



NES2012

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NES2012 Proceedings Preface

The NES2012 Conference proceedings contain 56 very interesting papers from a diverse variety of fields within the area of Ergonomics. The USB-stick also includes the Abstract Book with the program. The NES2012 Proceedings has a separate ISBN number stated in a separate ISBN document.

The NES conferences have a long tradition of serving as a meeting place for researchers and practitioners. The papers included in the proceedings are peer-reviewed scientific and practitioners' papers, reflecting the variety of ergonomics. The scientific papers from the research context, fulfilling scientific demands and the practitioners papers describing experiences from practice and fulfilling the demands to describe and report the results in a clear and sound way but not necessary fulfilling all the scientific criteria for papers.

The conference theme, "Ergonomics for Sustainability and Growth" has indeed been reflected in the different contributions. It gives promising evidence that the field of ergonomics will live on and flourish, developing deeper knowledge concerning how work environments, products and systems can be further developed to suit the needs, demands and limitations of humans as well as support a sustainable and prospering society.

We would like to thank all who have shown interest in the conference and contributed to it.

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Ann-Beth Antonsson

Chair NES2012 Scientific Committee

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ASSESSING USABILITY OF IT SYSTEMS

Kavathatzopoulos, Iordanis

Department of Information Technology, Visual Information and Interaction
Uppsala University, Box 337, SE-751 05 Uppsala, Sweden
E-mail: iordanis@it.uu.se

Personal skills and group processes are necessary in the production of knowledge to design and manage usable systems. AvI is a questionnaire that correlates these parameters of usability to utility and work environment. The main goal of AvI is to create a description of the processes that are necessary to achieve good usability: user participation, knowledge support, networking for coordination and cooperation etc, defined as philosophizing processes at personal and group levels. AvI's ambition is to indicate whether the preconditions for these processes are present in an organization, to allow these to arise and to function in a satisfying and fruitful way. The evaluation of AvI showed that reliability coefficients and correlations to independent criteria were high, supporting the original hypothesis: AvI can be used to acquire information about the above parameters of an IT system's usability in an easy and quick way. Although AvI only provides an indicative value, such a diagnosis of the usability of an organization's IT infrastructure is valuable as an alert and to determine the extent of further initiatives.

Keywords: Usability, Skills, Informal processes, Work environment, Health, Stress, Questionnaire, Evaluation, Reliability, Validity

1 Introduction

It is broadly accepted that user participation in systems development, system function, adaptation to organizational structures and user competence, determine IT systems' level of usability. This is achieved by supporting the emergence of personal skills and group dynamics to find answers to design and use issues. AvI (abbreviation of Användbarhetsindex, in Swedish; Kavathatzopoulos 2008) is a questionnaire that tries to correlate these parameters of usability to work environment and organizational profit.

There is a great need for evaluating the usability of IT systems in an easy and reliable way and there consequently exist many usability assessment methods. Methods like SUMI (2012), WAMMI (2012), PSSUQ (Lewis, 2002), QUIS (Chin, Diehl & Norman 1988), SUM (Sauro & Kindlund 2005) and SUS (Brooke, 1996) all focus on the description of issues like IT system functionality, satisfaction, effectiveness and efficiency. Although they are very useful and reliable they have a limitation in not trying to describe the importance of cooperation and coordination, and the possibilities of users to create spontaneous networks for support and dialogue. For an organization, the most important criterion for an IT system is of course its efficiency and effectiveness as well as satisfaction. We have therefore to focus our instrument on the structure and the use of an IT system, and the above parameters are connected to the goals of the user (Nardi 1996). Resolution of different contradictions that can arise in

this connection can be seen as the ground for good usability (Engeström 1987). In that sense, also work environment is an important aspect of efficiency and effectiveness. IT systems usability is dependent on good work environment, not only during the running of a system, but also earlier, during its construction, and later, during its further development.

User participation is of utmost importance for the construction and use of usable IT systems. Most of the problems that arise after installation are difficult to foresee and therefore impossible to prescribe in a manual or to train during introductory education. There is no obvious answer to design and use problems. Of course there are valid general principles, in the form of guidelines or standards on how to design usable IT systems, but the concrete features of a system have to be decided during the systems development process, separately for each new system, and in accordance with prevailing conditions. Furthermore, there are several “right” solutions to each design problem as well as to the way one should implement or use a system. There are always many different ideas on how to do all this in the best way, depending on the priorities of different groups such as users with varying needs or skills, budget frames and design concerns (Winograd 1997). Therefore, knowledge about how to design usable IT systems has to be found by running an open dialogue process where as many as possible of the stakeholders are involved since there are no ready-made answers to design issues. Basically this is a philosophizing activity, demanding certain personal skills as well as organizational processes that facilitate and support the search for the best design solution and the best way to implement and manage an IT system. It is about the ability of persons and groups to consider and integrate into the artefact all relevant aspects of usability (Kavathatzopoulos 2011; Kavathatzopoulos, Kostrzewa & Laaksoharju 2009).

One factor that facilitates and supports this process is users’ perceived responsibility for the system they feel they need as a tool for their activity or work, and the responsibility they feel they have to find solutions to all possible problems they are confronted with during its use. Spontaneous networks among users arise, with the aim to provide support and to transmit knowledge and expertise (Kavathatzopoulos 1991, 2001). Informal cognitive processes in the form of spontaneous networks, which correspond to personal philosophizing mental processes by allowing for dialog and cognitive support in the group, are very effective in solving problems and in promoting learning (Vygotsky 1962, 1978). Formal support structures and formal education also contribute to the good function of IT systems directly and indirectly by supporting networking. However, informal structures and processes among users are necessary to fill in the enormous amount of knowledge gaps left over; therefore an evaluation instrument has to focus on this aspect too. AvI connects IT systems efficiency, effectiveness and users’ work environment, to informal cognitive support processes.

The approach in AvI is based on the above theoretical assumptions. The main goal of AvI is to describe the processes behind usability; user participation, knowledge support, networking for coordination and cooperation etc. AvI focuses on whether the preconditions for these processes exist, to allow them to arise and to function in a satisfying and fruitful way. For example, user participation during the construction of an IT system is necessary in order to produce knowledge, through personal or group dialog, about what would be the most usable solution for a certain activity or work task.

The solution could be either strictly technical, thus automated, or presenting a user interface that supports the work in the best possible way. The result of the processes is not prescribed and consist in an open, self-critical, systematic, analytical and holistic dialog; a rational and scientific process; philosophizing. Informal knowledge support structures contribute mostly to this process allowing for dialog and transmission of knowledge.

2 Questionnaire and method

AvI is focused on the conception of different aspects of usability. Personal assessment of usability, mainly as a measurement of satisfaction, is the common method used in usability questionnaires like those mentioned above. Some try to focus on gathering objective data like SUM (Sauro & Kindlund 2005). But although SUM does contain independent measures, a part of the questionnaire still assesses participants' personal satisfaction. Considering personal understanding of usability is both meaningful and necessary given its role in any user participation process and its close connection to the skills producing design solutions.

AvI contains 46 questions divided into six subscales. *Development* subscale: usability is dependent on user participation during system construction. *Use* subscale: how well the system supports work tasks. *Competence* subscale: acquiring knowledge and skills. *Utility* subscale: contributing to efficiency and effectiveness. *Stress and Health* subscale: promoting healthy work environment. *Relations* subscale: facilitating cooperation and coordination. AvI evaluates an IT system on all these six variables, which are theoretically supposed to be different aspects of the same underlying main factor, that is, usability. The questions are grouped in subscales to give a picture of each area independent of the other areas. This division allows for detailed follow ups and for implementation of targeted measures. Each subscale focuses on a special area of interest, and all of them are important as aspects of usability according to the basic theoretical approach. For example, Relations subscale gives a picture of the group processes which support production of knowledge to design and manage usable IT systems. Competence subscale asks about skills and how these are acquired and supported by the organization. All questions are of Likert type with six alternatives for the participant to score. There are no open questions. Here is one sample question:

31. Does your organization encourage informal support between colleagues to solve problems related to the use of the IT system?

0	1	2	3	4	5
No, not at all					Yes, absolutely

AvI was tested in a sample of 466 participants. Participants in the study were employees in many different organizations and experienced users of various systems. The usability of a number of different IT systems used as support tools for work tasks was assessed. A digital version of AvI was created and adapted to each IT system evaluated by adding its name in the questions. The questionnaire was administered by the organizations themselves using their intranet communication systems.

To investigate if AvI is able to register any difference in usability after a change has been implemented on an IT system used in a certain organization, the actual IT system

had been evaluated before the improvement took place as well as some months after the change had been implemented.

In order to assess the role of organizational attitude regarding user participation, informal processes, and dialogue, the usability of administrative IT systems in two separate organizations was compared using AvI. The two organizations were different regarding their culture and hierarchical structure. One organization had established procedures for user participation, and for reception and treatment of design suggestions. It also supported user networks for participation in IT systems development and use; it allowed the emergence and running of cooperation and cognitive support networks among employees. The other organization had an authoritative attitude to IT systems development, and did not support informal work task and cognitive support networking.

Independent evaluation of usability took place in a third organization. An IT system was evaluated by AvI. Later on, people from this organization applied their own evaluation of the same system using different methods like interviews and observations allowing for the comparison of these results to the previous AvI score. Correlation to objective criteria has been missing regarding the validity of usability evaluation methods (Hornbæk & Lai-Chong Law 2007), but here the independent evaluation contained data about objective parameters like effectiveness and sick leave, thus allowing verification of AvI.

3 Reliability and validity

The results of internal reliability were very positive. The final version of AvI showed very high homogeneity, Cronbach's alpha was 0.99 for the whole questionnaire. For each of the subscales' internal reliability the results showed the same high levels except for the Development subscale which showed a relatively lower but still high homogeneity (Table 1).

Table 1. Internal homogeneity for all subscales of AvI.

<i>Subscales</i>	<i>Cronbach's alpha</i>	<i>n</i>
Development	0.83	46
Use	0.99	365
Utility	0.99	387
Competence	0.99	358
Stress and Health	0.99	393
Relations	0.99	368

AvI contains six subscales which focus on different aspects of usability. Data analyses on the same sample showed that the different subscales were strongly correlated to each other. All correlations were significant at 5% level. Development subscale showed lower correlations to the other subscales but still sufficiently high to be significant. One explanation for the lower correlations can be the number of participants. Since most of them did not participate in the development process they did not answer the questions in this subscale. Correlations varied between 0.37 and 0.92. There was a strong relationship among all parts of the questionnaire indicating a common factor for all subscales and questions (Table 2).

Table 2. Correlations between subscales of AvI.

<i>Subscales</i>	<i>Use</i>	<i>Utility</i>	<i>Competence</i>	<i>Stress & Health</i>	<i>Relations</i>
Development	0.38	0.37	0.41	0.34	0.43
Use	-	0.92	0.89	0.88	0.86
Utility		-	0.88	0.89	0.87
Competence			-	0.85	0.86
Stress & Health				-	0.86

Note: $N = 466$, $p < 0.05$

The validity of the questionnaire is supported by these results, which clearly showed that the instrument could assess differences in usability as an effect of system changes and development. Since the IT tools that were evaluated with AvI were developed further between the two assessment occasions, it was expected that the usability score would be higher in the final test. Indeed the results showed a higher overall usability score, 3.0 in a scale from 0 to 5, compared to 2.6 in the tests that were conducted before the changes to the IT system took place. The same tendency can be found for each subscale too, except for Development subscale where the focus was on user participation. This result was stable at a significant low level, 1.3, over both assessments. This was however expected as there was extremely low user participation in all change and development processes. Furthermore, AvI could differentiate the usability level of the use of IT systems between two organizations. These two organizations were different in their attitudes toward usability and control. The more flexible and open organization scored 2.6 in a scale from 0 to 5 and the other scored 1.6, as it was expected. In a final test it was shown that AvI correlated strongly with the results obtained by other methods evaluating the usability of the same IT system in the same organization (Åhlman 2009). Independent interviews and observations scored similarly as AvI and showed that the usability evaluation of IT systems was correlated to objective data about productivity and health condition of users.

4 Discussion

The evaluation of AvI showed that we have good reasons to trust it as a valid instrument; it assesses usability as a common underlying factor according to the theory. AvI is consistent and stable, and it can describe the status of theoretically significant parameters of usability like informal processes. Although it correlates to other methods used independently, as a next step in the development of the questionnaire it is necessary to test its correlation to objective criteria, like organizational output and sick leave, and to usability tools, like SUM, assessing objective parameters.

AvI can be used for easy and reliable usability evaluations of IT systems. Although AvI only provides an indicative value, such a diagnosis of usability in an organization's IT infrastructure is valuable as an alert and to determine the extent of further initiatives. AvI does not only evaluate the usability of an IT system but it can also assess the effect of changes and improvements providing guidance for further development. Furthermore, AvI is sensitive to organizational dynamics and culture, allowing it to be used as an instrument for evaluating and guiding organizational change. AvI correlates with other evaluation instruments and can easily be used to cover the aspect of usability in a battery of tests for various purposes. The homogeneity of AvI is high which allows

for a shorter version of the instrument. Whereas the full version gives more detailed information that can be used in a system's further development process, a short version is more suitable to apply often and regularly, either to monitor the usability condition of an IT system or to study the effects from on-going development. However, it is important to be cautious regarding the interpretation of the results after an evaluation. AvI, like almost all other usability instruments, shows participants' personal assessments, which are significant since they contribute to the creation of design solutions. But the same can be defined as non-objective data leading people to ignore them. AvI, like all other instruments, is not perfect and its score should never be overestimated or underestimated but always be interpreted with good judgment.

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