Human-Computer Interaction

Second Wave HCI

Activity Theory

COMS30029

aka #HCI_Theory

Aisling Ann O'Kane

Slide Credit: Matthew Purver, Oussama Metatla and Dan Bennett

Second Wave HCI
“Mess” is the message, groups and contexts

Activity Theory

What is Activity Theory

Modelling an activity system

Contradictions/Tension in activity systems

Examples & design implications

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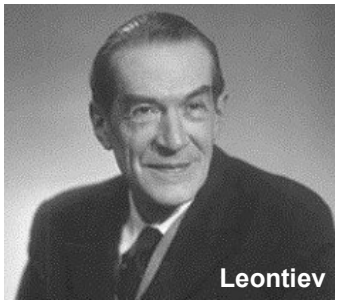
What is Activity Theory

A formal theoretical framework to analyse what people do…

A (soviet) psychological theory
- Originated in Marxist philosophy
- Framework for describing activities
- Perspectives that interlink individuals with social contexts of their activity

Vygotsky, Leontiev, Engeström
- Used in HCI in the 90s
  - More recently Bødker, etc.
  - Nardi, Kaptelinin at Apples (among others)



What is Activity Theory

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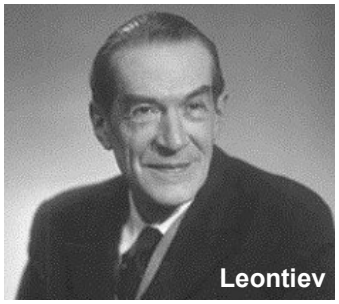


Notions and Principles

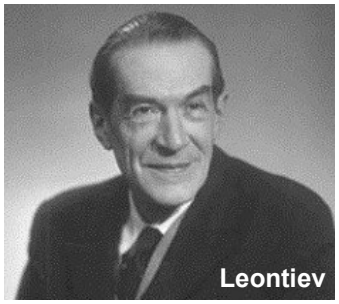
Activity theory is a conceptual approach **not** a predictive theory

Unit of analysis: Activity *in essence* consisting of:

- Subject (individual or group)
- Object or motives
- Tools/instruments
- Socio-cultural rules

Two key ideas:

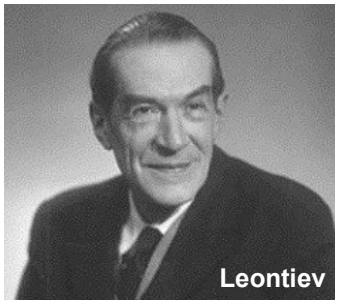
- Human mind can only be understood in terms of our interactions with the world
- This interaction (or activity) is socially or culturally determined



Notions and Principles

Five principles:

1. Object-Orientedness
2. Hierarchical structure of activity
3. Internalisation / Externalisation
4. Mediation
5. Development



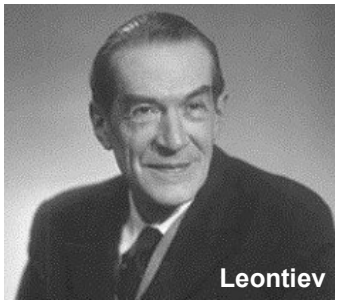
1 Object-Orientedness

Principle: *Every activity is directed towards something that objectively exists in the world, that is the* ***Object***

E.g. a computer program is an “object” of a programmer’s activity

Objects can be:

- Things
- People
- Social/cultural propersties (e.g. desire to be successful)

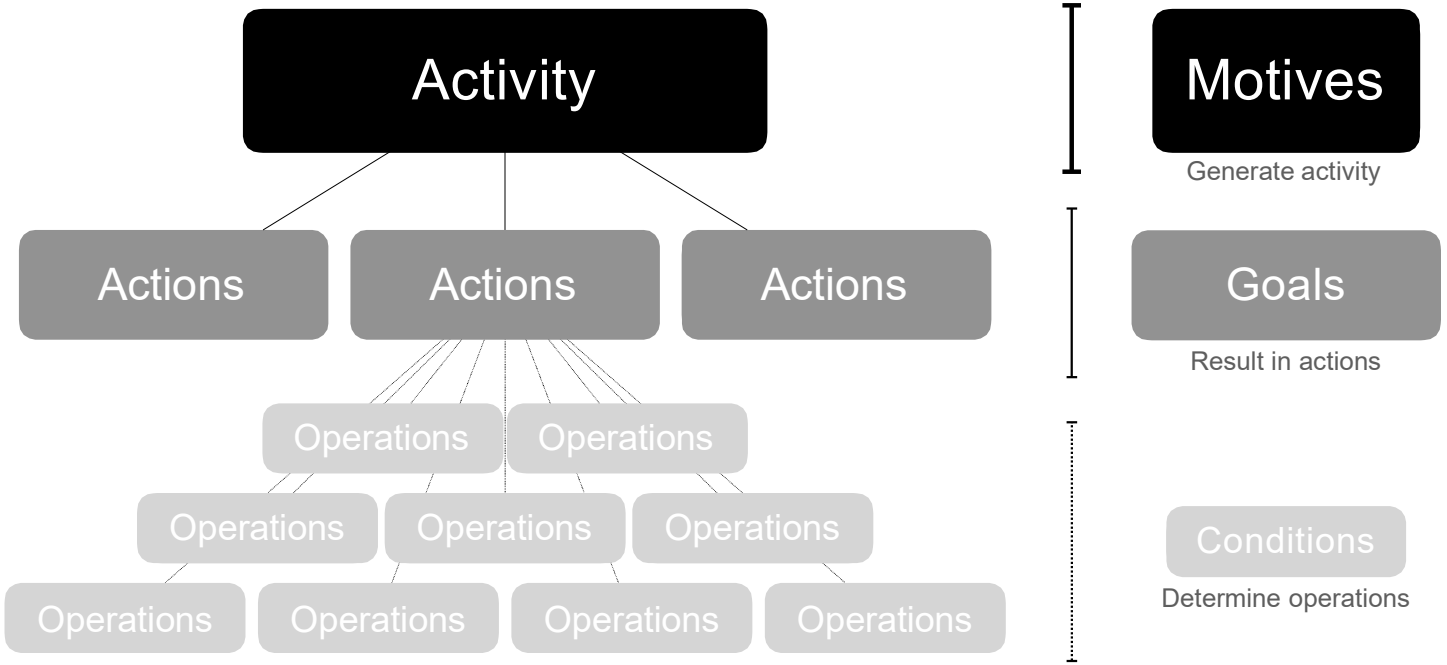


2 Hierarchical Structure of Activity

Activity: top level

Actions: discrete conscious components

Operations: unconscious mechanical means

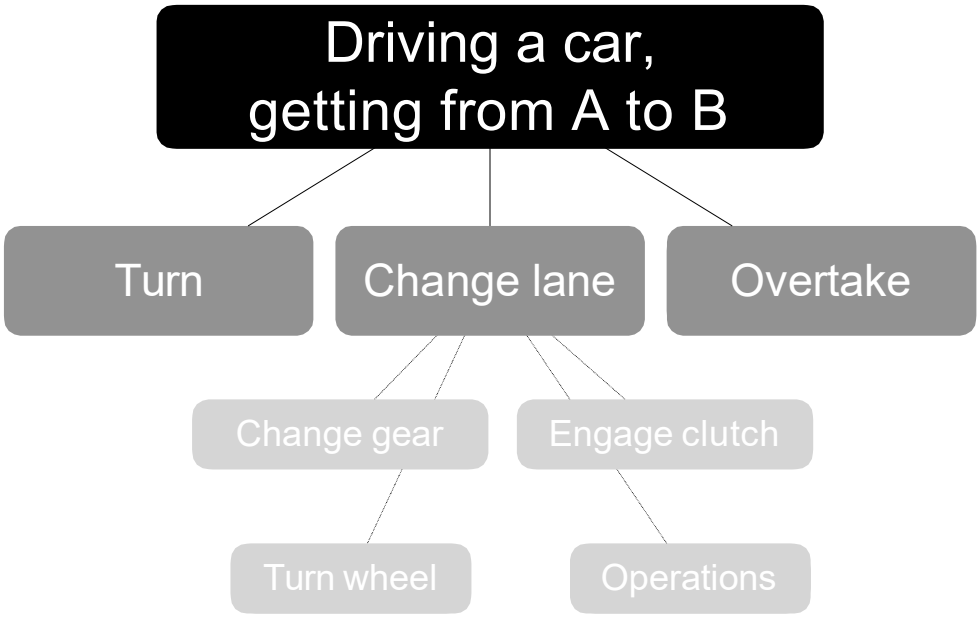


Example: A Driving Activity

Activity: top level

Actions: discrete conscious components

Operations: unconscious mechanical means



Motives
Generate activity

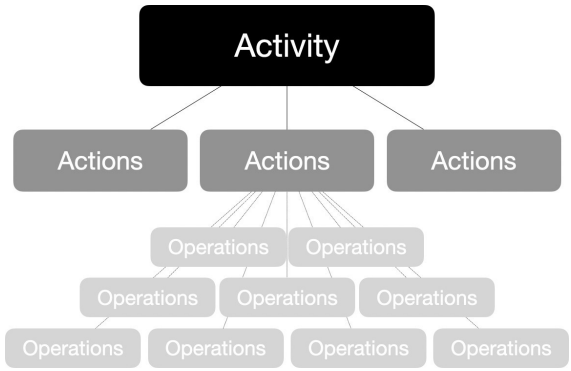
Goals
Result in actions

Conditions
Determine operations

3 Internalisation / Externalisation

Remember Phenomenology?

Principle: *Mental processes cannot be understood in isolation from external activities*



Internalisation: *Actions* transform into *Operations*

- Once learned, actions become automatic
- E.g. Driving: changing gears, engage clutch
  - Novice = actions (conscious efforts)
  - Expert = operations (unconscious, effortless)

Externalisation: Operations transform into Actions

- Breakdown situations
- E.g. Driving: clutch gets stuck, unfamiliar car

4 Mediation

Principle: *Tools shape the way humans interact with reality*

Shaping external activities *also* shapes internal activities too

Tools reflect the accumulated experience of other people who tried to solve the same problem

- Which led to modifying the tools to be more efficient

Tool mediation:

- How the tool is structured (size, material, form, etc.)
- Knowledge of how the tool should be used

5 Development

Principle: *Activity, practice and tool use evolve and get reformed by historical development and usage that unfolds over time*

The use of tool maybe more efficient than seen in a single observation

Influence on methodology of research
- active participation
- Monitoring the development of change over time

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"Mess" is the message, groups and contexts

Activity Theory

What is Activity Theory

Modelling an activity system

Contradictions/Tensions in activity systems

Examples & design implications

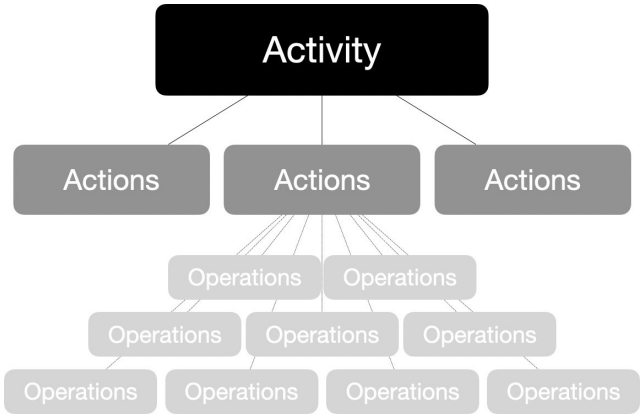
Modelling activity

Focus on the top level: Activity

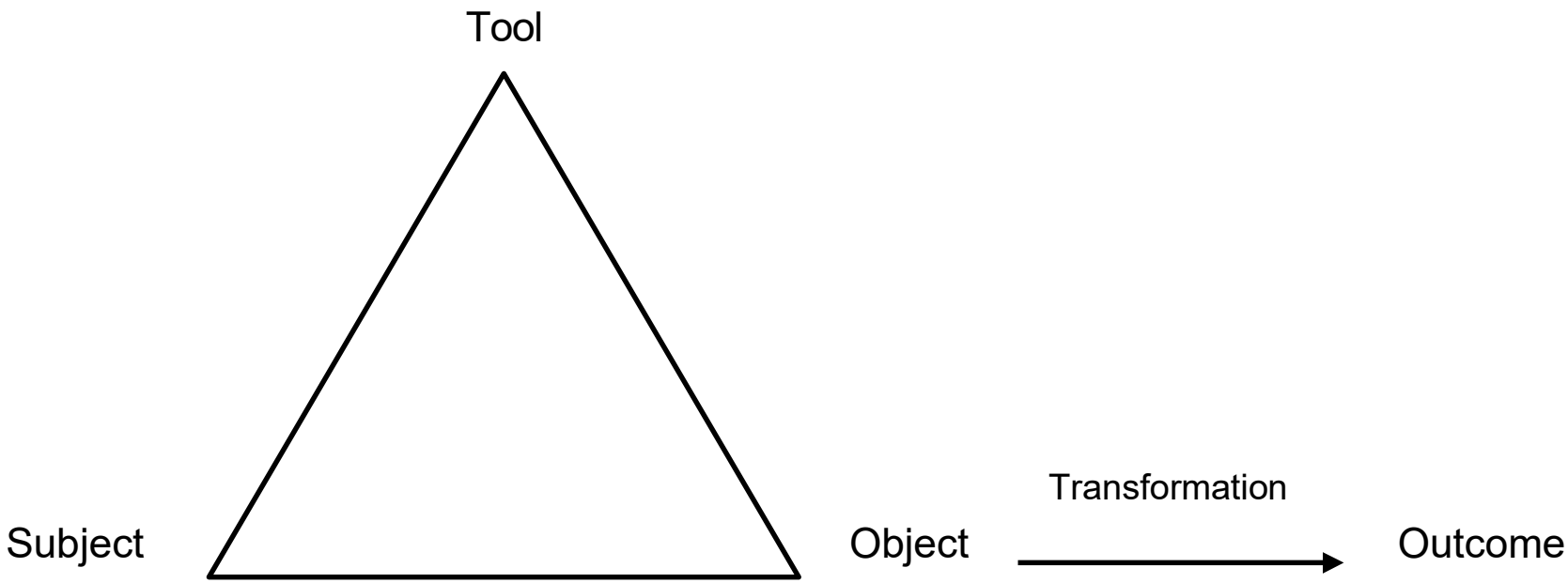
Modelled as a subject transforming an object using a tool

Activity is about change and transformation

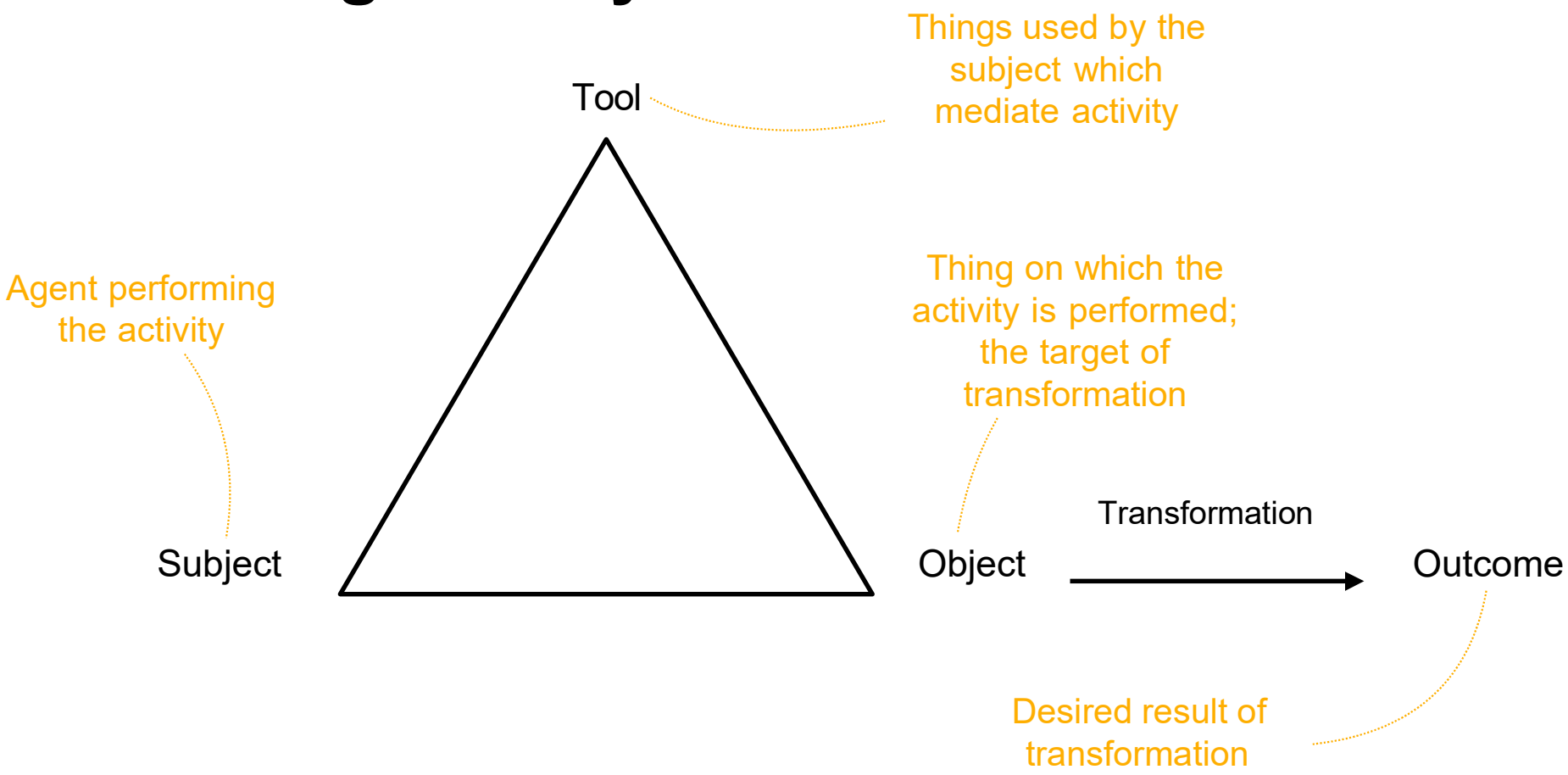
Activity has a purpose and is mediated by tools to achieve this purpose



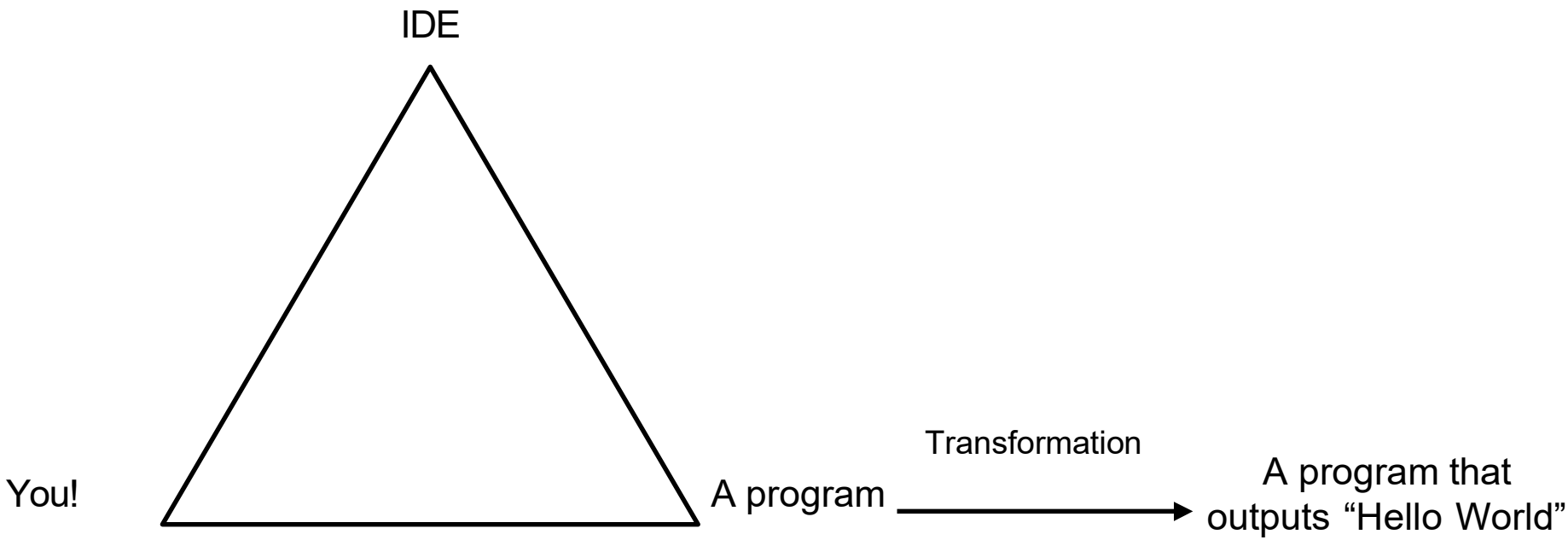
Modelling activity: Simple activity system



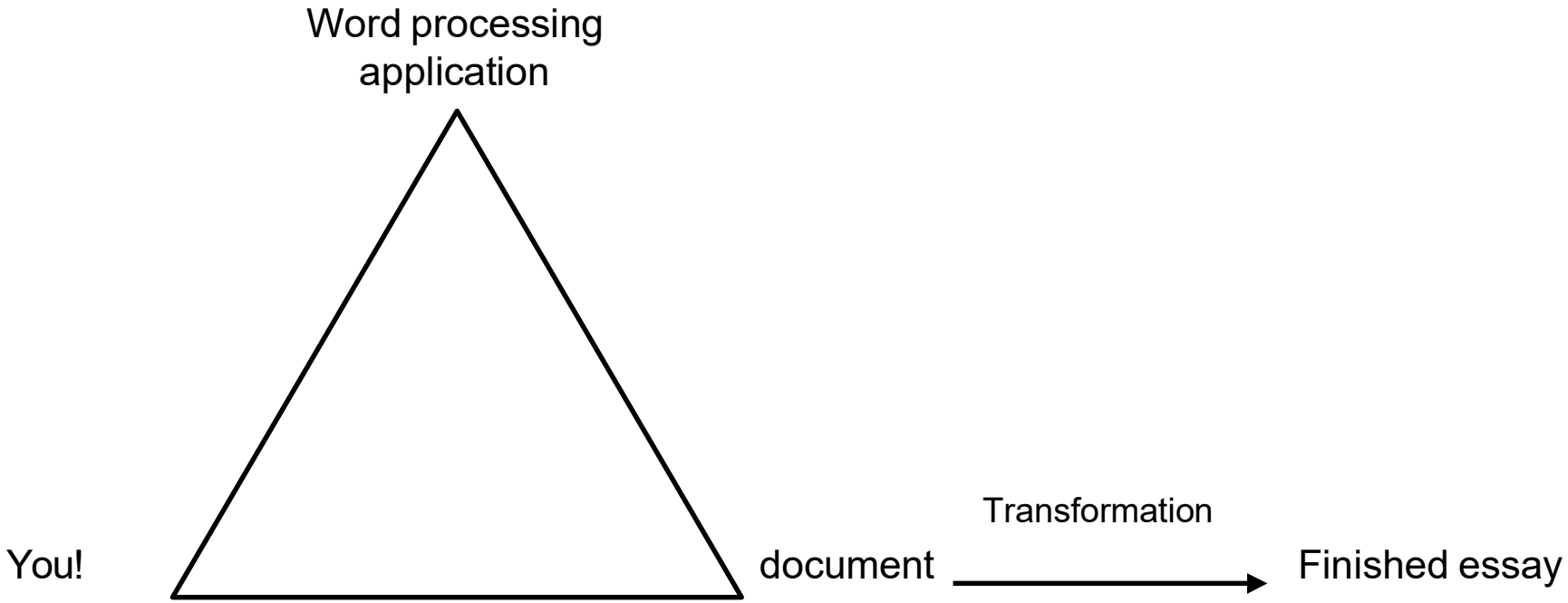
Modelling activity



Example: Coding Hello World!



Example: Writing an essay



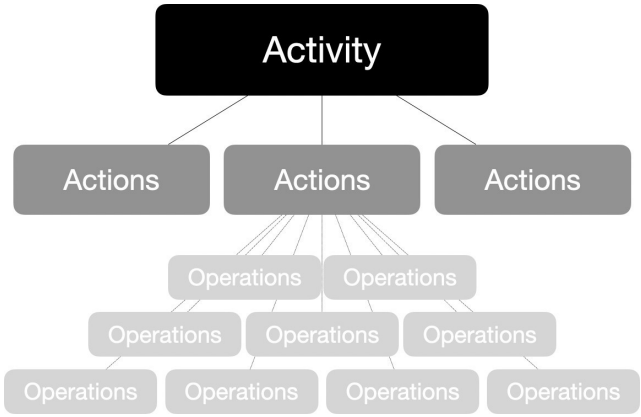
Modelling activity: Context

Relations between subject and object are not direct -> mediated by tools

All influenced by context

Modelled as:

- Community (all agents in a system)
- Rules (conventions, norms, policies)
- Division of labour
  - Horizontal: who does what
  - Vertical: social/power hierarchy



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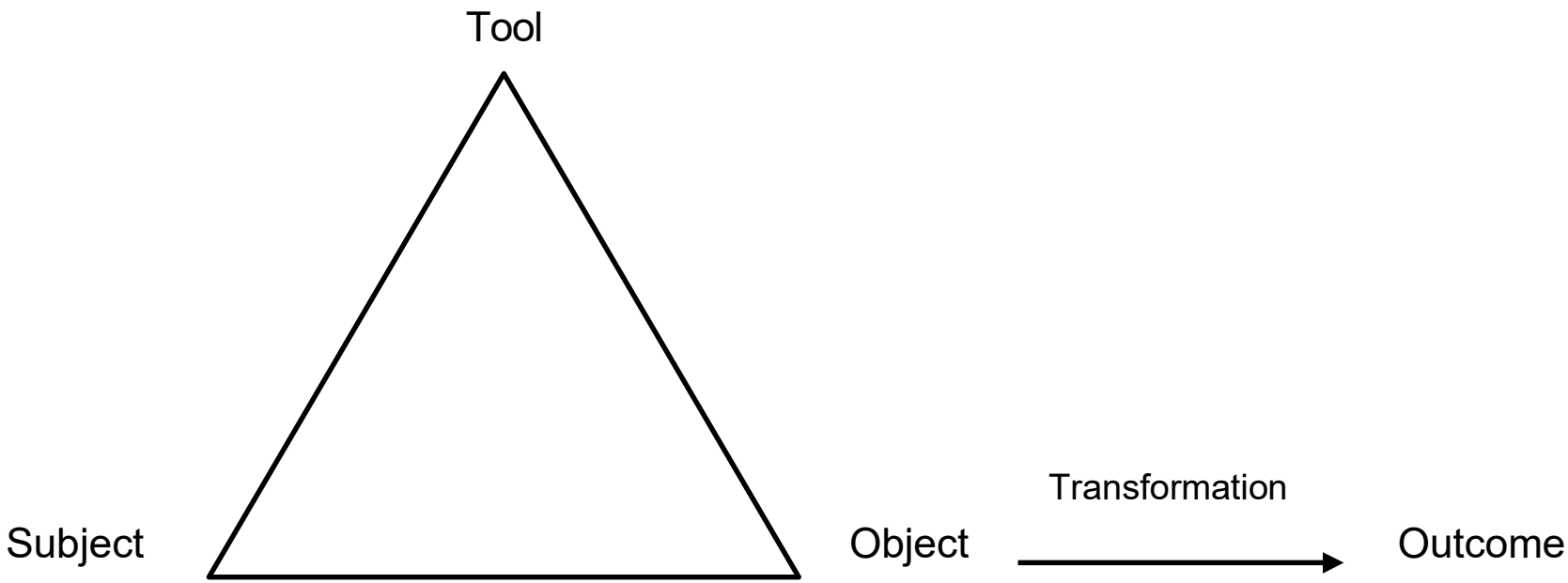
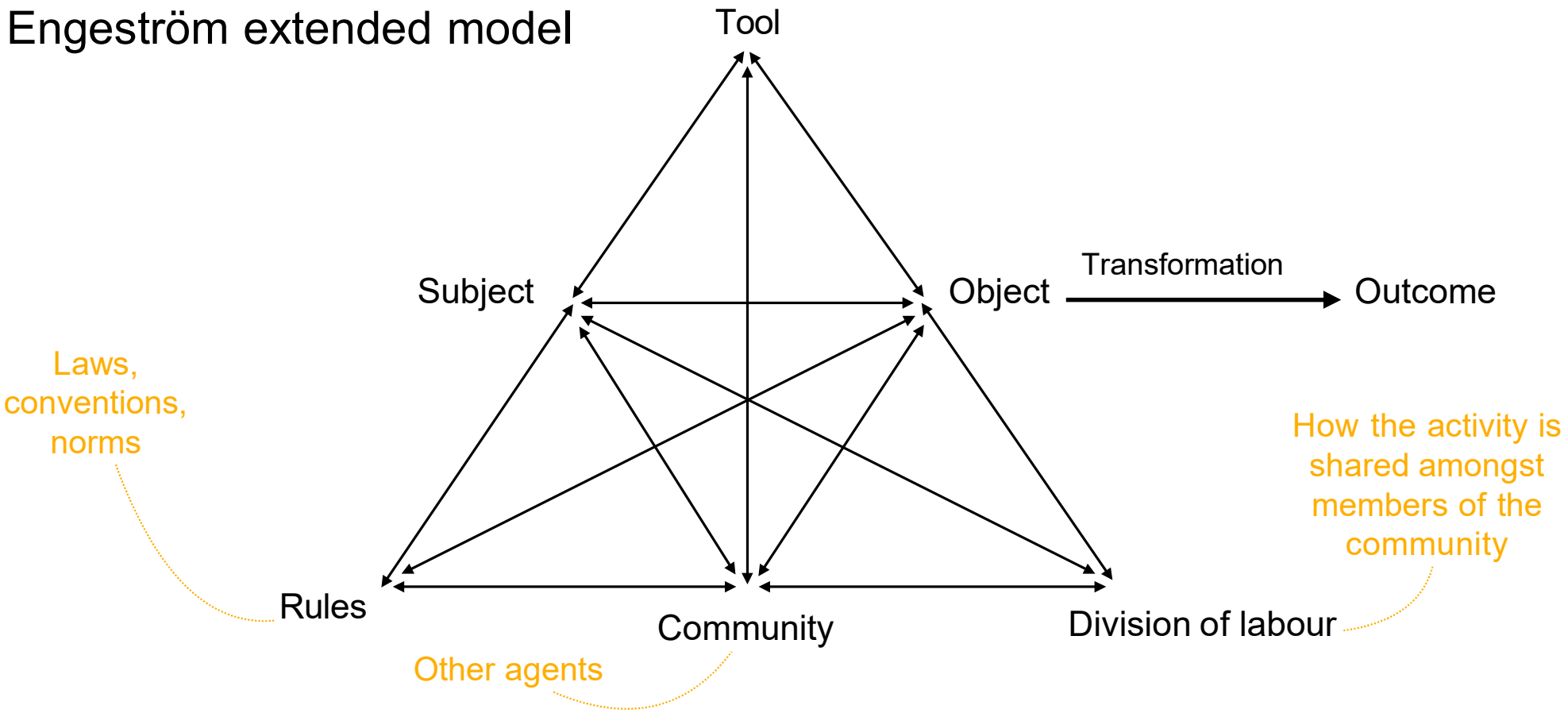


Modelling activity: Activity System

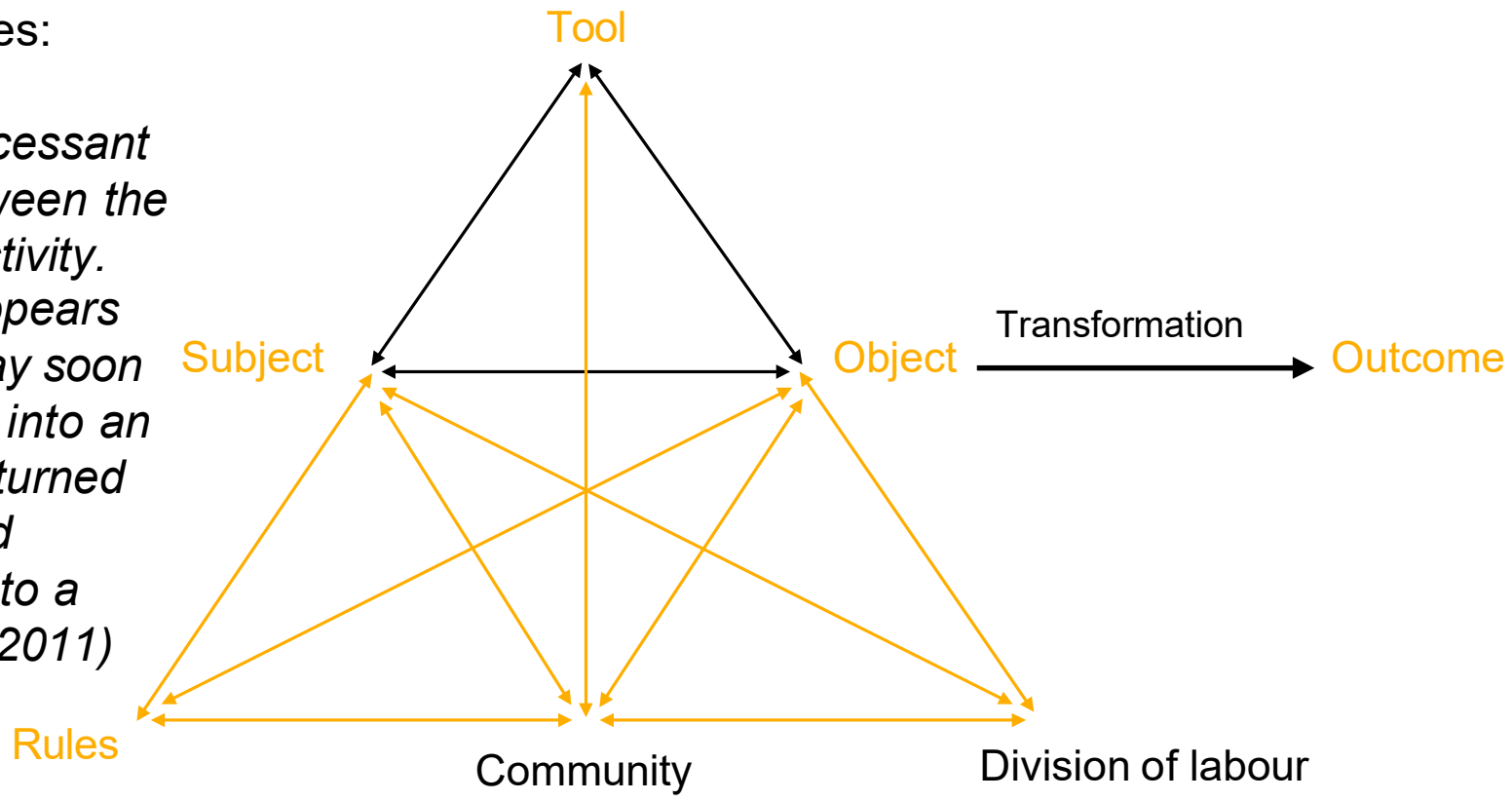
Engeström extended model



Modelling activity: Activity System

Engeström writes:

There is also incessant movement between the nodes of the activity. What initially appears as an object may soon be transformed into an outcome, then turned into [a tool], and perhaps later into a rule. CRADLE (2011)



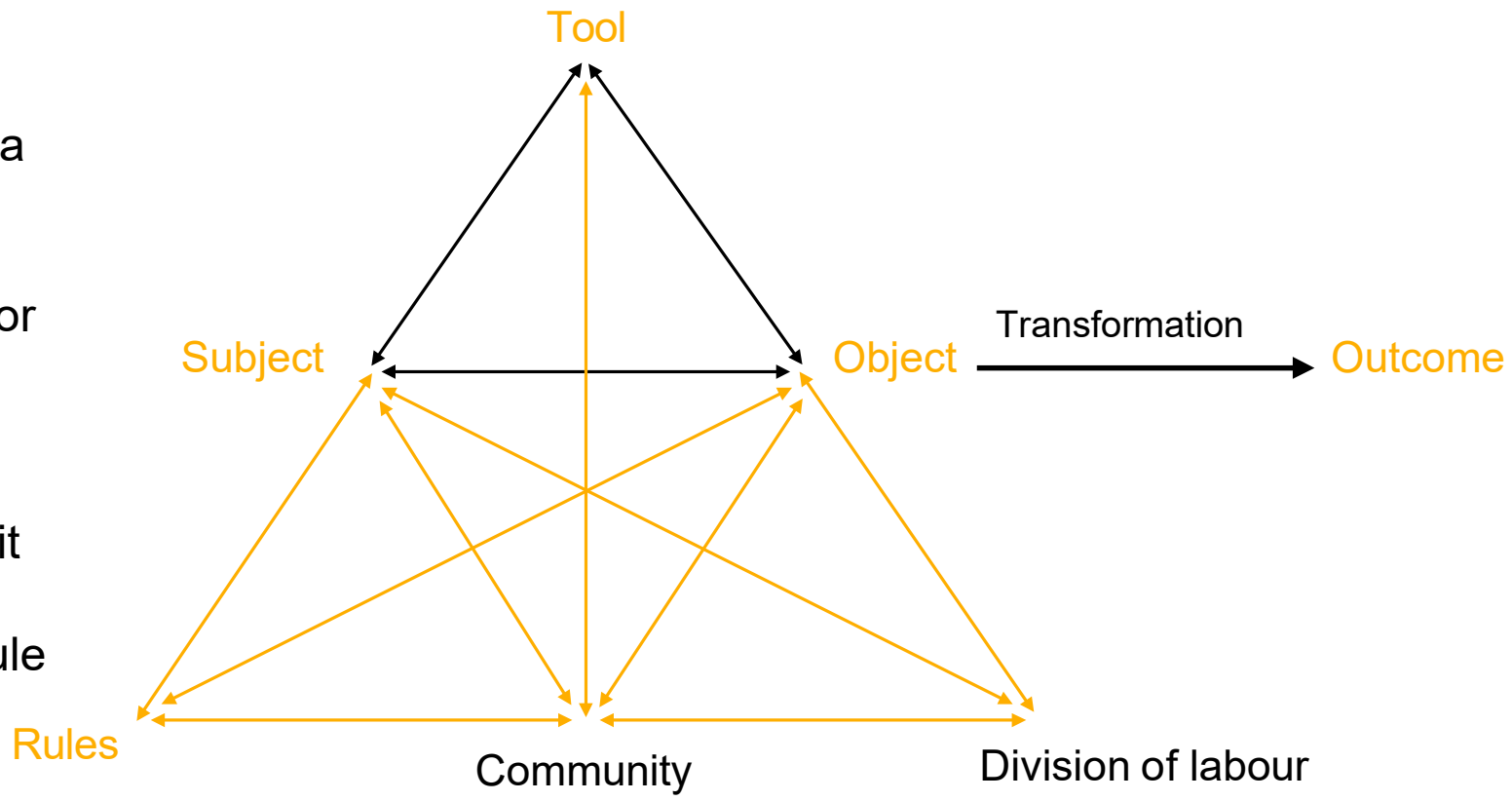
Modelling activity: Activity System

Example:

You are writing a program

This new class or new library becomes a tool

More you do it, it becomes a convention or rule



Second Wave HCI

"Mess" is the message, groups and contexts

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Contradictions/Tensions

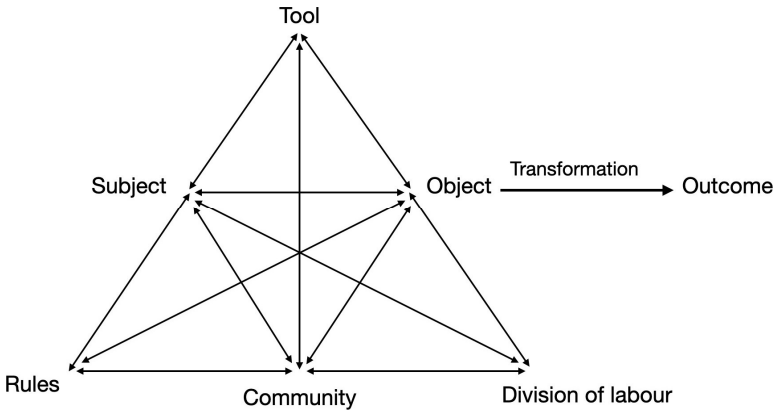
A conceptual tool for analysis in AT

Changes to some elements of the activity system -> causing imbalance

"Outcome" is no longer what is anticipated or desired

Identify issues by looking for contradictions (aka tensions) within an activity system

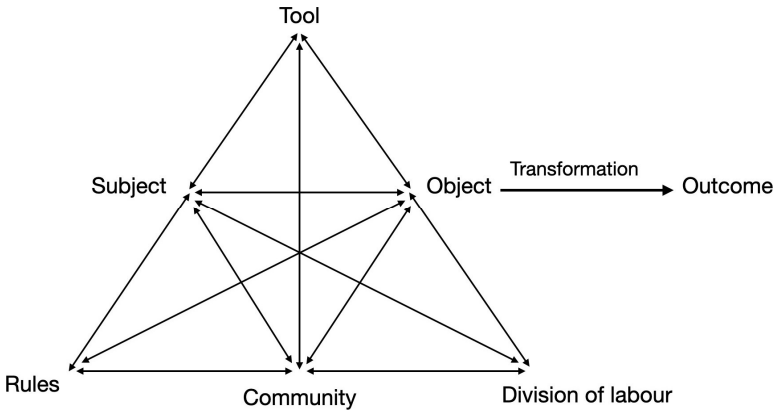
- Where might things go wrong (breakdown)?
- How might things change or develop?



Contradictions/Tensions

Types of contradictions:

- Primary: Within a single component
- Secondary: Between different components
- Tertiary: Within different version of the same activity
- Quaternary: Between different activity systems



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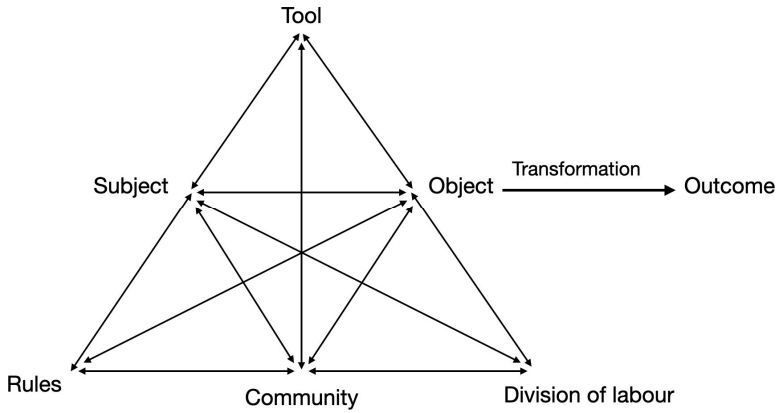


Primary Contradictions

Within a component of an activity system

Object <-> Object

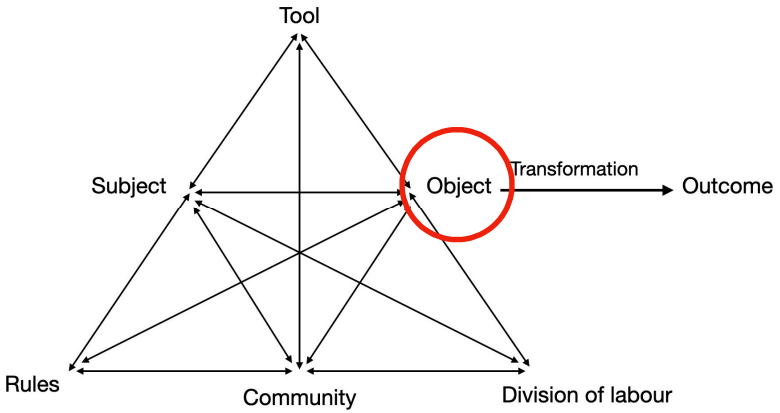
- e.g. conflicting requirements:
  - Pass HCI Theory exam vs. Gain long life knowledge & understanding
  - Physician: heal patient vs. Run the medical centre as a business

Subject <-> Subject

- e.g. Lack of skills

Tool <-> Tool

- e.g. insufficient RAM to run word processing application



Secondary Contradictions

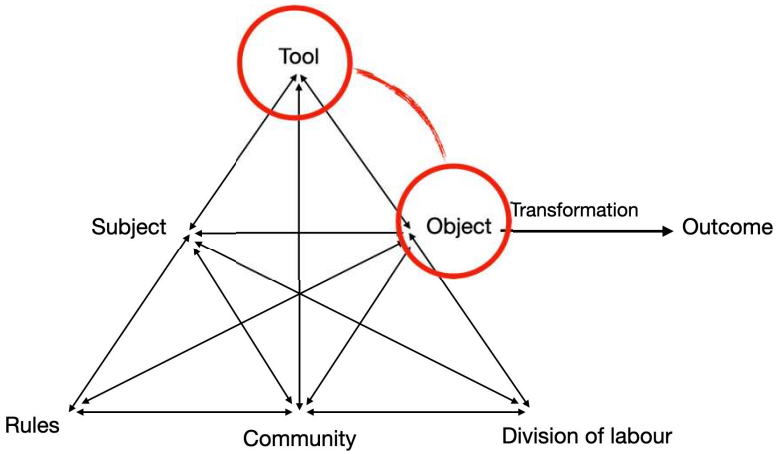
Between Two or more components of an activity system

Tool <-> Object

- Tool unsuited for the job
- Object changes the tool

Subject <-> Tool

- Tool changes the motivation of the subject



Activity Theory doesn't tell us how to solve tensions, but gives a framework for identifying them

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Example: Mastering an audio track

Analysing audio production activity by a visually impaired producer and a sighted accessibility trainer

Task: Mastering an audio track in a studio

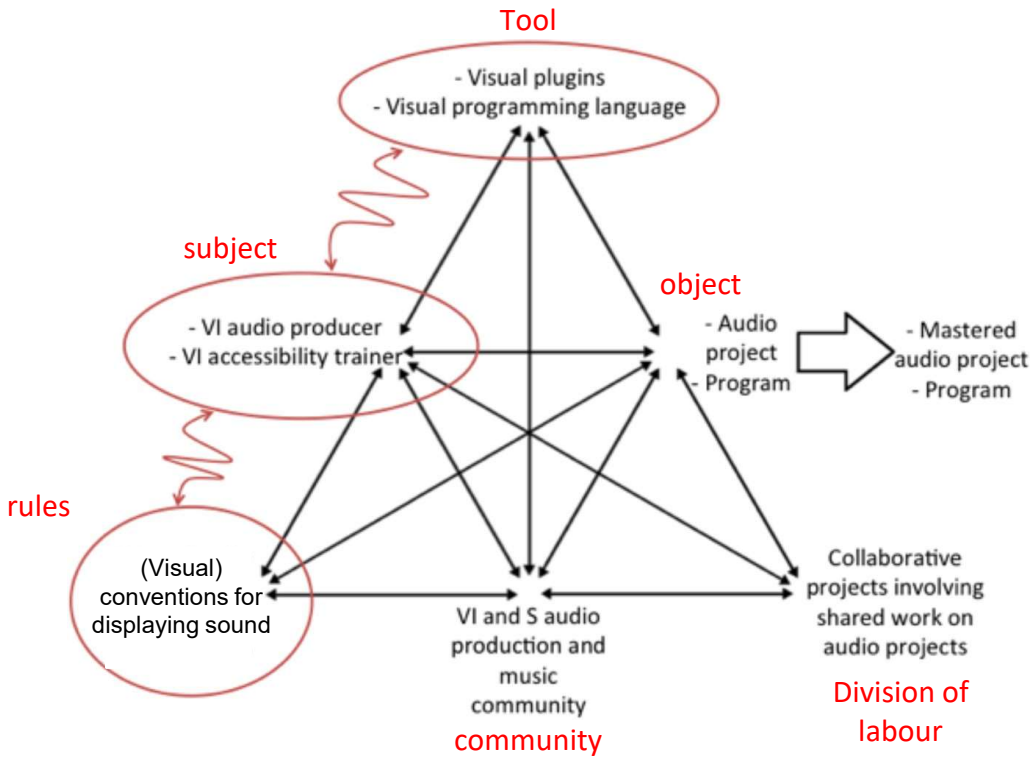
Editing graphs: a GUI, an audio-haptic interface

Metatla, O., Bryan-Kinns, N., Stockman, T., & Martin, F. (2013, September). Activity Theory as a Tool for Identifying Design Patterns in Cross-Modal Collaborative Interaction. In *IFIP Conference on Human-Computer Interaction* (pp. 232-240). Springer, Berlin, Heidelberg.

Example: Mastering an audio track

Activity system: Mastering an audio track

- **Subject**: visually impaired producer
- **Object**: music track
- **Outcome**: Mastered track
- **Tools**: Plugin, Digital Audio Workstation, screen-reader
- **Rules**: Standard mastering practice, a visually dominant tool
- **Community**: Studio production staff, musicians, clients and music community
- **Division of labour**: Sighted trainer, imports project from clients, monitors performance, VI producer masters projects



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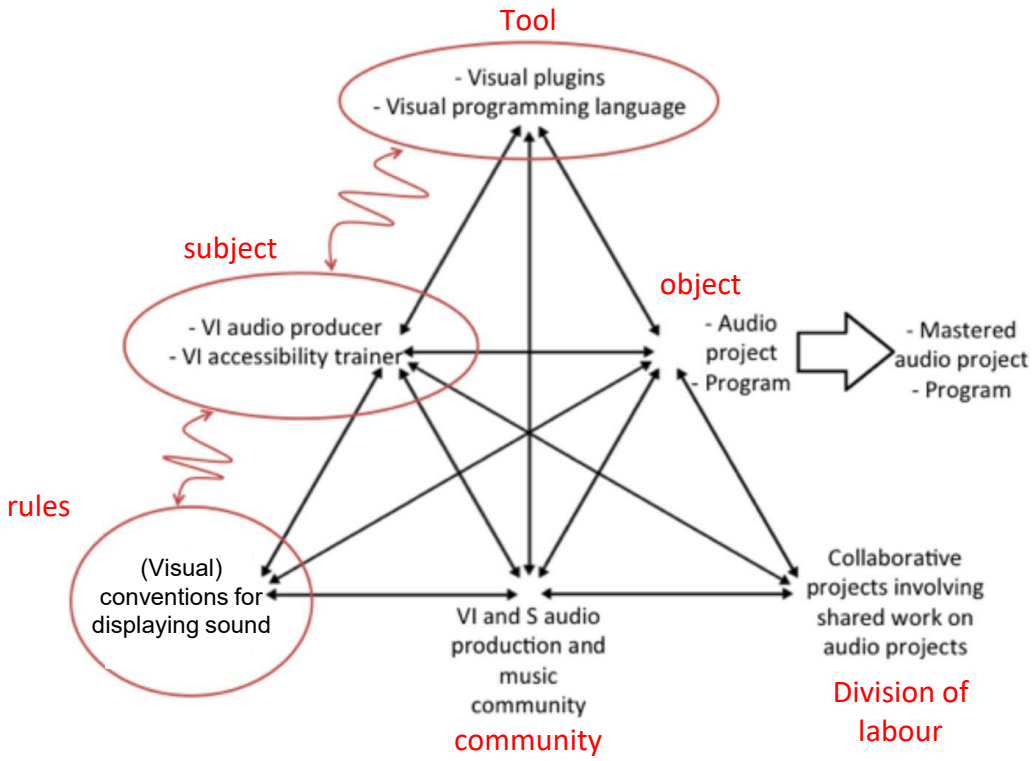
Example: Mastering an audio track

Secondary contradictions:

- Subject <-> Tool
  - Inaccessibility of tool
- Subject <-Rules>
  - Standard practice is visually dominant
  - Distracting audio output of screen-reader with audio editing



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Example 2: Merging branches

Analysing collaboration between sighted and visually impaired colleagues in a charity organisation with merging branches

Task: Updating organisational charts to reflect the merger

Editing graphs: a GUI, an audio-haptic interface

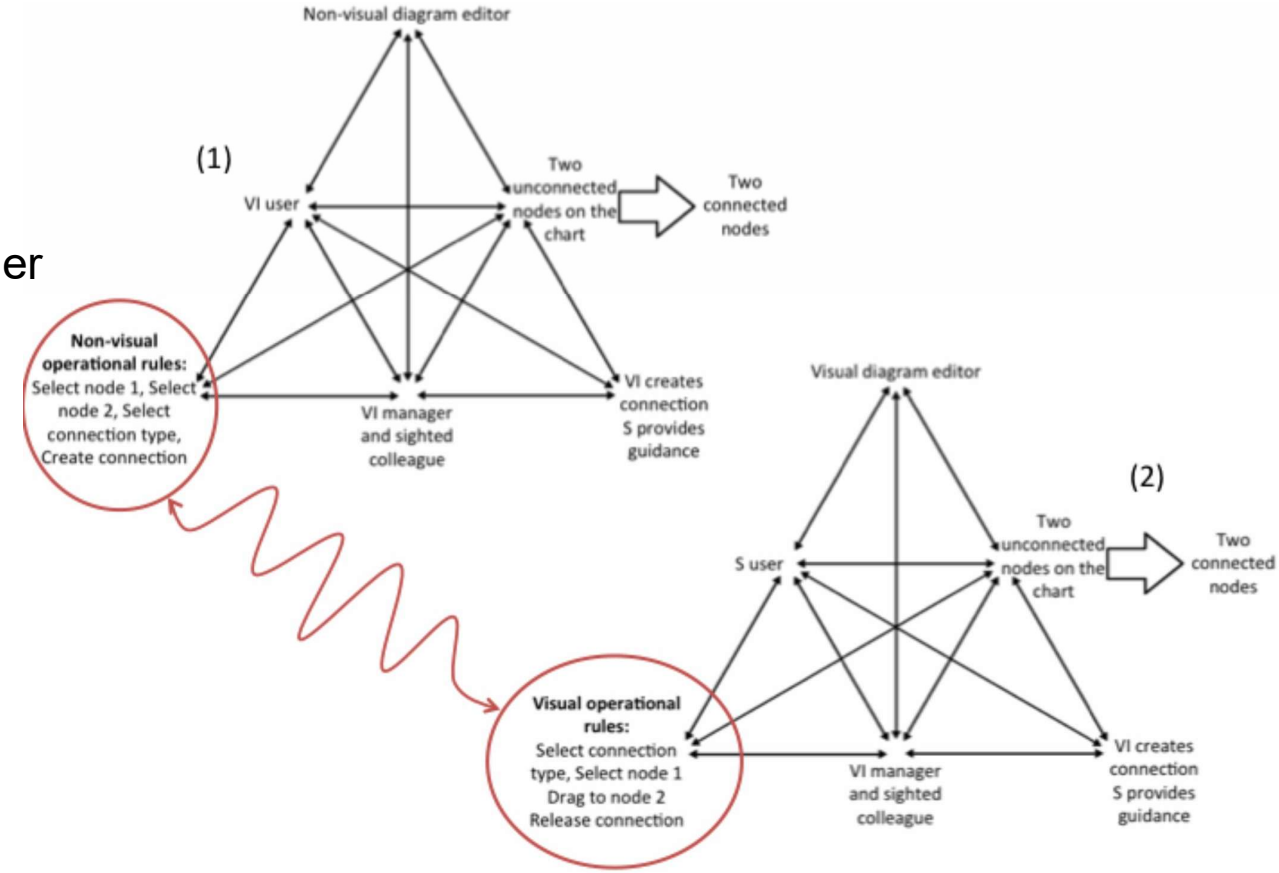
Metatla, O., Bryan-Kinns, N., Stockman, T., & Martin, F. (2013, September). Activity Theory as a Tool for Identifying Design Patterns in Cross-Modal Collaborative Interaction. In *IFIP Conference on Human-Computer Interaction* (pp. 232-240). Springer, Berlin, Heidelberg.

Example: Mastering an audio track

Two activity systems:

System 1
- **Subject**: visually impaired manager
- **Object**: unconnected chart
- **Outcome**: connected nodes
- **Tools**: non-visual editor

System 1
- **Subject**: sighted assistant
- **Object**: unconnected chart
- **Outcome**: connected nodes
- **Tools**: visual editor



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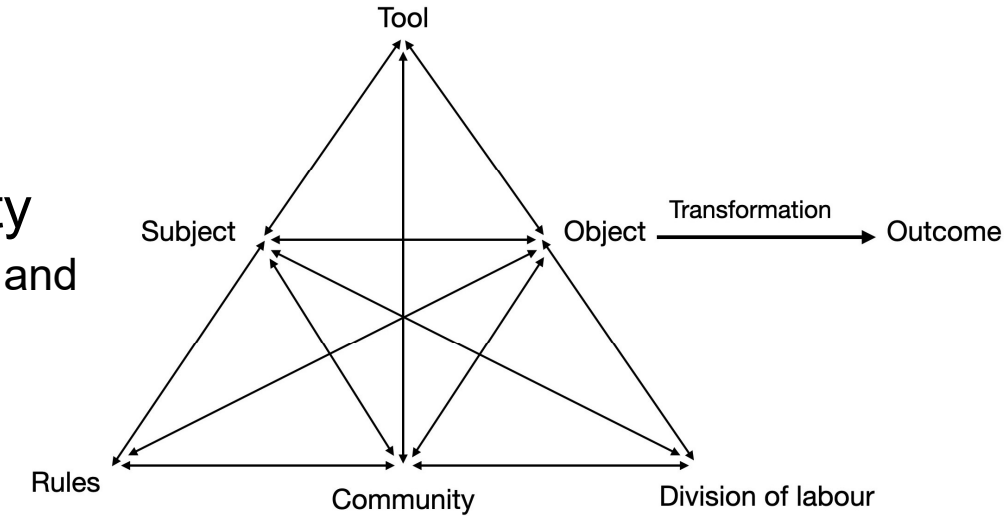
Design implications for HCI

Understand user's point of view
- Not the designers
- Not tasks

Attention to broad patterns of activity
- Not individual action/operation sequences and procedures

Attention to contradictions and transformations

Long research time frame
- Varied data collection methods



Design implications for HCI

Awareness of users' motives

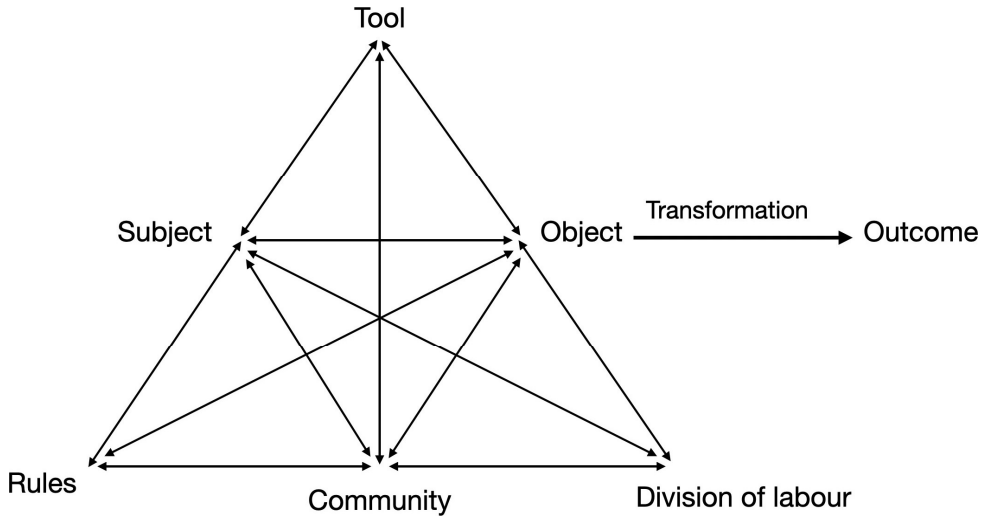
- Move beyond low-level goals

Awareness of social context effects

Awareness of contradictions

Design for transformation

- Actions -> Operations
- Object -> tool



See Kaptelinin et al. (1999) design check list

In summary…

Activity Theory helps us focus on Activity and its motivation
-> a move away from focus on *tasks* in HCI

An analytical tool: how a subject transforms an object using tools and how this is influenced of context and perpetual process of change

The use of tools reflect accumulated experience; tools and tool use have a mediating role: they accumulate and transmit social and cultural knowledge

Contradiction as an aid for critiquing designs and extracting design implications

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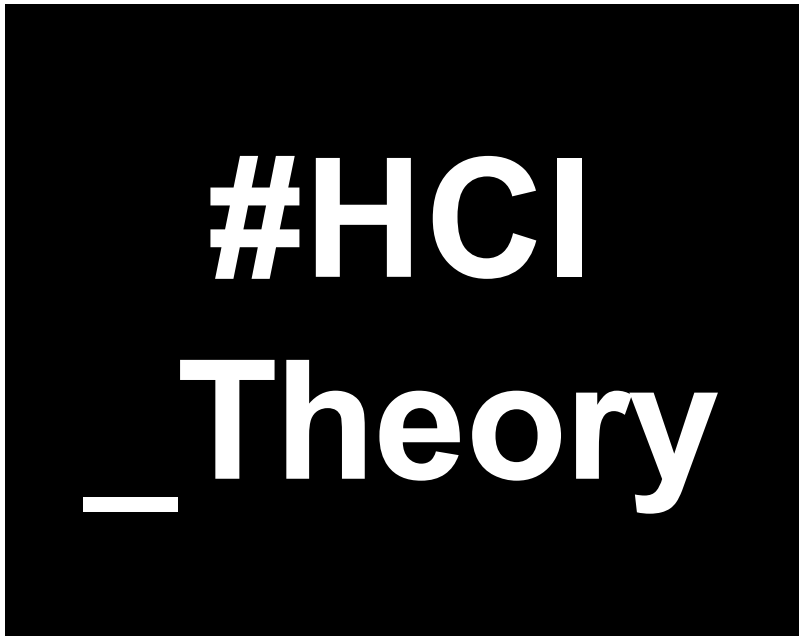
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