

Comparison of heuristic evaluation and user testing of public administration portal

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Abstract—This paper presents results of comparison of heuristic evaluation and user testing of usability of Czech public administration portal. Because there does not a list of heuristics for public administration portal evaluation exist, the methodologies for heuristics creation and heuristics application were suggested. At the same time, suggested methodologies were used for usability evaluation of the Czech public administration portal and results were compared to results of user testing of the same information system. This comparison can be useful when deciding what method to use for usability evaluation of this type of information system.

Keywords— heuristic evaluation, public administration portal, usability, usability engineering, user testing

I. INTRODUCTION

PUBLIC administration portal is an uniform access point to guaranteed information and electronic services of the public administration designated for citizens, enterprise subjects and public administration institutions. In the Czech Republic this portal is located on the URL address <http://www.portal.gov.cz>.

From the beginning this portal contends with criticism to its visual aspect. Although the portal passed a lot of important changes, its structure is the same and its user interface is not considered user friendly and intuitively for its end users.

But the usability of a user interface becomes extraordinary important in today's information age. The discipline dealing with it - usability engineering is quite new in terms of history, experience and number of trained people. An importance of the usability evaluation increased rapidly in last 10 years [1]. In contrast to the past, users are no longer forced to use particular product that does not fully satisfy their needs or requirements, just because there does not exist any other product. That is also why the measuring of usability had been underestimated.

At present, the usability is a fundamental part of software engineering [2]. It can reveal qualities of product as well as lack of functionality, which usually arises during the design phase. Moreover, the usability evaluation is not only limited to evaluating the quality of use of software products, it can test almost any kind of product that has an user interface such as remote controller as well as a cell phone [3], [4], [5].

II. PROBLEM FORMULATION

According to the [6], the term “usability evaluation method” is used to refer to any method or technique performing a usability evaluation of UI at any stage of its development. In [7] the usability evaluation methods are divided into three groups (e.g., [8] states five groups):

- user-centered evaluations (usability testing methods),
- expert-based evaluations (inspection methods),
- model-based evaluations.

These methods differ depending on the source used for the evaluation. This source can be users, usability experts, or models. All three methods rely on usability engineers or usability professionals to design, conduct, analyze, and report on the evaluations [8], [9].

TABLE 1
EVALUATION METHODS

Method	Analysis	Design	Testing
Card Sorting	x		
Kontextual interviews	x		
Focus groups	x		
Heuristic evaluation		x	x
Individual interviews	x	x	x
Paralel design		x	
On-line survey	x	x	x
Task analysis	x		
User testing	x	x	x
Use cases	x		

As stated in [2], user testing with real users is the most fundamental usability evaluation method and is in some sense irreplaceable, since it provides direct information about how end users use products and what their exact problems are with the concrete interface being tested.

During usability testing, participants use the system or a prototype to complete a specified set of tasks while the evaluator or specialized software records the results of the participants' work. The evaluator then uses these results to derive usability measures, such as the number of errors

and task completion time [2], [10]. Nielsen [11] claims that a usability test with five participants will typically reveal 80% of the site-level usability problems (e.g., home page, information architecture, navigation, etc.) and 50% of the page-level problems (e.g., understandability of the navigation structure).

In contrast to user-centered evaluations a usability inspection consists of evaluation methods whereby an evaluator examines the usability aspects of a UI design with a respect to its conformance to a set of guidelines [8].

The fundamental goal of all inspection methods is to find usability problems in an existing interface design and then use these problems to make recommendations for improving the usability of an interface [2].

Guidelines can range from highly specific recommendations to broad principles. Unlike the other usability evaluation methods, inspection methods fully rely on evaluator's judgment. A large number of detailed usability guidelines have been developed for web interfaces, some of them can be found for instance in [2], [12], [17].

Commonly used inspection techniques are heuristic evaluation [2] and cognitive walkthroughs [13]. The former is considered easy to learn, while the latter is considered neither as easy to learn nor easy to apply [14].

In heuristic evaluation, one or more evaluators independently evaluate an interface using a list of heuristics. After evaluating the interface, the evaluators aggregate their findings and associate severity ratings with each potential usability problem. The output of this evaluation is typically a list of possible usability problems [2].

A heuristic evaluation is the most informal inspection method [14], mainly because it relies on a small set of usability criteria. Since the heuristic evaluation is very cheap, fast and easy-to-use [14], it is therefore the most widely used inspection method [7].

Studies as [14] have also shown that the simpler the technique, the more effective the method is for identifying usability problems.

Actually, the most used usability evaluation methods are the user testing and heuristic evaluation. These methods have both advantages and disadvantages that are shown in the table 2. The heuristic evaluation appears favorable for cheap and quick finding of the most significant usability faults of an existing user interface.

Although some defined sets of heuristic criteria exist, there does not a formulated methodology of heuristic criteria creating exist. Existing criteria are often overly general and cover only common types of software interfaces. Sometimes a necessity to have a heuristics set available for the heuristic evaluation of nonstandard software can emerge.

Therefore, the goal of this paper is to suggest a methodology for heuristics creation and heuristics application for a heuristic evaluation of usability aspect of given user interface.

The requirements to the suggested methodology are:

- Systematic character (individual activities of the methodology have to be systematically organized)
- Simplification (simplified and illustrative description of a solved situation)
- Homogeneity (all parts of the methodology have to be suggested in the same manner)
- Measurability (parameterization and measurability of facts)
- Objectivity (objectivity of methodology results)
- Unambiguity (exact definition of all activities)

Except it, this methodology will be applied for a case study – heuristic evaluation of the Czech public administration portal.

III. METHODOLOGY OF HEURISTICS CREATION

A. Model of heuristics creation

The goal of this methodology is to create a suitable set of heuristic criteria that can be used for the usability evaluation of given information system – the Czech public administration portal in this case. The suggested steps of this methodology are shown on the Fig. 2.

TABLE 2
COMPARISON OF HEURISTIC EVALUATION AND USER TESTING

	Heuristic evaluation	User testing
Advantages	<ul style="list-style-type: none"> - Quick and cheap feedback for designers. - Easy of use. - Lower time demand. - Possibility of application of theoretical and practical experiences. 	<ul style="list-style-type: none"> - Findings are drawn from behaviour of real users, - Some usability problems can not be revealed by other methods. - It is executed in real conditions and it is possible to measure time necessary for task completion.
Disadvantages	<ul style="list-style-type: none"> - Dependency on concrete person that is doing analysis. - Necessity of using quality heuristic criterias. 	<ul style="list-style-type: none"> - Time and financial demands. - Dependency of results on participanta selection. - Necessity of multimedia equipment.

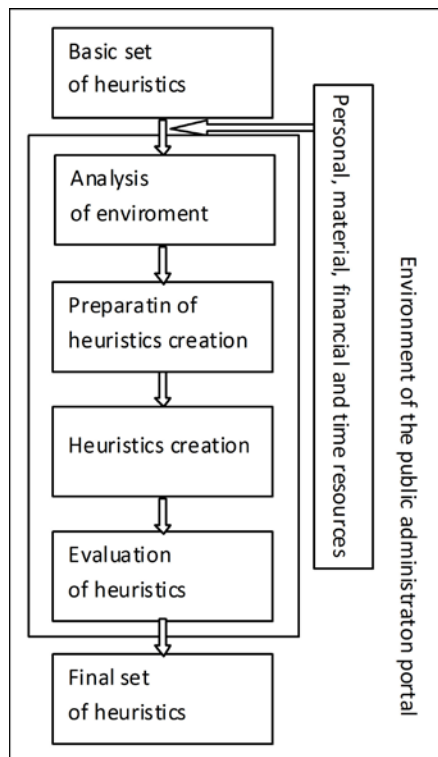


Fig. 1 Model of heuristics creation

B. Basic set of heuristics

Inputs to the suggested model are existing sets of known heuristics published by practitioners for different types of user interface. Simultaneously own heuristics based on previous experiences with given information system can be added.

C. Specification of requirements on resources

Four working roles are necessary for the heuristics creation:

- Project manager – project coordination, administration, training, communication with the main expert.
- Main usability expert – supervision, heuristics addition, validation of the result set of heuristics, assessment of accordance of the user and expert evaluation of heuristics.
- Member of project team 1 – a usability expert, creation and modification of the basic set of heuristics, evaluation of the suggested set of heuristics.
- Member of project team 2 – an end user, evaluation of the suggested set of heuristics.

The recommended number of team 1 and team 2 members is from 3 to 5 [13].

D. Environment analysis

An environment analysis consists of familiarizing with the concrete type of user interface and its specificity. It is necessary to familiarize with the basic functionality of system, end users and given environment where the system is used.

E. Preparation of heuristics creation

This phase includes activities necessary for resources acquiring, especially personal resources. This phase consists of these 6 steps:

1. Choice of a project manager
2. Choice of a main usability expert
3. Training of a main usability expert
4. Project teams forming
5. Training of project team members
6. Assignment of a workplace and equipment

F. Heuristics creation

During this critical phase the project team 1 selects, categorizes, adds and modifies the basic set of heuristics. This phase consists of four steps:

1. Choice of a scale for the heuristics importance rating
2. Definition of thematic heuristic categories
3. Assignment of heuristics to defined heuristic categories
4. Modification of heuristic sets

As a scale for the heuristics importance rating we suggest the five-degree scale (1 - not important, 2 - less important, 3 - medium important, 4 - important, 5 - highly important).

As an inspiration for the heuristics categories defining can be Nielsen [7] that suggests 10 categories like an aesthetics and minimalist design, help and documentation, visibility of the system status and so on.

An assignment of heuristics to heuristic categories is executed by the project team 1 with help by focus group method. Basic heuristics can be modified and added at this phase.

The set of heuristics is adjusted by project team 1 on the base of the following rules:

- Heuristic criterion has to fit to a category for the target system.
- Heuristic criterion has not be duplicate with other criterion.
- Heuristic criterion has to be defined clearly and simply.

G. Evaluation of heuristics

The result of this phase is a final set of heuristics. This phase consists of three steps:

1. Evaluation of heuristics from the importance point of view.
2. Aggregation of values for both project teams.
3. Assessment of the rate of correspondence between both project teams.

The evaluation of heuristics is carried out both by project team 1 and project team 2. The goal is to get a perspective from both an expert and real user point of view. Every team member gets a list of heuristics and evaluates heuristics from importance point of view.

The goal of the third step is to exclude criteria that both project teams assessed overly differently and exclude criteria that are not so important.

IV. METHODOLOGY OF HEURISTICS APPLICATION

A. Model of heuristics application

The goal of the heuristics application methodology is to evaluate the user interface of given information system from the usability point of view.

This evaluation can be useful for different reasons. The first reason can be a necessity to expose usability problems before these problems are solved. The next reason can be necessity to compare different versions of a system and investigate whether a new version has usability improvements. Another reason can be the possibility to compare two and more products from the usability point of view.

The model of this methodology is shown on the 2.

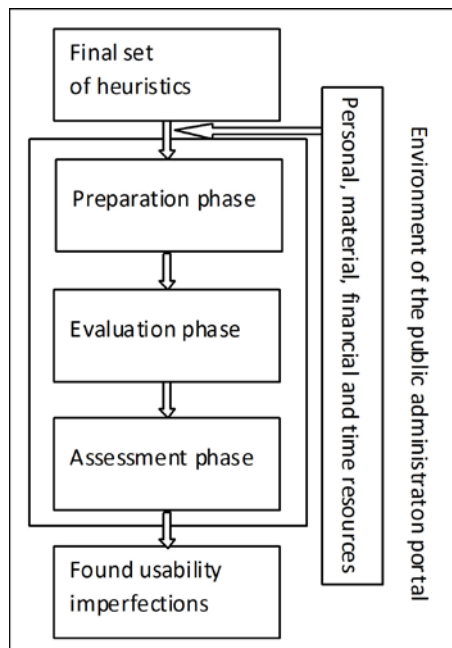


Fig. 2 Model of heuristics application

B. Final set of heuristics

The input to this model is a final set of heuristics created with help of the methodology of heuristics creation.

C. Specification of requirements on resources

Three working roles are necessary for heuristics application:

- Project manager – project coordination, administration.
- Main usability expert – preparation of heuristic evaluation, managing of evaluation, data processing, formulation of results.
- Project team – evaluation of a user interface by the set of heuristics.

D. Preparation phase

Preparation phase consists of two steps:

1. Project team creation
2. Suggesting of heuristic seriousness scale

As heuristic seriousness scale we suggest the following scale:

- 0- I do not agree that it presents a usability problem.
- 1- It is a cosmetic problem only.
- 2- It is a problem with less importance, solving it has a low priority.
- 3- It is an important usability problem with high priority of the solving.
- 4- It is a critical usability problem, it is necessary to solve it before the system is switched up.

E. Evaluation phase

Evaluation phase consists of two steps:

1. Training of evaluators
2. Evaluation of the user interface

During evaluation of user interface every team member is checking the user interface by the final set of heuristics. When a heuristic is not fulfilled, the importance of this fault is noted.

F. Assessment phase

Assessment phase consists of three steps:

1. Data processing
2. Evaluation of found usability lacks

G. Found usability imperfections

The outputs are found usability lacks. The suggestion of the problem solving can be attached to the usability testing report.

V. CASE STUDY: HEURISTIC EVALUATION OF THE PORTAL

A. Heuristics creation

As a case study of heuristic evaluation a usability evaluation of the Czech public administration portal was chosen.

A heuristic list suggested by University of Minnesota Duluth [14] was used as the input to our methodology. This set contains extensive list of heuristics divided to ten thematic categories. At the same time heuristics from the next resources [7], [10] were added to this list.

An analysis of the public administration portal showed that a graphic aspect of this portal is not compact and consistent through different sections of this web (the user interface of the portal is shown on the Fig. 3).



Fig. 3 Czech public administration portal

For example, the section “Maps” is built as an independent geographic information system with a different user interface (see Fig. 4). Therefore this section should be evaluated by a different set of heuristics and should be evaluated separately.

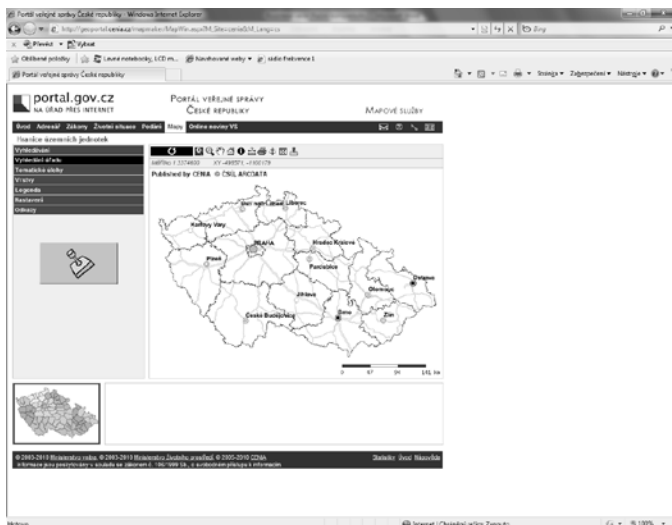


Fig. 4 Maps section on Czech public administration portal

For the heuristics creation two teams were created. The first team was represented by a usability expert, IT expert and webpage specialist. The second team was represented by three end users of the portal.

As heuristics thematic sets were defined:

- Visibility of system status
- Correspondence of system with real world
- User control and freedom
- Consistency and standards
- Esthetic and minimalist design
- Help and documentation
- Privacy

Next categories were not used because they are suitable for desktop applications only.

By this methodology 92 heuristic criteria were selected

for a heuristic evaluation of the public administration portal. These heuristics were divided to seven areas of usability aspects like an esthetics, help, documentation, and so on.

B. Heuristics application

Our evaluation team consisted of three experts – two of them were usability specialists and one was a webpage specialist. It was decided that the five degree scale would be used – the same scale like Nielsen published in his work [10].

Because a member of evaluation team was a non usability specialist, usability training was carried out. The part of this training was presentation of basic principles of the heuristic evaluation. Trainees were familiarized with the user interface of the public administration portal as well.

During evaluation the evaluators filled a form by “yes” or “no” answers. The answer “no” means that the heuristic criterion was not met. Simultaneously, evaluators filled seriousness degree of exposed issues – heuristics where the “no” was filled. The acquired data were then aggregated.

In total, 30 heuristics from 92 were not fulfilled. This heuristics were divided according the level of seriousness (see the table 2).

TABLE 2
NUMBERS OF NOT FULFILLED HEURISTICS

Seriousness of problem	Number of heuristics
4 (critical usability problem)	11 heuristics
3 (significant usability problem)	7 heuristics
2 (minor usability problem)	8 heuristics
1 (superficial usability problem)	4 heuristics

VI. RESULTS OF HEURISTIC EVALUATION

For the lack of space only critical found usability problems (heuristic violations) are presented in this paper:

1. Is a firm logo simultaneously a link to the homepage?
The logo picture of the portal is not a link to the homepage.
2. Is the URL meaningful and pleasant?
The URL address <http://www.portal.gov.cz> is hard to remember for end users.
3. Is the font size and font type suitable for easy reading?
The text is cramped and font is very small for reading.
4. Are visited and not visited web pages visually distinguished?
The highlighting of visited links is forbidden at the server.
5. Is it easy to return to the homepage by one click?
Some pages do not have a direct link to the homepage.
6. Is it easy to get to all main pages from the homepage?
The link to the transaction part of the portal is not easy to find.
7. Is it possible to expect consequence of every activity (for example a click to the link)?
Hypertext links to outside web pages are not graphically highlighted.

8. Is behavior of web pages as it is expected?
Some pages have inhomogeneous view with different menu types.
9. Are items in the main menu same through all system?
Some portal parts (maps, transaction part) have different menu position and menu items.
10. Are conventions met (for example underlined text used only for hyperlinks)?
It is not easy to recognize a link to outside web pages.
11. Is a structure of web pages simple and clear without useless complications?
The structure of the portal is very complicated by high amount of links to outside web pages. Some parts of web look differently.

VII. USER TESTING OF THE PORTAL

User testing of Czech public administration portal was conducted in 2007. Because user interface of this portal has not changed yet, the results of this experiment are still valid.

Execution of this experiment is possible divide to four steps:

1. Scenario creation
2. Choice of participants.
3. Usability testing realization
4. Evaluation of testing, found usability deficiencies

Chosen participants had to fulfill four tasks in the usability lab (see fig. 5):

1. Find out address of financial authority in Pardubice
2. Find out who has right for housing benefit.
3. Found out the living minimum in 2007.
4. Find out the maximum number of overtime hours per year.



Fig. 5 Usability lab

Five participants were chosen for the experiment:

- Payroll accountant, secondary school, female, 48 years old, specialist in social benefits, she works every day with internet.
- Call center operator, secondary school, female, 23 years old, she uses a computer every day, but internet only from time to time.
- University student, Faculty of Economics and Administration, female, 23 years old, she every day uses internet as an information source.
- Pensioner, secondary school, male, 65 years old, specialist in technology engineering, he uses a computer every day, but internet only from time to time.
- Network administrator, secondary school, male, 25 years old, he is a computers expert and he uses internet every day.

The reason for non-homogenous participant selection is a fact that public administration portals should be intended for broad spectrum of end users. That is why this sample of end users was chosen.

User testing of the public administration portal uncovered a lot of usability lacks. The most important usability lacks that were uncovered are in following areas:

- Homepage – impresses chaotically because there is a lot of information written by a very small font.
- Main menu – this menu is not well-marked and majority of end users do not notice it.
- Life situations – left menu is overly extensive, it is difficult to orientate here. Search results are not clearly arranged and they are not sorted by relevance.
- Laws – not clearly arranged presentation of individual laws, difficult searching, and difficult orientation in the individual laws.
- Searching – Results of searching are not sorted by relevance.

VIII. COMPARISON OF HEURISTIC EVALUATION AND USER TESTING OF THE PORTAL

Just as the heuristic evaluation the user testing also showed that the homepage is very chaotic and confusing. Users have a hard time by understanding the big amount of references, which, moreover, are not distinguished. So you do not know which links was already clicked on and which was not.

In addition there are three types of news on the main page - news from the public administration, required disclosures and news from portal.gov.cz. While the first two sections are updated often new reports on the portal are emerging every couple of months, sometimes for half a year. For this reason, there are quite unnecessary and should be moved.

Others problems identified by user testing are focused directly on end users, therefore, there was not possible to find by a heuristic evaluation. This is a classic example where it is better to perform both types of usability evaluation methods, because by combination of these methods it is possible to find

wide range of problems encountered in graphic design, and in a logical grouping of web functionality. If these tests were conducted at the design stage of portal development, unnecessary errors, which are also present seven years after its introduction would be avoided. As it turned out, the heuristic evaluation for usability evaluation of public administration portal is more beneficial than user testing. By heuristic evaluation it was found more usability faults resulting in total confusion of public administration portal.

IX. BENEFITS OF USABILITY IMPROVEMENTS

Economic evaluation of usability activities is important for two reasons, for demonstration of importance of usability engineering (for the cases when an organization has not integrated usability in its development process) and for effective usability engineering program planning (for the cases when an organization is mature in the sense of implementing of usability engineering).

When conducting economic analysis it is necessary to consider that the main objective of public administration institutes is not a revenue but offering of quality public services. Therefore it is necessary to consider intangible benefits as well. For example increase trust in public administration can lead to rising standard of living of inhabitant and it can results in social repose.

It is possible to mention the most important benefits of potential usability improvements of public administration portal:

- Reduction of user errors, increase success rate.
- Decrease support costs – well designed electronic forms do not need calls to an office.
- Decrease cost of traditional customer service channels – website has relatively low operating costs compared with more traditional channels for service distribution.
- More leisure time as a result of productivity increasing – Users can save a time they would spent on non-usability user interface.
- Increase a user satisfaction.
- Increase trust in the system.
- Increase trust in the public administration.
- Learning increase – it is not easily possible to train end users. Besides, the end users do not often consume the same services of public administration. End users are not readily accessible, and may not be known at all. Therefore end user interface must be extremely intuitive.
- Security increase – usability tends to minimization of user errors that can result in security risk for whole information system.

X. CONCLUSION

In this paper a methodology of heuristics creation and heuristics application is suggested. Suggested methodology is applied to public administration portal and compared to user testing. Generally, it is better to perform both types of usability

evaluation methods, because by combination of these methods it is possible to find wide range of problems encountered in graphic design, and in a logical grouping of web functionality.

Up to now, heuristic criteria sets were defined only on the base of professional experiences of usability experts. Several lists of recommended heuristics defined by leading usability experts exist, but these lists are designated for common types of web pages or desktop applications. We are sure of necessity of wide applicable methodology that can be used for heuristics evaluation of non standard user interface. Therefore we suggested that methodology and validated it when the Czech public administration portal was evaluated from the usability point of view.

Further, we created the set of heuristics concentrated to public administration portal. These heuristics can be used when different portals or different versions of the portal are compared.

In addition, we investigated the Czech public administration portal and found some imperfections in its user interface design. Elimination of this usability faults can indisputably yield important benefits. We suggest repeat this usability evaluation after important changes in the user interface of this portal.

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