

Ανοικτό Πανεπιστήμιο Κύπρου

Σχολή Θετικών και Εφαρμοσμένων Επιστημών

Μεταπτυχιακή Διατριβή στα Πληροφοριακά και Επικοινωνιακά Συστήματα



**«Ανάπτυξη Μεθόδου για την Αξιολόγηση Ευχρηστίας Ψηφιακών
Παιχνιδιών»**

Αντώνης Αθηνή

**Επιβλέπων Καθηγητής
Παναγιώτης Ζαχαριάς**

Ιανουάριος 2015

Ανοικτό Πανεπιστήμιο Κύπρου

Σχολή Θετικών και Εφαρμοσμένων Επιστημών

**«Ανάπτυξη μεθόδου για την αξιολόγηση ευχρηστίας Ψηφιακών
Παιχνιδιών»**

Αντώνης Αθηνή

**Επιβλέπων Καθηγητής
Παναγιώτης Ζαχαριάς**

Η παρούσα μεταπτυχιακή διατριβή υποβλήθηκε
προς μερική εκπλήρωση των απαιτήσεων για απόκτηση

μεταπτυχιακού τίτλου σπουδών
στα Πληροφοριακά Συστήματα

από τη Σχολή Θετικών και Εφαρμοσμένων Επιστημών
του Ανοικτού Πανεπιστημίου Κύπρου

Ιανουάριος 2015

Summary

It is generally accepted that the aesthetics, functionality, easy navigation, ergonomics and short loading time are some of the key features of any system. Of course these features are often in conflict, like an impressive system with many images requires a longer loading time. Therefore, when an evaluation system is designing, you should seek the optimal balance, depending on the target audience of the website addressed by the amount of information that includes the general style (George et al 1999). However first of all it is important to establish the purpose of the creation of this system. As part of this thesis is to create an electronic media and multimedia evaluation system for example (video games and other like websites) depend on specific features(heuristics).It is very important to create such a system because is called to serve specific needs such as:

- 1) To give the possibility to users to list comments and impressions in evaluative type, for websites and online games which either have visited or have been involved?
- 2) To have the ability to refer back to the site and notice the reviews and evaluations concerning a specific game or a website.
- 3) To have the ability of access to reviews easily and quickly by creating an account (be a member), where the critics that will observe will be free.
- 4) To have the ability observing existing reviews, to create his own review, or, to express his own opinion at the existing reviews.

The evaluation system called HepSystem has created after an extensive research at reviews of existing platforms and several evaluators forum on the internet concerning links reviews(system) and electronic toys and comments that are identified through social media and modern communication methods. The major goal of this system is to satisfy the optimum most of the massive needs of the people were being involved.

Concerning the issue of usability of the system, after assessment made through a special website by highly experienced, users gave answers to specific questions, and after the necessary feedback that was drawn from the answers of respondents, were repeated the steps of design, and improved in this way, the existing system.

The design of the HepSystem in its entirety, showed that if is designed a handy, yet productive in terms of performance evaluation system, can provide experience to users who observing the reviews. They will be also able to manage information and enrich their potential reduced information in the fields of their searches. At the same time will be satisfied by the number of reviews and will be able to express their views on the matter. Additionally it was felt that this opportunity offered to them the freedom to express their own opinions without watertight and stereotypes (eg word limits). Participants felt that the whole process was quite pleasant and enjoyable along with the positive information they had.

Περίληψη

Κάποια από τα βασικά χαρακτηριστικά οποιουδήποτε συστήματος είναι η αισθητική, η λειτουργικότητα, η εύκολη πλοήγηση, η εργονομία και ο μικρός χρόνος φόρτωσης. Βέβαια αυτά τα χαρακτηριστικά συχνά έρχονται σε σύγκρουση, π.χ. ένα εντυπωσιακό σύστημα με πολλές εικόνες απαιτεί μεγαλύτερο χρόνο φόρτωσης. Για το λόγο αυτό, κατά το σχεδιασμό ενός συστήματος, πρέπει να επιδιώκεται η βέλτιστη ισορροπία, που εξαρτάται από το κοινό στο οποίο απευθύνεται το σύστημα, από την ποσότητα της πληροφορίας που περιλαμβάνει και από το γενικότερο ύφος του, (Γεωργίου et al. 1999). Ωστόσο είναι σημαντικό πριν από όλα να καθοριστεί ο σκοπός της δημιουργίας του συγκεκριμένου συστήματος. Σκοπός της δημιουργίας του συγκεκριμένου συστήματος στα πλαίσια της παρούσας μεταπτυχιακής εργασίας είναι η δημιουργία ενός συστήματος αξιολόγησης ηλεκτρονικών μέσων και πολυμέσων όπως για παράδειγμα (ηλεκτρονικά παιχνίδια, και άλλους ιστότοπους) στην βάση συγκεκριμένων χαρακτηριστικών (heuristics).

Οι λόγοι για τους οποίους είναι σημαντικό να δημιουργηθεί ένα τέτοιο σύστημα είναι ότι καλείται να εξυπηρετήσει συγκεκριμένες ανάγκες όπως:

1. Να δώσει την δυνατότητα σε χρήστες να παραθέτουν τα σχόλια και τις εντυπώσεις τους κατά αξιολογικό τύπο, αναφορικά με ιστοσελίδες και ηλεκτρονικά παιχνίδια τα οποία είτε επισκέφθηκαν είτε έχουν ασχοληθεί.
2. Να έχει την δυνατότητα να ανατρέξει αναδρομικά στο σύστημα και να παρατηρήσει κριτικές και αξιολογήσεις που αφορούν ένα συγκεκριμένο ψηφιακό παιχνίδι ή μια ιστοσελίδα.
3. Να έχει την δυνατότητα εύκολης και γρήγορης πρόσβασης στις κριτικές με την δημιουργία ενός λογαριασμού (Member), όπου το περιεχόμενο των κριτικών που θα παρατηρείται του προσφέρεται δωρεάν.
4. Να έχει την δυνατότητα παρατηρώντας τις υφιστάμενες κριτικές να δημιουργήσει και ο νέος χρήστης την δική του κριτική, ή, να διατυπώσει την δική του άποψη σε συγκεκριμένη κριτική.

Μετά από μια σημαντική και εκτενή ανασκόπηση κριτικών για τις υπάρχουσες πλατφόρμες, και αρκετών αξιολογητικών φόρουμ που υπάρχουν στο διαδίκτυο αναφορικά με κριτικές συνδέσμων (sites) και ηλεκτρονικών παιχνιδιών, καθώς και παρατηρήσεις που έχουν εντοπιστεί μέσω των κοινωνικών μέσων δικτύωσης και των σύγχρονων μεθόδων επικοινωνίας, δημιουργήθηκε το HepSystem ώστε να ικανοποιήσει στον βέλτιστο δυνατό βαθμό τις πλείστες από τις μαζικές ανάγκες των ατόμων που συμμετέχουν.

Όσον αφορά το ζήτημα ευχρηστίας του συστήματος, μετά από αξιολόγηση που έχει γίνει μέσω μιας ειδικής ιστοσελίδας από έμπειρους χρήστες, οι χρήστες έδωσαν απαντήσεις σε συγκεκριμένα ερωτήματα, και έπειτα από την απαραίτητη ανατροφοδότηση η οποία αντλήθηκε από τις απαντήσεις των ερωτηθέντων, επαναλήφθηκαν τα στάδια του σχεδιασμού, και βελτιώθηκε κατά τον τρόπο αυτό το υπάρχον σύστημα. Ο σχεδιασμός του συστήματος στην ολότητα του, κατέδειξε ότι εάν σχεδιαστεί ένα εύχρηστο και συνάμα παραγωγικό από πλευράς απόδοσης σύστημα αξιολόγησης, μπορεί να προσδώσει εμπειρία στους χρήστες, οι οποίοι παρατηρώντας τις αξιολογήσεις θα είναι σε θέση να διαχειριστούν την πληροφορία και να εμπλουτίσουν την πιθανή μειωμένη τους πληροφόρηση στους τομείς των αναζητήσεων τους. Ταυτόχρονα θα μείνουν ικανοποιημένοι από το πλήθος των κριτικών και οι ίδιοι θα είναι σε θέση να διατυπώσουν τις απόψεις τους επί του θέματος. Επιπρόσθετα διαφάνηκε ότι με την ευκαιρία που τους προσφέρεται να διατυπώσουν τις δικές τους απόψεις χωρίς στεγανά και στερεότυπα (π.χ περιορισμοί λέξεων), οι συμμετέχοντες αισθάνθηκαν ότι η όλη διαδικασία, τους ήταν αρκετά ευχάριστη και διασκεδαστική παράλληλα με την θετική ενημέρωση που είχαν.

Ευχαριστίες

Σκοπός της παρούσας μεταπτυχιακής διατριβής, δεν ήταν η δημιουργία ενός ακόμα διαδραστικού συστήματος αξιολόγησης το οποίο θα κοσμεί τον ιστοχώρο, αλλά ένα απόλυτα παραγωγικό σύστημα αξιολόγησης το οποίο θα προσφέρει ευελιξία και απόδοση στους ενεργούς χρήστες του. Στο σημείο αυτό θεωρώ σημαντικό να ευχαριστώ τον αγαπητό μου καθηγητή και επιβλέποντα, κο, Παναγιώτη Ζαχαριά, για την πολύτιμη βοήθεια του καθώς και την ορθή του καθοδήγηση.

Επιπρόσθετα θα ήθελα να ευχαριστήσω όλους τους διδάσκοντες του Ανοικτού Πανεπιστημίου Κύπρου (ΑΠΚΥ), για τις εμπειρίες και τις γνώσεις που απεκόμισα κατά την διάρκεια της φοίτησης μου στο Μεταπτυχιακό Πρόγραμμα, Πληροφορικά και επικοινωνιακά Συστήματα, του ΑΠΚΥ.

Θα ήταν παράλειψη να μην ευχαριστήσω τον κο, Χάρη Καρακατσάνη, για την σημαντική συμβολή του και για την βοήθεια στην δημιουργία του Συστήματος Αξιολόγησης (HepSystem).

Επίσης θα ήθελα να ευχαριστήσω την οικογένεια μου, τα παιδιά, τους γονείς μου, τα αδέρφια μου, και φίλους, για την κατανόηση και στήριξη που μου παρείχαν καθ ' όλη την διάρκεια των σπουδών μου, αλλά ιδιαίτερα κατά την περίοδο της συγγραφής της Μεταπτυχιακής μου Διατριβής.

Εν κατακλείδι, ιδιαίτερες ευχαριστίες θα ήθελα να αποδώσω στην σύζυγο μου Γεωργία Αθηνή, και τον φίλο μου Σταύρο Χαραλάμπους, για την βοήθεια που μου προσέφεραν, αναφορικά με την επιμέλεια των κειμένων την σύνταξη και την διατύπωση όρων.

CONTENTS

Table of Pictures.....	ix
Table of Tables	xii
Chapter 1	1
Introduction	1
1.1 Goals of Thesis	1
1.2 Structure of Thesis	4
Chapter 2	6
Usability and Heuristic Evaluation.....	6
2.1 Introduction	6
2.2 What is usability?.....	8
2.3 Usability evaluation method.....	9
2.4 Heuristics Evaluation.....	11
2.4.1 Definition of Heuristics Evaluation.....	11
2.4.2 Heuristics Evaluation method	11
2.5 Studies based on heuristics evaluation.....	12
2.5.1 Studies on medical devices.....	12
2.5.2 Studies on e-government sites	15
2.5.3 Studies on multi-player games	18
2.5.4 Studies on intrusion detection system.....	20
2.5.5 Studies on ambient displays system	23
2.6 Summary of the results	24
2.7 Conclusion	25
Chapter 3	27
Heuristic Evaluation of Games.....	27
3.1 Introduction	27
3.2 Heuristics And Digital Games.....	28
3.3 Software and game heuristic development	29
3.4 Evaluation on games' aspects	31
3.5 Heuristic evaluation procedure	32
3.6 Principles of digital games playability	34

3.7	Methodology of research on digital games' use	34
3.8	Evaluation of heuristics' usability in digital games.....	36
3.9	Playability and player's experience.....	37
3.10	Gameplay metrics and player's experiences	37
3.11	Verification of the game by heuristics' use.....	38
3.12	Conclusion.....	39
Chapter 4		40
Methodology to develop the HepSystem		40
4.1	Introduction	40
4.2	The goals of system	43
4.3	Implementation phase.....	44
4.4	Testing and start production.....	45
4.5	Maintain and update	45
Chapter 5.....		46
System's development based on Evaluation of Games Playability		46
5.1	Introduction.....	46
5.2	Research before the system planning.....	48
5.3	Description of the HepSystem	51
5.3.1	Unsafe area of the system	51
5.3.2	Safe area of the system.....	53
5.3.2.1	Choose a plan	55
Step 1 - Select the number of evaluators		58
Step2- Select the heuristic protocol		60
Step3 - Define the goal		61
Step4 - Define a set of tasks		62
Step 5-Define the severity scale.....		63
Step 6 - Evaluation based on heuristics		65
Step7 - Prioritize the usability problems		66
Step 8 - Redesign suggestions based on evaluation.....		68
5.3.2.2	Modify and search a plan	70
5.3.2.3	Report	74

Chapter 6	77
Improvements on the HepSystem interface	77
6.1 Feedback on the HepSystem interface.....	77
6.1.1 Participants	78
6.1.2 Feedback procedure	78
6.2 Exploitation of results	85
Chapter 7	93
Conclusion.....	93
7.1 Introduction.....	93
7.2 Limitations of the research	95
7.3 Contribution of thesis.....	95
7.4 Suggestions for future research	96
Bibliography	97
Annex	103

Table of Pictures

Picture 2.1: Heuristic Evaluation on Medical Devices.....	14
Picture 2.2: Intrusion Detection System (IDS).....	21
Picture 2.3 : Presents graphically Heuristic Evaluation of a case study	26
Picture 5.1:GUI of the HepSystem	48
Picture 5.2: Web site of the Arvixe Web Hosting.....	48
Picture 5.3: Logo of Dreamweaver	49
Picture 5.4: FileZila – Ftp Client Software	49
Picture 5.5: FileZile – Ftp Client Software	50
Picture 5.6 : Left is the Client Side– Right is the Server Site	50
Picture 5.7:Welcome Page of the HepSystem	51
Picture 5.8 : HepSystem Page.....	52
Picture 5.9: Learn the HepSystem Page.....	52
Picture 5.10: Contact Form of the HepSystem.....	53
Picture 5.11: Wrong Login message	54
Picture 5.12:Login Web Page	54
Picture 5.13:Registration Form	54
Picture 5.14: Registration Confirmed Form.....	54
Picture 5.15: Choose Plan Form	55
Picture 5.16 : ID is connected with the user	55
Picture 5.17:Plan A Form.....	56
Picture 5.18:Create Button	57
Picture 5.19: Create Form	57
Picture 5.20: Inform User Form.....	58
Picture 5.21: Step1 –Button	58
Picture 5.22: Step 1 Form –Create the plan and input the number of Evaluators	59

Picture 5.23 : Step 1 – Confirmation form	60
Picture 5.24 : Step2 - Button	60
Picture 5.25: Step 2 Form – Select the Heuristic protocol	60
Picture 5.26 : Step 2 – Confirmation form	61
Picture 5.27 : Step3 - Button	61
Picture 5.28 : Step 3 Form – Identify and Define the goal of the heuristic evaluation	61
Picture 5.29 : Step 3 – Confirmation form	62
Picture 5.30: Step 4 - Button	62
Picture 5.31: Step 4 Form – Define a set of tasks to be performed during Evaluation Procedure...	62
Picture 5.32: Step 4 – Confirmation form	63
Picture 5.33: Step5 Button.....	63
Picture 5.34 : Step 5 Form – Define the Severity Scale.....	64
Picture 5.35: Step 5 – Completed Form	64
Picture 5.36 : Step 6 - Button	65
Picture 5.37 : Step 6 Form – Evaluation Based on Heuristics.....	65
Picture 5.38 : Step 6 – Completed Form	66
Picture 5.39 : Step 7 - Button	66
Picture 5.40 : Step 7 Form – Prioritize the Usability Problems	67
Picture 5.41: Step 7 – Completed Form	67
Picture 5.42 : Step 8 - Button	68
Picture 5.43 : Step 8 Form – Redesign suggestions based on Evaluation	69
Picture 5.44 : Step 8 – Completed Form	69
Picture 5.45: Modify-Search Buttons.....	70
Picture 5.46 : Search Form.....	70
Picture 5.47: Wrong Plan Code Form.....	71
Picture 5.48:Modify Form	71
Picture 5.49: Modification Competed Successfully Form	72

Picture 5.50 :After Modifications Form.....	72
Picture 5.51 : Search Form.....	73
Picture 5.52 : Report Buttons.....	74
Picture 5.53: Search Evaluation Report form.....	74
Picture 5.54:Wrong Plan Code Form.....	75
Picture 5.55: Report Form	75
Picture 6.1: Usability Evaluation Feedback	78
Picture 6.2: Tutorial how to Create a Plan.....	85
Picture 6.3:Tutorial, how to Evaluate a Plan.....	85
Picture 6.4:Tutorial, Step by Step Evaluation Procedure	85
Picture 6.5: Helpful links in the main form of the system	86
Picture 6.6:Improve Login form	86
Picture 6.7: Improve Registration form.....	87
Picture 6.8: Create and Evaluate buttons.....	87
Picture 6.9: Improve Steps.....	87
Picture 6.10: Improve information in Steps.....	88
Picture 6.11:Improve the Header	88
Picture 6.12 : Title in the tabs – Plan A.....	89
Picture 6.13 :Title in the tabs – Login Form.....	89
Picture 6.14: Improvements of Header.....	89
Picture 6.15:Improve size of Fonts	89
Picture 6.16: Improvements of the Buttons.....	90
Picture 6.17: Form for adding Comments.....	90
Picture 6.18:View the Comments.....	91
Picture 6.19 : Improvement on the main form of the system	91
Picture 6.20 : Rename the Labels of the buttons.....	92

TABLE OF TABLES

Table 1 : Nielsen's Usability Heuristics.....	114
Table 2 : Nielsen and Shneiderman heuristics.....	114

Chapter 1

INTRODUCTION

1.1 GOALS OF THESIS

The basic aim of this thesis is to design an evaluation system of usability in computer games and websites .The system is supported by the creation of a website specifically designed for assessment. Importantly, in order to create the specific system, existing scientific studies based on evaluation of usability in electronic systems have combined.

Recently, a large extent involvement of scientists with usability of electronic systems has developed, because many of the technology users spend much of their free time in dealing with computer games. Then it is considered by specialists to make life easier for users and games

designers by making their game more accessible through usability .Common feature of all evaluation systems is to facilitate the users' access to electronic systems.

This thesis present a system named HepSystem due to acronyms of words Heuristic Evaluation Playability System just because it is based on design of a system which checks the usability of both, a game and a website. When this new system will be completed, then it will be able to evaluate any electronic system and will not be limited to computer games and websites.

Usability is the inability of a human-made object to use and learn easily. The use object can be a software application, website, book, tool, machine, process, or anything a human interacts with. A usability study may be useful to a usability analyst or to designers, technical writers, marketing personnel, and others. It is widely used in consumer electronics, communication, and knowledge transfer objects (such as a cookbook, a document or online help) and mechanical objects such as a door handle or a hammer. Consequently usability means making products and systems easy in use, and matching them more closely to user needs and requirements.

Heuristic evaluation is a form of usability inspection where usability specialists observe whether each element of a user interface follows a list of established usability heuristics. Expert evaluation is similar, but does not use specific heuristics.

Consequently, the "original heuristics" are not enough to make a complete evaluation. It is better to base the evaluation on "original heuristics" by adding also more heuristics or make modification on existing heuristics in order to create the perfect list for this purpose. Following the below order of procedure is the best way to contract a good evaluation and take the best results.

Therefore the specific system design has the following goals:

- 1) To give the possibility to users making comments and expressing their opinions during the evaluation, referring to websites or online games which either have visited or have been involved.
- 2) To have the ability to refer back to the site and to notice the reviews and evaluations that concerns a specific game or a website.
- 3) To have the ability for easy and quickly access to reviews and create an account (Member), where the content of critics who will observe will be free.

- 4) To have the ability observing the existing reviews and create a new based on its own review.

As it is referred, this thesis is based on above goals and will be an effort to incorporate the innovative element which is usability asses not only on computer games but any other systems such as websites, portable microcomputers and mobiles.

The key research questions that were concerned by this thesis are:

- 1) Is it possible to design such a system?
- 2) Is it accessible for any user regardless of experience on know-how?

Eventually it will be investigated by qualitative procedure whether a system can be handy, functional and helpful for better software redesign regardless of user's knowledge level on technology.

So along designing the system procedure will be an effort of achieving the above goals and also emphasizing:

- System functionality
- The visualization of information, so as to attract user
- System organization in discrete areas in order to be the information table more accessible to user.

1.2 STRUCTURE OF THESIS

The organization structure which was followed for this master thesis is:

Chapter 2

This chapter describes several studies that were held regarding evaluation of a project by using heuristics. Examining several studies helps to understand how the researchers use heuristics to evaluate a system.

At first, will be an introduction to basic heuristics Evaluation method which was developed by Molich and Nielsen. Next, they will be examined several studies based on this theme and how experts approach to "Problem". The basic aim is to find out how they use these "original heuristics", and what kind of methodology they use until they agree to final "Set of Heuristics". Moreover, in this chapter will be an effort to summarize all the studies that are referred to this issue and reach to a conclusion.

Chapter 3

Chapter's purposes is to investigate firstly in advance studies that related to Heuristics regarding the games' playability and secondly to come up with a list of Heuristics and a set of rules. These heuristics will be used for system's evaluation which will be developed for this thesis.

Chapter 4

This chapter investigates the methodology of a website creation which supports the evaluation system of this thesis. Particularly explains step by step the way that the σύστημα was designed and the goals that will be achieved in its operation.

Chapter 5

This chapter presents an attempt implementation of the theory in practice, taking into account existing studies. Then presents in deep the creation of a website likes what does this website do and how it works. Eventually, presents the problems that were found along on its planning.

Chapter 6

At this chapter became an effort for website redesign based on feedback which is obtained by a group of experts on evaluation of a system's usability. After the collecting and estimating experts' opinions, were made specific changes to website in order to be more accessible and comprehensible to users.

Chapter 2

USABILITY AND HEURISTIC EVALUATION

2.1 INTRODUCTION

This chapter describes several studies that were held regarding a project's evaluation by using heuristics. Examining several studies, helps to understand how the researchers use specific heuristics for evaluating a system.

At first, it will be an introduction to basic heuristics Evaluation method which was developed by Molich and Nielsen. Next, they will be examined several studies based on this theme and how experts approach to «Problem» (Nielsen. J and Molich. R, 1990). The basic aim is to find out how they use these “original heuristics”, and what kind of methodology they use until they agree to final “Set of Heuristics”. Moreover, in this chapter will be an effort to summarize all the studies that are referred to this issue and reach to a conclusion, [02].

Heuristics are closely related to guidelines. So the distinguish between them is not always easy. In general, heuristics are more general principles of usability and are usually fewer in number. Each of the following study describes a set of heuristics and it is also documented, how they were developed.

The major technology growth and development, has created a need to focus to a broader meaning in human -machine interaction. Therefore designers had to understand how can integrate new forms of heuristics beyond that intentional. Also, designers must adopt new heuristics, depending on this situation, that will be convenient or pleasant.

So the concept of heuristics Evaluation has been introduced in human - computer interaction and new practices and methods are being developed around it. Concepts such as pleasure, aesthetics and emotions have been used to describe the condition of the user’s experience and satisfaction.

Despite the fact, that the community in human-computer’s interaction field has adopted an idea that the functionality and performance measures are not enough to judge the quality of a product, have been made small steps in a theoretical background to this direction, (Molich, R, and Nielsen, J. 1990). Research in human-computer’s interaction field has investigated “how” users use the product, “why” and “if” some users like to use certain products and not others, and what they gain from using them, [03].

Basing on heuristic Evaluation researchers’ sought they have been investigated new ways of approaching a design of interactive products and taking into account longer and experiential quality technology use rather than just the product’s quality.

In a heuristics’ evaluation, usability experts for example review site’s interface and compare it with accepted usability principles. Then they analyze some results in a list of potential usability issues. Easily can somebody reach to the conclusion that the usability is directly connected with

evaluation? However a heuristic evaluation should not replace usability testing, (Nielsen. J. 1994, see Table, 1). Although the heuristics relate to some criteria that affect a site's usability, the issues that are identified in a heuristic evaluation are different than those that were found in a usability test, [04].

Consequently a heuristic evaluation is a usability inspection method for computer's software which helps to identify usability problems in user's interface (UI) design. It specifically involves evaluators who are examining the interface and judging its compliance by recognized usability principles (the heuristics). These evaluation methods are now widely taught and practiced on the new media sector. UIs are often designed in a short space of time by a budget that may restrict the amount of money available to provide other types of interface testing.

2.2 WHAT IS USABILITY?

Usability is an ability of a human-made object to use and learn easily. The use object can be a software application, website, book, tool, machine, process, or anything a human interacts with. A usability study may be useful to a usability analyst or to designers, technical writers, marketing personnel, and others. It is widely used in consumer electronics, communication, and knowledge transfer objects (such as a cookbook, a document or online help) and mechanical objects such as a door handle or a hammer. Consequently usability means making products and systems easy in use, and matching them more closely to user needs and requirements.

It is very important to realize that usability is not a single, one-dimensional property of a product, system, or user interface. "Usability" is a combination of factors including:

- Intuitive design: A nearly effortless understanding of the site's architecture and navigation.
- Easy learning: How fast can a user who has never seen user's interface before accomplish basic tasks.
- Efficiency of use: How fast an experienced user can accomplish tasks?

- Memo ability: If a user can remember enough in order to use it effectively in his future visits after visiting the site.
- Error frequency and severity: How often users make errors while using the system, how serious the errors are, and how users recover from the errors
- Subjective satisfaction: If user likes using the system

2.3 USABILITY EVALUATION METHOD

Usability Evaluation method focuses on how well users can learn and use a product to achieve their goals. It also refers to how users are satisfied with this process. Gathering this information, practitioners use a variety of methods that gather feedback from users about an existing site or plans that related to a new site. Assessing the usability of a product has a purpose to identify usability problems and obtaining usability measures. The purposes of evaluation can be firstly improving the usability of product as part of design/development (formative evaluation), secondly, assessing the extent to which usability goals have been achieved (summative evaluation). The following Usability methods could be used in order to accomplish the evaluation:

(a) Usability Inspection Methods :

This section describes methods that can be used by experienced practitioners to assess usability issues. While these methods do not involve users directly, they can provide some useful insights, (Nielsen, 1994). However, the upper goal is to use them to supplement, not replace, direct user's involvement in testing designs and systems, [04].

(b) Usability Testing with Users :

Usability Testing: Usability testing involves the observation of users while they perform tasks with a hardware or software system.

The product may be a paper sketch, a wireframe, a storyboard, a display mock-up, a product in development, a working prototype, or a completed product. Usability testing can also be related to competitive products in order to understand their strengths and weaknesses.

A usability test can be a formative evaluation, which is related to design process so can find problems, improve the product or summative evaluation, conducted to validate design against specific goals.

Testing involves recruiting specific users as test participants and asking from users to complete a set of tasks. A test facilitator conducts the testing via a test protocol while the test sessions are typically recorded either by a video operator and/or an automated testing tool.

Usability testing should be related to participants who represent the real or potential users of the system. For some tests, users must have certain domain, specific knowledge and experience.

Usability testing consists of five primary phases:

- Planning
- Pretest or pilot
- Test sessions
- Post-test or debrief
- Results analysis, interpretation and presentation.

Also, other methods can be used for Usability testing like a)Benchmark Testing, b)Competitive Usability Testing, c)Summative Usability Testing d)Remote Evaluation e)Think Aloud Testing and finally f)Wizard of Oz.. These methods are not discussed in our thesis.

(c) Evaluate Usage of an Existing System :

Existing System Evaluations are done to determine the location, size of all components and current functioning status. These evaluations are usually done on older systems that predate permitting requirements.

(d) Questionnaire and Survey Methods:

Survey methodology studies a sampling of individual units from a population and an associated survey data collection technique, such as questionnaire construction and methods to improve the number and accuracy of responses to surveys.

2.4 HEURISTICS EVALUATION

2.4.1 DEFINITION OF HEURISTICS EVALUATION

Heuristic evaluation is a form of usability inspection which usability's specialists observe whether each element of a user interface follows a list of established usability heuristics. Expert evaluation is similar, but does not use specific heuristics.

2.4.2 HEURISTICS EVALUATION METHOD

Usually two to three analysts evaluate the system with reference to established guidelines or principles, noting down their observations and often ranking them in order of severity. The analysts are usually experts in human factors or HCI, but others, less experienced have also been shown to report valid problems.

A heuristic or expert evaluation can be related to various stages of the development lifecycle, although it is preferable to have already performed some form of context analysis to help the experts focus on the circumstances of actual or intended product's usage.

The benefits from the Heuristics Evaluation method are the following:

The method provides quick and relatively cheap feedback to designers. The results generate good ideas for improving the user interface. The development team will also receive a good estimate of how much the user interface can be improved.

It is generally accepted, that the feedback design is a very valid and useful method. It can also be obtained early on design process, while is checking conformity to establish guidelines, helps to promote compatibility to similar systems.

It is very beneficial to carry out a heuristic evaluation on early prototypes before actual users are brought in to help with further testing.

Usability problems that were found are normally restricted to aspects of the interface that are reasonably easy to demonstrate: use of colors, lay-out and information structuring, consistency of the terminology, consistency of the interaction mechanisms. It is generally agreed that problems have found by inspection methods and by performance measures overlap to some degree, although both approaches will find problems that are not found by others.

The method can seem overly critical as designers may only get feedback on problematic aspects of interface because this method is normally not used for the identification of 'good' aspects.

This method uses to identify usability problems based on established human factors principles. The method will provide recommendations for design improvements. However, as the method relies on experts, the output will naturally emphasize interface functionality and design rather than the properties of the interaction between an actual user and the product.

2.5 STUDIES BASED ON HEURISTICS EVALUATION

As it is mentioned before, several researchers use the heuristics evaluation methodology to study several issues like the usability of websites, the safety of medical devices, the playability of Mobile Multi-player games and many others. Several studies are discussed below which they have used heuristics evaluation.

2.5.1 STUDIES ON MEDICAL DEVICES

Many studies are concentrated on poor interface design or wrong use of medical devices. For some reasons the use of those devices many times leads the patient to injury and sometimes even

to death. Despite the fact that the medical errors can be occurring in any medical situations independently the user's experience, the studies are intended to discover the "truth" beyond this situation.

Also, the FDA (Food and Drug Administration) recognizes that a poorly designed user's interface can induce errors and operating inefficiencies even when the devices are operated by a well-trained user, (Obradovich et al. 1996 and Lin et al, 1998), after data were collected from the FDA between 1985 and 1989 reach to a conclusion that 45–50% of all devices where recalls stemmed from poor product design and software problems. The studies' reports on clearly medical errors and other documents show a clear link between usability problem and user error [05, 06].

Nielsen [1994] in a complete human factors engineering analysis for medical devices or software systems includes four major components: user, functional, task, and representational analyses. These four types of analyses, when are combined together and applied to a single product, can reveal the usability issue, [04].

Sawyer, et. al. [1996] have published guidelines for interface design and usability testing [07]. In response Lin. et al. [1998] says that the Food and Drug Administration (FDA, 2000) should include specific requirements for product's Usability, [08].

Shneiderman in his research in 1998 tries to evaluate patient safety of medical devices. According to Shneiderman, the list of the heuristics that were purposed by Nielsen wasn't enough to evaluate the medical devices. Therefore he introduced a list of the 10 standard heuristics that were purposed by Nielsen but he also modified and upgraded the list of heuristics. He has described eight golden rules that all good interface design users should follow.

Kieras, D, in 2001, pointed out that injuries may are results for medical devices that were used wrong instead from failure of the devices. In this research they try to modify the usability engineering technique which is called heuristic evaluation of usability problem in medical devices. Through the identification of usability's problems, it can indirectly identify that medical devices and potential trouble spots, are likely to cause medical errors, [09].

In addition, Shneiderman has described eight golden rules that all good interfaces users should follow. Based on their work, Zhang et, al. (2002), selected a set of 14 heuristics (see, Table 2), called as Nielsen and Shneiderman heuristics for evaluation of patient safety of medical devices.

They also concluded that such adaptation of heuristic evaluation for medical devices is very useful, efficient and effective on evaluating patient safety features, [10].

Similarly Grahal, carried out evaluation of infusion pump using Nielsen and Shneiderman heuristics. The evaluation's exercise carried out by 3-5 evaluators and it is reported that have captured 60-70% of the usability problems, [02, 10].

Edwards have applied **Heuristic Walkthrough (HW)** to evaluate and improve usability of the Electronic Health Record (EHR) system. In another case study, the usability evaluation of Automatic External Defibrillators (AED) was conducted according to Nielsen and Shneiderman heuristics. Moreover Diabetes tele-management system is also evaluated using Nielsen and Shneiderman heuristics (See, Table 2). For usability evaluation of this system, they have used 1-5 Likert scale and applied it uniformly to all heuristics [02, 10].



Picture 2.1: Heuristic Evaluation on Medical Devices

2.5.2 STUDIES ON E-GOVERNMENT SITES

The “standard heuristics” where applied on other areas like the *internet* and more specific on the *e-governments sites*. The term e-gov is, according to Sanchez and Araújo, (2003), to denote the set of activities that the government carries through Information and Communication Technology, [11].

Also, Tambouris, E, et, al 2005 refers to the online delivery of government information and services through the Internet or other digital media. The e-government portal should be available for the citizens 24 hours a day, seven days a week. Consequently the citizens can seek information according to their own needs, [12].

Access to government through Web interfaces has become commonplace recently as a consequence of pervasive use of Internet for access to information and services. Governments at national, regional and local levels have pursued opportunities to engage the public through Websites by providing access to publications and data, participating in decision-making processes, and through interactive services.

Online interactive services may include such facilities as petitioning, rate paying, licensing or information queries. The efforts are continued in order to be a diversity of quality implementation and levels for such services.

Strejcek and Theilb in 2003 support that e-government may be implemented in various ways. One approach is that the European Union has characterized four main tasks. The first one is the development of Internet-based services to improve access to public information and services. The second is the improvement of transparency of public administration by using the Internet. The third one is the full exploitation of technology information within public administration and finally the fourth one is the establishing e-procurement, [13].

Watson 2001, additionally says that through the internet, anybody could have access to the budget and investment plans of the city, not only to send and receive complains or suggestions regarding the public resources. Therefore the governments should work on the digital inclusion of

the citizens by investing on designing such web-portals that offers information efficiently and services to their, [14].

Kuk, 2002 also supports that the government should allow a broad range of citizens to access to governmental information and services, as well as to participate in a government decision-making process, [11].

Zazenlenchuk 2004, additionally supports that the Nielsen's usability heuristic evaluation method should be used, particularly in the initial phases of the project, [19]. The method consists of a set of rules that a usability expert should be looking at when evaluating an interface. The set of heuristics were upgraded to fit with the interaction requirements of the web site. Nielsen's heuristic rules were complemented with others rules to evaluate all possible e-gov sites, [15].

In contrast, many evaluators have found that Nielsen's list does not always satisfy their specific needs and they frequently require alternative guidelines or some re-interpretation of Nielsen's original descriptions in order to make sense of each item.

Zazenlenchuk, 2004, also supports that the difficulties of creating a single set of heuristics, that can accommodate every system, will be achieved thorough results, and can be interpreted reliably by multiple evaluators, [15].

Furthermore, Tambouris 2005, states that through the reliable web-sites citizens could have access to governmental information, get on-line services and also participate in the government decision-making process. These three items must be accessible in any e-Gov portal, [12].

A research which was held in Brazil dealing with the E-Government site uses the Nielsen's list of Heuristics. In this research the list of the Nielsen's heuristics was upgraded and grouped under five evaluation criteria, which are: a) Cognitive Effort, b) Tolerance, c) Reach, d) Physical effort and e) Trust. The research's result was to propose an inspection method of evaluating the e-gov and that was the g-Quality method. The new method is an extension of the heuristics evaluation and rules which were proposed by Nielsen, 2004, [16].

Tambouris et al. in 2007 analyzes electronic government separating the websites into three categories based on their characteristics. The first one is "Satisfy": meeting the citizens' needs. The second e-gov characteristic is "rendering services", which allow online transactions of the

government's products and services. The third e-gov characteristic is “promoting citizen participation” in government’s making-process decision, [17].

The challenge in designing these governmental portals is not to restrict or limit the people’s participation. For completing a democratic process, citizens should be able to receive a feedback about their suggestions or opinions measuring their influence in decision process.

Each e-Gov sites presents a configuration related to these three constitutive characteristics: information migration percentage, service offer and citizen’s participation capacity. Depending on the site’s features, a particular evaluation heuristic might be relevant or not in its evaluation. It means that while an e-gov website heuristic doing evaluation, it is very important to take into accounts what category is more relevant and what are website’s goals. An e-government site which is focused on on-line governmental services, the e-procurement, can’t offer the design tools for people’s participation, voting or giving opinions in an electronic forum. Another important fact that should be taken into account is the involvement of percentages regarding information, services, and participatory government’s processes that are migrated into Web. This action will indicate the government’s strategy and migration maturity.

Therefore when government tries to migrate the provision of services to the Web’s environment it must take into account the peculiarities of traditional means. It must guarantee access and information accuracy, non-repudiation of data, security and privacy.

Nielsen (2000), proposes that some of these peculiarities may trigger problems that are not detected by the Heuristic Evaluation method. Therefore, in order to embrace these peculiarities, which are not covered by the traditional evaluation method, is proposed broadening of the heuristic evaluation criteria for the e-Gov domain, [18].

A multidimensional Web-Based e-government evaluation was discussed in the in IEEE Computer Society and reached to the following Evaluation criteria for E-Gov. The criteria that have been agree were: a) usability testing b) user feedback c) usage data and d) web and internet performance data. Among them, the usability heuristics evaluation method of Nielsen was broadly used, Wood, (2003). Many of the evaluators have found that Nielsen’s list of criteria does not always satisfy their specific needs, so they required alternative guidelines or some re-interpretation of Nielsen’s original descriptions in order to make sense for each item. In order to access to electronic government domain on Web, should have in mind that citizen must the main

focus. It is realized that the heuristics could be grouped under five evaluation criteria, namely, [19]:

- Cognitive Effort
- Reach
- Physical Effort
- Trust
- Tolerance

Nielsen, (2004), supports that the 10 standard usability heuristics, do not accept any further explanation. Nevertheless, they had agreed that a new set of 16 (sixteen), usability heuristics were enough to have a secure and reliable e-government web site. They also agreed that Heuristics can be mapped to more than one criteria with similar or different importance, in the range 0-3, from least most important, [18, 20].

2.5.3 STUDIES ON MULTI-PLAYER GAMES

Furthermore, studies that were held on the Playability Heuristics for Mobile Multi –player Games show that multi-player games are engaging due to social interaction and competition with real players. Currently many digital games are multi-player or have multi-player features. When evaluating the playability of multi-player games, must be considered player-to player interaction.

Korhonen, (2006), dealing with Multi-Player games, concludes that multi-Player games often is considered to be more interesting and challenging than single-player games,. When the player is playing a game against another player instead of artificial intelligence (AI) is more unpredictable and therefore more enjoyable. Furthermore the player feels that playing with other players is more faire, so in case of a mistake, players feel that he can correct his mistake, [21].

A strong advantage of a multi-player game is that two or more players can play simultaneously in the same game session. The players may play concurrently or the play session may be asynchronous. In the asynchronous play sessions the player can access the same game world but not at the same time. Therefore the multi-player games can be divided into two main categories; a) The online games and b) proximity games. In case of considering the game level and how the game level is maintained from a game session to another then the multi-player games are also

divided into two categories which are: a) persistent games b) non-persistent games. In the persistent games, the game level is typically maintained on games servers and the players connect to them with a game client.

Players are connected to each other through the internet or other network technology which is available in online games. Therefore there is a peer-to-peer connection. In this case the players usually do not share the same physical space and of course they use their own device. So, it is easy to understand that in these games the player population can be ranged from a few to thousands.

The main goal of this study is to concentrate on the issues that affect the playability of mobile multi-player games and convert them to playability heuristics. Usually playability heuristics are similar to usability heuristics.

Koivisto (2005), states that there are various kinds of multi-player online games. For example, an online game that are played with mobile phones, has its specific features that should be considered when designing games for it – some offer new possibilities and some challenges [22].

Koivisto (2005) and Korhonen [2006] present the playability heuristic model which is going to be used for evaluating mobile games by using expert evaluation method. Currently the model consists of three modules: Game Play, Game Usability and Mobility. The playability of the games will be analyzed deeply in the chapter 3, [21].

Federoff (2002), also says that the evaluation of games with only the traditional usability heuristics would leave many important aspects unprocessed. So when a playability problem is covered with the Game Usability and Mobility modules are identified and fixed. As a result evaluators can focus only on the gameplay. The game usability and mobility modules will be discussed deeply in the next chapter, [23].

Cornett (2004), also states that the lack of communication between new and other players was probably the most significant obstacle for new players to get into the game [24].

Zagal et al. (2000), supports that the list of social interaction, the competition and cooperation are main design guidelines for a multi-player game. Even if collaboration is encouraged, in case of MMOGs, it needs to be noted, that some of the players may want to play multi-player games only sometimes, [25].

According to Blizzard, one of the main reasons for success of Blizzard's World of Warcraft game is that the player can play alone with any character he wants to the maximum level. Bruckman et al. (1994), express the concern about antisocial behavior in multi-user computer media systems. [26].

Korhonen (2006) supports that gameplay heuristics usually have to do with issues that arise when a player interacts with the game's mechanics. The modularity makes the heuristic model more flexible,[21].

Björk et al (2005), in their studies, they raised the case of limitation in the communication between the players. As result, the spam message is limited between the players and also makes the game more interesting. Sometimes, tactical information hiding can be used for creating a need for collaboration between the players. Therefore the limitations can be needed for keeping the amount of messages that a player receives in a reasonable level. Therefore the communication can be possible only between the players who are nearby in the game world, [27].

After a review of various multi-player studies, in order to conclude and propose an initial set of multiplayer gameplay heuristics, the research indicates that there are six issues that affect the playability of the multi-player game.

The propose playability heuristics are the following:

- a) The game supports communication
- b) There are reasons to communicate
- c) The game helps player to find other players and game, instances
- d) The game supports groups and communities
- e) The design minimizes deviant behavior
- f) The design hides the effects of network.

2.5.4 STUDIES ON INTRUSION DETECTION SYSTEM

Since the evolution of internet, people have been facing challenges of network security, Neumann, (1985). In order to face these security challenges, network users utilize various tools such as firewall, antivirus software, ethereal, nmap, nessus, and Intrusion Detection System (IDS), [28].

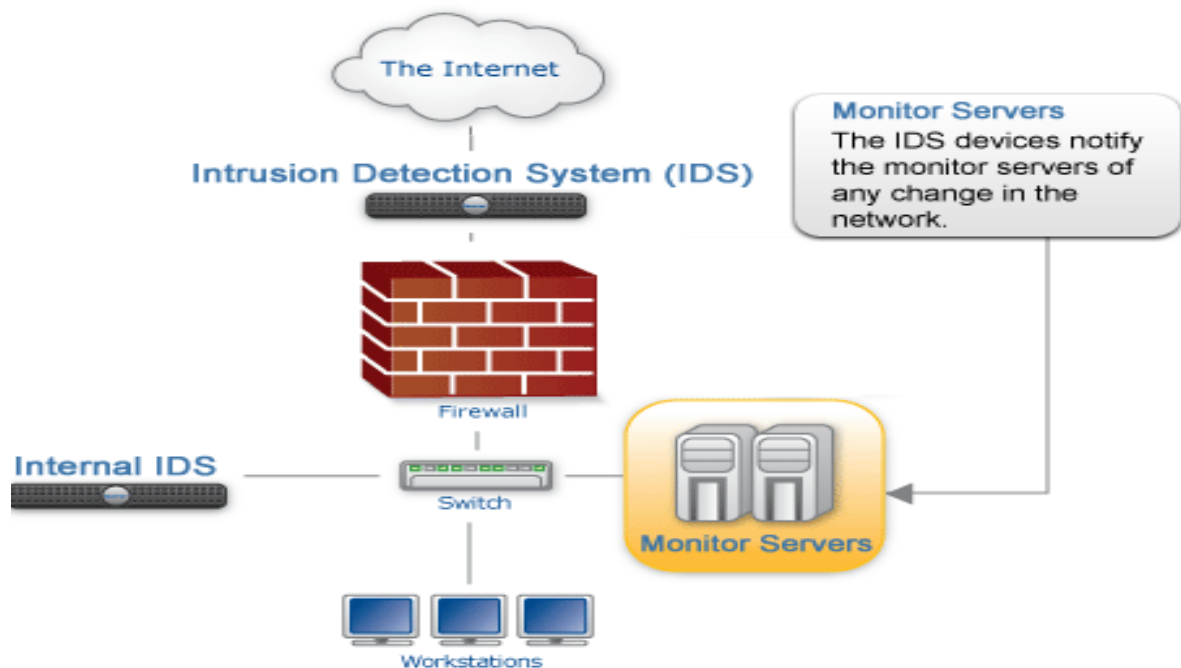
According to US-CERT the rate of incident of in year 2010 is nearly six times as compare to year 2005, therefore there is a need to focus on developing usability in security, Nurmuliani et .al (2004), [29].

One of the security tools is the Instruction Detection System (IDS) which plays vital role in addressing issues of network security. It is designed to provide a timely identification of malicious activities.

Neumann, 1985 dealing with usability Heuristics of Intrusion Detection System (IDS) uses Specialized Heuristics with Qualitative Indicators,[28].

Nurmuliani et .al (2004), supports in his research that IDS has effective response to the real attacks, [29].

However Nurmuliani et al (2004), points out that users very often fail to get these functional advantages from the IDS and therefore many users complain about its operation and maintenance of IDS, because the software do not succeed to face the malicious programs, [29].



Picture 2.2: Intrusion Detection System (IDS)

In addition McHugh in (2000) and Dhanjaniin (2005) concentrate their studies on IDS and they have discovered two main problems. The first problem is underlying technique which is used to detect the attacks. The second problem is about the user interaction .How users know for any attack and in case they have been informed, how fast they will respond to these attacks, [30, 31].

SANS Institute in (2001), observes that even with strong (financial) incentives, users tend to ignore security indicators, such as absence or invalidity of SSL certificates [33]. Zhou in (2004) has studied an IDS system and proposed a set of 6 heuristics for the usability improvement of IDS. The heuristics that he suggested was 4 heuristics from Nielson's heuristics and additional two (2) new heuristics exclusively for the IDS. The new heuristics that he suggests were a) "Display of information" and b) "Information navigation". This set of six heuristics is very useful but not enough to evaluate the IDS systems, [33].

Furthermore, Masone and Smith (2007), in their studies, have evaluated touch screen ventilator systems using qualitative indicators. The study has highlighted various challenges. For example, while using the IDS software such as considerations for deployment, configuration of security settings, log storage in IDS or availability of information, the software didn't operate normally. Therefore some more software was used in order to have a better operation, [34].

Similarly, Weiser and Brown, (1995), has discussed the issues on testing of IDS and he has pointed out that they have come across in several usability evaluation studies which are carried out using Nielsen's heuristics, [35].

Masone and Smith (2007), discussed the problems that related to security of the emails. They suggest that applications that are based on digital certificates, certification authorities and public key infrastructures should be used in order to have a safe connection, [34].

2.5.5 STUDIES ON AMBIENT DISPLAYS SYSTEM

Moreover in 1995, many interesting information have been pointed out by Weiser and Brown regarding heuristic evaluation of ambient displays. In this research, a technique for evaluating usability and effectiveness of ambient displays is presented. Ambient displays are abstract and aesthetic peripheral displays portraying non-critical information on the periphery of a user's attention. They generally support monitoring of noncritical information. Ambient displays have the ambitious goal of presenting information without distracting or burdening the user. This goal is difficult to design and difficult to define in measurable terms, [35].

Mynatt, et al. (2001), support that evaluation of ambient displays is difficult, so they have been limited in the past to formative ethnographies, and iterative, "living laboratories" in which applications are evolved over time as they are used by their creators. As a result, most ambient displays have not been evaluated at all. Without evaluation, it is hard to determine which displays are effective and why are effective. Therefore without specific information it is very difficult to improve the existing work, [36].

Inexpensive formative techniques could provide guidance at the early stages of design without time consuming. However, existing techniques like the GOMS or the heuristic evaluation are focus on systems with clearly defined tasks and goals. For example, one of Nielsen's heuristics calls for documentation "focused on the user's task" (J. Nielsen and the Nielsen Norman Group 2002), [37].

The differences are significant enough to bring into question the applicability of existing evaluation techniques to the domain of ambient displays. This research focuses on adapting heuristic evaluation because it is a widely used, inexpensive, formative evaluation technique which it is believed that it could be a useful tool for ambient display designers.

Additionally, Nielsen, (1993), wrote that "the difficulties in user testing some next-generation interfaces may mean greater reliance on the heuristic evaluation method" [38].

Similarly Baker et al. 2002, who applied heuristic evaluation to the domain of CSCW reached to a conclusion that the only way to adapt heuristic evaluation is to modify the existing heuristics, [39].

Moreover Katre, et al. (2010), supports that user can evaluate the usability of various IDS systems by using these heuristics. Usability evaluation is done by various methods such as cognitive walkthrough, formal usability inspection, heuristic evaluation or pluralistic walkthrough [40].

2.6 SUMMARY OF THE RESULTS

It is easily noticed that various researches were based on the “original” set of usability heuristics of “Molich and Nielsen, (1990). Researchers use the original usability heuristics to create their own heuristics because the “original” do not match to their research or sometimes they use various techniques to create proper usability heuristics for their purpose, [02].

Shneiderman, doesn't drop down the original Nielsen's heuristics but he also suggests eight new golden rules that user interfaces should follow. Shneiderman and other researchers reach to a conclusion that 14 new heuristics are enough. Also Shneiderman suggests that the severity rating scale should base on the scale from 0 to 4. Shneiderman uses 3-5 usability experts and he discovered that each individual evaluator could catch 60-75% of the heuristics problems. In compare with Nielsen's heuristics 3-5 evaluators were able to identify 40-60% of known usability issues.

Also Kuk, (2002), George he recommended in his research to extend the Nielsen's heuristic evaluation method. They proved that by extended method could find more problems, resulting in more negative ratings than the Nielsen's original method. They introduce 5 new Evaluation Criteria for E-Gov and filter Evaluation Criteria for G-Gov methods, [11].

Moreover, in compare with Nielsen's heuristics 16 new heuristics were created under 5 evaluation criteria. Also they suggest that the rating scale should base on the scale from 0 to 3. The most important fact is research was executed with or without extra heuristics of the Nielsen's Heuristic evaluation method. The results showed a significantly different result. For example the methodology with the extra heuristics found more problems in compare with the Nielsen original method.

Cornet et. al. (2004), uses in his research a completely different methodology in compare with others. He drops down the basic heuristics of Nielsen and he creates for first time the Playability Heuristic Model. In this research the playability has been divided into three modules a) Game Usability b) Mobility and c) GamePlay. After the reviewing of various multi-player studies, they

conclude and propose six new heuristics for playability and eight new heuristics for mobile multi-player games. The procedures were formulated based on findings from literature review and supplemented with findings from playability evaluations, [24].

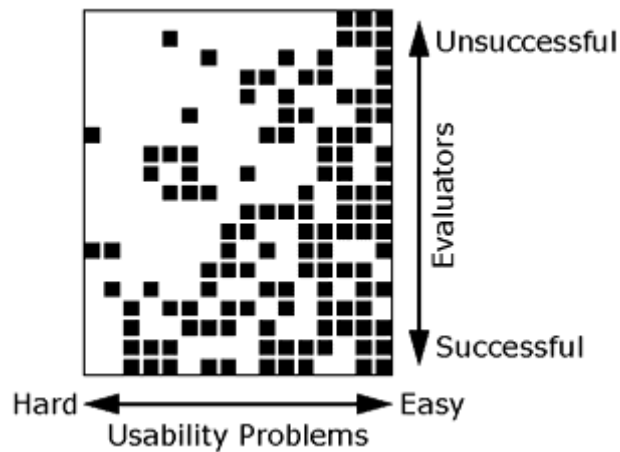
Finally, Neumann, (1985), in his study regarding the Intrusion Detection System (IDS), a new set of 35 Usability Heuristics for Usability evaluation of IDS was proposed. The specialized set of heuristics was categorized into relevant groups. The heuristics evaluation was carried out by three usability evaluators, [28].

2.7 CONCLUSION

Consequently, “original heuristics” are not enough to make a complete evaluation. It is better evaluation based on the “original’ heuristics but should be added more heuristics or should be made modification on existing heuristics in order to create the perfect list for right purpose. The best way to contract a good evaluation and take the best results is to follow the order of procedure below.

First of all, experts (users) should be chosen, 3-5 persons are enough. Secondly experts should be trained for 2-3 hours according to the topic of evaluation. A list of heuristics related to the topic of evaluation and should be sent to the experts’ email in order to prepare for evaluation. Then all evaluations from a pilot evaluation should be collected and the queries evaluations should be discussed. At the end, a new list of heuristics should be created and suggested for the final evaluation. Also it is important for evaluators to agree with evaluation procedure in order to have objective results.

Generally, heuristic evaluation is difficult to be done by a single individual, because one person will never be able to find all the usability problems to an interface. Luckily, experience from many different projects has shown that different people find different usability problems. Therefore, it is possible to significantly improve the effectiveness of this method by involving multiple evaluators.



Picture 2.3 : Presents graphically Heuristic Evaluation of a case study

The above picture2.3, shows an example from a case study of heuristic evaluation where 19 evaluators were used to find 16 usability problems in a voice response system which is allowing customers access to their bank accounts (Nielsen 1992), [41]. Each of black squares in picture2.3 indicates the finding of one of usability problems by one of the evaluators. The figure clearly shows that there is a substantial amount of non-overlap between the sets of usability problems that were found by different evaluators. It is certainly true that some usability problems are so easy to find that they are found by almost everybody, but there are also some problems that are found by very few evaluators.

Furthermore, one person cannot just identify the best evaluator and rely on that person's findings. First, it is not necessarily true that the same person will be the best evaluator every time. Second, some of the hardest-to-find usability problems (represented by the leftmost columns in picture2.3) were found by evaluators who didn't find many usability problems. Therefore, it is necessary to involve multiple evaluators in any heuristic evaluation. So it is recommended to use three to five evaluators since one does not gain that much additional information by using larger numbers.

Finally, as a discount usability technique, heuristic evaluation is easy to use, easy to master, efficient, effective, and useful. It can be used to identify a great proportion of major usability problems in a product in a timely manner with reasonable cost.

Chapter 3

HEURISTIC EVALUATION OF GAMES

3.1 INTRODUCTION

Heuristics' method is an accepted and widely used method for evaluating the usability both online and software development. Purpose of this chapter is to investigate in advance the studies that related to Heuristics regarding the Playability of games and finally to come up with a list of Heuristics and a set of rules. Heuristics will be used for the system's evaluation which was developed to support this thesis.

In addition, as the game industry matures and games become more complex, there is an increasing need to develop scientific methodologies for analyzing and measuring the player experience. These methodologies are very important and necessary in order to develop a better understanding of relationship and interactions between players and games.

3.2 HEURISTICS AND DIGITAL GAMES

It is known that Heuristics is a useful assessment tool for product designers and professionals evaluators in usability's field. In software industry productivity, heuristics are usually used to evaluate the usability of the main menu control (interfaces).

Additionally, Malone in (1982), states that basic goals, in software productivity, are to make software easy to learn and use. In contrast the design goals of a game are extremely opposed, usually the characteristics of games are «Easy to learn, harder to master» [42].

In game playability, there is a need of moving the investigation beyond the basic usability of the main control menu (interface) and to determine additional properties of having a game, like game's experience, the script and the game's structure.

Furthermore Deurvire in (2004), said that one of main goals of digital games is to entertain and engage the player to the game. This can include various aspects of design, including the history of the game, the challenge or even the mechanism of the game. Also, many studies have been held towards the direction of game design, such as the field of designing User-Centered. Many programmers have begun the implementation of human-computer interaction (HCI - Human Computer Interaction) on the toys' design, [43].

Desurvire in 2004 adapted a new set of Heuristics for software productivity of digital games. Total Heuristics presented at CHI 2004 as "Heuristics to Evaluate Playability" (HEP) [43].

Nielsen in (2004) also said that heuristic evaluation technique is useful and has potentials to develop a game based on evaluation standard. Heuristic evaluation is a technical inspection method which evaluators should investigate the interface from a set of usability principles called Heuristics, [16].

Dykstra 1993 and Nielsenin 2007, respectively had agree that heuristic evaluation does not make assumptions about the structure of a game therefore is flexible enough to adapt on specific regions [44, 45].

3.3 SOFTWARE AND GAME HEURISTIC DEVELOPMENT

So far, several studies were developed by various individual researchers, groups and professionals in game industry regarding the digital games. All studies have become at various and different results regarding heuristics evaluation for digital games, but the most important is that all the studies converge to the fact that the basic Nielsen heuristics 1994 are the base for further studies.

Malone in (1982), after a long study in games' usability, he created the first heuristics to evaluate educational games. Therefore in 1982, was issued the first list for the evaluation of educational games. [46]

Bias in (1994), states that much, usability inspection techniques are not suitable for digital games because are based on incorrect specification, [47].

Dykstra,(1993), also states that Heuristic evaluation does not make assumptions about the structure of a game, so are not flexible enough to adapt on specific areas [44].

In contrast to Nielsen, a research which was done by Desurvire, et al. in 1992 is shown that the heuristics that were presented by Nielsen 1994 can only be effective if they were combined with the heuristics which were presented by him to studies that had been prepared, [48].

Nielsen also states that many usability inspection techniques are not suitable for digital games because they are oriented around user interface concepts that are mainly used in desktop applications.

Falstein, game designer, published the first 400 design rules of the game that can be used by designers to make a game better [49].

Federoff in (2003) had compiled a list of heuristics especially for games, after a study which was carried out for a game development company [50]. The new heuristics were compared with the existing guidelines toy industry as well as the Nielsen heuristics which were published in (1994). Furthermore their study presents a set of Heuristics which are effective in helping to design digital games, [04].

Desurvire, (2007), in his study, regarding the HCI, he adapted a new set of Heuristics for evaluation of the playability (HEP). He also supports that more comprehensive standards are needed to identify usability problems [51].

Furthermore in 2004, Fullerton, said that play testing is one of the most common ways to reveal design problems, but this method requires an application that is playable only in the later stages of the development process of the game. The goal of digital games is to entertain and engage the player in the game. Finally he develops heuristics for the design of digital games [52].

Nielsen also said that heuristic evaluation is a useful technique and is able to make an assessment of a game based on the template. Heuristic evaluation is a technical inspection where evaluators investigate an interface from a set of usability principles that are called Heuristics. Moreover Nielsen supports that heuristic evaluation does not make assumptions about the structure of a game, and is flexible enough to adapt in specialized areas [48].

In addition Koeffel in (2007), says that formulation of heuristics is more universal than the one of usability guidelines, [53].

Also, Desurvire, et. al. (2008), in a study which was related to professional game designers in the game's studio, LucasArts, Sega, Microsoft, THQ and Disney, supports that the results have shown that the Playability of the games was ended early [54].

3.4 EVALUATION ON GAMES' ASPECTS

Clanton in (1998) offers a way to encapsulate the different usability issues of games into three areas: game interface, game mechanics, and game play. Game interface is a device which through of it player interacts with the game. Game mechanics are the physics of a game that are developed through a combination of animation and programming. Game play is a process by which a player reaches the goal of a game. These devices can make the game more functional and satisfying and also require design and evaluation [54].

Each person on a game production team will be responsible for one or more of these game's design aspects. These terms are easy to breakdown into usability terms, and are familiar to game designers. Typically usability language is not used within the game industry, and in fact, it is found that everyone had great trouble relating to the term usability itself. So, it is important, when discussing games, to use language that is understandable to both game developers and to those looking at games from a standard usability background. Though each of these areas of a game affects the other, an argument has been made that the game is the interface, and the interface is the game Cherny, Clanton, and Ostrom, (1997), it is still helpful to break down the concept of a game into components for discussion purposes, [56].

Game interface includes whatever is used to physically control the game such as a controller, joystick, mouse, or keyboard. Also, it is the visual representation of software controls that players use to set up their games, engage in a tutorial, move through a game, obtain their status in the game, save their games and exit the game.

Shelley in (2001), said that the interface is not typically identified as being a major aspect of user satisfaction, though it is noted that an online resource for developers of electronic games, even a poorly constructed interface can keep a player from enjoying game play. Game play includes problems and challenges and player must try to win the game. Crawford in 1982 defines game play as pace and cognitive effort. Shelley in 2001 agrees by equating fun with interesting decisions that have to be made in a required amount of time. All these aspects differ according to genre (e.g, adventure, role-playing, and first person shooter) and platform (e.g, coin-operated machine, personal computer, and console). For instance, adventure games have typically been played to the computer, but are now moving to consoles. How this action will change the genre? Adventure

gamers are not accustomed to the buttons of a controller, and console gamers are not used to the cerebral puzzles that are involved in adventure gaming. The usability of a game is similar to other software in this manner and the usability of a product cannot be evaluated without taking context into consideration, [57].

The main aspect of user's interface that has the potential to affect user's satisfaction is the scoring device, because it can provide flattery. A study by Fogg and Nass in (1997), found that users' rate systems flatter more favorably than those that do not, [58].

Game mechanics are the game's aspects that are typically tested by Quality Assurance (QA) personnel in game companies. The purpose of QA is to ensure that no broken games (games with programming bugs) get shipped. Game mechanics include the ways that player is allowed to move through the game environment (walk, run, jump, drive a car, drive down the road, drive off the road, etc.). Animators build these features, programmers implement them into the game engine, and then level designers place them into the game environments. These are three processes that game mechanics provide.

3.5 HEURISTIC EVALUATION PROCEDURE

Heuristic evaluation is an informal method of usability's analysis where a number of evaluators are presented with an interface design and asked to comment on it. Various experiments were showed that individual evaluators were mostly quite bad on doing such heuristic evaluations and that they only found between 20% and 51% of the usability's problems on interfaces that they evaluated. On the other hand, we could aggregate the evaluations from several evaluators to a single evaluation and such aggregates do rather well, even when they consist of only three to five people.

Therefore, two or three people independently evaluate the UI using the heuristics so that usability issues that each person finds can be compared. This evaluation technique can be used throughout the development process, from early screen shots to fully implemented code, but it is a good idea to run heuristic evaluations early in the development process so that the UI can be redesigned.

For example, any person which is interested can look at the entire UI using the consistency heuristic, and record where this principle is violated. When the list is made

of all the consistency issues for the UI, recommendations can be made on how to address the issues that were identified. Jacob Nielsen and Robert L. Mack et al.(1994), described in details the Usability Inspection Methods [59].

Shneiderman, (1998), in his research was focused on heuristic evaluation, because it has been shown to be one of the most cost-effective methods of finding usability problems, [60].

Nielsen on 2000 and 2004 supports that during heuristic evaluation; experts should walk through the interface and identify elements that violate usability heuristics. This method has become extremely popular in the realm of usability evaluation due to its low cost, low time commitment, and ease of application. Nielsen also says that evaluators can conduct the evaluation in a few hours with minimal training, [18, and 20].

As it has pointed out before, 3-5 usability experts were used and they independently evaluated the user's interface. A separate list of heuristics violations was prepared according to the 14 heuristics that were described above. They agree with the fact that a single usability's problem which is identified by an evaluator can be a violation of multiple heuristics, which means that the number of heuristic violations is typically more than the number of usability problems that are identified. Once, evaluators have identified potential usability's problems, the separate lists are compiled into a single master list. This is one of the most important steps to analysis; all problems must be read in order to eliminate duplicates. They could eliminate this step by having evaluators sequentially to evaluate the interface, with each evaluator passing the list on to the next. Finally the master list is given back to the evaluators who independently assess the severity of each violation. Therefore the ratings from the individual evaluators are then averaged.

In compare with, Nielsen has shown that each evaluator could individual catch 35% of the usability problems. In our case the 3-5 evaluators could detect 60-75% of the heuristics problems. This technique is very easy, even for those who were not trained in usability. It has found that 2-3 h of training, combined with clear examples, and a practice evaluation with feedback, is often sufficient to begin using this method of evaluation. Also is required a minimal training in human factors engineering and some heuristics' understanding. In case which evaluators have a knowledge of the domain in

which the interface is used and a training in human factor engineering , then the number of problems that could be identified is increasing.

Nielsen (1994), proposes three (3) groups of evaluators a) The novice Evaluators who had only general computer knowledge, b) the single experts who are called “single experts” – they are usability’s engineers but they have no specific domain knowledge and c) the “double experts” who had both domain knowledge and usability expertise. Nielsen figure out that the “novices’ identified approximately the 22% of usability’s problems. The “single experts” could found approximately the 41% of them and finally the “double experts’ could find the 60% of usability’s problems [61].

3.6 PRINCIPLES OF DIGITAL GAMES PLAYABILITY

According to Desurvire, (1994), the HEP is useful only in specific cases. The list of Heuristics Playability is a big list of Heuristics which is developed to be useful as a general list that could be modified for each particular game. Additionally Heuristics which they will prove effective, they would be developed specifically for a digital game which it will use a conceptual framework. The specific Heuristics should be developed at the beginning of a process to make it less costly [62].

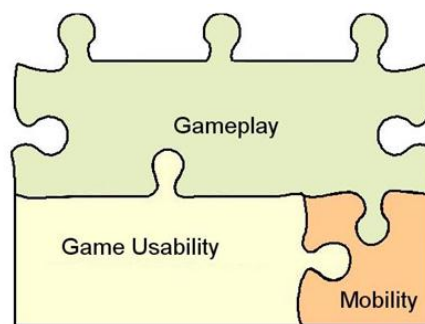
3.7 METHODOLOGY OF RESEARCH ON DIGITAL GAMES’ USE

The methodology which is used for evaluation of digital games is as follows: A set of criteria (Heps), will be used by several players, whose will observe and record the characteristics of game’s usability and playability. These players can be a simple player or experts on this subject.

A survey by a team's research which related to earlier research on the surveys and published by Desurvire 2008, Federroff 2003, Federroff 2002 and Fulton (2003), concludes that the upcoming issue is resulted in a set of Heuristics that were gathered, developed and refined specifically for digital games. Finally, they agree that HEP heuristics have to be divided into four general areas: Play, Story, Mechanics and Usability.

The four major categories (areas) were presented as follow:

- **Play:** Play is defined as the set of problems and challenges that a user must face to win a game.
- **Story:** History of a game includes all plot and character development
- **Mechanics:** The game includes programming which provides the structure in which the units interact with the environment.
- **Usability:** Usability of a game facing interface (interface) between the player and the game, which contains the information that a player uses to interact with a game (eg mouse, keyboard).



Picture 3.1 : Playability Heuristic Core Model

Koivisto [2005] and Korhonen H. (2006), present the playability heuristic model which is going to be used for evaluating mobile games with the expert evaluation method [21]. Currently the model consists of three modules: GamePlay, Game Usability and Mobility.

The Game Usability covers the game controls and the interface through which the player interact to the game. The game interface should allow the player to control the game and offer to a player all the possible actions and information about the status of the game.

Desurvire presents in CHI (2004) a study which proved through empirical data how these Heuristics were effective enough on helping in order to develop game design [43].

3.8 EVALUATION OF HEURISTICS' USABILITY IN DIGITAL GAMES

Desurvire, (2004), refers that although some usability's problems that are presented in games are similar to those seen in other areas, games have different specificity. For example in case of common software productivity, it is not desirable to make an error, but is not happen the same for games, [43].

Desurvire et. al. in (2008), say that in games player is forced to make mistakes because this is the only way to develop new skills and achieve the game's goal. He also states that designer's games require more comprehensive standards to identify usability problems, [54].

Fullerton (2004), argued that play testing is one of the most common ways to reveal design problems, but this process requires a satisfactory playability's implementation of them, which is exists only in the later stages of the development process of a game [52].

It should be noted that many usability inspection techniques are not suitable for digital games because of some different standards that obviously have nothing to do with the digital games. Therefore Bias et. al (2008), mentions that the data are not based on formal specifications and also Nielsen in 1997 observes that is oriented around the main user control which is used in desktop applications. Therefore, a set of concepts has to be created, so heuristic evaluation can be used to find usability's problems in digital games, [61].

Several researchers as Clanton, Desurvire and Federoff in 2004, who have previously developed heuristics for game's design, should be revised because heuristics that were developed by their studies are strongly oriented around engaging and fun, without dealing with particular user.

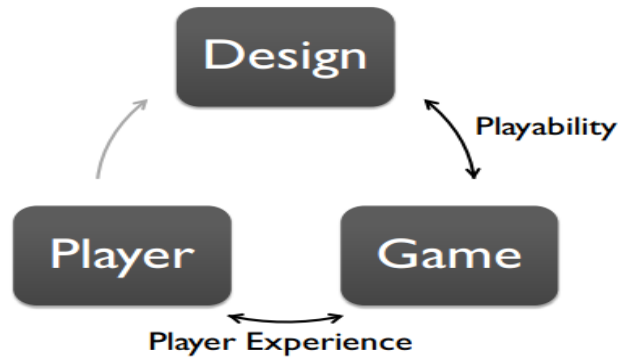
Additionally, Bias presents in details a pluralistic presentation, and the work's analysis of Annett, (1967), and Shepherd, (1989), which is based partly on the assumption that people will use an application to fulfill predefined tasks. However, the above concepts are not necessarily useful in games, since people behave differently depending on the strategy or motivation. In addition, some games are designed to promote an unstructured exploration, which means that it can be regarded as significant variability in how people choose to interact with the interfaces of a game, [61, 62, and 63].

3.9 PLAYABILITY AND PLAYER'S EXPERIENCE

As the game industry matures and games become more complex, there is an increasing need to develop scientific methodologies of analyzing and measuring player experience, in order to develop a better understanding of relationship and interactions between players and games. This panel gathers distinguished European playability and user's experience to discuss current findings and methodological advancements within player experience and playability research.

3.10 GAMEPLAY METRICS AND PLAYER'S EXPERIENCES

In conclusion, playability is a evaluative process which is directed toward games, whereas player experience is directed toward players. More precisely, playability methods evaluate games to improve design, whereas player experience methods evaluate players to improve gaming. Picture 3.2 shows that this separation of terms becomes important to the game design process, especially within a user research team for deciding, which methods to deploy at which stage of the process.



Picture 3.2 : The interface between player, game and game designer.

Since research in this direction is currently in a developmental stage, this aims' panel is giving an overview of current state-of-the-art methodologies. According to above picture playability is directed toward evaluating game design, whereas player experience has to be analyzed in the player-game interaction process.

3.11 VERIFICATION OF THE GAME BY HEURISTICS'USE

For verification of digital games a list of Heuristics was created. The heuristics were tested to the design of new games. A methodology was developed based on traditional techniques and had positive results that were presented in CHI 2004. Furthermore Desurvire in 2004 published a study whose goal was to adapt the existing principles of usability in a design of the game. This analysis identified a number of principles that helped to separate the good and bad games.

Therefore he published a list of 48 game's design principles. These principles classified games into high and low, and is particularly valuable, because they explain the differences between digital games and software productivity.

3.12 CONCLUSION

There have been several studies based on the method to be followed in order to evaluate correctly a digital game. The scholars' opinions diverge over time because naturally every researcher has his own point of view on usability of a game. There is a disagreement with the approach of Falstein and Barwood 2001, that the games should be designed according to certain rules. If a design of games follows particular "molds" then all games will be the same and stereotypes, therefore there won't be any excitement and interest for digital games. Furthermore a game is interactive and involves the player into it according to the story. If a game is designed based on some rules will be not guaranteed the game's usability and playability. Researchers converge that, according to heuristic evaluation method, is better to use the standard Heuristics of Nielsen 1994. Desurvire 2004, says that Heuristics should not be random but selected for each case.

As a conclusion, the results indicate that the HEP identifies qualitative similarities and differences with user's testing and that HEP is suitable for evaluating games in early stages of development. In combination with player, the HEP offers a new method such as HCI which could lead to a design of a more intuitive game.

Chapter 4

METHODOLOGY TO DEVELOP THE HEPSYSTEM

4.1 INTRODUCTION

The major growth of technology has created a necessity not only for a business but also for an individual of having involved with the new technology systems in order to cover their own needs. However, the design of an evaluation system creates a number of challenges. Apart from this, an evaluation system is one of the most modern ways of checking a program's usability. In addition, the creation of this system must be based in structure, to serve well-defined goals in order to be

successful. It must be designed according to these goals, according to the audience and its culture which represent.

The production of an evaluation system consists of following steps, from analysis to final production. While its structure is designing, is good to put down questions such as:

- What are the goals of this system ;
- Is the function analysis respond to the applications' form and system's functions and is depending on user's role (administrator, visitor, buyer, etc.)?
- The structure 's explanation and information for ergonomics, which clarifies how content is organized in the website;
- How responsive is the classification in the visitor's needs?
- What technologies can be used to build an evaluation system; what are the advantages and disadvantages of each technology which may, will be used? And the creative analysis, which makes it clear what is the appropriate design;

Then it is necessary to be developed an implementation phase. This part includes pages' planning and development on the system , development of the visual theme and others, as appropriate, creative elements (audio, video etc) the "translation" of a content in programming language (eg code HTML)and an incorporation of data on the content management tool, if necessary. Then it is important to activate the testing phase and the beginning of production. At this stage has to be ensured the proper site's operation to the visible parts (eg pages and applications used by the user) and to the invisible parts (eg content management tool). Alongside technicians' work who will do the tests, the final test can be done with the help of a user panel, which will represent a group of goals that the system is intended. Depending on their own comments, final adjustment scan be made before the system is presented to general public in the Internet.

The last of stages includes maintenance and updates. After the system "climb" to the Internet, should be updated to add new functions if necessary, and to correct any errors that were not detected along the testing phase. In short, an evaluation system must remain "live" after its publication. It is obvious that the production of a system can become a work for computer's

technician. It is needed the services of various experts such as graphic designers, ergonomic designers, programmers, testers, experts copyright etc. A good cooperation of these specialists in the same group is very important of creating an evaluation system.

Previously, they had highlighted the specific goals that are defined in order to create an evaluation system. The goals may be multiple, for example:

- Establish a relationship with the visitor, requesting, for example, e-mail address for sending him a newsletter.
- Reduce certain costs(example: calls to PBX) by facilitating access in certain types of information.
- Establish an evaluation company of your products or your services.

After the goals are identified, then the system should be developed by some parameters that will ensure the system's success, such as number of visitors, number of regular visitors. This procedure provides, inter alia, the use of a traffic measurement tool (Web Analytics). Then it is necessary to refer to the management and content tool. The content management tool (CMS - Content Management System) allows updating information from the operator itself, without technical intervention. At the stage of choosing a tool CMS, it should be confirmed that the choice will cover total needs. For example:

- How many languages are supported in the locality? Is CMS tool allows easy management of all these?
- What types of content should be managed by the CMS tool: text, video, photos?
- CMS tool allows easy change of «meta-tag» a page, so it is easy to register them(indexing)by search engines(search engines);
- Is it possible to add new modules to CMS tool: newsletter, forum, e-commerce module etc.

- Is CMS tool requires knowledge of HTML code or may be working on a «WYSIWYG» (What you see is what you get), such as word processing software?
- What is the procedure of publishing a new system to the site?
- What are the different content approval stages («content work flow»)of those responsible?
- Is the system focused exclusively on content management or can be incorporated into a range of other tools(CRM, ERP);
- What should be the level of security information?
- What is the level of service that will be insured?

The system is now a business critical application, which must has certain criteria of efficiency. For example if the system will be found off within, in what period should be identified and solved the problem? What should be the level of availability and the system response time, especially during peak traffic? What is the charge for these interventions? These questions should be put in the first development phases of a project, in order to avoid unpleasant surprises later (Interactive communication Greece Agency, website 2014).

4.2 THE GOALS OF SYSTEM

Undoubtedly the system that was created to support graduate thesis, is also helpful for students and researchers on the evaluation of a website or a game, etc. It was carried out using certain protocols. The site is free for all users, will simply have to become «member». The system's information is valid and accepted by all and the user can contact the site owner.

The first goal of this system is to create a software "system" in order to apply those that are referred to in section 2, 3. That is a system that just will perform "Evaluation". They can have access to the software both students and researchers that are involved in the Heuristics Evaluation.

Regarding the second goal which was the structure's analysis of information and ergonomics, like how content is organized in the system and how responsive is the classification to the visitor's needs. Undoubtedly this evaluation system accepts only visitors. Entrance to the site is free, is only enough the user's registration on the website. The visitor's purposes are firstly to learn the software and secondly to execute «Evaluation» wherever located easily, simply and quickly without the need for complex instructions and special knowledge.

The third goal is the technological analysis and the kind of technologies that can be used to build the specific system. Also what are the advantages and disadvantages of each technology that may be used to this system? It could be said that along system's construction there are two options .The first choice is to use technologies such as HTML, CSS, JAVASCRIPT, JAVA, JSP, SERVLETS etc. using the Netbeans software. The second option is to use easier languages such as PHP, CSS, which are supported by more than 90% of servers to the internet. The choice of first option is difficult because they are new technologies and of course not as well-known and widespread. So if is chose the first option, it contains potentially risk, because the design and construction of the system had to be made exclusively by the manufacturer. So in case of finding problems, possibly the assistance aid will be extremely difficult. Certainly this technology offers more options and features than the second option. If it becomes clear that the aim was to create a simple and easy system to perform a predetermined process then is good to be chose the second solution. Furthermore, the fact that it is easy language and widespread, could more easily achieve the manufacturer's goals.

According to creative Analysis the system's goal is to store information, to precede it and to present it. Both technologies support graphics and database. Therefore, the system will be under both presentation and functionality to whichever option they become.

4.3 IMPLEMENTATION PHASE

This phase includes the planning and development of pages (pages) of this system , the development of the visual theme and others, as appropriate, creative elements (audio, video etc) the "translation" of the content in programming language (eg code HTML) and the incorporation of data on the content management tool, if necessary. These phases include the planning and development of pages (pages) of the evaluation system in HTML code and the programming language PHP and integrate CSS for better graphics.

4.4 TESTING AND START PRODUCTION

This phase ensures the proper functioning of the site, in the visible parts (eg pages and applications used by the user) and in the invisible parts (eg content management tool). Alongside technicians work, who will do the tests, the final test will be done with the help of a user panel, which will represent the group of goals that the system is intended. This procedure is depending on technicians' comments and using them can be made final adjustments before leaving the "air" the system, the official "opening" of the Internet. They will become "Usability Tests" from specific users, who have formal experience to the subject.

4.5 MAINTAIN AND UPDATE

After the system «climb» to the Internet, should be able to add new functions if necessary, and to correct any errors that were not detected in the testing phase. As maintenance, upgrade and correction system will be systematically whenever necessary and whenever there needs upgrading and updates. The main intention is to upgrade both the functionality and the options. In this case the specific evaluation system will be a necessary and important tool for any student or researcher.

Chapter 5

SYSTEM'S DEVELOPMENT BASED ON EVALUATION OF GAMES PLAYABILITY

5.1 INTRODUCTION

The procedure and the methodology that it has to be followed are very complicated, whereas the steps of the procedure should be completed successfully. Data and information for the evaluation are changing during the process; therefore the system that will be developed should be flexible in order to adapt new values.

Moreover, on one hand the system should be as simple as possible and pleasant to user, but on the other hand the whole process is complicated and user will find difficulties on making evaluations.

Consequently, our great goal is to develop an evaluation system as “friendly” as it could be in order to understand in deep the procedure of the evaluation and try to create a system that it would satisfy the both sides.

First of all, have to think “simple’ and “realistic”. Simplicity is very important because users, experts or not, usually want to make the job as soon as possible and leave. Therefore in order to be achieved this goal, the system’s environment where the user will work should be friendly and simple .In addition, user should find all the necessary information in the same place ,otherwise he will spend time for searching in order to complete the procedure. As a result, users may drop down the procedure and exit from evaluation process.

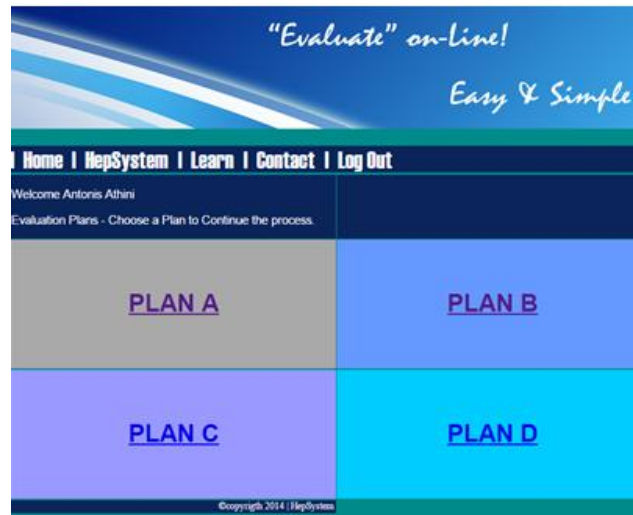
The methodology which is followed should stay on “behind” of the system. User is not interested about the system’ structure and how it works, but as it is mentioned previously he wants to make his “job”. Therefore it will be an effort to give to the user that he wants, a simple Graphical User Interface “GUI” and the same time the system’s procedure will flow normally.

Many times there is a problem in filling field forms because some people don’t understand what needed. As a result, sometimes the form remains empty or some parts of it are missing. In compare to this situation, the system can’t accept empty fields therefore the “GUI” design of the system should be “realistic”. Users should clearly understand what the fields ask in order to complete all necessary fields and have eventually a completed evaluation.

As a conclusion, “GUI” of this system should look like as in picture below [Picture: 5, 1].

It is easily noticed that “GUI” is very simple form and its structure make the user’s usability easier. In the same time user has the ability to fulfill any request nevertheless he forgot some steps or for any reasons he skipped them .The most important in “GUI” is that the user nevertheless he didn’t complete some fields, the specific process is still running . Furthermore the evaluation is not necessary to start from the beginning.

Moreover, the structure and the simplicity of GUI give directly to user all the necessary information that will be needed in order to complete the procedure. In addition to that GUI is being used as a “guide map” by the user, showing to him the steps that have to be followed.



Picture 5.1:GUI of the HepSystem

5.2 RESEARCH BEFORE THE SYSTEM PLANNING

Let's start from begging. The database of the evaluation system is hosted by a server “arvixe” which is located in the web address <http://www.arvixe.com>.



Picture 5.2: Web site of the Arvixe Web Hosting

It has rented a Web Hosting place in order to create the database for the HepSystem. Also the arvixe provides a domain name for this system and as an available domain name was www.online-evaluation.net. This system is dynamic therefore it couldn't be used one of the free websites which are available to the internet like the www.wix.com or the www.simplesite.com and many other free web builders.

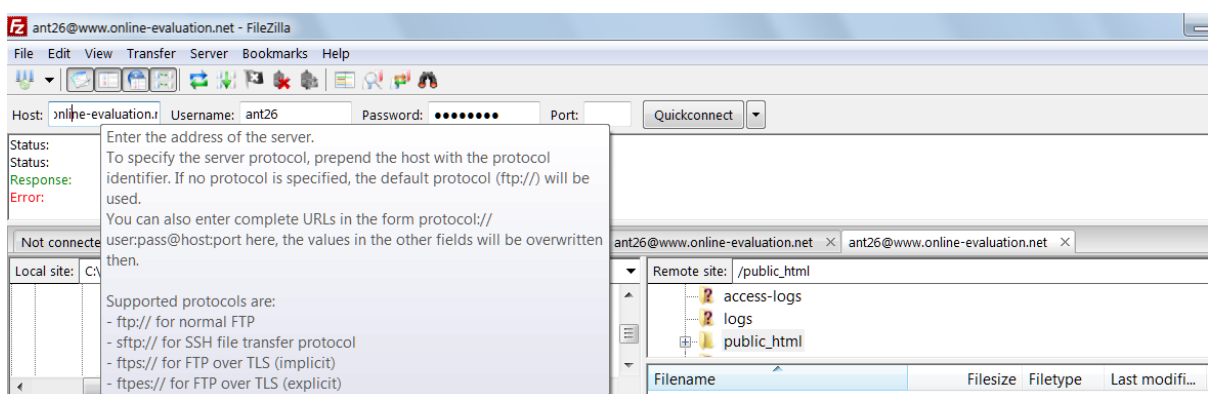


Version 8.0

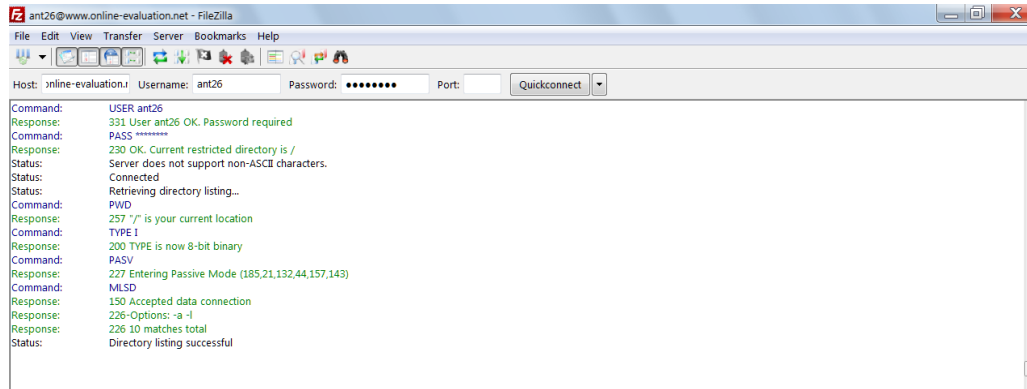
Picture 5.3: Logo of Dreamweaver

Therefore, it had to build a system from beginning until the end. It had been decided also the use of tool in order to be designed the system. Searching to the internet for better software for the study it was realized from comments that were posted, that the best software for designing systems is the Dreamweaver. Indeed, the software form was downloaded from the net. The problem was that the specific software wasn't familiar to me therefore I had to learn the operation for that software first. The next step was to watch some guide video from YouTube that were very helpful.

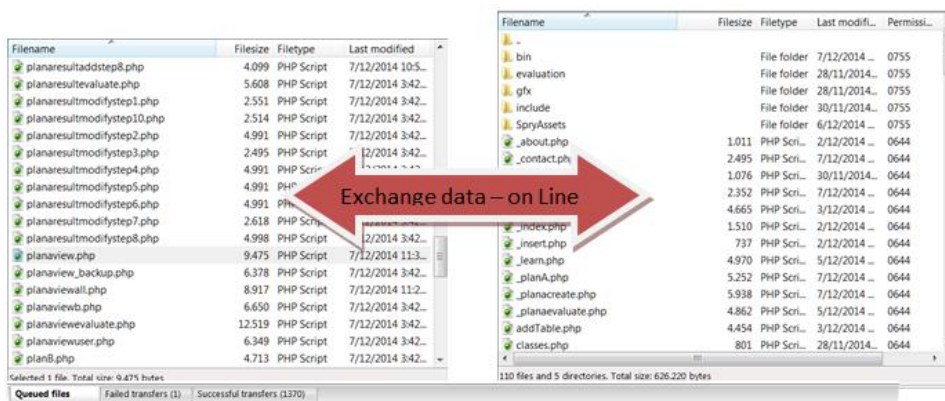
I also learned that I needed software to upload the web pages in my server. So I studied about the "FTP Client software" and the "FTP server software". The client software is connected directly with the server and therefore is called "FTP" direct connection. In our case, we have connected to the arvixe server and uploaded our data in a specific place which is occupied by the server specific for our website. The FTP is a direct connection as I previously said and the advantage of this connection is that provides fast and secure connection. The fileZilla software was used by the net and I downloaded it free from website <https://filezilla-project.org/download.php?type=client>.



Picture 5.4: FileZilla – Ftp Client Software



Picture 5.5: FileZilla – Ftp Client Software



Picture 5.6 : Left is the Client Side– Right is the Server Site

So, before start writing the code, I wrote down some hand notes about the forms of the system and what the software should do. Moreover, I created certain plans for the appearances of my forms.

Finally the following tools are needed to design and upload the web page:

- a) Macromedia Dreamweaver 8 – To design the Web Pages and implement the code PHP behind the HTML web pages.
- b) Client FileZilla Software – This is an Ftp Client Software to connect with the server. Actually I uploaded and downloaded the data from the server.

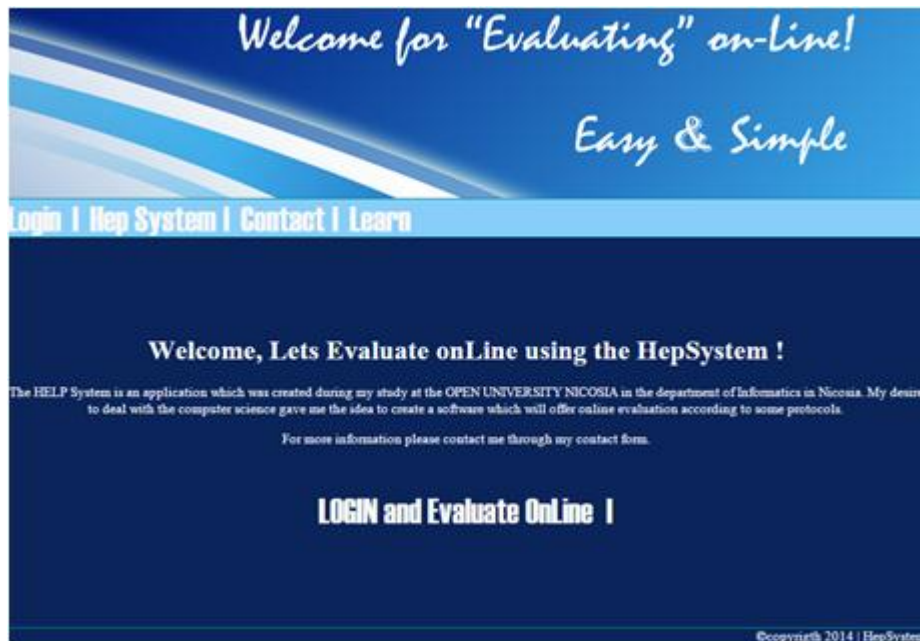
- c) Photoshop - A design program which provides graphics design for the site like the logo, the headers etc.

5.3 DESCRIPTION OF THE HEP SYSTEM

5.3.1 UNSAFE AREA OF THE SYSTEM

Welcome HepSystem Page

The front form of the system is a Welcome page, "index.php", which welcome the visitors. The welcome page is presented in the following print screen [picture 5.7] .

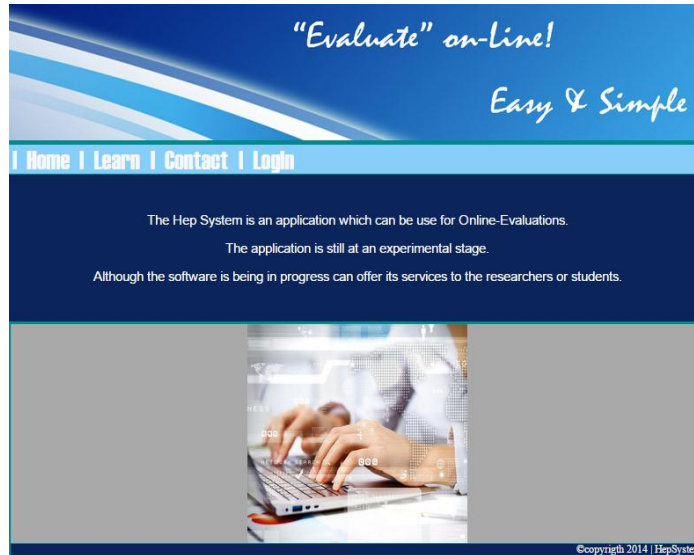


Picture 5.7 : Welcome Page of the **HepSystem**

The HepSystem is separated at two parts that the safe and the unsafe area. Visitors who are not registered to the system they can move to the unsafe area. In this place, users can move into various pages like the "HepSystem", "Contact", "Learn" or the "Login".

HepSystem Page

Page –HepSystem.php: This page gives information to user about the HepSystem and what is its purpose [picture 5.8].



Picture 5.8 : HepSystem Page

Learn HepSystem page

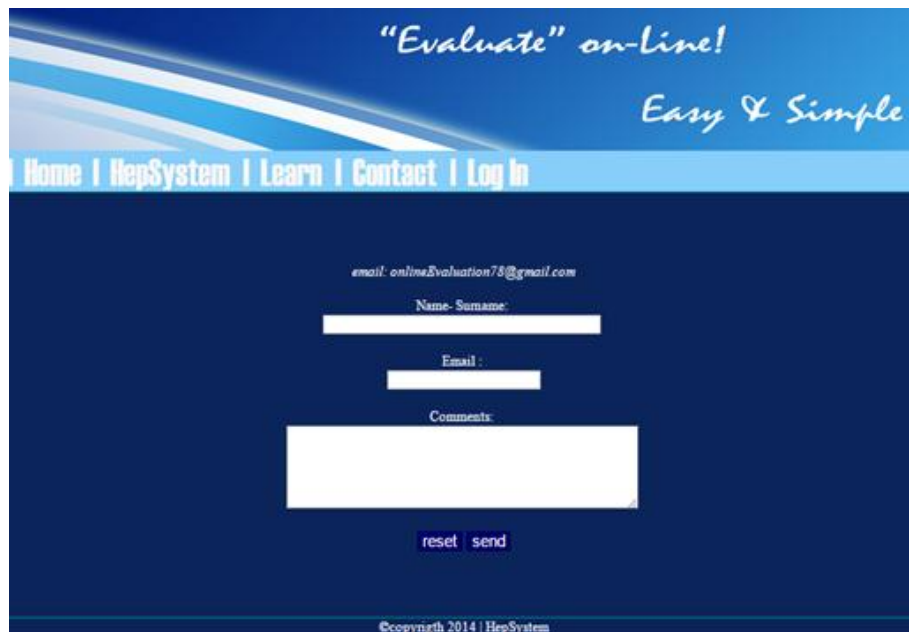
HepSystem –Learn.php: The learn page informs and explains to user how the system is working [picture 5.9].



Picture 5.9: Learn the HepSystem Page

Contact HepSystem page

HepSystem –Contact.php: At this page visitors can contact with me for more information about the system or any other question regarding the evaluation procedure [picture 5.10].



The image shows a contact form for the HepSystem. The form is centered on a dark blue background. At the top, there is a navigation bar with the text "Home | HepSystem | Learn | Contact | Log In". Below the navigation bar, the email address "email: onlineEvaluation78@gmail.com" is displayed. The form consists of three input fields: "Name-Surname", "Email", and "Comments". Below the "Comments" field, there are two buttons: "reset" and "send". At the bottom of the page, the copyright notice "©copyneth 2014 | HepSystem" is visible.

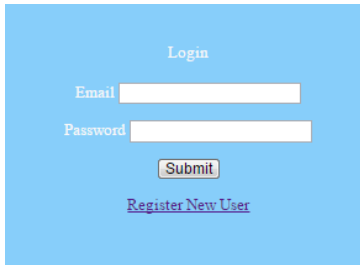
Picture 5.10: Contact Form of the HepSystem

5.3.2 SAFE AREA OF THE SYSTEM

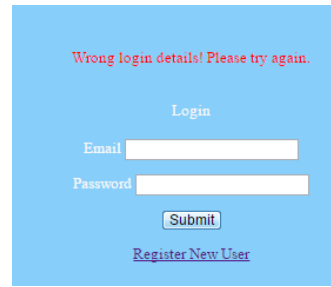
The safe area of the HepSystem starts after user makes successfully login in the system. Therefore user should be registered using the registration form in order to get a username and password. The email of the system can be the username for the user.

Login HepSystem page

HepSystem –Login.php: The most important page in the safe area of the system is the “Login.php” . The login page connects the safe area and login area .User should make login using this form which is presented in [Picture 5.12].



Picture 5.12: Login Web Page



Picture 5.11: Wrong Login message

The system validates the email address which is inputted by the user and in case that the email doesn't exist in the database then the system replies to the visitor the message "Wrong Login Details! Please try again" [picture 5.11].

Login HepSystem page

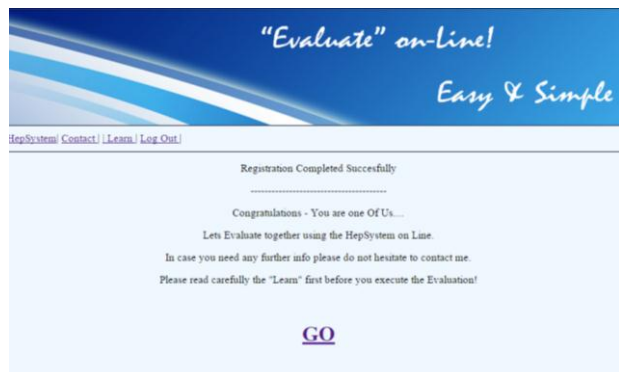
HepSystem –Registration.php:

At this point visitor has to make a choice. Either he enters to the system by making a registration or stays in the safe area [picture 5.13].

Picture 5.13: Registration Form

➔ Register New User

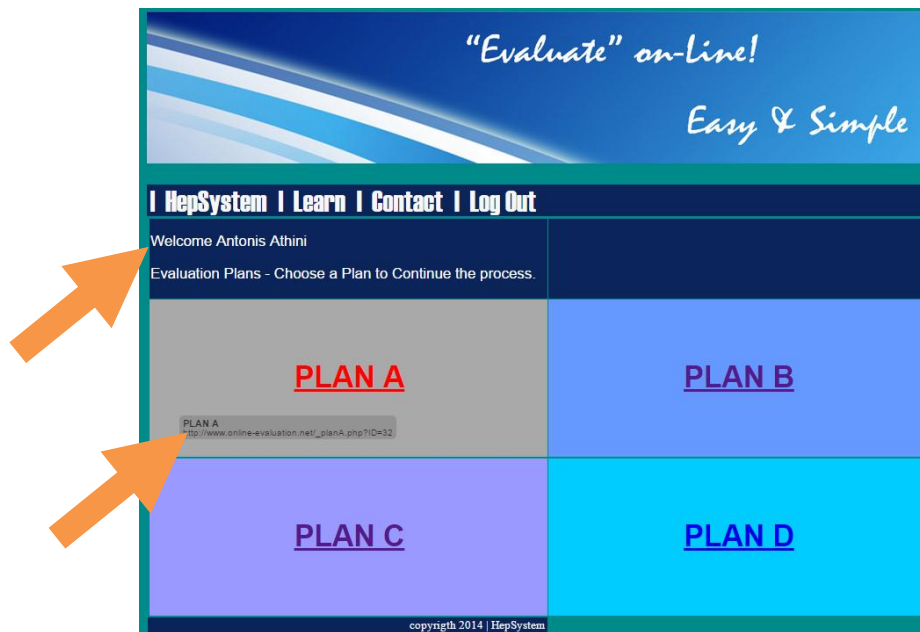
After completing the Registration Form user create its own "ID". The "Registration Confirm Form" informs him that the registration has been completed successfully [Picture 5.14].



Picture 5.14: Registration Confirmed Form

5.3.2.1 CHOOSE A PLAN

If the login is successful, see [Picture 5.10] , then the following form is appeared[Picture5.15].



Picture 5.15: Choose Plan Form

User should choose one of the following Plans. At the present stage the only plan which is working on experimental state is the “Plan A”. The other plans are under construction. The main purpose for these plans is to offer the user a variety of different options. For example PlanA is used only the standard Nielsen Heuristics, Plan B will offer the heuristics of Nielsen but also offers and the Shneiderman's Eight Golden Rules of Interface Design. Moreover the Plan C will offer to user the option to input any of heuristics he wants. Also it is easily noticed that user “Antonis Athini” has the ID=32. The ID=32 is a code which is generated and given by the system to the specific user. Therefore this ID number is unique for every user



Picture 5.16 : ID is connected with the user

.The ID of user “Antonis Athini” is ID=32, therefore this ID is connected with the user’s email and at this case user has the email ant.athini@cytanet.com.cy. [picture 5.16].

The ID is very important for this system otherwise user should have access to plans or reports which are held by other visitors in the web site.

`www.online-evaluation.net/_planA.php?ID=32`

Therefore the HepSystem is designed in such way checking whether the ID which is requesting by particular report belongs to a person who have email which is saved in our database. In case that combination is not completed then the procedure is aborted.

Finally user is led to the main page of the system, [picture 5.17]. This form is called **“PlanAcreate.php”**.

The form is separated in three parts. The first one “Create a Plan”, the second one “Evaluate a Plan” and the third one “Report”. Actually the first and the second part are connected. There is no difference between them in the system because the whole procedure consists of 8 steps and the steps should be completed consequently

Welcome Antonis Athini

Congratulations, You have chosen to evaluate with the Plan A

Just Click - Create and Evaluate

Create a Plan

Create your Plan

CREATE

Evaluate a Plan

Evaluate your Plan

EVALUATE

Report

REPORT

HISTORY

Modify - Search a Plan

SEARCH MODIFY HISTORY SEARCH all

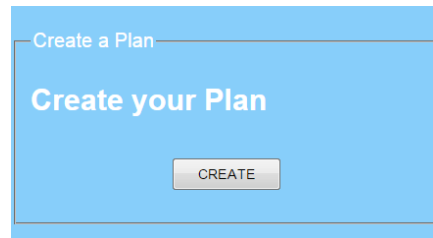
©copyright 2014 | HepSystem

Picture 5.17: Plan A Form

At this point the separation to the evaluation procedure is done emphasizing to user that the Step1 until Step 5 it is used only to input information in the system. The second part, from Step6 to Step8 is actually used for the evaluation of the plan.

Let's create a Plan.

The button "Create" should be pressed [Picture: 5.18: Create Button].



Picture 5.18: Create Button

The form off picture 5.19 is appeared to inform user about the steps that should be followed in order to complete the plan successfully.



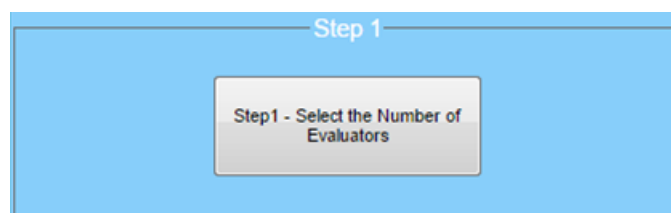
Picture 5.19: Create Form

At this procedure all steps should be completed therefore the user should start from the Step1. But even the user try to start from other step the system is pretty smart to inform user that he should move to step 1 [picture : 5.20]. The procedure's Steps are eight (8) and user should complete the steps consequently.



Picture 5.20: Inform User Form

STEP 1 - SELECT THE NUMBER OF EVALUATORS



Picture 5.21: Step1 -Button

User should start from Step1. He should create a plan and then in the same form he will execute the first step of its plan, [picture 5.21].

Obviously I could use separate forms for this creation but I choose to create only one page in order to be simpler to user.

Step1 Form: asks from user to fill the following fields, [picture 5.22].



Picture 5.22: Step 1 Form –Create the plan and input the number of Evaluators

Give Code: User must input the name of a plan that he wants to create. The name of the plan is unique and is saved as a code to the software. Therefore user should give to his plan a short and easy name. Because on one hand the certain code will be asked several times by the system and on the other hand user should be able to remember this “name”.

Give a Short Description: A short Description should be given explaining the Plan.

Input Date: The date that the plan is created should be inserted to the system .

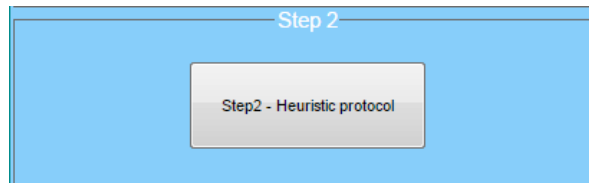
Number of Evaluators: System asks from user to input the number of the evaluators who are participating in the evaluation procedure. In the future the system will be upgraded to accept if the evaluators are experts or not.

Finally when all the fields are completed, the button “Complete Step1” should be pressed to save the data into the database.



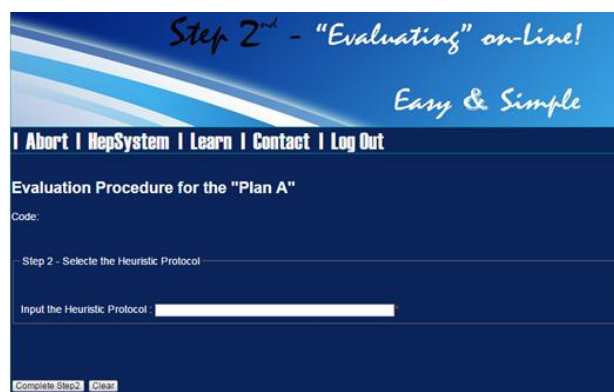
Picture 5.23 : Step 1 – Confirmation form

STEP2– SELECT THE HEURISTIC PROTOCOL



Picture 5.24 : Step2 - Button

Field: Input Heuristic Protocol: User must input the Heuristic Protocol. The protocol is depending on heuristics that are going to be used during the evaluation procedure, [picture 5.25].



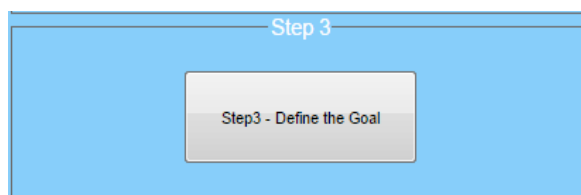
Picture 5.25: Step 2 Form – Select the Heuristic protocol



Picture 5.26 : Step 2 – Confirmation form

STEP3 – DEFINE THE GOAL

Field: Define the Goal: User must input the Goal of the Plan which is identified by the evaluators before the evaluation procedure has begun, [picture 5.28].



Picture 5.27 : Step3 - Button

Picture 5.28 : Step 3 Form – Identify and Define the goal of the heuristic evaluation

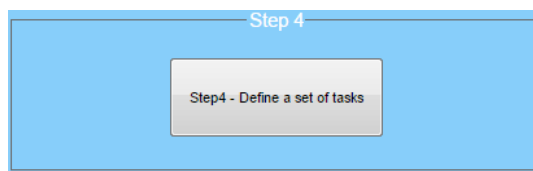
After the Goal in step 3 is completed successfully then the user is formed by confirmation form [Picture 5.29].



Picture 5.29 : Step 3 – Confirmation form

STEP4 – DEFINE A SET OF TASKS

Evaluator should input the tasks that will be examined in the evaluation procedure.



Picture 5.30: Step 4 Button

Also a brief description about the tasks is asked. The system can accept until 5 tasks at the moment. In the future some more tasks will be added [picture 5.31].



Picture 5.31: Step 4 Form – Define a set of tasks to be performed during Evaluation Procedure.

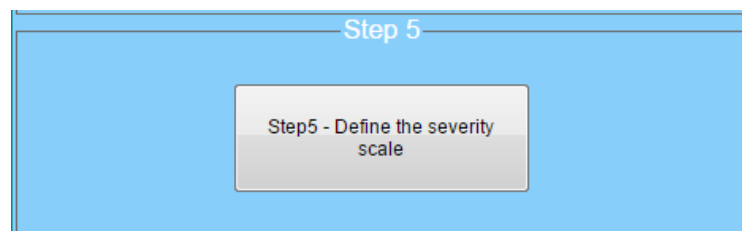
When Description and Brief Description are completed then the confirmation form [Picture 5.31] informs the user that the step 4 has been completed successfully.



Picture 5.32: Step 4 – Confirmation form

STEP 5-DEFINE THE SEVERITY SCALE

The user should define the severity scale. Depend on the scale that it has been agreed between the evaluators. There are various severity scales like 0 to 4 or 1 to 5 or from Low to High, [picture 5.34].



Picture 5.33: Step5 Button

Step 5th - "Evaluating" on-Line!
Easy & Simple

Abort Procedure | Hep System | Contact | Learn Log Out |
Evaluation Procedure for the "Plan A"

Step5 - Define the Severity Scale

Code:

Select the Severity Scale : (1..3, 1..5, low..high)

Create Step 5 Clear

Picture 5.34 : Step 5 Form – Define the Severity Scale

The same procedure is followed again. After user pressed "Create Step 5" button then the confirmation form [Picture 5.33] informs the user that the step 5 has been completed successfully.

Step 5th - "Evaluating" on-Line!
Easy & Simple

Abort, Hep System Contact Log Out

Congratulations! The
Step 5
is completed Successfully !

[Go to Step6](#)

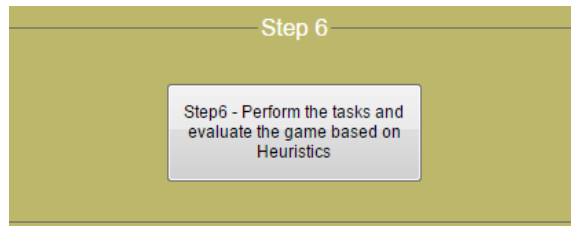
[Return Back](#) (You should complete all the Steps)

©copyright 2014 | HepSystem

Picture 5.35: Step 5 – Completed Form

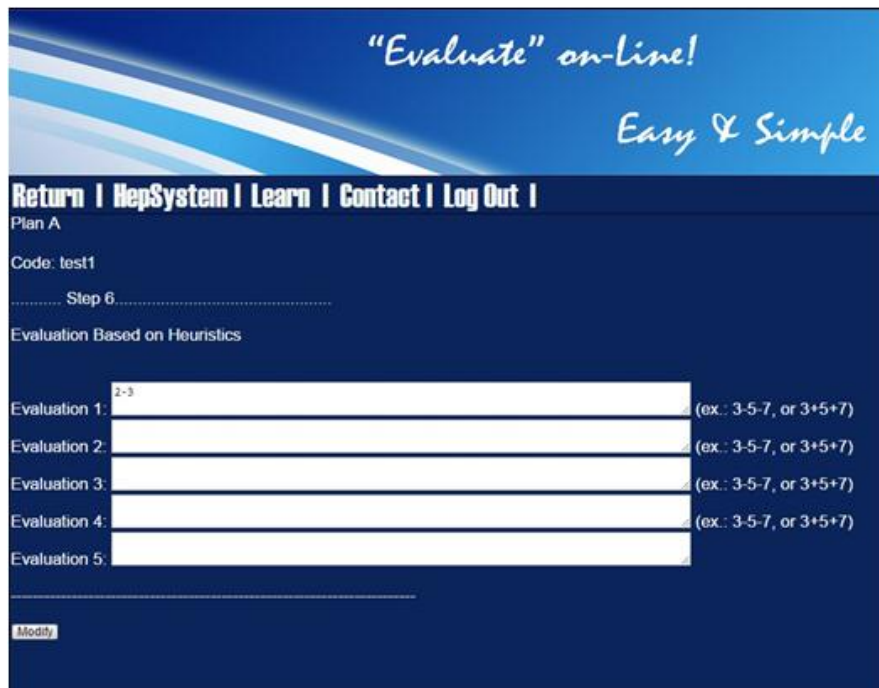
The second part of the evaluation procedure starts from step6 until the step8. After the first part has been completed, all information from evaluators are collected to prepare the second part of the evaluation.

STEP 6 – EVALUATION BASED ON HEURISTICS

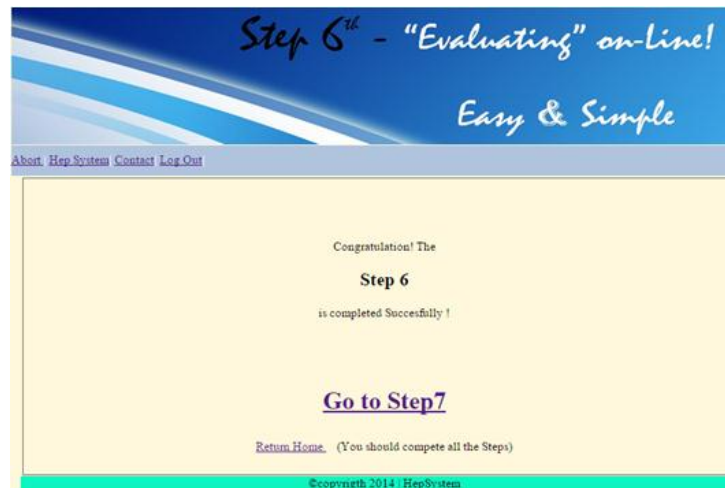


Picture 5.36 : Step 6 - Button

Evaluation procedure which is based on Heuristic is depending on the evaluation which has been done by evaluators. Therefore after the procedure will be finished the evaluators should gather together and decide which of the pre-defined tasks are connected with the protocol. The next step for evaluators is to complete the following form according to results [Picture 5.37]. The completed form at Picture 5:30 inform user that everything is ok and that he can move to step 7.

A screenshot of a web application interface. At the top, a blue banner contains the text "Evaluate" on-line! Easy & Simple. Below the banner is a navigation bar with links: Return | HepSystem | Learn | Contact | Log Out |. The main content area has a dark blue background. It displays "Plan A" and "Code: test1". Below this, it says "Step 6" and "Evaluation Based on Heuristics". There are five evaluation rows, each with a text input field and a label: "Evaluation 1: 2-3 (ex.: 3-5-7, or 3+5+7)", "Evaluation 2: (ex.: 3-5-7, or 3+5+7)", "Evaluation 3: (ex.: 3-5-7, or 3+5+7)", "Evaluation 4: (ex.: 3-5-7, or 3+5+7)", and "Evaluation 5:". At the bottom left, there is a "Modify" button.

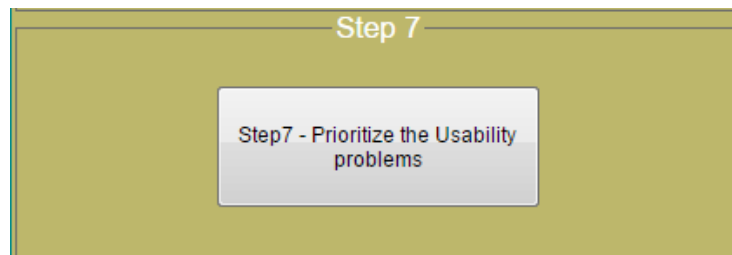
Picture 5.37 : Step 6 Form – Evaluation Based on Heuristics



Picture 5.38 : Step 6 – Completed Form

STEP7 – PRIORITIZE THE USABILITY PROBLEMS

Evaluators should prioritize the results of this specific evaluation. Unfortunately the system is not ready to make prioritization. Therefore after this procedure will be finished, all evaluators should gather together, collect all the Usability problems and decide how to prioritize them.



Picture 5.39 : Step 7 - Button

The prioritization scale is based on the severity scale that it has been already agree. The next step is to input the results of the prioritization into the system, see [Picture 5.40].

Step 7th - "Evaluating" on-line!
Easy & Simple

[Abort](#) | [HepSystem](#) | [Learn](#) | [Contact](#) | [Log Out](#)

Evaluation Procedure for the "Plan A"

Code:

Step 7 - Prioritize the Usability Problems

Prioritize the Usability Problems 1: (Depend on the selected severity scale ex: 1..3,1..5, low..High)

Prioritize the Usability Problems 2: (Depend on the selected severity scale ex: 1..3,1..5, low..High)

Prioritize the Usability Problems 3: (Depend on the selected severity scale ex: 1..3,1..5, low..High)

Prioritize the Usability Problems 4: (Depend on the selected severity scale ex: 1..3,1..5, low..High)

Prioritize the Usability Problems 5: (Depend on the selected severity scale ex: 1..3,1..5, low..High)

[Create Step 7](#) [Clear](#)

Picture 5.40 : Step 7 Form – Prioritize the Usability Problems

Step 7th - "Evaluating" on-line!
Easy & Simple

[Return](#) | [Hep System](#) | [Contact](#) | [Log Out](#)

Congratulation! The
Step 7
is completed Successfully !

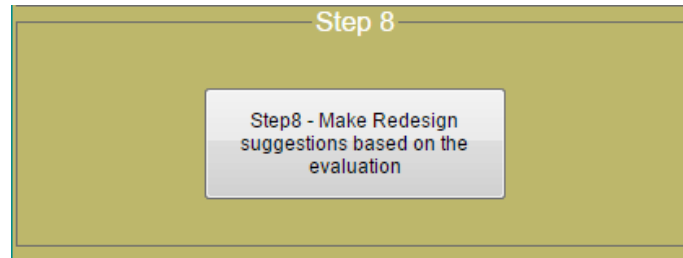
[Go to Step8](#)

[Return Back](#) (You should compete all the Steps)

Picture 5.41: Step 7 – Completed Form

STEP 8 – REDESIGN SUGGESTIONS BASED ON EVALUATION.


The last step of procedure is the Step 8. In this step user is asked to input several suggestions regarding the evaluation that it has been completed.



Picture 5.42 : Step 8 - Button

Possible suggestions that evaluators may do are based on these problems: a) Likely Difficulties, b) Specific Context/location, c) Possible Solutions and finally the d) Heuristic rationale

The following picture presents the fields that should be completed by user [Picture 5.43].

A screenshot of a web application interface. At the top, a blue banner contains the text "Step 8th - 'Evaluating' on-line!" in a white, handwritten-style font, and "Easy & Simple" in a white, cursive font below it. Below the banner is a dark blue navigation bar with white text: "Abort Procedure | Hep System | Contact | Learn Log Out |". The main content area has a dark blue background. It starts with the title "Evaluation Procedure for the 'Plan A'" in white. Below the title is the label "Code:" followed by a text input field containing "Step 8 - Redesign suggestions based on the evaluation". Underneath, the heading "Likely Difficulties" is followed by five rows, each with a label "Likely Difficulties 1:" through "Likely Difficulties 5:" and a corresponding white text input field. Each input field has a small upward-pointing arrow icon on its right side.

Specific Context /Location

Specific Context /Location 1 :

Specific Context /Location 2 :

Specific Context /Location 3 :

Specific Context /Location 4 :

Specific Context /Location 5 :

Possible Solutions

Possible Solutions 1 :

Possible Solutions 2 :

Possible Solutions 3 :

Possible Solutions 4 :

Possible Solutions 5 :

Heuristic Rationale

Heuristic Rationale for Problem 1 :

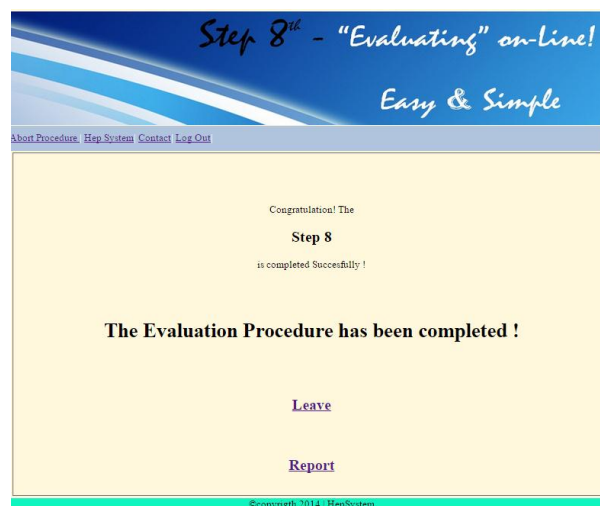
Heuristic Rationale for Problem 2 :

Heuristic Rationale for Problem 3 :

Heuristic Rationale for Problem 4 :

Heuristic Rationale for Problem 5 :

Picture 5.43 : Step 8 Form – Redesign suggestions based on Evaluation

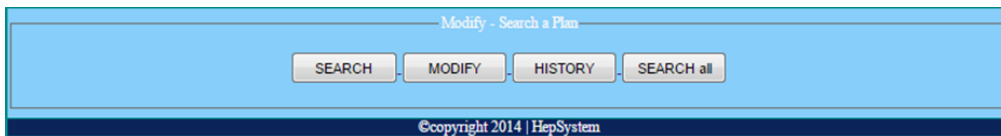


Picture 5.44 : Step 8 – Completed Form

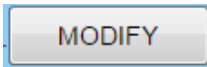
Finally all Steps have been completed successfully. User at the end of step 8 has the option whether to continue the “Report” or to “Leave” the procedure [Picture 5.44].

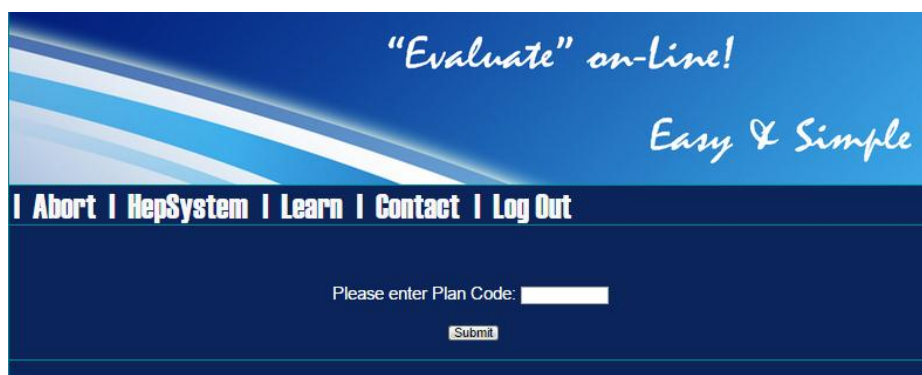
5.3.2.2 MODIFY AND SEARCH A PLAN

Supposing user needs to make some modifications, as a next step he can use Form “Modify” [Picture 5.45]. Moreover user can use the “modify form” even though the plan wasn’t completed successfully.



Picture 5.45: Modify-Search Buttons

 After user has pressed button “Modify” the system must know what plan to search. Therefore the search form is appeared and asks from user to input the plan code [Picture 5.46]. If the input plan code is invalid then the system can’t find this plan code in the database and a message is returned to user [Picture 5.47].



Picture 5.46 : Search Form

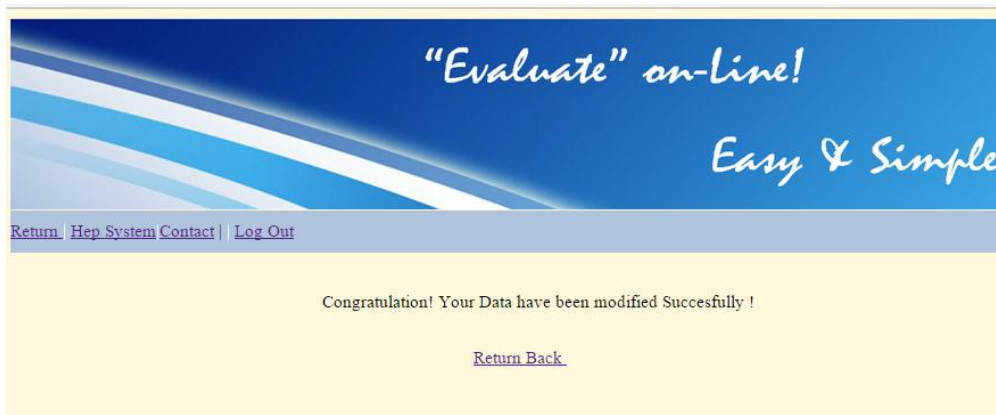


Picture 5.47: Wrong Plan Code Form

Supposing that the input code is valid then the “modify form” is appeared [Picture 5.48].

The form which is below [picture 5.48] we can easily notice that some fields are missing. So we conclude that the user who create the plan with the code test4, he didn't complete these fields for some reasons. Let's say that I modify only the “Description” of my plan and then press the button modify at the end of the form.

Picture 5.48:Modify Form



Picture 5.49: Modification Completed Successfully Form

Then the confirm modify form is informing the user that the modification is completed successfully [Picture 5.49]. Finally if user try to make modifications again with the same code, then the field Description for plan code “test4”, as show in the picture 5.50, is updated with the new values which was inserted by user previously [Picture 5.50].



Picture 5.50 :After Modifications Form



In addition, user can search in the database for a plan. He can't navigate plans that were created by other users. He can search only for plans that were created by himself with a specific “ID” which is for specific “Code”. The procedure is repeated the same. The system asks from the user to input the plan that he wants to search. If the plan is invalid then a wrong message informs the user that the input plan is not valid and as a result he should input another plan code or abort the procedure.

In case that the plan code is correct then the following form is created and presented to user[Picture 5.51].

"Evaluate" on-line!
Easy & Simple

Abort Procedure | HepSystem | Learn | Contact | Log Out

Plan A - Search Form

Code of the Plan: civ4
Description: Adventure Game
Date: 2014-05-09

Step 1- Select the number of "Evaluators"
Number of Evaluators: 5

Step 2- Selected Heuristic Protocol
The selected Heuristic Protocol is : 6

Picture 5.51 : Search Form

SEARCH all

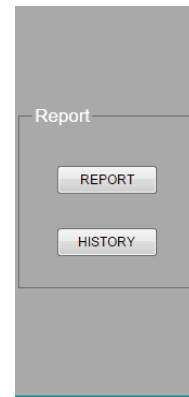
Also he can search for all plans that are saved in database and created by the user.

HISTORY

Moreover the history button provides to user records for all activities in the HepSystem.

5. 3.2.3 REPORT

In addition, if user wants a report, he can go to the Report area of Plan A main screen, [Picture 5.52]. The system offers to user the service to look for the report that he has already created. Reports are saved in system's database and therefore user can search for the report that he wants at any time independently if the plan was completed or not.

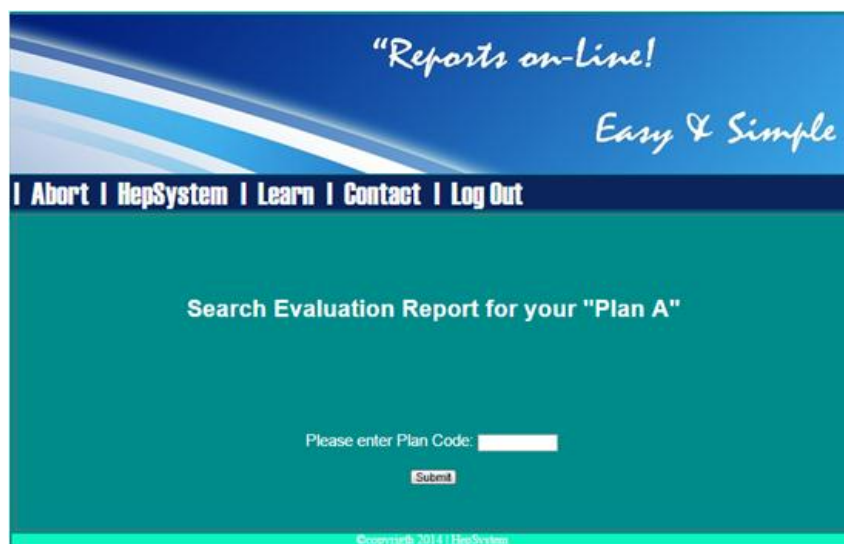


Picture 5.52 : Report Buttons

As it is mentioned above the report is executed by user in case he asked for it. The report in order to be useful, all steps should be completed successfully and correctly. Therefore if the evaluation procedure wasn't completed correctly then the report is useless because its fields will be empty.



On condition that user wants to execute the report, he should press the report button. Then Search Evaluation Report form is appeared asking him to input the report's plan that he wants [Picture 5.53].



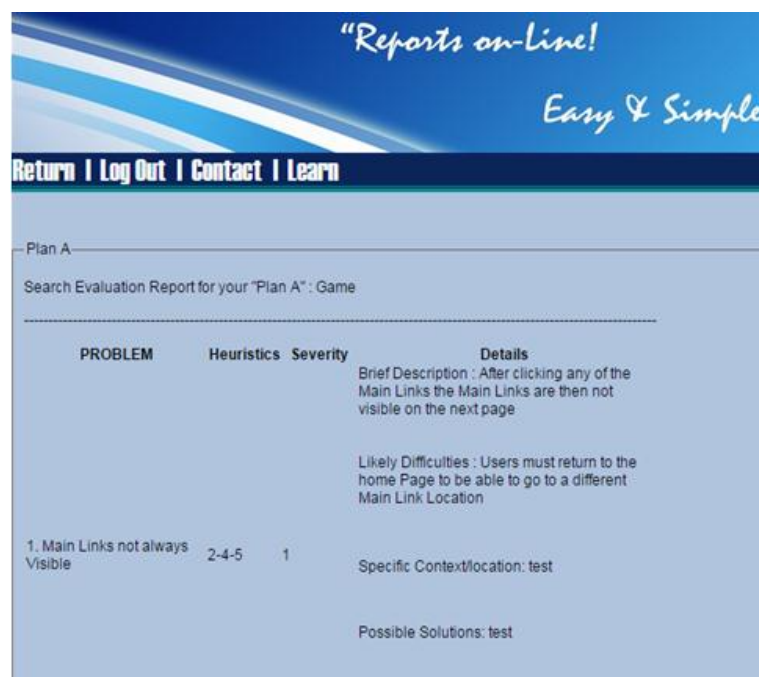
Picture 5.53: Search Evaluation Report form

Supposing that the input plan is invalid then a Wrong Plan Code Form informs user that the plan code that he inserted for searching is “Wrong”, meaning that such a plan code doesn’t exist in the system, therefore he should press the back button to return to previous situation [Picture 5.54].

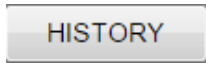


Picture 5.54:Wrong Plan Code Form

User tries again and if the plan code is correct then the report is created and presented to user [Picture 5.55]. The reports are saved in database and revealed any time the user asks for them. Of course user can print or save the report any time.



Picture 5.55: Report Form



History button was created to present to user all evaluation reports which are in database. This part of system it will be useful to user when he is looking for reports that were created in the past and he wants to have all reports massively in one page.

Chapter 6

IMPROVEMENTS ON THE HEPSYSTEM INTERFACE

6.1 FEEDBACK ON THE HEPSYSTEM INTERFACE

After the design completion of the HepSystem was necessary to take opinions from experts on the functionality and efficiency of the system. Therefore was used the online tool <http://www.feedbackarmy.com> [picture 6.1].

They have been asked ten specific users to evaluate the system which is supported by the website <http://www.online-evaluation.net> in order to be made improvements and corrections to the system [picture 6.1].

PICTURE 6.1: USABILITY EVALUATION FEEDBACK

6.1.1 PARTICIPANTS

The population from which the sample was taken consisted of 10 people. The sample was non-probabilistic in order to collect more useful information because according to Nielsen if users are heterogeneous, a sample of five people is sufficient to bring 85% of usability problems [64]. We selected 10 users who had experience in usability's evaluation.

The user's participation was unknown. The user involvement was unknown and therefore the results of the comments were true. As a result, their opinions and comments were considered seriously on the redesign of the HepSystem.

6.1.2 FEEDBACK PROCEDURE

As it referred, the HepSystem was evaluated by the Usability evaluation tool <http://www.feedbackarmy.com> [Picture 6.1]. The expert users visited the system <http://www.online-evaluation.net> and executed specific tasks.

The goal of usability testing is to obtain qualitative data from the analysis of results in order to measure primarily the interface's effectiveness and efficiency with its users. The measurement in the assessment will focus on specific questions as detailed below:

1. What does this system do?
2. What aspect of the system confused you?
3. What would improve this system?
4. How does it work?
5. Is my system easy to use?
6. Do users understand my system ?

According to the responses that were received for each question from the feedback process on usability research we have led to some conclusions which are listed below:

First Question: What does this system do?

On first question, it seems that all users understand what this site does. Consequently the first question is not needed any improvement.

Second Question: What aspect of the system confused you?

The answers to this question were various and different. Some of users responded regardless the question while some others suggested some helpful actions, such as adding a few examples of what can make the system or some videos that explain the use of it and how it works.

Comments from user 10: « Though there is basic information, I feel that there should be more in-depth information in the "HEP-System" link, possibly about in what instances can the site be used (examples) or possibly a video tutorial of where the system wants to go. Right now, the info is so basic, it is hard to visualize how one would use it »

Third Question: What would improve this system?

Responses to this question were very important because the redesign of system is based on them.

Below are summarized the proposals for improvement of system :

- Use application to help people understand the system.
- Give external link to provide details on the terms used in the system.
- Improve the look of the system by improving the fonts.
- System could be more simply - with a more organized format.
- The information on the learn page is lengthy - Examples would be helpful.
- The script on the home page is a little hard to read - And the type size is on the small side.
- Give a lot more details about the services that you provide.
- Give more information about the software right on the homepage.
- The "learn" page had some vital information. But I think the homepage needs more information about the product.
- The header, where one might expect a company or other entity name, is just some extremely difficult to read slogan of some sort.
- The core color scheme isn't too bad, though the background color is, but several pages on the member side have colors which clash terribly with the assortment of blues already presented.

- The lack of title tag in the code means that the tab within the browser that the user is viewing the site is filled with an ugly block of code, meaning it will probably get lost or, more likely, closed as an assumed popup, by users who have multiple tabs open.
- The log-in system, while potentially irrelevant as it is unclear if the information this site will handle is sensitive or not, doesn't replace password information with stars and, in fact, produces previously used passwords if you click the text field.
- Provide more links to various categories that the system could help in.
- There should be a testimonial section, so that others who come to the system can see how others used it.
- Move the "What is the HepSystem?" section to the main page and elaborate on it. It doesn't contain enough information to actually explain what the system is for. If I was searching for an evaluation site I would skip this one.
- Your links at the top of the page change places some even disappear and appear, depending on which page you are one; they should always be consistent. They should be labeled better as well so I know what the form is going to include. For example the "Abort" button, I didn't start anything to abort so it taking me back to the main form makes no sense.
- The text has good contrast but it is small and there isn't much definition between the sub categories.
- The pages have no visual interest. They are boring to look at.
- The email address isn't very professional. It tells me that this is a startup company that isn't so serious about impressions.

Fourth Question: How does it work?

This question is considered important and essential as the functioning of the system supported by the web site. The aim of this question is to get answers from users about the fact whether they have managed to do "Evaluation" with success. It seems that most users have failed for various reasons. These reasons are listed briefly below. Deeply will be analyzed in section 6.2.

- It works in steps. Step one is to create a plan. The second part is to evaluate your plan. The last step is to include reports.
- The process consists of three steps: Firstly, "Create a Plan", users need to complete five small steps. Secondly, "Evaluate your Plan", users have to input the information regarding the "real evaluation procedure" Thirdly, "Reports", to get the details about the evaluation, users should insert the code of the plan created in the first step.
- You login and enter the information you would like to evaluate by answering a series of questions.
- How it works, needs more explaining. Make a tab for it at the top and explain it in detail. From what I gathered, you fill in a form and the system evaluates it using Nielsen protocol. What Nielsen protocol is needs to be explained better. There isn't anything that really tells me how it works or what the 5 steps are that I fill out.

Fifth Question: Is my system easy to use?

This question has to do with the environment of the system. The aim is to measure the usability quality of system, and to what extent users are satisfied with their navigation within the HepSystem.

All users agree to the fact that the system is easy to use. However, some users gave some other comments which are unrelated to this question so they will not be taken into consideration at this stage.

Below answers are listed briefly to question 5:

- It's easy to navigate but it still it's a tad confusing.
- The site is very easy to use. Every step has the instruction in detail.
- Yes the site is easy to use.
- Yes, it is easy to get around the site using the tabs, and it seems contacting you would be easy.
- As of right now, the site is easy to use - yet hard to completely understand.
- The site is very easy to use. Where things are located is very user friendly.
- The site is simple in its layout and therefore easy to use and navigate.
- I have yet to determine the use of this site, but with the things mentioned above, no. It actually seems quite difficult and counter-intuitive to use.
- I think, as it is, it is very easy to use. However, that is largely because there is not a lot of information on it at the moment.

Sixth Question: Do users understand my system?

This question requires by users to stand out the usability from the efficiency, and really understand the purpose of the system. This website was made to support a HepSystem that performs "Evaluation on-Line". The system is in experimental state so should the user responses to be more specific in order to help in improving the software.

It seems that most users affected by the previous questions and do not focus on this issue.

Also, some others seem to have spent more time on the system and therefore have understood that the software is targeting to a particular category of people such as researchers or students or even professional evaluators who are looking for an evaluation tool.

Of course users need to have some knowledge before have to perform an evaluation. Therefore the system asks some specific items to perform the evaluation.

This question will be discussed in the section 6.2.

Below are some answers which were given to this question:

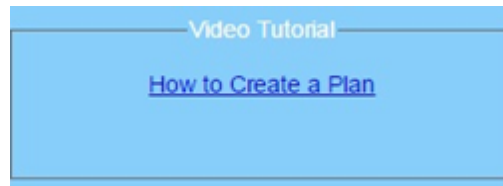
- I didn't really understand it because I really don't know what it does. Maybe I am in the minority on this.
- Yes, if users are looking for Online-Evaluation site and have knowledge in computer science field.
- Yes, the system can be understood.
- Perhaps a researcher or a person who was recommended toward your site would understand it a bit better than the "average Joe."
- I understand this system and am able to navigate it.
- Again, personally, I think that could be an issue. I have a general understanding of how the system works, but more detail would definitely be needed before I invested time or money into using it. The idea, itself, is great.

6.2 EXPLOITATION OF RESULTS

All proposals were taken into consideration and were made an effort to adopt the system which satisfies the original system design. Below are referred the suggestions that they were adapted to the system.

First Suggestion: Use application to help people understand the site.

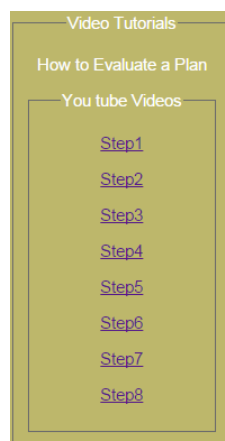
Several Tutorials have been putted to the forms of the system in order to help users understand the system's operation . The tutorials explain step by step how the system works.



Picture 6.2: Tutorial how to Create a Plan



Picture 6.3: Tutorial, how to Evaluate a Plan



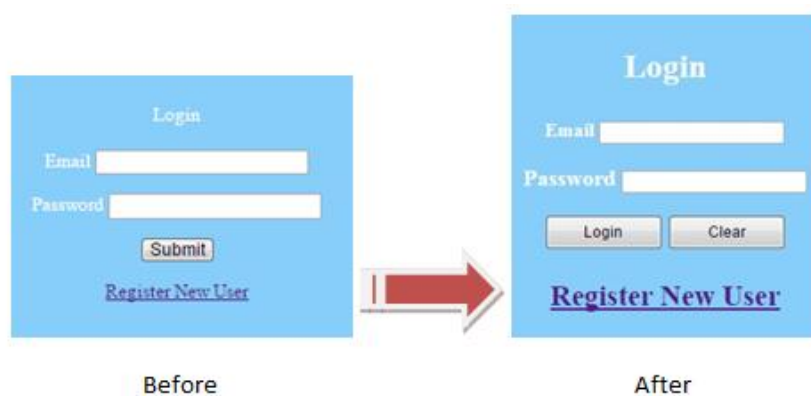
Picture 6.4:Tutorial, Step by Step Evaluation Procedure

Second Suggestion: Give external link to provide details on the terms that are used in the system. Even we have put links to topics on the subject of the evaluation system to help users to understand better the services which is offered on the system. [Picture 6.5].



Picture 6.5: Helpful links in the main form of the system

Third Suggestion: Improve the look of the login form to the system by improving the fonts.(Improve the Login Form Page and Register Form – The fonts weren't very good looking)[Picture 6.6, 6.7].



Picture 6.6:Improve Login form

The image shows a registration form with a light blue background. At the top, it says "Registration Form". Below this, there are five input fields: "Name", "Surname", "Email", "Password", and "Confirm Password". Each field has a small cursor icon. At the bottom of the form, there are two buttons: "Submit" and "Clear".

Picture 6.7: Improve Registration form

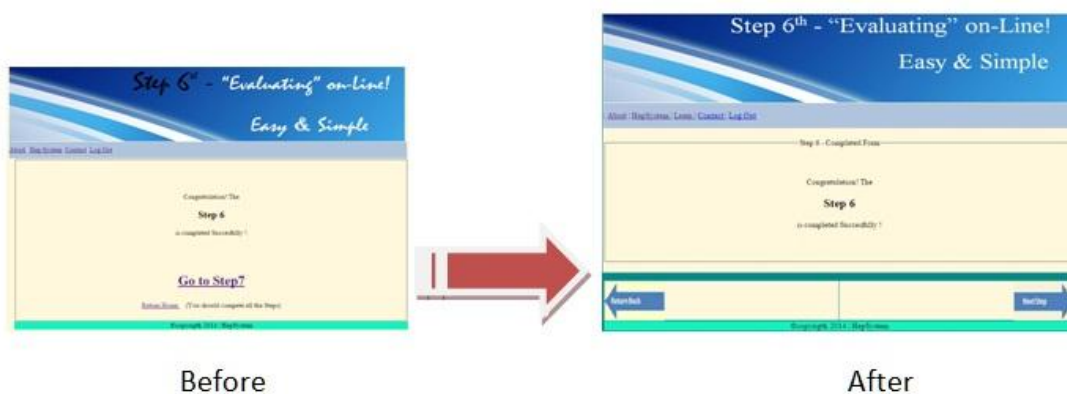
Fourth Suggestion: System could be more simply - with a more organized format.

- a) The buttons, "create" and "evaluate", are separated in order to be more understandable to users .User must create a plan using the form "create" and then proceed with the evaluation using the form "Evaluate". The form "Create Form" doesn't exist anymore [Picture 5.19]. User can complete evaluation procedure with this change in the HepSystem avoiding all buttons that are presented,[picture 5.19].



Picture 6.8: Create and Evaluate buttons

- b) The forms are simplified for user.Bows are used to the right and left of the forms to make it simpler and easier to user following the course of procedure [picture 6.9].

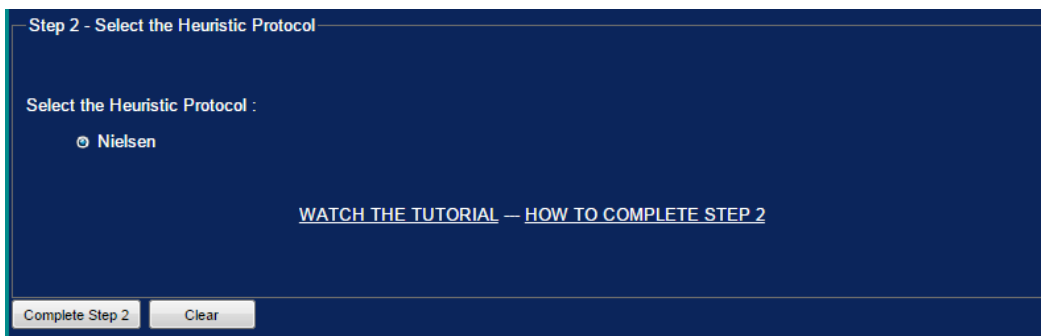


Picture 6.9: Improve Steps

- c) Same colors and motto are used for all pages of HepSystem. Users shouldn't have the feeling that they leave from the HepSystem when they change form.

Fifth Suggestion: The information on the learn page is lengthy - Examples would be more helpful.

Example is given in the main page of the evaluation system, therefore I think that there is no need to make any improvements in the learn page. Also a tutorial is provided at every step explaining to user how to complete the step's form. For example in [picture 6.10] which is below we can notice that there is a video link "Watch the Tutorial" explaining to user how to complete the form of the Step2.



Picture 6.10: Improve information in Steps

Also independently from video link there is the option to use the next link which is also very helpful. The link "How to complete step 2" is not video tutorial but a new page explains the purpose of step and how to be completed.

Sixth Suggestion: The header, where one might expect a company or other entity name, is just some extremely difficult to read slogan of some sort.

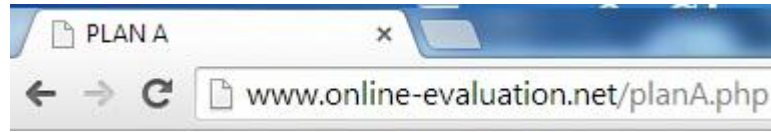
The following modification on the headers was done [picture: 6.11].



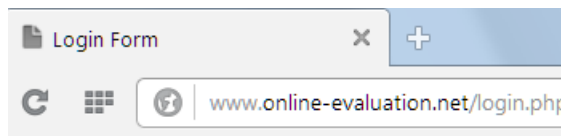
Picture 6.11: Improve the Header

Seventh Suggestion: Put title in the tabs. Some tabs have no title.

All tabs of the system have been checked and corrected in order to have a title.



Picture 6.12 : Title in the tabs – Plan A



Picture 6.13 : Title in the tabs – Login Form

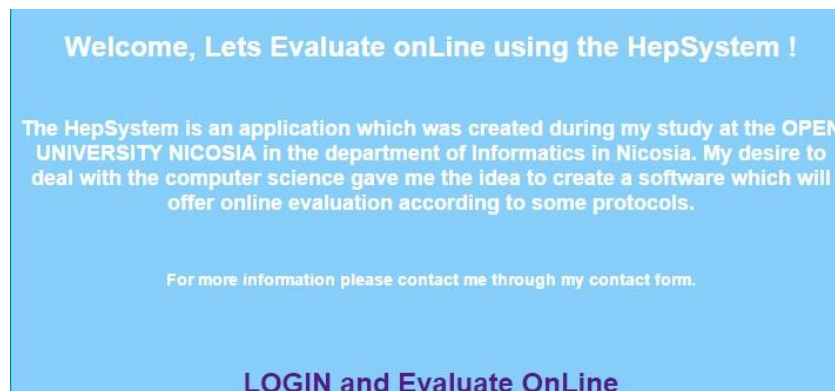
Eight Suggestions: The script on home form is a little hard to read - And the type size is on the small side. All pages and forms of HepSystem have been improved in order to be easily read. The font has changed, and the background was improved anywhere was needed [Picture 6.14] [Picture 6.15].



Old Header

New Header

Picture 6.14: Improvements of Header



Picture 6.15: Improve size of Fonts

Ninth Suggestion: Improve the size and the font of the buttons.



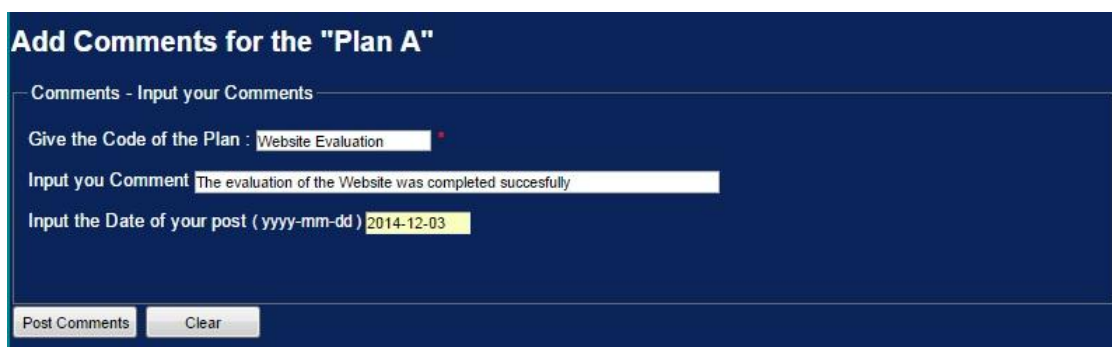
Picture 6.16: Improvements of the Buttons

Tenth Suggestions: Feel that there should be a testimonial section, so that others who come to the site can see how others used it.

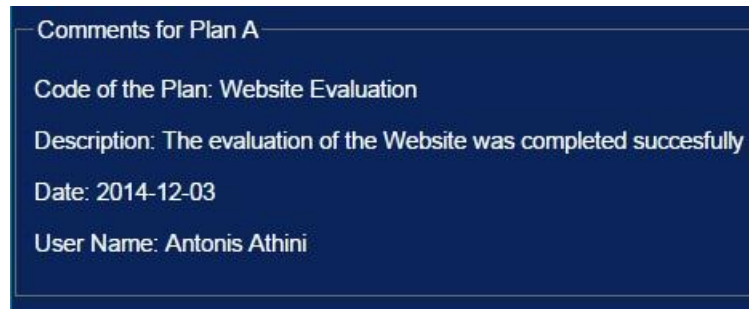
There is an option to user to post comments for evaluation or for HepSystem. Moreover user of HepSystem has access to other users' comments and reply to their comments regardless if it makes «evaluation» or not.

Furthermore the user can use the option “Report-History” and be informed about other user’s evaluation.

Also if you need more information you can use the option “Search – History » which also can have access to all projects, so it may be updated.

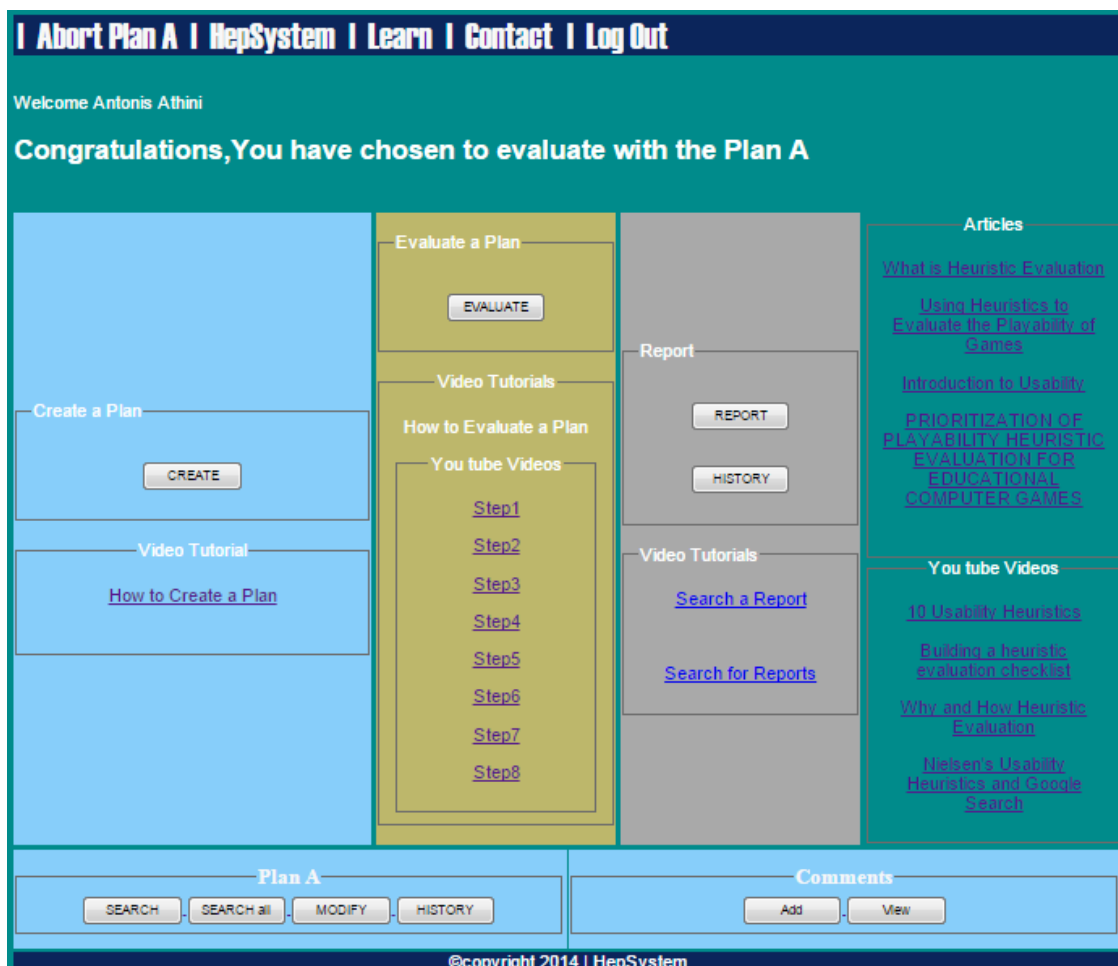
The image is a screenshot of a web form titled 'Add Comments for the "Plan A"'. The form has a dark blue background with white text. At the top, it says 'Comments - Input your Comments'. Below this, there are three input fields: 'Give the Code of the Plan : Website Evaluation', 'Input you Comment The evaluation of the Website was completed succesfully', and 'Input the Date of your post (yyyy-mm-dd) 2014-12-03'. At the bottom of the form, there are two buttons: 'Post Comments' and 'Clear'.

Picture 6.17: Form for adding Comments



Picture 6.18:View the Comments

Eleventh Improvement: Improve the main form of HepSystem to be more understandable and friendlier. The system is separated into 3 main parts. The first part is to create the plan. The second part is to evaluate online and the third part is the reports. The other parts of system are the buttons and tutorial links that are presented to the bottom of form.



Picture 6.19 : Improvement on the main form of the system

Twelfth Improvement: This improvement wasn't suggested by experts but it was introduced afterwards on system. According to Nielsen heuristic No.2 (H2) said that: "Match between system and the real world".

So, some simple but very useful improvements were done for better understanding program's procedure such as the names of the buttons. For example, some buttons were called «Submit» and renamed «Search». This change was made to help users who are not experts on computers. Consequently the rename of the button "Submit" to "Search" is understandable to everybody [Picture 6.20].



Picture 6.20 : Rename the Labels of the buttons

Chapter 7

CONCLUSION

7.1 INTRODUCTION

This study leads to some conclusions concerning the modern society and the features that have created due to technological revolution. Taking for granted that a large group of people are involved with the computer games makes us to understand that the demand of our times is to develop usability of programs.

Until today, the effort of designing usability programs is insufficient as on theoretical and practical point of view. Specifically the study found that most electronic games cannot lag on educational

and graphic design, but on complexity issue to navigate. As a result users without sufficient knowledge in new technologies, fail to complete computer games and therefore they are disappointed.

The main purpose of this thesis focuses on the design of a practical plan taking into account the needs and user's experience, combining the existing theories on the subject. This thesis introduces an innovative element, creating an online tool which can evaluate any digital system in the world of communication and information (websites, iPod, games, etc.).

Therefore, the design of this program has the following goals :

- 1) To give the possibility to the users to make comments and express their opinions during the evaluation, referring to websites or online games which either have visited or have been involved.
- 2) To have the ability to refer back to the site and to notice reviews and evaluations concerning a specific game or a website.
- 3) To have the ability for easy and quickly access to the reviews and to create an account (Member), where the content of critics who will observe will be free.
- 4) To have the ability observing the existing reviews and create a new which is based on its own review.

The above program's goals have been largely achieved. The system is able to offer a comprehensive evaluation process allowing the user to evaluate, to refer back to previous evaluations related to video games or websites .In addition offers the user quick and easy access to reviews of other users.

During system's design were combined previous theories of usability and specific references concerning the evaluation of electronic systems with the main axis the evaluation of digital games?

During the planning development and after completion, the system underwent to a usability testing with real users in order to check first whether they understand how the website works and secondly that there are no misunderstandings or difficulties of using the program. Furthermore, to be collected as much accurate information for system as possible. After testing was completed they have been improvements on system.

7.2 LIMITATIONS OF THE RESEARCH

Although, this system which was designed has been achieved its goals to a large extent, but still needs more planning in order to reach the high quality, which is required to approach the actual product that will be available to users. Therefore in this thesis is not possible to estimate whether the new system which was designed, will bind the user to complete the evaluation on real data. In case the system will be completed and incorporated into a real environment for some time by users, then it will be possible to evaluate the results that support many researchers through feedback.

7.3 CONTRIBUTION OF THESIS

After a long study to existing evaluation systems, especially in computer games, social networks, HepSystem is designed to improve the existing evaluation.

Thus, this study provides useful information for users, students, and for the other disciplines that are involved in web design such as graphic designers, computer systems designers, developers etc.

The dissemination and the constant evolution of electronic systems and demands of modern society for easier access to technology, requires by experts to adopt and implement innovative practices and not allowing system designers to be in rest. The goals must be constantly redefined, so the strategies and methods of evaluation that electronic applications follow.

Therefore the results of the research and the HepSystem which was designed, during the completion of postgraduate thesis will be beneficial:

A) To be sent to the working groups dealing with the design and evaluation of digital games.

B) To be published and present its results to the wider academic community (in journals etc).

7.4 SUGGESTIONS FOR FUTURE RESEARCH

The HepSystem is maybe the only free platform which has free access to evaluation for digital video games and websites. The results satisfactorily reflect the user's experience in evaluating issues and help to improve the program.

Therefore, the further research is suggested, completing the design of the system basing on anthropocentric methodology and continuous evaluation with possible different ways in order to timely discover and correct the problems. Completing the program's design is considered necessary to create a group that includes all disciplines that are required eg. Programmer, researcher and even electronic systems designer to fully implement the website. Also the incorporation of sounds and software to cover the needs of users with specific needs should be included in order to complete the system.

Moreover, when the system will be completed is proposed to investigate its effectiveness in two levels. Firstly, if this evaluation form which is designed, will bring improvements in digital games and electronics. Secondly, if possible failures of systems related to their design will be reduced. At the same time should be investigated for electronic tools that prefer the diverse population of users.

Finally, it should be immediately conducted a more systematic comparative users' research whether they prefer the new assessment system than previous and if they find it easier to use and more functional. Furthermore it should be investigated if they really change the existing evaluative system, will bring the expected benefits both, users and experts, in order to promote such evaluation systems on a large population that are seen by many theorists researchers.

BIBLIOGRAPHY

- [01] George, L. & Fogg, B. J., & Tseng, H. (1999, May). The elements of computer credibility. In Proceedings of the SIGCHI conference on Human Factors in Computing Systems (pp. 80-87). ACM.
- [02] Nielsen, J., and Molich, R. (1990). Heuristic evaluation of user interfaces, Proc. ACM CHI'90 Conf. (Seattle, WA, 1-5 April), 249-256
- [03] Molich, R., and Nielsen, J. (1990). Improving a human-computer dialogue, Communications of the ACM **33**, 3 (March), 338-348.
- [04] Nielsen, J. (1994). Heuristic evaluation. In Nielsen, J., and Mack, R.L. (Eds.), Usability Inspection Methods. John Wiley & Sons, New York, NY.
- [05] Obradovich JH, Woods DD. Users as designers: how people copewith poor HCI design in computer-based medical devices. HumFactors 1996;38(4):574–92.
- [06] Lin L, Isla R, Doniz K, Harkness H, Vicente KJ, Doyle DJ. Applying human factors to the design of medical equipment: patient-controlled analgesia. J ClinMonitComput 1998;14(4):253–63.
- [07] Sawyer D, Aziz KJ, Backinger CL, Beers ET, Lowery A, Sykes SM, et al. Do it by Design: An Introduction to Human Factors in Medical Devices. US Department of Health and Human Services, Public Health Service, Food and Drug Administration, Center for Devices and Radiological Health; 1996
- [08] Food and Drug Administration. Human Factors Implications of the New GMP Rule. Overall Requirements of the New Quality System Regulations. Available from: <http://www.fda.gov/cdrh/humfac/hufacimp.html> [2000, June 27]; 1998.

- [09] Kieras D. Using the keystroke-level model to estimate execution times. Unpublished report. Ann Arbor: Department of Psychology, University of Michigan; 2001.
- [10] "Shneiderman's Eight Golden Rules of Interface Design". Faculty.washington.edu. Retrieved 2011 09-20.
- [11] Kuk, George, Gow, Ian. Digital divide and quality of electronic service delivery in local government. In 2002 International Conference on the Digital Divide: Technology & Politics in the Information Age. 2002.
- [12] Tambouris, Efthimios, Gorilas, Stelios and Boukis, George. 2001. Investigation of Electronic Government. Available in : www.eurociti.org.br, 12/02/2005.
- [13] Strejcek, G. and Theilb, M. 2003. Technology push, legislation pull? E-government in the European Union. Decision Support Systems, Vol. 34, No. 3, pp. 305-313
- [14] Watson, T. Mundy, B. A Strategic Perspective of Electronic Democracy. In Communications of the ACM, Vol. 44, No. 1, pp. 27-30. 2001
- [15] Zazenlenchuk, T., In Search of the Holy Grail: Alternatives to Nielsen's Heuristics. 2004. http://www.indiana.edu/~usable/utips/february_03.htm, 13/01/2005.
- [16] Nielsen, J. Usability Metrics. Disponivelem <http://www.useit.com/alertbox/20010121.html>, 15/05/2004.
- [17] Tambouris, E., Liotas, N. and Tarabanis, K. (2007), A framework for Assessing eParticipation Projects and Tools, Proceedings of the 40 Th Annual Hawaii International Conference on System Sciences (HICSS), p. 90
- [18] Nielsen, J., Designing WEB Usability: The Practice of Simplicity. New Riders Publishing, 2000.
- [19] Wood, F. et al. A Practical Approach to e-Government Web Evaluation. IEEE Computer Society. p. 22-28. 2003.

- [20] Nielsen, J. Ten Usability Heuristics. Available on <http://www.useit.com/papers/heuristics/heuristic list.html>, 14/10/2004.
- [21] Korhonen H, Koivisto E.M.I Playability Heuristic for Mobile Games. In Proceedings of the 8th conference on Human-Computer Interaction with Mobile Devices and Service, MobileHCI '06, ACM Press (2006), pp. 9-16
- [22] Koivisto, E.M.I. and Palm, T. Iterative Design of Mobile Games. In Proceedings of Game Design and Technology Workshop, Liverpool, UK, 2005.
- [23] Federoff M. Heuristics and Usability Guidelines for the Creation and Evaluation of FUN in Video Games. Thesis at the University Graduate School of Indiana University, 2002.
- [24] Cornett S., The Usability of Massively Multi-player Online Roleplaying Games: Designing for New Users. In Proceedings of ACM CHI 2004, ACM Press (2004) pp. 703-710.
- [25] Zagal J.P., Nussbaum M., Rosas R., A model to Support the Design of Multi-player Games, *Presence: Teleoperators and Virtual Environments*, Vol. 9, No 5, MIT Press, 2000, pp. 448-462.
- [26] Bruckman A, Curtis P, Figallo C, Laurel B, Approaches to Managing Deviant Behaviour in Virtual Communities. In *Proceedings of ACM CHI 1994*, ACM Press (1994), pp.183-184.
- [27] Björk, S., Holopainen, J. Patterns in Game Design. Charles River Media, Hingham, MA, 2005.
- [28] Neumann.: Audit Trail Analysis and Usage Collection and Processing. Technical Report Project 5910, SRI International (1985).
- [29] N. Nurmaliani, D. Zowghi and S. Williams.: Using Card Sorting Technique to Classify Requirements Change. IEEE International Requirement Engineering Conference, Kyoto, Japan, pp 240-248 (2004).
- [30] John McHugh, Alan Christie and Julia Allen.: The Role of Intrusion Detection Systems. IEEE Software, pp 42-51 (2000).

- [31] Dhanjani Nitesh and Clarke Justin.: Network Security Tools. O'reily Media Inc. (2005).
- [32] SANS Institute: Intrusion Detection System: Definition, Need and Challenges (2001).
- [33] Zhou Andrew, Blustein James and Heywood Nur-Zincir: Improving Intrusion Detection System through Heuristic Evaluation. IEEE CCECE 2004-CCGEI, Niagara Falls, pp.1641-1644 (2004).
- [34] Masone, C. and Smith, S.: Towards Usefully Secure Email, IEEE Technology and Society Magazine 26(1), pp. 25-34 (2007)
- [35] Weiser M. and Brown J. S.. Designing calm technology. Internet: <http://www.ubiq.com/weiser/calmtech/calmtech.htm>, 1995.
- [36] Mynatt E., et al. Digital family portraits: Providing peace of mind for extended family members. In Procof CHI 2001, pp. 333–340. ACM Press, 2001.
- [37] Nielsen J. and the Nielsen Norman Group. Internet: <http://www.useit.com/papers/heuristic/>, 2002.
- [38] Nielsen. J. Noncommand user interfaces. Communications of the ACM, 36(4):83–99, Apr. 1993.
- [39] Baker K., et al. Empirical development of a heuristic evaluation methodology for shared workspace groupware. In Proc. of CSCW 2002, pp. 96–105. ACM Press, 2002.
- [40] Dinesh Katre Ganesh Bhutkar, and Shekhar Karmarkar.: Usability Heuristics and Qualitative Indicators for the Usability Evaluation of Touch Screen Ventilator Systems. Human Work Interaction Design, Usability in Social.
- [41] Nielsen, J. 1992. Finding usability problems through heuristic evaluation. Proceedings ACM CHI'92 Conference (Monterey, CA, May 3-7), 373 - 380.
- [42] Malone, T.W. Heuristics for designing enjoyable userinterfaces: Lessons from computer games. In John C.Thomas and M. L. Schneider (Editors), Human Factorsin Computing Systems, Norwood, NJ: Ablex PublishingCorporation, 1982.

- [43] Desurvire, H., Caplan, M., and Toth, J. A. Using heuristics to evaluate the playability of games. Ext.ABSTRACTS CHI 2004, 1509-1512.
- [44] Dykstra, D.J. A Comparison of Heuristic Evaluation and Usability Testing: The Efficacy of a Domain-Specific Heuristic Checklist. Ph.D. dissertation, Department of Industrial Engineering, Texas A&M University, 1993.
- [45] Nielsen, J. How to Conduct a Heuristic Evaluation. www.useit.com/papers/heuristic/heuristic_evaluation.html, 2007.
- [46] Malone, T.W., Heuristics for designing enjoyable user interfaces: Lessons from computer games. In John C.Thomas and M. L. Schneider (editors), Human Factors In Computing Systems, Norwood, NJ: Ablex Publishing Corporation, 1982.
- [47] Bias, R, 1994, "The pluralistic usability walkthrough: coordinated empathies", in Nielsen, J,and Mack, R, (eds), Usability Inspection Methods, John Wiley and Sons, New York.
- [48] Desurvire,H.W.,Kondziela,J.M.&Atwood, M.E. What is gained and lost when using evaluation methods other than empirical testing. In Proceedings of HCI International 1992, Cambridge University Press, A.Mark, D.Diaper,M.D.Harrison (Eds),1992
- [49] Falstein, N. and Barwood, H. The 400 Project. Available at http://theinspiracy.com/400_project.htm.
- [50] Federoff, M. User Testing for Games: Getting Better Data Earlier. Game Developer Magazine (June 2003).
- [51] Desurvire, H., Jegers, K., Wiberg, C.: Evaluating Fun and Entertainment: Developing A Conceptual Framework Design of Evaluation Methods. In: Facing Emotions: Responsible experiential design INTERACT 2007 conference, Rio, Brasil (2007)
- [52] Fullerton, T., Swain, C., Hoffman, S. Game Design Workshop: Designing, Prototyping, and Play testing Games, CMP Books, 2004.
- [53] Koeffel CA (2007) Heuristics for tabletop games. Master's Thesis, Department of Digital Media, Upper Austria University of Applied Sciences Hagenberg.

- [54] Desurvire, H., Wiberg, C.: Master of the Game: Assessing Approachability in Future Game Design. In: ACM CHI 2008 conference, CHI 2008 International Conference on Computer Human interaction Florence Italy (2008)
- [55] Clanton, C. An Interpreted Demonstration of Computer Game Design. In Proc. CHI 1998, 1-2.
- [56] Cherny, L., Clanton, C., and Ostrom, E. Entertainment is a Human Factor: A CHI 97 Workshop on Game Design and HCI. SIGCHI Bulletin 29, 4 (October 1997), 50–54.
- [57] Shelley, B. (2001). Guidelines for developing successful games. Gamasutra, Online Journal.
- [58] Fogg, B. J., & Nass, C. (1997b) How users reciprocate to computers: an experiment that demonstrates behavior change. In Proceedings of CHI 1997, ACM Press, 331-332..
- [59] Nielsen, J. Heuristic evaluation. In Nielsen, J. and Molich, R.L (eds.) 'Usability Inspection Methods', New York: John Wiley & Sons, 1994.
- [60] Shneiderman, B., Designing the User Interface: Strategies for Effective Human-Computer Interaction: Third Edition, Addison-Wesley Publ. Co., Reading, MA (1998).
- [61] Bias, R. The pluralistic usability walkthrough: coordinated empathies. In Usability Inspection Methods, CHI 2008 Proceedings · Game Zone April 5-10, 2008 · Florence, Italy 1461 Nielsen, J. and Mack, R.L., Eds. John Wiley & Sons, New York, (1994), 65–78.
- [62] Annett, J. and Duncan, K.D. Task analysis and training design. Occupational Psychology 12, (1967), 211-221.
- [63] Shepherd, A. Analysis and training in information technology tasks. In Task Analysis for Human-Computer Interaction, Diaper, D., Ed. Ellis Horwood, Chichester, (1989), 15-55.
- [64] Nielsen, J. "Why You Only Need to Test with 5 Users", 4/26/2014. <http://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/>.

ANNEX

Table 1: Nielsen's Usability Heuristics

A/A	Heuristic and Description
1	Visibility of system status
2	Match between system and the real world
3	User control and freedom
4	Consistency and standards
5	Error prevention
6	Recognition rather than recall
7	Flexibility and efficiency of use
8	Aesthetic and minimalist design
9	Help users recognize, diagnose, and recover from errors
10	Help and documentation

Table 2 : Nielsen and Shneiderman heuristics

A/A	Heuristic and Description
1	[Consistency] Consistency and standards. Users
2	[Visibility] Visibility of system state. Users should be
3	[Match] Match between system and world. The image
4	[Minimalist] Minimalist. Any extraneous information
5	[Memory] Minimize memory load. Users should not
6	[Feedback] Informative feedback. Users should be given
7	[Flexibility] Flexibility and efficiency. Users always
8	[Message] Good error messages. The messages should
9	[Error] Prevent errors. It is always better to design interfaces
10	[Closure] Clear closure. Every task has a beginning
11	[Undo] Reversible actions. Users should be allowed to
12	[Language] Use users' language. The language should
13	[Control] Users in control. Do not give users that impression
14	[Document] Help and documentation. Always provide