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

From *Where the Action Is* (Dourish, 2001)
Historical Development of HCI

**Electrical**

- 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

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

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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**

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

Macintosh System 4.2, 1987
Historical Development of HCI

Graphical

• 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

Macintosh System 4.2, 1987
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**

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

Kismet (Breaseal, 2000)

Spark (Vilhjálmsson, 2004)
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

A → [Box] → B
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

Subject  Tool  Object
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**
  - **Subject**
  - **Tool**
  - **Object**
Activity Theory

**Example 1**

A software team programming a system for a client

Diagram:
- **Tool**: computers, programming tools
- **Subject**: the team
- **Object**: bug-free application
Activity Theory

Example 2

Being a graduate student at UC Berkeley

- **Subject**: student
- **Tool**: books, computers, colleagues, courses, professors
- **Object**: learning, graduating, finding a job, having fun
Activity Theory Concepts

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

#### Hierarchical Structure

<table>
<thead>
<tr>
<th>Activity</th>
<th>Actions</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>conscious goal-oriented</td>
<td>automatic, unconscious</td>
</tr>
</tbody>
</table>
Activity Theory

Hierarchical Structure

Example 1

<table>
<thead>
<tr>
<th>Activity</th>
<th>Building a house</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions</td>
<td>Putting the roof up, transporting bricks by truck</td>
</tr>
<tr>
<td>Operations</td>
<td>Hammering, changing gears when driving</td>
</tr>
</tbody>
</table>
Activity Theory

Hierarchical Structure

Example 2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Completing a software project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions</td>
<td>Programming a module, arranging meetings</td>
</tr>
<tr>
<td>Operations</td>
<td>Using OS</td>
</tr>
</tbody>
</table>
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.

![Triangle Diagram](attachment:image.png)

- **Subject**
- **Tool**
- **Object**

Intentions, desires, prospective outcomes that motivate and direct activity
Activity Theory

**Object**

Can be physical thing or ideal object

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Intentions, desires, prospective outcomes that motivate and direct activity

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Activity Theory

Object

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

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.

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 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?

![Diagram showing the relationship between Subject, Tool, and Object in 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

How do you...
...feel?

cool
hot

I handle
I button
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!