

Hans-Christoph Hobohm (Hrsg.)

Informationswissenschaft zwischen virtueller Infrastruktur und materiellen Lebenswelten

**Information Science between
Virtual Infrastructure and Material Lifeworlds**

Unter Mitarbeit von Judith Peffing

Proceedings des 13. Internationalen Symposiums
für Informationswissenschaft (ISI 2013)

Potsdam, 19. bis 22. März 2013

vwh

Verlag Werner Hülsbusch
Fachverlag für Medientechnik und -wirtschaft

A framework for evaluating the usefulness of digital libraries

Jasmin Hügi, René Schneider

Haute Ecole de Gestion de Genève
7, route de Drize, CH-1227 Carouge
{jasmin.hugi|rene.schneider}@hesge.ch

Abstract

In this paper we present a methodological framework for a usefulness evaluation of digital libraries and information services that has been tested successfully in two case studies before developing a corresponding tool that may be used for further investigations. The tool is based on a combination of a knowledge base with exploitable and modifiable questions and an open source tool for online questionnaires.

1 Introduction

Recent years have seen a considerable increase in evaluating the usability of digital libraries and several methods (e.g. heuristic evaluations, user acceptance testing) have been established. Unfortunately the matter of usefulness, which has the same importance in the realm of online libraries and information services, is less investigated. It should be noted that in the context of this paper, a ‘usefulness evaluation’ (of digital libraries) is seen as a method which has been developed in the context of usability evaluations and therefore differs from information quality theories and assessments.

In: H.-C. Hobohm (Hrsg.). Informationswissenschaft zwischen virtueller Infrastruktur und materiellen Lebenswelten. Tagungsband des 13. Internationalen Symposiums für Informationswissenschaft (ISI 2013), Potsdam, 19.–22. März 2013. Glückstadt: Verlag Werner Hülsbusch, suppl. S. i–xii.

Thus, usability and usefulness can be seen as two sides of the same coin, with a direct analogy to this metaphor, since coins can clearly be divided into an interface (usability) which indicates the value that comes along with it (usefulness). The same is true for digital libraries: without a useable interface, the information behind, i.e. the digitized data, is useless. On the other hand, even the best interface does not serve any purpose if the data is not of use for the user. Since digital libraries provide generally large-scaled masses of structured and unstructured data which generally causes high costs, the need to evaluate usefulness is evident.

Similar to usability evaluations, the usefulness of information can be evaluated before, during and after the realization of a digital library to justify the costs for new digitization or licensing or to decide to abolish existing information because users do not consider this to be useful any longer.

This paper aims to describe different methods which are currently in use in order to evaluate the usefulness of digital libraries. In the context of a research project named PECCI (= **P**lateforme d'**E**valuation pour les **C**entres d'**I**nformation) that started with two different field studies regarding the usefulness of digital libraries, an eleven-step approach has been developed in order to structure and facilitate future analysis of usefulness. The experiences of this study subsequently led to the creation of an electronic platform with a framework that allows adjustable elaboration of a survey. This survey is based on questions derived from the aspects and attributes of usefulness and can be transformed to the granularity of the project under investigation. These questions can be directly transformed into a questionnaire. Persons interested in evaluating the usefulness of a digital library or its content will be able to quickly create a survey without having to consult an expert.

2 Models and methods

Interestingly, usefulness always played a minor role in human computer interaction in the past and evaluating it separately by using specific models and methods was rarely considered.

2.1 Modeling

First investigations concerning a clear distinction between usability and usefulness as major factors in human computer interaction were made by Davis (1989) to predict the user's intention in the so-called Technology Acceptance Model based on the perceived ease of use and the perceived usefulness. Ten years later, Dillon/Morris (1999) developed a slightly more complex model, named P3-Framework, to investigate the interdependence between power, perception, and performance focusing on a system's utility, the user's attitude, and last but not least usability. Fuhr et al. (2001) developed a first model with a specific interest in the usefulness of digital libraries with four dimensions, namely data/collection, technology, users and use, and numerous measurable attributes. This concept was refined in later works, for example by Sandusky (2002) or Saracevic/Covi (2000) who again set the focus on collecting attributes and the corresponding levels that were either applied to the system or the user.

Later on, Tsakonas/Kapidakis/Papatheodorou (2004) and Tsakonas/Papatheodorou (2006) developed a model named Interaction Triptych Framework on which the work presented in this paper is based. This framework investigates the relationship between three major components: system, user, and content provided, whereas the relationship between the user and the content defines the evaluation axis of usefulness. This axis is constituted by five attributes or evaluation variables, specifically a) relevance (i.e. the appropriateness of the information found corresponding to the user's needs); b) format (e.g. .pdf, .jpg or .doc); c) reliability (i.e. the importance and trust given to a search result in correspondence to the information need or a given task; d) level (such as meta data, abstract, full text, etc.), and e) coverage (i.e. the timeliness in terms of up-to-dateness or diachronic completeness). In a nutshell, the attributes and their equivalent variables describe the interaction between user and content as a result of the user's information literacy, his actual needs and preferences, the available content and the corresponding system functions for presentation, transmission and storage.

As will be seen later, this model has been itself a very useful base for the investigations conducted in this project. However, two more dimension have been added to cover two more aspects of a user's perception of usefulness, namely f) satisfaction, (i.e. in how far the content offered meets the user's expectations according to his own belief and desire), and, as a consequence

of the latter, g) competition, (i.e. the user's competitive comparison of the experienced system after experiencing the tested system).

2.2 Methods in Use

After establishing adequate models for evaluating usefulness, the question of appropriate methods arises. As described earlier, the necessity for a separate evaluation of a system's usefulness or, more precisely, the usefulness of the content provided in an information system and especially a digital library has emerged quite recently. Hence, the position or role of usefulness evaluations as opposed to usability evaluations is not really clear yet. Strictly speaking, usefulness evaluations might either be seen as a discipline *sui generis* or as a mere offspring or sub-discipline within the overall realm of usability. The authors of this paper prefer to return to the coin metaphor described earlier which underlines the interdependent relationship of the two aspects and the general need to always evaluate both sides of the coin.

Along with this reflection on the subject comes the question of the specific methods that have to be used to appropriately evaluate the usefulness attributes. Following the argumentation of the preceding paragraph, purists might proclaim a methodology of its own, while others might refer to the vast number of existing and well proven methods of usability research. Once again, the coin metaphor allows a conciliatory approach, in the sense that usability testing itself might cover usefulness aspects with the help of questions covering content perception, or usefulness evaluations can be realized using existing methods while adjusting, adapting or shaping them to cover the attributes of the model described.

To date, existing studies have made use of a considerable range of methods, such as questionnaires, structured interviews, focus groups, user observation, thinking aloud tests and log file analysis. In this context, Saracevic (2004) – after having compared 80 evaluation studies – distinguishes between seven different approaches, where the focus is either on the system, the user, the usability (as a mixture of the latter two aspects), the ethnographic, anthropological, sociological or economic approach. Xie (2006) carried out a study in which the participants could develop their own set of criteria for the evaluation of a digital library. They were then asked to evaluate a digital library of their choice by applying their criteria. In a further study, Xie (2008) applied the methods of a diary, questionnaire and survey. The partici-

pants were asked to find information for six questions in two different digital libraries. They were asked to write down the whole search process. In a second part, they were asked to rate the importance of given criteria and add new ones if necessary. In a third part, the participants were instructed to apply their chosen criteria to the two digital libraries in order to evaluate them. Finally, Tsakonas/Papatheodorou (2006) executed a large survey to evaluate the usability and usefulness of information services, i.e. digital libraries, electronic journals and information portals. Besides testing different functionalities, the survey consisted of a questionnaire that put usability and usefulness into relation.

The major advantage of using a questionnaire consists in the priority given to user needs, which are difficult to estimate without directly asking the user. The method also allows the creation of user stories or personas by either directly by including open questions in the questionnaires or by abstracting them indirectly from the answers given. Both results may lead to a fact-based decision concerning the creation, deletion or adaptation of content-based services. They may also be used to define adequate user profiles for subsequent usability tests.

3 Practical Implementation

As has been shown in the previous chapters, the variety of methods used for usefulness evaluations are rather low, which does not mean that every new evaluation needs its own heuristics. There is also no evidence that a usefulness evaluation has to be related to a particular task presented to the user and thus become a different kind of usability test. To clarify these circumstances, we decided to start with two separate case studies to encircle the subject of usefulness.

3.1 Case studies

The two case studies were working packages of two different but connected research projects. They were commissioned by two Swiss institutions that provide information services, firstly by infoclio.ch, the Swiss portal of the historical sciences (www.infoclio.ch), and secondly by the Swiss national

sound archives (www.fonoteca.ch). In both cases, all services are digital and there is no direct contact between the institution and the users.

The study concerning the Swiss historical portal infoclio.ch was built around an online survey (with incentives for participants) in order to evaluate the usefulness of the information portal. As the portal contains different databases, a blog, an event calendar, etc., questions were developed specific to each component. An overall assessment by the user was included in the survey and a few benchmark questions as well. At the end of the study, the collected quantitative data was analyzed and presented with four personas based on this data.

The study concerning the Swiss National Sound Archives was focused around listening spots for copyrighted audio files and started with ethnographic interviews in three institutions housing a listening spot. The interviews were followed by an online survey containing questions focused on the usefulness and usage of the listening spots and questions regarding satisfaction with the content provided on the website of the Swiss National Sound Archives.

As stated earlier, the questionnaires for the two studies were elaborated on the basis of the attributes defined by Tsakonas and Papatheodorou in their Interaction Triptych Framework (the attributes are relevance, format, reliability, level and coverage). As it is rather rare to obtain the questions used in other usefulness studies and/or the studies contained a limited number of questions, it was decided to develop new questions going into detail for every attribute. These questions were then discussed with the stakeholder who added new ones or deleted some of them. After discussions with the stakeholders, the model developed by Tsakonas et al. was extended and two more attributes were added in order to correspond to their expectations, namely satisfaction and competition.

Satisfaction was added because whenever a digital library is of use to a user and when there are no major problems with the usability, it should positively and measurably influence the user's degree of satisfaction. Therefore, the attribute of satisfaction represents an indirect way of measuring the usefulness of a system. In the case of a non-satisfactory attitude of a user, it is very important to identify the source of this non-satisfaction. Is it due to usability issues and the user's inability to access a specific content although it is there? Or is it because of the non-relevance of the system's content with respect to the specific needs of the user? The answers to such questions

provide meaningful insights into the usefulness level of a system and indicate the components which are causing problems.

The attribute of competition provides knowledge about competitive services which may be consulted by a user. This attribute makes it possible to go beyond the hermetic view of a system in order not only to compare it with the users' needs and preferences, but to take its environment into account in the analysis. Any given system is always exposed to competitors, as competitive services influence the users' expectations and model their behavior.

Questions about competition also enable a comparison of the proposed contents and services with similar systems. The user may then indicate preferences for each component of the system. The attribute of competition also comprises an analysis between different components within the same system. Elements such as a blog, a database or databases, a news section, etc. can be compared with each other. This provides an insight into the component of the system which is most useful to the users. It is then possible to adjust the invested effort according to the ranking of each component.

These two new attributes cover aspects of a digital offer's usefulness which cannot be covered entirely by the other components of the Interaction Triptych Framework. Thanks to the supplementary information gained by asking questions regarding these aspects, further insights are possible. We therefore suggest extending the existing model by these components and to also take them into consideration when doing a usefulness evaluation.

In order to make the concept of usefulness as visual and understandable as possible, a mind map was created containing usefulness as the core concept, followed by the dimensions (or attributes) which are detailed in simple and general questions that could also show up in a survey (Fig. 1).

This concretization of parameters helped the stakeholders to understand the concept of usefulness. In addition, the mind map functioned as a starting point for further discussion and represented the central point during the whole evaluation process. As questionnaires and especially online-questionnaires are to be kept as short as possible to not demotivate the potential and actual participants, the number of questions had to be limited. The mind map allowed the stakeholders to see which aspects of usefulness could be explored and as a consequence made it easier for the stakeholders to decide which aspects are to be investigated and which aspects are to be ignored. In this context, it is important to know that the stakeholders were invited at several points in time to modify, add or delete questions according to the specific objectives of their evaluation. In the final stage, the questions were

transferred into an online questionnaire, disseminated by different means of communication (e.g. mailing lists, micro-blogs, social networks, newsletters, and the stakeholder's website itself).

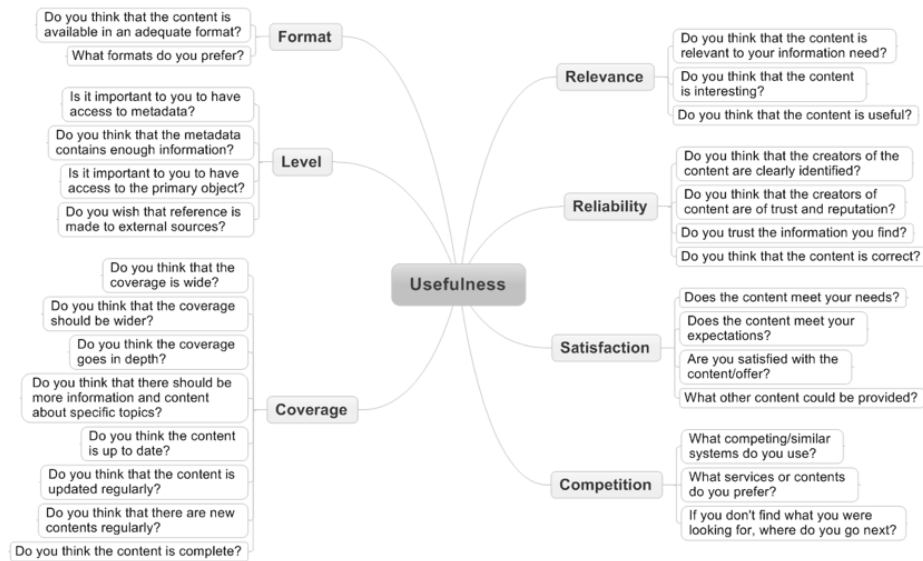


Fig. 1 Mind map (http://campus.hesge.ch/id_bilingue/doc/Usefulness_en.bmp <February 18, 2013>)

The evaluation process finished with an analysis of the obtained data and further explanations regarding this data together with recommendations for improving the service. A final meeting was also held with the stakeholders involved in the evaluation process. For further explanations see Birri Blezon/Hügi/Schneider (2011).

To make similar evaluations easier, the whole evaluation process, which can be interpreted as an assessment process, was subsumed in an eleven-step approach as follows:

1. Brief review of the object of interest and prior usability studies regarding this object
2. Analysis of the system's interface, its content and the context behind it
3. Execution of ethnographic interviews to get to know the users and their needs
4. Discussion with the stakeholders about the system which is to be investigated and about the blueprint containing the aspects and dimensions under investigation (mind map)

5. Stakeholders decide which dimensions of usefulness should be investigated with possible additions of questions to the blueprint
6. Elaboration of the (online) questionnaire
7. Confirmation and/or modification of the questionnaire by the stakeholders
8. Survey (maybe with an incentive), including call for participation, advertisement and promotion
9. Statistical and qualitative analysis of the results
10. Compilation of the results: design of personas by applying the social persona approach (Birri/Schneider 2011)
11. Presentation of the results to the stakeholders including recommendations and an impetus for their realization.

As can be easily seen, the process itself implies mutual compliance and also tries to yield compliance concerning the transfer and conversion of its result.

3.2 Building a general framework: PECE

One of the main objectives of this study was the transfer of the gained knowledge to librarians. As a consequence, the study aimed to develop a framework which librarians could follow in order to conduct their own usefulness evaluations.

We build a model of the whole process that allowed us to extract mesoscopic questions based on the specific questionnaires used in each case study, which represented the most difficult undertaking. In this context, mesoscopic questions represent questions void of all specific context, such as the library name or the service name. The complexity lay in the need to keep the questions specific enough so that a) their purpose is still understandable and b) they may be adapted to every one's own context with minimum effort.

In order to make the process and the collection of mesoscopic questions available to the public, an online platform was developed to provide a usefulness evaluation tool (usefulness.ch). This tool is based on the open source web application LimeSurvey which is dedicated to the creation of questionnaires and conducting online surveys. LimeSurvey is mainly based on PHP and MySQL and is currently the most complete open source software for surveys with an active community (limesurvey.org).

LimeSurvey provides an enormous amount of functions and allows parameterizing of surveys in detail. This inevitably leads to high complexity

within the interface. As many of the provided functions of this software were not used for the usefulness.ch platform, a new interface which works as a layer on top of the software was created.

In addition to the online survey software, the platform usefulness.ch provides a template questionnaire which contains all mesoscopic level questions. A user of this tool first of all obtains theoretical information about usefulness evaluations and the process. After creating an account on the platform, the user can access the template questionnaire. From this template questionnaire, the user can choose the questions which are to be integrated into his own questionnaire. In a further step, he may then modify the chosen questions according to the context of the evaluation purposes and add his own questions. After having completed the questionnaire, it is possible to either conduct the survey directly on the usefulness.ch platform or to export the survey. The exported survey can be imported on the official LimeSurvey website (see conditions of use on their website), where the user can access the full range of functions as needed.

If the survey is conducted via the online platform, a link is provided which can be sent to potential participants or integrated into a website for example. The responses are collected on the platform and can be exported once the survey has ended. The results can be downloaded in the .lsv format which is readable by any table-processing program like Excel.

The usefulness.ch platform is available in German or French and usage is free of charge.

4 Conclusions

Elaborating questionnaires, carrying out related ethnographic interviews and potentially combining this with other methods implies time consuming and tedious work if this is being carried out for the first time. However, as soon as these methods are transferred into an equivalent framework, the same process can be done with less effort and more ease. This finding led to the creation of our knowledge base in the form of a mesoscopic collection of questions that are of interest for usefulness evaluations of digital library content. As a consequence, libraries will be able to manage evaluations themselves by simply modifying the questionnaire according to their needs and

accompanying this with ethnographic interviews and a log file-analysis if needed. This tool might be helpful whenever strategic decisions have to be made, e.g. the acquisition or suppression of digital content, especially when they imply high costs. After a usefulness evaluation, the stakeholders will have an insight into the users' needs for new services and the level of satisfaction or non-satisfaction with existing services.

Future evaluations of digital libraries will equally examine the aspects of both usability and usefulness to yield a complete picture of the user's feedback on a digital library. However, due to the very innate relationship between the user and the content, it seems likely that this will only be possible in user-centered evaluations and less with experts alone. Their task will instead consist in the elaboration of appropriate questions.

It seems clear that after decades of putting the emphasis on evaluating a system's usability, the exploration of its usefulness, i.e. the usefulness of a digital library's content, is about to gain more and more interest. There is still much work to be done to establish this relationship and to build a solid methodological fundament. The work described in this paper can be considered as a contribution towards a further step in this process.

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