THE USE OF HEURISTIC METHOD TO ASSESS THE USABILITY OF UNIVERSITY WEBSITE

Terézia Kvasnicová[1], Iveta Kremeňová[2], Juraj Fabuš[3]

[1] Ing. Terézia Kvasnicová, Žilinská univerzita v Žiline, Fakulta Prevádzky a ekonomiky dopravy a spojov, Katedra spojov, Univerzitná 1, 010 26 Žilina, e-mail: terezia.kvasnicova@fpedas.uniza.sk
[2] doc. Ing. Iveta Kremeňová, PhD. Žilinská univerzita v Žiline, Fakulta prevádzky a ekonomiky dopravy a spojov, Katedra spojov, Univerzitná 8215/1, 010 26 Žilina, Slovenská republika, e-mail: iveta.kremenova@fpedas.uniza.sk
[3] Ing. Juraj Fabuš, PhD. Žilinská univerzita v Žiline, Fakulta Prevádzky a ekonomiky dopravy a spojov, Katedra spojov, Univerzitná 1, 010 26 Žilina, e-mail: juraj.fabus@fpedas.uniza.sk

Keywords: usability, web usability, heuristic evaluation.

ABSTRACT

Websites have many functions such as to sell products and services, inform about company and their business, educate users, entertain users and can be used as a communication tool, a branding tool and can help to improve company's image. The most important is that web pages are usable. If it is difficult to use a website, visitors leave it.

In this article we describe theory of usability, website usability principles and one of the usability testing methods - heuristic evaluation and its theory. We present different heuristic principles by different authors.

We use heuristic evaluation to assess the usability of University of Zilina website. We identify many usability problems and prepare the task list for the realization team, who propose the new university web site.

INTRODUCTION

Companies as well as public institutions can benefit from having a website. Websites are nowadays used not only as a sales method, information tool, but also as a communication tool in marketing.

Websites have many functions such as to sell products and services, inform about company and their business, educate users, entertain users and can be used as a communication tool, a branding tool and can help to improve company's image.

Schools and universities have a special place in the market of information and knowledge. They offer opportunities to be educated in some special area. The market of educational institutions is huge; there is a competition for students. Although the reputation and the quality of institution is a major advantage, they must think about the target group, who are young people spending several hours per day browsing websites.

Schools and universities should have their own web pages, which represent them and perform many functions: information, communication, publication, cultural, social, etc. University websites are intended for employees, students interested in studying, partner schools, public authorities and the general public.

The most important is that web pages are usable. If it is difficult to use a website, visitors leave it.

The marketing department of University of Zilina in Zilina is working on a proposal for a new university website. The current web page contains a number of usability errors. Therefore, we decided to test the University home page and highlight the existing errors. Thanks to current detection, their re-occurrence of the new site can be prevented. The output of our analysis will be recommendations for the development team.

USABILITY

The word usability has become the most inflected in the design and management of web sites and applications worldwide in recent years. When computer manufacturers began to track users and their behavior, however, spoke of "User friendly systems" - that is, the user-friendly system. However, since the user does not need the system to be friendly to him, new professionals replaced the term to CHI (Computer-Human Interaction), HCI (human-computer interaction), UCD (user-centered design), MMI (man-machine interface) HMI (human-machine interface), OMI (operator-machine interface), UID (user-interface design), HF (human factors). Nielsen (1993) prefers the term usability and a point out that usability is not obvious, one dimension part of the user interface.

Nielsen (1993) first defined usability as a quality attribute - something that is easy to use. More particularly it relates to how quickly a person can learn something used as effective in use, such as the use memorable as prone to making mistakes and how happy "to" users use. (Nielsen, Loranger, 2006).

Usability is defined thus qualitative 5 parts (Nielsen, 1993):

Learnability - determines how easy it is to understand the key role in working with the first interface. Assessing whether a user is unclear what is the interface dedicated and what to do to meet the target.

Efficiency - determines how fast you can perform them. The more often the task is performed, the greater emphasis should be placed on efficiency and thus the speed of execution.

Memorability - determines how difficult it is to use web interface after a long period of disuse.

Error rate - determines how much of errors users make when working with interface

Satisfaction - determines the user's satisfaction with the use of the interface and its features.

Krug (2006) as a basic rule for creating web pages considers that the creators of pages do not force users to think. In the web interface is therefore necessary to provide the user with an environment with which will have to learn to work. You can not require users to study manuals guide when they are only interested in specific information. The user interface must be intuitive and frugal.

Web usability is a procedure for the design and website design, which can ensure that users with it will be easy to work and achieve the desired objectives. If the page is well designed, user makes a minimum of errors and can find what they need. The basic methodology for achieving usability is user-centered design (UCD) Thus, a proposal for the user. "User-oriented design is a philosophy and a process", writes Makulová (2007). It's a philosophy that puts the center stage of man, not the case. It is a process that focuses on cognitive factors such as perception, memory, learning, problem solving, etc., which are suitable for human interaction with the system.

Developers should propose usable website. So it is necessary to measure usability. There are many methods for testing usability, an overview is presented below:

- Temperature maps "clicks".
- Eye tracking - eye camera.
- AB test.
- Heuristic evaluation.
- Questionnaire.
- Interview.
- User testing.

We pay attention to heuristic evaluation in this article.

HEURISTIC EVALUATION

Heuristic evaluation (Nielsen and Molich, 1990; Nielsen 1994) is a usability engineering method for finding the usability problems in a user interface design so that they can be attended to as part of an iterative design process. Heuristic evaluation involves having a small set of evaluators examine the interface and judge its compliance with recognized usability principles (the "heuristics").These heuristics are general rules that seem to describe common properties of usable interfaces. In addition to the checklist of general heuristics to be considered for all dialogue

elements, the evaluator obviously is also allowed to consider any additional usability principles or results that come to mind that may be relevant for any specific dialogue element. Furthermore, it is possible to develop category-specific heuristics that apply to a specific class of products as a supplement to the general heuristics (Nielsen and Molich, 1990; Nielsen 1994).

Typically, a heuristic evaluation session for an individual evaluator lasts one or two hours. Longer evaluation sessions might be necessary for larger or very complicated interfaces with a substantial number of dialogue elements, but it would be better to split up the evaluation into several smaller sessions, each concentrating on a part of the interface.

Heuristic evaluation does not provide a systematic way to generate fixes to the usability problems or a way to assess the probable quality of any redesigns. However, because heuristic evaluation aims at explaining each observed usability problem with reference to established usability principles, it will often be fairly easy to generate a revised design according to the guidelines provided by the violated principle for good interactive systems. Also, many usability problems have fairly obvious fixes as soon as they have been identified.
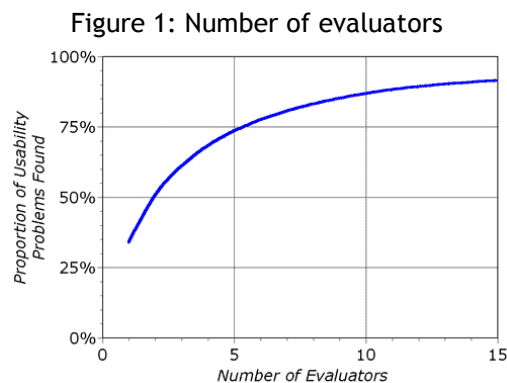
Digital Communications Division in the U.S., Department of Health and Human Services' (HHS) Office of the Assistant Secretary for Public Affairs (2014) published on their website www.usability.gov the main advantages and disadvantages of heuristic (Table 1).

Table 1: Advantages and disadvantages of Heuristics

Advantages	Disadvantages
- It can provide some quick and relatively inexpensive feedback to designers. - You can obtain feedback early in the design process. - Assigning the correct heuristic can help suggest the best corrective measures to designers. - You can use it together with other usability testing methodologies. - You can conduct usability testing to further examine potential issues.	- It requires knowledge and experience to apply the heuristics effectively. - Trained usability experts are sometimes hard to find and can be expensive. - You should use multiple experts and aggregate their results. - The evaluation may identify more minor issues and fewer major issues.

Source 1: http://www.usability.gov/how-to-and-tools/methods/heuristic-evaluation.html

Figure 1 (Nielsen, Landauer, 1993) shows the proportion of usability problems found as more and more evaluators are added. The figure clearly shows that there is a nice payoff from using more than one evaluator. It would seem reasonable to recommend the use of about five evaluators, but certainly at least three.

Figure 1: Number of evaluators

Source 2: http://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/

Nielsen and Landauer (1993) present such a model based on the following prediction formula for the number of usability problems found in a heuristic evaluation:

$$\text{Problems Found}(i) = N(1 - (1-l)^i),$$

where Problems Found(i) indicates the number of different usability problems found by aggregating reports from i independent evaluators, N indicates the total number of usability problems in the interface, and l indicates the proportion of all usability problems found by a single evaluator. In six case studies (Nielsen and Landauer 1993), the values of l ranged from 19 percent to 51 percent with a mean of 34 percent. The values of N ranged from 16 to 50 with a mean of 33. Using this formula results in curves very much like that shown in Figure 2, though the exact shape of the curve will vary with the values of the parameters N and l, which again will vary with the characteristics of the project.

Danino (2001) agrees with Nielsen: The more evaluators you use, the more usability problems you'll reveal. However, studies on the subject have shown that the benefit/cost ratio decreases at about five evaluators. Further Danino (2001) advises who should be these evaluators:

- Those with experience – if you can find 5 evaluators who are experts in software ergonomics, and in the field in which the software is applied, a well-planned evaluation program will typically find 81%-90% of usability problems with your interface
- Those without experience – if you don't have 5 free experts at your fingertips, don't worry. A student with no knowledge of software ergonomics will find 22% to 29% of usability problems.

Heuristic Evaluation is known to find more than 90% of usability problems if it's performed by 3 to 5 experienced people.

Nielsen's heuristics are probably the most-used usability heuristics for user interface design. Nielsen developed the heuristics based on work together with Rolf Molich in 1990. The final sets of heuristics that are still used today were released by Nielsen in 1994. The heuristics as published in Nielsen's book Usability Engineering are as follows:

Visibility of system status. - The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.

Match between system and the real world. - The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

User control and freedom. - Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

Consistency and standards. - Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Error prevention. - Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Recognition rather than recall. - Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

Flexibility and efficiency of use. - Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Aesthetic and minimalist design. - Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Help users recognize, diagnose, and recover from errors. - Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Help and documentation. - Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information

should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

Nielsen is expert and leader in heuristics, but Jill Gerhardt-Powals (1996) also developed a set of cognitive principles for enhancing computer performance. These heuristics are similar to Nielsen's heuristics but take a more holistic approach to evaluation. Gerhardt Powals' principles are below:

- Automate unwanted workload:
    - free cognitive resources for high-level tasks.
    - eliminate mental calculations, estimations, comparisons, and unnecessary thinking.
- Reduce uncertainty:
    - display data in a manner that is clear and obvious.
- Fuse data:
    - reduce cognitive load by bringing together lower level data into a higher-level summation.
- Present new information with meaningful aids to interpretation:
    - use a familiar framework, making it easier to absorb.
    - use everyday terms, metaphors, etc.
- Use names that are conceptually related to function:
    - context-dependent.
    - attempt to improve recall and recognition.
    - group data in consistently meaningful ways to decrease search time.
- Limit data-driven tasks:
    - reduce the time spent assimilating raw data.
    - make appropriate use of color and graphics.

Weinschenk and Barker (2000) created a categorization of heuristics and guidelines by several major providers into the following twenty types:
1. User Control: heuristics that check whether the user has enough control of the interface.
2. Human Limitations: the design takes into account human limitations, cognitive and sensorial, to avoid overloading them.
3. Modal Integrity: the interface uses the most suitable modality for each task: auditory, visual, or motor/kinesthetic.
4. Accommodation: the design is adequate to fulfill the needs and behavior of each targeted user group.
5. Linguistic Clarity: the language used to communicate is efficient and adequate to the audience.
6. Aesthetic Integrity: the design is visually attractive and tailored to appeal to the target population.
7. Simplicity: the design will not use unnecessary complexity.
8. Predictability: users will be able to form a mental model of how the system will behave in response to actions.
9. Interpretation: there are codified rules that try to guess the user intentions and anticipate the actions needed.
10. Accuracy: There are no errors, i.e. the result of user actions correspond to their goals.
11. Technical Clarity: the concepts represented in the interface have the highest possible correspondence to the domain they are modeling.
12. Flexibility: the design can be adjusted to the needs and behavior of each particular user.
13. Fulfillment: the user experience is adequate.
14. Cultural Propriety: user's cultural and social expectations are met.
15. Suitable Tempo: the pace at which user works with the system is adequate.
16. Consistency: different parts of the system have the same style, so that there are no different ways to represent the same information or behavior.
17. User Support: the design will support learning and provide the required assistance to usage.
18. Precision: the steps and results of a task will be what the user wants.
19. Forgiveness: the user will be able to recover to an adequate state after an error.

20. Responsiveness: the interface provides enough feedback information about the system status and the task completion.

Those principles include similar heuristics, which are oriented for easy usability and especially the user. Gerhardt Powals' principles give attention to the data, while Weinschenk and Barker define heuristics in a wider range.

We agree with Nielsen´s heuristics that are complex.

METHODOLOGY

We analyze the website www.uniza.sk, official web pages of University of Zilina in Zilina in Slovakia. University of Zilina was established at 1. September 1953. The first name was College of Transport and Communication, in 1996 was renamed to the University of Zilina, which has almost 11 000 students per year.

We have three experienced evaluators from Netperfect Company. They provide their customers professional analysis and design studies websites and graphic materials. They use modern technology research called eye tracking that tracks eye movement of the user. Its use is combined with other methods in order to cover all phases of operation of promotional material to users.

We use heuristic evaluation by Nielsen, all ten heuristics and we try to find usability problem on university web site.

Web page of University of Zilina is a website that informs about events at the University; contains links to other external sites and the faculties (blue arrow in figure 2). This page is intended for students, prospective students, employees and for the society. The site is organized in four navigations (figure 2):
- Menu 1 - main menu (violet arrow in figure 2 right).
- Menu 2 – submenu (violet arrow in figure 2 left)
- Menu 3 - links to the websites of the faculties of the University.
- Menu 4 – links to Moodle, Library, Intranet, and Directory (white arrow).
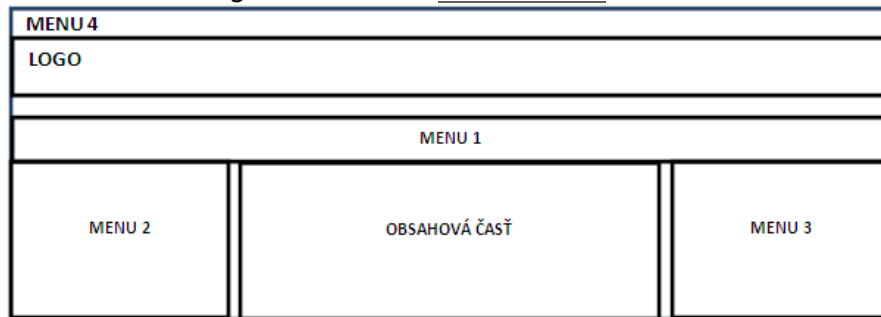The middle part of the screen (red arrow) is shown the text section.

Figure 2: Homepage www.uniza.sk
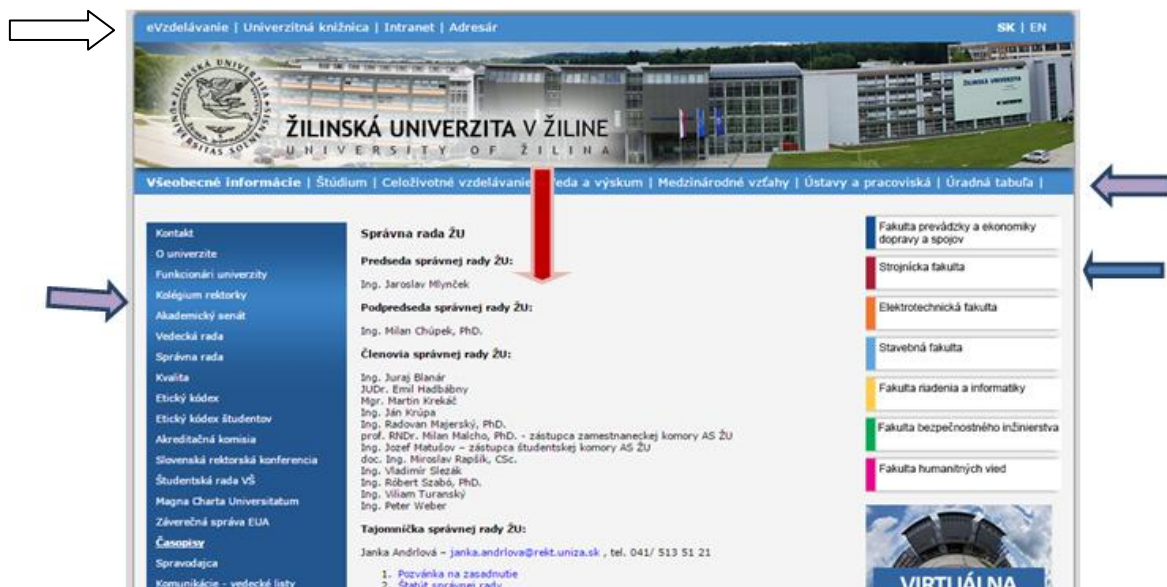
Source 3: Authors

Figure 3: Frame of www.uniza.sk

Source 4: Authors

RESULTS

Our three experienced evaluators from Netperfect Company examined the web site and judged its compliance with recognized usability principles.

Visibility of system status
- When you click on Menu 1 is not evident, which are offered subject links. This problem is most evident in the smaller monitors.
- When you click on Menu 1, the Text section in the center of the screen does not change (Figure 4).

Figure 4: Two screens of different Menu 2, after clicking on another part of Menu 1 – Text section is the same
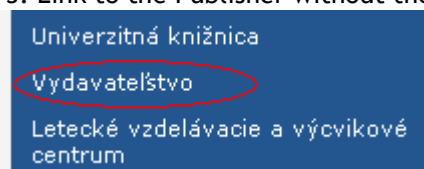

Source 5: Authors

- When you select "Institutes and organizations" in Menu 1, open external websites, the same is happen in Menu 2.

The system does not inform users about what is going on, where they are.

Match between system and the real world
- Publisher is called EDIS – the link is missing the name of publishers (Figure 5).

Figure 5: Link to the Publisher without the name

Source 6: Authors

User control and freedom
- There is a directory – after click on, user can search employees.

Figure 6: Directory of employees

Source 7: Authors

- There is no search window.
- Undo and Redo buttons are available.

Consistency and standards
- International relations – as a part of Menu 1 has in Menu 2 many links, they all means the same, but have a different name.

Figure 7: Menu 2 of International relations

Source 8: Authors

- Links to Erasmus charter and Erasmus Policy are in different parts of Menu 1
- Link to AIESEC is independent as a link in Menu 2, although there is a section Student organizations.

Error prevention
- There isn´t any error prevention tool.
- There isn´t the page map.

Recognition rather than recall
- Calendar of events is helpful; it is bad placed (on the right site down), user can it overlook.
- Menu 4 - Moodle (eVzdelávanie), Library (Univerzitná knižnica) and Intranet are helpful and good placed.
- Menu 3 – links to the websites of the faculties of the University, is helpful, good placed.

Flexibility and efficiency of use
- There are "Important links", they are bad placed (on the right site down), user can it overlook.
- Menu 4 is useful and can speed up the interaction.

Aesthetic and minimalist design
- On the main page is a video that does not work.
- On the main page in Text section – there are Actualities. User can find there article about history.

Figure 8: Text in the wrong section.
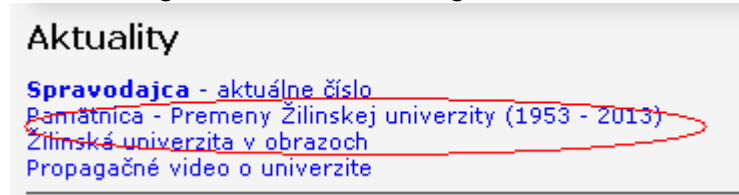
Source 9: Authors

- Menu 1, section Study has in its Menu 2 link to the publishing activities. They should be placed elsewhere.
- Menu 2 has a lot of Links, which have a lot of text. It cancels attention.

Help users recognize, diagnose, and recover from errors
- Error messages 404 and 403,6 have been found without the explanation of problem and with no solution for user.

Figure 9: Error messages 404 and 403,6 have been found
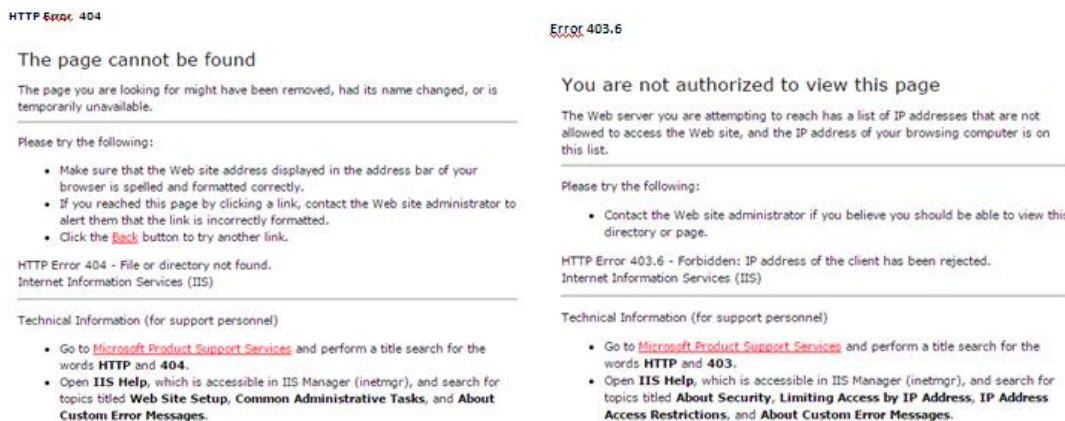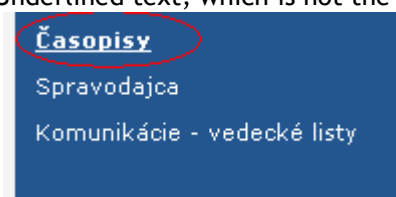

Source 10: Authors

Help and documentation
- There is no search window, no help function.

There were found other errors:
- One topic is in many categories.
- Underlined text evocate it is going on link. If no, this text must not be underlined.

Figure 10: Underlined text, which is not the link.

Source 11: Authors

CONCLUSION

In the article we describe website usability principles and one of methods - heuristic evaluation and its theory.

We used heuristic evaluation by testing university website of University of Zilina. We identify many usability problems, as we shown in part Results. We also identify the main tasks for the realization team, who propose the new university web site. The task list is below:

• Defining the mission and target group. From the home page, it must be clear on what and on whom it is focused.
• The structure must be transparent - the main menu should include categories that a new visitor understands and that are arranged thematically, for example Student, Candidates, Employee, etc. One topic should be just in one category.
• The content must be reduced as much as possible.
• The content must be updated regularly (old information must be hidden).
• Broken links must be removed.
• Text must not be underlined, if it is not a link.
• It is necessary to supplement the search box.
• Add the search function in "Adresár" (Directory) by workplaces.

Helpful can be also Top 10 Design Guidelines by Sherwin (2014).

One of the biggest criticisms of heuristic evaluation is that it tends to uncover many low-severity problems or issues that aren't really problems (false positives). An additional practical problem is that multiple usability experts should be used. It can often be more expensive and difficult to find 3-5 usability professionals as it is to test 3-5 users.

Even though heuristic evaluation finds many usability problems, are not found by user testing.

Of course is necessary to do further research in this area and analyze website usability with use of others methods such as eye tracking.

REFERENCES

Molich, R., Nielsen, J. (1990). *Improving a human-computer dialogue*, Communications of the ACM 33, 3 (March), 338-348.

Nielsen, J., Molich, R. (1990). *Heuristic evaluation of user interfaces*, Proc. ACM CHI'90 Conf. (Seattle, WA, 1-5 April), 249-256.

Nielsen, J. (1994a). *Enhancing the explanatory power of usability heuristics*. Proc. ACM CHI'94 Conf. (Boston, MA, April 24-28), 152-158.

Nielsen, J. (1994b). *Heuristic evaluation*. In Nielsen, J., and Mack, R.L. (Eds.), Usability Inspection Methods, John Wiley & Sons, New York, NY.

Nielsen, J. (1995). *10 Usability Heuristics for User Interface Design. From:* http://www.nngroup.com/articles/ten-usability-heuristics/ ISSN 1548-5552

Nielsen, J., Landauer, T. K. (1993). *A mathematical model of the finding of usability problems*. Proceedings ACM/IFIP INTERCHI'93 Conference (Amsterdam, The Netherlands, April 24-29), 206-213.

Nielsen, J. (1992). *Finding usability problems through heuristic evaluation*. Proceedings ACM CHI'92 Conference (Monterey, CA, May 3-7), 373-380.

Nielsen, J. (1995). *How to Conduct a Heuristic Evaluation*.
From: http://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/

Sherwin, K. (2014). *University Websites: Top 10 Design Guidelines*.
From: http://www.nngroup.com/articles/university-sites/

Neil, T. (2009). *6 Tips for a Great Flex UX: Part 5.* From: http://designingwebinterfaces.com/6-tips-for-a-great-flex-ux-part-5

Nielsen, J. (1994). *Usability Engineering*. San Diego: Academic Press. pp. 115–148. ISBN 0-12-518406-9.

Gerhardt-Powals, J.(1996). *"Cognitive engineering principles for enhancing human - computer performance"*. International Journal of Human-Computer Interaction 8 (2): 189–211. doi:10.1080/10447319609526147

Usability.gov. (2015). *Heuristic Evaluation - Usability Methods – What is a heuristic evaluation?* From: www.usability.gov

Weinschenk, S., Barker, (2000). *Designing Effective Speech Interfaces*. Wiley. ISBN-13: 978-0471375456

Danino, N. (2001). *Heuristic Evaluation – a Step By Step Guide Article*

From: http://www.sitepoint.com/heuristic-evaluation-guide/

Digital Communications Division in the U.S. Department of Health and Human Services' (HHS) Office of the Assistant Secretary for Public Affairs. (2014). *Heuristic Evaluations and Expert Reviews*. From: http://www.usability.gov/how-to-and-tools/methods/heuristic-evaluation.html

Sauro. J., (2011). *What's the difference between a Heuristic Evaluation and a Cognitive Walkthrough?* From: http://www.measuringu.com/blog/he-cw.php

Makulová, S. 2007. *Použiteľnosť webových sídiel ako základný predpoklad ich úspešnosti*. From: http://www.elet.sk/?pouzitelnost-pristupnost&sprava=pouzitelnost-webovych-sidiel-ako-zakladny-predpoklad-ich-uspesnosti

Krug. S., 2006. *Nenuťte uživatele přemýšlet!* Computer Press, 2006. ISBN: 9788025129234. 168.

www.netperfect.sk

www.uniza.sk

GRANT SUPPORT

AUTHORS' BIOGRAPHIES

Ing. Terézia Kvasnicová is a PhD. student. She graduated from the Faculty of Economics, Matej Bel University in Banska Bystrica in 2010. Subsequently, she worked for an international company in the field of electronic services. Since 2014 is PhD. student at the Faculty of Operation and Economics of Transport and Communications, University of Žilina. The theme of the dissertation is a methodology for evaluating the usability of web interface of electronic services.

Assoc. Prof. Ing. Iveta Kremeňová, PhD., University lecturer and Head of Department of Communications, Faculty of Operation and Economics of Transport and Communications, University of Zilina, Slovakia. In her teaching and research activities at the University of Zilina works since 1983, since 1999 as an associate professor and since 2003 she has been the Head of the Department of Communications. Within the study programs Ecommerce Management and Postal Engineering provides lectures in Business Management, Project Management and Management Information Systems. She is a member of EUNIS. She is the tutor of 2 internal and 3 external PhD students in the field of study Branch and Sector Economy. Research areas are innovative methods and SMART Learning Technologies as well as substitution services will e-commerce.

Inf. Juraj Fabuš, PhD., University lecturer of Department of Communications, Faculty of Operation and Economics of Transport and Communications, University of Zilina, Slovakia. He provides lectures in Business Management, Project Management and Management Information Systems. Research areas are innovative methods and SMART Learning Technologie, e-learning.