



The Interaction between Gender, Age, and Multimedia Interface Design

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In this study we assumed that multimedia design contributes to an interest in learning by young children. Thirty kindergarten children were exposed to interactive multimedia stories. With the help of the Pollimeter tool (Lampert, 1981), we examined previous experience with computers, level of covert time-on-task, and level of satisfaction with various interfaces. The findings indicate that different interfaces have a different impact on boys and girls as regards covert time-on-task and level of satisfaction with the interface. Boys who are more familiar with computer games show a greater covert time-on-task than girls, as also a higher level of satisfaction. Younger boys and girls were found to show higher satisfaction than older children.

Keywords: multimedia; user-interface; gender differences; kindergarten.

Introduction

Multimedia Learning User-Interface is what connects the computer with the learner; it is the means of interaction between the two (Lucas, 1991). The user does not only learn the content, but s/he also learns how to deal with the synthetic programmed environment. The ease of use, and the uniformity of the interface, has great implications, since they may make possible a learning experience more interesting and effective (Edwards and Holland, 1994).

Weiss (1994) claims that a multimedia user interface is constructed from a number of separate components:

- a. *The presentation interface*—which controls the way in which the user perceives the information.
- b. *The conversation interface*—which controls the way the system is communicating with the user and the user with the system.
- c. *The navigation interface*—which controls the way in which the user moves from one part of the information to another.
- d. *The control interface*—which controls the way in which the user controls the different activities, by means of icons and windows.

The visual design of the interface therefore affects the impression that the user gets from the interface. It also affects how the learner understands the interface, and his or her desire to use it (Mayes, 1992).

In this study, we examined the degree to which the different components of the interface create a positive emotional reaction to the media, or in other words, provide intrinsic satisfaction (Holland *et al.*, 1987) and create covert positive thoughts towards the media. The detection of the most suitable interface for boys and girls will make it possible to prepare computerised learning experiences that appeal to both genders.

We found clear differences among the various interfaces between boys and girls on level of satisfaction. Some of the findings support findings already in the literature which others are reported here for the first time.

To simplify the elements of the interface and the results of the study, we used two concepts from cinematology (Hodges and Sasnett, 1993):

- a. Mise-en-scene—the pagination of single scenes, and
- b. Montage—the combination of scenes and transition from one scene to the next.

We found that girls prefer the components of the mise-en-scene interface while boys prefer the components of the montage interface.

Procedure and Tools

Thirty preschoolers in a typical Israeli kindergarten took part in this study, 11 girls and 19 boys, in two age groups: 4–5—nursery level (12) and 5–6—kindergarten level (18). The relationship between gender, age and multimedia interface design was measured by covert time-on-task—thoughts or covert reaction to the activity and intrinsic satisfaction—positive emotional reaction to the actual activity.

Three multimedia books, classical children stories with no gender bias, were chosen from different publishers. Each one has a different interface design including different dominant colours, different quality of animation and sound, and different levels of interactivity. Each child was exposed to one random chosen interactive multimedia story for improving reading skills. Each book was introduced to an equal number of boys and girls.

Before the activity they were asked to answer a questionnaire, which examined their previous computer experience (see Table 1).

Immediately after the activity they were asked to answer a questionnaire, which examined covert time-on-task (Snir, 1989) and intrinsic satisfaction from the various interfaces (Weiss, 1994). Three statements (see Table 2) were related to time-on-task measurements as developed by Snir (1989).

The other 41 statements related to user satisfaction were divided into four aspects:

1. Presentation interface (seeing the information).
2. Control interface (use of icons).

Table 1. Previous experience

Statements
1. I'm playing computer games almost every day.
2. It's the first time I'm playing a multimedia game.
3. I have similar games at home.
4. I can play computer games by myself.

Table 2. Time-on-task

Statements
1. I was very concentrated during the game.
2. While I was playing my thoughts wandered elsewhere.
3. I paid attention while working with the computers.

3. Conversation interface (communications between user and system).
4. Navigation interface (movement from place to place).

The satisfaction questionnaire was developed by Shneiderman (1992), and adapted to suit this research population (Tables 3–6).

Due to the young age of the research participants we used the Pollimeter Ruler (Lampert, 1981). The ruler (Figure 1) was designed to measure behaviour based on visual moving elements that enable almost anyone to present their opinion, on a continuous scale, without difficulty.

The Pollimeter is comprised of two basic units: a housing unit with a rectangular opening, and a coloured ruler that moves in the housing. The research participants move the ruler in order to indicate their opinion towards any subject by dividing the area seen in the window between two colours, where the one represents lower satisfaction of agreement (black), and the other the higher satisfaction of agreement (white).

Table 3. Presentation interface

Statements
1. I like it when music accompanies the whole game.
2. I like it when a commentator's voice explains me how to play.
3. I like seeing a lot of short films.
4. I like seeing long films.
5. I like seeing a lot of drawings on the screen.
6. I like seeing a lot of colour on the screen.
7. The colours blue and grey are pleasant.
8. I like it when there is a lot of green.
9. Moving drawn images attract me to play.
10. I like a lot of yellow/red.

Table 4. Control interface

 Statements

1. I like big buttons.
 2. I like coloured buttons.
 3. I like round buttons.
 4. I like square buttons.
 5. It is convenient for me when there are arrow buttons.
 6. I like drawings that are buttons.
 7. I like a screen without any buttons at all.
 8. I like it when there is a button for exiting the game.
 9. I like it when the cursor changes it's shape all the time.
 10. It is convenient for me when the buttons are arranged at the bottom.
 11. It is convenient for me when the buttons are arranged at the top.
 12. It is convenient for me when the buttons are arranged on the side.
 13. I like it when the buttons change shapes at every stage.
 14. It confuses me when there are a lot of buttons.
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Table 5. Conversation interface

 Statements

1. I like hearing a voice talking, when I wish it.
 2. It is good that I can change my mind and make another move as I wish.
 3. I like it that when I make a mistake the computer helps me understand.
 4. I like it when there is a large choice.
 5. I like it when I am told to write things during a game.
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Table 6. Navigation interface

 Statements

1. I have to know how to carry on with the game.
 2. I need it to be easy for me to go backwards in a game.
 3. I have to see the navigational buttons all the time.
 4. I like surprises after every click.
 5. I like quick transitions.
 6. I like a slow pace for a game.
 7. I like it when the whole screen changes at once.
 8. I like it when only parts of the screen change.
 9. I am surprised every time animation appears.
 10. I like it when there is animation at the whole of the screen.
 11. I like it when there is animation at the top of the screen.
 12. I like it when there is animation at the bottom of the screen.
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Table 7. Interaction between age, story and gender

Software		Story 1		Story 2		Story 3	
Gender	Age	Young	Old	Young	Old	Young	Old
Boys	M	8.35	6.52	5.82	5.93	7.07	6.07
SD	19 = N	(0.43)	(1.00)	(0.93)	(0.98)	(0.40)	(0.37)
Girls	M	7.57	3.21	5.17	5.25	5.46	5.64
SD	11 = N	(0.55)	(0.85)	(0.85)	(1.36)	(0.62)	(0.58)

$F(11,18) = 4.30, p < 0.05.$

Table 8. Interaction between gender and story with regard to covert time-on-task

Sex	Software	Story 1	Story 2	Story 3
Boys	M	9.00	9.50	6.05
SD	N = 19	(0.98)	(0.69)	(2.67)
Duncan test		A	A	B
Girls	M	7.62	9.00	9.66
N = 11	SD	(1.92)	(1.27)	(0.47)
Duncan test		A	A	A

$F(11,18) = 5.59, p < 0.01.$

Table 9. Interaction between gender and age

Sex	Age	5-6	4-5
Boys	M	9.31	9.55
N = 19	SD	(0.57)	(0.90)
Duncan		A	A
Girls	M	7.77	8.85
N = 11	SD	(1.17)	(1.22)
Duncan		B	A

$F(11,18) = 4.89, p < 0.01.$

The children could also elect different shades of black and white if they were not sure whether the answer to the statement was black (no) or white (yes). The shades elected by the children were exhibited on the scale of the respondent's side while the scale of numbers, which was seen only by the researcher, was on the interviewer's side.



Figure 1. The Pollimeter Ruler[®].

The Pollimeter has many advantages, mainly with young subjects. Its simple structure makes it possible for everyone to express his or her opinion without difficulty. It does not depend on the verbal ability of the user. It enables the interviewees to expose themselves to other visual alternatives, before making their decision (Lampert, 1979).

Results

We carried out an F test (manova) in order to examine the assumption that there are differences among boys and girls in different age groups regarding covert time-on-task and intrinsic satisfaction of various multimedia educational interfaces.

Variance analysis was performed to examine the influence of age, gender, type of interactive story, and the influence of interaction is having on children with 'previous experience with computer games'. The findings indicate significant differences in the primer effects:

- gender with regard to intrinsic satisfaction of control interface,
- age with regard to intrinsic satisfaction of control interface, and
- age with regard to intrinsic satisfaction of conversation interface.

It seems also that significant interaction was found between:

- gender and interactive storybook with regard to time-on-task,
- age and gender with regard to intrinsic satisfaction with the interactive storybook, and
- age, storybook and gender with regard to intrinsic satisfaction with control interface.

In order to examine the source of the differences, 'simple main effect' tests were performed on all of the primary effects and interaction that were found to be significant. The findings regarding the interaction between *age*, *story* and *gender* are presented on Table 7, and illustrated on Figure 2.

Looking at Table 7 and Figure 2, one can see that boys' grades of intrinsic satisfaction with control interface, is higher than the girls' grades. As for the younger boys, their grades are higher than those of the older boys, for stories 1 and 3.

On the other hand, the older girls are more pleased with the control interface in stories 1 and 2, while the young girls prefer the control interface in story 3. It is evident, therefore, that there are differences between boys and girls in the different age groups.

The findings regarding the interaction between *gender and story* are presented on Table 8, and illustrated on Figure 3.

Looking at Table 8 and Figure 3, one can see that there are differences regarding covert time-on-task among boys and girls, in interactive storybooks 1 and 2. However, a significant difference exists among boys and girls regarding covert time-on-task in storybook 3 (the Duncan's test for each gender separately).

The findings regarding the interaction between *age and gender* are presented on Table 9, and illustrated on Figure 4.

Looking at Table 9 and Figure 4, one can see that boys' grades regarding the intrinsic satisfaction of an interactive storybook, are relevantly high, compared with the girls' grades. Also, the grades provided by the younger children, by both boys and girls, are higher than the grades provided by the older ones. However, a significant difference between boys and girls was found among the older children regarding intrinsic satisfaction of educational software (the Duncan's test).

In summary, the assumption of this study was that differences among boys and girls would be found regarding the intrinsic satisfaction with the interactive storybooks and their interfaces in the following aspects: display, conversation, navigation, and control.

In the examination of the source of the variance, we have found that the design of the interface has a significant influence on the learner. Indeed, the findings expose a significant

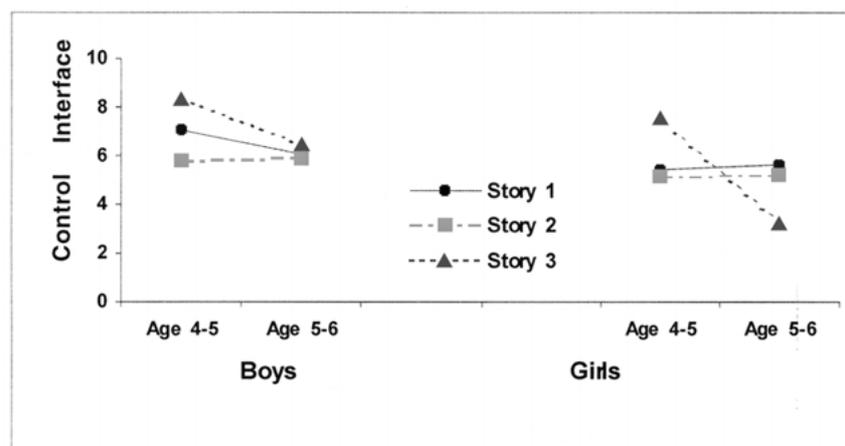


Figure 2. Interaction age, story and gender as regards intrinsic satisfaction of the control interface.

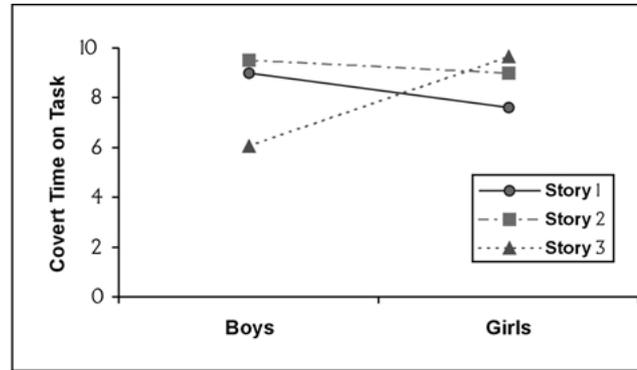


Figure 3. Interaction gender, and interactive story as regards covert time-on-task.

difference among the genders, in the different age groups, regarding intrinsic satisfaction with the control interface. Furthermore, the findings point out to a significant difference among the genders regarding time-on-task. It was also found that there is a significant difference among the different ages regarding intrinsic satisfaction with the control interface and the conversation interface. As for the display interface, no significant differences were found among the genders in the different age groups.

Discussion

The study examined whether differences among boys and girls in the different age groups on covert time-on-task and on intrinsic satisfaction, are differentially associated to educational interfaces. The findings regarding covert time-on-task and intrinsic satisfaction

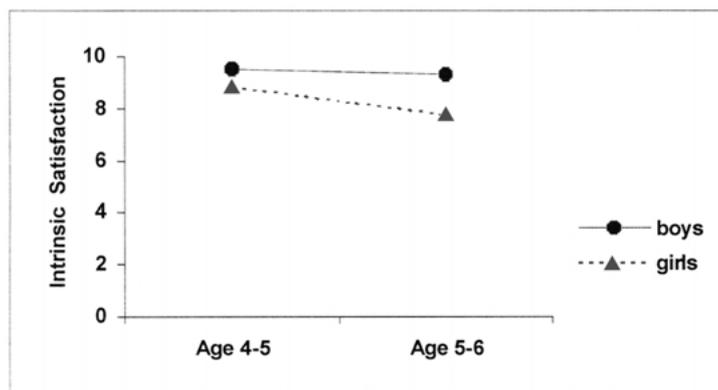


Figure 4. Interaction age and gender as regards intrinsic satisfaction of an interactive storybook.

indicate significant differences with multimedia learning interfaces among boys and girls in the different age groups. These findings, which examined the influence of interface design on the user, reflect similar results in the literature on variety age groups from preschoolers to college students through high school and elementary school (Crook, 1991; Perry and Greber, 1990; Plamondon, 1994; Preece, 1994; Colley *et al.*, 1995; Miller *et al.*, 1996).

The aim of this research was to identify the first signs of change in attitude towards interface elements that occurs in the early age. The results of this study suggest that there are interface elements that draw girls to interact with multimedia contents, and other multimedia elements that appeal to boys. This is where the influence of multimedia learning interfaces on covert time-on-task comes from, since not only the content is important in learning environment, but the way the learner interfaces with it is important too. This is why, apparently, an interaction between gender and age with regards to intrinsic satisfaction was found. The interaction points out that boys express higher intrinsic satisfaction than girls, and younger children (from both genders) express higher intrinsic satisfaction than the older children do. Interestingly, Comber *et al.* (1997) have found similar results, where boys reported a more positive attitude than girls, and older girls reported a less positive attitude towards the computer, than the younger girls.

However this study suggests a new finding, which to our best knowledge is not addressed in the literature. It suggests that there exist an interaction between the control interface of educational multimedia software and age, and an interaction between gender, multimedia educational software, and age with regard to intrinsic satisfaction of control interface.

These findings emphasise the effect discussed in the literature recently that, both educational software, and the interfaces are having on the learner (Gil'ad, 1995). The way the information is served to the learner, and the nature of the dialogue between the user and the system, affect the learners' will to use it. As well as, the shape of the screen and the management of the message determine our personal preferences.

Conclusion

Colley *et al.* (1995), on their study about the differences between genders in the use of computers, indicate that girls compared to boys, are in an inferior position. Girls' self image as to their control of technologies do not reach their full potential. This way, invaluable human capital is wasted. However, our study implicate, that careful design of multimedia interface can make the use of multimedia content appealing and satisfying to both genders.

In this research, an initial attempt was made to examine the differences of satisfaction with multimedia learning interfaces between boys and girls and to find the root of the problem. Based on this initial examination, we recommend developing a model of styles of design for learning interfaces in multimedia, for boys and girls. One can assume that the development of a model such as this will be important for the development of multimedia

computer learning programs that suit the different learning interests of both genders. However, since no empirical studies were found in this specific area, this research recommends carrying out additional research whose aim is to establish, substantiate and extend the findings of the current research, and create gender equality in educational practice (Severiens and Dam, 1997). We also recommend using an interface checklist based on our user satisfaction questionnaire, (presentation interface, conversation interface, navigation interface, and control interface) to help future designers verify gender aspects of their products.

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