User-Centered Systems Design

Donald Norman wrote back in 1986:

- "But user-centered design emphasizes that the purpose of the system is to serve the user, not to use a specific technology, not to be an elegant piece of programming. The needs of the users should dominate the design of the interface, and the needs of the interface should dominate the design of the rest of the system."

Norman’s modell

- Designerns modell
- Användarens modell
- Systembild
- System
- Dokumentation

Conceptual Design

- DESIGN MODEL
- USER’S MODEL
- SYSTEM IMAGE

Not everyone knows what you know!
### E.g. John Karat’s view on UCD

- "For me, UCD is an **iterative process** whose goal is the development of **usable** systems, achieved through involvement of potential users of a system in system design."
  

- "I suggest we consider UCD an adequate label under which to continue to gather our knowledge of how to develop usable systems. It captures a commitment the usability community supports—that you **must involve users** in system design—while leaving fairly open how this is accomplished."
  

### Lack of common definition of UCSD

- Usability engineering (Nielsen, Mayhew)
- Human-centered design (ISO 13407)
- Goal-directed design (Cooper)
- Usage-centered design (Constantine & Lockwood)
- Contextual design (Wixon & Holtzblatt)
- Customer-centered design (Beyer & Holtzblatt)
- Cooperative design (Scandinavian School) (Greenbaum & Kyng)
- Participatory design (Muller, Haslwanter & Dayton)
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ISO 13407 – Human-centered design processes for interactive systems
Principles / Best practices / Success factors

- A **principle** is a commonly accepted fundamental rule or law from which other principles can be derived.
- We have identified a set of key principles or best practices for UCSD.

Background to the principles for UCSD

  - Early – and continual – focus on users.
  - Empirical measurement.
  - Iterative design.
  - Integrated design – wherein all aspects of usability evolve together.
- ISO 13407, Human-centered design processes for interactive systems.
  - Active involvement of users and a clear understanding of user and task requirements.
  - Appropriate allocation of function between users and technology.
  - Iteration of design solutions.
  - Multi-disciplinary design.
Definition of User-Centered Systems Design

“User-centered systems design is a process focusing on usability throughout the entire development process and further throughout the system life cycle. It is based on the following key principles.”


User focus

- The goals of the activity, the work domain or context of use, the users’ goals, tasks and needs should early guide the development.
  - All members of a project must understand the goals of the activity, the context of use, who the users are, their situation, goals and tasks, why and how they perform their tasks, how they communicate, cooperate and interact, etc. This helps in creating and maintaining a focus on the users’ needs instead of a technical focus.
  - Activities, such as identifying user profiles, contextual inquiries and task analysis, must be a natural part of the development process.
  - Make sure that all project members have met real or potential users, for instance, by visiting the workplace. Descriptions of typical users, tasks and scenarios could, for instance, be put up on the walls of the project room/area to maintain the user focus.
Active user involvement

- Representative users should actively participate, early and continuously throughout the entire development process and throughout the system lifecycle.
  - The users should be directly involved, both in the development project and in related activities, such as, organizational development and the development of new work practices.
  - The users must be representative of the intended user groups.
  - Specify where, when and how users should participate in the development. Identify appropriate phases for user participation and specify their characteristics. Emphasize the importance of meeting the users in context, for instance, at their workplace.
  - Note the important difference between domain experts (very familiar with the activity, but not necessarily potential users) and real users. Domain experts can be members of the development team but real users should be involved on a temporary basis, in single activities during the analysis, design and evaluations of design solutions.
The systems development should be both iterative and incremental.

- It is impossible to know exactly what to build from the outset. Hence, UCSD requires an approach which allows continuous iterations with users and incremental deliveries so that design suggestions and solutions can be evaluated by the users before they are made permanent.
- An iteration should contain a proper analysis of the users’ needs and the context of use, a design phase, a documented evaluation with concrete suggestions for modifications and a redesign in accordance with the results of the evaluation. These activities do not have to be formal. An iteration could be as short as half an hour, as long as it contains all three steps.
- Incremental development means that, based on an overall picture of the System Under Development (SUD), priorities are set and the system is divided into parts that can be delivered for real use. Each increment is iterated until the specified goals have been met. Evaluations of the increments in real use should influence the design of the subsequent increments. Let the software grow into the final product.
Simple design representations

- The design must be represented in such ways that it can be easily understood by users and all other stakeholders.
  - Use design representations and terminology that are easily understood by all users and stakeholders so that they can fully appreciate the consequences of the design on their future use situation. Use, for instance, prototypes (sketches and mock-ups) and simulations.
  - Abstract notations, such as use cases, UML diagrams or requirements specifications are not sufficient to give the users and stakeholders a concrete understanding of the future use situation.
  - The representations must also be usable and effective. The goal is that all parties involved share the same understanding of what is being built.
Prototyping

- Early and continuously, prototypes should be used to visualize and evaluate ideas and design solutions in cooperation with the end users.
  - Use multiple paper sketches, mock-ups and prototypes to support the creative process, elicit requirements and visualize ideas and solutions. The prototypes should be evaluated with real users in context.
  - It is essential to start with low-fidelity materials, for instance, quick sketches, before implementing anything in code.
  - Work with prototypes in cooperation with the users in context (contextual prototyping).
  - Start with the conceptual design on a high level and do not move on to detail too quickly. If possible produce several prototypes in parallel.
Prototyping

Evaluate use in context

- Baseline usability goals and design criteria should control the development.
  - Critical usability goals should be specified and the design should be based on specific design criteria. Evaluate the design against the goals and criteria in cooperation with the users.
  - Early in the development project, one should observe and analyze the users' reactions to paper sketches and mock-ups. Later in the project, users should perform real tasks with simulations or prototype tasks and their behavior and reactions should be observed, recorded and analyzed.
  - Be sure to specify goals for aspects that are crucial for the usability and that cover critical activities as well as the overall use situation.
Explicit and conscious design activities

- The development process should contain dedicated design activities.
  - The user interface design and the interaction design are of undisputed importance for the success of the system. Far too often, the UI and interaction design “happens” as a result of somebody doing a bit of coding or modeling rather than being the result of professional interaction design as a structured and prioritized activity.
  - Remember that to users the user interface is the system. The design of the SUD as regards the user interaction and usability should be the result of dedicated and conscious design activities. The construction of the SUD should adhere to that design.
A professional attitude

- The development process should be performed by effective multidisciplinary teams.
  - Different aspects and parts of the system design and development process require different sets of skills and expertise.
  - The analysis, design and development work should be performed by empowered multi-disciplinary teams of, for instance, system architects, programmers, usability designers and interaction designers.
  - A professional attitude is required and so are tools that facilitate the cooperation and efficiency of the team.
Multidisciplinary teams

Usability champion

- Usability experts should be involved early and continuously throughout the development lifecycle.
  - An experienced usability expert (usability designer) or possibly a usability group, should be on the development team.
  - The usability designer should be devoted to the project as an “engine” for the UCSD process from the beginning of the project and throughout the lifecycle.
  - The usability designer must be given the authority to decide on matters affecting the usability of the system and the future use situation.
Champions

Holistic design

- All aspects that influence the future use situation should be developed in parallel.
  - Software does not exist in isolation from other parts of, for instance, a work situation. When developing software for the support of work activities, the work organization, work practices, roles, etc, must be modified.
  - All aspects should be developed in parallel. This includes work/task practices and work/task organization, user interface and interaction; on-line help; manuals; user training, work environment, health and safety, etc.
  - Other parts of the context of use such as: hardware equipment, social and physical environments, etc. must also be considered in the integrated design process. The responsibility should be placed with one person or a team.
Processes customization

- The UCSD process must be specified, adapted and/or implemented locally in each organization.
  - UCSD and usability cannot be achieved without a user-centered process. There is, however, no one-size-fits-all process.
  - Thus the actual contents of the UCSD process, the methods used, the order of activities, etc, must be customized and adapted to the particular organization and project based on their particular needs.
  - A UCSD process can be based on a commercial or in-house software development process, where activities are added, removed or modified. Existing methods and techniques may well be re-used, if they comply with the above factors/practices.
A user-centered attitude

- A user-centered attitude should always be established.
  - UCSD requires a user-centered attitude throughout the project team, the development organization and the client organization.
  - All people involved in the project must be aware of and committed to the importance of usability, but the degree of knowledge on usability may differ depending on role and project phase. The key principles defined in this paper can serve as a common ground.
Definition of User-Centered Systems Design

“User-centered systems design is a process focusing on usability throughout the entire development process and further throughout the system life cycle. It is based on the following key principles.”

Usability

- People tend to believe that usability is something that can be added on. *That is not true!*
- The usability of a system is defined as:

  "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."

ISO 9241-11 Guidance on usability

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A UCSD process framework

**Vision and plan**
- Initial concept
- Business objectives and goals
- Plan for UCSD

**Analyze requirements and user needs**
- Users, user context and scenarios
- User needs, usability requirements and design goals

**Feedback**
- Plan the next iteration
- Suggestion for changes
- Project planning based on the outcome

**Design for usability by prototyping**
- Conceptual design
- Interaction design
- Detailed design

**Evaluate use in context**
- Evaluate early and continuously
- Measure usability, business and effects

**Construct and deploy**
- Continuous focus on users and usability
- Usability testing and monitoring

Activity lists

- The purpose of the activity list that accompanies each principle is to elaborate on what it takes to apply a principle. The activity list suggests activities of a general nature alongside appropriate methods or tools for the achievement of the principle. The principles are general but the activity list should be developed specifically to fit each organization.

- The activity list serves as both a To-do list and a checklist, where each item can be "ticked off". There are three options for each activity:
  - **No** = we decided to not perform this activity. We gave rationales for this decision and had a general agreement on the motives.
  - **Yes** = we performed this activity, in full or to the extent that the project team and management, found appropriate.
  - **N/A** = we found that this activity was not applicable. The rationales for this were clearly stated and agreed on. We have conducted other activities to compensate for this.

Example of activity list for – User focus...

- Vision, purpose goal and constraints of the target activity analyzed and understood by all project members.
  - Tools and methods: Goals analysis, Focus groups
- Identification, description and prioritization of all user groups.
  - Tools and methods: User analysis
- Visualization and characteristics of target user groups made available to everyone in the project.
  - Tools and methods: Decorate a project room with artifacts, etc. that illustrates the users work situation, environment and characteristics.
- Potential limitations and restrictions in the users’ capabilities (for instance vision impairments or language problems) are clear to everyone in the project.
- Target user groups have guided the development.
  - continues
...example of activity list for – User focus

- continued

- The users have expressed their impressions of current system and expectations on future system.
  - Tools and methods: Users asked about good things and bad things in their current work situation, Think-out loud.
- Users observed as they were performing their tasks in context.
- Use situation documented
  - Tools and methods: Video and still camera, scenarios, personas
- Tasks analyzed.
  - Tools and methods: Task analysis
- Copies of artifacts (forms, documents archives, notebooks, etc.) used by the users collected.

Application of the principles

- **Explanation model** – to analyze and communicate why organizations, projects or processes did not meet their goals as regards usability
- **Process development** – for defining a UCSD process
- **Process / organization customization** – to customize or adapt an organization, project or development process to UCSD
- **Process / organization assessment** – to assess the user-centeredness of an organization, project or process
- **Knowledge transfer** – to teach and transfer knowledge about UCSD,
- **Procurement support** – support for procurers as a basis for specifying requirements on the design process as such
Using the principles in practice

- These 12 principles ensure a truly user-centered approach and generate several benefits. They facilitate communicating, assessing and developing processes for the analysis, design, evaluation, construction and implementation of an interactive system. They help in maintaining the focus on the users and the usability throughout the entire development process.

- We fully appreciate that it will be more or less impossible to start applying the principles in one strategic shift. Adopting them gradually is probably more feasible and practicable. It is, however, important to comply with the principles to as large an extent as possible, at any point in time.

What you can do

- Decide on how important usability is.
- You specifically have to address usability aspects to achieve a usable system.
- A specific and explicit approach and philosophy is needed – user-centered.
- Include user-centered activities and foster a common understanding among all stakeholders about the importance of usability.
- Ensure active user participation.