



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



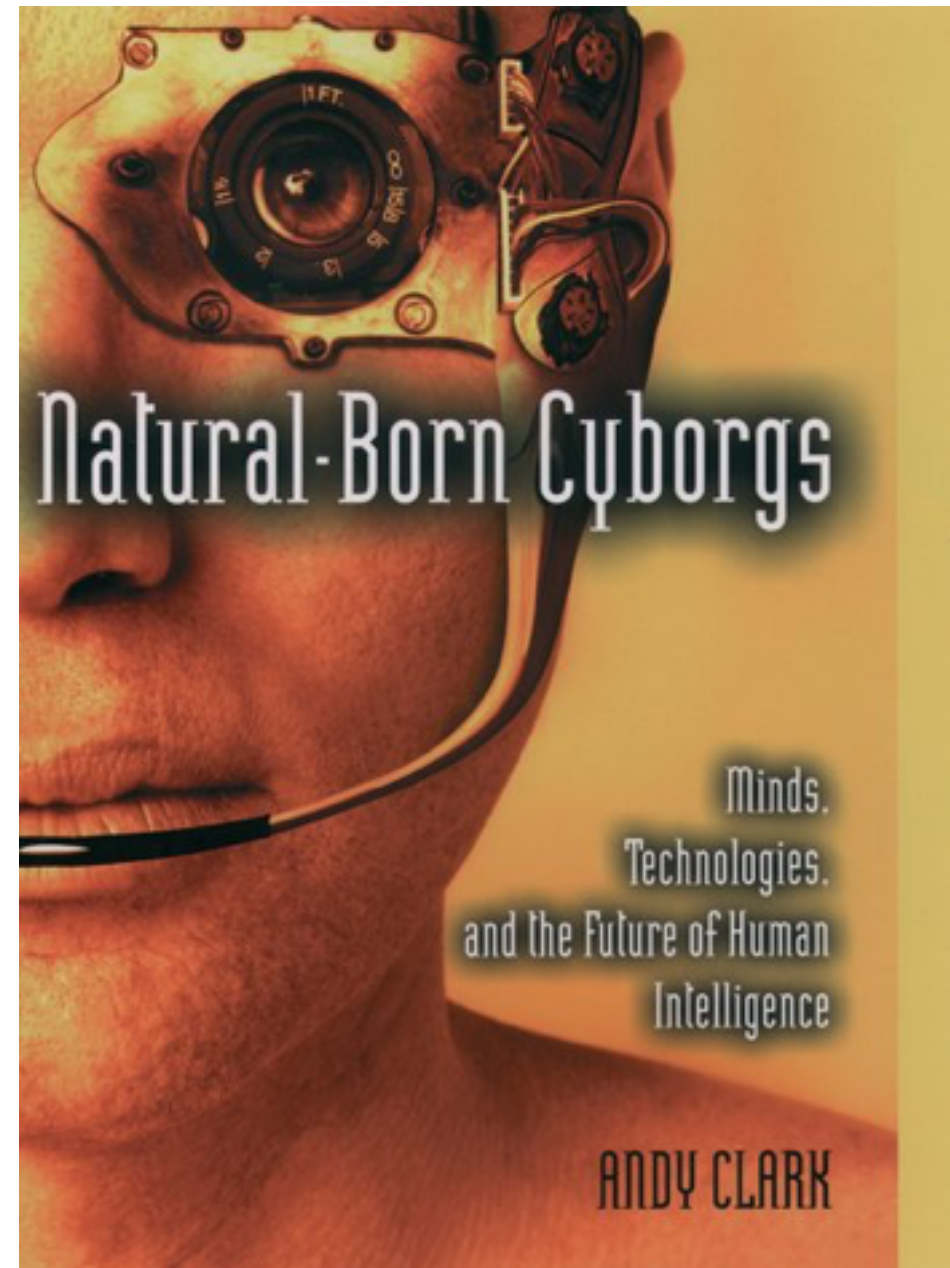
External cognition

Extended cognition: Natural born cyborgs

“Scaffolding”

External manipulation as a method of “thinking”

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





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)

CONTROLLING OUR DATA? USER-TAILORED PRIVACY DECISION SUPPORT

Bart Knijnenburg, Clemson University

Transparency and control don't work

Privacy issues are an undying obstacle to the adoption of social and mobile technologies. Privacy researchers argue that transparency and control empower users to regulate their privacy at the desired level. Unfortunately, the privacy settings in modern systems are **too numerous and complex** to expect users to make careful decisions. In effect, transparency and control often do not work:

- Informing users about privacy practices makes them more wary
- Simple privacy notices aren't useful, but detailed notices are too complex
- Users claim they want control over their data, but avoid actually taking it

There's no simple way to 'nudge' privacy

More recently, researchers have suggested to use privacy nudges: subtle yet persuasive cues that make it easier for the user to make the 'right' privacy decision. Proposed nudges are privacy indicators, justification messages, smart default settings, post delay timers, and sentiment feedback. Unfortunately, nudges also fail to work, because the **'right' privacy decision depends on the user and the context** of the decision.

The solution is adaptive privacy decision support

User-tailored privacy is an approach to privacy that measures users' privacy-related characteristics and behaviors, uses this as input to model their privacy preferences, and then provides them with adaptive privacy decision support. This support can take the form of personalized **justifications**, context-adaptive **default settings**, or privacy-setting **interfaces** tailored to the user's needs.

This approach solves the problem of one-size-fits-all nudges by tailoring the nudges to the user and her context. These adaptive nudges reconcile the need for extensive customizability with users' lack of skills and motivation to manage their own privacy settings.

Users' privacy preferences have been shown to depend on the data requested, the user him/herself, the recipient of the data, and other (system specific) factors. Implementing user-tailored privacy thus requires us to **contextualize users' privacy decisions**. This contextualized understanding can then be used to provide **personalized decision support**. This poster outlines several ongoing and completed research efforts into each of these directions.

Contextualizing Privacy Decisions

Privacy profiles – part I
This work analyzes disclosure preferences in three datasets (an Android app recommender, a social network, and an e-commerce website) totalling over 1,000 participants, and shows that users do not just have a generic disclosure tendency, but that their disclosure behavior is inherently **multi-dimensional**: they have different disclosure tendencies for different types of information. Moreover, the work demonstrates that users can be categorized into a small set of **disclosure profiles** that capture most of the variability in these tendencies.

Privacy profiles – part II
This work moves the idea of privacy profiling beyond simple disclosure behaviors, toward the broader privacy management strategies employed by social network users. Analysis 308 Facebook users' privacy behaviors of uncovered **six privacy management strategies**: Privacy Maximizers, Selective Sharers, Privacy Balancers, Self-Censors, Time Savers/Consumers, and Privacy Minimalists. Follow-up work (in submission) analyzes the relationship between these six privacy management strategies and **six privacy proficiency profiles** to discover that Experts are not always Privacy Maximizers, and Privacy Minimalists are not always Novices.

Recipient grouping
This work introduces a practical methodology for creating a privacy-relevant **segmentation of the recipients** of personal information that is based on the psychometric principles of discriminant and convergent validity. It applies this methodology in an online prototype study with 449 participants to develop a concise categorization scheme for the specification of privacy preferences in social networks. The analysis resulted in three categorizations with an increasing level of granularity (5, 10, and 14 categories). A follow-up study with 485 participants (bit.ly/cis2014) tested these categorizations at different levels of granularity to see which categorization users found most satisfying to use. This work found that **5 recipient categories were sufficient** to adequately capture most users' privacy preferences.

Adaptive decision support systems

Adaptive justifications
This work tested the potential benefit of adaptive disclosure justification messages. A comprehensive study of several types of justifications (bit.ly/tis2013) had found that when applied non-adaptively, such justifications did not increase user trust, satisfaction, or selective disclosure. The follow-up analysis presented in this work demonstrates that **adapting the type of justification to the user's gender and disclosure tendency** significantly improves the effectiveness of privacy justifications.

Sharing recommendations
This work helps users choose the optimal way to share their location by asking them to **evaluate the activity** they are performing at the shared location (i.e. "What do you think about this activity?"). A study with 100 participants found that this evaluation is strongly related to users' sharing behavior. A subsequent study with 368 participants used this knowledge to adapt the available location-sharing options to the user's evaluation of the activity. It found that a **short list of recommended sharing options** is more helpful than showing users all the available sharing options.

Adaptive request order
This work studies adaptive request orders in a demographics-based health recommender system. The system asks demographics questions in a sequential order, and recommendations are adapted to the user's answers on the fly. The user can skip a question if they deem it too sensitive. A study with 672 participants tested several means of ordering the recommendations. Request orders that **automatically trade off usefulness and sensitivity** of the items to be disclosed improved the users' experience.





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