The Impact of Game Usability to Player Attitude

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Abstract. In this paper, we investigated the impact of game usability and other game features to the player's attitude. The purpose was to understand what factors influence the players opinion and evaluation of the game. The research was carried out on number of students who answered a survey questionnaire. The analysis of the data showed that game usability and quality of game interface is the most important factor.

Introduction

Usability is defined as one of the main product quality attributes in the international standard ISO 9126. It defines the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 13407).

Computer software is usually used for a specified work-related task while game playing is voluntary (Jørgensen 2004). Game players try to achieve goals and win some kind of challenge, while user of normal computer software try to complete certain task as easily and efficiently as possible.

There is rather limited amount of research done about game usability or quality of game user interfaces. Some researchers focused on applying heuristic evaluation to evaluate game usability (Federoff 2003, Desurvire et al. 2004,

Sweetser and Wyeth 2005). There are also some studies about applying usability testing methods to computer games (Pagualayan et al. 2003). We did not find empirical studies that support the view that usability and user interface plays an important role in game playing experience, or is a factor in buying a game.

In this study, our goal was to investigate what sources information players use in order to evaluate a game and also what aspects of the game affect mostly the player's attitude toward the game. We also tried to formulate player profiles based on clustering methods.

The paper is organized as follows. Section 2 presents the research methods used in this study. It discusses the survey technique and the use of the questionnaire to collect the data needed for the study. Section 3 presents the characteristics of the participants that answered the questionnaire. Sections 4-7 show the results of the data analysis. Section 8 concludes the paper by pointing out the importance of the study and future work ideas.

Research methods

The *research questions* of this study are: what things affect the players' decisions to get a game, and what things players find disturbing while they play. We try to determine if game usability plays an important role in the evaluation of and decision to get a game. We have also tried to determine if it is meaningful to profile the players by finding groups of players with similar characteristics, and to investigate to what extent the factors affecting the decision to get a game differ from one group to another.

Our study is an exploratory study which uses quantitative research design. We used the *survey* technique to collect the data about players' attitudes and opinions towards games. According to Kraemer (1991), the survey technique is based on three different characteristics. One is that the survey technique produces quantitative descriptions of some aspects of a study population. It is used to answer research questions like: who, what, where, how many, how much (Järvinen 2001). The second characteristic of the survey technique is that the collection of the data is done by asking people to answer structured questions, usually through a questionnaire or interview. The third characteristic is that the data is gathered about a representative sample of the entire population under study. The sample *representativeness* criterion is important to assure that the results obtained based on the sample are capable of being generalized to the entire population.

As the data collection instrument we used a *questionnaire* which contained structured questions intended to be responded by selected people. The population under study was student population in Finland. The questionnaire was administered to students from both a public and an open university. We chose students as target population from two reasons. One reason was that the students

are an enough heterogeneous group of people, with a wide range of age, working experience, interests, and game playing experience. The second reason was the fact that it is relatively easy to collect the desired information for the present study by asking students. The sample size was 123 participants. The questionnaire consisted of three categories of questions, and consequently, variables. The first category included background questions regarding gender, age and education. The second category included questions about players' characteristics regarding playing experience and preferences. We refer to the information obtained from these questions as profile data. The third category included questions that asked about factors and things influencing decision to get a game, and the things that the players consider most disturbing when playing.

After we collected the data, we used different statistical techniques to analyze the data. Our data was mainly categorical or interval data. We performed 1-D analysis to summarize data, highlight the characteristics of the participants, and answer questions such as what, and how many? We then applied 2-D analysis in order to determine what relationships exist between the variables used in the study. We applied multivariate techniques, namely clustering analysis, to determine different profiles of the players. We also tested whether the results obtained from data analysis were statistically significant. For example, we used Pearson's chi square test to determine the significance of the relationships between variables.

Participants

The participants in this study were 123 students who answered a questionnaire. 22 respondents (18%) replied that they do not play computer or console games and they did not answer the last part of the questionnaire. Their characteristics are presented in Table I.

Table I Background information about respondents who do not play games

Attribute	Value	Percentage	Median	Mode
Gender	2: Male	5%	3	3
	3: Female	95%		
Age	3: 20-25	14%	5	6
	4: 26-30	14%		
	5: 31-40	27%		
	6: 41-50	36%		
	7: 51-60	9%		
Education	3: professional school	9%	5	5
	4: college	23%		

	5: university	68%		

The background information of the 101 respondents who played at least once is presented in Table II. We can see that in this group 72% are men, 48% are in the age group 20-25, and 70% are college graduates.

Table II Background information about respondents who play games

Attribute	Value	Percentage	Median	Mode
Gender	2: Male	72%	2	2
	3: Female	28%		
Age	2: 16-19	2%	4	3
	3: 20-25	48%		
	4: 26-30	19%		
	5: 31-40	19%		
	6: 41-50	10%		
	7: 51-60	3%		
Education	3: professional school	7%	4	4
	4: college	70%		
	5: university	23%		

Profile data

Besides the demographic data regarding gender, age, and education, we collected information about the experience of playing, amount of time of playing, quantity of games, platform of games and type of games played. In the following, we call these five attributes *profile attributes*. We performed 1-D and 2-D analysis for this data and the results are presented in the sequel.

1-D analysis of profile data

Table III Experience

Question (variable)	N	percent	median	mode	mean	std
EXPERIENCE **A. How long have you been playing computer or console games?**	101	100 %	7	7	6.41	1.18
3 less than 1 year	8	8 %				
4 1-2 years	1	1 %				
5 3-5 years	6	6 %				
6 6-9 years	13	13 %				
7 10 years or more	73	72 %				

Table IV Time

TIME B. How much do you play in an average day?	101	100 %	2	2	2.65	0.90
2 less than 15 minutes	60	59 %				
3 15-59 minutes	20	20 %				
4 1-2 hours	17	17 %				
5 3-5 hours	4	4 %				
6 6 hours or more	0	0 %				

Table V Quantity

QUANTITY C. How much computer and console games do you have?	101	100 %	3	2	3.07	1.12
2 less than 10	43	43 %				
3 11-20	25	25 %				
4 21-49	16	16 %				
5 50 or more	17	17 %				

Table VI Platform

PLATFORM D. Do you play computer games or console games?	101	100 %	2	2	2.59	1.00
2 I only play computer games	66	65 %				
3	20	20 %				
4 equal amount of both	8	8 %				
5	4	4 %				
6 I only play console games	3	3 %				

Table VII Type of game

TYPE E. What type of games do you play most?	99	100%	4	2	3.98	1.88
2___action games	24	24.24 %				
3___strategy games	21	21.21 %				
4___roleplaying games	19	19.19 %				
5___simulators	13	13.13 %				
6___multiplayer online games	10	10.10 %				
7___sports games	6	6.06 %				
8___another genre	6	6.06 %				

2-D analysis of profile and background data

According to Jambu (1991), the objectives of 2-D data analysis are to express and highlight the relationship between two variables. For this purpose, we created cross-tabulations for each pair of data variables representing background and profile information. We performed *Pearson's chi-square* test in order to express and test the relationships between the variables. To interpret the result of the chi-square test we should look at the *significance value*. If the chi-square value

corresponds to a significance level smaller than 0.05 the relationship between variables is significant. The smaller the significance level, the more significant is the relationship between two variables. The *chi square value* represents a measure of association between two variables.

Table VIII summarizes the results of cross-tabulations and chi-square tests relevant to our research questions. The table shows only the significant relationships. Therefore, the data did not account for a significant relationship between *experience* of playing and amount of *time* a respondent is playing during a day. Table VIII reveals interesting associations, for example, between *gender* and *experience* of playing (men have longer experience than women have), and *gender* and amount of *time* of playing during a day (men play more time during a day). Other interesting relationships are found between the amount of *time* of playing during a day and the *number of games* (the bigger the amount of games, the more time of playing), but this seems to be available only in the case of men. It appears that, regardless the number of games they have, women do not play more or less time. *Experience* and *number of games* appears to be a true relationship that accounts for the fact that the longer the experience, the more games the users have.

Table VIII Chi square test results from cross-tabulation of the profile and background attributes

Pair of variables	Chi square value	Significance level
Gender – Age	16.455	0.006
Gender - Experience	26.414	0.000
Gender – Time	9.548	0.023
Gender – Quantity	16.120	0.001
Age – Experience	51.184	0.000
Age - Time	36.537	0.001
Education –Time	17.821	0.007
Experience- Quantity	23.997	0.020
Time - Quantity	30.384	0.000

The first association, *gender – age*, reveals that in the sample under study, men are younger than women are, that is, there are more young persons among the men respondents than among the women respondents. This fact is important in analyzing and interpreting other relationships in which the gender and age attributes are involved.

Analyzing the relationship *age – experience* in more detail, we found that the relationships holds only for men. Therefore, the age attribute does not represent a general factor for experience. This observation helps to conclude that the relationship *gender – experience* is true, meaning that men have more experience than women have in playing games.

The relationship *gender – quantity* seems not to hold either, when analyzed in more detail. Only men in the age group 20-25 years appear to be very different from women with respect to the number of games they possess.

Regarding the *age and time* association, we found that this holds only for men. The women behaviour remains the same regardless the age, but the young men play more time than the old men do.

The relationship *education – time* holds only for the men. Accordingly, men with lower level of education (secondary school or professional school) play longer time than men with college degree or university degree play.

Game evaluation data

In this section, we analyze the answers to questions from the last category. These questions reflect the way the players evaluate different games and what things they consider when they decide to buy or download new games. To answer the research questions, we performed 1-D analysis of the data collected through this last category of questions. Tables IX – XII show the results of 1-D analysis of the game evaluation data.

Table IX Important factors affecting the decision to get a game

F. What things affect your decision to get a game?				
	Median 4	Mode 5	Most important N=89	Affect decision N=97
2 game reviews on TV			4 %	25 %
3 game reviews in computer magazines			17 %	42 %
4 reviews of other game players			35 %	52 %
5 your own impression when trying the game or its demo			44 %	58 %

The most important *factor affecting the decision to get a game* is for 44 per cent of the respondents their own impression when trying the game or its demo (Table IX). At a close distance the reviews of other game players is the most important factor for 33% of the respondents. Even if only 17 per cent of the respondents considered it as the most important thing affecting the decision to get a game, 42 per cent of respondents mentioned the computer magazines' reviews on games as influencing their decision. The games reviews on TV have the most influence on only 4% of the respondents and only 25% have mentioned them as affecting the decision to get a game.

Table X Important factors in game reviews

G. What things in game reviews affect your decision to get the game?										
Put all things in order of importance (1 is the most important, 2 the second most important and so on)	N	median	mode	Most	2	3	4	5	6	Least
a) overall rating of the game	82	2	1	40 %	15 %	7 %	12 %	11 %	5 %	10 %
b) rating of the game graphics	77	4	4	3 %	10 %	23 %	26 %	19 %	17 %	1 %
c) rating of the sound and music of the game	69	6	6	0 %	0 %	9 %	7 %	20 %	35 %	29 %
d) rating of the user interface and the playability of the game	82	2	2	21 %	35 %	17 %	13 %	7 %	5 %	1 %
e) difficulty level and the broadness of the game	80	3	2	9 %	25 %	18 %	18 %	18 %	9 %	5 %
f) screenshots and videoclips in the review	71	5	7	11 %	6 %	17 %	6 %	11 %	13 %	37 %
g) the plot of the game	86	2.5	1	30 %	20 %	12 %	17 %	7 %	7 %	7 %

The most important things in *game reviews* that affect player decision to get a game are the overall rating of the game (for 40% of the respondents it was the most important), the plot of the game (the most important for 30%), and the user interface and playability of the game (the most important for 21%). The least important seem to be the sound and music and game graphics (

Table X).

Table XI Important factors when testing the game

H. What things when testing the game or its demo affect your decision to get the game							
Put all things in order of importance (1 is the most important, 2 the second most important and so on)	N	median	mode	Most	2	3	4	Least
a) graphics in the game	87	3	3	11 %	30 %	31 %	23 %	5 %
b) sound and music in the game	77	5	5	0 %	8 %	16 %	23 %	53 %
c) user interface and playability of the game	89	1	1	52 %	24 %	16 %	8 %	1 %
d) difficulty level of the game	83	4	5	4 %	19 %	23 %	25 %	29 %
e) the plot of the game	90	2	1	40 %	23 %	14 %	14 %	8 %

The most *important things when testing the game or its demo* which influence the decision to get the game are the user interface (the most important for 52% of the respondents), and the plot of the game (the most important for 40% of the participants). The least important aspects of the game appear to be the sounds and music and the difficulty level of the game (Table XI).

Table XII Most disturbing things while playing

I. What things disturb you most while playing?										
Put all things in order of importance (1 is the most important, 2 the second most important and so on)	N	median	mode	Most	2	3	4	5	6	7	Least
a) bad graphics	88	3	3	14 %	15 %	23 %	16 %	17 %	11 %	3 %	1 %
b) bad sound and music	78	5	7	0 %	10 %	12 %	18 %	15 %	21 %	23 %	1 %
c) bad user interface and playability	94	2	1	47 %	24 %	15 %	3 %	4 %	4 %	2 %	0 %
d) difficulty level too high	81	4	4	10 %	16 %	15 %	22 %	19 %	6 %	12 %	0 %
e) difficulty level too low	78	5	6	0 %	6 %	18 %	14 %	14 %	26 %	22 %	0 %
f) game is too short	80	5	6	6 %	9 %	10 %	16 %	19 %	23 %	18 %	0 %
g) boring plot	86	2	1	30 %	26 %	13 %	10 %	9 %	6 %	6 %	0 %

Respondents have recognized that the *most disturbing things while playing* are bad user interface (the most disturbing for 47% of the respondents) and a boring plot (the most disturbing for 30% of the respondents). Other things that disturb players are a too high difficulty level, bad graphics, and too short game (Table XII).

Determining player profiles

In Section 3 and 4, we have investigated the respondents of the survey with respect to background information (gender, age and education) and playing behaviour (experience, time, quantity, platform and type of games). We called these latter six attributes, profile attributes. In this section, we try to group players

in homogenous clusters that account for different player profiles. After we group users in homogeneous clusters, so that players within each cluster have similar features (i.e., similar profile), we will investigate how the decision to buy games differs from one group to another.

In order to group the respondents in homogenous clusters, we applied *cluster analysis*. We clustered the data using the procedure recommended by Sharma (1996). We used the MathWorks (2002)'s Statistics Toolbox for Use with Matlab in order to perform the clustering of the data.

We chose as *clustering variables*: playing experience (in years), amount of time of playing during a day, and amount of games. These are discrete or categorical variables obtained from the answers of single-form questions. The three variables we chose to be clustering variables (named as Experience, Time, and Quantity) are measured on ordinal scales that range from 3-7, 2-6, and respectively, 2-5. The 1-D analysis of these attributes is presented in Section 4, Table III – Table V. The 2-D analysis of the clustering variables (summarized in Table VIII) reveals that there is no relationship between experience of playing and amount of time a respondent is playing during a day. In contrast, the chi square test reveals strong relationships between the experience of playing and the number of games the respondents possess, and between the amount of time the users play and the number of games they have. As it can be seen from Table VIII, the strongest association is between the *amount of time of playing during a day and the number of games* (holding only in the case of men – see discussion in Section 4), followed by the degree of association between *experience and number of games*.

We decided to use first hierarchical clustering to obtain an intermediate solution for determining the structure of the data set. We performed several experiments by using different hierarchical clustering algorithms with different distance measures. We found that the solutions that group the respondents in *6 clusters* are the most appropriate one.

We then performed K-means clustering algorithm that used as initial clustering centroids different solutions obtained previously, after applying hierarchical clustering. In the K-means algorithm we used the squared Euclidean distance. We compared different solutions obtained and chose the one that was the best in terms of the mean of the silhouette values.

Table XIII presents the selected clustering solution. Each cluster is described by the clusters' centroids, here, the median values of the each clustering variable.

Table XIII Clusters' centroids

Cluster id	Observations		Experience	Time	Quantity
1	12	12 %	7	4	4.5
2	14	14 %	7	4	3
3	38	38 %	7	2	2
4	8	8 %	5	2	3

5	20	20 %	7	2	5
6	9	9 %	3	2	2

In Table XIV, we describe the clusters in terms of both background attributes (gender, age, education) and profile attributes (experience, time, quantity, platform, and type). A good clustering solution will reassert the relationships that resulted after performing 2-D analysis.

Table XIV Clusters' composition

		Cluster 1 N1=12	Cluster 2 N2=14	Cluster 3 N3=38	Cluster 4 N4=8	Cluster 5 N5=20	Cluster 6 N6=9
Gender	Male	100 %	86 %	61 %	62.5 %	90 %	33 %
	Female	0 %	14 %	39 %	37.5 %	10 %	67 %
Age	16-19	0 %	0 %	0 %	0 %	10 %	0 %
	20-25	92 %	79 %	34 %	25 %	45 %	22 %
	26-30	0 %	21 %	26 %	25 %	10 %	22 %
	31-40	8 %	0 %	21 %	38 %	30 %	11 %
	41-50	0 %	0 %	13 %	13 %	5 %	33 %
	51-60	0 %	0 %	5 %	0 %	0 %	11 %
Education	professional school	17 %	0 %	11 %	0 %	0 %	11 %
	college	75 %	100 %	53 %	75 %	85 %	56 %
	university	8 %	0 %	37 %	25 %	15 %	33 %
Experience	3 less than 1 year	0 %	0 %	0 %	0 %	0 %	89 %
	4 1-2 years	0 %	0 %	0 %	0 %	0 %	11 %
	5 3-5 years	0 %	0 %	0 %	75 %	0 %	0 %
	6 6-9 years x	8 %	7 %	24 %	25 %	0 %	0 %
	7 10 years or more	92 %	93 %	76 %	0 %	100 %	0 %
Time	2 less than 15 minutes x	0 %	0 %	92 %	63 %	55 %	100 %
	3 15-59 minutes	0 %	36 %	8 %	38 %	45 %	0 %
	4 1-2 hours	83 %	50 %	0 %	0 %	0 %	0 %
	5 3-5 hours	17 %	14 %	0 %	0 %	0 %	0 %
Quantity	2 less than 10 x	0 %	14 %	79 %	25 %	0 %	100 %
	3 11-20	0 %	86 %	21 %	63 %	0 %	0 %
	4 21-49	50 %	0 %	0 %	13 %	45 %	0 %
	5 50 or more	50 %	0 %	0 %	0 %	55 %	0 %
Platform	2 I only play computer games	75 %	50 %	63 %	87.5 %	70 %	56 %
	3 mostly computer games	17 %	43 %	18 %	0 %	20 %	11 %
	4 equal amount of both	8 %	7 %	8 %	0 %	5 %	22 %
	5 mostly console games	0 %	0 %	8 %	0 %	5 %	0 %
	6 I only play console games	0 %	0 %	3 %	12.5 %	0 %	11 %
Type	2 action games	33 %	14 %	32 %	38 %	20 %	11 %
	3 strategy games	25 %	21 %	21 %	13 %	20 %	22 %
	4 role-playing games	17 %	36 %	16 %	13 %	15 %	22 %
	5 simulators	8 %	0 %	16 %	25 %	15 %	11 %
	6 multiplayer online games	17 %	14 %	0 %	0 %	20 %	22 %
	7 sports games	0 %	0 %	8 %	13 %	10 %	0 %
	8 another genre	0 %	14 %	8 %	0 %	0 %	11 %

By looking at the clusters' centroids (Table XIII) and clusters' composition (Table XIV), we interpret the six clusters as follows. We have highlighted the values in the Table XIV that form the characteristics of the clusters.

Group 1: The players in this group have a long experience of game playing, they spend a relatively large amount of time playing during a day (between 1 hour and 5 hours), and they have large quantity of games. They are mainly young men (age group 20-25 years), and their education is professional school or college. In

addition, they mostly play only computer games and some of them play console games too.

Group 2: The players in this group have a long experience of game playing. The range of the amount of time spent playing is from 15 minutes to 5 hours. In this respect, the group is not very homogenous. They have a less number of games than those in cluster 1 (mostly between 11 and 20 games). They are mainly young men (age group 20-30 years), but the group comprise women too (14%). All persons in this group are college graduates. Half of them play only computer games, 43% play mostly computer games and 7% play equal amount of console and computer games.

Group 3: The players in this group have a long experience of game playing (over 6 years). They play less than 15 minutes during a day, and most of them (79%) have less than 10 games. They are both men (69%) and women (31%), with ages between 20 and 60, and college and university graduates. In addition, 63% of them play only computer games and 3% play only console games. 34% play both console and computer games.

Group 4: The players in this group have a medium experience of game playing (between 3 and 9 years), and they spend a relatively small amount of time playing during a day (63% play less than 15 minutes, and the rest of the group up to an hour). They have a medium quantity of games (63% have between 10 and 20 games). They are both men and women, with ages between 20 and 50, college and university education. They are only computer games players (87.5%), or only console games players (12.5%).

Group 5: The players in this group have a long experience of game playing, they play less than 15 minutes a day (55%) or between 15 minutes and 1 hour (45%). They possess a large number of games. They are mainly men (with ages from 16 to 50), college or university graduates. 70% of them play only computer games and 30% of them play console games too.

Group 6: The players in this group have a short experience of game playing (89% played less than a year). All of them play less than 15 minutes a day, and have less than 10 games. They are women in proportion of 67% and men in proportion of 33%, with ages between 20 and 60. They are mostly college graduates (56%). Most of them play only computer games and 11% some of them play console games too.

Differences in game evaluation by different groups of players

In this section, we compare the six groups of players with respect to the way they evaluate the games. We try to determine if players of different profiles use different criteria to evaluate the games, and to form their decisions to get a game.

Table XV What things affect your decision to get a game?

		Cluster identifier					
		1	**2**	**3**	**4**	**5**	**6**
2	game reviews on TV	8 %	43 %	18 %	25 %	35 %	11 %
3	game reviews in computer magazines	**58 %**	**64 %**	29 %	38 %	**50 %**	11 %
4	reviews of other game players	**50 %**	**71 %**	**47 %**	38 %	**60 %**	11 %
5 demo	your own impression when trying the game or its	**58 %**	**57 %**	42 %	**75 %**	**65 %**	**67 %**

Groups 1, 2, and 5 consider that game reviews in computer magazines, reviews of other game players and own impression affect the decision to get a game. Most of the players in group 3 agree that the review of other players influence their decision. In groups 4 and 6, people seem to agree that own impression is important in the decision to get a game.

Table XVI What things affect your decision to get a game mostly?

		Cluster identifier					
		1	**2**	**3**	**4**	**5**	**6**
2	game reviews on TV	0 %	8 %	3 %	0 %	6 %	11 %
3	game reviews in computer magazines	33 %	23 %	10 %	0 %	22 %	11 %
4	reviews of other game players	8 %	**46 %**	**50 %**	29 %	33 %	11 %
5 demo	your own impression when trying the game or its	**58 %**	23 %	37 %	**71 %**	39 %	**67 %**
	median	**5**	**4**	**4**	**5**	**4**	**5**
	mode	**5**	**4**	**4**	**5**	**5**	**5**

When asked to choose the most important factor that contributes to the decision to get a game, 58% of the people in group 1 said that own impression is most influential. In group 2, it seems that no majority consensus is reached but reviews of other games players seem to be the most important for 46% of the respondents. In group 3, 50% say that the most affecting thing is the reviews of other players. Groups 4 and 6 are again in consensus that own impression is the most important. In group 5, people are not homogeneous with respect to the answers to this question.

Table XVII What things in game reviews affect your decision to get the game?

scale 1-7 (most -least) , median	Cluster identifier					
	1	**2**	**3**	**4**	**5**	**6**

a) overall rating of the game	**2**	**2**	**1.5**	2.5	4	3
b) rating of the game graphics	4.5	5	3	3	4	4
c) rating of the sound and music of the game	6	6	5	6	6	6.5
d) rating of the user interface and the playability of the game	**2**	2.5	**2**	**2**	3	**2**
e) difficulty level and the broadness of the game	2	3	4	3	4	4.5
f) screenshots and video clips in the review	5	7	5.5	5	6	4
g) the plot of the game	4	3	**2**	3	**2**	**2**

For people in group 1, the most important things in game reviews that affect the decision to get a game are overall rating of the game, rating of the user interface and playability of the game, and difficulty level and broadness of game. The least important thing is the rating of the sound and music of the game. This group is similar with group 2; the difference is that in the latter the least important are the screenshots and video clips in the review. Group 3 considers as the most important thing the overall rating of the game together with the rating of the user interface and playability of the game as well as the plot of the game. The least important are the screenshots. For the group 4, the most important are the rating of the user interface and playability and the overall rating of the game. The least important is the rating of the sound and music. For the group 5, the most important is the plot of the game and the least important the sound and music and the screenshots. For the group 6, the most important are the rating of the user interface and playability and the plot of the game, and the least important is the rating of the sound and music.

Table XVIII What things in testing the game or its demo affect your decision to get the game

scale 1-5 (most -least) , median	Cluster identifier					
	1	2	3	4	5	6
a) graphics in the game	3.5	3	2.5	**2**	**2**	3
b) sound and music in the game	5	5	4	5	5	4.5
c) user interface and playability of the game	**1**	**1.5**	**2**	**2**	**1**	**1**
d) difficulty level of the game	3	3	4	3	4	2.5
e) the plot of the game	3	**2**	**1.5**	**1.5**	**2**	**2**

Group 1 and group 2 consider the user interface and playability of the game as the most important things that affect the decision to get a game, and the sound and music as the least important. For the group 2, very important is also the plot of the game. Group 3 consists of people for which the plot of the game is the most important when testing a game. It follows the user interface and playability. The least important for these players are the sound and the difficulty level of games. Group 4 and 5 consider equally important the user interface and playability, the plot and the graphics. The least important are the sound and music. Group 6 is similar to group 2, and considers the most important the user interface and the plot of the game. As within other groups, the least important are the sound and music of the game.

Table XIX What things disturb you most while playing?

scale 1-8 (most -least) , median	Cluster identifier					
	1	2	3	4	5	6
a) bad graphics	6	5	3	3	3	3
b) bad sound and music	6	6	4	6	5	5
c) bad user interface and playability	**2**	2.5	**2**	**1**	**1**	**2**
d) difficulty level too high	4.5	3	4	4	4	3
e) difficulty level too low	4	4.5	6	5.5	5.5	5
f) game is too short	4	3	5	5	5.5	6
g) boring plot	3.5	**2**	**2**	**2**	2.5	**2**

When asking to judge what are the most disturbing things while playing a game, people in all groups, but group 2, showed towards bad user interface and bad playability. People in group 2 consider the most disturbing a boring plot. However, many of people in this group pointed out the bad user interface, and many people in the other groups mentioned as the most disturbing thing a boring plot. For group 1 and 2, the least disturbing things are bad graphics and bad sound and music. People in group 3 considers the least disturbing a too-low difficulty level and the fact that the game is too short (not a surprise given the fact that people in this group play less than 15 minutes a day). People in group 4, 5 and 6 agree that the least disturbing things are the bad sound and music, a too-low difficulty level and the fact the game is too short. Another interesting difference

between the groups is that while for groups 1 and 2 (people who play longer during a day) the bad graphics are the least disturbing, for people in group 3, 4, 5 and 6 (who mostly play less than 15 minutes) the bad graphics appear to be disturbing.

Testing the significance of the differences found between groups

By using the chi-square test, we found out that the six groups are different with respect to the following characteristics: gender, age, education, experience, time, quantity, and some of the evaluation answers. Table XX shows the attributes with respect to which the differences between groups are significant. The smaller the significance level, the more significant is the difference between clusters with respect to a particular attribute.

Table XX Significant differences of the groups are found with respect to these attributes

Attribute	Chi-square value	Significance level
Gender	18.812	0.002
Age	43.192	0.013
Experience[c]	186.342	0.000
Time[c]	106.142	0.000
Quantity[c]	137.659	0.000
F_3	10.971	0.052
G_f	51.673	0.008
H_a	35.930	0.016
H_d	30.908	0.056
I_a	60.739	0.004

c) Clustering variables

It appears that the clustering solution was validated by the chi-square test results because the most significant differences were recorded for the clustering variables. Some interesting thing to notice is the fact that all respondents (regardless of the profile to which the respondent belongs) seem to agree on the criteria used to evaluate a game, and on the most disturbing things at a game.

Conclusions

The goal of this study was to find out what things affect the players' decisions to get a game and what things players find disturbing while they play. We also tried to determine if game usability plays an important role in the evaluation of a game and decision to get a game. We found from the survey that game usability and the quality of user interface are very important for players. We found also that the participants in the study are guided after their own impression when trying the game, reviews of other game players and game reviews in computer magazines

for evaluating a game for further acquisition. We also tried to determine if it is meaningful to profile players by finding groups of players with similar characteristics. We found from the survey that there were six groups of players that represent six different player profiles. For all six groups, usability and user interface played an important role in the decision to get a game.

We did not find in the literature previous empirical studies supporting the view that the usability and quality of the user interface play an important role in game playing experience or is a factor in buying a game. Based on this survey, it seems that usability is very important for game design and evaluation.

This study focused on a sample representing students. It would be interesting to investigate in future other categories of game players with respect to the factors that affect their decision to buy/get a game, as well as the impact of game usability and user interface to their attitudes toward a game. The study can also be extended to investigate the degree to which usability affects the players' attitudes toward mobile games.

References

Desurvire, H. Caplan, M. & Toth J. A. (2004). "Using Heuristics to Evaluate the Playability of Games". *CHI 2004 extended abstracts on Human factors in computing systems,* pp. 1509-1512.

Federoff, A. A. (2003), "Heuristics and Usability Guidelines for the Creation and Evaluation of Fun in Video Games". *http://melissafederoff.com/thesis.html*

ISO 13407. (1999). "Human-centered design processes for interactive systems" *International standard.*

ISO 9126. (2001). "Software Engineering, Product quality, Part 1: Quality model" *International Standard.*

Jambu, M. (1991). "Exploratory and Multivariate Data Analysis". *Academic Press, Inc.*, San Diego, CA

Järvinen, P. (2001*). On Research Methods*. Tampereen Yliopistopaino Oy, Juvenes-Print, Tampere

Jørgensen, A. H. (2004) "Marrying HCI/Usability and Computer Games: A Preliminary Look". Proc. NordiCHI 2004, Tampere, Oct. 2004, 393-396.

Kraemer, K. L. (1991), "Introduction" In K. L. Kraemer (ed.) *The Information Systems Research Challenge: Survey Research Methods*, Vol. 3, Harvard Business School, Boston

The MathWorks (2002) Statistics Toolbox for Use with Matlab, User's Guide, Version 4, The MathWorks, Inc.

Pagulayan, R. J., Steury, K. R., Fulton, B. and Romero, R. L. (2003). "Designing for fun: User-Testing Case Studies". In *Funology: From Usability to Enjoyment* by Blythe, M. A., Overbeeke, K., Monk, A. F. and Wright, P. C. Dordrecht: Kluwer Academic Publishers.

Sharma, S. (1996). *Applied Multivariate Techniques*, John Wiley & Sons.