week

02

Activity Theory and HCI

Implications for user interfaces

Outline

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

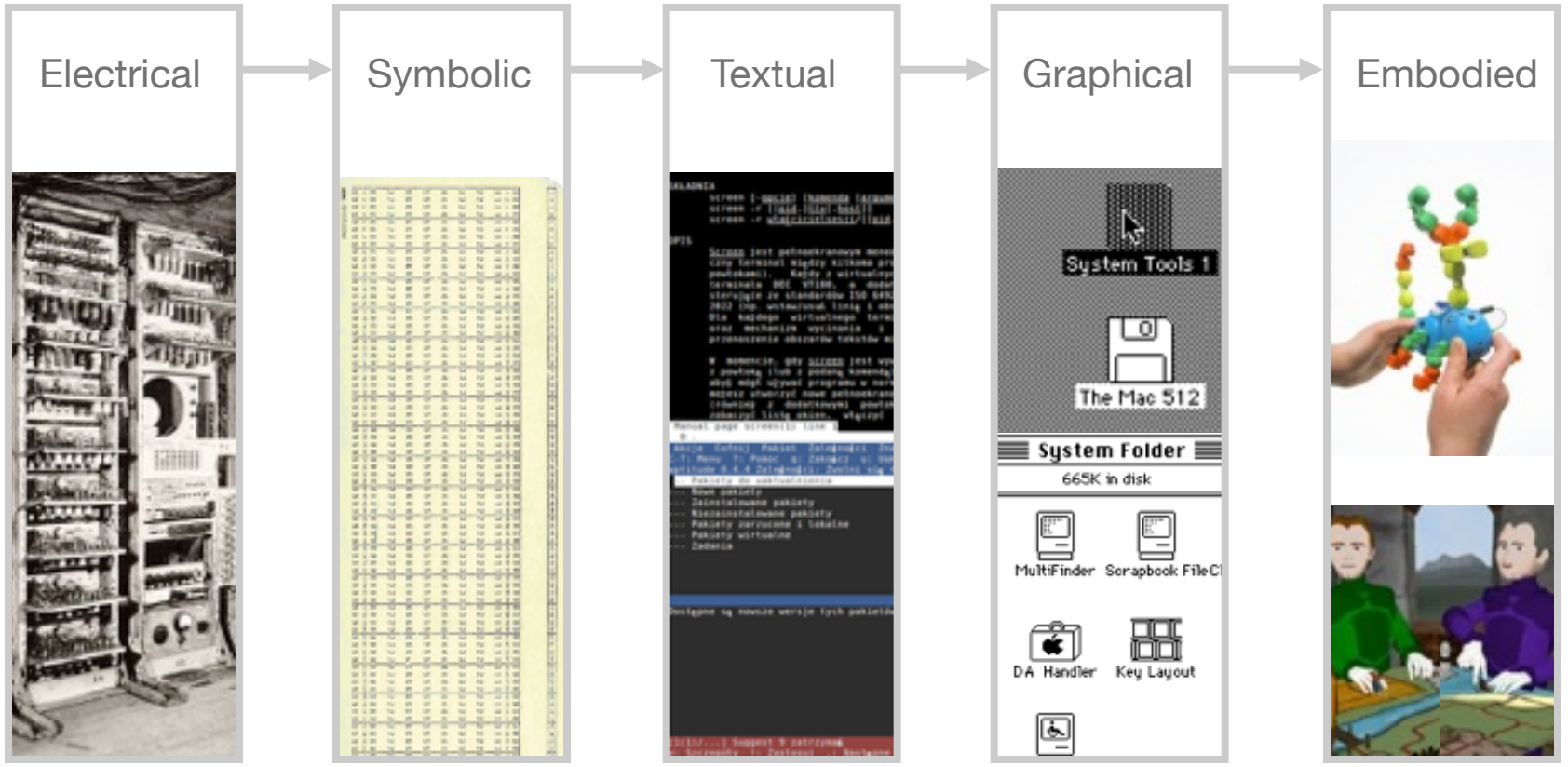
Historical Development of User Interfaces

From electrical to embodied interactions

"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)

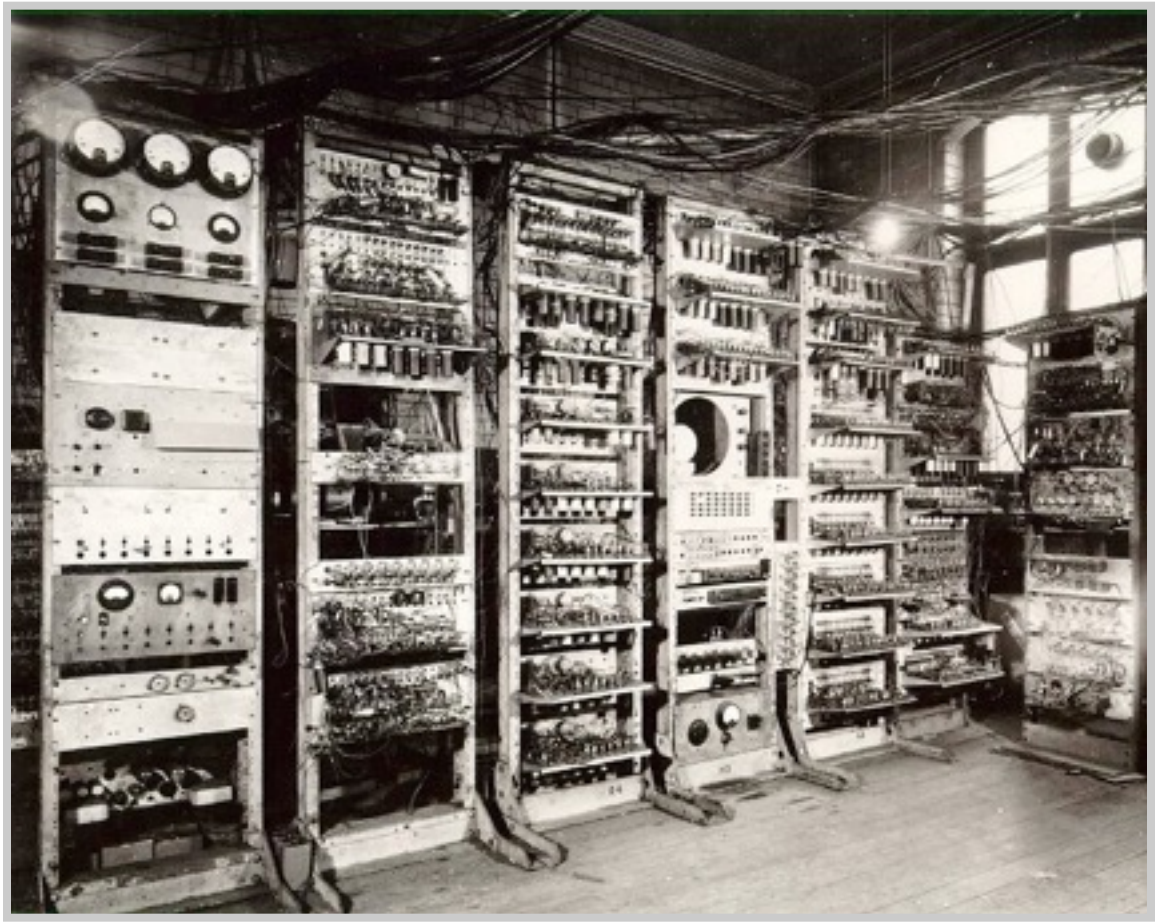
Historical Development of UIs



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

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

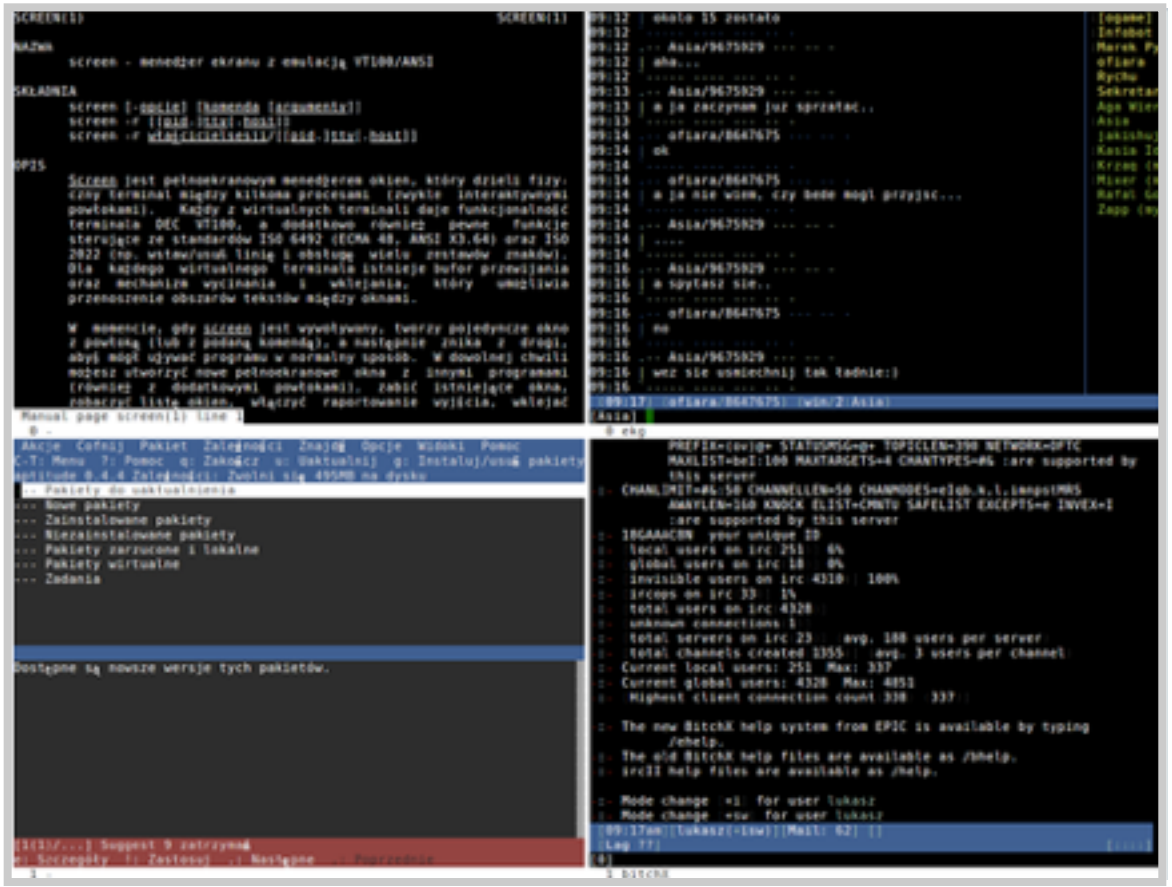
Symbolic

- 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

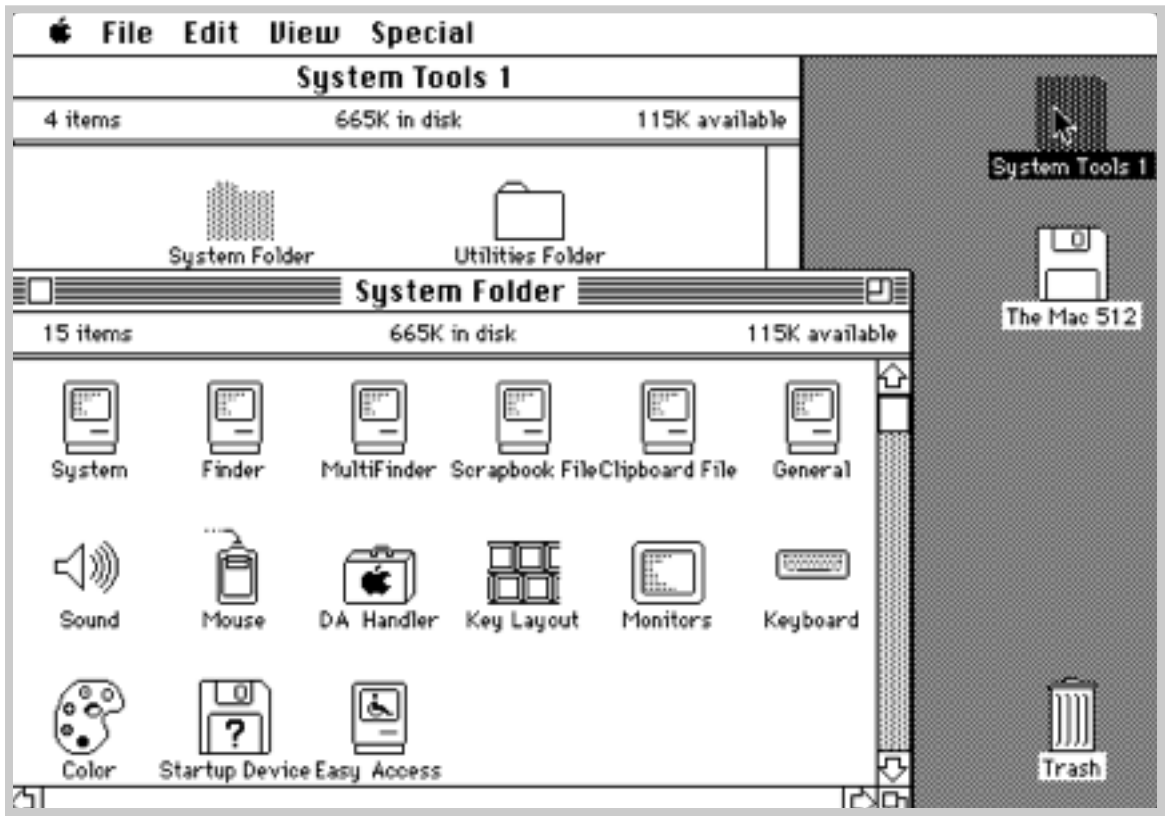


- Takes advantage of the best-developed form of symbolic interaction: written language
- More like a “dialog”

E.g., early UNIX, DOS

Historical Development of HCI

Graphical

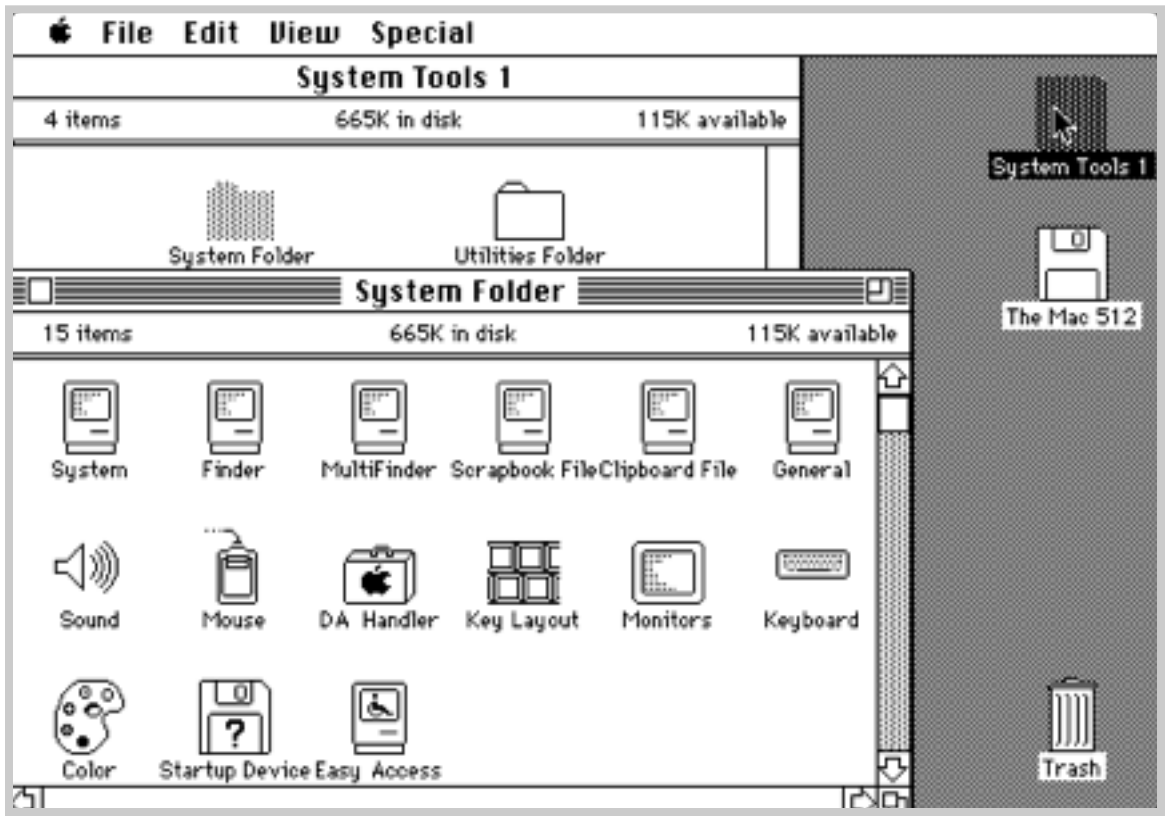


Macintosh System 4.2, 1987

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

Historical Development of HCI

Graphical



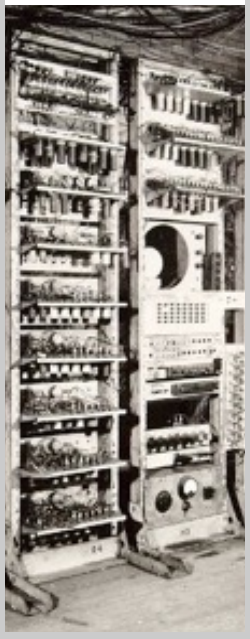
Macintosh System 4.2, 1987

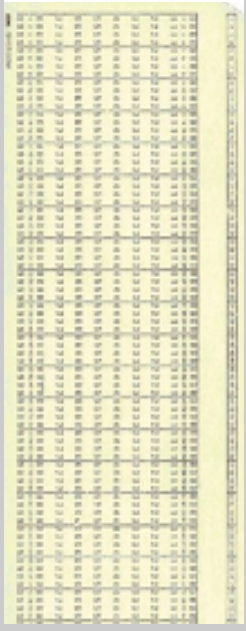
Exploit more sets of human skills:

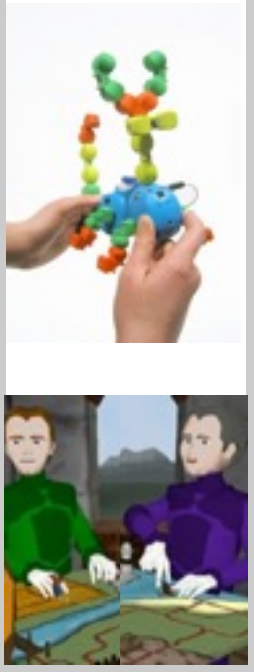
- **Peripheral Attention**
  Primary space, secondary space (e.g., windows and dashboards)
- **Pattern recognition and spatial reasoning**
  Opportunities to arrange data spatially
- **Information density**
  A picture really can be worth a thousand words (e.g., diagrams)
- **Visual metaphors**
  File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

Embodied Interaction

Electrical → Symbolic → Textual → Graphical → Embodied

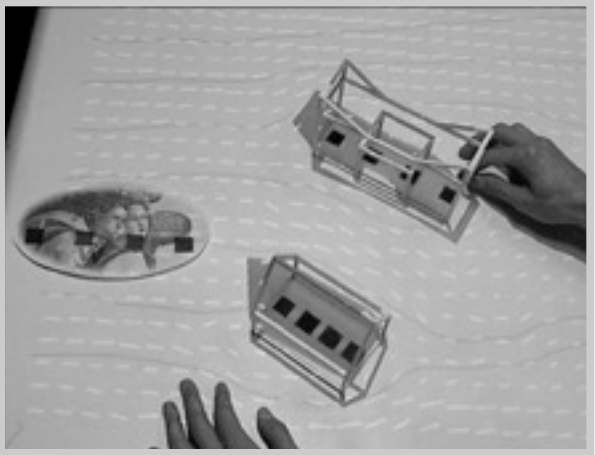






Historical Development of HCI

Tangible Interaction

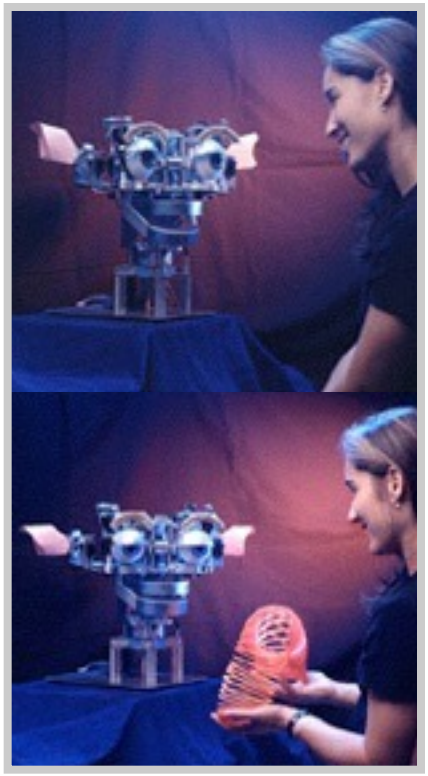


- Computation that moves beyond desktop
- Interaction is incorporated more richly in our daily experience of the physical world

- Trend 1: Distribute computation across a variety of devices
- Trend 2: Augment the everyday world with computational power

Historical Development of HCI

Social Computing



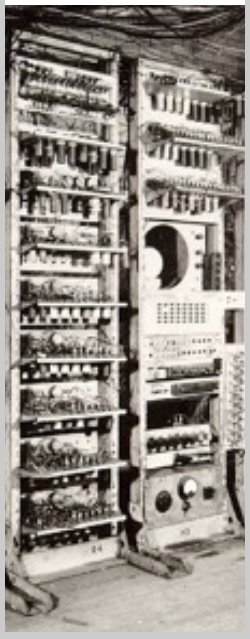
Kismet (Breaseal, 2000)

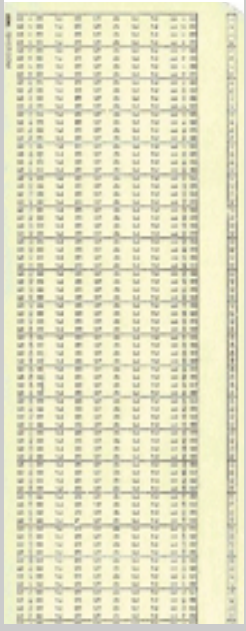
Spark (Vilhjálmsson, 2004)

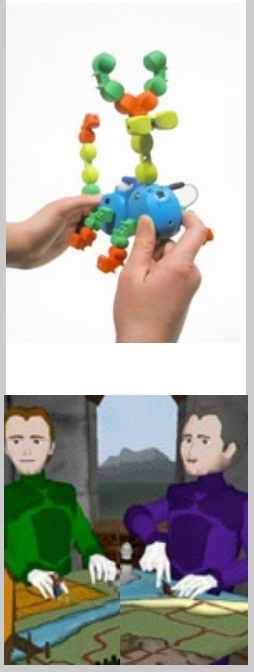
- The application of sociological understanding to the design of interactive systems

Embodied Interaction

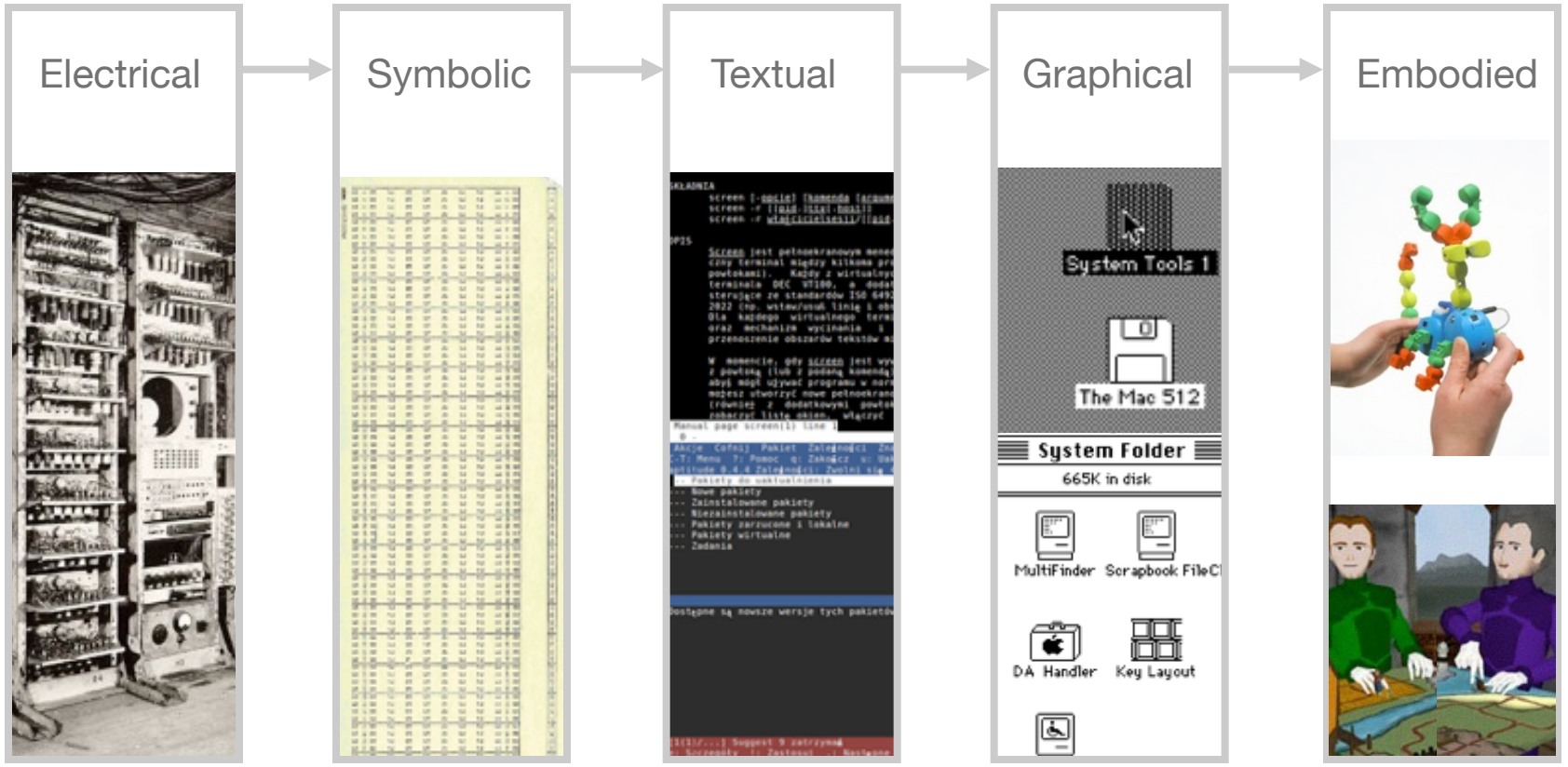
Electrical → Symbolic → Textual → Graphical → Embodied







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

Understand technology as part of the larger scope of human activities.
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

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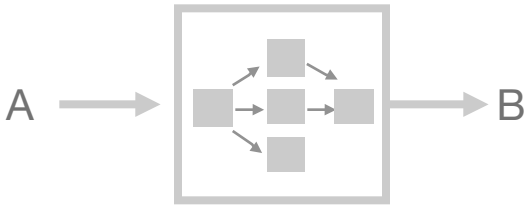
Behaviorist (circa 1930's)
Observable behaviors

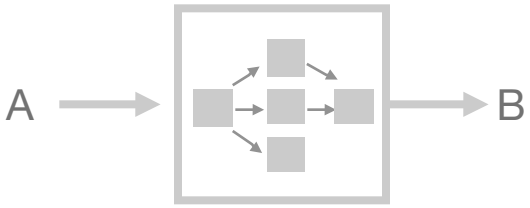


Cognitivist (circa 1950's – 1990's)
Mental models

Activity Theory

Brief Background

Behaviorist (circa 1930's)
Observable behaviors



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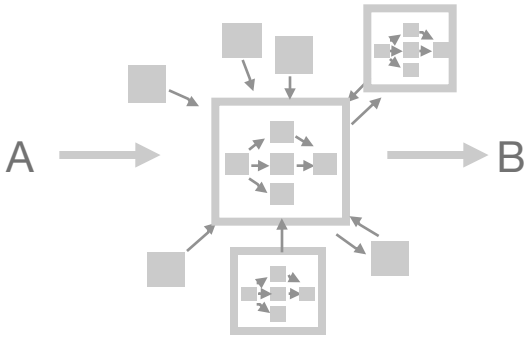
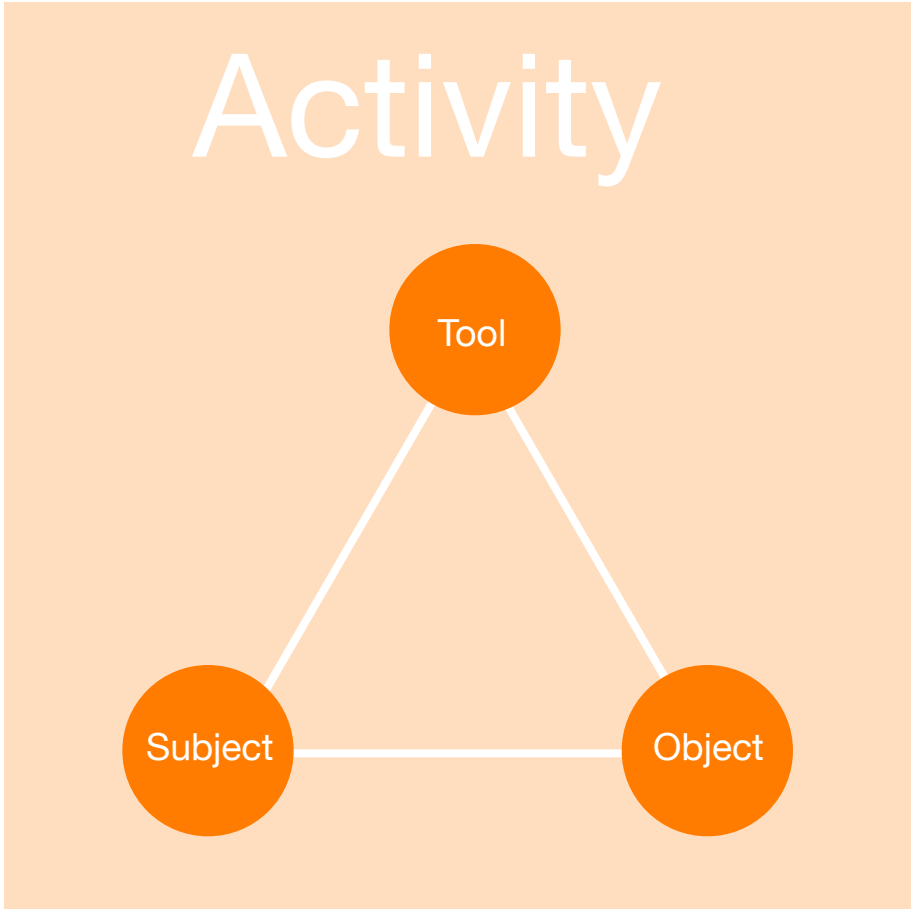


Social Constructivist (circa 1950's – 1990's)
Activities and context

Activity Theory

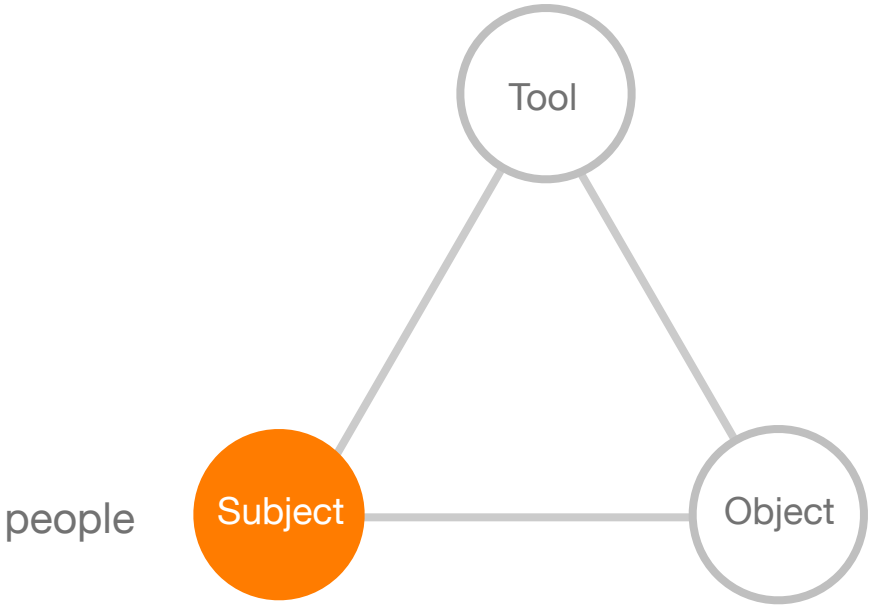
Unit of Analysis



Activity Theory

Unit of Analysis

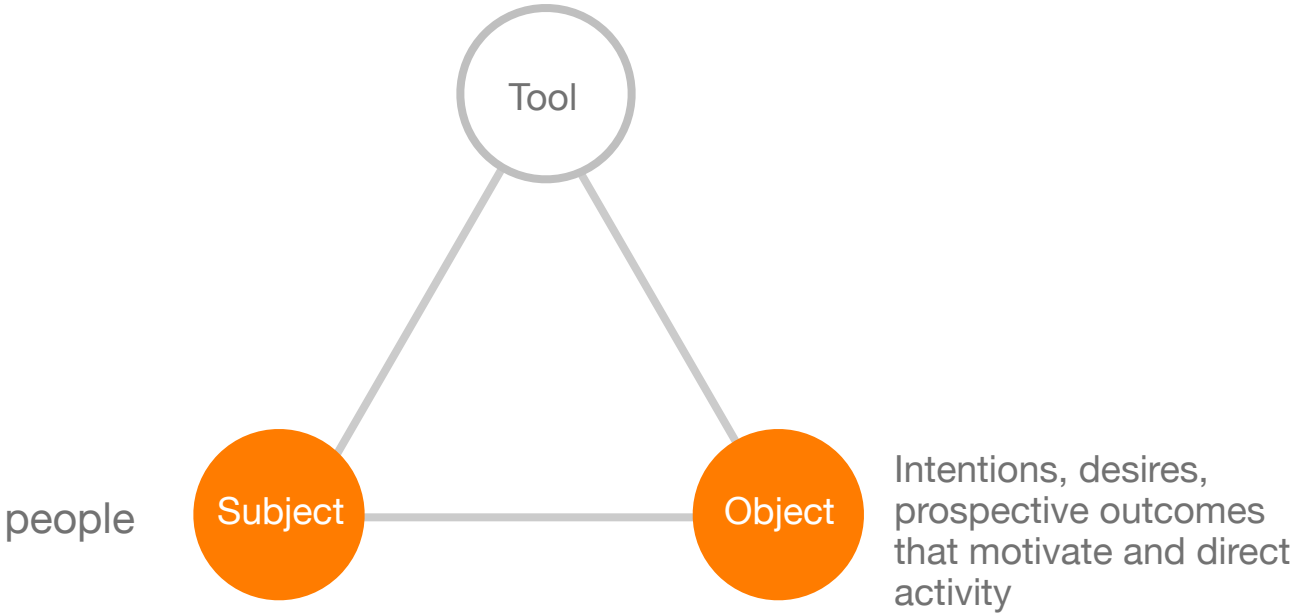
People act as **subjects** in the world



Activity Theory

Unit of Analysis

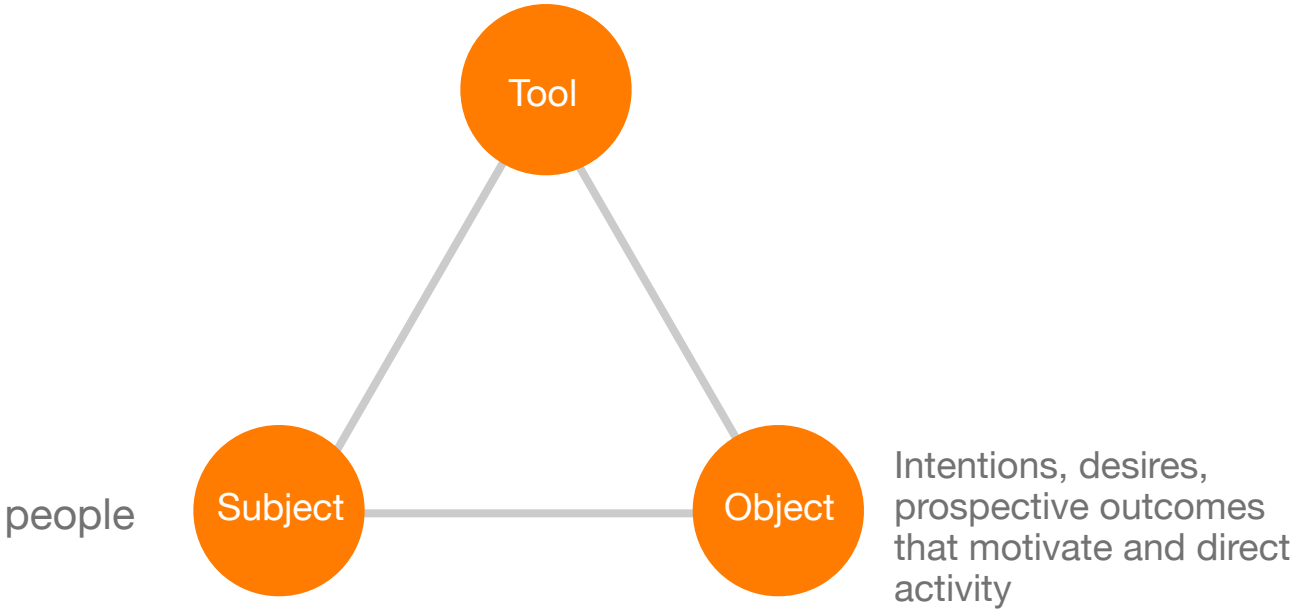
People act as **subjects** in the world, constructing and instantiating their intentions and desires as **objects**.



Activity Theory

Unit of Analysis

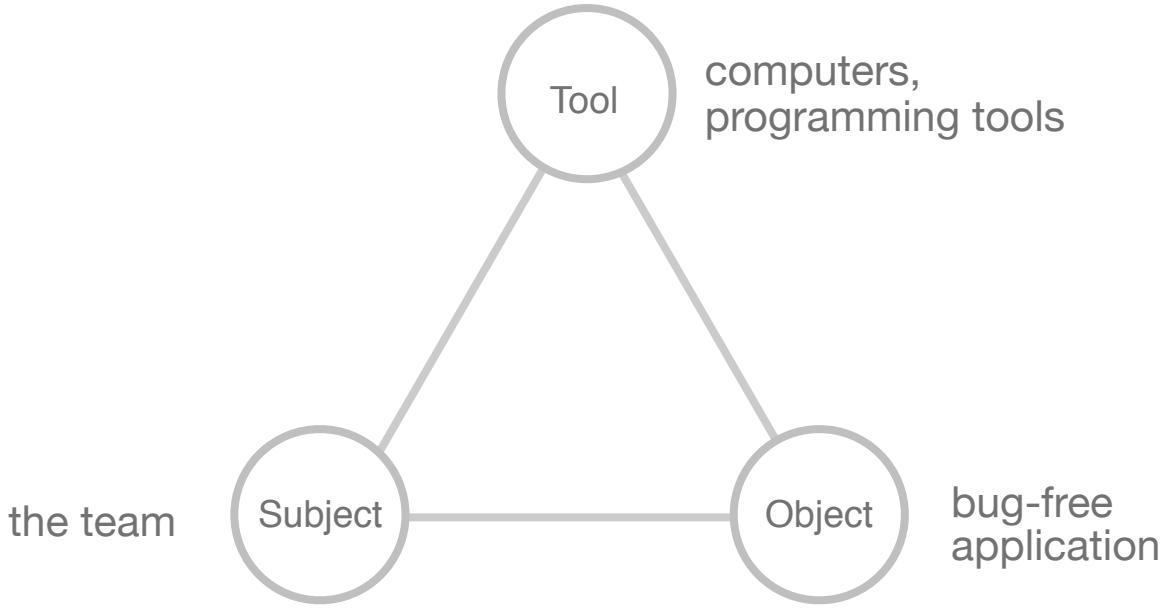
Tools mediate between people and the world. Activity theory casts the relationship between people and tools as one of **mediation**.



Activity Theory

Example 1

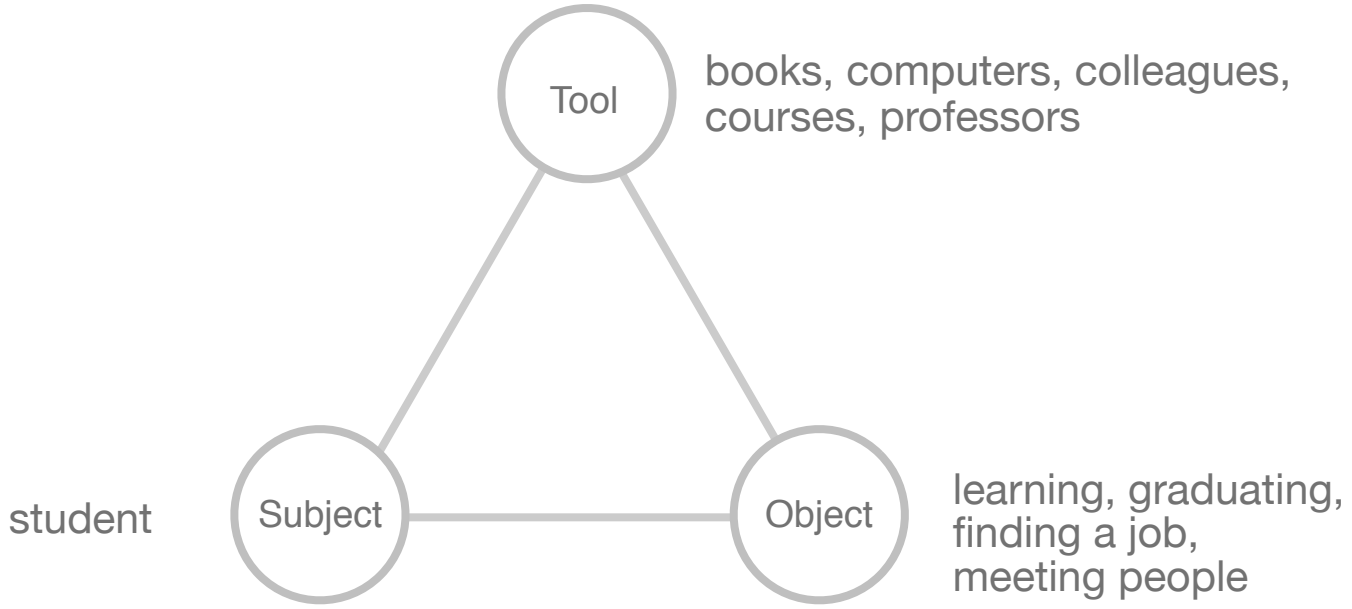
A software team programming a system for a client



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 Theory

Hierarchical Structure

Example 1

Activity Theory

Hierarchical Structure

Example 2

Activity Theory

Hierarchical Structure

Example 3

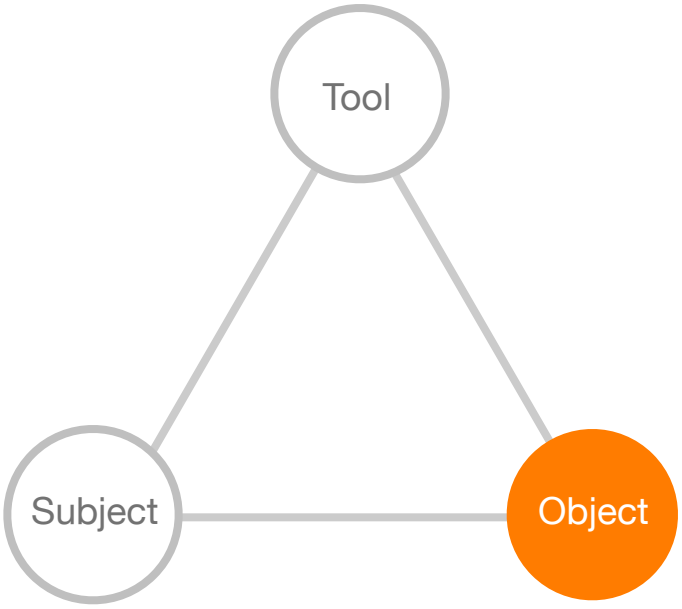
Activity Theory

Hierarchical Structure

Activity Theory

Object

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

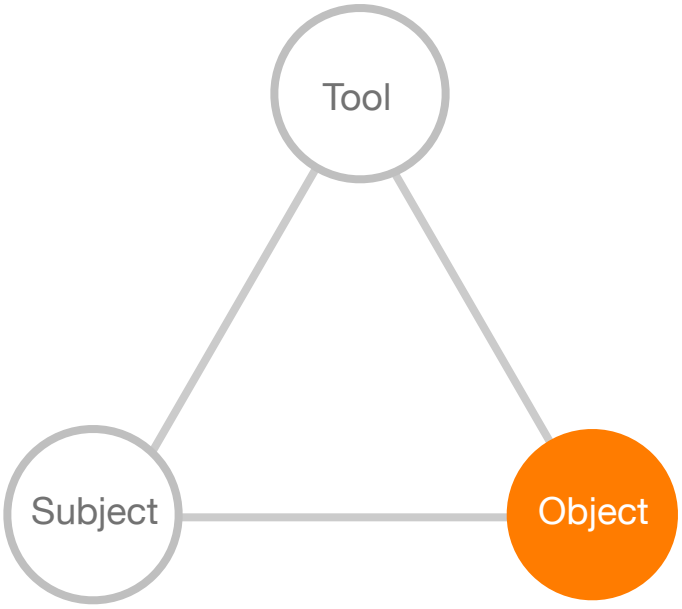


Intentions, desires, prospective outcomes that motivate and direct activity

Activity Theory

Object

Can be physical thing or ideal object



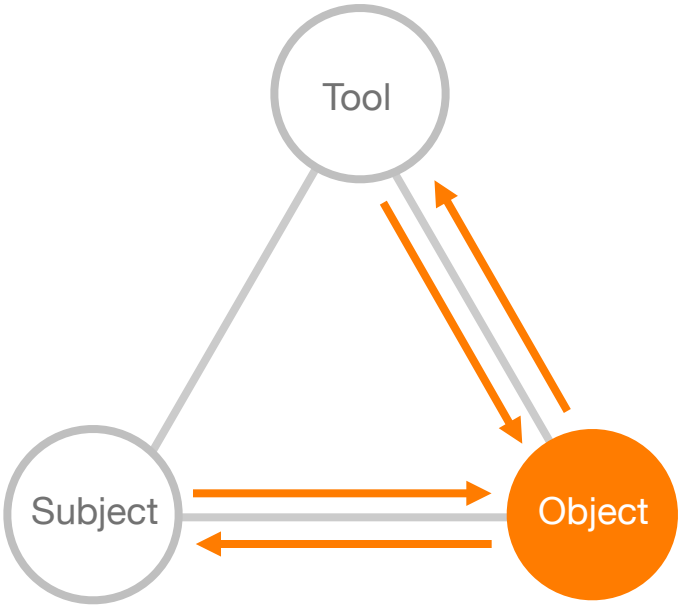
Intentions, desires, prospective outcomes that motivate and direct activity

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.



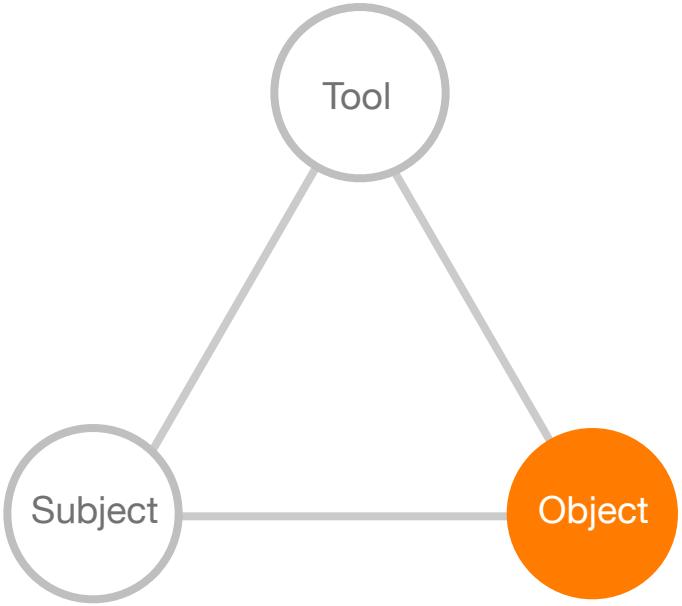
Intentions, desires, prospective outcomes that motivate and direct activity

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

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

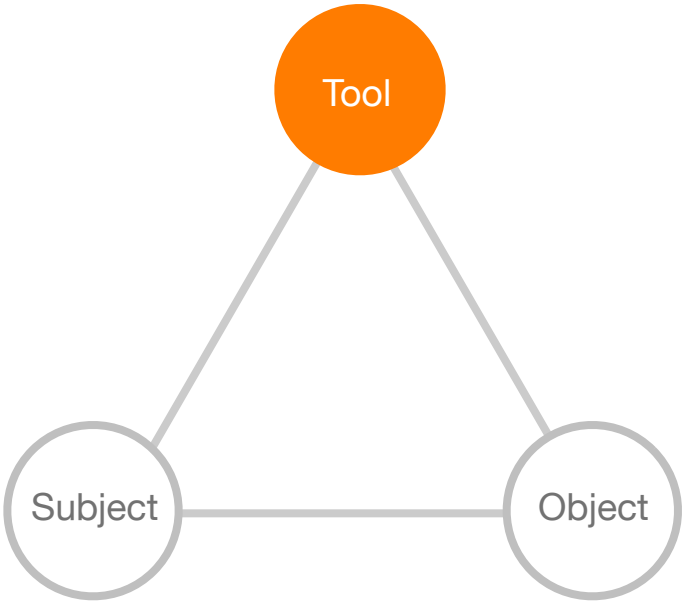
Externalization

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.

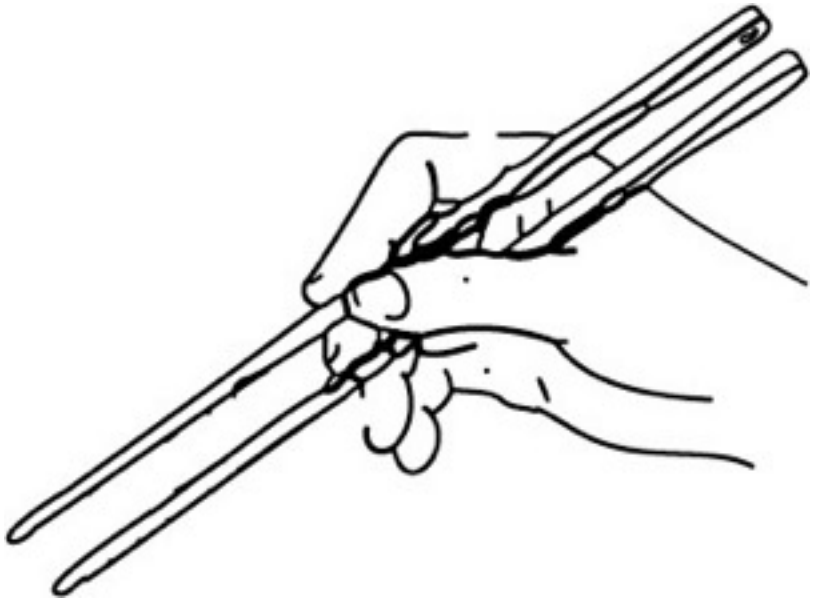


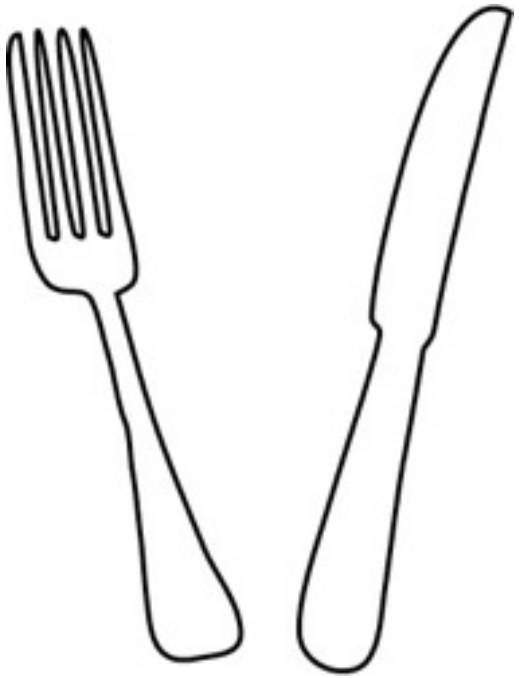
Activity Theory

Tools and Mediation

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

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

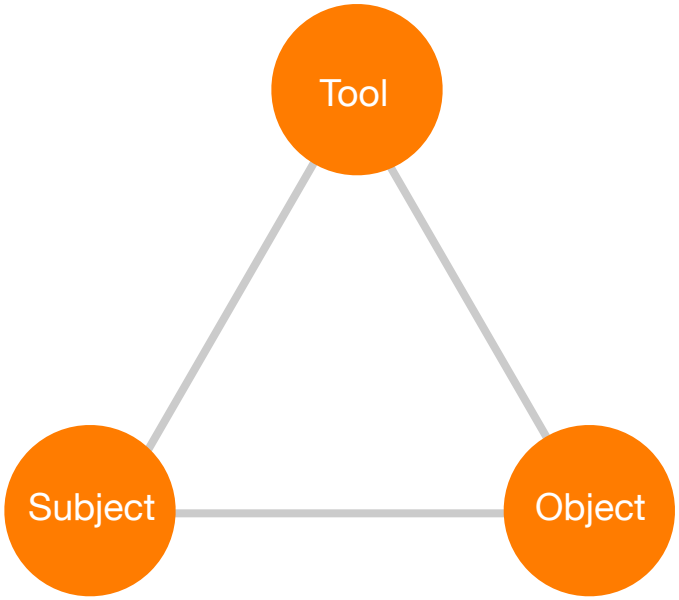
Human activity unfolds over time in a historical frame.

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

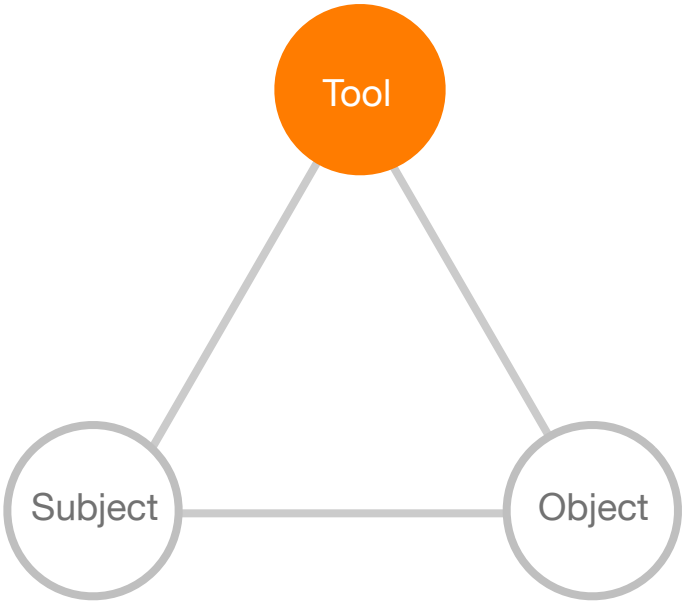
Design that is sensitive to people's ability to grow and change.

Activity Theory: Summary

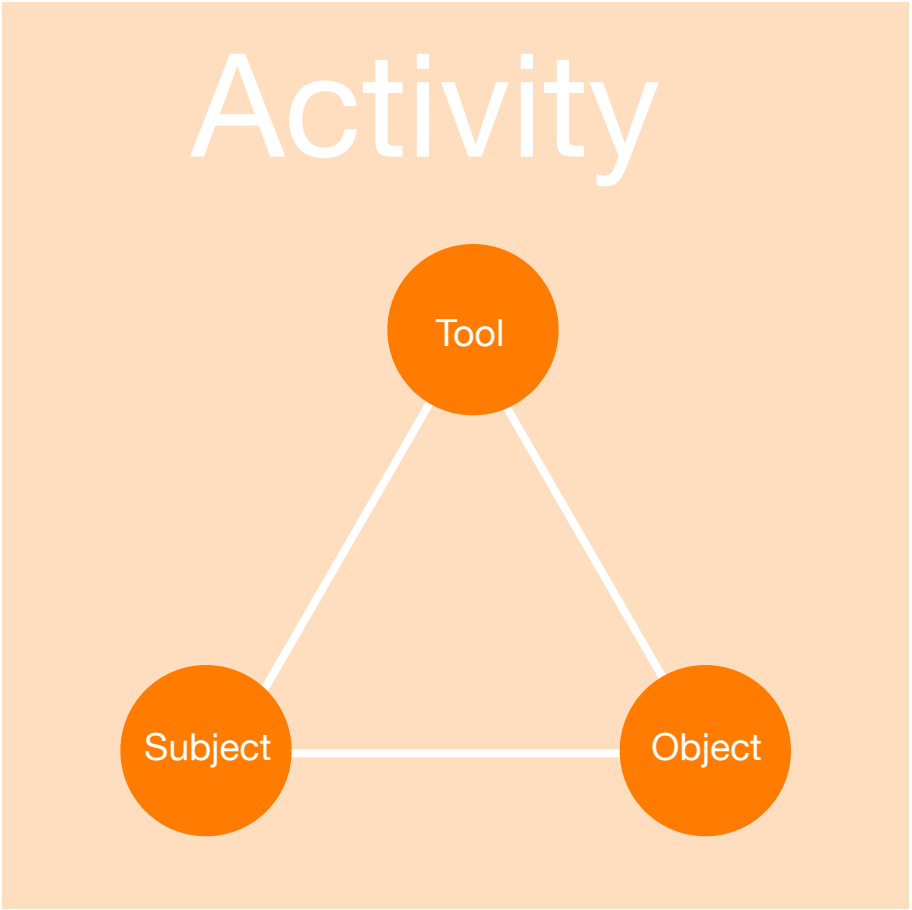
- Hierarchical structure of activity
- Object-oriented
- Internalization and Externalization
- Tool mediation
- Development



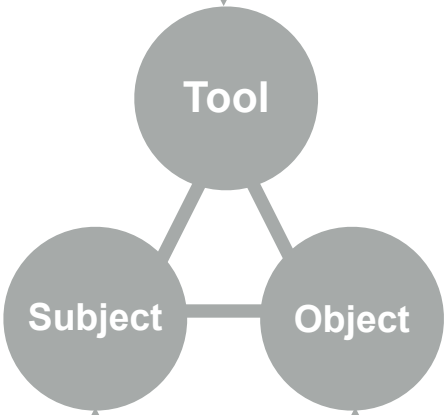
Why Should We Care about Activity Theory?



System That Supports Human Activities. Not Just Tools.



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

- 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!