Course: Human Computer Interface (HCI)

Week 12 - Conceptual Model Activities & Evaluation Techniques

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Learning outcomes

Week 12 - Conceptual Model Activities & Evaluation Techniques

At the end of the lecture, you will be able to:

(i) Define conceptual models and the guiding design principles

(ii) Describe various activities involved in conceptual model development

(iii) Describe the principle of visibility, feedback and mapping to evaluate conceptual models

Course Description

- The course begins with an introduction to Human Computer Interface (HCI) concepts, i.e. the human (brain, human visual system, visual perception and optical illusions), the computer and the interface perspectives.
- Theories and principles to design for attention will be covered and thereafter psychological and social interaction to address use of cognition and use of proper language and metaphors (menus).
- User-centered design and human-centered design will be covered in detail to understand how the two terminologies are similar and how they differ.
- Architectures for user interfaces mainly Graphical User Interface will lead the course coverage to user experience, universal design, design principles, conceptual model, heuristics and golden design rules.
- Information retrieval and utilization architectures will then be connected to designing rich interactive systems using styles that enhance usability (web and mobile) and easy navigation.
- User experience and support will be covered as we look into methods of evaluating interactive systems

Introduction:

- ✓In order to understand how to use things or products, we need conceptual models of how they work, therefore conceptual models are critical to good design[1].
- ✓Good design is an act of **communication** between the **designer and the user**, except that all the communication comes from the appearance of the device itself.

1. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 7

- ✓Devices must explain themselves including their location and operation of the controls required through a conceptual model.
- ✓There is a natural relationship between the device location and the operation they control, therefore, users always know which control does what and this is called *natural mapping*[2].
- ✓When designers fail to provide a conceptual model, users will be forced to make up their own, and the ones they make up are likely to be wrong.

2. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg.8

Guiding Design Principles

i. Feedback

- ✓ Feedback is critical in design and it is given by showing the *effect of an action*.
- ✓ Without feedback, users always wonder whether anything has happened or not.
- ✓ Users start guessing: was the button pushed hard enough? Has the machine stopped working? etc[3].
- ✓ Without feedback, users turn equipment off at improper times or restart unnecessarily, losing all their recent work.
- ✓ Or they repeat the command and end up having the operation done twice, often to their disadvantage.

3. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 7-8

ii. Constraints

- ✓The surest way to make something easy to use, with few errors, is to make it impossible to do otherwise i.e., to constrain the choices.
- ✓**Example:** to prevent users from inserting batteries or memory cards into their cameras the wrong way, thus possibly harming the electronics, design them so that they fit only one way, or make it so they work perfectly regardless of how they were inserted[4].

4. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 7-8, 28

- ✓Failure to design with constraints is one reason for warnings, attempts to give instructions, tiny diagrams on the camera, in obscure locations, often in the same color as the case and **unreadable**.
- ✓If instructions have to be pasted on something (push here, insert this way, turn off before doing this), it is badly designed.

iii. Affordances

- ✓ Good designers make sure that appropriate actions are perceptible and inappropriate actions invisible.
- ✓ Affordance brings out possible uses, actions, and functions.
- ✓ Example: How can we move an object? what can it support? Can anything fit into its crevices, over it, or under it? Can we grab it? which parts move? which parts are fixed?
- ✓ A flat plate affords pushing, an empty container affords filling etc.
- ✓ ***Affordances suggest the range of possibilities, constraints limit the number of alternatives.***
- ✓ Thoughtful use of affordances and constraints in design allows users to determine proper course of action[5].

5. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 8

PROVIDE A GOOD CONCEPTUAL MODEL

- ✓ A good conceptual model allows users to predict the effects of their actions.
- ✓ Without a good model users operate by routine, blindly; they carry out operations as they were told to do them; they can't fully appreciate why, what effects to expect, or what to do if things go wrong.
- ✓ As long as things work properly, users can manage to carry on with their tasks.
- ✓ When things go wrong, however, or when they encounter a novel situation, then they need a deeper understanding, a good model.

- ✓For everyday things, conceptual models need not be very complex. After all, scissors, pens, and light switches are pretty simple devices.
- ✓Users do not have to understand the underlying science of each device in existence, only the relationship between the controls and the outcomes.
- ✓When the model presented to users is inadequate, wrong or nonexistent, users can have challenges.

Communication in Conceptual Models

- ✓The design model is the designer's conceptual model and the user's model is the mental model developed through interaction with the system.
- ✓ The system image results from the physical structure that has been built including the documentation, instructions, and labels.

- ✓ Designers expect user model to be identical to the design model, but the designer doesn't talk directly with the user[6].
- ✓ All communication takes place through the system image and if the system image does not make the design model clear and consistent, then users will end up with the wrong mental model as shown in figure 1.

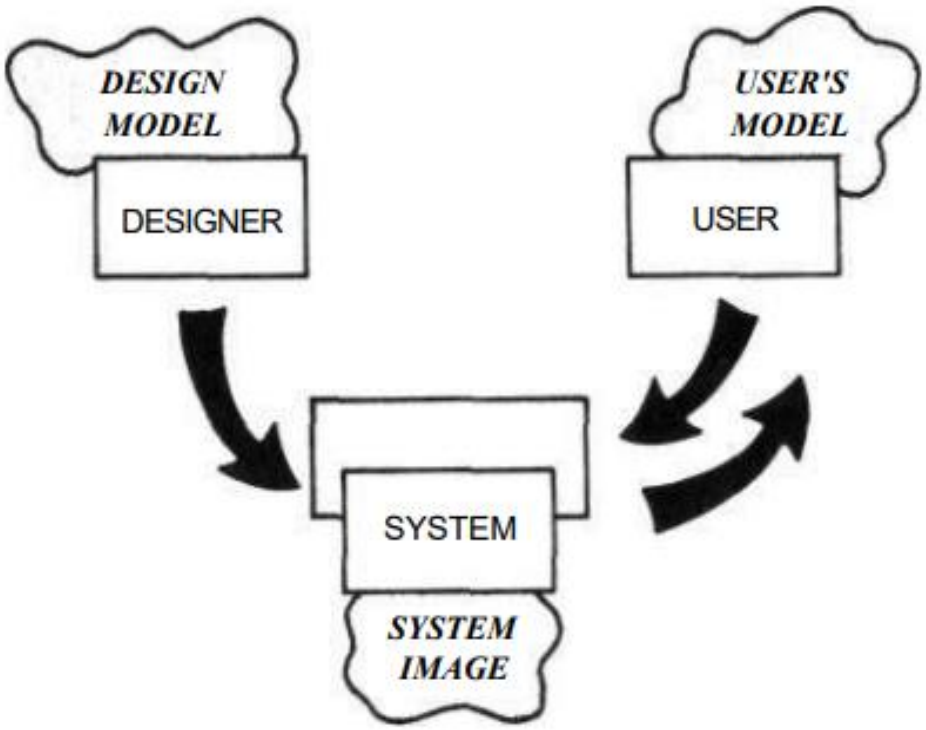

Figure1: Communication from system image to the design model and mental model.

Adopted from: The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 32

- ✓ Conceptual models are important in the design of mental models, i.e., the models' people have of themselves, others, the environment, and the things with which they interact with.
- ✓ People form mental models through experience, training, and instruction.
- ✓ Mental model of a device is formed largely by interpreting its perceived actions and its visible structure.

- ✓When the system image is incoherent or inappropriate, the user cannot use the device easily.
- ✓If it is incomplete or contradictory, there will be errors.
- ✓If the conceptual model is wrong, it is impossible to set the controls.
- ✓If the number of possible actions exceeds the number of controls, there is apt to be difficulty

Activities involved in conceptual model development

A. Instructing

✓ Examples include commands in Microsoft Disk Operating System (MS DOS) or Unix, control keys and menu options in windows.

Benefit:

✓ quick and efficient for repetitive actions.

Drawback:

× Users have to remember a large set of command names

B. Conversing

✓ Examples include help facilities, search engines, voice or natural language-based system

Benefit:

✓ friendly for novice users

Drawbacks:

× Misunderstandings for Natural Language Processing (NLP) are likely to occur

× Repetition and inefficiency e.g., phone-based systems

× Too much expectation e.g., for intelligent or animated agents.

C. Manipulation and navigation

Benefits:

- ✓ Users can learn basic functions rapidly
- ✓ Easy to remember how to use
- ✓ Usually, no error messages
- ✓ Users receive immediate responses
- ✓ Users feel in control

Drawback:

- ✗ Expecting reactions like the physical ones

D.Exploring and browsing (based on activities)

- ✓Examples include CD-ROMs, web pages and conceptual models based on objects and focusing on particular object such as spreadsheets (Ms. Excel)

THE PRINCIPLE OF VISIBILITY

- ✓ A device is easy to use when the set of possible actions is visible and where the controls and displays apply natural mappings.
- ✓The principles are simple but rarely incorporated into design.
- ✓Good design takes time to plan and is thoughtful.
- ✓It takes conscious attention to the needs of the user and sometimes the designer gets it right[7]

7. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 33-39

- ✓ The problems caused by inadequate attention to visibility are all demonstrated with one simple appliance: *the dial-up telephone handset*[8].
- ✓ *What is bad about the design of the telephone?*
- ✓ There was no visible structure and the mappings were arbitrary:
- ✓ There was no relationship between user actions and results to be accomplished

8. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 33-39

- ✓The controls had multiple functions and good feedback was lacking, so users were never sure if the desired results had been obtained.
- ✓The system was not understandable and its capabilities were not obvious.
- ✓The relationship between user intentions, required actions, and the results were completely arbitrary.

- ✓Whenever the number of possible actions exceeds the number of controls, challenges are likely to occur
- ✓The telephone system had twenty-four functions, and only fifteen controls, all of which were not labeled for specific action[9].

9. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 33-39

THE PRINCIPLE OF MAPPING

- ✓ Mapping is a technical term meaning the relationship between two things, here it is between controls, their movements and the results in the world.
- ✓ Consider the mapping relationships involved in steering a car. To turn the car to the right, one turns the steering wheel clockwise (so that its top moves to the right).
- ✓ The user must identify two mappings here: one of the many controls affects the steering, and the steering wheel must be turned in either direction.
- ✓ The wheel and the clockwise direction are natural choices meaning they are visible, closely related to the desired outcome and they provide immediate feedback[10].

10. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 39-43

- ✓Natural mappings combine physical analogies and cultural standards for immediate understanding.
- ✓The mappings are then easily learned and always remember
- ✓**Example:** designers can use spatial analogy, e.g., to move an object up, users need to move the control up.
- ✓To control an array of lights, arrange the controls in the same pattern as the lights.
- ✓Similarly, a louder sound can mean a greater amount where amount and loudness are related - add more to show incremental increases[11].

11. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 39-43

- ✓Other natural mappings follow from the principles of perception and allow for the natural grouping or patterning of controls and feedback.
- ✓Mapping problems are many and this is one of the fundamental causes of difficulties.

THE PRINCIPLE OF FEEDBACK

- ✓Feedback refers to sending information back to the user
- ✓Information about what action has been done and the accomplished result
- ✓Feedback is a popular concept in the science of control and information theory.
- ✓It would be difficult for people to communicate, if a person tries to talk to someone yet they cannot hear their own voice, or trying to draw a picture with a pencil that leaves no mark: there would be no feedback[12].

12. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 43-44

- ✓Why are the dial-up telephone systems so difficult to learn and to use?
- ✓Basically, the problem is that the systems have more features and less feedback[13].

13. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002). Pg. 43-44

Content Covered *in Week 12 - Conceptual Model Activities & Evaluation Techniques*

(i) We have defined conceptual models and the guiding design principles

(ii) We have described various activities involved in conceptual model development

(iii) We have described the principle of visibility, feedback and mapping to evaluate conceptual models

Course Text Books

1. Human-computer interaction (3rd ed.), Dix, A., Finlay, J., Abowd, G., & Russell, B. New Jersey: Prentice Hall. ISBN-10: 0130461091, ISBN-13: 978-0130461094, (2004).

2. Designing for Effective Human/Computer Interaction (4th ed.), Schneiderman, B., Plaisant, C.: Pearson Education, Inc.: ISBN 0-321-19786-0, (2005).

3. The design of everyday things, Norman, D. A. New York: Basic Books. ISBN-10: 0465067107, ISBN-13: 978-046506710, (2002).

4. Designing the user interface: Strategies for effective human-computer interaction (5th ed.), Shneiderman, B., Plaisant, C., Cohen, M., & Jacobs, S. New Jersey: Prentice Hall. ISBN-10: 0321537351, ISBN-13: 978-0321537355, (2009).