EXPERIENCE WITH USABILITY TESTING OF WEB PORTALS

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Abstract: The paper reports on the experience regarding usability evaluation of broad-reach web portals. The designed methodology advocates a number of usability test methods along with specialists' inspection and provides a comprehensive quantitative and qualitative assessment feedback. Our experience accords with the claim that we should not rely on isolated evaluations, but instead on combine assessment methods. In this paper we present and discuss mainly the results obtained through user-based usability evaluation. The results indicate that chosen research instruments, measures and methods for usability testing were consistent. Conversely, the results of the designed guideline inspection did not conform to the ones obtained through the end user testing. Although proved promising, some of the guideline-based evaluation aspects need improvement.

1 INTRODUCTION

Usability is the key issue in human-computer interaction (HCI) and is related to ease of use and to ease of learning. It becomes defined within a relationship among task, user and system purpose. For this reason there is no simple definition, or meaningful single measure of usability.

When considering usability of a *web portal*, a site that functions as a point of access to information on the Web, it should be noted that current research on usability evaluation is mostly concerned with focused, domain specific portals. This is the result of the global trend of portal specialization. In such context it is difficult to find any studies related to broad-reach web portal assessments.

This paper reports on the experience regarding the design of a methodology for usability evaluation of *broad-reach web portals*. The main motivation for our research came from reports stating that the most visited Croatian web sites are broad-reach web portals, implying end users and designers' familiarity with such kind of sites.

We conducted the experiment in order to evaluate how easy and efficient those broad-reach portals are. Portal usability is viewed as *efficacy in use*, considered primarily as involving measures of user performance and *ease of use*, envisaged as

involving subjective judgments. Additionally it is augmented with a significant feedback acquired through *guideline inspection*, a less formal heuristic evaluation.

A strong point in such an approach is the chance to supplement results from the guideline-based assessment with the user-based one, enhanced with a feedback on the users' pleasure while working with the portal. The results go in hand with the assertion that we should not rely on isolated evaluations. Instead, usability assessment methods should be combined, hence obtaining different kinds of usability improvement suggestions.

In this paper we discuss and present interpretations of the results achieved through employed user-based usability methods. The complementing test methods proved to be consistent. Conversely, results of the designed guideline-based evaluation were not in agreement with the ones obtained from the usability testing. Consequently, our method for guideline inspection raised a couple of concerns which will be addressed in our future work.

The paper has the following organization. Section 2 briefly introduces some background of the research, addressing web portals and web usability, providing the rationale for the methodology. An approach to usability evaluation along with achieved results is described in what follows. Section 4 brings the discussion and interpretation of findings,

additionally offering some directions for future research. Section 5 closes the paper.

2 WEB PORTALS AND WEB USABILITY

Web portal, generally considered as a single point of access to information, resources and services on a wide range of topics (Waloszek, 2001), is typically based on the more advanced technologies that go beyond simple interface of the just information based standard web page. *Broad-reach portals*, also called "general" or "generic" portals, bring together services such as search engines, e-mail, news, forums, event guides, maps, on-line shopping, travel information and the like. Accordingly, information presented in every page can be delivered to a number of users having different needs, motivations and goals which the portal design has to reflect.

Market research findings related to the Croatian web sphere undertaken in the last few years report that broad-reach portals are the most visited web sites (GFK Croatia, 2006; GemiusAudience, 2007). This is the basic distinction from the countries with high level of Internet literacy, where there are much more *specialized web portals* seen as gateways to the variety of web information related to the specific context (Tatnall, 2005). In terms of the choice of content and layout, major Croatian broad-reach portals have the semblance of the web sites of broadsheet newspapers or public service broadcasters (Tomić-Koludrović and Petrić, 2004).

On the other hand, an improvement of usability as a quality of use in context (Bevan and Macleod, 1994) is nowadays perhaps the most important goal of current research in the field of human-computer interaction. Most used assessment methods are grouped into two categories, e.g. (Nielsen, 1993; Lewis, 2005):

- *usability test methods*; user-based which involve end users, hence including user testing, focus groups, interviews, questionnaires and surveys;
- *usability inspection methods*, without end users consisting of heuristic evaluations and cognitive walkthroughs as the most often used ones.

Research related to *web usability* recently has had a tendency to bring together those two basic approaches, *cf.* (Hornbæk, 2006). Concerning *web portal usability*, it should be noted that the current studies are mostly concerned with domain specific portals. Namely, in the context of the global trend of web portal specialization, recent research related to usability evaluation is mostly concerned with the focused portals (somewhere called "vertical" or "domain specific" ones) such as enterprise or corporate portals (Boye, 2006), travel portals (Shelat and Stewart, 2004; Carstens and Patterson, 2005), news portals (Tsui and Paynter, 2004), library web portals (Brantley *et al.*, 2006), tourist portals (Klausegger, 2006), healthcare web portals (Theng and Soh, 2005) and similar.

Apparently, while there is a number of studies related to usability evaluation of specialized web portals, some additionally taking into account the particular cultural context e.g. (Theng and Soh, 2005; Tsui and Paynter, 2004; Fang and Rau, 2003), there is hardly any research dealing with *broad-reach portal assessment*.

Taking into consideration outcomes of the undertaken research concerning web portals and usually employed usability assessment methods, the aim of our study is related to the design of appropriate methodology for broad-reach portal usability evaluation. The study is placed in Croatian web sphere where broad-reach web portals are much more popular and accepted than specialized ones. Such context seems appropriate for this research, since it implies end users and designers familiarity with such kind of portals.

3 THE EXPERIMENT

In order to achieve the key objective, the design of the most visited Croatian broad-reach portals was evaluated. We conducted a controlled experiment which advocates scenario-guided user evaluations involving a number of usability testing methods used to collect both quantitative data and qualitative "remarks", *cf.* (Shackel, 1991). Furthermore, user-based testing is supplemented with less strict heuristic evaluation (Nielsen, 1994), i.e., guideline inspection. This follows the literature that suggests that usability inspection needs to be combined with usability test methods, e.g. (Holzinger, 2005; Hornbæk, 2006; Uldall-Espersen *et al.*, 2007).

Such approach, understood to be a combination of behaviour and opinion based measures obtained under experimental control which is additionally augmented with expert assessment, is described in the following.

3.1 Methodology

In the following sections we describe the experimental methodology adopted to assess the effectiveness, efficiency and satisfaction in addition

to expert evaluation of selected Croatian broad-reach portals and the results obtained.

3.1.1 Participants

The study involved thirty participants with basic computer literacy. According to their practical experience in web design, they were classified in two different groups composed of fifteen participants. The "practitioner" group was composed of three independent sub-groups of randomly chosen participants including computer science experts, marketing experts knowledgeable in Internet issues as well as students of web design. On the other hand, the "non-practitioner" group was consisted of three independent sub-groups of randomly chosen participants consisting of young participants, middle aged and elderly ones.

Furthermore, a particular group of ten "instant experts" (Wright and Monk, 1991) for guideline-based evaluation was formed. Those were web design practitioners who are familiar with the principles of the good user-centred designs in addition to the evaluation approaches and who provided usability expert assessment of the selected web portals.

3.1.2 Instruments, Measures and Portals

User assessment was conducted individually, with Internet access and a screen capturing software for tracing the users' actions and navigation. We measured task time and achievement. End user testing was based on criteria expressed in terms of few measures (ISO/IEC, 2006):

- objective performance measurement of *effectiveness* (percent task completion) in using the portal,
- objective performance measurement of *efficiency* (time on task) in using the portal and
- users' *subjective assessment* of the web portal usage.

System Usability Scale (SUS), as a simple standard, ten-item *attitude questionnaire* with five-point Likert scale (Brook, 1996), was used for the subjective valuation. As an additional subjective feedback, answers to the *semi-structured interview* were collected.

In order to perform a less formal heuristic evaluation, specifically guideline inspection, an *evaluation form* consisting of a set of adapted principles augmented with portal-related auxiliary guidelines was prepared. Individual expert's marks and comments were collected. The score for every portal was calculated as an average mark on a seven-point Likert scale.

We included four *broad-reach web portals* in our experiment: Index portal (www.index.hr), Net portal (www.net.hr), Vip portal (www.vip.hr) and T-Portal portal (www.tportal.hr). As already stated before, those portals were selected as the most visited whilst also the earliest broad-reach web portals. For an insight to a broad-reach portal user interface, a screenshot of the Vip portal is illustrated in Figure 1.
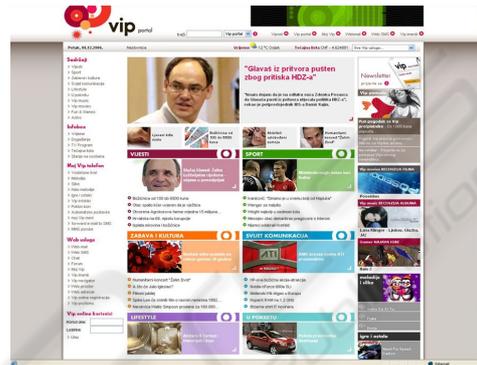
Figure 1: Screenshot of Vip broad-reach web portal.

3.1.3 Experiment Design and Procedure

In order to understand the effect of web portal design in a sample work situation, we elaborated a work scenario, a sequence of typical tasks and user actions. To test assigned tasks and time interval, clarity and unambiguousness of measuring instruments for subjective assessment and adequacy of hardware and software support, *pilot testing* was performed.

We chose three typical tasks which structure and location on the portals was not changed over time. The tasks covered different topics, offering to diverse groups of involved participants' a similar opportunity for finding task-related information. For each selected portal, undertaken tasks were the same and the probability of their completion was similar as well. See Figure 2 to get insight into the performed tasks.

The evaluation procedure was carried out individually with each test user, using a personal computer with Internet access in addition to a software and hardware support for tracing and recording results of task completion. Within each evaluation session all the portals were assessed, where the order of their evaluation was randomly selected. The allocated session's average time per every participant was 45 minutes.

SCENARIO FOR TASK-BASED TESTING

Imagine that you are interested in some information related to diverse aspects of everyday living. In order to find relevant data, you are kindly asked to refer to the respective site of Index web portal (www.index.hr) and complete three tasks.

The tasks are the following:

1. find information related to the traffic situation on A1 highway in the direction from Zagreb to Split as well as the daily temperature in Split

2. search for the today's first show on RTL television which is scheduled after 9 PM

3. find and print one recipe for the main meal

After your complete the allocated tasks, you are kindly asked to proceed with the evaluation session.

Figure 2: Undertaken tasks.

An evaluation procedure consisted of the following steps:

- task-based end user testing,
- usability satisfaction questionnaire,
- semi-structured interview and
- guideline inspection.

Task-based end user testing involved a scenario-guided user assessment with three tasks selected to show the portal basic functionality. It enabled us to determine user *efficiency* and *effectiveness* while working with the web portal. A user's objective accomplishment measure, labelled as *fulfilment*, was calculated as an average time spent on all allocated tasks weighted with successfulness of task completion. For each user, the time limit for all assigned tasks was 15 minutes per portal.

An *usability satisfaction questionnaire* supported the assessment of the users' subjective satisfaction with diverse interaction aspects. We used SUS questionnaire, as it is argued that it yields the most reliable results across sample sizes (Tullis and Stetson, 2004). Its questions addressed different aspects of the user's reaction to the portal as a whole, providing an indication of a level of statement agreement on a five-point Likert scale. Furthermore, the feedback from the questionnaire was augmented with the users' answers in a *semi-structured interview*. In this interview we additionally asked the participants to rate and comment on the portal's *visual attractiveness* as well.

End user testing of web portal usability additionally brought together with guideline-based evaluation provided a more precise broad-reach

portal usability assessment. In order to overcome the problem of not having enough usability experts who could be involved in the portal evaluation process, we had the *guideline inspection* performed by "instant experts", web design practitioners familiar with the HCI principles. A detailed evaluation form with Nielsen's usability heuristics (Nielsen, 1994), as a set of ten key principles, was adapted to portal context and augmented with a series of auxiliary guidelines, as additional explanations of web portals design *cf.* (Granić *et al.*, 2004; Wood, 2004; MIT, 2004; Preece *et al.*, 2002; Nielsen and Tahir, 2002). In the provided evaluation form experts had (i) to specify a level of their agreement with the principle/guideline and related set of auxiliary guidelines on a seven-point Likert scale as well as (ii) to provide comments in order to justify the assigned mark. Furthermore, remarks and observations concerning the overall guideline-based assessment procedure were more then welcome.

The guideline-based evaluation coupled with the task-based end user testing, the attitude questionnaire and the interview, provided a sufficient quantitative and qualitative assessment feedback. In the following we present experimental results and findings, considering in details the ones obtained by means of usability testing. Namely, due to paper length limitations, the results of guideline inspection will be addressed in our further report.

3.2 Results

Results acquired through the usability test methods in addition to the main findings obtained in guideline-based inspection are addressed in what follows.

3.2.1 Results of Usability Test Methods

Descriptive statistics of the objective accomplishment measure *fulfilment,* including arithmetic means, standard deviations and significance levels of Kolmogorov-Smirnov coefficient for normality of distribution is presented in Table 1. Result of the distribution for measure *fulfilment* on the T-Portal web portal differs significantly from normal distribution (K-S = 0.008). Accordingly, Friedman's test as a non-parametrical procedure was performed. Statistically significant value of chi square (χ^2 = 49.4, df = 3, p < 0.01) indicates the existence of differences in the objective accomplishment measure among portals (see Table 1).

Table 1: Results of objective accomplishment measure fulfilment for the four selected portals (note that lower M score means better result).

fulfilment	M	SD	K-S	M Rank	df	χ^2	p
Index portal	59.77	38.726	0.292	1.57	3	49.4	<0.01
Net portal	108.40	46.300	0.720	2.93			
Vip portal	62.13	17.211	0.656	1.87			
T-Portal portal	171.64	168.143	0.008	3.63			

Table 2: Results of subjective satisfaction measure SUS for the four selected portals (note that higher M score means better result).

SUS	M	SD	K-S	df	F	P
Index portal	75.33	18.820	0.819	29	746.94	<0.01
Net portal	56.00	25.194	0.902			
Vip portal	77.83	15.821	0.319			
T-Portal portal	51.75	23.836	0.961			

Descriptive statistics of results acquired for subjective satisfaction measure *SUS* for each and every participant on every web portal is shown in Table 2. No statistical difference in the distribution of the results from the expected normal distribution was found (K-S$_{1,2,3,4}$ > 0.05).

In order to test the difference among portals, the analysis of variance as a parametric procedure was applied. Significant F-ratio (F = 746.94, df = 29, p < 0.01) indicates the existence of differences among the portals in the results related to the obtained subjective measure (see Table 2). Additionally, we also considered all accomplished experimental results related to the two groups of participants – the practitioner group and the non-practitioner one. The differences in the user's objective accomplishment and subjective satisfaction usability measures between the two groups were tested with t-tests for small independent samples.

Statistically significant difference between the groups was found for results of the *fulfilment* measure (t = 2.95, p < 0.01). The group of practitioners showed better results on mean values (mean = 308.4, SD = 57.217) than the non-practitioners group (mean = 495.46, SD = 238.479). The mean *fulfilment* results are shown in Table 3.

Table 3: Results of objective accomplishment measure fulfilment for the two groups of participants (note that lower score means better result).

fulfilment	practitioners	non-practitioners
N	15	15
M	308,40	495,46
SD	57,217	238,479
t	2,95	
df	28	
p	<0,01	

On the other hand, a statistically significant difference was not found for the results related to the subjective satisfaction measure *SUS* (t = 1.95, p = 0.062) between the practitioner group of participants (mean = 243.17, SD = 51.317) and the non-practitioner one (mean = 278.67, SD = 48.531). Pearson's correlation coefficients for the participants' results in the achieved usability objective and subjective measures are shown in Table 4.

Table 4: Pearson's correlation coefficients of overall results (* significant correlations at level of p<0.05).

Correlations of overall results	r
SUS –fulfilment	0.14
SUS –visual attractiveness	0.41*

A statistically significant correlation coefficient was not found between overall *SUS* and overall *fulfilment*. Conversely, significant correlation was

found between overall *SUS* and score for overall *visual attractiveness*.

3.2.2 Results of Usability Inspection Method

The arithmetic means of the marks from a seven-point Likert scale of the guideline evaluation forms for assessed portals show the following results. The highest mark was given to Vip web portal (mean = 5.38), followed by Net portal (mean = 4.85), T-Portal portal (mean = 4.64) and Index portal (mean = 4.01).

Furthermore, we considered the outcomes achieved in the guideline-based evaluation in addition to the ones obtained throughout the usability testing. The ranking of the selected broad-reach web portals was compared.

Considering the objective accomplishment measure, Index portal and Vip portal scored the best result, followed by Net portal and T-Portal web portal. The subjective satisfaction measure provided similar rankings too. On the other hand, in the guideline-based evaluation Index portal achieved the lowest rank, while Vip portal remained on a high-level, followed by Net portal and T-Portal broad-reach web portal.

4 DISCUSSION AND FUTURE WORKS

4.1 Interpretation of the Results

The results of the task-based end user testing showed statistically significant differences among the assessed portals according to the measure of user's objective accomplishment. This suggests that web portals could be ranked by mean values. The results of the subjective satisfaction measure also showed differences among evaluated portals and their ranking by mean values.

It is important to point out that the measures of user's objective accomplishment and her/his subjective satisfaction were not significantly correlated. Our results are in accordance with the ones of the meta-analytic research report on correlations among usability measures calculated from the raw data of 73 studies (Hornbæk and Law, 2007). This yet again implies the appropriateness of the applied usability test methods for portal evaluation, since it confirms independence of the objective and subjective measurements.

The overall achieved results could be further related to the most frequent statements from the interviews. Namely, the participants felt especially pleased and comfortable working with the portals

where their objective achievement was high. The end users considered them as broad-reach web sites with good quality of information structure, respectable layout and straightforward navigation.

Correlation between overall *SUS* results and overall *visual attractiveness* indicates that a pleasant appearance influences the subjective perception of portal usability. The interview statements also support this finding. Namely, it happened that the users usually emphasized the portals' *visual attractiveness*, assigning high subjective ratings. Such assumption is in line with related studies which, along with the related HCI issues, also address aesthetics aspects of design, *cf.* (Tractinsky *et al.*, 2000; Hassenzahl, 2004).

The results of the objective accomplishment measure revealed expected differences between non-practitioners and practitioners, the latter being faster and more successful in the tasks' achievement. This indicates that the selected tasks and the objective accomplishment measure were consistent. On the other hand, the measure of subjective satisfaction did not show any statistically significant difference between these two groups. Such finding indicates that the questionnaire itself and its translation to Croatian language could be considered as an appropriate instrument for user subjective assessment.

Moreover, our experience suggests that the choice of the sample size in addition to the structure of engaged end users ("practitioner" and "non-practitioner" groups of participants) is also in line with the outcomes of related studies. Specifically, in the Hornbæk and Law's (2007) meta-analysis of usability measures, the average number of participants involved per study was 32 (SD = 29, ranging from 6 to 181).

Conversely, the achieved result of guideline-based assessment did not conform to the ones obtained throughout applied usability testing. The highest ranked web portal in the end user testing scored as the lowest one in the "instant expert" usability evaluation. There are two possible reasons for such an outcome − the designed evaluation form and/or the selection of usability specialists involved in the web portal guideline-based assessment.

Concerning the first reason, some of adapted Nielsen's principles showed poor applicability in the web portal context, not providing any useful information for portal usability improvement. Moreover, a number of guidelines should be more comprehensible and auxiliary guidelines revised and redundant ones excluded. Accordingly, a new set of guidelines is needed, the one which is not so strictly based on Nielsen's heuristics.

Regarding the choice of usability "instant experts", significant difference in acquired

information suggests non-homogeneity of the group concerning their HCI expertise. Such problem was hard to prevent due to inadequate number of resident HCI specialists as well as high costs of possible foreign experts' engagement.

Although our guideline inspection has proved very promising, some of its aspects need improvement. Conducted assessment obtained comprehensive quantitative and qualitative data which analysis defined the first steps of our future work: (i) revision of the designed evaluation form and (ii) subsequent assessment with adequate sample of experts.

4.2 Future Steps

The results acquired throughout the applied methodology show that the designed guideline inspection, as a less formal heuristic evaluation, although proved very promising needs to be improved. This is in line with recent research on heuristic evaluation which is focused on improving its effectiveness and efficiency with respect to user testing, *cf.* (Hvannberg *et al.*, 2007). Consequently, our future work will be focused on quantitative and qualitative analysis of the results obtained through guideline-based assessment and will first and foremost address two important aspects: the evaluation form issues and the instant experts selection.

Furthermore, future work will subsequently go into two directions also taking into account the following issues:

- first, in order to upgrade the applied usability inspection method and develop a methodology for web portal usability evaluation (i) the instant experts selection and the evaluation form issues should be revised according to the quantitative and qualitative analysis of the obtained results and (ii) the redesigned methods should be applied for the assessment of more specialized Croatian web portals
- second, in order to improve the applicability of the developed methodology to practice and to achieve its broad generalization, an inclusion of a cross-cultural sample should be considered.

5 CONCLUDING REMARK

Design of most visited Croatian broad-reach web portals was assessed both through a number of usability test methods with diverse groups of end users on the one hand and the usability inspection method on the other. The designed evaluation methodology, as an approach which is based on (i) scenario-guided user evaluations used to collect both quantitative data and qualitative "remarks" and (ii) specialists' assessment, provided a comprehensive valuation feedback.

The experience reported on in this paper indicates that the chosen research instruments, measures and methods for user-based usability evaluation were consistent. Conversely, the results of the designed usability inspection method were not in agreement with the ones obtained from the user test methods. Consequently, the guideline-based evaluation, even though showing respectable potential, raised a couple of concerns which will be addressed in our future work.

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