Designing for Societal Problems: The Role of People

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Previously...
...and now
How do we begin designing these things?

Imagine a new gadget and build it

Study what people need and come up with a solution

Ask people what they want

Other?
Human Factors 101...

“making it easy for Homer to do the right thing”
“Why do smart people sometimes do dumb things?”

Our actions and decisions are ‘nudged’ and shaped, sometimes without us knowing, by these Performance Influencing Factors (PIFs), or the context in which behaviour occurs...

<table>
<thead>
<tr>
<th>PEOPLE factors</th>
<th>WORK factors</th>
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<tbody>
<tr>
<td>Physical capability</td>
<td>Clarity of signs, signals, alarms</td>
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<td>Fitness, physical health</td>
<td>Labelling and identification</td>
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<tr>
<td>Competence, experience, familiarity</td>
<td>Displays and controls</td>
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<td>Expectations, assumptions, mental models, habits</td>
<td>Difficulty or complexity of task</td>
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<td>Intelligence</td>
<td>Routine or unusual task</td>
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<td>Drugs, alcohol and medication</td>
<td>Divided attention and competing tasks</td>
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<tr>
<td>Emotional stress</td>
<td>Distraction and interruptions</td>
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<tr>
<td>Confidence</td>
<td>Time pressure</td>
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<tr>
<td>Domestic issues</td>
<td>Procedures, job aids and other documentation</td>
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<tr>
<td>Job satisfaction, morale, motivation</td>
<td>Information quality and availability</td>
</tr>
<tr>
<td>Age</td>
<td>Preparation for task (e.g. permits, risk assessments)</td>
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<td>Tools, equipment &amp; Personal Protective Equipment (PPE)</td>
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<td>Positioning and layout of plant and equipment</td>
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<td>Working environment (e.g. noise, lighting, temperature, ventilation, space, access)</td>
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HCI (or CHI)

Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.
The Evolution of HCI

Early Human Factors/Ergonomics (1900s ->)

Human-Computer Interaction (1980->)

HCI: 80’s Dominant Model
- “Know the User” = Applied Cognitive Psychology
- Information Processing Model of Human
- User modeling, experimental manipulations, corpus of knowledge regarding human sensory, perceptual, cognitive capacities....
- Psychologist as user surrogate
- Belief in translation of theory into design practice
Problems with HCI in the 90's

- Problems of Applied Cognitive Psychology approach
- Little impact of controlled experiments
- Little impact of user modeling paradigm
- Design Practitioners disillusioned
- Academics questioning possible role (e.g. Landauer, Let's Get Real (1991))
- Search for new conceptual frameworks, new methods
Problems with HCl in the 90's

“The theory of human cognition is now and may forever be too weak to be the main engine driving HCl.”
Landauer, Let’s Get Real (1991)

“...nobody’s got any idea. We’re just poking at things with sticks.” Cosima, Orphan Black (2014)

The mind is a ‘black box’ to us...
Participatory Design

- ...where the people destined to use the system play a crucial role in designing it.
The Scandinavian Approach...1970's

- Explicit concern with democratization
- Importance of labour process
- Need for mock-ups, prototypes
- Mutual learning required
- Methods for understanding work (Future Workshops, etc.)
- Cooperative Design (1990's)
CSCW is a generic term, which combines the understanding of the way people work in groups with the enabling technologies of computer networking, and associated hardware, software, services and techniques.

- From Psychology, Sociology, Anthropology
- Understanding Cooperative Work
- Articulation Work - cooperating individuals must somehow be able to partition work into units, divide it amongst themselves and, after the work is performed, reintegrate it.
- Ethnography - Role of Workplace Studies
- Interdependence in work
- Need for articulating their work with others
- ‘Cooperative Work’ is NOT ‘Group Work’
From Human Factors to Human Actors (Bannon 1991)

"Within the Human Factor approach, the human is often reduced to being another system component, with certain characteristics, such as limited attention span, faulty memory, etc. that need to be factored into the design equation for the overall human - machine system...

By using the term "human actors" emphasis is placed on the person as an autonomous agent that has the capacity to regulate and coordinate his or her behaviour, rather than simply being a passive element in a human-machine system.

This change in terminology may help in adjusting one's perspective..."
From Human Factors to Human Actors (Bannon 1991)

- Individuals --> Groups/ Ensembles
- Laboratory --> Workplace
- Novices --> Experts (Professionalization)
- Analysis --> Design
- User-centered --> User-involved
- Requirements --> Iterative Prototyping
- Product focus --> Process focus
- Usability --> Desirability?
Interaction Design (mid 1990s-→)

“Interaction design is a new discipline: a fusion of aesthetics and culture, technology and the human sciences. It concerns the design both of the services these technologies might offer, and the quality of our experience of interacting with them.” Interaction Design Institute, Ivrea

“software is not just a device with which the user interacts; it is also the generator of a space in which the user lives. Interaction design is related to software engineering in the same way architecture is related to civil engineering.” Terry Winograd
Interaction Design (mid 1990s-→)

The Design of Interaction
- From computation to communication
  “there will always be a need for machinery and a need for software that runs the machinery, but as the industry matures, these dimensions will take on the character of commodities, while the industry-creating innovations will be in what the hardware and software allow us to communicate.”

- From machinery to habitat
  From interface to interspace -“a space is not just a set of objects and activities but a medium in which a person experiences, acts and lives.” (Terry Winograd “The Design of Interaction” in P.J. Denning & R.M.Metcalfe (1997) Beyond Calculation: The Next 50 years of Computing)
User Interface

The user interface (or Human Machine Interface) is the aggregate of means by which people (the users) interact with a particular machine, device, computer program or other complex tool (the system).

The user interface provides means of:
- Input, allowing the users to manipulate a system
- Output, allowing the system to produce the effects of the users' manipulation.

UI Development
UI Design
UI Evaluation
Types of interfaces

Text (MS-DOS)
GUI (Graphic User Interface)
Auditory interfaces
Tangible/Haptic Interfaces
Smell/Olfactory Interfaces
Position/Movement based Interfaces
Usability

Usability is a term used to denote the ease with which people can employ a particular tool or other human-made object in order to achieve a particular goal.

Usability can also refer to the methods of measuring usability and the study of the principles behind an object’s perceived efficiency or elegance.

In human-computer interaction and computer science, usability usually refers to the elegance and clarity with which the interaction with a computer program or a website is designed.

It can also refer to the efficient design of mechanical objects such as a door handle or a hammer.
Evolution of Usability

**Usability Evaluation**
- A typical task was: "Please evaluate our user interface, and make it easy to use."
- The user participates as a test subject.

**Interaction Design**
- A typical task was: "Please help us designing this user interface so that it is easy to use."
- The user participates as a test subject in the iterations.

**User Research**
- A typical task was: "Please help us find what the users really need so that we know how to design this user interface."
- The user is observed and interviewed, providing rich qualitative data about usage patterns, needs and desires.

**Strategic Design**
- A typical task is: "Look at this area of life, and find us something interesting."
- End-users involved richly in all phases of the process.
Accessibility

Accessibility is a general term used to describe the degree to which a system is usable by as many people as possible. In other words, it is the degree of ease with which it is possible to reach a certain location from other locations.

It is not to be confused with usability which is used to describe how easily an entity (e.g., device, service, environment) can be used by any type of user.

Accessibility can also be viewed as the "ability to access" the functionality, and possible benefit, of some system or entity; such a definition brings in access-based individual rights laws and regulations.

One meaning of accessibility specifically focuses on people with disabilities and their right of access to entities, often through use of assistive devices such as screen-reading web browsers or wheelchairs.
Interfaces for Disabled Users

**Brainport**, developed by Paul Bach-y-Rita, originally as an aid to help stroke victims regain their sense of balance. A camera transmits images that are transferred to an electrode array that the user rests against their tongue. This enables the users to 'see' the image with their tongue.

**Mobile Lorm Glove**, designed for communication between deaf and blind people. Lorm is a language used by deaf/blind people, which uses hand touch. It was invented by Hieronymus Lorm in the 19th century.

**Tobii PCEye** Device enabling basic interaction with computer operating systems using the eye.
Interfaces for Disabled Users

**Tongue Drive**: A magnet is attached to the user's tongue. The position of this magnet is picked up by sensors, either positioned outside the face by the user's cheeks, or in a dental retainer. This system enables accurate positioning interfacing with computers or wheelchairs.

Brain Computer Interface (BCI) Invasive or partially invasive BCI offers the most reliable “interface” with the brain.

Steve Hoffman – TED Talk
Current Trends

- Understanding the everyday world of human activity
- Computers viewed as communication devices, not simply as calculators
- Artefacts as mediators in human activity
- Ubiquitous computing, sensors, as infrastructures
- Paying attention to location, and meaning of place
- Need for exploring novel interaction paradigms (e.g. haptic interfaces, multimodality, performance)
- Need to explore meaning of technology for people
Trends

Ubiquitous Computing, Ambient Intelligence

Ubiquitous or Pervasive Technology (Weiser, early 90's)

Computers move “out of the box” into the human/social world...the ‘disappearing” computer.....

Embedded systems Human “liberated” from PC
- Sensor Networks
- Wireless removes wires!
- “Wearables” Form & Settings are key
- Location systems more open Design Space
- Augmented Reality Usability needs
- Physical/Digital interfaces...
Implications for HCI

- Computers need specific instructions. Ambiguity is not welcome.

- Point-and-click has yet to be replaced. For complex operations, the learning curve can be steep.

- MixFab is an experiment in (hopefully) the right direction.

- Is this the direction that HCI / technology is going in? How long before this is possible?

In the meantime...
Implications of UbiComp for HCI

- Notion of “Interface” between Human/Machine problematic

- Human is not simply a “brain”, it also has a body

- We also have feelings, experiences - fundamental to our thinking

- The social and cultural world - make us human

- Moving away from fitting people to computers (e.g. computer literacy) to fitting computers into human and social life
Implications for HCI

- From H-C-I to H-C-H-I
- View computer as medium through which we act on world, communicate with others
- Need to understand interactivity in deeper way
- Need of new foundations for HCI
- Opens up the field to the issue of experience