
Vorlesung 9, den 16. Dezember 1999

Donnerstag, den 16. Dezember 1999

163



Einführung in die Kognitive Ergonomie

Wintersemester 1999/2000

1. Usability principles, illustrated with reference to an e-mail system
2. Designing part of a mental model for an email system

WWW-Seite: <http://www.cs.uni-sb.de/users/jameson/ke/>

Principles Formulated as Questions

Principles Concerning Learnability (1)

164

Predictability

- Can \mathcal{U} predict the effects of his actions on the basis of experience with previous actions?
- Can \mathcal{U} at any moment determine what actions can be performed?
(*operation visibility*)

Synthesizability

- Can \mathcal{U} perceive and understand the effects of his actions on the system state?
- Are the effects of \mathcal{U} 's actions immediately perceivable or only after \mathcal{U} has taken special steps to perceive them (*immediate vs. eventual honesty*)?

Principles Concerning Learnability (2)

Familiarity

- Can \mathcal{U} exploit his prior knowledge when learning to use \mathcal{S} ?
- Do the properties of objects in \mathcal{S} suggest what can be done with them (*affordances*)?

Generalizability

- Once \mathcal{U} has learned how to achieve a specific goal with \mathcal{S} , can he use similar methods to achieve similar goals - either with \mathcal{S} or with other systems?

Principles Concerning Learnability (3)

Consistency

- Can the behavior of \mathcal{S} - and the actions that \mathcal{U} needs to perform with \mathcal{S} - described in terms of a small number of general rules, or does \mathcal{U} have to learn a lot of specific rules and exceptions?
(Note: Consistency can arise at many levels and take many different forms)

Principles Concerning Flexibility (1)

Dialogue initiative

- Can \mathcal{U} initiate an action whenever it makes sense for him to do so?

Multithreading

- Can \mathcal{U} switch very quickly between tasks (*interleaving*)?
- Can \mathcal{U} even send or receive two messages at the same moment (*concurrency*)?

Task migratability

- Can \mathcal{U} pass control over task execution to \mathcal{S} - or take control from \mathcal{S} - as appropriate in the given situation?

Principles Concerning Flexibility (2)

Substitutivity

- Can \mathcal{U} choose between different ways of inputting a given piece of information to \mathcal{S} ?
- Is \mathcal{S} capable of presenting a given piece of information to \mathcal{U} in different ways?
- Can \mathcal{U} use \mathcal{S} 's output when specifying his input (*equal opportunity*)?

Principles Concerning Flexibility (3)

Customizability

- Can \mathcal{U} adapt aspects of \mathcal{S} to suit his own preferences or needs (*adaptability*)?
- Does \mathcal{S} automatically adapt aspects of its behavior to \mathcal{U} (*adaptivity*)?

Principles Concerning Robustness (1)

Observability

- Can \mathcal{U} find out what he needs to know about the state of \mathcal{S} - without disturbing that state (*browsability*)?
- Does \mathcal{S} explicitly offer \mathcal{U} *defaults*, reducing \mathcal{U} 's need to recall and specify actions?
- Can \mathcal{U} still perceive some reminder of a change in \mathcal{S} 's state some time after the change has occurred (*persistence*)?

Recoverability

- Can \mathcal{U} easily return to a desired previous system state (e.g., after an error)?

171 **Principles Concerning Robustness (2)**

Responsiveness

- Can \mathcal{U} perceive changes in \mathcal{S} 's state immediately after they occur (in particular, immediately after \mathcal{U} has given an input)?
- If not, can \mathcal{U} at least perceive immediately that \mathcal{S} is responding in some way to a change?

Task conformance

- Can \mathcal{U} perform all of the tasks he wants to perform with \mathcal{S} (*task completeness*)?
- Can \mathcal{U} perform his tasks in a natural way, given his own understanding of the tasks (*task adequacy*)?

Designing a Mental Model

Some Contents of a Mental Model of \mathcal{S}

173

Objects

What objects am I dealing with here?

Messages, folders, addresses, files, ...

Tasks

What tasks can I perform with this system?

Send messages

Now or later

To individuals or groups

With or without copies to myself

...

Methods

What steps do I need to perform in order to achieve a given goal?

How do I add a new address to the address book?

How do I store a message so that I can send it later, but only after I've decided to do so?

Mental Models in the Design Process

174

System-centered approach

- Design \mathcal{S} so that it works in a way that the designers consider appropriate
- See how to convey to \mathcal{U} an appropriate mental model of \mathcal{S}

User-centered approach

- Design a good mental model that \mathcal{U} might have of \mathcal{S}
- Design \mathcal{S} so that it works according to this mental model

 175 **Desiderable Properties of Mental Models**

Learnability

\mathcal{M} should include building blocks from \mathcal{U} 's previous experience

It should be possible for \mathcal{S} 's appearance and behavior to convey \mathcal{M} to \mathcal{U}

Other criteria

\mathcal{M} should allow \mathcal{U} to perform the desired tasks in a satisfactory way

Various evaluation criteria may be relevant

Speed, avoidance of errors, low cognitive load, ...

Example Object Hierarchy

176

Message

Origin OR

Message written by \mathcal{U}

Sending status XOR

Already sent

Now being created

Stored for later sending

Intended time of sending XOR

To be sent at the next connection

To be sent some time in the future

Message received by \mathcal{U}

Reading status XOR

Not yet retrieved from server

Retrieved but not yet read

Already read

Conveying Object Hierarchies (1)

What aspects of \mathcal{S} can convey the object hierarchy?

- Appearance of objects on screen
E.g., different icons, different locations

- Distinctions made by actions performed on objects
"Store for mailing after the next connection"
"Store for mailing at some time in the future"

- Help texts
(To be viewed as a last resort)

Conveying Object Hierarchies (2)

How could the message hierarchy in our example system \mathcal{S} be conveyed more effectively?

Work for Class 10

Reading for Class 10

179

Reading for Class 10, January 20th (!!) 2000

1. Read everything that you should have read so far but didn't

2. Read through Section 4.3, "Principles to Support Usability", which you now should be able to understand on the basis of the discussion in Class 9

Homework for Class 10 (1)

180

1. Consider each of the principles concerning learnability and flexibility in Section 4.3:

Try to find an example where the design of \mathcal{S} violates the principle. If you find one, describe it, and suggest how the design could be modified accordingly.

If you can't find such an example, give an example where the design satisfies the principle especially well.

Note:

This exercise will take longer than the ones we've done so far, but it should be especially instructive.

And besides, you have more time than usual, because of the two postponed lectures.

Homework for Class 10 (2)

2. Try to find an example where:
 - a. the mental model held by \mathcal{U} *should* include a certain category of objects, if \mathcal{U} is to be able to work effectively with \mathcal{S}
Example in the email system: the category: "Messages to be sent sometime in the future, after I have decided to do so"
 - b. the appearance and behavior of \mathcal{S} do not make it easy for \mathcal{S} to acquire the corresponding concept

How should the design of \mathcal{S} be changed to avoid this discrepancy?

Consider two basic strategies:

- Eliminate the need for the category in question
E.g., eliminate the option of saving messages for some indefinite future time
- Make \mathcal{S} suggest the category more clearly