

**“People react positively when
things are clear and
understandable”**

Dieter Rams



www.interaction-design.org

CS3205 – HCI in Software Development

Conceptualizing Interaction

Goals Today: To Understand...

- How to frame your problem space.
- How to conceptualize the interaction.
- How to define a conceptual model.

What is a Problem Space?

- “A Problem Space is the bounds within which an interaction takes place. It includes the relevant parties, objects, tasks, behaviors, etc.”

What Does It Mean To Conceptualize Interaction

- “To conceptualize the interaction is to define the interaction within a problem space abstractly without reference to any particular technology or design.”

Imagine

- You are designing a system that enables people to share photos, videos, music, documents, etc.
 - Let's pretend that no sharing software currently exists.
- Do you begin by sketching out possible interfaces?
- Or do you start by asking users about their experiences sharing photos, videos, music, documents, etc.??

Imagine

- We've already seen that a good designer understands users first!
- It's also important to:
 - Understand the Problem Space
 - Conceptualize the Interaction
- Remember, that design is a process and although we attempt to provide basic steps for it in this class, one can rarely follow a checklist blindly when designing.

Understanding The Problem Space

- Rarely will anyone design something that is perfectly novel!
- Usually need to understand:
 - The current interaction available with technology.
 - The interaction(s) available without technology that mimic the same task.

Example: Sharing Media

- What kinds of interaction exist for this that involve as little technology as possible?

Sharing Media

- Hand the media to your friend.
The most basic form of sharing.
- What are the characteristics of
this interaction?



Sharing Media

- What are some of the problems and/or issues with this form of sharing?
- How can your design ideas overcome these?



Sharing Media

- Ways to improve this basic interaction?
 - Both parties can keep the media after it is “shared”.
 - No need to necessarily meet in person.
- What aspects of interaction to keep?
 - Concept of everyone having a personal library.
 - Others?



Problem Space: Perspectives

- Caution: different team members will often have different assumptions about the problem space.
- You need to define the problem space as a group, decide on a set of mutual terminology, etc.

Why Are Assumptions Dangerous?

- They can lead you to ASSUME incorrectly how users feel about a product or design.

Example: 3D TV



- What are some of the assumptions the designers (likely) made?

Example 3D TV

- Some assumptions:
 - People are okay with wearing 3d glasses when watching TV. -R
 - People don't mind paying A LOT of money for the new 3d enabled models. - NR
 - The successful experience of watching 3d films in a movie theater translates to a home living room. -?
 - People would really enjoy the enhanced clarity and color detail provided by 3D. – R
 - People will be happy carrying around their own special glasses – R for select group of users
 - Others?

Benefits of Understanding Problem Space EARLY

- Orientation
- Enabling the design team to ask specific kinds of questions about how the conceptual models will be understood by the targeted users.

Benefits of Understanding Problem Space EARLY

- Open-mindedness
- Preventing the design team from becoming narrowly focused early on.

Benefits of Understanding Problem Space EARLY

- Common Ground
- Allowing the design team to establish a set of common terms that all can understand and agree upon, reducing the chance of misunderstandings and confusion arising later on.

Conceptual Models!

- A conceptual model is:
 - “a high-level description of how a system is organized and operates” (Johnson and Henderson, 2002, p 26)
- Enables
 - “designers to straighten out their thinking before they start laying out their widgets” (p 28)
 - Conceptual Model

Conceptual Models!

- *The most important thing to design is the user's conceptual (mental) model. Everything else should be subordinated to making that model clear, obvious, and substantial. That is almost exactly the opposite of how most software is designed.* (Liddle, 1996, p. 17)

Exercise

- I am going to show my new web application that will let you schedule appointments with your clients
- What picture did you draw in your head?

Exercise

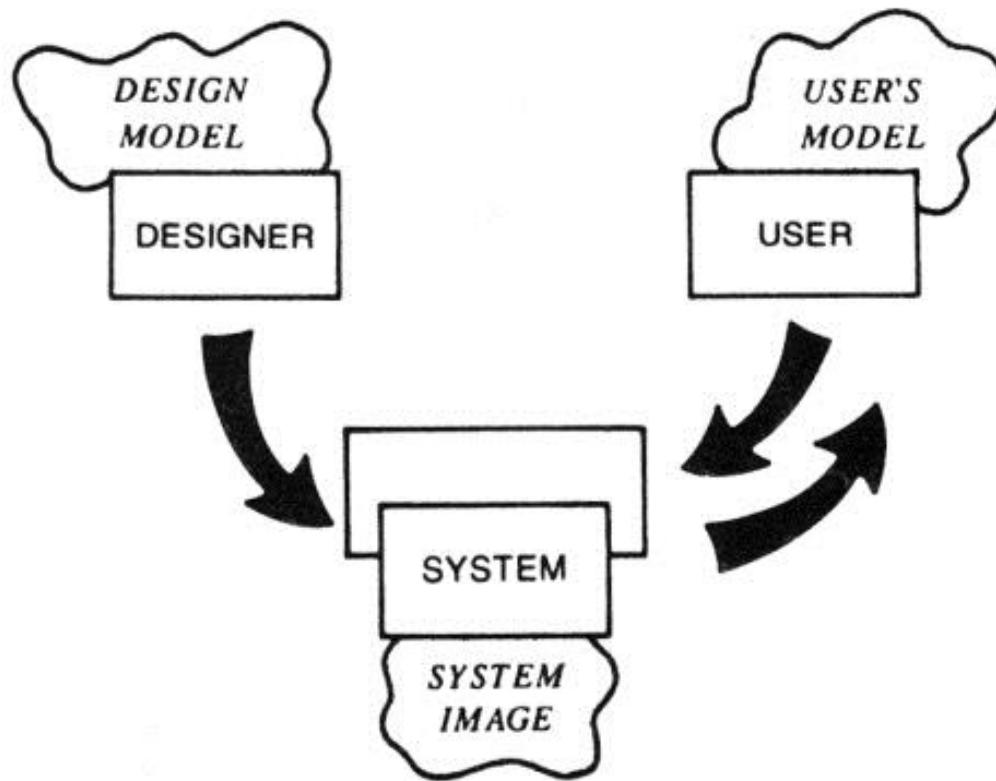
- You may have thought about the following:
 - A calendar
 - Contact list
 - Creating an appointment
 - Reminders about an appointment

Whatever picture you draw in your head is your mental model.

As a designer, when I sit down to design I have to design it keeping in mind the model you (my user) will build in your mind.

- That means, I will have to ensure that my design of the web application should have concepts like managing a Calendar, Contact List, Appointment, Reminder etc.
- This design model that I will build to communicate the design of my web application with everyone is called the Conceptual Model.

Overview



Video Break!

- Let's watch some movies!
- http://www.youtube.com/watch?v=xNqs_S-zEBY
- <http://www.youtube.com/watch?v=TudFAEUkR9Y>

Core Components of A Conceptual Model

- Metaphors / Analogies
- Concepts (or Objects)
- Relationships (between Concepts)
- Mappings (or Operations)

Metaphors / Analogies

- The major metaphors and analogies that are used to convey to the user how to understand what a product is for and how to use it for an activity.
- Example (The Internet)
 - Browsing the web
 - Bookmarking
 - The idea of following links to explore what information is available.

Concepts

- The concepts that users are exposed to through the product, including the task–domain objects they create and manipulate, their attributes, and the operations that can be performed on them.
- Example (The Internet):
 - URLs
 - Web Pages
 - Links

Relationships (Between Concepts)

- The relationships between those concepts, e.g. whether one object contains another, the relative importance of actions to others, and whether an object is part of another.
- Example (The Internet)
 - Links connect Web Pages together.
 - Etc...

Mappings

- The mappings between the concepts and the user experience the product is designed to support or invoke.
- Slightly different than relationships.
- Example (The Internet):
 - Revisit site by looking at the history
 - The user invokes a 'Bookmark' to pull up a web page.
 - Others?

The Desktop

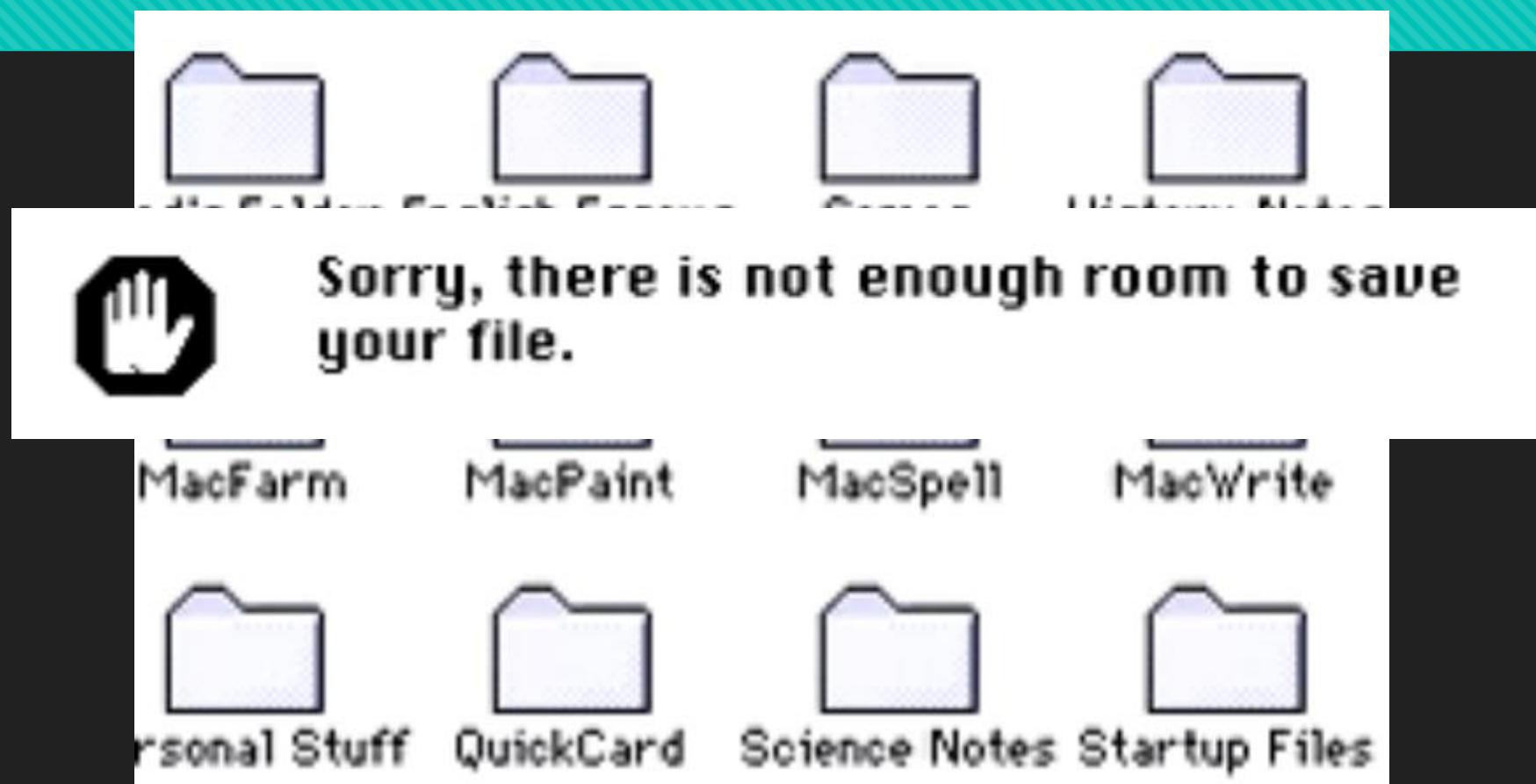


Example of failed conceptual model



- *From Norman

Example of failed conceptual model



○ *From Norman

Example of failed conceptual model



○ *From Norman

Let's Talk About Google Glass

<https://developers.google.com/glass/design/ui>



What is the conceptual model here?
[Link](#)



Be Careful!

- Metaphors are NOT perfect, and indeed have many valid criticisms!
- 1) *Breaks the rules.*
 - E.g., Desktop trash can ON TOP of the desk?
- 2) *Too Constraining*
 - I.e., A computer can do some things faster (and better) than the physical design can.
 - E.g., Deeply nested folders

Be Careful!

- 3) *Conflicts with design principles.*
 - Trying to force the metaphor too literally can cause bad design choices.
 - E.g., Mac trashcan used to mean both “delete this” and “eject this”. Has since been improved.
- 4) *Not being able to understand the system functions beyond the metaphor.*
 - If the metaphor is too literal, users won’t understand the aspects of your system that don’t fit the metaphor.

Be Careful!

- 5) *Overly literal translation of a bad design.*
 - If the physical object being mimicked is poorly designed, than your software probably will be also.
- 6) *Limits the designers creativity in conjuring up new designs.*
 - IMO, the best of the six criticisms.
 - Solution? Strive for balance!

Video Break: Conceptual Model

- <http://www.youtube.com/watch?v=nJVoYsBym88>

Interaction Types

- Most conceptual models fit into one of these four 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

Interaction Types: Instructing

- *Instructing*—where users issue instructions to a system. This can be done in a number of ways, including: typing in commands, selecting options from menus in a windows environment or on a touch screen, speaking aloud commands, pressing buttons, or using a combination of function keys.
- Very common conceptual model, underlying a diversity of devices and systems – e.g. word processors, VCRs, vending machines
- Main benefit is that instructing supports quick and efficient interaction – good for repetitive kinds of actions performed on multiple objects

Interaction Types: Instructing



Which is easiest and why?



Interaction Types: Conversing

- Conversing—where users have a dialog with a system. Users can speak via an interface or type in questions to which the system replies via text or speech output.
- Underlying model of having a conversation with another human
- Range from simple voice recognition menu driven systems to more complex ‘natural language’ dialogs
- Examples include timetables, search engines, advice-giving systems, help systems
- Also virtual agents, toys and pet robots designed to converse with you

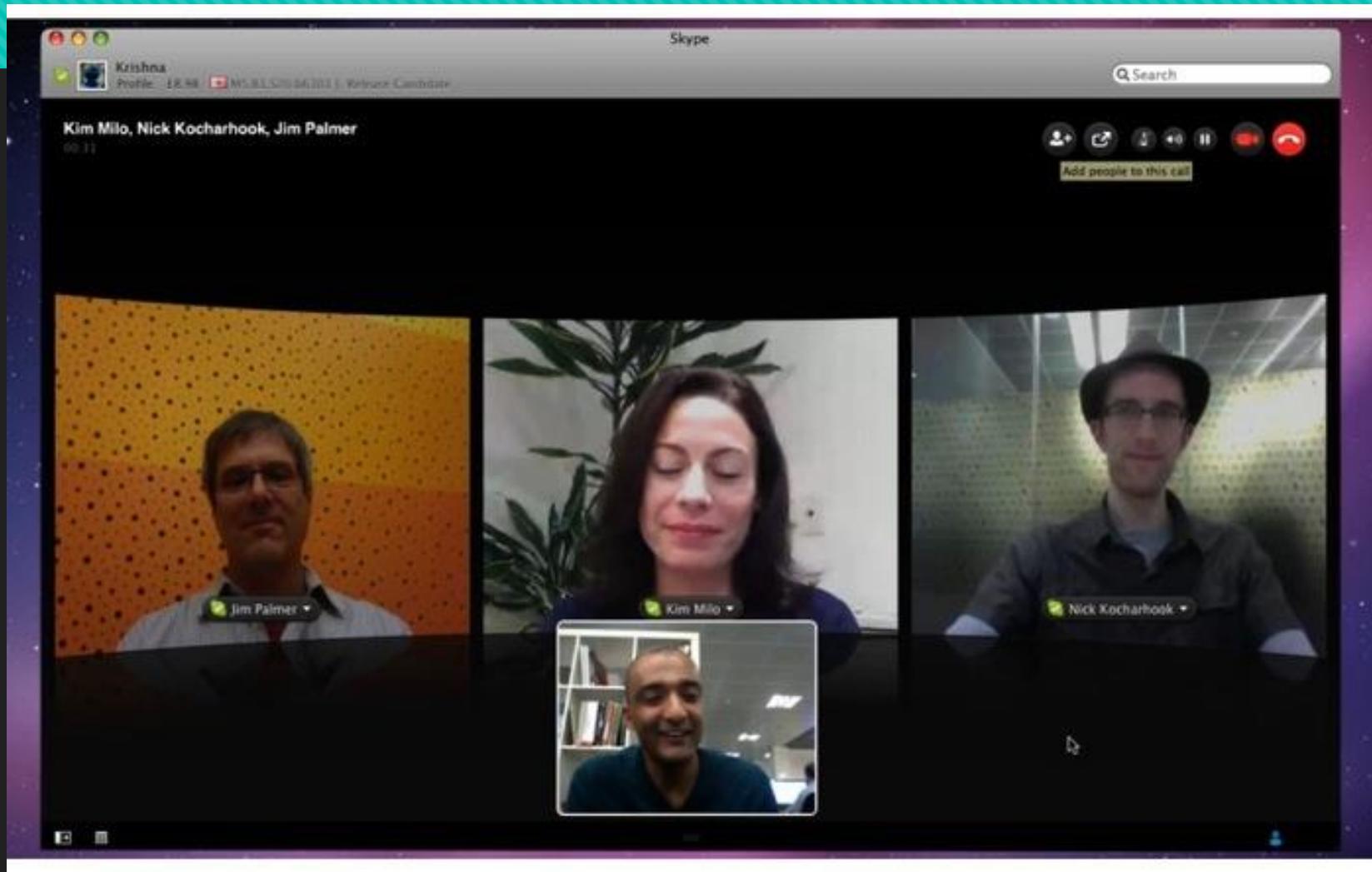
Advantages & Disadvantages of the Conversing Interaction Type

- Allows users, especially novices and technophobes, to interact with the system in a way that is familiar – makes them feel comfortable, at ease and less scared
- Misunderstandings can arise when the system does not know how to parse what the user says

Interaction Types: Conversing



Interaction Types: Conversing



Interaction Types: Manipulating

- *Manipulating*—where users interact with objects in a virtual or physical space by manipulating them, e.g. opening, holding, closing, placing. Users can hone in on their familiar knowledge of how to interact with objects.

Interaction Types: 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 (e.g. Wii) or air gestures (e.g. Kinect) to control the movements of an on screen avatar
- Tagged physical objects (e.g. balls) that are manipulated in a physical world result in physical/digital events (e.g. animation)

Interaction Type: Manipulating – Direct Manipulation (DM)

- Shneiderman (1983) coined the term DM, came from his fascination with computer games at the time
- – 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

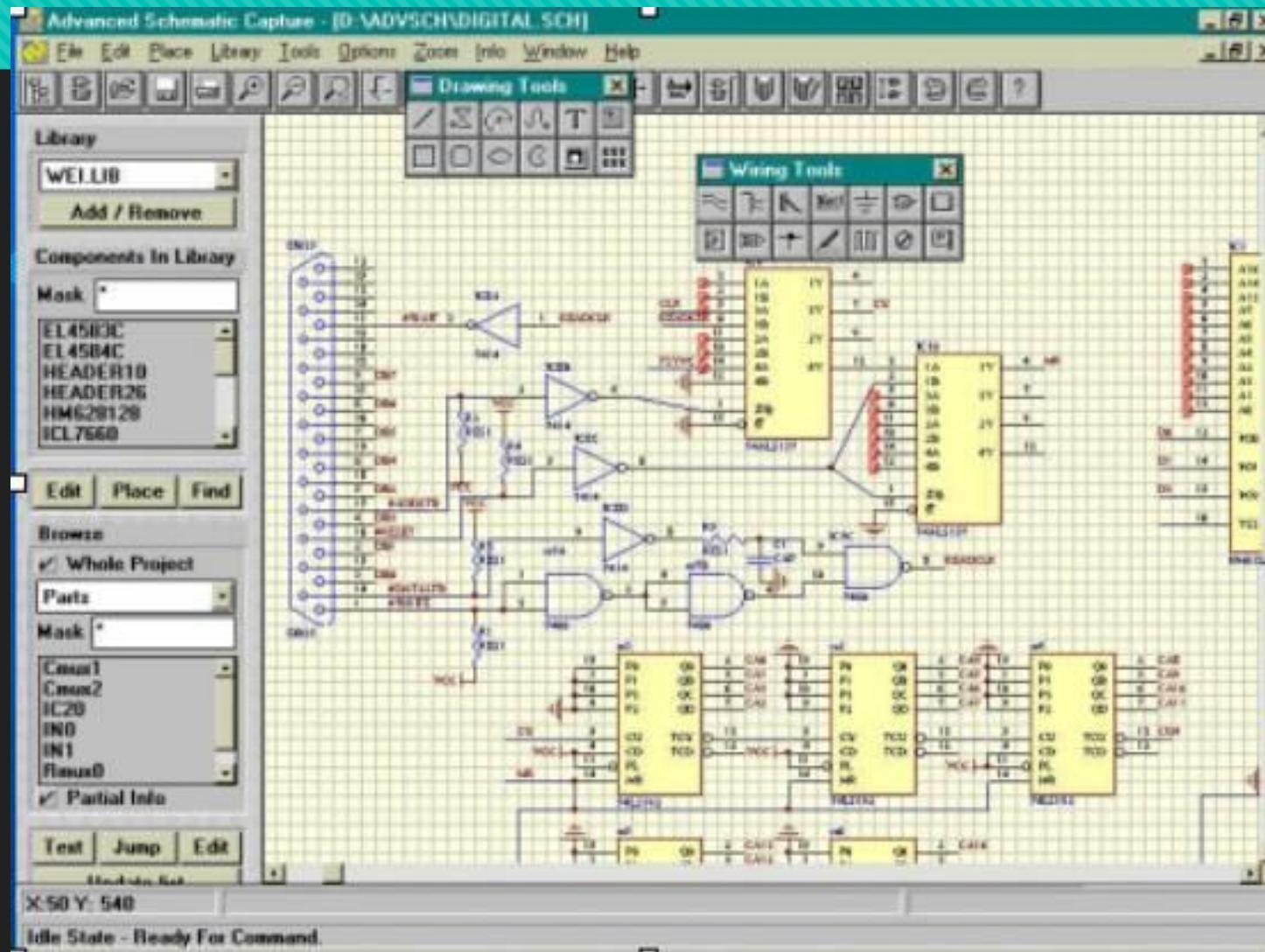
Why is DM so enjoyable?

- 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

What are the 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
 - – e.g. spell checking
 - Can become screen space ‘gobblers’
 - Moving a mouse around the screen can be slower than pressing function keys to do same actions

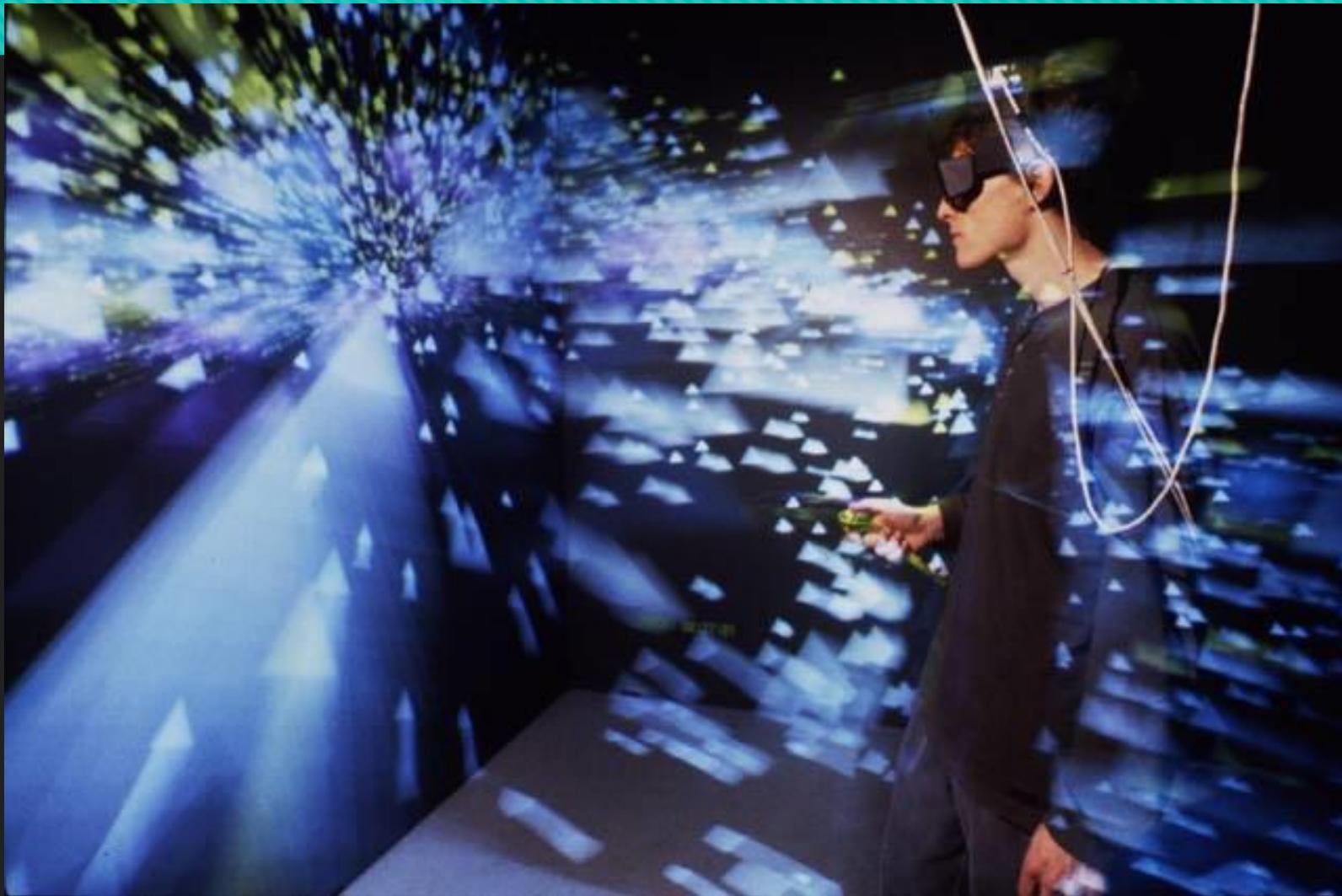
Interaction Types: Manipulating



Interaction Types: Exploring

- where users move through a virtual environment or a physical space. Virtual environments include 3D worlds and virtual reality systems. They enable users to hone in on their familiar knowledge of physically moving around. Physical spaces that use sensor-based technologies include smart rooms and ambient environments, also enabling people to capitalize on familiarity.
- Involves users moving through virtual or physical environments
- Physical environments with embedded sensor technologies – Context aware

Interaction Types: Exploring



Which conceptual model is best?

- Direct manipulation is good for 'doing' types of tasks, e.g. designing, drawing, flying, driving, sizing windows •
- Issuing instructions is good for repetitive tasks, e.g. spell-checking, file management •
- Having a conversation is good for children, computer-phobic, disabled users and specialized applications (e.g. phone services) •
- Hybrid conceptual models are often employed, where different ways of carrying out the same actions is supported at the interface - but can take longer to learn

Conceptual models: interaction and interface

- Interaction type: – what the user is doing when interacting with a system, e.g. instructing, talking, browsing or other
- Interface type: – the kind of interface used to support the mode, e.g. speech, menu-based, gesture

Many kinds of interface types available...

- Command
- Speech
- Data-entry
- Form fill-in
- Query
- Graphical
- Web
- Pen
- Augmented reality
- Gesture
- (for more see chapter 6)

Which interaction type to choose?

- Need to determine requirements and user needs
- Take budget and other constraints into account
- Also will depend on suitability of technology for activity being supported
- This is covered in course when designing conceptual models

4 Concepts Related To Conceptual Models...

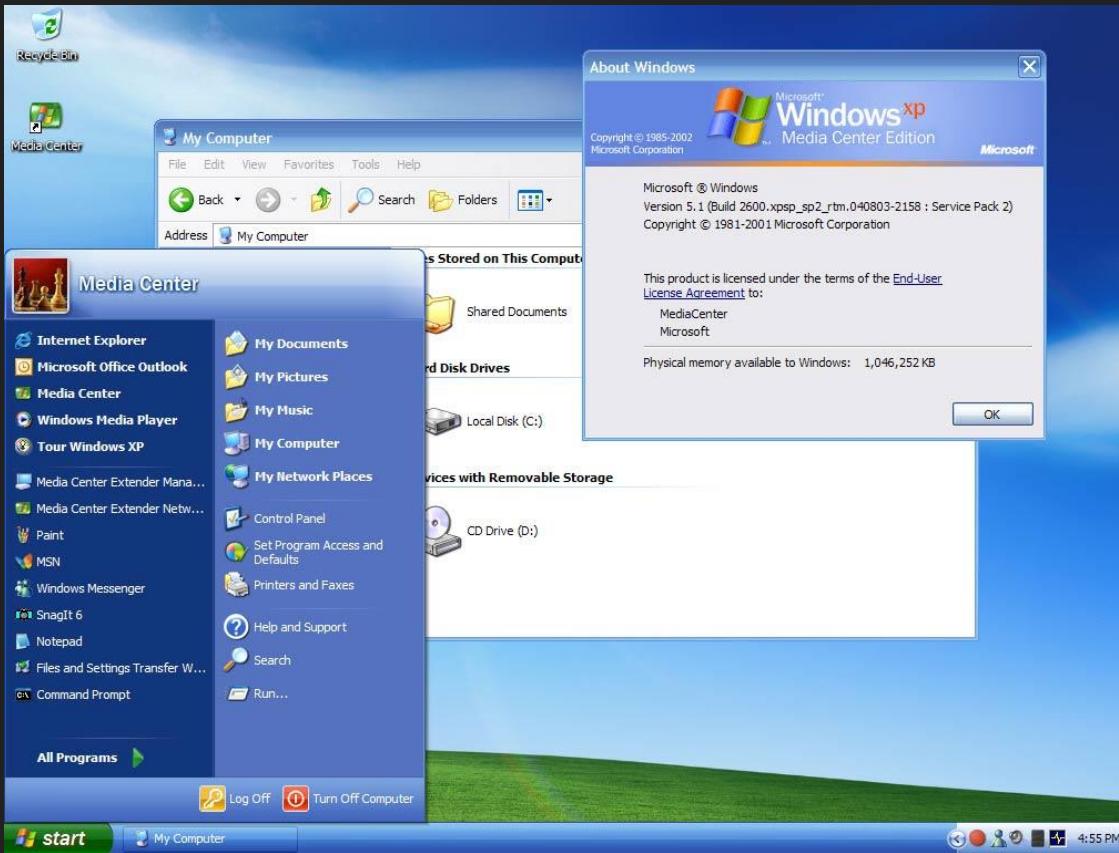
- 1) Paradigms
- 2) Theories
- 3) Predictive Models
- 4) Frameworks

Paradigms

- A set of practices that a community has agreed upon.
Includes:
 - The questions to be asked and how they should be framed.
 - The phenomena to be observed.
 - The way in which findings from studies are to be analyzed and interpreted.

Paradigms: Example

- WIMP (Windows, Icons, Menus, and Pointer)



Paradigms: Example

- WYSIWYG (What You See Is What You Get)

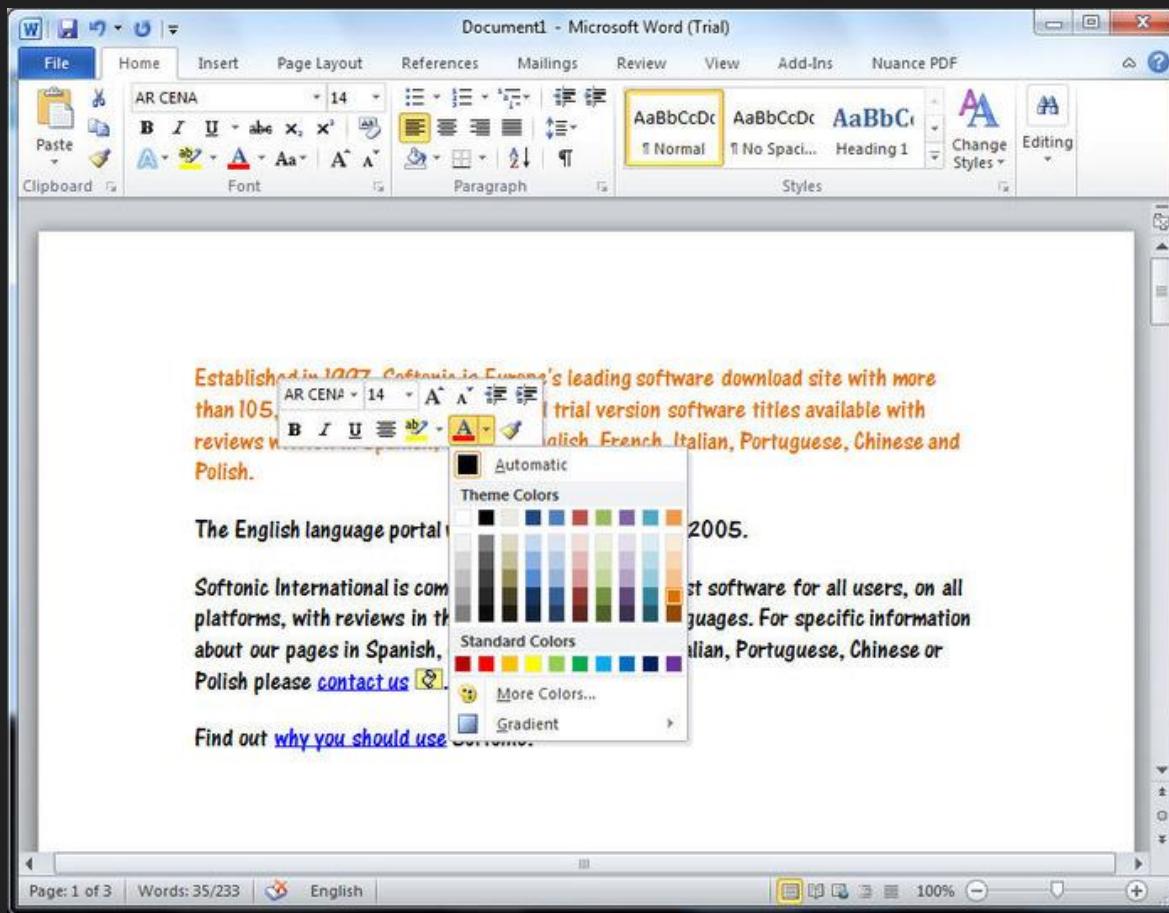
Listing 2: LaTeX example

```
\documentclass[12pt]{article}
%options include 12pt or 11pt or 10pt
%classes include article, report, book, letter, thesis
\title{This is the title}
\author{Author One \\ Author Two}
\date{\today}
\begin{document}
\maketitle
This is the content of this document.
This is the 2nd paragraph.
Here is an inline formula:
$V=\frac{4}{3}\pi r^3
And appearing immediately below
is a displayed formula:
$$V=\frac{4}{3}\pi r^3
\end{document}
```

^^ Latex: Not WYSIWYG!

Paradigms: Example

- WYSIWYG (What You See Is What You Get)



Theories

- Theories of Cognition, Memory, Etc. can often inform and/or inspire a design.
- E.g., Limiting the memory requirements of the user is often a good idea.
- We will see examples of this soon!

Predictive Models

- A method for predicting how usable an interface is as a function of certain design characteristics.
- E.g., calculating how long it will take a user to find and click on a button as a function of the button's size and how far away it is on the screen.
- Models are validated by empirical data (i.e., real users using various interfaces).

Frameworks

- A set of steps, concepts, questions, etc. for guiding designers.
- Later in the course, we will see the DECIDE framework which provides steps for evaluating prototypes.

Summary

- Conceptual Models are a strong way to understand the design space without narrowing in on a particular design too quickly.
- Must keep in mind the drawbacks.

Summary

- Other forms of design inspiration can be useful (in conjunction with conceptual modeling).
 - Paradigms
 - Theories
 - Models
 - Frameworks
 - *We will see some of these in more detail in the next few lectures!

What's Coming Up?

- Design Principles!
- Usability Laws!
- Visual Principles
- Etc...