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WEB SITE ANALYSIS: A REVIEW AND ASSESSMENT OF PREVIOUS RESEARCH

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ABSTRACT

The emergence of the World Wide Web as a major communication and transaction channel stresses the preeminent importance of a company's Web site for representing the organization, interacting with customers and conducting transactions. In comparison to other channels, the opportunities for targeting specific market segments are somehow limited, due to the Internet's worldwide reach and predominantly anonymous users. Additionally, an ever-increasing number of customers are going online, which prevents the fine tuning of a site for specific user groups. Therefore, it seems essential that organizations possessing Web presence should be well aware of their site's general functionality and how it is perceived by Internet users. For many years the analysis of Web sites has been one of the major topics for both scholars and practitioners, which led to a huge number of different techniques being used for the evaluation of sites. Furthermore, a variety of different theories and models have been developed which include the effects of Web sites as dependent or independent variables. In this paper, I compare different approaches to Web site analysis and present a classification framework. Numerous examples will be given to illustrate the various dimensions of the framework. Furthermore, benefits and drawbacks of the respective methods will be discussed where applicable. The results provide important insights into the current state-of-the-art of Web analysis and will be supportive for anyone planning to conduct a Web analysis as well as for someone who is interested in getting an overview of the research field.

Keywords: Web analysis, Web sites, Web Evaluation, Metrics

I. INTRODUCTION

A company's Web site may be perceived as its global, worldwide accessible representation on the Internet; therefore, it has to simultaneously satisfy the needs of many heterogeneous groups, which not only vary according to their demographic and psychographic characteristics, but also according to the technical equipment which is available. Contrary to other communication and transaction channels, the actual appearance of a company's homepage on a user's screen may be influenced by a number of technical factors, which cannot be directly controlled by the organization operating the site. Examples include the browser version being used and the settings, the installed plug-ins, the monitor solution and the amount of bandwidth being available.

Previous research has shown that the operational effectiveness of a Web site, which can be measured e.g. by number and duration of visits, has a significant influence on marketing performance [Lii et al. 2004]. Besides other causes, poor Web site design and long server down times can be held responsible for the failure of several DotComs [Razi et al. 2004]. In addition to that, customers' changing expectations and perceptions over time impose an additional problem for Web designers and system operators [O'Neill et al. 2003]. Under these

circumstances, it seems natural that a great demand for reliable and valid metrics exists, which could help to measure a Web site's performance and its impact on the users. Interestingly, many constructs in Web analysis are not consistently defined and more than one measurement approach exists. Huang [2005, p. 842], for example, develops an instrument to measure Web performance as perceived by customers, which he defines as "Web users' subjective evaluative judgment toward a particular Web site." Contrariwise, Huizingh [2002, p. 1225] perceives Web site performance as the "number of visitors and the managerial satisfaction with the site."

The beginning of Web site evaluation can be traced back to the work of Boyd Collins, who founded the Infofilter project in 1995, which was the same year O'Connor and O'Keefe [1997, p. 171] associated with the "World Wide Web gold rush." The Infofilter initiative strived to "provide librarians and others with timely and accurate reviews of Internet resources." In order to do so, they "tried to identify objective criteria for Internet resource reviews, created and revised reviews themselves and participated in the editorial process for Internet resource reviews." The project, which was dependent on the work of volunteers, ceased its operation in July 1997 due to the emergence of competing initiatives which had better funding and superior resources. The criteria they originally used included authority, content, organization, currency, search engine, graphic design and the innovative use of the medium. Further information about the project and the reviews can still be found on Infofilter's Web site (www.usc.edu/users/help/flick/Infofilter/). The same year in which the Infofilter project began its operation, Jacob Nielsen started his Alertbox (www.useit.com/alertbox) and Hoffman et al. [1995] proposed a structural framework for examining the commercial activity on the Web. They introduced a categorization framework for commercial Web sites which differentiated between six distinct functional categories, including (1) Internet storefront, (2) Internet presence, (3) content, (4) mall, (5) incentive site and (6) search agent. Most notably, 50 out of the 70 references they cited stem from the same year the paper was written, which indicates that 1995 was the year in which systematic ways and concepts of analyzing Web sites emerged.

During the following years, a huge amount of Web analysis studies and research projects have been carried out by both scholars and practitioners with a wide variety of applied methods and goals. With so many projects in progress, it seems natural that many different approaches are used. In order to give scholars and practitioners a better understanding about previous endeavors and to enable them to build on existing research, this paper summarizes and compares aspects of a huge number of Web studies. In the beginning, a framework is developed which depicts several dimensions of Web analysis. In the following sections each dimension is described in more detail and practical examples from previous studies are given. Additionally, in the appendix numerous papers are listed and classified.

II. FRAMEWORK FOR WEB ANALYSIS

In this paper, I concentrate on the external evaluation of Web sites, which pertains to the information a third party can get out of a certain Web site or the impression one gets when visiting the site. I therefore explicitly ignore all information that may be available only to a site's operator, such as log files or click stream information. As a starting point for my research I used several key terms, such as *Web analysis* or *Web evaluation* to search for relevant journal and conference papers especially in the Information Systems and marketing domain. The references sections of these publications then served as sources for further investigations. In addition to that, popular search engines were used for detecting papers and projects not being listed in scholarly databases such as ABI/Inform or EBSCO. By using methods of content analysis, I classified the Web analysis projects and finally I came up with the framework being shown in Figure 1, which presents an outline of the remainder of the paper.

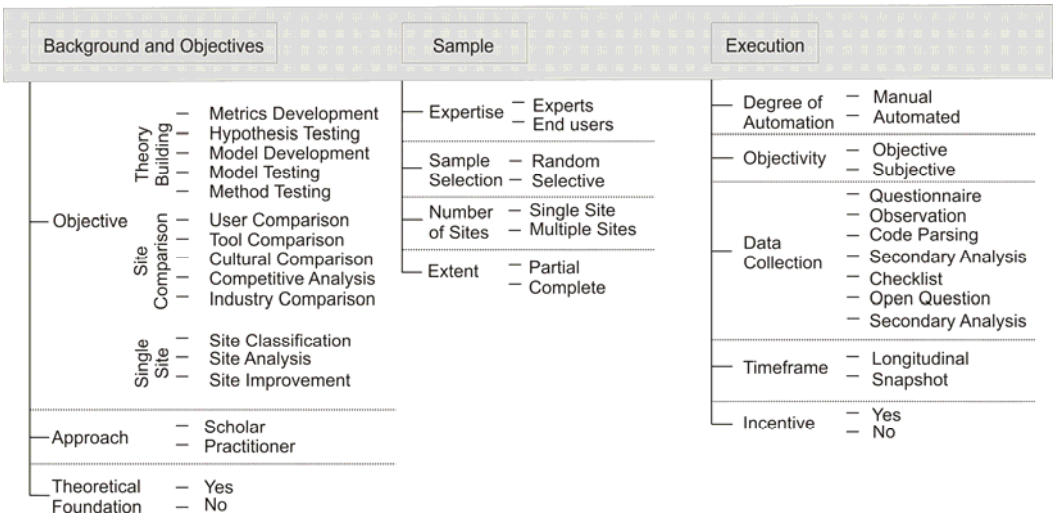

Figure 1. A Framework for Web Analysis

I divide my framework roughly into three sections. I start with a discussion of the various research backgrounds and objectives, which basically outlines what the various papers and projects are all about and how the research is conducted. I identify three major objectives, including approaches which aim at testing hypotheses or theories, comparisons of sites and strategies to assess a single site. While most of the studies cited in this paper have a scholarly approach, I additionally present several examples which are targeted toward a non-scholarly audience. Furthermore, many of the scholarly papers at least mention some previous theories upon which their research is built. Others have no explicit theoretical foundation.

The second section deals with the sample which is chosen for assessment, including both the sample of the sites and the evaluators (if applicable). Expertise refers to the amount of previous or specialized knowledge an evaluator possesses. In many cases, it may be desirable to have sites evaluated by end users without any specific Internet knowledge in order to measure the perception of a Web site, while in other cases it may be necessary to ask experts about a site's features. During the sample selection process the number of sites being analyzed has to be defined, as well as whether a random sample or a selective sample is chosen. I further differentiate whether a single site or a number of sites are evaluated. The latter is frequently the case when comparisons are made. The extent refers to the actual amount of a site being analyzed. Particularly when user surveys are conducted, only parts of a site are examined.

In the third section, I discuss how the study is conducted. The degree of automation addresses the issue of whether the process of analysis is done by human beings or by software tools. While some projects try to gather objective criteria, which are independent of the person or tool performing the analysis, other studies explicitly concentrate on users' perceptions, thereby conducting subjective assessments. Concerning the methods by which data is collected, a number of alternatives are used in scholarly literature, which will be discussed later on in more detail. Most of the papers I found used snapshot analyses, i.e. they conducted their analysis only once. However, there exist some projects which concentrate on reporting sites' developments over time. Finally, I checked whether incentives were given to survey participants.

In the following sections different dimensions of Web analysis are sequentially discussed. I am aware that some sections may partially overlap. Furthermore, not all papers being cited in the references are categorized according to all dimensions. Therefore, I concentrate on using salient examples as an illustration. In the appendix a brief overview on the papers I used can be found, including the most important criteria.

III. BACKGROUND AND OBJECTIVES

OBJECTIVE

A huge number of objectives of Web analysis projects exist. In contrast to studies which primarily concentrate on a descriptive analysis of results, including those from consultants and market researchers [e.g. Deecke et al. 2005, Rogowski et al. 2005], it is the scholarly papers which strive especially to either develop new metrics or use previously validated instruments to test theories. These studies focus more on assessing the reliability and validity of measurement instruments rather than on the actual rating of single sites. Among those aspects of Web sites which are of major interest for researchers are the quality of the Web site, performance aspects and users' satisfaction.

Aladwani and Palvia [2002], who develop a measure for Web quality, use a comparison of sites from a bank, a bookshop, a car manufacturer and an electronics retailer to examine the reliability of the proposed instrument. By conducting a principal component analysis they assess the dimensionality of their construct. A different approach is pursued by van Iwaarden et al. [2004], who do not assess Web sites, but instead use two different student samples to identify the quality aspects perceived to be the most important. They conclude that the quality dimensions originally developed by Zeithaml et al. [1990] in the SERVQUAL instrument, are equally useful in e-business. Similarly, Barnes and Vidgen [2001] use SERVQUAL to further develop and enhance their WebQual instrument.

In order to measure a site's performance, Huang [2005] differentiates between utilitarian and hedonic aspects. He uses exploratory and confirmatory factor analyses and MultiTrait-MultiMethod models to validate his instrument. As was mentioned above, there are various way to measure a site's performance, including the number of visitors and managerial satisfaction [Huizingh 2002], informational attributes (e. g. customer contact information) [Chung and Law 2003] or user satisfaction, likelihood of return and frequency of use [Palmer 2002].

By combining information systems research on user satisfaction and marketing perspectives on customer satisfaction, McKinney et al. [2002] explore the role of expectation and disconfirmation regarding information quality and systems quality. Their results provide an instrument for analyzing Web customer satisfaction within the expectation-disconfirmation paradigm. Abdinnour-Helm et al. [2005] adapt the end-user computing satisfaction instrument for the Web and come up with content, accuracy, format, ease of use and timeliness as the major dimensions. They validate their research by using confirmatory factor analysis and invariance analyses.

Further examples of papers which deal with metrics can be found in Table 1. Kim et al. [2002] use the constructs developed by the Roman architecture critic Vitruvius (firmitas, utilitas, and venustas), and come up with six architectural dimensions for Internet businesses, namely internal stability, external security, information gathering, order processing, system interface and communication interface. In order to measure consumer expectations of online information provided by bank Web sites, Waite and Harrison [2002] use a factor analysis to identify consumers' information requirements. In contrast to the previously mentioned studies, they do not explicitly focus on generating a new measurement instrument. Instead, they categorize items which are generated by two focus groups. Agarwal and Venkatesh [2002] use the Microsoft usability guidelines as a starting point and develop sub-dimensions of usability in a four-phase process.

Besides developing new instruments, the classification of different sites stands out as a central objective of many Web analysis projects. An early effort to categorize Web sites according to their functional elements stems from Hoffman et al. [1995], who differentiate between online storefront, Internet presence, content, mall, incentive site and search agent. These functions may be used as building blocks for successful sites, with commercial Web site design including online storefront sites, Internet presence sites and content sites. Being one of the first papers presenting a framework, they do not explicitly use metrics for classification, but instead define categories and give numerous examples of each type. In order to determine the constituents of a successful site D'Angelo and Little [1998] conduct an extensive literature review and finally come up with a list of ten characteristics which they

apply for the comparison of twenty different sites. They do not concentrate on a certain type of site. Instead, they use characteristics which might be perceived as being important for all types of Web sites. Contrariwise, Evans and King [1999] use a literature review to identify the most important categories and factors for their B2B Web site assessment tool.

Table 1. Development and Improvement of Metrics

Author(s)	Focus	Web Site Dimensions
Abdinnour-Helm et al. [2005]	Satisfaction	Content, Accuracy, Format, Ease of Use, Timeliness
Agarwal and Venkatesh [2002]	Usability	Content, Ease of use, Promotion, Made-for-the-medium, Emotion
Aladwani and Palvia [2002]	User-Perceived Web Quality	Specific Content, Content Quality, Appearance, Technical Adequacy
Kim et al. [2002]	Architectural Quality of Internet Businesses	Internal Stability, External Security, Information Gathering, Order Processing, System Interface, Communication Interface
McKinney et al. [2002]	Web-Customer Satisfaction	Web Information Quality Satisfaction, Web System Quality Satisfaction
van Iwaarden et al. [2003] van Iwaarden et al. [2004]	Applying SERVQUAL for Web sites	Tangibles, Reliability, Responsiveness, Assurance, Empathy
Waite and Harrison [2002]	Consumer expectation of online information provided by bank Web sites	Transaction Technicalities, Decision-making Convenience, Interactive Interrogation, Speciality Information, Search Efficiency, Physical Back-up, Technology Thrill

Over 120 quality characteristics and attributes for the academic site domain are listed by Olsina et al. [1999], with up to 80 of them being directly measurable. Their primary goal is to classify and group the single elements, which are then placed into four major categories, namely usability, functionality, site reliability and efficiency. In a subsequent paper Olsina and Rossi [2002] illustrate how their Web Quality Evaluation Method (WebQEM) can be applied. González and Palacios [2004] construct an index based on literature reviews and they themselves assign the relative weights to the respective categories based on the expertise of the authors. In order to analyze the functionality of Web sites comprehensively, Yeung and Lu [2004] develop a framework in the form of a two-dimensional grid, which classifies four types of functions (information, communication, downloading, and transaction) and addresses a wide range of e-commerce activities (e.g. advertising, sales and distribution). They use a sample of three major oil companies to demonstrate the application of their grid. Unlike related approaches, they do not strive to develop certain benchmarks or performance metrics, but instead leave it up to the reader to interpret the data thereby avoiding potential pitfalls which may occur when the weights of metrics are being calculated. However, such data are more complex to interpret. In order to account for the peculiarities of automated Web site analysis, Signore [2005] suggests a number of criteria according to presentation, content, navigation and interaction which can be evaluated automatically.

The improvement of sites is another major objective of Web analysis research. In order to make a Web site more effective, Palmer and Griffith [1998] propose to match design characteristics, including e.g. media richness, promotional activities and online sales with information intensity aspects of the firm. Although being a conceptual piece of research, their framework represents one of the early approaches to search for antecedents of Web design. By using (a) functional and navigational issues, (b) content and style, and (c) contact

information as metrics, Johnson and Misic [1999] develop a benchmarking tool and compare their own college's Web site to 45 other school Web sites. They report the ability to customize the evaluation to the organization and the situation at hand to be one of major strengths of their benchmarking approach. Rather than comparing their site to related sites, they strive to identify ideas and practices which could be adopted to improve their own site. Based on a matrix of business functions (promotion, pricing, transaction, services) and customer values (information, friendliness, responsiveness and reliability), Wan [2000] builds a matrix which supports a development plan for commercial Web sites involving all aspects of a transaction. He illustrates the usage of his framework by comparing three different online bookstores (Amazon.com, Barnesandnoble.com, Borders.com).

Finally, some authors use the metrics for competitive analyses. Schubert [2002] illustrates the functionality of the Extended Web Assessment Method (EWAM) by performing an analysis of Web sites in two different business sectors (consumer goods and e-banking). The criteria being evaluated in her method can be clustered into usefulness, ease of use, and trust. In addition to that, she differentiates between different phases of a transaction (information, agreement, settlement, after-sales). Her findings show that most of the Web sites being analyzed do not come up to the original expectations. Agarwal and Venkatesh [2002] compare airlines, bookstores, auto manufacturers and car rentals according to their perceived usability. They demonstrate a heuristic evaluation procedure for examining the usability of Web sites and conclude that their instrument contributes an important metric to help managers predict the success of e-commerce. Table 2 gives an overview of the aforementioned papers.

Table 2. Site Classification, Analysis and Improvement

Author(s)	Focus	Web Site Dimensions
Agarwal and Venkatesh [2002]	Usability of Web sites	Content, Ease of Use, Promotion, Made-for-the-Medium, Emotion
D'Angelo and Little [1998]	Constituents of Successful Sites	Ten selected characteristics (e.g. proper use of fonts, number of images, proper use of colors)
Evans and King [1999]	B2B Web Site Assessment Tool	Home Page, Overall Site Design and Performance, Text Content, Audio-Visual Elements Interaction and Involvement
González and Palacios [2004]	Web Assessment Index	Accessibility, Speed, Navigability, Site Content
Hoffman et al. [1995]	Functional Categories of Commercial Web Pages	
Hung and McQueen [2004]	Web Evaluation Instrument from a First-Time Buyer's Viewpoint	Variety of Web functions
Johnson and Misic [1999]	Development of a Benchmark for Web sites	Functional/Navigational issues, Content and Style, Contact Information
Olsina et al. [1999]	Web site Quality Evaluation Method (QEM)	Usability, Functionality, Site Reliability, Efficiency
Olsina and Rossi [2002]	WebQEM	Usability, Functionality, Reliability, Efficiency

Author(s)	Focus	Web Site Dimensions
Palmer and Griffith [1998]	Matching Site Design with Information Intensity Aspects of the Firm	Media Richness, Design, Product Information, Hyperlinks, Product Support, Promotional Devices, Online Distribution, Tech Support
Schubert [2002]	Extended Web Assessment Method (EWAM)	Usefulness, Ease of Use, Trust
Wan [2000]	Matrix of Business Functions and Customer Values	Information, Friendliness, Responsiveness, Reliability
Yeung and Lu [2004]	Functionality Grid for Web site Evaluation	Information, Communication, Downloading, Transaction

A great deal of contemporary IS research is about developing and testing theories by building models and empirically testing them. Accordingly, quite a few models exist which include attributes of Web sites either as independent (cf. Table 3) or dependent (cf. Table 4) variables. Madeja and Schoder [2003] measure the impact of several attributes of Web sites on corporate success in e-business. In addition to that, they differentiate between B2B and B2C companies. Their findings suggest that in the case of B2B companies, interactivity and immediacy positively impact corporate success, whereas media richness and variety as well as availability and ease-of-use impose the most important factors for B2C companies. The model from Scharl et al. [2003] combines data gathered both manually and automated and explains overall online success (awareness, booking, inquiries) for the hotel industry.

Based on an extensive literature research Zahedi et al. [2001] propose a framework that not only takes into account individual factors (e.g. demographic variables, professional knowledge), but also cultural factors (power distance, collectivism vs. individualism, masculinity vs. femininity, uncertainty avoidance, long-term vs. short-term orientation, polychronic vs. monochronic time orientation). They suggest that these serve as antecedents for design effectiveness which in turn influences the overall satisfaction with Web design. In contrast to most other frameworks, their approach takes into account that differences in intercultural perceptions of Web sites exist. Although not explicitly specifying a model, Singh et al. [2003] use a comparison of domestic and Chinese Web sites from 40 U.S.-based international companies in order to test for cultural differences. Their results show that the Web is not a culturally neutral medium but instead has many cultural markers. By combining consumer characteristics and Web usage characteristics, Huizingh and Hoekstra [2003] develop a model that strives to explain flow as well as a hierarchy of other effects, namely attention, cognition, affection and conation. Their findings suggest that the involvement of the consumers with the topic and the flow they experience during their visit are the most important determinants for the effects under investigation.

The conceptual model from Zahedi et al. [2001] shows overall satisfaction with the Web design as the dependent variable and a number of cultural and individual factors as antecedents for design effectiveness which in turn influences the satisfaction. They give a lot of propositions which might serve as an useful starting point for further empirical studies. Liang and Lai [2002] take a consumer-oriented perspective to derive functional requirements for e-store design. By analyzing three online bookstores in Taiwan, they find that hygiene factors (e.g. security, service phone) are important when consumers decide whether they want to shop online, while motivational factors (e.g. search engine, home delivery) influence the choice between different sites. Media richness factors (e.g. price comparison, customized information) turn out to be least important. The model proposed by Huang [2003] addresses the problem of whether Web sites can be designed to be both utilitarian and hedonic. By using both aspects as independent variables and complexity, novelty and interactivity as antecedents (with the latter ones influencing a user's flow experience), he concludes that successful sites must satisfy both the information and entertainment needs of users.

A completely different set of indicators determining consumers' attitudes toward a site is investigated by Rose et al. [2005]. They concentrate on the influence of download time on the

attitude toward the page and the retailer. Their findings indicate that objective download delay is not a critical determinant of the attitude toward an e-retailer.

The performance of the Web site (being indicated by managerial satisfaction and number of visitors) serves as the dependent variable in the paper from Huizingh [2002]. Company characteristics, the Web initiative, Web site characteristics and the Web strategy serve as independent variables in his research framework. His results show that most of the influencing factors in his model influence the performance of Web sites. The model from Lii et al. [2004] uses certain Web site features (multimedia, entertainment), accessibility and reliability to predict Web operational effectiveness, online productivity and online sales growth rate. By using a structural equation modeling approach, their results suggest that reliability bears the most important effect on a site's effectiveness.

Table 3. Models with the Web site as the Independent Variable

Author(s)	Dependent Variable(s)	Dimensions of Web Sites being analyzed
Huang [2003]	Web performance (utilitarian vs. hedonic)	Complexity, Interactivity, Novelty
Huizingh and Hoekstra [2003]	Attention, Cognition, Affection, Conation	Web Usage Characteristics
Liang and Lai [2002]	Consumer Choice	Hygiene factors, Motivators, Media Richness Factors
Madeja and Schoder [2003]	Corporate Success in E-Business	Interactivity, Immediacy, Connectivity, Media Richness and Variety, Availability, Information Richness, Ease-of-Use, Individualization and Customization
Rose et al. [2005]	Attitude toward Web Page, Attitude toward Retailer	Actual Delay, Estimated Delay
Scharl et al. [2003]	Awareness, Bookings, Inquires	Interactivity, Navigation, Layout, Textual
Zahedi et al. [2001]	Overall Satisfaction with Web Design	Usability, Reliability, Comprehensibility, Clarity

Singh et al. [2005] develop a model to measure users' reactions to Web pages. The attitude toward a Web page serves as an endogenous variable which is determined by evaluations (positive and negative feelings) and itself has an impact on behavioral intentions. In comparison to that, Drèze and Zufryden [2004] are interested in how the visibility of a site (i. e. the presence of a brand or product in a consumer's environment) is influenced by factors such as online and offline advertising, external links, online news reports and discussion groups. They conclude that online visibility is more important for traffic generation than advertising spending or user awareness.

In the case of automated Web site evaluations, the tools themselves frequently become the focus of research. Comparisons of different tools have been conducted by e.g. Brajnik [2000] and Ivory and Chevalier [2002]. An overview of the state of the art of automating usability evaluation of user interfaces can be found in Ivory and Hearst [2001]. The paper from Ivory et al. [2003] concentrates especially on the needs of handicapped users. They analyze how automated evaluation and transformation tools might be used to develop sites for users with diverse needs. Their results suggest that some classes of users are not adequately supported, e.g. those with motor impairments or difficulty with mouse or keyboard usage.

Table 4. Models with the Web Site as the Dependent Variable

Author(s)	Dependent Variable(s)	Dimensions of Web Sites being analyzed
Drèze and Zufryden [2004]	Site visibility	References to a site
Huizingh [2002]	Performance of the Web Site	Web Initiative, Web Site Characteristics, Web Strategy
Lii et al. [2004]	Web Operational Effectiveness, Online Productivity, Online Sales Growth Rates	Feature (Multimedia, Entertainment), Accessibility, Reliability
Singh et al.[2005]	Attitude toward Web page (influencing behavioral intention)	Feelings, Evaluations, Attitudes

APPROACH

In this paper I mainly concentrate on scholarly research. Nonetheless, it has to be mentioned that a huge number of analyses exist, which are targeted for a broad audience rather than for a comparatively small group of academics. Often the form of a contest is chosen when Web sites are compared and in most cases an expert jury is used. Examples include the 2000 Worldwide Web 100, a ranking of the Fortune 500 companies which was done by the London School of Economics [Evans et al. 2000], and the Webby Awards (www.webbyawards.com), an ongoing contest where participation is dependent upon a fee. In addition to that, consultants and market researchers frequently compare different Web sites between countries, as did Forrester Research who looked at 20 U.S. sites and 16 Japanese sites [Rogowski et al. 2005], or within a country, as did Roland Berger, who used the 500 leading Austrian companies as their population [Deecke et al. 2005]. In comparison to scholarly surveys, less information is given about how the measures being used were generated and validated.

Besides concentrating on the analysis or comparison of sites, many scholarly papers also aim at developing new instruments or enhancing existing ones. Therefore they concentrate especially upon issues such as the objectivity, reliability and validity of the instruments used for measurement. As a first step sample items usually have to be generated or taken from existing literature. Aladwani and Palvia [2002] report to have used a Delphi study in order to evaluate the items and eliminate repetitive and inappropriate ones. Even when objective features are assessed, such as the number of bad links, errors can happen due to unqualified evaluators. Kim et al. [2002] state that they first trained 30 persons in using their coding schema, and later they allowed them code to one sample independently. They reached a kappa ratio for intercoder reliability of 0.954 on average.

Those studies which have chosen to integrate aspects of Web sites into a model usually report a number of statistics which can be used to assess the overall fit of the model. Such indicators include e.g. Cronbach's alpha and factor loadings for parts of the model as well as e.g. normed Chi-square, RMSEA, GFI and AGFI for the whole model [e.g. Abdinnour-Helm et al. 2005, Ethier et al. 2004, Rose et al. 2005].

Industrial Web analysis projects, which mainly concentrate on site improvements, may be seen as a third category, besides scholarly research and contests. One example is given by Fujitsu, which develops the so-called scenario-based walkthrough. By having users first define the objectives of a target Web site, and by having evaluators afterwards answer questions about the steps of operation needed to perform, they invent a cost-effective way for improving a Web site's usability [Segawa et al. 2005].

THEORETICAL FOUNDATION

Most scholars who analyze Web sites derive their items from previous research or from personal expertise. However, few researchers explicitly base their survey on an existing theory. Frequently they use existing instruments and adapt them for analyzing Web sites, as do Abdinnour-Helm et al. [2005] with the End-User Computing Satisfaction Instrument (EUCS). Similarly, van Iwaarden et al. [2004], [2003] adapt the SERVQUAL instrument, which

was originally developed by Zeithaml et al. [1990] and is commonly used in marketing research. In order to develop constructs for measuring Web-customer satisfaction, McKinney et al. [2002] apply theoretical perspectives from IS research (end user satisfaction) and analyze information quality and system quality as antecedents of Web customer satisfaction, which is based on the model proposed by DeLone and McLean [1992]. Furthermore, they use the expectation-disconfirmation paradigm and SERVQUAL, both widely used in marketing literature, upon which to build their model. Zhang and von Dran [2000] apply Herzberg's two-factor theory for differentiating between factors which will be taken for granted by users and those factors which will add extra value by producing satisfaction and enjoyment. Later they extend their research model by integrating quality dimensions and relate the quality characteristics to certain design features [von Dran and Zhang 2002]

IV. SAMPLE

EXPERTISE

When performing a manual evaluation, the expertise of the jury plays a crucial role for the quality of the outcome. One example of an evaluation which is primarily based on a single expert's opinion includes Jacob Nielsen's Alertbox, which is currently updated every two weeks (www.useit.com/alertbox/). When the sample size is comparatively low, the evaluation process may be done by a single person. When checklists are used and objectivity is guaranteed, the evaluation process may even be carried out by the researchers themselves. An alternative would be to adequately train a number of evaluators in order to reach a common understanding. Building upon Nielsen's usability guidelines, Levi and Conrad [1996] use two groups of experts: a group of four user interface experts and four developers. They were given a project overview and usability principles (heuristics) prepared by the experimenters. Their results show that both groups performed quite similarly, although in this research a number of restrictions exist, in that they examine a prototype containing a significant number of easy-to-find usability problems.

In order to find benchmarks for their own college's Web site, Johnson and Misic [1999] first identify relevant sites and then they develop the metrics. The actual assessment, which includes the comparison of 45 sites, is done by a person who is both a graduate student and an employee of the college of business. In this case, the measurement instrument is developed by the researchers and only the evaluation process is performed by a student. Yeung and Lu [2004], who concentrate on measuring objective criteria, report that they carried out all measurements in duplicate. Whenever a discrepancy occurred, a further check by the primary researcher is made. Singh et al. [2003] use doctoral students to assess the reliability of the instrument. By having four students assigning a random list of category items to several cultural dimensions, they not only assure interjudge reliability but also content validity.

As far as prestigious awards are concerned, professionals who are familiar with the Internet are usually chosen as judges (e.g. www.webbyawards.com). Liu et al. [2000] select the Webmasters of the Fortune 1000 in order to find antecedents for the design quality of Web sites. Similarly, Huizingh [2002] opt for 651 Web sites from two directories (Yahoo and Dutch Yellow Press) and contact the companies themselves. After accounting for sites which are unavailable, their response rate turns out to be 19.4 per cent. Lii et al. [2004] address the chief marketing officers at selected manufacturing companies.

Contrariwise, it might be necessary to purposely ask end users who more closely resemble average customers. Survey participants may include general Internet users or samples from industry-specific databases such as Internet shoppers who are interested in certain industries (e.g. travel or hotels [Jeong et al. 2003]), or female shoppers who have purchased apparel online [Kim and Stoel 2004]). Similarly, Huang [2003] uses academic and continuing education programs to contact the users. In many scholarly research papers students are used for the assessment process [e.g. Barnes and Vidgen 2001; Dellaert and Kahn 1999; Palmer 2002].

Especially when new measurement instruments are constructed and tested, a number of subsequent surveys may be necessary. McKinney et al. [2002], who use undergraduate and

graduate students as their sample, report to have initially consulted ten Internet customers and experts in order to evaluate their instruments for face and content validity. Subsequently they use two pilot tests, with 47 usable responses each, followed by two rounds of data collection with 330 and 238 usable responses, respectively. The major advantages of using students include a homogeneous sample, the ability for giving them instructions [Huizingh 2000], their familiarity with the Internet and the comparative ease to create experimental settings [Rose et al. 2005]. Kim et al. [2002] recruit students on campus through advertisements and train them in the coding schema. At the end of the training the students have to evaluate a test site in which the results were verified by the research directors. In addition to that, a kappa ratio for intercoder reliability is calculated. However, generalizing these results may be possible only to a limited extent [Abdinnour-Helm et al. 2005], especially when sites are analyzed where students' involvement may be low [cf. Kim and Stoel 2004, Koufaris 2002].

SAMPLE SELECTION

In most research projects the number of sites which are evaluated is limited by the human resources being available, and a tradeoff has to be made between the depth and the breath of the survey. Generally speaking, random or selective samples of Web sites can be differentiated. Huizingh [2000], for example, uses a sampling procedure that combines quota sampling and proportionate stratified sampling. By using two directories (Yahoo and Dutch Yellow Pages), he ensures a broad sample base. In his paper a quota sampling is used to avoid the dominance of IT-companies.

Another strategy used for evaluation is to purposely pick a certain site for analysis or as a reference. In order to find the best practices which may be useful to incorporate into their own college Web site, Johnson and Misic [1999] first define several criteria (e.g. alma maters of College of Business graduate teaching faculty, 1994-1997 GMAT score recipient, 1997-1998 AACSB salary survey report), which are then used to identify relevant sites. Since their target is to improve their own site rather than comparing different sites, they purposely select their sample. The same is done by Li [1998] who conducts a content analysis of three American newspapers (*The New York Times*, *Washington Post*, *USA Today*) in order to analyze their approach to Web design.

In some cases a feasible alternative may be to let the users themselves choose a Web site with which they are familiar. This might be helpful when the research focuses on constructing or validating a measurement instrument. Kim and Stoel [2004] ask 273 U.S. female online shoppers to use the online apparel retailer which they had visited most often in the past year. They argue that non-shoppers or non-frequent shoppers may not be able to develop meaningful perceptions of Web site attributes. Huang [2005] randomly assigns to each evaluator two Web sites which belong to the same product company. She lets the users visit the Web sites as long as they want in order to familiarize themselves with the sites.

Other studies concentrate exclusively on a certain industry or a geographical region in order to allow for direct comparisons. Scharl et al. [2003] use the hotel industry as their research object and combine variables being gathered with an automated Web site analysis with dependent measures collected in an offline survey. As a demonstration as to how his framework can be used, Wan [2000] compares online bookshops in regard to a number of functions which generate value for the customers. In order to compare Web sites from different countries and sectors, Schubert [2002] purposely uses a comparatively small sample (four sites from the consumer goods and the e-banking sector respectively, which originate in different countries). One site of each group is used as the best practice example, thereby serving as a kind of benchmark. Yeung and Lu [2004] concentrate on a sample of Hong Kong-based companies and use related studies from the US and Europe to compare their findings. Palmer and Griffith [1998] use 250 Web sites from the U.S. Fortune 500 as their sample, and argue that this selection probably utilizes the widest array of Web technologies. A similar selection process is made by D'Angelo and Little [1998], who select a list of award-winning sites from Windows magazine as well as from Yahoo!. In order to account for cultural differences Singh et al. [2003] analyze domestic and Chinese sites from 40 U.S.-based companies.

NUMBER OF SITES

While automated methods of analysis suffer from fewer restrictions as to how much is being analyzed, manual methods usually face a tradeoff between the evaluation of a few sites by many users or of having a multitude of sites examined by only a handful of judges. Studies which concentrate on the validation of a survey instrument may even concentrate on a single site, which is evaluated by a multitude of users. This is the case with Abdinnour-Helm et al. [2005], who revise and revalidate the End-User Computing Satisfaction (EUCS) instrument by having 176 students evaluate a single site (www.landsend.com). Barnes and Vidgen [2001] use three different sites (eBay, Amazon, QXL) and a student sample, in order to assess the validity of the WebQual instrument and the perceived quality of the sites.

Other surveys focus on the comparison of sites, with each judge analyzing every site. This is especially feasible when objective analyses (e.g. checklists) are performed and the judges are well-trained. By using a classification framework with three categories (promotion of product and services, provision of data and information, processing of business transactions) and four types of value creation, Ho [1997] compares a total of 1,800 sites from 40 different industries. If the main focus of the research lies on the validation of a measurement instrument or the building of categories, no real world sample might even be necessary. Waite and Harrison [2002] ask users to assess on a five-point Likert scale the extent to which they would agree or disagree that they would expect certain features to be present on an excellent Web site of a bank.

EXTENT

Analyzing Web sites can be seen as a tradeoff between the number of attributes being assessed, the number of sites and the depth of the site. While some surveys explicitly concentrate only on the evaluation of the homepage [Zhang et al. 2000], others strive to analyze the whole site. An example for the latter includes Scharl et al. [2003] who use the open-source mirroring tool HTTrack to capture the source code from publicly available hotel sites and who perform an automated analysis. A different approach might be to request users to perform certain tasks and asking them about their experience, no matter which parts of the site they will use [Abdinnour-Helm et al. 2005].

V. EXECUTION

DEGREE OF AUTOMATION

The nature of the Web allows for both a manual and an automated evaluation. When a manual analysis is conducted, human beings are used to assess a site, whereas in the case of an automated evaluation a software tool is used to automatically generate metrics about a certain site. A manual analysis can either be used to generate subjective assessments of a site, such as the perceived quality, or to check for the existence of particular objects, such as a sitemap.

Table 5. Manual versus Automated Analysis of Interactivity

Manual Analysis		**Automated Analysis**
Subjective Kim and Stoel [2004]	**Objective** Perry and Bodkin [2000]	Bauer and Scharl[2000]
I can interact with the Web site to get information tailored to my specific needs. The Web site has interactive features, which help me accomplish my task. The Web site allows me to interact with it to receive tailored information. The Web site adequately meets my information needs.	E-mail/Contact us Surveys Quizzes Signups Apply for password	No. of forms [total/distinct/fields] No. of documents with JavaScript [total] No. of Java applets [total/distinct] No. of MailTo-links [total/distinct]

Table 5 provides an example of how different methods may be used to assess a site's level of interactivity. While Kim and Stoel [2004] use a 7-point Likert scale to assess how users perceive the general level of a site's interactivity, Perry and Bodkin [2000] count the actual appearance of two-way communication opportunities on Fortune 100 company Web sites. An alternative approach is pursued by Bauer and Scharl [2000]. By using an automated tool (Weblyzard) for parsing the source code of a site, they can tell the total number of forms which are available, as well as the average number of fields which are used in a form. This example clearly demonstrates the benefits and drawbacks of the respective methods. While the subjective assessment allows one to tell how users perceive a site, it does not indicate the actual type of information being gathered on a Web site or the types of available interaction tools. Subjective assessments are often applied when a large number of sites is analyzed at once, and users give only their overall impression. An objective and detailed manual assessment of available components allows one to see what kind of information is being gathered, but usually it is more time consuming. While an automated analysis can be used to gather data about the entire site (possibly including thousands of pages) and human data collection errors are excluded, no further information about a form's purpose and its perceived appearance can be collected.

A comparison of the functionality of a number of automated tools can be found in Brajnik [2000]. Ivory and Chevalier [2002] go one step further and compare three automated Web site evaluation tools (WatchFire Bobby, UseableNet LIFT, W3C Validator) from both the designers' and the users' perspectives. At first, experienced designers deploy the tools to improve the sites and then the users' report on their perceived differences. They then report that the three automated evaluation tools were not as effective as they originally hypothesized in improving usability and accessibility.

By combining manual and automated approaches, additional information can be gathered, as was demonstrated by Palmer [2002] who used multiples sources, such as a jury, the search engine Alexa and an agent (WebL). Another example includes the study from Scharl et al. [2003], who combine in a single model dependent variables being gathered in a paper-and-pencil survey (awareness, bookings and inquiries) with independent variables collected by an automated tool (e.g. distinct forms, broken links, standardized type token ration).

OBJECTIVITY

As was shown in Table 5, manual analyses can be conducted as objective evaluations by using checklists, which require a "yes" or "no" answer. Another possibility would be to ask the survey participants about their perceived assessments of single constructs related to a site. For the remainder of this paper, I perceive objective assessments as being independent of the person conducting the evaluation, as is the case when the existence of certain functionalities (e.g. search function, site map) is evaluated. I thereby differ slightly from the objectivity notion of Olsina and Rossi [2002] who embark on a strategy that is evaluator-driven by domain experts as being more objective than user-driven strategies.

In order to make checklist results comparable, indices are created which add up the existence of certain criteria. Keevil [1998] proposes a usability index which includes a comprehensive assessment as to how the information can be found (e.g. include site map), the information can be understood (e.g. described purpose and uses of product), and user tasks can be supported (e.g. reply forms which are shorter than one page). Furthermore he includes the technical accuracy (e.g. correct product names and numbers) and the presentation of the information (e.g. consistent format throughout the site). The total usability index is calculated by accumulating the unweighted scores. A similar instrument is proposed by Hung and McQueen [2004], who use a scoring system for their criteria (ease-of-identification, ease-of-use, usefulness of information and interactivity) ranging from 0 to 10. Short verbal descriptions are given to facilitate the assignment of ratings.

In order to overcome the problem of unweighted sums which may not adequately represent the actual importance, Evans and King [1999] propose to weight each single indicator based on the characteristics and the needs of the target markets (e.g. MIS managers, buyers for resellers, sales managers, small business owners). An even more sophisticated system is presented by Agarwal and Venkatesh [2002], who present a multi-step approach whereby

evaluators first determine the relative importance of a category. A total of 100 points is distributed among five major categories (content, ease of use, promotion, made-for-the-medium and emotion), and then subdivided among different subcategories. In a next step users are asked to provide ratings for specific Web sites. By doing so, the users themselves assess the relative importance of certain Web sites or products. In order to increase the validity of the score Huizingh [2000] demands that his researchers, students working in teams made up of two persons each, have to agree upon subjective estimates. Olsina and Rossi [2002] define the elementary quality preference (EP) as the percentage of a satisfied requirement for a given attribute within a range between 0 and 100 per cent. Their tool WebQEM requires the specification of a multicriteria scoring model. In order to enhance criterion and subcriterion weight value assessment in their framework assessing Web site quality, Moustakis et al. [2004] apply analytic hierarchy process (AHP). They use 122 participants for gathering criterion weight values and finally conduct a factor analysis to calculate the respective factor loadings.

The above mentioned approaches clearly indicate that no one way exists which is best for weighting indicators. While some authors use unweighted sums of sub-criterions, others try to rate items according to their actual importance. While weighted items allow for a more differentiated view, it has to be taken into account that their relative importance is always determined by the sample being used to calculate them [cf. Russell, 2002].

DATA COLLECTION

Several years have passed since Ducoffe [1996 p. 26] noted that ". . . only a small proportion of the general population has been exposed to the Web. . . " and used personal interviews for assessing the perceived value of online advertising. Most surveys nowadays are either done with paper or pencil or directly on the Web. The latter allows for the instant collection of the responses in a data base and therefore reduces potential errors, which may be caused by the manual transcription. In an addition to that, online questionnaires allow for some kind of interactivity, such as pointing out to a respondent that some questions have not been answered, or using sliders instead of Likert scales, which are continuously adjustable [Treiblmaier et al. 2004]. In some cases data originally being collected for other purposes may be used. Madeja and Schoder [2003] draw upon a survey that includes the executives from 1,308 companies who were interviewed by market research professionals. By sorting out those companies which have no Web page online at the time of the survey and those which cannot provide information about the success of its electronic business activities, a total of 469 usable data sets remains.

To analyze the influence of attributes such as download time, controlled lab experiments have to be used. In order to explore the impact of 5-, 30-, and 45-second download delays on the attitude toward an e-retailer, Rose et al. [2005] apply an experimental design with data being collected from 172 students.

TIME FRAME

Most available Web analysis studies concentrate on a snapshot analysis which is done at a single point in time. However, some studies explicitly look at the development of sites over a certain period of time. Examples include the work of Yeung and Lu [2004] who use a sample of Hong Kong-based commercial Web sites which are measured on three separate occasions during a period of 2.5 years. They make snapshots by copying the entire contents of each page and analyzing it offline. Furthermore, they report that the original sample consisted of 156 Web sites and that technical problems emerged and some sites disappeared, so that in the end only 98 sites could be used for the analysis. Their results show that while the sampled sites generally grew larger in content their functionality was only marginally enhanced.

Longitudinal analyses may also be used in order to correct incidental changes of the Web site. Li [1998] analyzes the pages of three American online newspapers for ten consecutive days. He also uses an observation of three days' publications one month before and one month after the coding period to ensure that the general design remained relatively stable.

INCENTIVE

As far as incentives are concerned, several different strategies exist. Some researchers do not offer any incentives at all and rely upon the general interest of the respondents or on students who do the evaluation as part of their course work. Other researchers pay small amounts of money to every person taking part in the survey, such as Huang [2005], who gives $5 to every student willing to evaluate two different sites, Liang and Lai [2002] who offer $16 to students who have to familiarize themselves with the sites of three online-bookstores or Kim et al. [2002] who report to have solicited users with monetary compensations. Lii et al. [2004] offer the results of the survey to the participants (chief marketing officers of selected manufacturing companies), a strategy that may be feasible when the respondent has a high interest in the survey's output. Contrariwise, Fogg et al. [2001] appeal to the participants' philanthropy by offering a donation of $10 to charity groups for every participant which in turn ensures the support of these organizations in gathering contributors.

VI. CONCLUSION

By analyzing previous studies of Web analysis, I have shown that a plethora of varying approaches exists, which differ according to the theoretical background and objectives, the samples being chosen and the execution of the survey. Numerous examples have been given to illustrate how Web analyses are conducted and to show their respective benefits and drawbacks. Although such an enumeration can never be exhaustive, it may nonetheless provide important insights into how practitioners and scholars design and conduct their Web analyses.

By gaining a general understanding of what has been done before, both scholars and practitioners may benefit from building their analyses upon previous studies. This paper has shown that a multitude of options may be feasible for analyzing Web sites and that there is no one best way for doing so. By creating a general awareness for the availability of validated research instruments and by highlighting the creative potential of numerous research projects, this paper may be helpful to anyone planning to conduct a Web survey.

Based on the results of this meta-survey, I would give the following suggestions to researchers, who plan to conduct a Web survey or who wish to integrate a Web analysis into their own research:

- Researchers who are starting a new project should take a comprehensive in-depth look at literature first. Although most scholarly research includes a literature review section, I found a huge amount of overlap in many papers, especially when new metrics are developed, which indicates that the same scales are "developed" over and over again. This is caused by the incredible amount of papers being published, which include some kind of Web analysis. Although my list in the appendix is by no means exhaustive, it may provide a useful starting point for fellow researchers.
- Given the huge popularity of Web analysis in IS research and the dearth of unambiguous scales, further research is needed to carefully conceptualize the constructs and develop new metrics based on well-established procedures [Churchill 1979]. An example of how this can be accomplished can be found in Webster and Martocchio [1992], who have systematically developed a measure for microcomputer playfulness.
- The various objectives of Web analysis, which are shown in the appendix, may spur the creativity of other researchers as to what can be done. Possible objectives include e.g. the development of metrics, testing of hypotheses and models, comparison of sites, users and industries and the improvement of sites.
- The framework, which I have developed, can be used by other researchers to structure their research projects. By taking into account the various options being available, researchers might be able to better position their paper within existing streams of research.
- Given the constant change in Web development, replication studies might offer important insights as to how the Web has changed over time. I found few examples for longitudinal studies during my literature review. Therefore, I would

suggest that building on excellent previous studies, many of which can be found in the appendix, may lead to papers which are publishable in high quality journals.
- When developing the framework for Web analysis, I followed a bottom-up approach and looked at the details of existing projects. By creatively combining the various dimensions of the framework (objectives, approach, theoretical foundation, etc.), researchers can come up with new ideas for their own projects.
- I found an astonishingly small number of papers which explicitly refer to an existing theory. Building up a strong theoretical base by using well-accepted theories and developing new ones might be a rewarding challenge for aspiring researchers.

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APPENDIX: WEB SITE ANALYSES

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Abdinnour-Helm et al. 2005	MD (satisfaction)	S	176 end (st)	1	M	S	Q	S	n. s.
Agarwal and Venkatesh 2002	MD (usability)	S	1.475 end	21	M	S	Q	S	$10
Aladwani and Palvia 2002	MD (quality)	S	104 end (st)	4	M	S	Q	S	n. s.
Aladwani 2002	MD (easiness, usefulness)	S	387 end (st)	1	M	S	Q	S	N
Aladwani 2003	CA	S	80 end (st)	2	M	S	Q	S	n. s.
Amant 2005	SI (conceptual paper)	S	n. a.	n. a.	M	O	Q	S	n. a.
Barnes and Vidgen 2001	MD (WebQual)	S	39 end (st)	3	M	S	Q	S	n. s.
Barnes and Vidgen 2001	MD, CA (WebQual)	S	54 end (st)	3	M	S	Q	S	n. s.
Barnes and Vidgen 2004	SA	S	420 end	1	M	S	Q	S	n. s.
Bart et al. 2005	MoD, MT	S	6.831 end	25	M	S	Q	S	n. a.
Basu 2003	MD (conceptual paper)	S	n. a.	n. a.	n. a.	S/O	n. a.	n. a.	n. a.
Bauer and Scharl 2000	SC, SA	S	n. a.	30	A	O	C	S	n. a.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Bauer et al. 2005	MD (various dimensions), SA	S	280 end	1 (self-chosen)	M	S	Q	S	n. s.
Becker 2002	SC	S	n. a.	17	M/A	O	O	S	n. a.
Bentley et al. 2003	SA	S	110 end (st)	16	M	S	Q	S	n. s.
Brackett and Carr 2001	MT (attitude toward advertising)	S	421 end (st)	n. a.	M	S	Q	S	n. s.
Brajnik 2000	TC (conceptual)	S	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Brajnik 2004	SI, TC (conceptual)	S	n. a.	n. a.	A	O	n. a.	n. a.	n. a.
Choi and Kim 2004	TC	S	5 Tools	n. a.	A	O	CP	S	n. a.
Chung and Law 2003	MD (Web site performance), CA	S	46 exp/ exp	80	M	S	Q, CL	S	n. s.
Cox and Dale 2002	MD (Web site quality)	S	exp	30	M	S/O	Q/CL	S	n. a.
Cyr and Trevor-Smith 2004	SC (cultural comparison)	S	3 exp	90	M	O	CL	S	n. a.
Cyr et al. 2004	SC (cultural comparison), MD (design, trust, satisfaction, loyalty)	S	62 end (st) / end	1 (two versions)	M	S	Q	S	n. s.
Cyr and Bonanni 2005	MT (gender differences)	S	76 end (st)	1	M	S	Q	S	n. s.
Cyr et al. 2005	SC (cultural comparison)	S	114 end	1 (two versions)	M	S	Q	S	n. a.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
D'Angelo and Little 1998	SI, CA	S	exp.	20	M	O	CL	S	n. a.
Deecke et al. 2005	SA, CA	P	n. s.	158	M	S/O	Q	L	Results
Dellaert and Kahn 1999	MT (influence of waiting time on site evaluation)	S	~297 (st)	n. s.	M	S	Q	S	n. s.
Drèze and Zufryden 2004	MD, MT (Web site visibility)	S	5000 end	100	M/A	O	CL	S	n. s.
Ducoffe 1996	MT (attitude toward Web advertising)	S	318 end	n. a.	M	S	Q	S.	n. s.
Eighmey and McCord 1998	MD, SC	S	31 end	5	M	S	Q	S	n. s.
Erskine et al. 1997	SI (conceptual)	S	11 end	1	M	n. a.	n. a.	S.	n. s.
Ethier et al. 2004	MT (satisfaction)	S	215 end (st)	4	M	S	Q	S	$10
Evans and King 1999	MD (design, performance, content, interaction), CA	S	exp.	10	M	S/O	CL	S	n. a.
Evans et al. 2000	CA	P	exp.	100	M	S	Q	L	n. a.
Fogg et al. 2001	MD	S	1.410 end	1	M	S	Q	S	$ 10 donation per respondent

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Galletta et al. 2006	MT (user, performance, attitude, behavioral intentions)	S	160 end (st)	2 (32 versions)	M/A	S/O	Q/(automated tool)	S	n. s.
González and Palacios 2004	MD (accessibility, speed, navigability, content)	S	n. s.	200	M/A	O	CL	S	n. a.
Ho 1997	SC	S	exp.	1,800	M	O	M	S	n. s.
Hoffman et al. 1995	SC (conceptual paper)	S	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Hong and Kim 2004	MT (user satisfaction, loyalty)	S	2381 end	300	M	S	Q	S	$ 10
Huang 2003	MT (Web performance)	S	243 end (st)	Favorite sites	M	S	Q	S	n. s.
Huang 2005	MD (Web performance)	S	912 end (st)	8	Q	8	Q	S	$ 5
Huizingh 2000	SC, IC	S	exp (st)	651	M	S/O	Q/CL	S	n. s.
Huizingh 2002	MT (performance of Web site)	S	109 exp	109	M	S/O	Q	S	n. s.
Huizingh and Hoekstra 2003	MT (attention, cognition, affection, conation)	S	80 end	1	M	S	Q	S	n. s.
Hung and McQueen 2004	MD (conceptual paper)	S	n. a.	n. a.	M	S/O	Q/CL	n. a.	n. a.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Ivory and Hearst 2001	TC	S	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Ivory et al. 2001	MD, CA	S	n. a.	163	A	O	CP	S	n. a.
Ivory and Chevalier 2002	TC	S	22 end	5 (site versions)	M/A	O (task completion)	O (log data)	S	n. s.
Ivory et al. 2003	TC	S	9 exp	5	A	O	CP	S	n. s.
Jeong et al. 2003	MT (information satisfaction, behavioral intention)	S	1,743 end	16	M	S	Q	S	sweepstake
Johnson and Misic 1999	SI	S	1 exp (st)	45	M/A	S/O	CL	S	n. a.
Keevil 1998	MD (conceptual paper)	S	n. a.	n. a.	M	O	CL	n. a.	n. a.
Kim et al. 2002	MD (quality)	S	30 exp/ 16.679 end	62	M	O/S	CL, Q	S	n. s.
Kim and Stoel 2004	MT (satisfaction)	S	273 end	1 (self-selection)	M	S	Q	S	n. s.
Kim and Stoel 2004	MD	S	273 end	84	M	S	Q	S	n. s.
Kim and Xu 2004	MT (purchase intention)	S	513 end	1	M	S	Q	S	$ 5 (lottery)
Kim et al. 2006	MT (ease of use, usefulness)	S	90 end (st)	1 (4 versions)	M	S	Q	S	n. s.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Koufaris 2002	MT (unplanned purchases, intention to return)	S	280 end	1	M	S	Q	S	$10 gift certificate
Lassar and Dandapani 2003	HT	S	471 end (mostly st)	1	M	S	Q	S	n. s.
Lee et al. 2005	MT (information search, enjoyment, business transactions)	S	427 end (st)	n. a.	M	S	Q	S	n. s.
Levi and Conrad 1996	SI	P	8 exp	n. a.	M	S	CL	n. a.	n. a.
Li 1998	HT	S	2 exp.	3	M	O	CL	L	n. a.
Liang and Lai 2002	MT (consumer choice)	S	30 end (st)	3	M	S	Q	S	$16
Lii et al. 2004	MT (Web operational effectiveness)	S	178 exp	n. a.	M	S/O	Q	S	results
Liu and Arnett 2000	MD, MT (design quality)	S	119 exp	n. a.	M	S	Q	S	n. s.
Liu et al. 2000	MD, MT (design quality)	S	119 exp	n. a.	M	S	Q	S	n. s.
Liu et al. 2001	MD, MT (design quality)	S	119 exp/68 end (st)	n. a./6	M	S	Q	S	n. s.
Liu and Arnett 2002	SC	S	3 exp	499	M	O	CL	S	n. a. / n. s.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Liu et al. 2004	MT (trust, behavioral intention)	S	436 end (st)	1 (2 versions)	M	S	Q	S	n. s.
Liu et al. 2006	CA	S	n. s.	50	M	O	CL	S	n. s.
Luo and Seyedian 2003/04	MT (site value, satisfaction)	S	180 end	n. a.	M	S	Q	S	n. s.
Lynch and Beck 2001	UC	S	515	1 (self-chosen)	M	S	Q	S	N
Madeja and Schoder 2003	MT (corporate success)	S	469 exp	469	M	O/S	Q	S	n. s.
Mateos et al. 2001	MD, CA	S	exp	65	M/A	O	CL	S	n. s.
Mayer and Krupa 2002	SI	S	n. a.	1	M	n. a.	n. a.	L	n. a.
Maynard and Tian 2004	CA	S	exp	100	M	S	Q	S	n. a.
McHenry and Borisov 2006	CA	S	exp	80/85	M	O	CL	L	n. a.
McKinney et al. 2002	MD (satisfaction)	S	568/312 end (st)	4	M	S	Q	S	n. s.
McMillan and Hwang 2002	MD	S	126 end	2	M	S	Q	S	n. s.
Miyazaki and Fernandez 2000	IC	S	exp	381	M	O	CL	S	n. a.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Miyazaki and Krishnamurthy 2002	SC, HT	S	3 exp/204 end/	60	M	S	Q	Q	n. s.
Moustakis et al. 2004	MD	S	122 end (st)	n. a.	M	S	Q	S	n. s.
Murphy et al. 1996	CA	S	exp	37	M	O	CL	S	n. a.
Murphy et al. 2003	CA	S	exp	200	M	O	SA, CL	S	n. a.
Muthitacharoen and Palvia 2002	MT (behavior)	S	179 end (st)	n. a.	M	S	Q	S	n. s.
Muylle et al. 2004	MD	S	837 end	Sites from 8 categories	M	S	Q	S	5 x 50$
Nel et al. 1999	CA	S	33 end (st)/ 5 exp	20	M	S	Q	S	n. a.
O'Connor and O'Keefe 1997	MD	S	exp	4	M	n. a.	n. a.	S	n. a.
Okazaki 2004	CC	S	4 exp.	100	M	O	CL	S.	n. s.
Olsina et al. 1999	MD (Web quality)	S	exp.	6	A/M	O	CL, CP	S	n. a.
Olsina and Rossi 2002	MD (Web quality), SI, CA	S	n. a.	5	A	O	CP	S	n. a.
O'Neill et al. 2003	MD	S	267 end (st)		M	S	Q	S	No

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Palmer 1997	CA (retail formats)	S	end (st)	42	M	O	CL	S	n. s.
Palmer and Griffith 1998	SC	S	n. s.	250	M	O,S	CL,Q	S	n. s.
Palmer and Griffith 1998	SI (conceptual paper)	S	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Palmer 2000	CA (retail formats)	S	end (st)	44	M	O	CL	L	n. s.
Palmer and Eriksen 2000	IC	S	exp (2/6 st)	50	M	O	CL	S	n. s.
Palmer 2002	MD (usability, design, performance)	S	end (st)	250	A, M	S, O	CP, Q	L	n. s.
Parmanto and Zeng 2005	MD (accessibility)	S	exp.	29	A	O	CP	S	n. a.
Paynter and Satitkit 2001	CA	S	101 end (st)	30	M	O, S	CL	S	n. a.
Perry and Bodkin 2000	CA	S	exp	100	M	O	CL	S	n. a.
Rao and Frazer 2006	CA	S	exp	202	M	O	CL	S	n. s.
Robbins and Stylianou 2001/2002	CC	S	n. s.	90	M	O	CL	S	n. s.
Rogowski et al. 2005	CA	P	exp	36	M	S, O	Q	S	n. s.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Rose et al. 2005	MT (attitude toward delay, page, retailer)	S	172 end (st)	2	M	S	Q	S	n. s.
Saeed et al. 2005	MT (usefulness, ease of use)	S	114 end (st)	1	M	S	Q	S	n. s.
Scharl et al. 2003	MT (awareness, bookings, inquires)	S	144 exp	328	M/A	O	CP/Q	S	n. s.
Scharl and Bauer 2004	CA	S	n. a.	492/15/22/30	A	O	CP	L	n. a.
Schubert 2002	MD (extended Web assessment method), CA	S	exp	4/4	M	S	Q	S	n. s.
Seethamraju 2004	MT (Web quality)	S	140 end (st)	1	M	S	Q	S	n. s.
Segawa et al. 2005	SI (conceptual paper)	P	exp	1 (case study)	M	n. a.	n. a.	n. a.	n. a.
Shchiglik and Barnes 2004	CA	S	60 end (st)	3	M	S	Q	S	n. a.
Signore 2005	MD (presentation, content, navigation, interaction) conceptual paper	S	n. a.	n. a.	A	O	n. a.	n. a.	n. a.
Singh and Dalal 1999	SI	S	19 end (st)	10	M	S	Q	S	n. s.
Singh et al. 2003	CA	S	2 exp.	80	M	O/S	CL	S	n. a.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Singh and Baack 2004	CC	S	4 exp.	95	M	O	CL	S	n. s.
Singh et al. 2005	MoD (attitude, behavioral intention)	S	77 end (st) / 99 end (st)	4/1	M	S	Q	S	n. s.
Singh et al. 2005	MT (attitude, behavioral intention)	S	540 end (st)	1	M	S	Q	S	Course credit
Spieler 2001	SI (conceptual paper)	P	n. a.	n. a.	M	O	CL	n. a.	n. a.
Still 2001	CA	S	exp	150	M	O	CL	S	n. a.
Takahashi 2005	SI (conceptual paper)	P	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Tilson et al. 1998	MD	S	18 end	4	M	S	Q	S	n. s.
van der Heijden 2003	MT (attitude, intention, behavior)	S	825 end	1	M	S	Q	S	n. s.
van der Heijden 2004	MT (intention to use)	S	1,144 end	1	M	S	Q	S	n. s.
van der Merwe and Bekker 2003	MD	S	3 exp	6	M	S/O	CL	S	n. a.
van Iwaarden et al. 2003	MD (SERVQUAL for Web sites)	S	293 end (st)	n. a.	M	S	Q	S	n. s.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
van Iwaarden et al. 2004	MD (SERVQUAL for Web sites)	S	541 end (st)	n. a.	M	S	Q	S	n. s.
van Waes 2000	MeT	S	12 end (st) / 10 end / 20 end	2/2/4	M	S	O	S	n. a.
Venkatesh et al. 2006	CC, HT, IC, MT	S	370 end (st) / 766 end	5/4	M	S	Q	S (follow-up survey)	movie ticket and coupon (€ 15)
von Dran and Zhang 2002	MD (Web site quality) conceptual paper	S	n. a.	n. a.	M	S	Q, CL	n. a.	n. a.
Waite and Harrison 2002	SI	S	12 end/ 253 end (st)	n. a.	n.a.	S	Q	S	n. s.
Wan 2000	SI	S	n. a.	3	M	O	CL	S	n. a.
Webbyawards (2006)	CA	P	exp.	n. a.	M	S	Q	L	award (for sites)
Winter et al. 2003	MD, HT	S	85 end (st) / 154 end (st)	Self-chosen/4	M	S	Q	S	n. s.
Yang et al. 2005	MD	S	1992 end	1	M	S	Q	S	n. a.
Yen et al. 2005	MD (conceptual paper)	S	n. a.	n. a.	M	S/O	Q, CL	n. a.	n. a.
Yeung and Lu 2004	CA	S	exp (st)	98	A, M	O	CL	L	n. s.

Author	Background and Objectives		Evaluators and Sites		Execution				
	Objective	Approach	Expertise	No. of Sites	Degree of Automation	Objectivity	Data Collection	Timeframe	Incentive
Yeung and Lu 2004	MD (Web site functions), SC	S	exp.	3	A, M	O	CL	S	n. a.
Young and Benamati 2000	CA	S	1 exp	500	M	O	M	S	n. a.
Zahedi et al. 2001	MD (Satisfaction) conceptual paper	S	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.	n. a.
Zhang et al. 2000	MD, CA	S	40 end (st)	197	M	S, O	Q, CL	S	n. s.
Zhang and von Dran 2000	MD (satisfiers and dissatisfiers)	S	76 end (st) / 79 end (mostly st.)	n. a.	M	S	Q	S	n. s.
Zhang et al. 2000	MD	S	39 end (st) / 37 end (st) / 8 (7 st)	1	M	S	Q	S	n. s.
Zhang et al. 2001	MD, CA, IC	S	64 end (st)	n. a.	M	S	OQ	S	n. s.
Zhang and von Dran 2001	MD	S	70 end (mostly st)	1	M	S	Q	S	n. s.
Zhang and von Dran 2001/02	MD	S	76 end (st) 67 end (st)	1/6 domains	M	S	Q	S	10$
Zhao et al. 2003	CC	S	2 exp	100	M	O	CL	S	n. a.

Caption

Objective*	Approach	expertise	Degree of Automation	Objectivity	Data Collection	Timeframe
CA … Competitive Analysis CC … Cultural Comparison HT … Hypothesis Testing IC … Industry Comparison MD … Metrics Development MeT … Method Testing MoD … Model Development MT … Model Testing SA … Site Analysis SC … Site Classification SI … Site Improvement UC … User Comparison TC … Tool Comparison	P… Practitioner S … Scholar	end … end users exp … experts st … students	A … automated M ... manual	O … objective S … subjective	CL … checklist CP … code parsing O … observation OQ … open question Q … questionnaire SA … secondary analysis	L … longitudinal S … snapshot

n. a. … not applicable

n. s. … not specified

* When metrics are developed, the constructs are shown in brackets. In the case of models we list the dependent or endogenous variables.

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