SWE3053

Human Computer Interaction

Lecture 25

User Requirement Analysis

Food for your MIND

Rubber hand effect ……

Rubber hand in VR/MR

Rubber Hand Illusion in IVR

- Mimic the scenario normally used, but using a virtual arm rather than a rubber arm
- IJsselsteijn et al. 2006 using mixed reality
- Hägni et al. 2008 using moving virtual arms on large screen
- Slater et al. 2008 using stereo powerwall

From Slater et al. 2008

How to study user requirement?

Task Analysis

- Hierarchical Task Analysis
- Observation
- Ethnographic study

User Analysis

- Persona
- Diary
- Survey
- Interview
- Focus group

Diary

What is a Diary?

- A document created by an individual
  - who maintains regular recordings about events and time in their life
- Useful for recording information that is fluid and changes over time
  - such as user mood, events
- Many users have been keeping diary already
  - Work log
  - Social networks (such as facebook)
-

Why use diaries in HCI?

- Collect data when the user is not being observed
  - Users may have different reactions when being observed
- Collecting data that is fluid and changes over time
- Surveys can lead to biased data
- Good for studying usage patterns that cross multiple technologies, locations, and environments
- Collecting more detailed data than surveys
- Record data close to the event
  - Instead of asking the user to recall an event (record bias)
- Combining diaries with other research methods
- Good for researching situations where users move around and don't stay in one place

Challenges with diaries

- Users sometimes are not introspective
  - not even aware of the event
  - and therefore may have trouble recording it in a diary entry
- Users may not follow through and record
- Generally harder to recruit users for diary study
- Data is both qualitative and quantitative
  - Pros: But collect both depth and breath data
  - Cons: Data analysis may take a long time
-

Participants for a diary study

- Participants need to be motivated
  - Usually through money!
- The diary study would be structured so that it yields useful data
- Provide example scenarios for taking diary
  - e.g. video instruction

Data collection

- How will the diaries be recorded?
  - Paper?
  - Electronic?
  - Voice recording?
  - Pictures?
  - Smart phones? Tablets?
- Use whatever is most natural for the participants

When to record an entry?

- Participants should be given clear guidance on when to perform an entry in the diary
  - What activities are of interest?
  - What events, incidents, or feelings should result in a diary entry?
  - How often should diary entries be made?
  - How detailed should the entries be?
- Make sure NOT to pay participants based on the number of diary entries

When to record an entry?

- Two weeks is often an appropriate length of time for a diary study
- If diary reports are turned in during the study period, researchers should monitor the incoming reports, check on who is not reporting diary entries, or if the entries are not providing useful data
- Reminders and feedback can be sent during the period of the diary study
- Possibly, sensors can be used to determine when it is appropriate to remind users (e.g. during strenuous activities)

Interviews and Focus Groups

Ask the users

- Direct conversations as tools for data collection
  - Understand requirements, needs, problems
- Interviews – one at a time
- Focus groups – many
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- Pros
  - Go deep
  - Flexible
- Cons
  - Skill to manage
  - Time and resource intensive
  - Recall problems
  - Most people don’t know what they want

Who to interview

- End Users
- Beyond users – Stakeholders
  - Anyone who may be affected by the use of a system
- Interview representatives of different groups from different perspectives
- Key informants: particularly useful/informative individuals

Types of Interviews

Fully Structured

Semi-Structured

Unstructured

Less structure: greater difficulty in conducting and interpreting interview

But

More opportunity for insight

Comparing the types

- Fully structured – Orally-presented survey
  - Stick with the script
  - Good for comparison across individuals
- Semi-structured
  - pre-specified questions
  - starting point for discussion
  - Digression is ok
  -
- Unstructured – initial question, possible list of topics, but no pre-defined script
- Less structure good for open ended exploration

Focused & contextual interviews

- Go beyond asking questions
- Ask participant to
  - Demonstrate use of technology
  - Show artifacts (papers, photos, etc.)
  - React to “probes” - props or prototypes designed to elicit reaction

Interviews vs. focus groups

- Interviews take time
  - Often 1 hour or more/response
  - Several hours for analyzing notes
- Focus groups
  - More people in less time
  - Up to 8-12 people at once

Focus groups: pros and cons

- Pros
  - Broad range of viewpoints and insights
  - Each group will likely have at least one person who will stimulate others to talk
- Cons
  - Hard to manage group dynamics
  - Generally can't be fully structured
  - May need to ask fewer questions
  - Selection can be challenging

Open-ended questions

- “What did you think about the web page?”
- Invite elaboration, discussion
- Ask users to complete a sentence
  - “My favorite web browser feature is...”
- Conceptual mapping
  - Draw pictures or layouts to describe understanding of a situation or problem

Enriching the interview process

- Props - devices for prompting interviewee, e.g., a prototype, scenario

Other guidelines

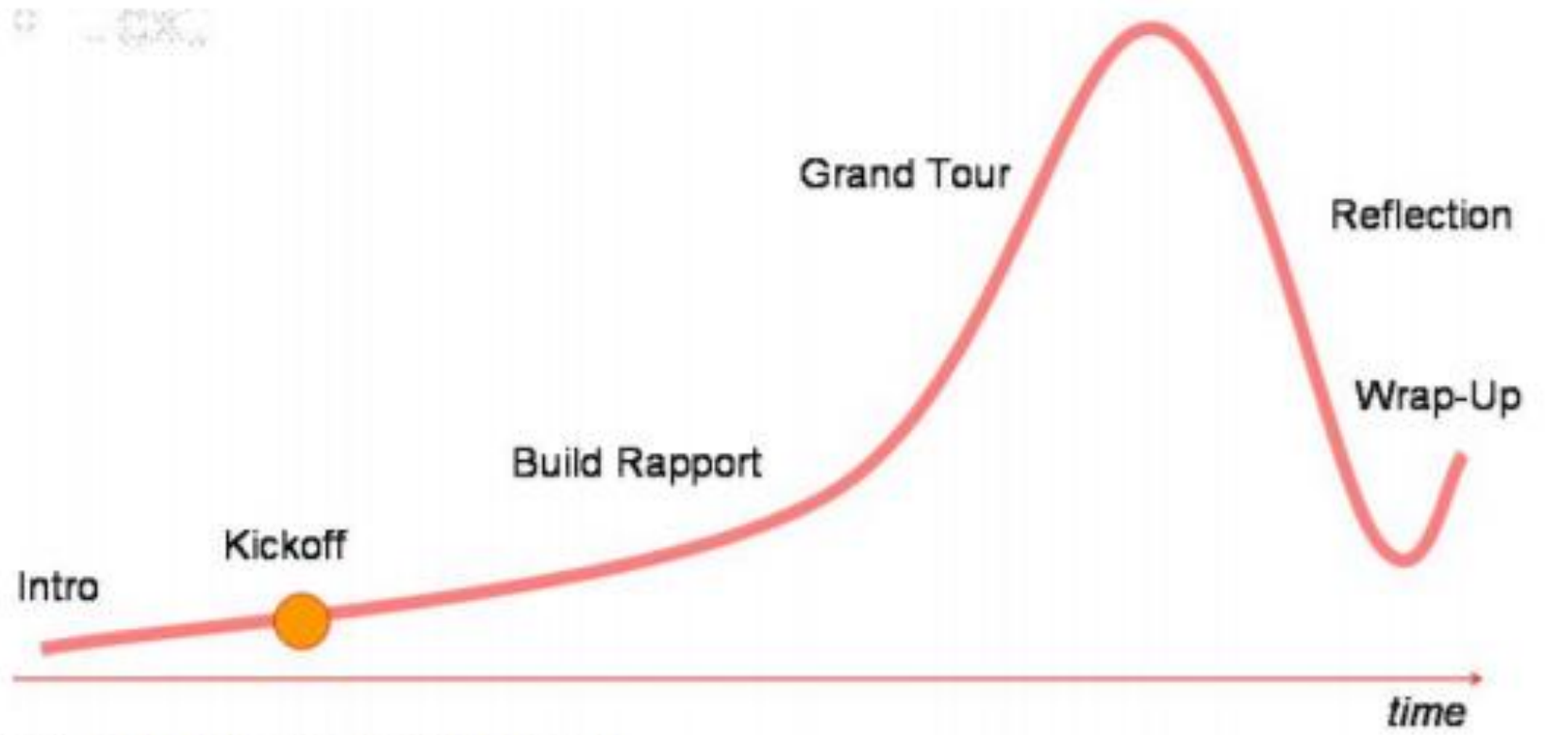
- Simple questions – no jargon
- Avoid compound questions with multiple parts
  - Not "“What were the strengths and weaknesses of the menu layout and the toolbar?”
  - Ask two separate questions instead.
  - Or four…
- Avoid judgmental phrasing or tone
  - Possible bias

Preparing for interviews

- Pilot test – w/ colleagues and participants
  - Good for logistics and for confidence
- Write an interview guide listing what to do and when
  - Particularly good if multiple researchers are involved
- Logistical backups
  - Batteries for laptop, audio recorder, extra paper, etc.

Interviews

Visually, the interview process might look like this:



(Thanks to Michael Barry for this model)

Here are some extremely truncated examples of questions for each stage:

- **Introduction**: "Hi, I'm a Stanford student studying coffee. I'm interested in hearing about your experience with coffee. There are no right or wrong answers, I just want to hear what you have to say."
- **Kick-off**: "Do you drink coffee?"
- **Build rapport**: "Did you have a coffee today? How was it? Do you have a favorite coffee?"
- **Grand Tour:** "Can you describe your most memorable coffee experience? Why was it so unique? What happened?"
- **Reflection:** "If you were designing the ultimate coffee shop based on your ideal experience. . ."

Note taking

- Audio and video recordings are fine..
  - But, paper notes are still important
  - Transcription can take many hours
- Record insights, non-verbal responses, etc.
  - Try to record what you can, but
  - Don't do so at the expense of listening
- Summarize written notes as soon as possible after the interview
- before you forget...

Challenges of focus groups

- Manage the room. Be prepared to deal with
  - Digressions
  - Arguments
- Give everyone a chance to talk
  - Address them directly
  - “Joan, what do you think about...?”

Telephone or online

- Phone, web chat, email, conference calls
- Pros
  - Easy, inexpensive
  - Reach more people with less effort
  - Potentially powerful screen, audio capture
- Cons
  - Lack of face-to-face contact
  - Fewer non-verbal cues
  - Pacing can be harder

Hybrid Method

- You may mix can create your own method
- For example:
  - A phone interview
  - Asking the participants to recall event of yesterday (Diary)
  - Based on a semi-structured survey
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Prototyping

Prototyping

- What is a prototype?
- Why prototype?
- Different kinds of prototyping
  - Low fidelity
  - High fidelity
- Compromises in prototyping
  - Vertical
  - Horizontal
- Paper Prototype

What is a prototype?

Prototyping
- quickly putting together a working model (a prototype)
- in order to test various aspects of a design
- illustrate ideas or features
- gather early user feedback.

Prototype is a partial and concrete representation of the design

For Example:
- a miniature car
- a miniature building or town

Prototypes are:
- Cheap
- Quick
- Less accurate renditions of the design

Why prototype?

Brings designs to life for:
- Designers, Users, Stakeholders

For visualization and reflection:
- Visualize important aspect of designs
- Allows designers to explore ideas and alternatives
- Prototypes answer questions, and support designers in choosing between alternatives

For evaluation and feedback
- To run preliminary usability studies
- Stakeholders can see, hold, interact with a prototype more easily than a document or a drawing
- Get feedback earlier, cheaper
  → reduce potential project risk
- Evaluate alternative ideas, concepts or even concrete design
  → It is important not to commit to one design idea in the early stage
- Easier to change and throw away

Why prototype?

For communication
- Prototype can be used as a communication vehicle
- A picture worth a thousand words
- Team members can communicate effectively
- Used for communication with clients and stakeholders (e.g. explanation and persuasion)
- Presentation of concepts and ideas

Used properly, prototyping is at the heart of human-centred design

• Advantages & Disadvantages of Prototyping

Advantages	***Disadvantages***
Users can try the system and provide constructive feedback during development	Each iteration builds on the previous iteration and further refines the solution. This makes it difficult to reject the initial solution as inappropriate and start over.
An operational prototype can be produced in weeks	Formal end-of-phase reviews do not occur. Thus, its is very difficult to contain the scope of the prototype.
Users become more positive about implementing the system as they see a solution emerging that will meet their needs	System documentation is often absent or incomplete, since the primary focus is on development of the prototype.
Prototyping enables early detection of errors	System backup and recovery, performance, and security issues can be overlooked.

Prototyping Example

- Apollo Space Missions
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- The engineers at Apollo missions built a full-size cardboard prototype of the lunar landing module
- To test the position and size of the windows in relation to the field of view of the astronauts.
- This experimentation led to the design decision that the astronauts would stand not sit inside the lander.
- This allowed the windows to be smaller, saving crucial weight.

Prototyping Example

- The Space Suit
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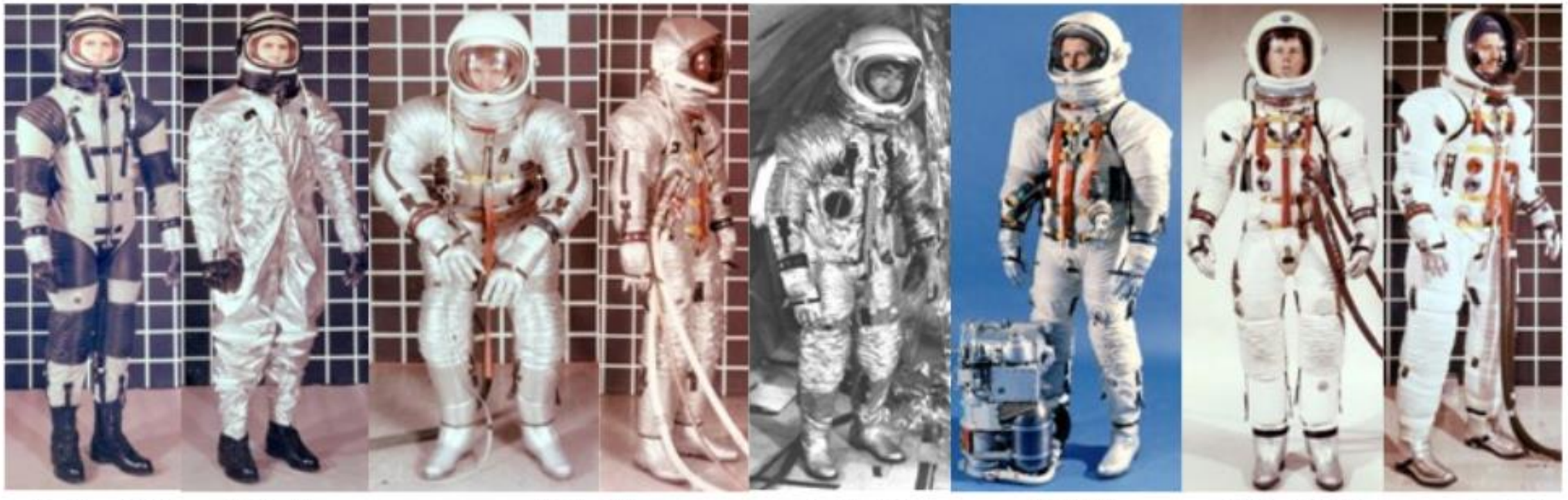
- 1962-1965, NASA designed a series of prototype model spacesuit, with unsatisfactory results



Prototyping Example

- The Space Suit
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- In June 1965, NASA MSC at Houston established an in-house competitive test program to select spacesuit configuration
- Evaluation is based on 65 separated tests and evaluation

AX-5L

AX-1C

AX-6H

Fidelity of prototype

Fidelity
- How “real” is the prototype with respect to the target design

Fidelity has many dimensions ...

Filtering dimensions of prototyping

Filtering dimension	Example variables
Appearance	size; color; shape; margin; form; weight; texture; proportion; hardness; transparency; gradation; haptic; sound
Data	data size; data type (e.g., number; string; media); data use; privacy type; hierarchy; organization
Functionality	system function; users' functionality need
Interactivity	input behavior; output behavior; feedback behavior; information behavior
Spatial structure	arrangement of interface or information elements; relationship among interface or information elements – which can be either two-or three-dimensional, intangible or tangible, or mixed

Manifestation dimensions of prototyping

Manifestation dimension	Definition	Example variables
Material	Medium (either visible or invisible) used to form a prototype	Physical media, e.g. paper, wood, and plastic; tools for manipulating physical matters, e.g. knife, scissors, pen, and sand-paper; computational prototyping tools, e.g. Macromedia Flash and Visual Basic; physical computing tools, e.g. Phidgets and Basic Stamps; available existing artifacts, e.g. a beeper to simulate a heart attack
Resolution	Level of detail or sophistication of what is manifested (corres-ponding to fidelity)	Accuracy of performance, e.g. feedback time responding to an input by a user (giving user feedback in a paper prototype is slower than in a computer-based one); appearance details; interactivity details; realistic versus faked data
Scope	Range of what is covered to be mani-fested	Level of contextualization, e.g. website color scheme testing with only color scheme charts or color schemes placed in a website layout structure; book search navigation usability testing with only the book search related inter-face or the whole navigation interface

Table 11.2 The definition and variables of each manifestation dimension

What to prototype?

- Technical issues
- Work flow, task design
- Screen layouts and information display
- Difficult, controversial, critical areas

Low-fidelity vs. Hi-fidelity Prototyping

- Low-fidelity Prototype
  - Uses a medium which is unlike the final medium, e.g. paper, cardboard
  - Quick, cheap and easily changed
  - Intended to demonstrate general look and feel of the interface
  - Used early in the design cycle to show general conceptual approaches without much investment in development
  - Changing features simulated by adding and removing post-it notes
  - Can use acetate and wipe-off pens
  - Examples:
    - sketches of screens, task sequences, etc
    - ‘post-it’ notes
    - storyboards
    -

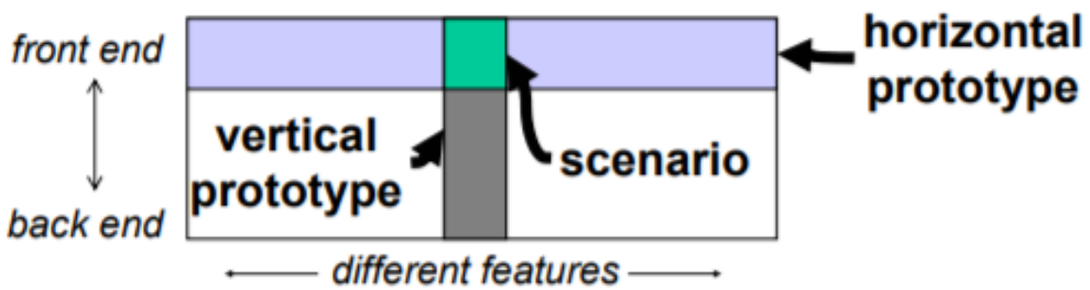
Low-fidelity vs. Hi-fidelity Prototyping

- High-fidelity Prototype
  - Represent the core functionality of the products user interface.
  - Interact with user interface that is close to a real system.
  - Useful for an evaluation of the main design elements (Content, Visuals, Interactivity, Functionality)
  - Have a similar look and feel to the final product.
- Can be used to measure how fast a person can learn the system
- Building high fidelity prototypes consume resources and have high cost
- Useful for getting client approval before developing all the functionality.
  - "The site will look like this. Would you like changes before I go on?"
- Prototypes should shift from Low-Fi to Hi-Fi as project progresses
- Beware: Building something unrealistic – rising client's unrealistic expectation.

Compromises in prototyping

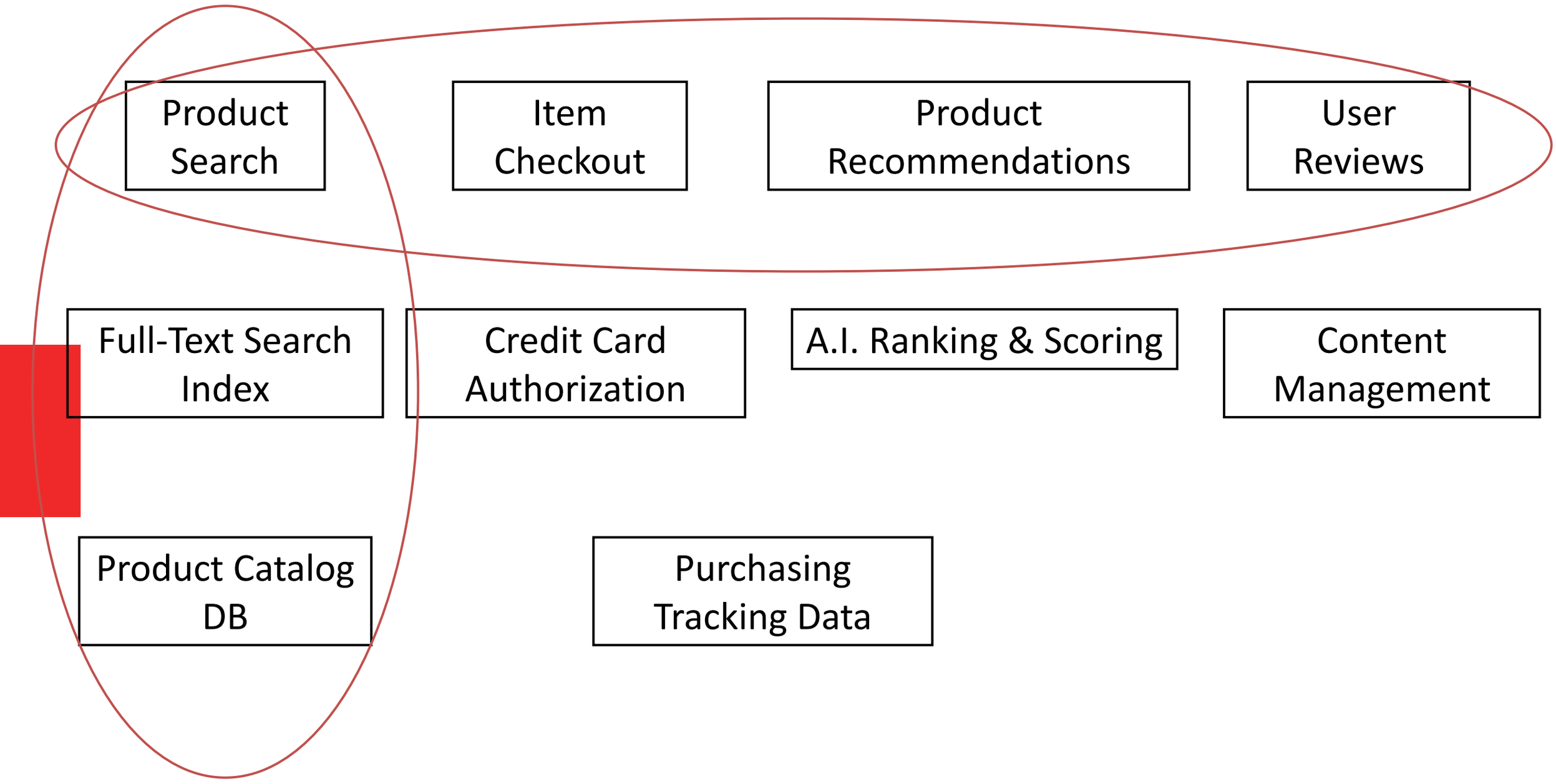
- All prototypes involve compromises
- Compromise – selection of what to include and what not to
  - What to include:
    - What is the purpose of the prototype?
    - What questions are you asking using the prototype?
  - What not to include:
    - How many resources you have (time, money, human resources)

- Two common types of compromise
  - horizontal: provide a wide range of functions, but with little detail
    - Breath: the amount of features
  - vertical: provide a lot of detail for only a few functions
    - Depth: the degree of functionality



• Horizontal vs. Vertical Prototypes

- Horizontal: Wide range with little detail (sales tool)
- Vertical: Much detail for few functions (incremental dev)



Risks in Prototyping

- Client may believe that system is real.
  - Demos good for selling product ideas
  - Unrealistic expectations
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- Software prototypes may have slow response, sketchy icons, test halting bugs, etc.
- Implementers make poor choice
  - Justified in prototype but not in real system
  - Tempting to build real system same way
  -
- Prototype is not identical to the real system
  - Users may interact differently due to different response characteristics
  - Must interpret prototype experience with care

• Do we need prototyping??

Two “points of interest” for companies to adopt prototyping based methodologies are:

- Point 1: They allow us to reduce the cost and time-to-market of a system.
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- Point 2: For companies building critical systems, prototyping would help them perform formal verification when required. These methodologies provide high level of reliability in the system design and implementation.

Presenting Designs in a Meeting

- If presenting to Senior Management:
  - Vision
  - Concepts
  - Key features
  - Impact
  - Image
- If presenting to client:
  - Detail of design
  - Workings of system

Presenting Designs in a Meeting

- If aimed at getting a contract:
  - The main selling point
  - Differences between your product and others
- If aim is to agree a concept:
  - Restate client brief
  - Clarify requirements
  - Scope the project
-

Presenting Designs in a Meeting

- If evaluating early designs:
  - Design principles
  - How the parts fit together
  - Basic navigation
- If evaluating detailed designs:
  - Size
  - Shape
  - Colour
  - Text

Presenting Designs in a Meeting

- Be clear on what the presentation is about:
  - Functionality and events?
  - Content and structure?
  - Interactions and usability?
  - Look and feel?
  - Ease of use?