Modern theories

Fundamentals of Human-Centered Computing

Modern theories

An overview of modern HCI theories:

– External cognition

– Distributed cognition*

– Ecological cognition

– Ethnomethodology

– Situated Action*

– CSCW theories

– Activity Theory*

Beyond cognition

External, Distributed, and Ecological cognition

Beyond cognition

Criticism: Cognitive psychology doesn't work for HCI

Because it only models what is "inside the head"

Solution: Create a conceptualization of cognition that works for HCI

Beyond cognition

Cognition is **external**

Study the interplay between mind (internal representation) and interface (external representation)

Cognition is **distributed**

Study how cognition is shared among people, technology, environment

Cognition is **constrained**

Study how the environment affects interaction

External cognition

Representations of information can be seen as external parts on one's cognition

E.g. diagrams versus text

- They contain the same information, but diagrams are easier to process

- Simultaneous information makes it easier to make inferences

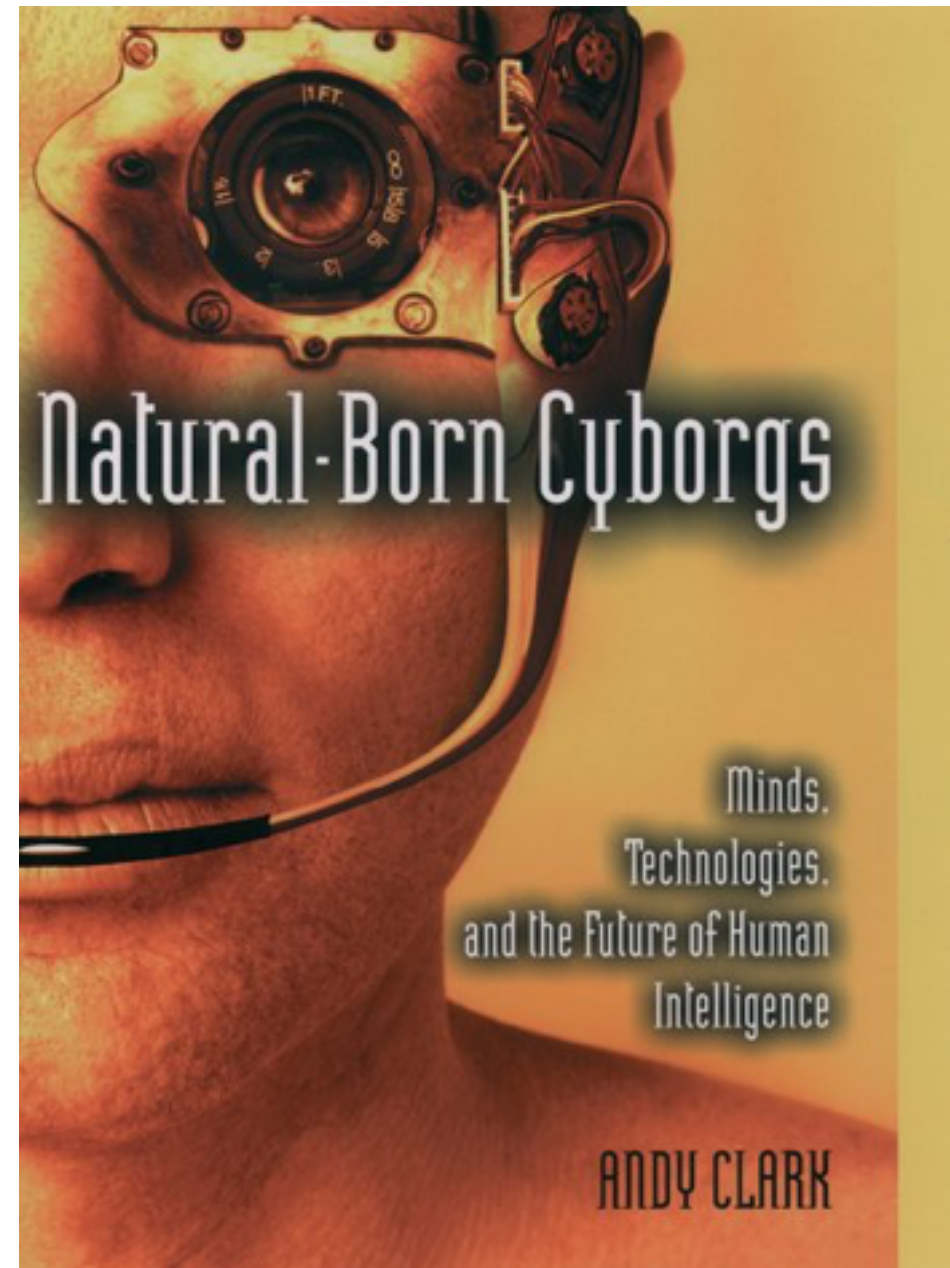See Norman: Knowledge in the head vs. knowledge in the world

External cognition

Extended cognition: Natural born cyborgs

"Scaffolding"

External manipulation as a method of "thinking"

e.g. Interactive displays that link abstract representations to concrete simulations

Natural-Born Cyborgs

Minds. Technologies. and the Future of Human Intelligence

ANDY CLARK

External cognition

Goal: find the optimal representation for cognitive manipulation

Methods:

- Resources model (to explain how external representations can be used in cognition)

- Cognitive dimensions (to measure how well this works)

An effective interface allows for a **structuring of external resources** that requires little reliance on internal resources in order to achieve one's goals

Distributed cognition

Combination of people, systems, and artifacts *is* a cognitive system

Why study cognition at this level?

  Only looking at the individual is a form of reductionism

  Studying the whole system is actually easier

How?

  Ethnography; study how information flows through a system at different levels of granularity

Distributed cognition

Assumptions of "DCog"

An organization is a cognitive architecture

Artifacts play an active role in cognition

Focus on:

Planning and problem-solving

Communication (both verbal and non-verbal)

Coordination (rules, procedures)

Knowledge creation and sharing (through artifacts, training, communication)

Ecological Psychology

Gibson: cognition should be studied as interaction between human and environment

Constraints and affordances (see Norman)

Entry points (from a clue to an invitation)

Turn to the social

Ethnomethodology, Situated Action, and CSCW theories

Turn to the social

Criticism: Cognitive psychology ignores social aspects of HCI

Solution: bring in sociologists and anthropologists

Ethnomethodology: Study HCI as social phenomena

Situated Action: examine the social context in which HCI occurs

CSCW theories: study interaction and collaboration between people, supported by computers

Ethnomethodology

Ethnography: a method of studying people that involves immersing oneself in their world

Ethnomethodology: studying people with the purpose of understanding how they make sense of the world

Not a theory but an approach

　　Bottom-up, sometimes anti-theoretical

Careful observation exposes taken for granted work practices that turn out to be key in (re)designing the system

Ethnomethodology

Should ethnomethodology result in design implications?

Some say not, because it unfairly abstracts away from the findings

However, if you can, it can be very powerful

Make sure your ethnography has a practical end goal (helping end-users) and/or is generalizable to other contexts

This prevents a "gap" between the results and their practical application

Situated Action

Approach from cultural anthropology

Situation Action studies interactions between people and the world they inhabit

  Highly detailed account of what they do

Assumes that actions are constrained and supported by social and physical circumstances

  People use these circumstances to achieve their goals

Situated Action

Result: An account of how technology is actually used, contrasted with how it is supposed to be used

  From a reasoned to an observed user model

Why are they different?

  Because plans may change due to the situation!

Practical result: Make technology fit the work practice

CSCW theories

Computer-Supported Collaborative Work

How people perform collaborative tasks using computers

Uses theories from sociology and social psychology

E.g. TIP: Group work is more than performance; at each stage one must also focus on group well-being and member support; systems must support this

E.g. Social loafing: how to prevent people from slacking off when they are in a group

Activity Theory

...and a comparison

Activity Theory

Studies subject, activity, and object (as in objective)

Explain a practice based on its:

- operations (means satisfy a condition)

- actions (means to attain a goal)

- activities (means to fulfill a motive)

Focus on the development, culture, and history surrounding the activities, and any tensions that arise

Activity Theory

Human-computer interaction is framed as the use of artifacts as a means of mediating an activity

Social context gives meaning to this practice

The field of HCI can study the cultural practice of learning to use and using artifacts

...for operations, actions, and activities

A comparison

Let's compare Distributed Cognition (DCog), Situated Action (SA), and Activity Theory (AT) in terms of their:

- treatment of user goals

- treatment of humans and artifacts

- opportunity for generalization

- overall merit

User goals

DCog: The system (a combination of subjects and artifacts that together perform a task) provides the goal

SA: goals are retrospective reconstructions of what happened; the situation is the driving factor

AT: Goals exist at several levels, but originate from the subject's intentionality

Humans v. artifacts

DCog: Artifacts are pulled to the human side, and assigned cognitive capabilities

SA: Humans are pulled to the artifact side; they are reactive ciphers that react to stimuli in a behaviorist manner (controlled by the situation)

AT: Humans control their activities; artifacts are just the mediators these activities

Generalizations...

DCog: ...are the result of analyzing the collective manipulation of artifacts, and the transformation of representations as they permeate through the system

SA: ...do not happen, due to the idea of moment-by-moment analysis (but less purist versions exist)

AT: ...can occur by looking at the historical development of activities and the artifacts that exist as mediators between subject and activity

Overall merit

DCog: Provides a formal analysis of artifacts and how they are used, and produces comparative data across settings

SA: Acknowledges the fluidity of goals and plans, but the exclusive focus on the situation may reduce its usefulness

AT: Like DCog, but treats consciousness at the individual level; situation influences but does not determine the actions