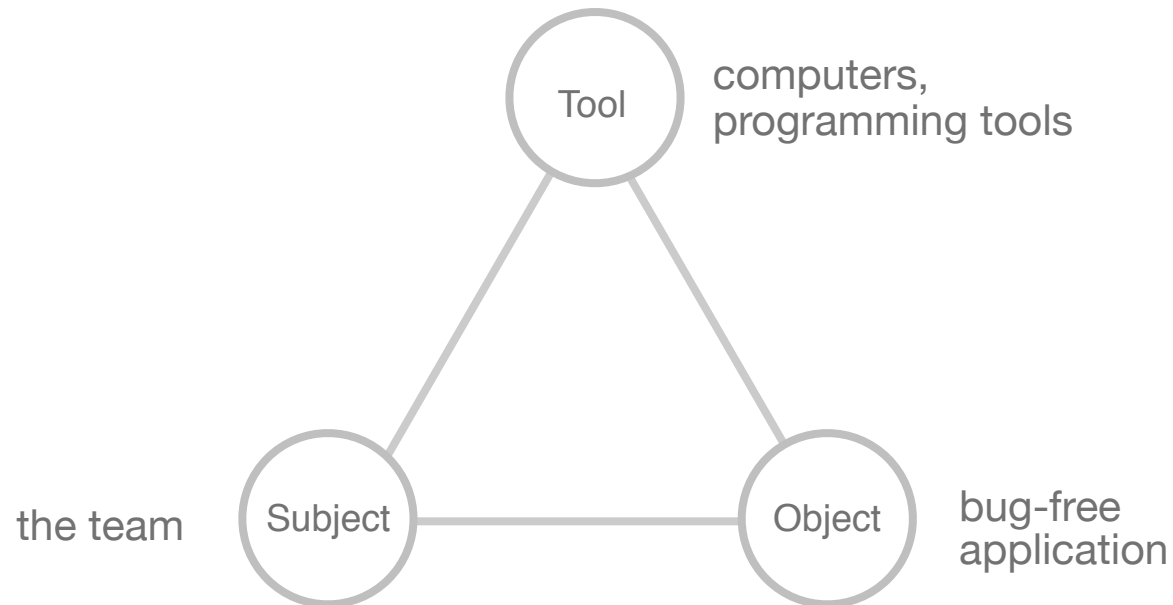


## Activity Theory

# Example 1

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A software team programming a system for a client

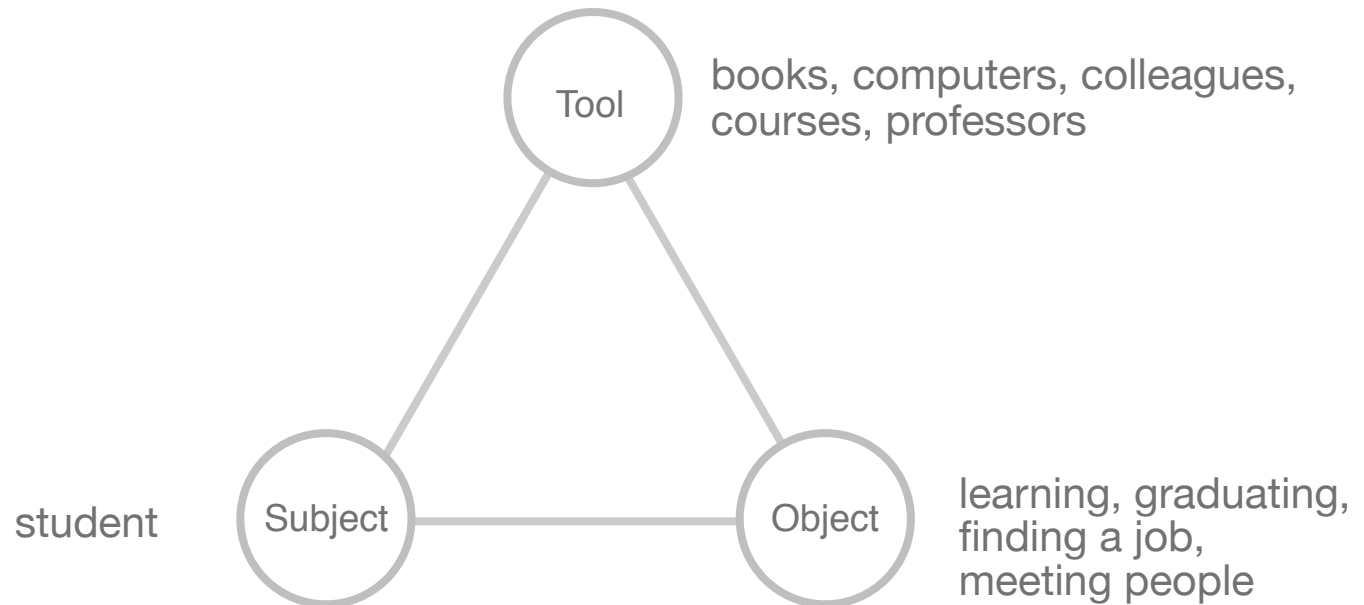


## Activity Theory

# Example 2

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Being a graduate student at UC Berkeley





# Activity Theory Concepts

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

## Activity Theory

# Hierarchical Structure

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Activity



Actions

conscious  
goal-oriented



Operations

automatic,  
unconscious

## Activity Theory

# Hierarchical Structure

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## 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

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## Example 2

**Activity**

Completing a software project

**Actions**

Programming a module, arranging meetings

**Operations**

Using OS

## Activity Theory

# Hierarchical Structure

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## Example 3

**Activity**Being a  
grad student**Actions**

Passing exams

**Operations**

???

## Activity Theory

# Hierarchical Structure

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Activity



Actions

conscious  
goal-oriented



Operations

automatic,  
unconscious

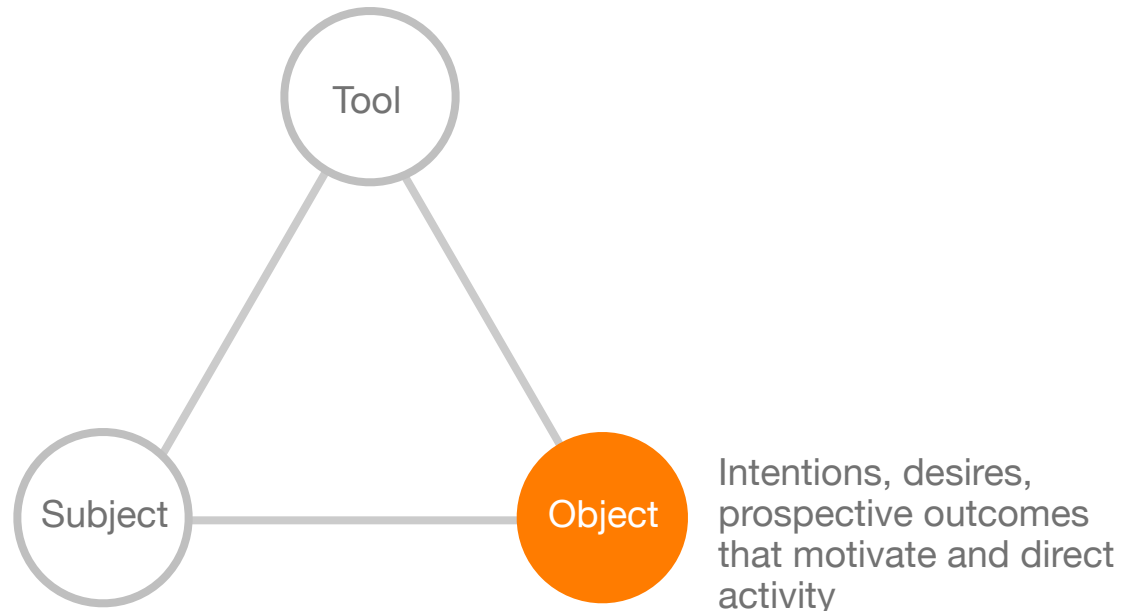


## Activity Theory

# Object

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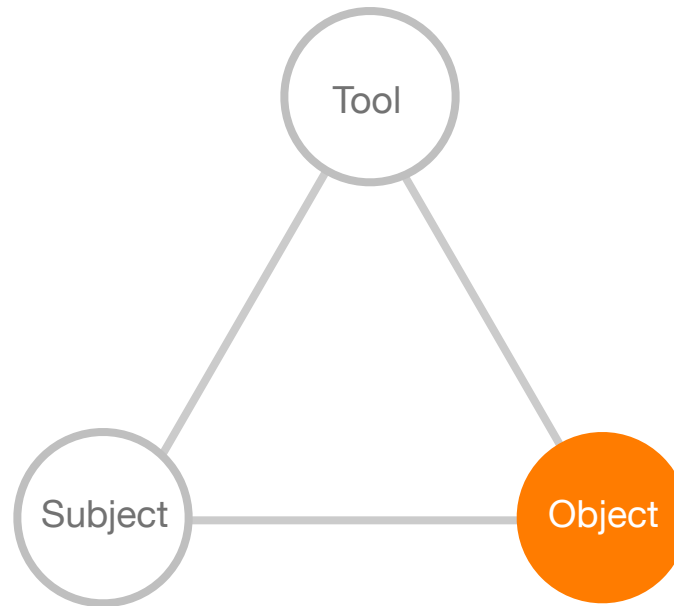
**Object** gives meaning to what people do.  
Objects separate one activity from another.



## Activity Theory

# Object

Can be physical thing or ideal object



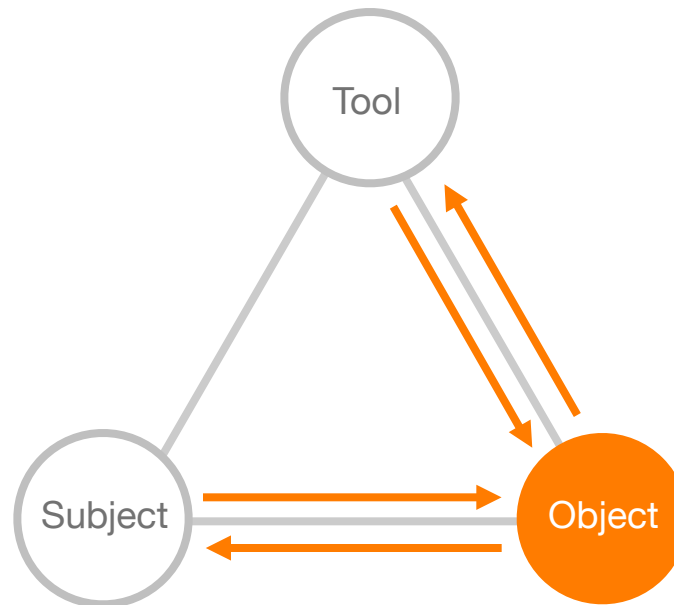
Intentions, desires, prospective outcomes that motivate and direct activity

## Activity Theory

# Object

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

Activity unfolds in a **social context**, transforming both the subject and the tool.



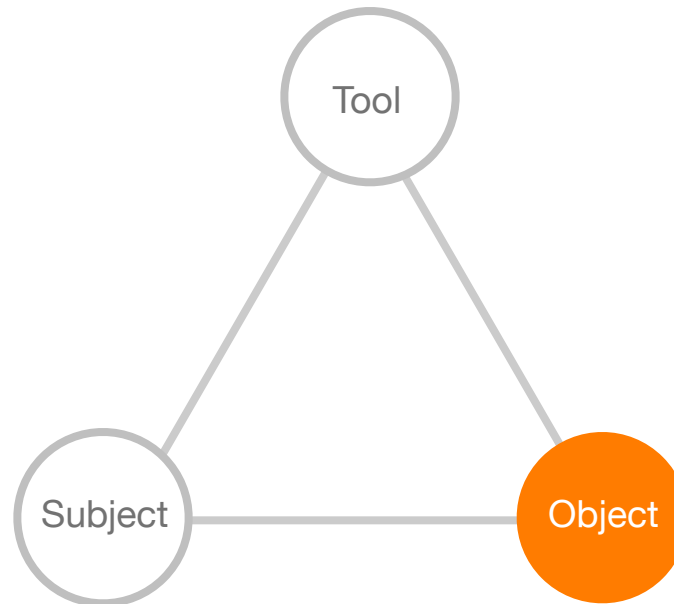
Intentions, desires, prospective outcomes that motivate and direct activity

## Activity Theory

# Object

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

Objects constrain and direct what we do.



Intentions, desires, prospective outcomes that motivate and direct activity

## Activity Theory

# Internal and External Activity

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

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

## Activity Theory: Internalization / Externalization

# Internalization

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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

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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.

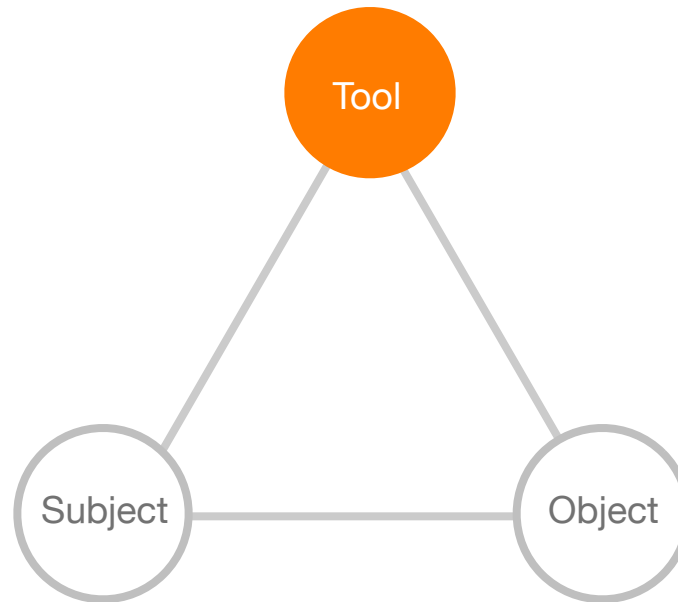


## Activity Theory

# Tools and Mediation

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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.



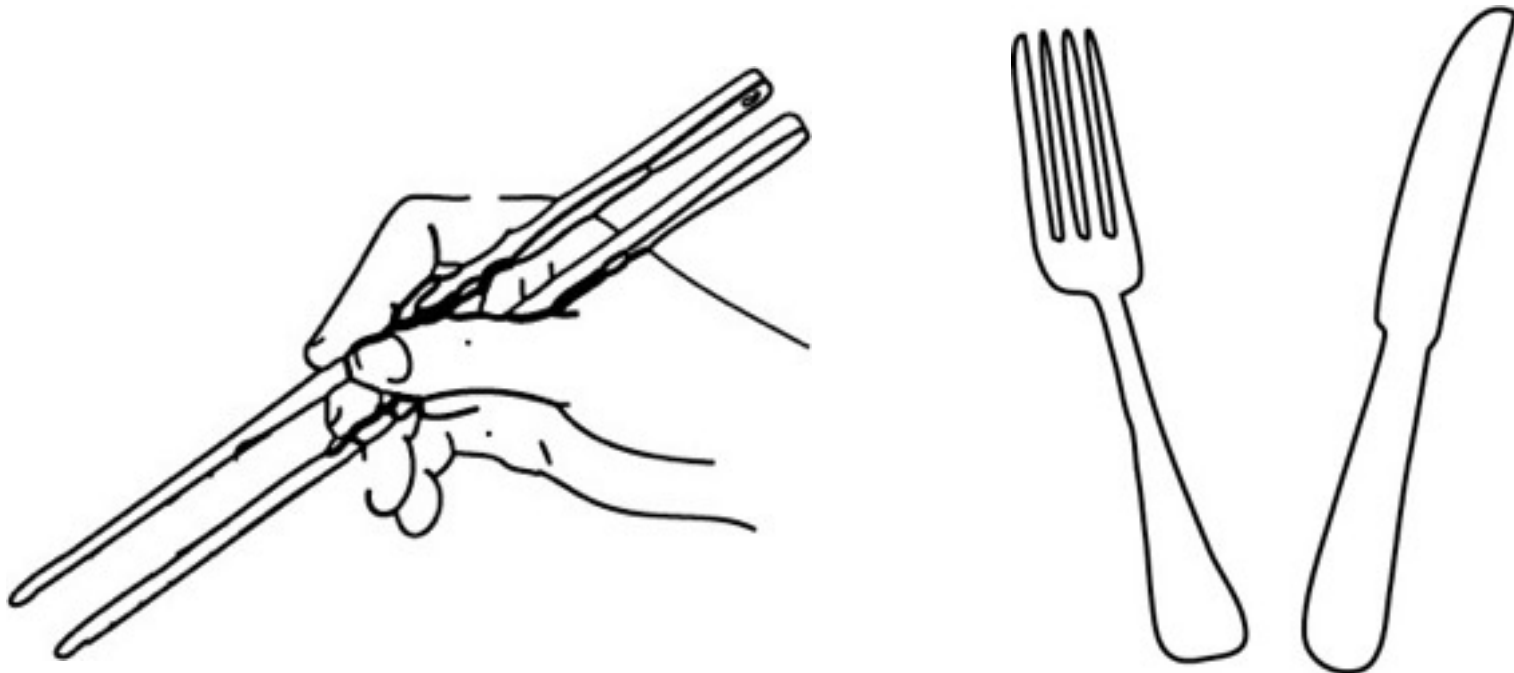


## Activity Theory

# Tools and Mediation

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Use of tools is an accumulation and transmission of social knowledge. Human experience is accumulated in the structural properties of tools, such as their shape or material, as well as in the knowledge of how the tool should be used.



## Activity Theory

# Development

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Human activity unfolds over time in a historical frame.

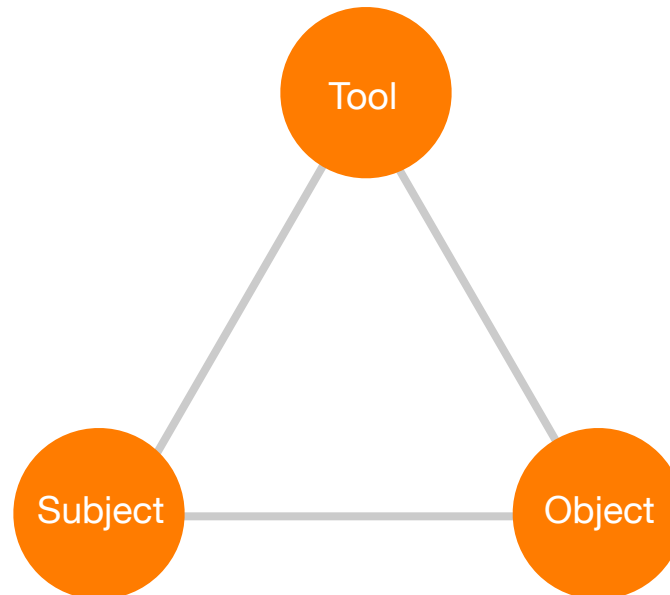
The long view: we cannot understand activity if we do not watch it cycle, grow, change.

Design that is sensitive to people's ability to grow and change.

# Activity Theory: Summary

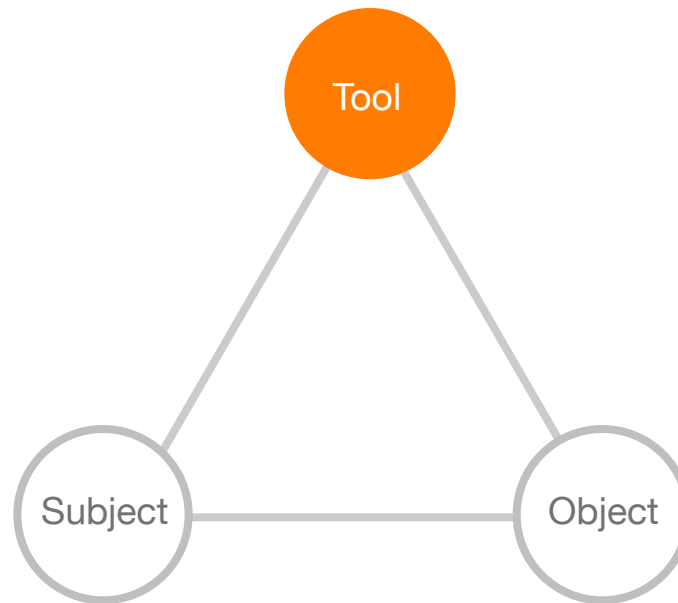
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- Hierarchical structure of activity
- Object-oriented
- Internalization and Externalization
- Tool mediation
- Development



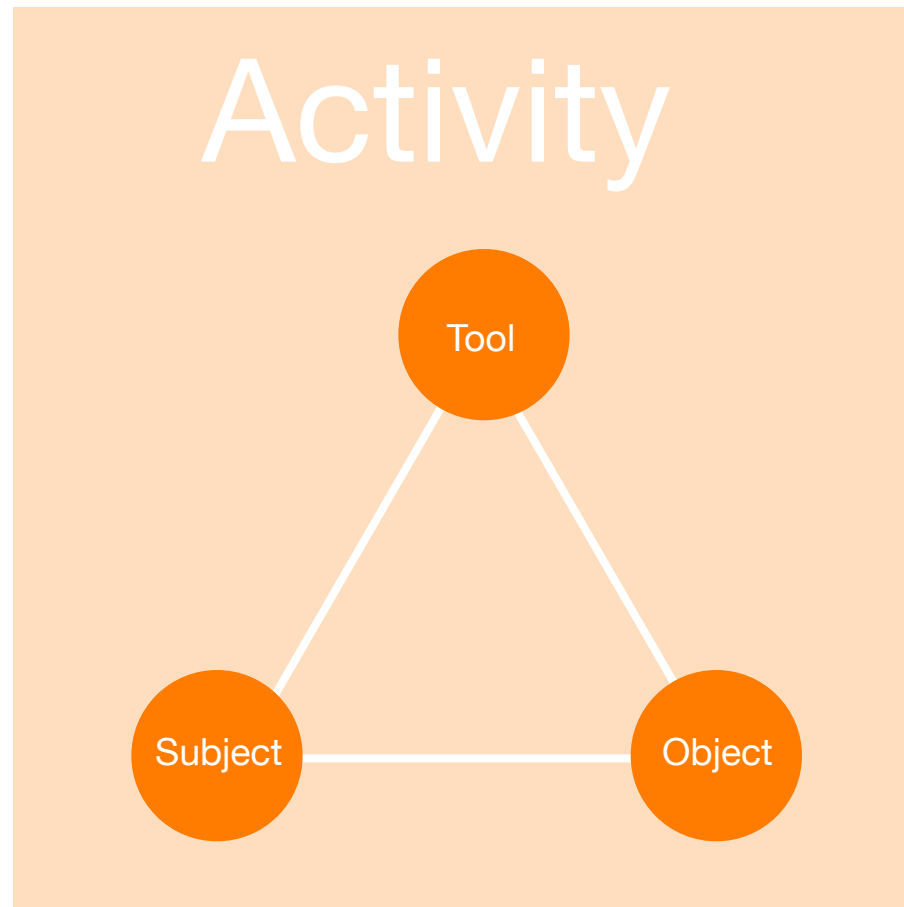
# Why Should We Care about Activity Theory?

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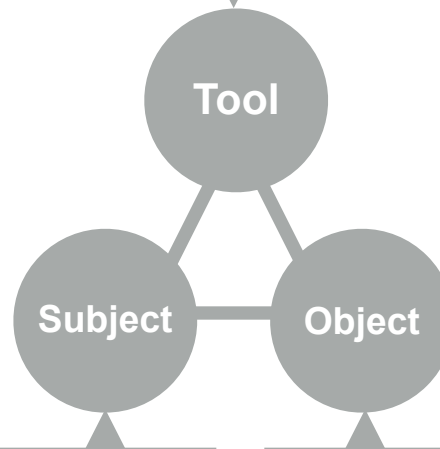


# System That Supports Human Activities. Not Just Tools.

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What is the **tool** you are designing? How does the tool help mediate the relationship between the subject (people) and object (intentions, desires, prospective outcomes that motivate and direct activity)?



Who is the **subject**? Describe the users of your system. E.g., What is the age range and what is their background? What kinds of expectations may your users bring before they even interact with your system?

What is the **object** of the activity (intentions, desires, prospective outcomes that motivate and direct activity)? Object can be a physical thing or an ideal object (e.g., owning a particular house, or owning any house).

# For Wednesday

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- Bring \$75 if you are purchasing the lab kit
- Bring your laptop
- Reading for Wednesday 9/10
  - Physical Computing (Introduction and chapters 1, 2 & 3)  
by O'Sullivan and Igoe

# Thanks!