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Departamento de Electrónica,  
Telecomunicações e Informática

## User-Centered Design Interactive Software Lifecycle

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universidade de aveiro

<http://www.usability.gov/>

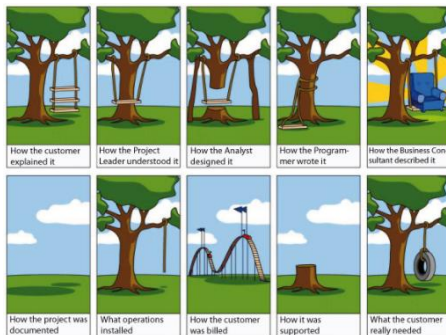
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## Outline

- Iterative design
- User-centered design
- Interactive Software Lifecycle

2

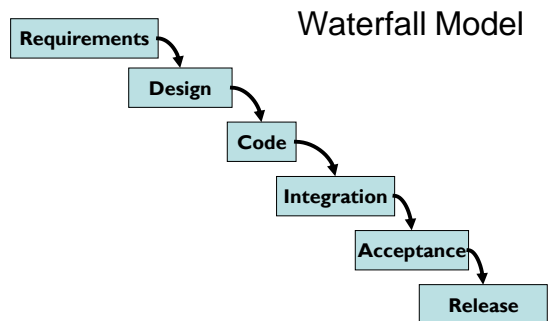
## The problem of interactive systems design...



3

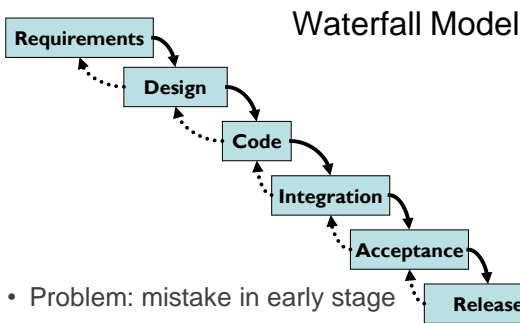
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## Traditional Software Engineering Process



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## Feedback in the Waterfall Model



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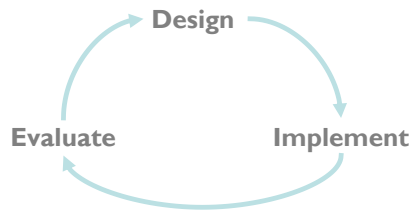
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## Waterfall Model Is Bad for UI Design

- User interface design is risky
  - So we're likely to get it wrong
- Users are not involved in validation until acceptance testing
  - So we won't find out until the end
- UI flaws often cause changes in requirements and design
  - So we have to throw away carefully-written and tested code

6

## Iterative Design



7

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## Iterative Design the Wrong Way



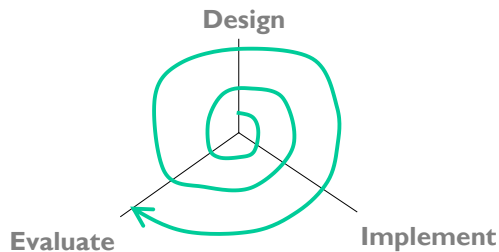
- Every iteration corresponds to a release
  - Evaluation (complaints) feeds back into next version's design
- Using your paying customers to evaluate your usability
  - They won't like it
  - They won't buy version 2

Spring 2011

8

8

## Spiral Model



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## User-Centered Design

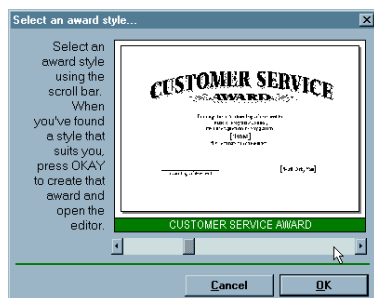


- Considers the needs of the users during the entire design process
- Iterative design
- Early focus on users and tasks
  - user analysis: who the users are
  - task analysis: what they need to do
  - involving users as evaluators, consultants, and sometimes designers
- Constant evaluation
  - Users are involved in every iteration
  - Every prototype is evaluated somehow

10

10

## Early Prototypes Can Detect Usability Problems



11

11

## Iterative Design of User Interfaces



- Early iterations use cheap prototypes
  - **Parallel design** is feasible: build & test multiple prototypes to explore design alternatives
- Later iterations use richer implementations, after UI risk has been mitigated
- More iterations generally means better UI
- Only mature iterations are seen by the world

12

12

## User-Centered Design



- Involves knowing:
  - **Usability principles** (independent from technology)
  - **Usability paradigms** (more technology dependent)
  - Methods
  - evaluation
- We must know the **success examples** (usability paradigms)
- Understand **why they work** (usability principles)
- Use the **adequate methods** (user-centered approach)
- And **test**, re-design, test, redesign

...

until we attain the usability goals

13

13

## Methodologies for user-centered design (UCD)



- Usability testing
- Context interviews
- First click tests
- Focus groups
- Individual interviews
- On-line surveys
- Personas
- Scenarios
- Task analysis ...

<http://www.usability.gov/how-to-and-tools/methods/user-research/index.html>

14

14

## User Centered Design (UCD)



- ISO standard 13407 (1999) - *Human centered design processes for interactive systems*:

"Human-centered design is an approach to interactive system development that focuses specifically on making systems usable. It is a multi-disciplinary activity."

- There are several proposals of UCD methodologies
- All are iterative
- And include usability evaluation in iterations



<https://www.w3.org/WAI/redesign/ucd>

<http://www.usability.gov/how-to-and-tools/methods/user-research/index.html>

15

15

## Benefits of User Centered Design (UCD)



- Following UCD best practices, helps to identify challenges upfront so that a solution can be found early
- By putting a larger emphasis on UCD principles and practices, iterative improvements can be made and avoid costly large scale rework
- The "10%" rules:
  - 10% of IT staff should be user experience (UX) professionals
  - 10% of budget dedicated to UX.

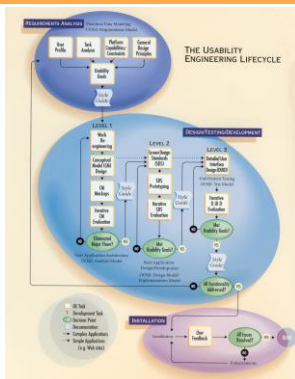


<http://www.usability.gov/what-and-why/benefits-of-ucd.html>

16

16

## Example of UCD Methodologies



(Mayhew, 1999, chap.1)

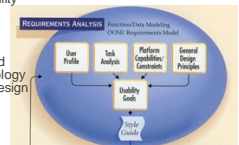
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18

## Example of UCD Methodologies: Requirement analysis



- User Profiles** Establish user characteristics important for UI design
- Contextual Task Analysis** Obtain a user-centered model of work as it is currently done; extract the product usability requirements
- Platform Capabilities and Constraints** Establish capabilities and constraints of the technology platform which limit UI design alternatives
- General Design Principles** Identify principles and guidelines that may be relevant for the product under development
- Usability Goal Setting** Establish specific quantitative and qualitative usability goals to drive UI design

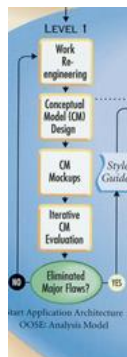


19

19

## Design testing and development – Level 1

<b>Work Reengineering</b>	Reengineer the current user work model to realize the potential of automation and more effectively support business goals
<b>Conceptual Model Design</b>	Establish a coherent and rule based, high level UI design framework to set the stage for design at lower levels
<b>Conceptual model Mock-ups</b>	Support evaluation, refinement, and validation of the Conceptual Model Design
<b>Iterative Conceptual Model Evaluation</b>	Evaluate, refine and validate the Conceptual Model Design



20

20

## Design testing and development – Level 2

<b>Screen Design Standards</b>	Establish a set of design standards to set the stage for detailed UI Design
<b>Screen Design Standards Prototyping</b>	Support the evaluation, refinement and validation of the Screen Design Standards
<b>Iterative Screen Design Standards Evaluation</b>	Evaluate, refine, and validate the Screen Design Standards
<b>Style Guide Development</b>	Document the Conceptual Model Design, the Screen Design Standards and the output of Requirement Analysis



21

21

## Design testing and development – Level 3

<b>Detailed User Interface Design</b>	Design the complete, detailed product User Interface
<b>Iterative User Interface Evaluation</b>	Evaluate, refine, and validate key subsets of the detailed User Interface Design
<b>Installation</b>	
<b>User Feedback</b>	Obtain usability data after a product has been installed and used Inform the UI Design for later releases or related products



22

22

## Another Example of UCD Methodologies

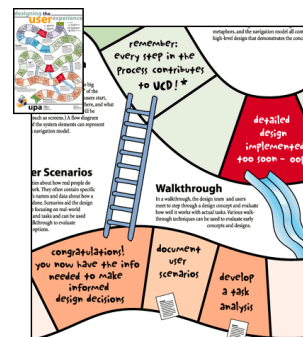
"Designing the User Experience"

The path to more usable products

Four phases:

- analysis
- design
- implementation
- deployment

<https://uxpa.org/>  
<http://uxpamagazine.org/>



23

23

## User-Centered Design in IHC course: Design

- Task & user analysis
  - "Know thy user" – Personas, scenarios
- Design principles
  - Learnability
  - Visibility
  - Efficiency
  - Error prevention and error handling
  - User control and freedom

24

24

## User-Centered Design in IHC course: Implementation

- Prototyping
  - Cheap, throw-away implementations
  - Low-fidelity: paper, Wizard of Oz
- GUI implementation techniques
  - Interaction Styles
  - Input & Output
  - Layout, colors, constraints

25

25

## User-Centered Design in IHC course:Evaluation

- Evaluation puts prototypes to the test
- Expert evaluation
  - Heuristics and walkthroughs
- Empirical evaluation
  - Watching users do it



26

26

## User-Centered Design in IHC course



Interação Humano-Computador  
Human-Computer Interaction

Project n° 2:  
Design Implementation and test of an Interactive Application

**Introduction**  
This project is aimed at the development of an interactive application prototype following a user-centred design methodology. The prototype shall be functional; however, simplifications may be done as the focus of the assignment is the User Interface (UI) and not having a fully functional application (leave out most of backend implementation).

**Schedule and deliverables**

Date	Deliverables (evaluation%)
04-08/03/2019	Limit for project proposal on <a href="#">shared link</a>
18-21/03/2019	slides on requirements analysis to discuss with teacher (20%)
25-28/03/2019	Paper prototype for testing during lab class. Usability test of the application prototype in lab class (15%)
20-24/05/2019	Usability test of the application prototype in lab class (20%)
May 27-01/06/2019	Final presentations and demo (45%)
June 03-07/06/2019	Final submission via Moodle
May 27/2019 23:55	Includes: final presentation and application code

**Project phases**  
Developing an interactive application involves a series of steps; a "user-centred design" approach shall be used. The final report shall cover all the phases of the project, namely:

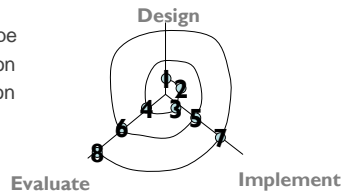
27

27

## User-Centered Design in IHC course



1. Project selection/Task analysis
2. Requirements analysis
3. Paper prototype
4. User testing
5. Computer prototype
6. Heuristic evaluation
7. Full implementation
8. Usability test



28

28

## Summary



- Models for software development
  - Waterfall model makes sense for low-risk projects
  - Iterative or spiral models are needed when the requirements and design space are unknown or risky
  - UI development is often risky
- User-centered design process
  - Iterative, prototype-driven
  - Early focus on users and tasks
  - Constant evaluation

29

29

## Main Bibliography



- Deborah Mayhew, *The Usability Engineering Lifecycle*, Morgan Kaufmann, 1999
- Ian Sommerville, *Software Engineering*, 9th ed., Addison Wesley, 2010  
[http://fs.host.cs.st-andrews.ac.uk/Books/SE9/WebChapters/PDF/Ch\\_29%20Interaction\\_design.pdf](http://fs.host.cs.st-andrews.ac.uk/Books/SE9/WebChapters/PDF/Ch_29%20Interaction_design.pdf)  
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### Interesting Links

- <https://www.nngroup.com/>
- <http://www.usability.gov/>
- <http://uxpa.org/>
- <https://www.w3.org/WAI/research/ucd>

30

30