Chapter 3: Interaction Design Process

The Resonant Interface
HCI Foundations for Interaction Design
First Edition

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Section II – Designing Interaction
Chapter 3 – Interaction Design Process

• Iterative Design
• User-Centered Design
• Interaction Design Models
• Overview of Interaction Design Models
Iterative Design

• Interaction design is an iterative process
  – One step forward, two steps back
• The knowledge path is constantly moving forward
User-Centered Design (USD)

• How do designers come up with an interface that’s not in your face? That just does what you want, and doesn’t make you waste time doing what it wants? (IBM, 2006)
User-Centered Design (UCD)

• Pioneered by Donald Norman’s research laboratory at the University of California at San Diego.

• The objective of UCD is to develop a design framework that enables interaction designers to build more usable systems.

• ISO Standard—Human Centered Design Processes for Interactive Systems
User-Centered Design

- Design should emerge from the user’s
  - tasks
  - goals
  - environment

- Focuses on human-centric issues
  - cognition
  - perception
  - physical attributes and conditions
    - user
    - environment
User-Centered Design

• The basic tenants of user-centered design:
  – Early focus on users and their tasks
  – Continuous evaluations to determine ease of learning and ease of use
  – Iterative design
User-Centered Design

- UCD projects generally involve the following methods:
  - User Participation
  - Focus Groups
  - Questionnaires
  - Ethnographic Observations
  - Walkthroughs
  - Expert Evaluations
  - Usability Testing
Interaction Design Models

• Waterfall Model
• Spiral Model
• Dynamic Systems Development Method
• Prototype-Based Models
• Discount Usability Engineering
• Contextual Inquiry
Interaction Design Models - Waterfall Model

- Winston Royce (1970)
  - Spacecraft missions
    - Planning
    - Commanding
    - Post-flight analysis
Interaction Design Models - *Waterfall Model*

- Analysis and Coding
- Small projects
- Programmers are the users
- Requirements are fixed
- Not user-centered
Interaction Design Models - *Waterfall Model*

- Advantages of the waterfall model:
  - Highly disciplined process of documentation
  - Easily observable development progress
  - Easy to create budget
  - Consistent review process

- Disadvantages of the waterfall model:
  - Document centric; can be difficult for customer to understand
  - Not user centered
  - Makes assumptions about requirements that are inflexible
Interaction Design Models - *Spiral Model*

- Barry Boehm (1988)
  - More flexible
  - Centered on risk reduction
  - Incorporates prototype development
  - Encourages iteration
  - Starts with value proposition
    - identifies a particular corporate mission that could be improved by technology
Interaction Design Models - *Spiral Model*
Interaction Design Models - *Spiral Model*

- Breaks project into subprojects identifying specific risks
  - Budget and schedule predictability
  - System integration problems
  - User interface errors
  - Requirement instability resulting in code modification at a late stage
  - Mission-critical sensitivity to error
  - Investment versus productivity gains
  - High-level improvements that are incompatible with the client culture
  - Mismatches to the user project’s needs and priorities
**Interaction Design Models - Spiral Model**

- **Advantages of the spiral model include the following:**
  - Appropriateness for large-scale enterprise systems
  - Flexibility in terms of its sensitivity to the dynamic nature of the software industry
  - High sensitivity to risk at each stage of development

- **Disadvantages of the spiral model include the following:**
  - Complex nature makes it difficult for customers to grasp
  - Requires extensive information regarding risk assessment
  - Undetected risks can be problematic
**Interaction Design Models - Dynamic Systems Development Method (DSDM)**

- Rapid Application Development (RAD)
- The Dynamic Systems Development Method (DSDM)
  - Not-for-profit consortium [www.dsdm.org](http://www.dsdm.org)
  - Currently in version 4.2
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*
Interaction Design Models - Dynamic Systems Development Method (DSDM)

• Time-sensitive
• Business-centered
  – Main focus – on-time delivery of high-quality software for current business needs
  – 80% of a software solution can be developed in 20% of the time required to complete a total solution.
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*

• Time frame and allocated resources are fixed
• Functional requirements are flexible
• Three stages
  – Pre-project, feasibility study, and business study phases
  – Iteration between the functional model iteration, design and build iteration, and implementation phases
  – Post-project phase
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*

- The DSDM framework recognizes nine principles:
  1. **Active user involvement** is imperative.
  2. The **team must be empowered** to make decisions.
  3. The focus is on **frequent delivery of products**.
  4. **Fitness for business purpose** is the essential criterion for acceptance of deliverables.
  5. **Iterative and incremental development** is necessary to converge on an accurate business solution.
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*

- The DSDM framework recognizes nine principles:
  6. All changes during development are reversible.
  7. Requirements are baselined at a high level.
  8. Testing is integrated throughout the life cycle.
  9. Collaboration and cooperation among all stakeholders is essential.
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*

- The DSDM Core Techniques
  - Facilitated Workshops
  - Timeboxing
    - Investigation
    - Refinement
    - Consolidation
  - MoSCoW (prioritize requirements)
    - Must have
    - Should have
    - Could have
    - Won’t have
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*

- The DSDM Core Techniques
  - Modeling
  - Prototyping
    1. **Business**—Demonstrate the business processes being automated.
    2. **Usability**—Demonstrate how the user interacts with the system.
    3. **Performance and Capacity**—Test for system robustness.
    4. **Capability/Technique**—Test conceptual designs.
  - Testing
  - Configuration Management
Interaction Design Models - *Dynamic Systems Development Method (DSDM)*

• **Advantages of the DSDM:**
  – Provides a technique-independent process
  – Flexible in terms of requirement evolution
  – Strict time and budget adherence
  – Incorporates stakeholders into the development process

• **Disadvantages of the DSDM:**
  – Involves progressive development of requirements
  – Focus on RAD can lead to decrease in code robustness
  – Requires full commitment to DSDM process
  – Requires significant user involvement
  – Requires a skilled development team in both the business and technical areas
Interaction Design Models - *Prototype-Based Models*

- Prototypes are used to develop, demonstrate and test design ideas
- Appropriate for small-scale projects
- Enable discussions of:
  - Look and feel
  - Scope
  - Information flow
  - Product concept
Interaction Design Models - *Prototype-Based Models*

- Throwaway Prototyping Model
- Evolutionary Prototyping Model

• Advantages of prototyping include the following:
  – Easy for users to give feedback
  – Reduced development time and cost
  – Involvement of the user in the development process

• Disadvantages of prototyping include the following:
  – Can be viewed by client as the final product
  – May lead to insufficient analysis due to the ease of development
  – Difficult for developers to discard and start creating the final product from scratch
Interaction Design Models - *Discount Usability Engineering (DUE)*

- Jakob Nielsen (1994)
- Nielsen argued that the benefits derived from even small amounts of user testing would have a significant impact on the usability of the design.

- DUE is based on the use of the following three techniques:
  - Scenarios
  - Simplified thinking aloud
  - Heuristic evaluation
Interaction Design Models - *Discount Usability Engineering (DUE)*

- Nielsen suggested that the number of problems that could be identified from a usability test with $n$ users can be calculated according to the following equation:

$$N [1(1L)n]$$

where:

$N$ total number of usability problems in a design
$L$ proportion of usability problems discovered with a single participant
Interaction Design Models - *Discount Usability Engineering (DUE)*

- Nielsen proposed a set of 10 usability heuristics that could be used by designers to investigate and document usability problems.
  - DUE requires some experience
  - Should be done by a few reviewers to avoid personal bias
  - Will help to indicate issue frequency
  - Should be done early in the design process
Interaction Design Models - *Contextual Inquiry*

  *Contextual Design: Defining Customer-Centered Systems.*

- Involves
  - Observation
  - Inquiry
  - Interpretation

- It is based on four main principles:
  - Context
  - Partnership
  - Focus
  - Interpretation
Interaction Design Models - *Contextual Inquiry*

- **Context**
  - how and why people use software products
- **Partnership**
  - partnering with a typical user in a master/apprentice relationship.
Interaction Design Models - *Contextual Inquiry*

- **Focus**
  - Observations are focused on collecting information, which can be categorized as follows:
    - **Tools**—The various applications people use to perform their tasks.
    - **Artifacts**—Nondigital tools required by the work but not part of the design.
    - **Terminology**—The labels and terms people use to identify objects and processes.
    - **Sequences**—The order in which people perform their tasks.
    - **Methods**—Organization techniques used by the workers.
    - **Interactions**—How and why people interact with each other.
Interaction Design Models - *Contextual Inquiry*

- **Interpretation**
  - An affinity diagram is a way to sort, organize, and prioritize observations
  - They involve post-it notes and grouping observations
  - The team creates models of:
    - Communication flows
    - Information sequences
    - Physical environments
    - Corporate culture structures
  - They lead to the conceptual models of the design
Overview of Interaction Design Models

• Elements that appear in many of the standard models
  – Cost and risk analysis
  – Observation
  – Task analysis
  – Requirements assessment
  – Conceptual design
  – Physical design
  – Prototyping
  – Evaluation
  – Usability testing
  – Implementation
  – Maintenance
The Design Process Model

Discovery
- Task Analysis
- Storyboarding
- Use Cases
- Primary Stakeholder Profiles
- Documentation

Design
- Conceptual Design
- Personas
- Scenarios
- Flowcharts
- Physical Design
- Low Fidelity Prototypes
- Wireframes
- Functional Prototypes

Evaluation
- Usability
- Testing
The Design Process Model

• Discovery Phase questions
  – What are the components of the project
  – Who is involved
  – What are the current work space and work flow like
  – What are the contextual and extraneous factors that affect the work flow
The Design Process Model

- **Design**—The design phase has two parts:

  - **Conceptual Design**—What are the possible ways in which the design can address the needs of the problem space?
    - Personas,
    - Scenarios,
    - Use cases, etc.

  - **Physical Design**—What are the possible ways that the conceptual design can be realized in the real world?
    - Low-fidelity prototypes
    - Wireframes
    - Functional prototypes
The Design Process Model

• **Evaluation—Questions**
  – How can we determine the relative merits of one design over another
  – How can we measure the success of a proposed design
  – How can we get real users to give us feedback about a proposed design
  – How can we incorporate usability testing at the early stages of the design process

• This is documented by the results of formal and informal usability testing.

• Evaluation is not a discrete phase, it is layered