Multimodal Metaphors for Note taking in E-learning

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ABSTRACT
This research investigates the use of multimodal metaphors to communicate information in the interface of e-learning application in order to reduce the visual communication by incorporating auditory stimuli. Three experimental studies conducted to investigate the effect of using multimodal metaphors in e-learning applications. The first experiment introduced an empirical study to investigate the effect of including multimodal metaphors such as text, graphic and recorded speech in e-learning applications. The second study was dedicated to evaluate usability and learning performance of three different modalities including avatars, earcons, and speech to present the same information about e-note taking and reducing the load on the users’ visual channel. The third experimental study was conducted to investigate the combination of multimodal metaphors including earcon with colour, human-like avatars, and video in the interface of e-learning. These investigations were evaluated by 40 users and comprised two different interface versions in each experimental e-learning tool. The results derived showed that the use of multimodal metaphors in an e-learning system could significantly contribute to enhancing the usability and learning performance. These results provide a set of empirical guidelines for the use of multimodal metaphors in e-learning interfaces.

Key-Words: - Avatar, E-learning, Speech, Earcons, Multimodal

Introduction
Now days, most of on-line applications are crowded interfaces and convey information to users via visual channel only. Therefore, other human senses could be involved in human computer interaction to employ more interaction metaphors within the visual channel, the auditory channel or both. “The auditory channel, as a whole, has been neglected in the development of user-interfaces, possibly because there is very little known about how humans understand and process auditory stimuli” [1]. Interfaces that offer interaction using more than one sense are highly demanded. This is called multimodal metaphors. Rigas et al, suggest that the use of multimodal metaphors in application learning interfaces can be more useful to communicate the information that ‘needs’ to be communicated to the user [2, 3, 4]. Also, they found that the use of speech and non speech in interface application helped the users to make fewer mistakes and reduced the time taken when accomplishing their tasks [5, 6]. Other several studies have been carried out to test the use of multimodal metaphors in visual user interface and to evaluate and examine the affect of these metaphors on the usability of computer applications [12, 14, 15, 17]. Some of these studies suggest that the use of multimodal metaphors such as speech sounds, non speech sound and avatar could improve the usability of computer interfaces in many different ways including e-learning application [10, 11, 13, 16]. Nevertheless, more investigate sill need in this field. Using multimodal interaction in a multiple interfaces including e-learning can enhance human-computer interaction [7]. In this experiments, we investigated the effect of including multimodal metaphors such as
graphic, earcons, recorded speech, video and avatar with simple facial expressions to communicate data, and see how the addition of these metaphors affect the usability of an e-learning system [8, 9].

Overall Aims

The overall aim of experiments is to investigate the use of multimodal note-taking in e-learning interfaces, and produce a set of empirically derived guidelines for the use and design of multimodal metaphors in e-learning interfaces. The multimodal metaphors used in this study were based on the human auditory and audio-visual channel. These included recorded speech, earcons as the auditory metaphors, and graphic and colour as the visual metaphors. The audio-visual metaphors consisted of human and cartoon-like avatars with simple facial expressions. The usability parameters were efficiency, effectiveness, and users’ satisfaction.

Discussion of Experimental Work

This work describes an experimental study conducted to investigate the usability of multimodalities such as graphic, speech, earcons, and avatars for making e-notes in the interface of e-learning applications. The usability parameters considered in the study are efficiency, effectiveness, and users satisfaction. The first experiment introduced an empirical study to investigate the effect of including multimodal metaphors including text, graphic and speech in e-learning applications.

In order to carry out comparative investigation, two independent groups were used to evaluate two different interfaces of an experiment e-learning platform. The second platform was based on a multimodal interface used by the experimental group; this interface consisted of three multimodality tools to improve the efficiency of e-learning: text, speech, and graphics.

![Multimodal Interface](image.png)

Figure 1 shows the multimodal interface
Two different versions of the experimental e-learning tool were tested by a group of 40 users for the second experimental work. Each version offered different modalities including avatars, earcons, graphic, and speech to present the same information about e-note taking. The purpose for including these audio visual metaphors was to reduce the load on the users’ visual channel and to include their auditory sense in obtaining the presented information.

The third experimental study in this research investigated the efficiency, measured by task completion time and error rates, of including: the combined effect of human-like avatars with simple facial expressions; and video, earcons with colour, and speech in e-learning interfaces. The experiment included two different interface versions of the experimental e-learning tool.

Apart from the addition of video and earcons with colours, the experimental platform tested in this experiment was similar to that used in the second experiment. The main objective of this experiment was to obtain the users’ views on the usability effects of combining of earcons, colours, and human-like avatars— as opposed to using cartoon-like avatars.

**Main Conclusions**

This section briefly reviews the general conclusion of three experiments, showing that the amount of information delivered by one sense will be reduced. Using more than one communication channel to receive different types of information will enhance usability of computer systems interfaces.

The results derived from the first experiment for both the textual and the experimental group was analyzed.

Figure 2 shows the textual interface
It was found that the use of graphic and speech metaphors were significantly more efficient, effective, and produced greater user satisfaction than when included in the textual interface. T-test values were used to check the significance of the difference between the mean values of time observations obtained from the experiments. The results showed that using a combination of speech and graphic was more efficient in terms of reducing the time needed by participants to finish the required tasks and had a reduced rate of errors. However, the results demonstrated that there was not a significant difference between the two interfaces in terms of tasks completion time when both groups used text to add notes. Moreover, the metaphors used in this experimental were found to be more effective, had a positive effect, and enhanced the interaction process between the user and the interface. Also, participants completed a higher number of tasks when these metaphors were provided, particularly when these tasks were of higher complexity.

Finally, participants who used the e-learning interface were significantly more satisfied than participants who used the textual interface. According to user’s answers, it can be surmised that using multimodal metaphors, including recorded speech, graphic, and text, were more efficient than using only text in the delivery of information for learning.

The results obtained from the second experiment showed there 30%, 25% and 17% of the participants preferred to use the application based on avatar, earcons and recorded speech, respectively. The remaining 12% of the participants preferred to use the application with text and graphic.

The results derived from the third experiment showed that the combination of earcons, colour, and human-like avatars in e-learning systems could significantly contribute in enhancing user learning performance and usability in terms of efficiency, effectiveness, and user satisfaction.

<table>
<thead>
<tr>
<th>Mean answering time</th>
<th>Experimental Group</th>
<th>Textual group</th>
</tr>
</thead>
<tbody>
<tr>
<td>All tasks</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Easy</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Moderate</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Difficult tasks</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Recall</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Recognition</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 3: Mean values of time taken by users in both groups to complete all tasks
References


