Usability Evaluation Factors Research in Network Database System

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Abstract. Based on the analysis and summary about the domestic and international network database usability evaluation, this paper hold an idea that the database usability evaluation is one kind of evaluation based on the relationship among three factors like the database system, the content of database and the user. On this basis, this paper built a new set of network database usability evaluation factors, and suggested that we should make an usability evaluation from the following aspects like database effectiveness, efficiency, system performance, 4 level indicators of users' satisfaction and 24 secondary indicators so that the evaluation can be well-targeted and highly practical. Finally, this paper took the case of WANGFA as an example to make an application exploration. Network database is mainly engaged in academic research for researchers. WANGFAN, CNKI, VIP and the National Library & Documentation Centre are top 4 datebases in China that continuously shared by people. Continues to digital and network resource sharing, improving the efficiency of users of digital resources is the main goal of excellent network database. However, in the construction of the database, if simply to pursue advanced automation technology, not care about the user's needs ,convenience, efficiency and other point of usability view, it will not improve the customer satisfaction index and not reach the expect result of the system. Therefore, Usability evaluation for network databases is particularly important. In the perspective of usability, this article created a set of network database usability factors combined with a case.

Keywords: Network database, Usability evaluation, User satisfaction, Chinese Database.

1 Definition of Usability

The definitions of usability in ISO9241/11 and GB/T3187-97 are relatively practical while the evaluation factors proposed by some scholars are much more suitable for research. These researches mainly include three kinds of studies. The first is the evaluation of contents and services provided by system, such as effectiveness (Booth 1989; Shackel 1986, 1991; ISO 1994; Kengeri 1999); usefulness (Booth 1989), ease of use (Shackel 1981; Furtado 2003) and functionally correct (Brinck et al. 2002). The second is the evaluation of user's using system, such as efficiency (Oulanov & Pajarillo 2002; Nielsen 1993), learnability (Hix&hartson1993) and errors (Nielsen 1993). The

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third is the evaluation of the user's subjective feelings, such as the attitude (Booth 1989; Shackel 1986, 1991), satisfaction (Nielsen1993; ISO 1994) and subjectively pleasing (Brinck et al. 2002). Table 1 compares various perspectives on the attributes of usability [1].

Table 1. Attributes of Usability

Autors (time)	Attributes
Shackel (1981)	ease of use, effectiveness
Shackel (1986,1991)	effectiveness, learnability, flexibility, user attitude
Booth (1989)	usefulness, effectiveness, learnability, attitude
Hix&hartson (1993)	initial performance, long-term performance, learnability, retainability, advanced feature usage, first impression, and long-term user satisfaction
Nielsen (1993)	learnability, efficiency, memorability, errors, satisfaction
Dumas&Redish (1993)	perform tasks quickly and easily
Guillemette (1995)	effectively used by target users to perform tasks
Gluck (1997)	useableness, usefulness
Kengeri et al.(1999)	effectiveness, likeability, learnability, usefulness
Clairmont et.al (1999)	successfully learn and use a product to achieve a goal
Outlanov&Pajarillo (2002)	affect, efficiency, control, helpfulness, adaptability
Kim (2002)	interface effectiveness
Brinck et al.(2002)	functionally correct, efficient to use, easy to learn, easy to remember, error tolerant, and subjectively pleasing
Furtado et.al(2003)	ease of use and learning

2 Related Research in Network Database

2.1 Research Abroad on this Topic

Oulanov and Pajarillo (2003) took a two-stage study, compared to two availability which one based on text and the other one based on the availability of New York University Library website. Their standards of the evaluation is impaction, efficiency, control, help and adaption [2]. Sueli Mara Ferrira and Denise NunesPithan (2005) evaluated the InfoHab (the Center of Reference and Information in Habitation) digital libraries, got data from six users which are different from academic background and experience. Their study used some methods including personal interview, library model, direct observation, audio and video. Meanwhile, the study used Usability evaluation criteria such as easy to learn, efficiency, error rate, effectiveness and user satisfaction [3].

Giannis Tsakonas and Christos Papatheodorou (2005) proposed a triple interaction model for digital libraries, electronic journal platform, portals, e-prints and some complex web information service system which required some interaction behavior. This model analyzed the web information services elements of the system(system, content, user), and the relationship between the availability and usefulness [4]. In 2008, combined with other researcher's results, some secondary indicators were added to this model [5].

2.2 Domestic Research on this Topic

At present, the evaluation of network database focused on the following points.

The Evaluation of the Network Database System. As one of the research results of the national social science foundation project "The Establishment and Application of Evaluation Criteria System for Networked Information Resources", WANG Huizhi, YUE Quan (2008) aims to take usage of the Evaluation Criteria System for Networked Databases, nine network databases are investigated and evaluated [6]. TIAN Qing, CHE Yao (2008) launched a series of elaboration on the meaning, the content and the method of the evaluation standard of network database in university libraries [7]. LIANG Lijun, HUANG Xiaoli (2008) used a Fuzzy Comprehensive Evaluation and established a system of network database evaluation which have six-level indicators and 30 second evaluation index [8]; YE Peizhen (2007); YU Xiaochong, HU Manggu (2007); WANG Yuan, LAI Maosheng (2006); ZHAO Wei (2006); ZHANG Liyi (2004) etc. researched the database evaluation in the perspective of database content, search system function, the situation of usage, cost-effective, service.

In these assessments, most of the evaluation is from the overall point of view in the database, the evaluation covers all the aspects of network database; the evaluation factors they selected is lack of a theoretical foundation; the evaluation method is single except the questionnaire.

Research on Evaluation Factors of Customer Satisfaction. GAN Liren, LI Li (2010) identifies key dimensions of information product and service quality provided by library website and develops user satisfaction index model for library website (ICSI-L) with its own characteristics based on American Customer Satisfaction model [9]. LI Li, GAN Liren (2009) explores the perceived quality of information user, identifies the key dimensions of information products and services quality provided by academic database website, and develops the assessment model of information user satisfaction [10]. XIE Zhaoxia, LI Li (2007) proposed ICSI-D model based on the customer satisfaction in scientific literature network database research [11]. GAN Liren, MA Biao (2004), An ACSI-based evaluation framework for the database websites is presented and multi-layer fuzzy integrative evaluation system is applied in database, Then the user satisfaction level of four famous database websites is evaluated.

Usability Evaluation Research in Network Database. LIN Haohui test the three major networks including the homepage, search interface, search performance, page of results and help documentation based on the usability can be understand as five different parts ,efficient, easy to learn, easy to remember, fewer mistakes and user satisfaction [13]. HU Xiaoqing, ZHANG Jianyong (2009) put forward a new set of evaluation indicators of usability on the basis of the traditional evaluation theory of usability, including intelligibility, operability, information accessing, identifying information, errors, efficiency and user satisfaction [14].

At present, the usability evaluation of network database has just started, the related research papers is also less. The existing evaluation is lack of theory, poor in systematic, less in some new availability method, less research in the potential demand, it is not conducive to improve the existing products and services.

2.3 Usability Evaluation Methods

Foreign scholars integrated with a variety of methods during the network database usability evaluation, such as Jones and Sumner (2002), taking web log analyse, collective evaluation, survey instruments, semi-structured interviews and other methods evaluate the national science, technology, engineering and mathematics digital libraries [15]. Dickstein and Mills (2000) research the usability of Arizona State University Library Web site, using the heuristic evaluation, cognitive walkthrough, card sorting, and formal usability methods [16].

MA Cuichang [17], a domestic scholars, supposed that usability test methods in network database contained three parts: investigation, verification and testing-related. we should choose different methods applied the different goals in different steps, look at the Table 2 shows .

Table 2. Network Database Usability Evaluation Methods

Step	Task or Goal	Method
investigation	Understanding the user' needs ,habits and the level of understanding the system through conversation or observation the process of using the system	Ethnography, Contextual observation, Focus Group, Questionnaires、Web Log Analyse and Interview
verification	Usability experts, software developers, users and other experts associated with usability testing	Heuristic evaluation and Cognitive walkthrougn
Testing-related	The evaluators understand the system's availability through operating systems or prototype to perform a specific task by users.	Cognitive walkthrough, Sound thinking
others	Card Sort, Category Membership Expectation, Claims Analysis, Concept-based Analysis of Surface and Structural Misfits, CASSM, Paper Prototyping	

3 Usability Evaluation Model

As mentioned above, the researches of usability evaluation of networking database have poor operability without outstanding secondary indicators of evaluation system. Using Giannis Tsakonas and Christos Papatheodorou's interaction triptych framework model, this article has built a new model, as the Figure 1 shows.

This new model considers that the main point of usability evaluation network database is focus on the relationship between database system, content and users .the system refers to the hardware and software components; content refers to all the database resources; user refers to people who using the resources. System manifested the content (data resources) through the hardware, software; users hope getting the information quickly and effectively, on the other hand, the system should respond appropriately towards the user's behavior. However, the main purpose of the user still hope to get exactly information they need. This mainly reflected in the content on the effectiveness. Therefore, the usability of database system focused on database performance, efficiency, effectiveness evaluation.

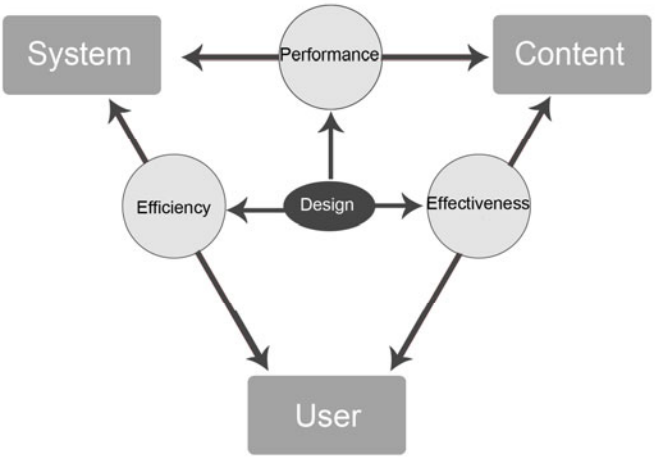

Fig. 1. Usability Evaluation Model

More importantly, this model emphasizes the importance of design. With the help of design, the performance of system can be improved, the content validity can be enhanced, the efficiency of system can be increased and the customers' satisfaction can also be promoted. Such as function planning, information architecture and interface design.

With the network database usability relational factors model and take ICSI-D model supposed by XIA Zhaoixa, LI Li (2007)and ICSI-L model proposed by GAN Liren, LI Li (2010) as reference, adding the user satisfaction index factor, we create the sets of network database usability evaluation factors, as is shown in Table 3.

Table 3. Network Database Usability Evaluation Factors

first-level indicators	effectiveness	efficiency	Performance	user satisfaction
Secondary indicators	related content document classification content authority precision update frequency	navigation category retrieval methods feedback aesthetic glossary level learnability	download speed accuracy memory response time error correction	the possibility of finding anticipated information help function personalized service feedback reasonable charges, is it the best database user complain whether it is worthwhile to continue to use

4 Case Study

4.2 Test Method

In this user test, we choose three key usability research methods. First, heuristic evaluation , 2-3 usability experts was invited to evaluate WANFANG database(The major reason is that our school have bought the all data resources);Second, task walkthrough, we set some representative tasks, invited some users to finish this tasks, use screen recording software to record the user's operation during their operation. In order to find more potential customers demand we combined with contextual interview, sound thinking method and semi-structured interview. Third, satisfaction questionnaires were used after the users finished the tasks.

4.2 Subjects Selected

We take the study from University of Freiburg, choosing four different types of people, because the web searching experience by past is a great impact factor when using the database. In order to find more usability problems, during this user test, we choose four separate users with different experience.

Table 4. Subjects Selected

Types	Introduction	Subject
Web+Usability+	familiar with Web use and "usability" issue	Our team members,3 person
Web+ Usability -	familiar with Web use , unfamiliar with "usability" issue	Out of our team, more familiar with the network database ,5 person
Web-Usability +	unfamiliar with Web use , familiar with "usability" issue	Department of Mechanical Engineering Graduate ,4 person
Web-Usability -	unfamiliar with Web use , unfamiliar with "usability" issue	Freshman,5 person

4.3 Task Design

According to the characteristic of WANGFAN database, five main functional modules were tested, including homepage, simple search interface, advanced search interface, search results and details of the interface. We set 2-3 tasks in each module, covering the main functions. To ensure react the common problem, each subject was required to do the same tasks, but specific to the search conditions (such as author, title, nominations, etc.) were different.

4.4 Discussion

Most users only use simple function of the database system, they input a few keywords; Most users expect search results output in relevant; In the handing of search results, most users visit only a few front pages; the click on the relevant link is less; When the search results can not satisfy the information needs, firstly, users will check the

accuracy of the keywords and different ways of expression, then, choose different types of database, if it is still not satisfied, users will replace other Databse, what's worse, they will give up the research behavior.

When customer use the network database, the goal is so strong, rarely concerned with other non-relative content. The motivation is different from surfing on the net, the former is targeted, while the later purpose is weak and vulnerable to other attractive content.

Correlation analysis is not enough, the current analysis including references, cited documents and related blog posts, it is not fully satisfy the needs of users. Poor in error correction, after the user input a wrong keyword especially the English keywords, the system will not give the right correction keywords.

Primary user is unclear in some terminology. Such as "Classic essay firstly" "Related BOWEN" "Knowledge context", some users can not understanding the meaning. Out of this, in the literature category, lack of some fund categories, users can not retrieve some funds contents.

5 Conclusion

The purpose of usability evaluation is finding more potential needs though a variety of combination methods. To do this, the system availability will be increased, the user experience will be enhanced, customer satisfaction and loyalty will be increased. This study build a set of usability evaluation factors based on the availability of domestic and foreign research results. We suppose that the usability evaluation in network database is focused on the relationship among database system, content and user. The outstanding performance of three aspects is 4 first-level indicators which are efficiency, effective, performance and user satisfaction and corresponding 24 secondary indicators. Through refining the usability evaluation factors, it has a better operability and a good foundation of implementation in the future usability evaluation.

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