User-Centered Design: UCD Theory & Methods

Andrea Peer, Iowa State University
Agenda

• Introduction
• Defining UCD
• Models for UCD
• Usability vs User experience
• UX lab overview
Introductions

• Andrea Peer

• 3rd year P.h.D. student, ISU HCI / MIS

• Experience

  • 4 years in Air Force doing UCD, UX, & usability (kinda)

  • 4 years in industry

  • 3 years of study & consulting gigs
Where Are We?

HCI

UCD

User Experience

Usability
Defining UCD

- Norman
- International Organization for Standardization (ISO)
- Usability Professional Association (UPA)
- ACM Special Interest Group Computer Human Interaction (SIGCHI)
- Usability.gov
- Leaders in the field
UCD According to Norman

- “The Psychology of Everyday Things” (Norman, 1988)
- Design based on the needs of users
  - Simplify structure of tasks
  - Making things visible
  - Capturing conceptual maps
  - Affordances

*Norman (1988)*
UCD According to ISO

- ISO 13407 & ISO TR 18529
- Human-Centered Design Principles
  - Active involvement of users and a clear understanding of user and task requirements
  - An appropriate allocation of function between users and technology

Nigel Bevan (2009)
“User-Centered Design (UCD) is an approach to design that grounds the process in information about the people who will use the product. UCD processes focus on users through the planning, design and development of a product.” (UPA, 2010)
UCD According to SIGCHI

- Graphic design basics
- Alternative system development process
- Task analysis
- Design specifications
- Design analysis
- Industrial design basics
- Empirical analysis of design

SIGCHI (1996)
“User-centered design (UCD) is an approach for employing usability. It is a structured product development methodology that involves users throughout all stages of Web site development, in order to create a Web site that meets users’ needs. This approach considers an organization’s business objectives and user’s needs, limitations, and preferences.”
UCD According to Andrea

Data-Driven
Grounded in measured & observed user behavior

Contextual
Performance and satisfaction focus

Focus on users and their tasks
Measured ROI

Process for systems development & evaluation
throughout the SDLC

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UCD According to Andrea

- A philosophy - We believe...
  - The users know what they want. They just don’t have the skills, knowledge, abilities or understanding of the problem space to communicate what they want.

- A set of practices
  - Theoretically can be plugged into any software development process

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UCD According to You

• How would you define UCD?
Models for UCD

- UCD Process models
- Variables to consider with UCD
Models for UCD

- Usability.gov
- Usability Professional Association (UPA)
- Usability Planner Tool
- Usability Body of Knowledge (Usability BOK)
## UCD Process Models

### Usability.gov

<table>
<thead>
<tr>
<th>Stages</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Planning your site</td>
<td>• Business objectives as they relate to the website</td>
</tr>
<tr>
<td>2. Collecting Data from Users (Analyze)</td>
<td>• Users - tasks &amp; goals</td>
</tr>
<tr>
<td>3. Developing prototypes (Design)</td>
<td>• Information needs of users</td>
</tr>
<tr>
<td>4. Writing content</td>
<td>• User expectations and experience</td>
</tr>
<tr>
<td>5. Conducting usability testing with users</td>
<td>• Hardware and software used by users</td>
</tr>
</tbody>
</table>
# UCD Process Models

## UPA

<table>
<thead>
<tr>
<th>Stages</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Analysis</td>
<td>• Specify the context of use - user intended use and context</td>
</tr>
<tr>
<td>2. Design</td>
<td>• Specify requirements - business requirements, user goals</td>
</tr>
<tr>
<td>3. Implementation</td>
<td>• Create design solutions</td>
</tr>
<tr>
<td>4. Deployment</td>
<td>• Evaluate designs - usability testing</td>
</tr>
</tbody>
</table>

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UCD Process Models

UPA

http://www.upassoc.org/usability_resources/about_usability/what_is_uccd.html
# UCD Process Models

Usability BOK

<table>
<thead>
<tr>
<th>Stages</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Analysis and requirements</td>
<td>• Users</td>
</tr>
<tr>
<td>2. Design</td>
<td>• Tasks</td>
</tr>
<tr>
<td>3. Evaluation (Test &amp; Measure)</td>
<td>• Environment</td>
</tr>
<tr>
<td>4. Implementation</td>
<td>• Comparatives</td>
</tr>
<tr>
<td>5. Management (Planning &amp; Feasibility)</td>
<td>• Project background</td>
</tr>
<tr>
<td></td>
<td>• Business goals</td>
</tr>
<tr>
<td></td>
<td>• Constraints</td>
</tr>
</tbody>
</table>
Figure 1: UCD principles and IST project activities

Bevan (2002)
## UCD Process Models

### Usability Planner

<table>
<thead>
<tr>
<th>Stages</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Concept</td>
<td>• Cost-benefits</td>
</tr>
<tr>
<td>2. Planning</td>
<td>• Risks</td>
</tr>
<tr>
<td>3. Understanding Needs</td>
<td>• Constraints</td>
</tr>
<tr>
<td>4. Requirements</td>
<td>• Project</td>
</tr>
<tr>
<td>5. Analyze Requirements</td>
<td>• User</td>
</tr>
<tr>
<td>6. Design / Development</td>
<td>• Task</td>
</tr>
<tr>
<td></td>
<td>• Product</td>
</tr>
<tr>
<td></td>
<td>• Context of use</td>
</tr>
<tr>
<td></td>
<td>• Human / Resource</td>
</tr>
</tbody>
</table>

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http://www.usabilityplanner.org/#home
<table>
<thead>
<tr>
<th>Stages</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explore the problem space</td>
<td>• Business factors</td>
</tr>
<tr>
<td>2. Profiles, Personas,</td>
<td>• Process factors</td>
</tr>
<tr>
<td>Scenarios</td>
<td>• UCD factors</td>
</tr>
<tr>
<td>3. Task analysis</td>
<td>• Product factors</td>
</tr>
<tr>
<td>4. Design &amp; Prototyping</td>
<td></td>
</tr>
<tr>
<td>5. Development</td>
<td></td>
</tr>
<tr>
<td>6. Deployment &amp; Evaluation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
UCD Activities

Explore the Problem Space

Profiles, Personas, Scenarios

Task Analysis

Design & Prototyping

Development

Deployment & Evaluation

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Exploring the Problem Space

- System concept/idea
- Market research
- Data log analysis
- Wants & needs analysis
- Organization climate assessment
Profiles, Personas, Scenarios

• Creating the database of users
• Capturing key data on users
• Personas - Grouping users into meaningful groups
• Contextualize
Task Analysis

• Identifying user triggers
• Understanding desired endpoints & success criteria
• Recognizing critical paths
• Contextual inquiries
• Ethnographic research
Design & Prototyping

• Testing design alternatives
• Information architecture analysis
• Low fidelity to high fidelity prototyping
• Functional testing
• Integrated workflow testing
Development

• Persona campaign
• Unit testing based on personas and scenarios
• Developer and UCD team collaboration
• Field tests of personas
Deployment & Evaluation

- Usability testing
- Data log analysis
- User feedback
- Task analysis
- Measure ROI
Project Management Practices

Business Culture

Business Goals

Business Buy-In

SD Team Dynamics

SD Resources

Change Management Practices

Market Research

Target User Group (s)

Stage of System Development

System Success Criteria

System Evaluation

Product

Process

SD = Software Development

UCD = User-Centered Design

H1.1
H1.2
H1.3
H1.4
H1.5
H2.1
H2.2
H2.3
H2.4
H3.1
H4.1
H5.1
H5.2
H6.1
H7.1
H7.2
H8.1
H9.1
H10.1
H11.1
H12.1
H13.1
H14.1

X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
X13
X14

Y1
Y2

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## Business Factors

<table>
<thead>
<tr>
<th>Var</th>
<th>Title</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>Business Culture (BC)</td>
<td>An organization’s absorptive capacity to implement UCD practices. Organization’s user centeredness.</td>
</tr>
<tr>
<td>X2</td>
<td>Business Goals (BG)</td>
<td>High level business strategic vision and market penetration strategy.</td>
</tr>
<tr>
<td>X3</td>
<td>Business Buy-In (BB)</td>
<td>Commitment and support from organization leadership.</td>
</tr>
<tr>
<td>X4</td>
<td>SD Team Dynamics (TD)</td>
<td>Maturity of team on team dynamics continuum. User-centeredness of team.</td>
</tr>
<tr>
<td>X5</td>
<td>SD Resources (R)</td>
<td>Resources dedicated to software development to include money, people, and materials.</td>
</tr>
</tbody>
</table>

### Business Goals

Business goals refer to the high-level business strategic vision and market penetration strategy. They are essential for guiding the overall direction of the organization. High-quality business goals lead to improved performance and competitive advantage.

### Business Culture

Business culture is defined as an organization’s absorptive capacity to implement user-centered design (UCD) practices. It encompasses the organization’s user-centeredness, which is critical for successful UCD initiatives. A strong business culture encourages innovation and supports the adoption of new practices.

### Business Buy-In

Business buy-in refers to the commitment and support from organization leadership. It is crucial for the success of any initiative, as leadership endorsement helps in overcoming resistance and ensures alignment with organizational goals.

### SD Team Dynamics

SD team dynamics involve the maturity of the team on the team dynamics continuum and their user-centeredness. These factors directly impact the effectiveness of the team in delivering user-centered designs.

### SD Resources

SD resources are the dedicated resources to software development, including money, people, and materials. Adequate resources are essential for the successful execution of any project.
## Business Factors

### Market Research (MR)
- **Definition:** Identified market opportunities and strategies to penetrate the target population of users.

### Target User Group (UG)
- **Definition:** The identified target population of users based on market research and business strategy. A prioritized list of stakeholders and end-users.

### System Success Criteria (SS)
- **Definition:** Measurable return on investment goals for the product, business and brand. Desired process improvement measures.
# Process Factors

<table>
<thead>
<tr>
<th>Var</th>
<th>Title</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>X8</td>
<td>Change Management Practices (CM)</td>
<td>Measures both the macro (culture) and micro (process) levels of an organizations ability to change.</td>
</tr>
<tr>
<td>X9</td>
<td>Project Management Practices (PM)</td>
<td>Identifies the current project management practices according to PMP standards.</td>
</tr>
<tr>
<td>X10</td>
<td>SD Methodology (M)</td>
<td>The type of software development methodology the company uses for the given product.</td>
</tr>
<tr>
<td>X11</td>
<td>Stage of System Development (S)</td>
<td>The maturity of the product as well as the stage of development (concept to maintaining).</td>
</tr>
</tbody>
</table>
## UCD Factors

<table>
<thead>
<tr>
<th>Var</th>
<th>Title</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>X12</td>
<td>UCD Knowledge (K)</td>
<td>Organizational knowledge and previous experience with UCD activities.</td>
</tr>
<tr>
<td>X13</td>
<td>UCD Activities (A)</td>
<td>Current UCD activities being used throughout the system development process.</td>
</tr>
<tr>
<td>X14</td>
<td>Access to User Population (UP)</td>
<td>An organizations ability to physically or remotely bring users into the development process.</td>
</tr>
</tbody>
</table>
# Product Factors

<table>
<thead>
<tr>
<th>Var</th>
<th>Title</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y1</td>
<td>System Evaluation (SE)</td>
<td>User experience evaluation matched to user experience goals. System performance.</td>
</tr>
</tbody>
</table>
You Decide

• What is User-Centered Design to you?

Need ideas...visit the UX Lab site

http://uxlab.hci.iastate.edu/
Good Usability does not make a Good user experience.
Take Home

• Know where you are in the HCI world
• Establish your definition of UCD
• Follow a UCD process (make your hybrid)
• Focus on user experience
ISU HCI UX Lab

uxlab.hci.iastate.edu

Book the lab
Back Up Slides
Cost Justifying UCD

- ROI of UCD
- Cost-benefits of UCD
- Measuring UCD
- Linking UCD to ROI
Cost Justifying UCD

- HFI Animation
- The ROI of User Experience with Dr. Susan Weinschenk
- http://www.youtube.com/watch?v=O94kYyzqvtc&feature=related
Cost Justifying UCD

• Calculating cost-benefits
  • Development
  • Sales
  • Use
  • Support

Beven (2005)

Cost Justifying UCD

The cost of NOT using UCD

- Rule of thumb: "Once a system is in development, correcting a problem costs 10 times as much as fixing the same problem in design. If the system has been released, it costs 100 times as much relative to fixing in design" (Gilb, 1988; IBM, 2001).

- "It is common for usability efforts to result in a hundred percent or more increase in traffic or sales" (Nielsen, 1999a)

Bias (2005)
Cost Justifying UCD

The cost of NOT using UCD

- "80% of software life cycle costs occur during the maintenance phase and were associated with 'unmet or unforeseen' user requirements and other usability problems" (Nielsen, 1993).

Bias (2005)
Cost Justifying UCD

Misalignment

• "The average user interface has 40 flaws (this is a low estimate for web sites). Correcting the easiest 20 of these yields an average improvement in usability of 50%. The big win, however, occurs when usability is factored in from the beginning. This can yield efficiency improvement of over 700%" (Landauer, 1995).

Bias (2005)
Cost Justifying UCD

Balance

• "You can increase your sales on your site as much as 225% by providing sufficient product information to your customers at the right time" (User Interface Engineering, 2001).
Cost Justifying UCD

- Resources
  - “Cost-Justifying Usability” by Bias
  - Bevan (2005) Case Study
Cost Justifying UCD
Andrea Guidelines

- Business goals
- Brand goals
- User experience goals
- Important differentiators
- Value propositions
- Who, Where, What, When, Why

Courage & Baxter (2005)
Cost Justifying UCD
You Decide

• Do you have challenges in cost justifying?

• What measures are important in your context?
UCD According to ISO

- TC 159/SC 4 - Ergonomics of human-system interaction
- ISO 9241-230 (ISO TR 16982) - Usability methods supporting human-centered design
- ISO 13407 - Guidance on software accessibility
UCD According to ISO

- TC 159/SC 4 - Ergonomics of human-system interaction
- ISO TR 18529 - Human-centered lifecycle process descriptions
- ISO 18152 - Specification for the process assessment of human-system issues
UCD According to ISO

• ISO 13407 & ISO TR 18529

• Human-Centered Design Principles

• Active involvement of users and a clear understanding of user and task requirements

• An appropriate allocation of function between users and technology

Nigel Bevan (2009)
UCD History

• Jobs in industry
  • Human Factors Specialist
  • Usability Engineers
  • User Experience Specialist
  • User-Centered Design Specialist
  • Human-Centered Design Specialist
Reporting UCD Findings

- Story time
Reporting UCD Findings

- Usability.gov - short form and long form
Usability vs UX

• UX and UI - Chicken and the Egg

• http://www.youtube.com/watch?v=2wZUTe70w1Y&feature=related