729G12

Distributed and situated cognition
Lecture 5: Activity Theory & Artifacts

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Course compass

Embodied cognition  Situated cognition  Distributed cognition
(Low-level abstractions)  (in practice)  (High-level abstractions)

Activity theory: high-level abstractions with a focus on activities
Literature

• Kaptelinin (2014, not Kaptelinin & Nardi, 1999 as it says in the study questions)
• Garbis (2002, chapter 3 & 4)
• Leontiev (1977) Activity, Consciousness, and Personality.
• (Luria (1963) Restoration of function after brain injury)

Activity theory in concepts

"Activities" as unit of analysis
"Subjects" - "Objects"
"Mediational tools" (cognitive artifacts)
"Internalization" - a focus on development
Ontologically situated in a social and physical reality
A social developmental perspective in psychology

1917: A demand for a Marxist psychology

Vygotsky's "cultural historical psychology"

The human mind is social in nature
Culture & Society --> Mind

Activity - between subjects and objects

Activity

Subject <-> Object

Individual
Group
Organization

Vygotsky (1978) & Leontiev (1978)
Activity - between subjects and objects

Objects and object-directiveness

"...an object (in the sense of a goal) is something pursued by the subject." (Garbis, p. 40)

"The world is structured; it comprises discrete objectively existing entities, that is, objects" (Kaptelinin, 2014)

"In other words, the object motivates the subject - it is a motive." (Kaptelinin & Nardi, 2006)

What?
Lost in translation

What objectively exist in the world

Object

RU. "Predmet"  
GE. ("Gegenstand")

RU. "Obyekt"  
GE. ("Objekt")

Hegel
-Gegenstand is an object of knowledge, consciousness and intention
-Objekt is something real, independent of the subject

Leontyev
-Predmet: the object of activity - the target (or content) of a thought or an action
-Obyekt: deals mostly with material things existing independently of the mind
The subject/object relationship

"Activity refers to a specific level of subject-object interaction, the level at which the object has the status of a motive"

-Kaptelinin & Nardi, 2006

Activities and actions

(Kaptelinin & Nardi, 2006)
Activity

Subject: social group
Object (motive): To drive to Stockholm

Actions

Pack car
Drive car

Operations

Shift gear
Stay in lane

The subject/object relationship

In-the-moment perspective:
Physical strength determines weightlifting

The historical/developmental perspective:
Weightlifting determines physical strength
Higher and natural functions

Higher psychological functions

Moving from the external to the internal

Remembering a set of words
Preschool children, middle school children, and university students
Half of them were allowed to use cuing picture cards (mediational tools) during encoding and recall

Dinner

(Kaptelinin & Nardi, 2006, adopted from Leontiev 1931)
Moving from the external to the internal

(Kaptelinin & Nardi, 2006, adopted from Leontiev 1931)

Moving from the external to the internal

Mediator (M)

Process

Development and internalizations

(Kaptelinin & Nardi, 2006, adopted from Leontiev 1931)
Moving from the *internal* to the *external*

Aging
Skill decomposition/improvement
New tool
...

Mediation
Activities \( S \leftrightarrow M \leftrightarrow O \) are always mediated.

- Artefacts.
- Objects
- "Mediators"
- Directs attention
- Shape interaction with reality
  - (Shaping external \( \rightarrow \) shaping internal)
- History & culture
  - Tools are created and transformed in activities
  - Accumulation and transmission of social knowledge
The difference between graduate and novice bartenders

Part 1:
"Speed drill": to mix four drinks as quickly as possible
Meantime they counted backwards from 40

Part 2:
"Speed drill": to mix four drinks as quickly as possible
Uniform opaque glasses

Beach (1993)
The activity triangle - the basic unit

Leontiev (1978)

Objectives and division of labor
The extended activity triangle

Mediations tools

Subject

Object

Rules

Community

Division of labor

Engeström (as referred to in Garbis, p.41)

The development of a control room

Johansson & González (Strålskyddssäkerhet 2012:1)
The development of a control room

The Activity Checklist

Two checklists across four categories: One for evaluation...

<table>
<thead>
<tr>
<th>Evaluation Version</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement</strong></td>
</tr>
<tr>
<td>People who use the target technology and/or the target action or target goals</td>
</tr>
</tbody>
</table>
The Activity Checklist

Two checklists across four categories: One for design...

<table>
<thead>
<tr>
<th>DESIGN VERSION</th>
<th>Measurands</th>
<th>Environment</th>
<th>Learning/representation articulation</th>
<th>Development</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Role of existing technology in producing the outcomes of target actions</td>
<td>Track, available to users</td>
<td>Integration of existing technology with other tools</td>
<td>Use of tools at various stages of target action lifecycle</td>
</tr>
<tr>
<td></td>
<td>Access to tools and systems necessary to perform target actions</td>
<td>Tools and materials</td>
<td>Use of tools through externalization and reflection</td>
<td>Time and effort necessary to learn how to use existing technology for tools and materials</td>
</tr>
<tr>
<td></td>
<td>Specialized and localized organization of networking environments</td>
<td>Division of labor, including synchrony and asynchronous distribution of work</td>
<td>Use of tools for simulating target actions for their actual implementation</td>
<td>Use of tools for simulating target actions in their actual implementation</td>
</tr>
<tr>
<td></td>
<td>Realization of conflicts between various goals and goals associated with other technologies and activities</td>
<td>Rules, norms, and procedures regarding social</td>
<td>Identification of problem articulation and help request in case of breakdowns</td>
<td>Identification of problem articulation by creating points of breakdown</td>
</tr>
<tr>
<td></td>
<td>Integration of individual target actions and other actions into higher-level actions</td>
<td>Components of target actions that are to be internalized</td>
<td>Strategies and procedures of providing help to colleagues and collaborators</td>
<td>Strategies and procedures of providing help to colleagues and collaborators</td>
</tr>
<tr>
<td></td>
<td>Transformation of existing activities into future activities supported with the system history and implementation of new technology</td>
<td>Use of tools for simulating target actions in their actual implementation</td>
<td>Anticipated changes in the environment and the level of activity</td>
<td>Use of tools for simulating target actions in their actual implementation</td>
</tr>
</tbody>
</table>

AT and DCog

Similarities

- Transformations between the internal and the external
- Internal processes can never be analyzed without an understanding of external cultural processes
- Process and changes over time
- Functional perspectives from two perspectives (Garbis, p.74)
AT and DCog

Similarities

Subject with a Goal

System functionality

Artifact mediation

AT and DCog: goals

Within distributed cognition we often have predefined goals of the system - where the relationship to the individual is unknown

AT does not presupose an objective for an activity (reasonable for interaction design and HCI?)

...Hutchins would likely agree, but recall the three-level analytical framework where we start somewhere else (Garbis)
AT and DCog: agency

- DCog: coordination between stable units
- AT: Greater focus on individual flexibility/improvisation

Reflexivity  Resistance  Creativity

AT and DCog: cognitive artifacts

DCog view humans and artifacts on the same level of analysis (Kaptelinin & Nardi)
...leading to artifacts that have semantic content (Kaptelinin & Nardi)
...but recall the three-level analytical framework (Garbis)
AT and DCog: mediation

Culturally developed artifacts are important for both DC and AT

Cognitive artifacts

For more comparisons between AT and DCog pay extra attention to p. 42-44, p. 54-55, p. 73-75 in Garbis

* Distributed cognition (Hutchins) Check *
* Activity theory (Kaptelinin & Nardi etc.) Check *

Norman

* Person plus (Perkins)
Norman's definitions (1)

"Anything invented by humans for the purpose of improving thought or action counts as an artifact, whether it has a physical presence and is constructed or manufactured, or whether it is mental and taught." (Norman, 1993, p.5)

Norman's definitions (2)

“Artificial devices designed to maintain, display, or operate upon information in order to serve a representational function.” (Norman, 1991, in Garbis, 2002, p.58)
Norman's definitions (3)

“Cognitive artifacts are extensions of what man used to do with his mind in the same way as physical artifacts are the extensions of what man used to do with his body.” (Garbis, p.59)

Contrasting Norman's views (1)

The decomposition of internal and external representations (Norman):

Decomposition can be a way to understand the resources used to attain a goal

Assumes that internal representations and the person remain unchanged when using the external world (Garbis)
Constrasting Norman's views (2)

The extension of internal abilities (Norman):

What about how the subject is changed when using the artifact? (Garbis, see also Person Plus, p.62-63)

What about the social dimension of cognition and artifact use? (Garbis, see also Hutchins and AT)

Artifacts as the thing in between subject and objective (The gulf of..., p.70):

"Mediation" instead view it as a resource through which information flows
Person plus

**Person plus (Perkins in Garbis)**
The equivalent access hypothesis: The important thing is the ability to access information
Recall... Bateson lecture 2
But how do we access? And what are the effects of using artifacts?

**A new task:**
Person perspective (Norman)
A new activity/task (Pea, Garbis, p.65-66)
A new cognitive process (Lave, lecture 2, and Hutchins next lecture)

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Next lecture

Cognition in the wild: a re-formulation of the history of cognitive science
(Hutchins: Chapter 9 & "How a cockpit remembers its speed")

Compare artifact discussion to extended mind
(Clark & Chalmers, seminar 3)