

Design and Evaluation of Just-in-Time Help in a Multi-Modal User Interface

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Abstract

In order to optimally support learning, help should be given at an appropriate level: providing the users with *new information*, *relevant* to and *needed* for their task. This paper discusses the design and evaluation of such a help system, applied in the Radiology domain.

Keywords

On-line help, adaptation, mixed locus of control, intelligent user interface, interface agent

INTRODUCTION

In the past, we have developed an *artificial teacher* based on a multi-agent architecture [4]. One of the agents adapted the content and timing of help to the individual student, using layered explanations. The need for help is not restricted to the educational domain. Users need more and more help on how to operate systems (like phones), as the amount of functionality increases rapidly. A lot of research has already been done on intelligent assistance to computer software users [2]. As a test bed, we have built a prototype for the Radiology domain, which explains its own operation, tailored to the individual user.

DESIGN OF JUST-IN-TIME HELP

Explanations should be relevant to a user's task: they should contain information either on how to perform the basic functionality, or on how to perform the task more efficiently (or more accurately) using advanced functionality. We have adopted the following rules regarding the timing of explanations: (1) Explanations are given when the user explores a function (e.g., by touching a control) or completes an action related to that function. (2) Explanations on advanced functionality are given when the user has used related basic functionality.

As the level of expertise of users can vary per functionality, the content of an explanation should be tailored to the knowledge of the individual user on their current task. We regard an explanation as consisting of many parts. Each part

of an explanation should only be given if it is helpful to the user. So, explanation parts are only presented if (1) they have not been presented to the user before, and (2) the user has not already performed the action to which the explanation part is related. It should be noted that these rules are probably too simple, as users may forget. In future, we will need to take into account the time elapsed since the last time the explanation part was presented or the action performed.

The system only has very limited information on what the user wants to do and what the user already knows. Therefore, explanations can be interrupted at any time, by any action. The system remembers what parts of the explanation have not yet finished, and repeats those parts when a new occasion occurs. Explanations are presented in audio, with synchronized text appearing at the bottom of the screen. For some explanations, animated examples are given to demonstrate how the function can be used.

THE PROTOTYPE SYSTEM

The prototype system has a touch screen and voice control, but the latter was disabled during the experiment. The following interactions and explanations were relevant for the experimental tasks. Eight other functions and three explanations were also available.

- Brightness and Contrast can be set using sliders. They can be set simultaneously by using a so-called "dual control" method. Explanation parts: (1) How to use a slider, (2) How to drag a slider indicator, (3) How to use dual control, (4) Example of dual control. The dual control explanations are only given after both brightness and contrast sliders have been used.
- Zooming occurs by pressing the Zoom button, and panning by dragging the image. After zooming in, the image is zoomed out by pressing the Zoom button again. Explanation parts: (1) how to pan, (2) how to zoom out.
- Shutters (image borders) can be dragged. Adjacent shutters can be dragged simultaneously by using a so-called "corner method". Explanation parts: (1) how to set a shutter, (2) how to drag a shutter, (3) example of setting a shutter, (4) how to use the corner method (only given after the user has set two adjacent shutters individually).

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EVALUATION

Experimental design

A between-subjects design was used: in group I the system provided explanations, in control group II not. Sixteen subjects participated in the experiment: all used computers in their jobs, but had no experience with touch screens. Group I was told that explanations could be given, but not when and in what form. Both groups were given the same tasks. In all tasks, they had to make an image on the system look like a target image. Three types of tasks were used: *Brightness-Contrast*, *Zoom-Pan*, and *Shutter* tasks. Of each type, three instances were used. Subjects also filled out a questionnaire, based on the Isometrics questionnaire [1].

Results and discussion

Usefulness of explanations

The subjects clearly needed the explanation to discover the dual control and corner methods. Only subjects who had received the explanations used them (5 in each case). In particular, the Zoom-Pan results indicate an advantage of having the explanations. The pan interaction can be viewed as consisting of two steps: 1) touching the image with the pen, 2) moving the pen over the image. Subjects in group I touched the image significantly earlier (1st, 1st, 1st, 2nd, 2nd, 2nd, 3^d, and 3^d action after having zoomed in) than those in the control group (2nd, 9th, 10th, 12th, 15th, and 60th action). Two subjects in group II did not touch the image at all. Fewer "irrelevant" actions were found in group I than in the control group (six subjects touched the shutters at least six times). In the last task instance, two subjects in group II still assumed shutters played a role in panning, and were interleaving shutter presses with panning operations. Interestingly, three users in group II recommended incorporating on-line help. Unfortunately, the content of the explanations was not always clear: two users misunderstood the Pan and Corner-method explanations.

Timing of explanations

Six subjects agreed that the system seemed to know when to explain. However, improvements are still needed:

- The system should use a threshold to distinguish between a tiny movement, and a real movement. None of the subjects received the shutter explanation, because the system incorrectly noted that they had already used one.
- Subjects tended to listen to the complete explanations, but six subjects interrupted at least one explanation. Interruptions occurred often near the end of a sentence. This may be due to reading being faster than speaking, to the subject grasping the meaning of a sentence before it is finished, or to the subject thinking the explanation only consisted of one sentence.
- The dual-control explanation part is too long: three sentences form one part. This has as disadvantage that all sentences are repeated, even when the user has

already heard the first two. This happened four times to one subject. It should be broken down into more parts.

User control

A problem with systems that take initiative tends to be that users do not feel in control [3]. However, the responses of both groups to the control related questions were very similar, showing that the initiative of the system did not negatively impact the users feeling in control.

CONCLUSION

The explanations helped users to discover and use interactions, in particular, panning, dual control, and the corner method. In general, subjects felt in control of the system. User control should be further improved by enabling the user to explicitly ask for explanations, and to repeat them.

The timing of the explanations is good, but can still be improved. An elaboration of the explanation should be given when the user (1) performs the start of an interaction without completing it (like touching the image but not dragging it), or (2) performs a an action with no effect (like moving a shutter outwards when at its maximum position). To avoid unnecessary repetition, explanations should be broken down into shorter parts. It should be investigated whether repetition is still needed when an explanation part is interrupted *near* the end, and how "near" should be defined in that case. The combination of audio and text seems good, as audio is more attention grabbing (two subjects did not notice the text), and text is less transient. An indication should be given when an explanation is about to start, and how much is to follow. As subtle reminders, text-only explanations could be provided when the explanation has already been given in audio.

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