Week 3:

Understanding & Conceptualizing Interaction

Conceptualizing design

Proof of concept

- Conceptualize what the proposed product will do

Why the need to conceptualizing design?

- To scrutinize vague ideas and assumptions about the benefits of the proposed product in terms of their feasibility
- How realistic is it to develop?
- How desirable and useful?

Assumptions and claims

- Write down your assumptions and claims when coming up with a new design
- Try to defend and support them by what they will provide
- Those that are difficult to articulate
  - Can highlight what ideas are vague or unrealistic
  - Identify human activities and interactivities that are problematic
- Iteratively work out how the design ideas might be improved

What is an assumption?

- Taking something for granted when it needs further investigation

  - For example, people will want to watch TV while driving

Technotopic Narratives and Networked Subjects: Preparations for Everyday Life in Cooltown

What is a claim?

- A claim is stating something to be true when it is still open to question

  - For example, "a multimodal style of interaction for controlling GPS — one that involves speaking while driving — is safe."

Activity: How will enabling robot waiters to speak to customers enhance their experience?

Source: Xinhua, Guo Cheng

What is the problem being addressed?

- The benefits:
  - The robot could take orders and entertain customers by having a conversation with them
  - The robot could make recommendations for different customers, such as restless children or fussy eaters
- But just assumptions
- The real problem being addressed:
  "It is difficult to recruit good wait staff who provide the level of customer service to which we have become accustomed."

Working through assumptions

- Many unknowns need to be considered in the initial stages of a design project
  - Where do your ideas come from?
  - What sources of inspiration were used?
  - Is there any theory or research that can be used to inform them?
- During the early ideation process
  - Ask questions, reconsider assumptions, and articulate concerns

A framework for analyzing the problem space

- Are there problems with an existing product or user experience? If so, what are they?

- Why do you think there are problems?

- How do you think your proposed design ideas might overcome these?

- If you are designing for a new user experience, how do you think your proposed design ideas support, change, or extend current ways of doing things?

Activity

- What were the assumptions and claims made about watching 3D TV?

Figure 3.2 A family watching 3D TV

Source: Andrey Popov, Shutterstock

Assumptions and claims: how realistic?

- There was no existing problem to overcome
    - What was being proposed was a new way of experiencing TV
- An assumption
    - People would really enjoy the enhanced clarity and color detail provided by 3D
- A claim
    - People would not mind paying a lot more for a new 3D-enabled TV screen because of the new experience

Benefits of conceptualizing

Orientation

- Enables design teams to ask specific questions about how the conceptual model will be understood

Open-minded

- Prevents design teams from becoming narrowly focused early on

Common ground

- Allows design teams to establish a set of commonly agreed terms

From problem space to design space

- Having a good understanding of the problem space can help inform the design space

  - For example, what kind of interface, behavior, functionality to provide

- Before deciding upon these, it is important to develop a conceptual model

Conceptual model

- A conceptual model is:

  "…a high-level description of how a system is organized and operates" (Johnson and Henderson, 2002, p26)

- A conceptual model enables:

  "…designers to straighten out their thinking before they start laying out their widgets" (Johnson and Henderson, 2002, p28)

- Provides a working strategy and framework of general concepts and their interrelations

Components

- Metaphors and analogies
  - Understand what a product is for and how to use it for an activity

- Concepts that people are exposed to through the product

  - Task–Domain objects, their attributes, and operations (for example, saving, revisiting, organizing)

- Relationship and mappings between these concepts

First steps in formulating a conceptual model

- What will the users be doing when carrying out their tasks?
- How will the system support these?
- What kind of interface metaphor, if any, will be appropriate?
- What kinds of interaction modes and styles to use?
  - Always keep in mind when making design decisions how the user will understand the underlying conceptual model

Conceptual models

- Many kinds and ways of classifying them
- The best conceptual models are often those that appear:
  - Obvious and simple
  - The operations they support are intuitive to use

Interface metaphors

- Interface designed to be similar to a physical entity but also has own properties
  - For example, desktop metaphor, and web portals
- Can be based on activity, object, or a combination of both
- Exploit user's familiar knowledge, helping them to understand 'the unfamiliar'
- Conjures up the essence of the unfamiliar activity, enabling users to leverage this to understand more aspects of the unfamiliar functionality

Examples of interface metaphors

- Conceptualizing what users are doing
  - For instance, surfing the Web

- A conceptual model instantiated at the interface
  - For example, the desktop metaphor

- Visualizing an operation
  - For instance, an icon of a shopping cart into which the user places items

The card metaphor

- The card is a very popular UI. Why?
  - It has familiar form factor
  - It can easily be flicked through, sorted, and themed
  - It structures content into meaningful chunks (similar to how paragraphs are used to chunk a set of related sentences into distinct sections)
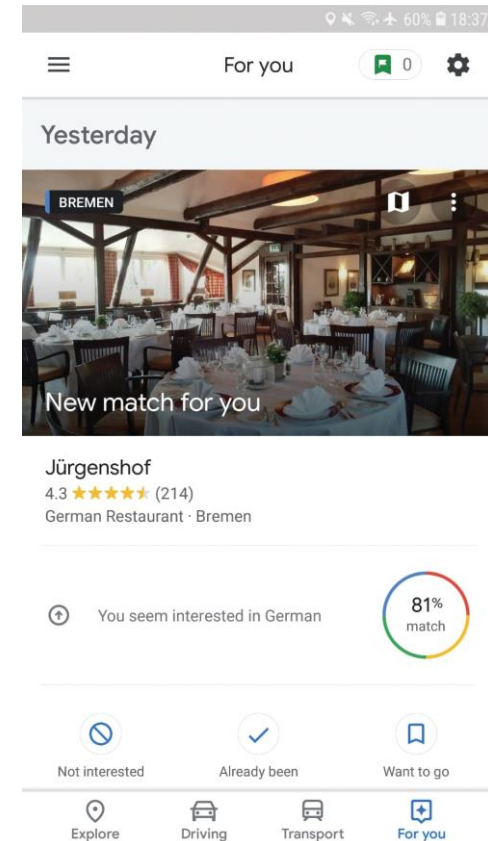 - Its material properties give the appearance of the surface of paper

Figure 3.5 Google Now card for restaurant recommendation in Germany

Source: Johannes Shonning

Benefits of interface metaphors

- Makes learning new systems easier

- Helps users understand the underlying conceptual model

- Can be very innovative and enable the realm of computers and their applications to be made more accessible to a greater diversity of users

Problems with interface metaphors

- Break conventional and cultural rules
  - For instance, recycle bin placed on desktop
- Can constrain designers in the way that they conceptualize a problem space
- Conflicts with design principles
- Forces users to understand only the system in terms of the metaphor
- Designers can inadvertently use bad existing designs and transfer the bad parts over
- Limits designers' imagination in coming up with new conceptual models

Activity

- Describe the components of the conceptual model underlying most online shopping websites, for example:

  - Shopping cart
  - Proceeding to check-out
  - 1-click
  - Gift wrapping
  - Cash register

Interaction types

- Instructing
  - Issuing commands and selecting options
- Conversing
  - Interacting with a system as if having a conversation
- Manipulating
  - Interacting with objects in a virtual or physical space by manipulating them
- Exploring
  - Moving through a virtual environment or a physical space
- Responding
  - The system initiates the interaction and the user chooses whether to respond

1. Instructing

- Where users instruct a system and tell it what to do
    - For example: Tell the time, print a file, or save a file

- Very common conceptual model underlying a diversity of devices and systems
    - For instance: Word processors, VCRs, and vending machines

- The main benefit is that instructing supports quick and efficient interaction
    - Good for repetitive kinds of actions performed on multiple objects

Which is easiest and why?

2. Conversing

- Underlying model of having a conversation with another human

- Ranges from simple voice recognition menu-driven systems to more complex 'natural language' dialogs

- Examples include timetables, search engines, advice-giving systems, and help systems

- Also virtual agents, chatbots, toys, and pet robots designed to converse with you

Pros and cons of conversational model

- Allows users, especially novices, to interact with a system in a way that is familiar to them

  - Can make them feel comfortable, at ease, and less scared

- Misunderstandings can arise when the system does not know how to parse what the user says

  - For example, voice assistants can misunderstand what children say

"If you'd like to press 1, press 3.
If you'd like to press 3, press 8.
If you'd like to press 8, press 5..."

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3. Manipulating

- Involves dragging, selecting, opening, closing and zooming actions on virtual objects

- Exploit's users' knowledge of how they move and manipulate in the physical world

- Can involve actions using physical controllers (for example, Nintendo Wii) or air gestures (such as, Microsoft Kinect) to control the movements of an on-screen avatar

- Tagged physical objects (for instance, balls) that are manipulated in a physical world result in physical/digital events (such as animation)

Direct Manipulation (DM)

- Ben Shneiderman (1983) coined the term DM
- Three core properties:
  - Continuous representation of objects and actions of interest
  - Physical actions and button pressing instead of issuing commands with complex syntax
  - Rapid reversible actions with immediate feedback on object of interest

Benefits of direct manipulation

- Novices can learn the basic functionality quickly

- Experienced users can work extremely rapidly to carry out a wide range of tasks−even defining new functions

- Intermittent users can retain operational concepts over time

- Error messages rarely needed

- Users can immediately see if their actions are furthering their goals, and if not, do something else

- Users experience less anxiety

- Users gain confidence and mastery and feel in control

Disadvantages of DM

- Some people take the metaphor of direct manipulation too literally

- Not all tasks can be described by objects, and not all actions can be done directly

- Some tasks are better achieved through delegating, for example, spell checking

- Can become screen space 'gobblers'

- Moving a cursor using a mouse or touchpad can be slower than pressing function keys to do the same actions

4. Exploring

- Involves moving through virtual or physical environments

  - Users can explore aspects of a virtual 3D environment
  - Physical environments can also be embedded with sensors that when detect the presence of someone will trigger digital or physical events to happen

- Many examples of virtual environments, including cities, parks, buildings, rooms, and datasets

  - Enable users to fly over them and zoom in and out of different parts

Seeing things larger than life in VR
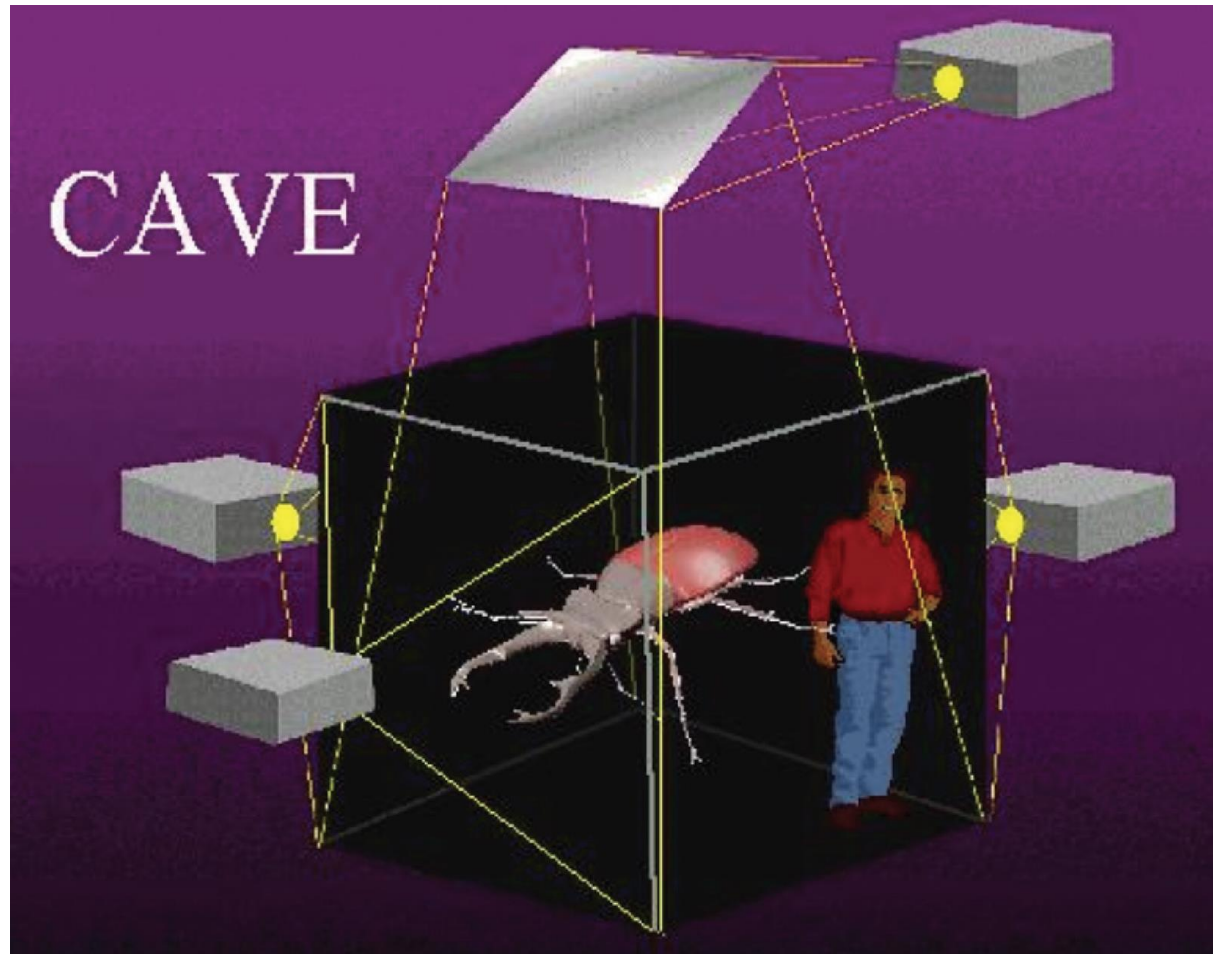
Cyber-Insects in the CAVE *Source*: Alexei A. Sharov

Exploring data in VR
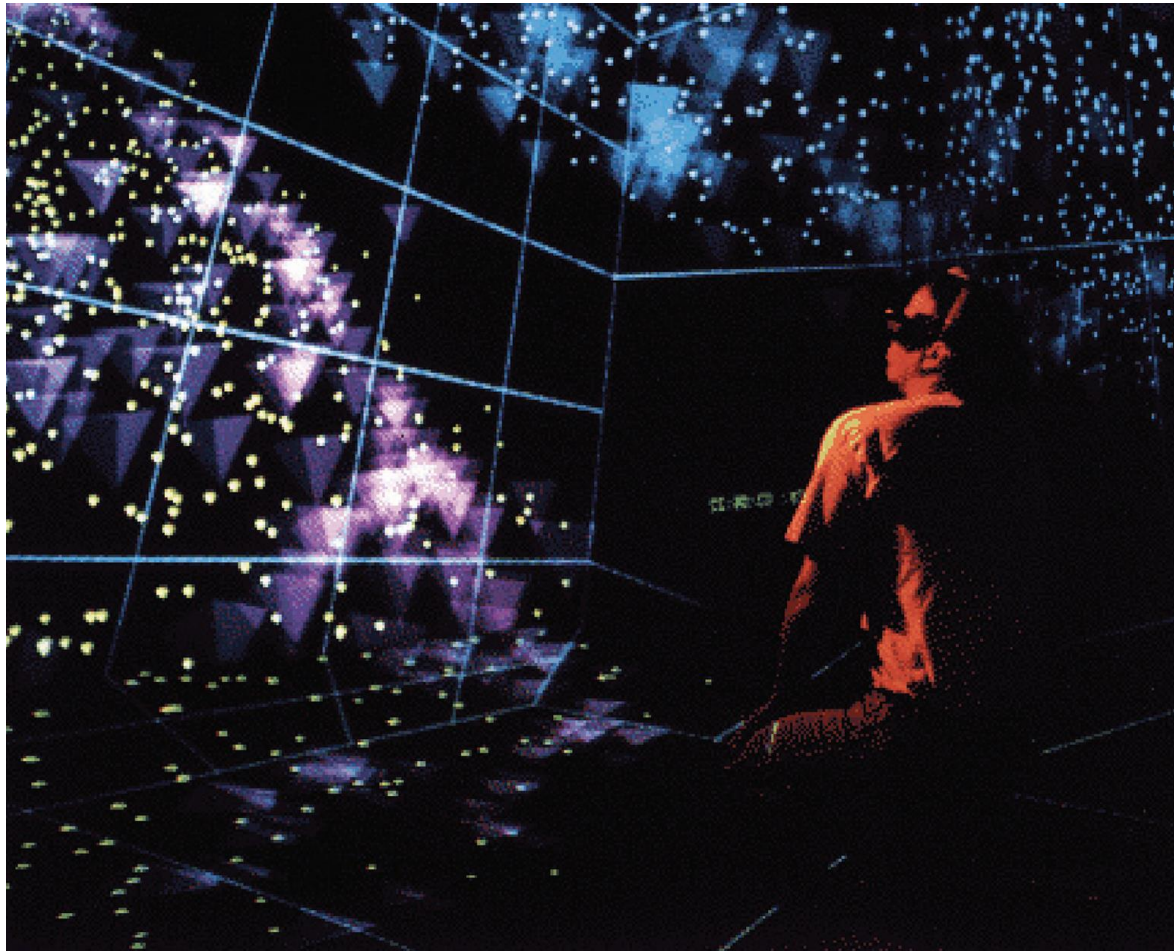

Image courtesy of Kalev Leetaru, National Center for Supercomputing Applications, University of Illinois.

Responding

- System takes the initiative to alert user to something that it "thinks" is of interest
- System does this by:
  - Detecting the location and-or presence of someone in a vicinity and notifies them on their phone or watch,
  - What it has learned from their repeated behaviors
- Examples:
  - Alerts the user of a nearby coffee bar where some friends are meeting
  - User's fitness tracker notifies them of a milestone reached
- Automatic system response without any requests made by the user

This type suggested by Christopher Lueg et al. (2018)

Potential cons of system-initiated notifications

- Can get tiresome or frustrating if too many notifications or the system gets it wrong

- What does it do when it gets something wrong?
  - Does it apologize?
  - Does it allow the user to correct the advise or information?

Choosing an interaction type

- Direct manipulation is good for 'doing' types of tasks, for example, designing, drawing, flying, driving, or sizing windows

- Issuing instructions is good for repetitive tasks, for example, spell-checking and file management

- Having a conversation is good for certain services, for instance, finding information or requesting music

- Hybrid conceptual models are good for supporting multiple ways of carrying out the same actions

Difference between interaction types and interface styles

Interaction type:

- A description of what the user is doing when interacting with a system, for example, instructing, talking, browsing, or responding

Interface style:

- The kind of interface used to support the interaction, for instance, command, menu-based, gesture, or voice

Many kinds of interface styles available (see Chapter 7)…

- Command

- Speech

- Data-entry

- Form fill-in

- Query

- Graphical

- Web

- Pen

- Augmented reality

- Gesture

Other sources

Conceptual knowledge that is used to inform design and guide research include:

- Paradigms
- Visions
- Theories
- Models
- Frameworks

Paradigm

- Inspiration for a conceptual model

- General approach adopted by a community for carrying out research

  - Shared assumptions, concepts, values, and practices
  - For example, desktop, ubiquitous computing, in the wild

Examples of new paradigms in HCI

- Ubiquitous computing

- Pervasive computing

- Wearable computing

- Internet of Things (IoT)

Visions

- A driving force that frames research and development
- Invites people to imagine what life will be like in 10, 15, or 20 years' time
  - For example, Apple's 1987 knowledge navigator
  - Smart cities, smart health
  - Human-centered AI
- Provide concrete scenarios of how society can use the next generation of imagined technologies
- Also raise ethical questions such as, privacy and trust

Questions raised by tech visions

- How to enable people to access and interact with information in their everyday lives

- How to design user experiences where there is no obvious user control

- How and in what form to provide contextually-relevant information to people

- How to ensure that information passed around interconnected devices and objects is secure

Theory

- Explanation of a phenomenon
  - For example, information processing that explains how the mind, or some aspect of it, is assumed to work

- Can help identify factors relevant to the design and evaluation of interactive products
  - Such as cognitive, social, and affective

- Can be used to predict what users will do with different interfaces

Models

A simplification of an HCI phenomenon

- Enables designers to predict and evaluate alternative designs

- Abstracted from a theory coming from a contributing discipline, for example:

  - Don Norman's (1996) model of the Seven Stages of Action

  - Marc Hassenzahl's (2010) model of the user experience

Frameworks

- Set of interrelated concepts and-or specific questions for 'what to look for'
- Provide advice on how to design user experiences
  - Helping designers think about how to conceptualize learning, working, socializing, fun, and emotion
- Focus on how to design particular kinds of interfaces to evoke certain responses
- Come in various forms:
  - Such as steps, questions, concepts, challenges, principles, tactics, and dimensions

A classic HCI framework

Don Norman's (1988) framework of the relationship between the design of a conceptual model and a user's understanding of it

Consists of three interacting components:

- *The Designer's Model*
    - The model the designer has of how the system should work

- *System Image*
    - How the system actually works, which is portrayed to the user through the interface, manuals, help facilities, and so on

- *The User's Model*
    - How the user understands how the system works

Summary

- Developing a conceptual model involves:
  - Understanding the problem space
  - Being clear about your assumptions and claims
  - Specifying how the proposed design will support users
- A conceptual model is a high-level description of a product in terms of:
  - What users can do with it and the concepts they need to understand how to interact with it
- Interaction types provide a way of thinking about how to support user's activities
- Paradigms, visions, theories, models, and frameworks
  - Provide ways of framing design and research