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Defining Usability How Library Practice Differs from Published Research

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abstract: Library / information science professionals need a clearly articulated definition of usability / Web usability to implement intuitive websites. In this study, the authors analyzed usability definitions provided by the ARL library professionals and those found in the library / information science and computer science-information systems literature. Quantitative and qualitative methods were used to identify similarities and differences between the attributes emphasized by the two sets of definitions based on information behavior models and human-computer interaction (HCI) frameworks. Results indicated that both groups overlooked critical usability elements, such as environment and information objects / content / resources. Thus, the authors proposed a working, multi-faceted definition that presents a holistic view of usability.

Introduction

As the popularity of Web-based information systems grows, the need for high-quality usability / Web usability (hereafter referred to as usability) is critical for organizations responsible for an information system's content, design, and maintenance. A clearly articulated definition of usability is crucial for stakeholders of a system to gain a consistent understanding of its construct.[1] This, in turn, could serve as a building block for establishing good usability policies, standards, and guidelines (PSGs). Examples of well-defined concepts leading to the development of commonly observed PSGs are evident in standard and guideline publications set forth by top standard-making institutions and organizations. When reading standards published by International Organization for Standardization (ISO), Institute of Electrical and Electronics Engineers (IEEE), and American National Standards Institute (ANSI), one will notice that a definition of terms precedes guidelines and standards to provide a uniform understanding of the associated terminology.[2] Gerald J. Alred and other scholars also indicate that in technical writing, it is critical for definitions to be clear and accurate; thus

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writers need to define concepts and terms in order to precisely identify their fundamental qualities.[3] Their declarations, in conjunction with the observation derived from standard publications prepared by ISO, IEEE, and ANSI, make the authors believe that having an explicit, unambiguous, and consistent definition is essential in creating sound usability PSGs for system design and Web development.[4] Designing information systems often involves complex specifications, therefore design documentation should be concise and uniformly understood by all parties. By the same token, to build, implement, and support functional Web-based information systems, it is imperative to have standards, guidelines, and principles containing clearly defined terms that make explicit the concept of usability.

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Through a review of selected literature in the library and information science (LIS) and computer science-information systems (CS-IS) fields, the authors found a few regularly cited definitions of usability. Definitions provided by Jakob Nielsen and the ISO were the two most frequently cited sources. According to Nielsen, usability of a system is multi-dimensional and includes five properties: easy to learn, efficient to use, easy to remember, low error rate, and high user satisfaction. The ISO definition stated usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use." When reviewing ISO's definition, Whitney Quesenbery points out these vital characteristics are essential for any usability definition, yet additional attributes, such as engagement, should be included for usability enhancement.[5]

Wayne Gray and Marilyn Salzman indicate that usability does not have a precise enough definition, yet denoting this complex, multi-faceted concept is complicated and confusing. Thomas Pack asserts that "the term has been used so often in so many different contexts, it is in danger of losing its precise meaning."[6] These remarks may shed light on why it is difficult to build functional, effective information systems and websites that are acknowledged as focusing on user needs. This might also explain why there is limited written documentation, such as usability PSGs, that articulates the meaning of key terms to eliminate ambiguities.[7]

Well-constructed definitions promote better understanding of PSGs leading to consistent practices and therefore more uniform outcomes. One example is the term *information literacy*. Documents addressing the set of information skills covered by this term use the American Library Association's (ALA) definition of information literacy as stated by the Final Report of the ALA Presidential Committee on Information Literacy. The ALA definition formed the basis of the competency standards for information literacy in higher education set by the Association of College and Research Libraries, and, considered the seminal definition for the term, is referenced in most information literacy-based PSGs.[8] Another example is the term *information architecture*. The American

Society for Information Science assembled a special interest group at its Summit 2000 Meeting to develop an authoritative definition for this term. After soliciting member input, the group determined by consensus that Rosenfeld's would serve as the working definition of that concept.[9]

Usability as a field of study (e.g., user study, testing, design methods) has evolved over the last three decades; reports on library Web usability testing have proliferated since late 1990s. However, the discussion in the literature on the comparison of usability definitions is minimal. This current study aims to identify usability attributes emphasized in two sets of usability definitions: one set is provided by library professionals, and the other is collected from the formally published literature. In addition, the authors compare the two sets of definitions, further analyzing the attributes by applying information behavior models and human-computer interaction (HCI)/usability frameworks. The goal of this initiative is to examine whether there were any discrepancies between the two constituencies and, based on the findings as well as the theoretical frameworks, propose a more holistic approach to defining usability.

Literature Review

According to Ken Eason and other researchers, although usability has an increasingly important role in HCI, there is no universally agreed upon definition. Individual researchers have endeavored to capture the essence of this concept by defining it, but have not reached a consensus. To highlight the importance of user cognitive aspects and mental models in system design, Philip Barnard et al., suggest that "to be truly 'usable,' a system must be compatible not only with the characteristics of human perception and action but, and more critically, also with users' cognitive skills in communication, understanding, memory, and problem solving."[10]

Brian Shackel proposed an operational definition of usability focusing on the need for system evaluation throughout the development life cycle. He also emphasized effectiveness, learnability, flexibility, and attitude as the four criteria for a usable system that would allow users to accomplish a range of specific tasks. Paul Booth shared Shackel's perspective on task performance; yet he considered that the specifications and measurements of the flexibility of a system are a difficult prospect. Thus, Booth modified Shackel's criteria to usefulness, effectiveness, learnability (or ease of use), and attitude (or likeability). Although Booth's definition is similar to that of Shackel's, his notion of "usefulness" addresses users' needs which, according to Jeffrey Rubin, is the core of user-centered design. Rubin echoed Eason's claim acknowledging a void with the lack of a universal usability definition. In addition, Rubin noted that in the usability community, definitions containing one or more of Booth's four components were widely accepted.[11]

Usability, from a usability engineering perspective, can be measured in various dimensions, such as user performance, flexibility of the designs, learnability, error rate, and user's satisfaction. Both Nielsen, and Joseph Dumas and Janice Redish tend to place a strong focus on measurable properties in their definitions. Nielsen emphasized that the usability of a system has multiple dimensions: easy to learn, efficient to use, easy to remember, low error rate with zero catastrophic error, and user satisfaction.[12]

Additionally, Nielsen put forward ten heuristics of inspection methods to achieve these goals because he thought these criteria are essential in developing interactive systems.[13] According to Dumas and Redish, "usability means that the people who use the product can do so quickly and easily to accomplish their own tasks." Their definition enumerated four critical points: users, productivity, tasks, and ease of use. They also contended that a system with functions does not guarantee usability; hence they promoted iterative usability testing to capture users' feedback.[14]

The frequently cited ISO 924-11 defines usability as the way in which target users can use a system to accomplish particular tasks and achieve a degree of effectiveness, efficiency, and satisfaction.[15] This definition has been criticized due to its overemphasis on task and goal; as a result, it loses sight of less tangible aspects, such as user experience. It is difficult to apply 'effectiveness' and 'efficiency' to contexts where elements such as engagement and pleasure are in higher priority than these; and while the definition is quite suitable for work-related contexts, it does not fare well with information seeking or online services.[16]

The relevance of a system to users' needs, subjective feelings, learnability, efficiency, and system features, such as enabling users to modify previous steps that may have caused errors, is also important. These ideas relate to usefulness, a criteria set forth by Booth, as well as user experience.[17] The notion that a system should support its users and enrich their experience throughout the interaction process is parallel to Katy Campbell and Robert Aucoin's observation. They noted that usability entails the relationships between users and the tools they use, and that a quality system "makes it easy to learn, easy to use, easy to remember, error tolerant and subjectively pleasing."[18]

With the emergence of the World Wide Web, usability has remained critical to information systems. Web usability takes into account a user's experience when reading or interacting with a site.[19] For Web-based information to be usable and appealing to users, a fundamental requirement of Web usability is to provide its targeted users, including people with disabilities, with appropriate functionality for access and interaction. In addition to the issue of accessibility, some researchers promote the idea that Web usability consists of learnability, throughput, flexibility of a website, as well as a user's attitude toward it; this addresses the various needs of users, including the affective element.[20] Even though the platform of information systems has changed, and system users and users' attitudes have gained more attention, the majority of concepts presented in these definitions are quite similar to those depicted pre-World Wide Web. Nielsen expanded his own usability definition and extended Rubin's user-centered design concept to Web usability. Brenda Battleson et al., suggested that in the Web environment, usability means that a system needs to be easy to learn, remember, and use, with a low error rate for its intended users and the specific tasks it is designed to support.[21]

Other researchers have taken into consideration information organization and structure in regard to Web usability. They advocated that usability should incorporate website consistency, ease of navigation for task performance, clarity of interaction, ease of reading, information organization, speed, and layout.[22] This perspective addresses information architecture and task flow. Additionally, Web usability refers to developing intuitive websites, so the average users can easily navigate for needed information without a struggle. Steve Krug's concept of intuitiveness emphasized Jef Raskin's idea

that familiarity is essential in designing information space in Web environments.[23] On a similar note, Cheryl Dee and Maryellen Allen asserted that an easy-to-use end-user interface is an essential component of a usable system. Alison Head extended Dee and Allen's perspective by attending to the cognitive aspect of information processing, because focusing on interface alone is a very narrow view of Web usability. An easy-to-use interface is simply the surface level of usability; the core value of "usability is rooted in cognitive science—the study of how people perceive and process information through learning, the use of memory, and attention."[24] Benjamin Keevil and other scholars have concurred with this notion and stressed that a more usable site should help its users to successfully find needed information.[25] In this regard, well-structured information space and useful information are major dimensions of usability.

Information gathering in a digital environment is a dynamic process of human interaction with information systems. This interaction involves both the user's cognitive space and the information space, which consists of information objects as well as the information retrieval (IR) system.[26] In addition, interactive communication occurs among a user's cognitive space, information space, and environment. When a user interacts with information, that engagement is a cognitive process. Based on definitions and concepts laid out in HCI, Tefko Saracevic proposed the stratified interactive IR model in which "users (with a host of variables of their own) are related to a situation (task, problem-at-hand) within an environment, each having a number of characteristics and dynamics."[27]

Aligned with Saracevic's IR model, Nicholas Belkin introduced the information-seeking episode model, comprising three components: the user, the information objects with which the user interacts through the system, and intermediaries (such as humans and/or tools) that support the interaction between the user and the information objects. He stressed the nature of interaction depends on the user's goals, problems, and situations.[28] Tom Wilson's information seeking behavior model asserted that cognitive, physiological, and affective needs are interrelated. His model elaborated on the environment factor by taking more specific aspects—work, socio-cultural, politico-economic, and physical—into account, noting that the social role of a user in conjunction with the environment would affect the user's needs.[29]

Although distinct in their own approaches to the representation of information behavior or information seeking process, several key elements presented in the above mentioned models by Ingwersen, Saracevic, Belkin, and Wilson reflect the components in Shackel's usability framework, which built upon HCI approaches by Bennett and Eason.[30] Shackel illustrated the dynamic interplay of four principle components: user, task, tool, and environment. He expressed that usability depends on the design of the tool with respect to its users, their tasks, and the environments.[31] In their HCI framework, Ping Zhang and Dennis Galletta highlighted similar aspects; these included human, technology, interaction, task, and context. They indicated that humans apply technology to perform tasks relevant to their jobs or personal needs in specific settings or contexts.[32] Understanding and addressing the intricate interaction between humans and technology should lead to positive influences and outcome on system designs and usability issues.

Research Objectives

Since usability is rooted in HCI, which applies information-processing psychology to form its cognitive frameworks, a usability definition that encompasses ideas from such areas as information behavior and HCI could facilitate a better understanding of the evolving concept of usability. This in turn might possibly promote a more stable and consistent system design and Web environment for end users. In analyzing literature in information science, Wilson indicated a discrepancy between research and practice.[33] To date, no research on the comparison of usability definitions has been conducted to investigate any gaps existing between researchers and practitioners. Thus the authors initiated this study to identify usability attributes emphasized in usability definitions provided by the library professionals at the academic institutions of the Association of Research Libraries (ARL) and those in the formally published literature. The authors selected the library professionals who are directly involved in Web development and tend to have more practical perspectives on usability, in contrast to the literature, which is inclined to be theoretical. This current study aimed to meet the following objectives:

- Analyze the usability definitions provided by the library professionals at the academic institutions of the Association of Research Libraries (ARL).
- Examine the usability definitions formally published in the literatures of Library and Information Science (LIS) as well as Computer Science-Information Systems (CS-IS).
- Identify similarities and differences between these two sets of definitions.
- Investigate how these two sets of definitions address the focal points of the human information behavior models and HCI frameworks.

Methodology

Data Collection

For this study, the authors looked at how usability is defined by library practitioners as well as in the literature. The target population of the library practitioners was the 113 academic members of ARL. Since library websites function as the portal to information resources and services in the academic environment, and ARL libraries are identified as the most prestigious research libraries in the United States and Canada, the authors expected that these libraries would make comparable investments in their Web presence.

In late 2007, an online questionnaire was distributed through e-mail, querying library professionals who are directly involved in Web development at these institutions on various aspects of Web usability, including Web usability PSGs, usability testing, staffing, and resources. When the survey was closed in 2008, 84 institutions had participated in this study. Sixty-seven of the participants responded to the open-ended question "Please define Web usability in your own words." The responses to this specific question constituted the first data set (hereafter referred to as definitions provided by library professionals).

To gain insight into the theoretical aspect of how usability is defined in research, a second data set (hereafter referred to as formally published definitions) was collected

through a review of the CS-IS and LIS literature in the 2007 Institute for Scientific Information (ISI) Journal Citation Reports (JCR). The 56 journal titles under the Information Science & Library Science category in the Social Science edition, and the 92 journal titles under the CS-IS category in the Science edition were selected to take into account the interdisciplinary nature of usability.[34] Fifteen journals overlapped the two subject lists. The authors searched all of these publications for usability definitions published prior to 2009 using two citation databases, Scopus and Web of Science (WoS).The authors limited each search using the combination of one ISI journal title and the phrase *Web usability*. Searches through the two citation databases ensured that sources from the two subject areas were more fully represented in our sample. The searches retrieved a total of 440 records; 219 from Scopus and 221 from WoS. The authors each read the 440 articles to identify definitions of "usability" and "Web usability"; of these, 36 articles contained definitions. For the articles that included definitions referenced in other sources, the authors located those cited sources and added them to the data set. In total, 63 formally published definitions were compiled and constituted the second data set.

Content Analysis

The two sets of definitions were analyzed following Weber's standard content analysis procedures.[35] The authors drew concepts from the key terms identified in each definition to form categories of usability attributes. For example, *frustration*, *pleasing*, and *confusion* were terms categorized as *Attitude,* which includes satisfaction. The 67 definitions by practitioners produced 445 terms, and the 63 formally published definitions generated a total of 502 terms. These terms fell under 11 attribute categories, nine of which have been documented in the literature.[36] Attributes such as *Memorability/Retainability*, *Low Error Rate/Error Tolerance*, *Efficiency*, and *Interface/Design* reflect Nielsen's usability heuristics: minimize user memory load, prevent errors, provide short cuts, and have a consistent presentation, respectively.[37]

Two of the 11 attributes were created by the authors based on the content analysis: *User Characteristics* (referring to type of user, level/experience of user, and demographic information) and *Context/Purpose* (referring to context in use, environment, and purpose of use). Frequently, Web developers design systems that require prior knowledge from users; they expect users to know the system instead of designing a system that fits general users' mental model. As Head noted, the cognitive aspect is important because systems that provide cognitive cues, such as metaphors, add familiarity and thus increase intuitiveness.[38] This is especially crucial when a task is not just fact-finding, but in-depth research. The authors added the *User Characteristics* attribute to emphasize the user-centered concept and anticipated that it would be an important property of usability addressed in these two sets of definitions. The *Context/Purpose* attribute was created to address the physical, social, and cultural environments, which play an integral role in how well a system works within a particular setting.[39] In addition, this attribute takes into account the users' goals and situations. The 11 attributes constituted this study's coding scheme. The attributes together with their descriptions are presented in Table 1.

Each author coded both data sets in their entirety. All discrepancies in coding were resolved through discussions until 100 percent agreement was reached among the three authors. In order to ascertain coding reliability, percent agreement and Jacob Cohen's

Table 1.

The 11 attributes of usability with their corresponding descriptions

Attribute	Description
Attitude	The system should be pleasant to use so that users are subjectively satisfied when using it—they like it.
Context/ Purpose	The environment within which the system exists and the users' context and purpose for using the system.
Control/ Flexibility	The system allows users to manipulate, adapt, customize, personalize, and access, using various devices and means; and it is compatible with varying applications.
Effectiveness	The system should be functionally correct and helpful, allowing users to perform their tasks and achieve their goals.
Efficiency	The system should be efficient to use so that once the user has learned the system, a high level of productivity is possible.
Interface/ Design	The technical and visual design concerns of the system or website interface, including its design elements (e.g., color, font, images/icons), design consistency, navigation (its breadth and depth), information architecture, and task flow.
Learnability	The system should be easy to learn, easy to use, and intuitive, so that its user can rapidly start accomplishing work.
Low error rate/ Error tolerance	The system should have a low error rate, so that users make few catastrophic errors during the use of the system and if they do make errors they can easily recover from them.
Memorability/ Retainability	The system should be easy to remember so that the casual user is able to return to the system after not having used it for some period of time without having to learn everything all over again.
Usefulness	Users find the content/information useful for their needs and tasks.
User characteristics	The system addresses users' cognition, information processing, mental model, level of knowledge/skill (novice, infrequent, advanced, experienced, etc.), and demographic characteristics.

kappa coefficient were used to compare the authors' coding results and those of the two graduate students blind to the purposes of this study. The computed values of these two measures were all above the often-cited threshold of 0.70.[40] Hence, the coding was deemed to be reliable.

Statistical Methods

The authors applied descriptive statistics to show the distribution and percentage of the 11 attributes. A chi-square (χ^2) analysis was performed to determine if usability attributes emphasized in definitions and library ranking are dependent. A one-way analysis of variance (ANOVA) was used to compare usability attributes emphasized in formally published definitions among four five-year periods. To determine the differences and similarities between the formally published definitions and those provided by the ARL library professionals, the authors conducted chi-square (χ^2) analyses and *t*-test.

In addition, the authors employed a hierarchical cluster analysis to graphically map the proximity of the 11 usability attributes to each other based on how often they were referred to in the same definition. Cluster analysis is a statistical method used mainly for classification purposes.[41] This process requires converting a data set into a distance matrix that reflects the similarity or dissimilarity between pairs of objects (in this case, attributes of usability). The resulting matrix, based on how often these 11 attributes were referred to in the same definitions, consists of measures of similarity, known as co-occurrence measures. The higher the co-occurrence measure, the more similar the objects are. Two separate similarity matrices were constructed: one was for the formally published definitions and the other was for definitions provided by library professionals. The two similarity matrices underwent the cluster procedure in SPSS, producing two sets of dendrograms (or tree diagrams) for the 11 attributes, one for each of the definition sets. Of the many hierarchical clustering methods, the authors applied the average linkage scheme (distances between any two clusters is the average distance between all possible pairs of stimuli in the two clusters), because it is robust and suitable for most hierarchical clustering exercises.[42]

Deriving Focal Points from Theoretical Frameworks

One of the objectives of this study was also to examine how the two sets of definitions address key elements of human information behavior models and HCI frameworks as published in the literature. Wilson's information behavior model considered the user as the central focus of information environments and described the relationship users have with the other components of the environment. Ingwersen's cognitive model of IR interaction included five distinct elements: information object, interface/intermediary, individual user's cognitive space, social/organizational environment, and the IR system setting; the last two elements were in line with those of Wilson. Wilson's model represented an effort to tie notions of information seeking behavior to issues associated with information systems design. Saracevic's stratified model proposed three levels of interactions between a user and an information system: 1) interactions between the users and the interface of the information systems; 2) the user's cognitive engagement in judging the relevance of the information object; and 3) the user's application of useful

information found to the problem-at-hand within a given environment. Belkin considered the dynamics among the users, the information objects, the information systems, the user's intended goals, and situations in his episode model.[43]

These four models clearly depicted the interactive aspects of users, problems, systems, information objects, and environment in digital settings. Although coming from the perspectives of information behavior or information seeking process, these elements, with the exception of information objects, closely match the major components in Shackel's as well as Zhang and Galletta's frameworks: user, task, tool / technology, and environment / context. In an attempt to examine how these 11 attributes account for the key factors presented in Shackel's usability and Zhang and Galletta's HCI frameworks, as well as information behavior models introduced by Ingwersen, Saracevic, Belkin, and Wilson, the authors categorized the 11 attributes based on five focal points derived from these theoretical foundations: user, task, system, environment, and content (See Table 2).[44]

Results

Definitions Provided by Library Professionals

The results from the analysis of the 445 terms provided by library professionals indicated that the top five most emphasized attributes were *User Characteristics* (21.12 percent), *Learnability* (20.22 percent), and *Effectiveness* (15.51 percent), followed by *Interface/Design* (13.71 percent) and *Control/Flexibility* (11.46 percent). *Memorability/Retainability* (0.67 percent) and *Low Error Rate/Error Tolerance* (0.67 percent) received the least attention (See Table 3 Section A).

In reviewing the 67 library professionals addressing each of the attributes, the authors found that 54 (80.6 percent) focused on *User Characteristics* in their definitions, 47 (70.15 percent) on *Effectiveness*, and 43 (64.18 percent) on *Learnability*. This presents a different priority order of the attributes from the term analysis. In contrast to the high number of library professionals who included *User Characteristics* in their definitions, only seven of the 67 definitions (10.45 percent) contained the *Attitude* attribute (see Table 3 Section B).

The authors then reviewed the definitions divided into three groups and arranged in tiers according to the ARL academic library ranking. The three groups were those ranked 1 through 38 (Tier I), 39 through 76 (Tier II), and 77 through 114 (Tier III). A Chi-square analysis showed that usability attributes and library ranking are dependent ($\chi^2 = 33.376$, $df = 20$, $p < 0.05$), that is, professionals at libraries ranked at different levels emphasized the various usability attributes differently. The top three usability attributes for Tier I were *User Characteristics* (11.46 percent), *Learnability* (8.09 percent), and *Effectiveness* (5.84 percent); for Tier II, they were *Learnability* (6.29 percent), *Interface/Design* (5.39 percent), and *Effectiveness* (5.39 percent); and Tier III were *Learnability* (5.84 percent), *User Characteristics* (4.72 percent), and *Effectiveness* (4.27 percent). Some attributes had acute differences, such as *Usefulness* (Tier I: 4.72 percent, Tier II: 0.45 percent, and Tier III: 2.25 percent) and *User Characteristics* (Tier I: 11.46 percent, Tier II: 4.94 percent, and Tier III: 4.72 percent). The authors conducted further analysis by filtering out the *Usefulness* and *User Characteristics*, separately and together, and found no statistical significance

Table 2.

Five focal points derived from widely accepted information behavior models and HCI frameworks, with their representing attributes

Focal Point	Attribute
People / Users	User characteristics, Attitude / Satisfaction
Tasks	Effectiveness, Efficiency
System / Technology	Learnability, Memorability / Retainability, Low error rate / Error tolerance, Interface / Design, Control / Flexibility
Environment	Context / Purpose
Information objects / content / resources	Usefulness

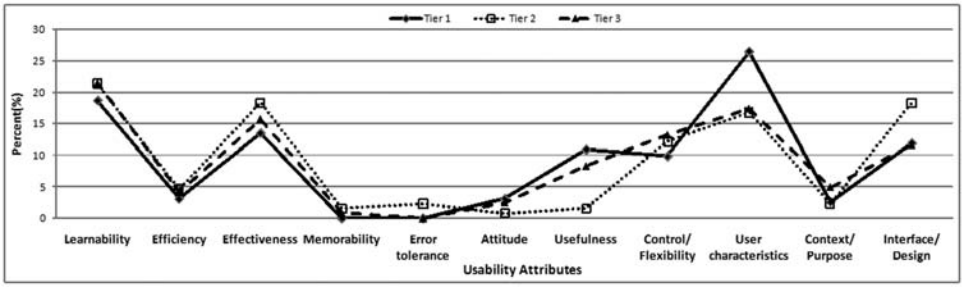

Figure 1. Percentage of terms used in definitions from library professionals by usability attributes and tier rank of ARL academic libraries

in the emphases on the remaining attributes among the three tiers. This result indicates that the two attributes, *Usefulness* and *User Characteristics*, are the contributing variables to the differences. *Learnability* and *Effectiveness* are mentioned as one of the top three attributes by all of the library groups; while *Usefulness*, *Memorability/Retainability*, and *Low Error Rate/Error Tolerance* were among the consistently less frequently emphasized attributes (see Table 4, Figure 1).

Formally Published Definitions

An analysis of the 502 terms in the 63 formally published definitions indicated that the three most emphasized attributes of usability were *Learnability* (19.12 percent), *Effectiveness* (18.33 percent), and *User Characteristics* (16.73 percent) followed by *Attitude* (12.35

Table 3

Section A. Frequency, percentage, and mean number (with the Standard Deviation) of terms used in library professionals' definitions by usability attributes (n=445)

Section B. Number and percentage of the participating libraries that addressed each of the attributes within the definitions (n = 67)

Usability Attribute	Freq.	%	Mean	SD	No. of Libraries	%
Attitude	10	2.25	0.15	0.50.	7	10.45
Context/Purpose	14	3.15	0.21	0.62.	9	13.43
Control/Flexibility	51	11.46	0.76	0.99	34	50.75
Effectiveness	69	15.51	1.03	1.10	47	70.15
Efficiency	17	3.82	0.25	0.50	15	22.39
Interface/Design	61	13.71	0.91	1.37	30	44.78
Learnability	90	20.22	1.34	1.53	43	64.18
Low error rate/Error tolerance.	3	0.67	0.04	0.27.	2	2.99
Memorability/Retainability.	3	0.67	0.04	0.21.	3	4.48
Usefulness	33	7.42	0.49	0.89	22	32.84
User characteristics	94	21.12	1.40	1.37	54	80.60
Total	445	100.00				

Table 4

Frequency and mean number of terms used in definitions from library professionals by usability attributes and rank of ARL academic libraries

	Tier I Ranks 1-38 (n=27)				Tier II Ranks 39-76 (n=22) .				Tier III Ranks 77-114 (n=18)			
Usability Attribute	**Freq.**	**%**	**Mean**	**SD.**	**Freq.**	**%**	**Mean**	**SD.**	**Freq.**	**%**	**Mean**	**SD**
Attitude	6	1.35	0.222	0.51.	1	0.22	0.045	0.21.	3	0.67	0.167	0.71
Context/Purpose	5	1.12	0.185	0.62.	3	0.67	0.136	0.47.	6	1.35	0.333	0.77
Control/ Flexibility	19	4.27	0.704	1.03	16	3.60	0.727	1.03	16	3.60	0.889	0.90
Effectiveness	26	5.84	0.963	1.43	24	5.39	1.091	0.92	19	4.27	1.056	0.73
Efficiency	6	1.35	0.222	0.51.	6	1.35	0.273	0.55.	5	1.12	0.278	0.46
Interface/Design	23	5.17	0.852	1.20	24	5.39	1.091	1.85	14	3.15	0.778	0.88
Learnability	36	8.09	1.333	1.78	28	6.29	1.273	1.45	26	5.84	1.444	1.29
Low error rate/Error tolerance	0	0.00	0.000	0.00.	3	0.67	0.136	0.47.	0	0.00	0.000	0.00
Memorability/ Retainability	0	0.00	0.000	0.00.	2	0.45	0.091	0.29.	1	0.22	0.056	0.24
Usefulness	21	4.72	0.788	1.19.	2	0.45	0.091	0.29	10	2.25	0.556	0.70
User characteristics	51	11.46	1.889	1.87	22	4.94	1.000	0.69	21	4.72	1.167	0.86
Total	193	43.37		.	131	29.44		.	121	27.19		

Table 5

Frequency and percentage of terms used in the formally published definitions by usability attributes and subject area of source

Usability Attribute	Subject Area of Source			Total (%)
	CS-IS	LIS	O	
Attitude/Satisfaction	20 (3.98%)	19 (3.78%)	23 (4.58%)	62 (12.35%)
Context/Purpose.	9 (1.79%)	7 (1.39%)	8 (1.59%)	24 (4.78%)
Control/ Flexibility	11 (2.19%)	5 (1.00%)	3 (0.60%)	19 (3.78%)
Effectiveness	31 (6.18%)	28 (5.58%)	33 (6.57%)	92 (18.33%)
Efficiency	19 (3.78%)	11 (2.19%)	21 (4.18%)	51 (10.16%)
Interface/Design	8 (1.59%)	10 (1.99%)	5 (1.00%)	23 (4.58%)
Learnability	30 (5.98%)	36 (7.17%)	30 (5.98%)	96 (19.12%)
Low error rate/Error tolerance	3 (0.60%)	6 (1.20%)	12 (2.39%)	21 (4.18%)
Memorability/Retainability	2 (0.40%)	9 (1.79%)	8 (1.59%)	19 (3.78%)
Usefulness	8 (1.59%)	2 (0.40%)	1 (0.20%)	11 (2.19%)
User characteristics	28 (5.58%)	32 (6.37%)	24 (4.78%)	84 (16.73%)
Total (%)	169 (33.67%).	165 (32.87%)	168 (33.47%)	502 (100.00%)

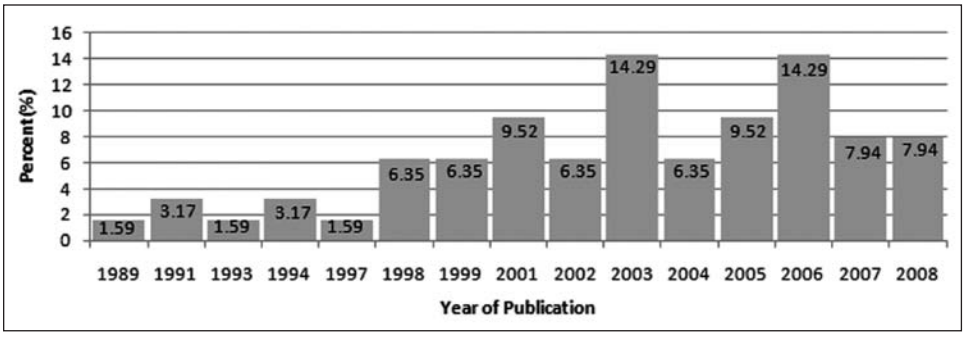

Figure 2. Number of sources with formally published usability / Web usability definitions by year of publication (n=63)

percent), and *Efficiency* (10.16 percent). *Control/Flexibility* (3.78 percent), *Memorability/ Retainability* (3.78 percent), and *Usefulness* (2.19 percent) were least mentioned (see Table 5).

While these sources were published between 1989 and 2008, almost half (46 percent) were published over the last five-year period, 2004 to 2008. A comparison of the number of sources published during the first ten years (17.4 percent) and the second ten years (82.6 percent) revealed a dramatic increase of 475 percent (see Figure 2). A further analysis of the distribution of the sources in five-year intervals showed that four publications (6.3 percent) were published between 1989 and 1993; seven (11.1 percent)

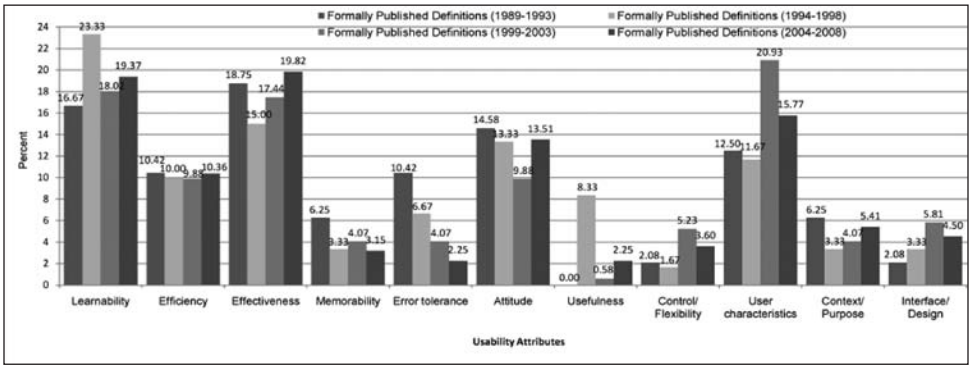

Figure 3. Comparison of attributes by five-year periods

between 1994 and 1998; 23 (36.5 percent) between 1999 and 2003; and 29 (46 percent) between 2004 and 2008.

In addition, the authors examined the attributes in the source publications based on five-year periods. The top attribute for each period was: 1989–1993, *Effectiveness* (18.75 percent); 1994 –1998, *Learnability* (23.33 percent); 1999–2003, *User Characteristics* (20.93 percent); and 2004–2008, *Effectiveness* (19.82 percent). Many of the attributes received

Table 6

Mean and standard deviation of number of terms from both sets of definitions

	Formally published definitions (n=63)		Definitions provided by library professionals (n=67)			
	Mean	SD	Mean	SD	t	Sig.*
Section A: by Usability Attribute						
Attitude/Satisfaction	0.984	0.99	0.149	0.50	5.84***	0.0000
Context/Purpose	0.381	0.55	0.209	0.62	1.68	0.0957
Control/Flexibility	0.302	0.61	0.761	0.99	3.20***	0.0017
Effectiveness	1.460	1.34	1.030	1.10	1.99**	0.0486
Efficiency	0.810	0.84	0.254	0.50	4.49***	0.0000
Interface/Design	0.365	0.75	0.910	1.37	2.83**	0.0054
Learnability	1.524	1.55	1.343	1.53	0.67	0.5064
Low error rate/Error tolerance	0.333	0.74	0.045	0.27	2.88***	0.0047
Memorability/Retainability	0.302	0.59	0.045	0.21	3.24***	0.0015
Usefulness	0.175	0.49	0.493	0.89	2.52**	0.0129
User characteristics	1.333	1.81	1.403	1.37	0.25	0.8057
Section B: by Usability Focal Point						
People/users	2.286	2.27	1.552	1.48	2.16**	0.0327
Tasks	2.270	1.88	1.269	1.35	3.46***	0.0007
System/Technology	2.857	2.79	3.119	2.51	0.56	0.5746
Environment	0.381	0.55	0.224	0.62	1.52	0.1301
Information Objects/ Content/ Resources	0.175	0.49	0.478	0.89	2.40**	0.0176

*Two-tailed. *** $p < .005$, ** $p < .05$

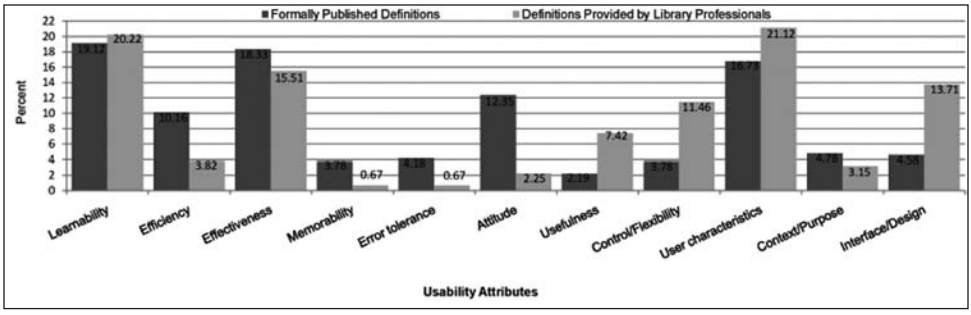

Figure 4. Percentage of each attribute found in both sets of definitions

consistent attention over the years; these included *Efficiency*, *Attitude*, *Context/Purpose*, *Control/Flexibility*, and *Interface/Design*. *Low Error Rate/Error Tolerance* decreased over the years, and *Usefulness* spiked for the years 1994–1998. (see Figure 3).

Comparisons of the Two Sets of Definitions

A *t*-test determined the differences and similarities between the formally published definitions and those provided by the ARL library professionals. Except for three usability attributes, namely *Learnability*, *User Characteristics*, and *Context/Purposes*, the two sets of definitions differed in their emphasis, albeit with varying degrees. As Table 6 Section A and Figure 4 demonstrate, the largest discrepancies occurred with *Attitude*, *Efficiency*, *Memorability/Retainability*, *Control/Flexibility*, and *Low Error Rate/Error Tolerance* attributes. Attributes with less pronounced differences were *Interface/Design*, *Usefulness*, and *Effectiveness*. A chi-square test determined whether the usability attributes emphasized are independent of the definition source (i.e., formally published literature and ARL professionals). A significant chi-square value ($\chi^2 = 126.21$, df =10, $p < 0.001$) indicated that the focus of usability attributes were dependent on the source of the definitions, and this confirmed the above assertion that the two sets of definitions differed in their emphasis.

To compare these two sets of definitions with respect to which attributes were mentioned in the same definition (i.e., the co-occurrence of the attributes), the authors applied a hierarchical cluster analysis. The dendrograms for both formally published definitions and those provided by library professionals showed three distinct clusters of the attributes. In both sets of definitions, *Learnability*, *User Characteristics*, and *Effectiveness* co-occurred in the same definition with the highest frequencies. However, there were slight differences in the co-occurrence of the other attributes in the clusters. For instance, in the definitions provided by the library professionals, these three attributes co-occurred more frequently with *Control/Flexibility* and *Interface/Design* than the other six attributes. On the other hand, in the definitions published in the literature, these three attributes co-occurred more frequently with *Efficiency* and *Attitude* instead (see Figures 5 and 6).

Since usability is integral to the information seeking process, the authors examined how the attributes fit into the key elements of HCI frameworks and information behavior

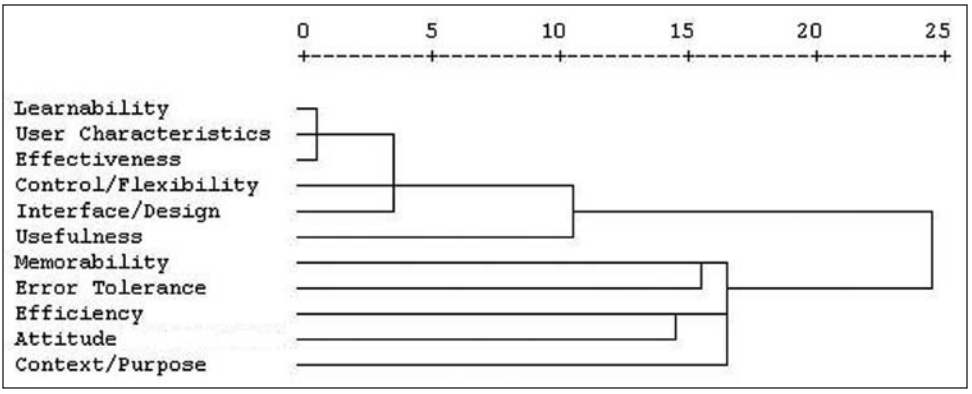

Figure 5. Dendrogram of usability attributes in definitions provided by library professionals

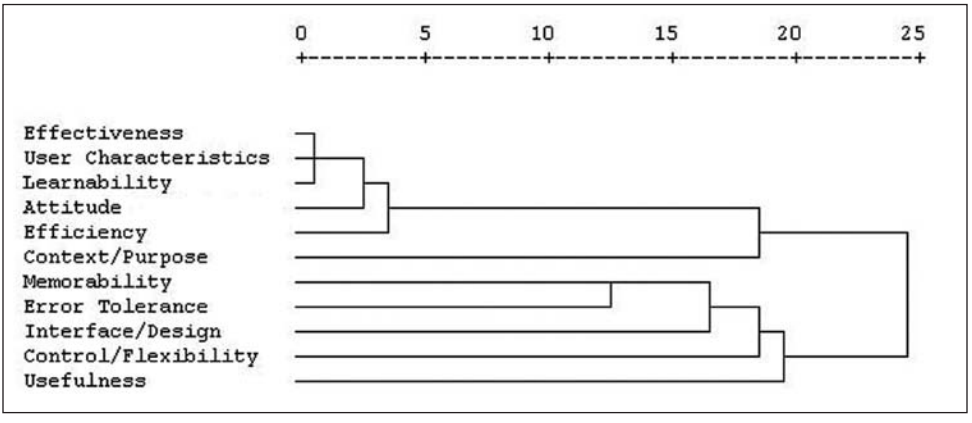

Figure 6. Dendrogram of usability attributes in formally published definitions

models. These two sets of definitions were compared according to the five focal points (*People/Users*, *Tasks*, *System/Technology*, *Environment*, and *Information Objects/Content/Resources*) noted in the methodology section above. The *t*-tests showed that the categories with statistically significant differences were *Tasks*, *Information Objects/Content/Resources*, and *People/Users* ($p < 0.005$). As shown in Figure 6, the difference between the two groups regarding terms used to address the five focal points was a minimum of 1.41 percent (*Environment*) and a maximum of 11.11 percent (*System/Technology*).

The formally published definitions used more terms relating to *People/Users*, *Tasks*, and *Environment*, while professionals applied more terms relevant to *Information Objects/Content/Resources* and *System/Technology*. On average, the literature provided 0.734 more terms that described *People/Users*, 1.000 more for *Tasks*, and 0.157 more for *Environment*. On the other hand, library professionals used 0.262 more terms that highlighted *System/Technology*, and 0.303 more for *Information Objects/Content/Resources* (see Table 6 Section B). A chi-square test, based on the frequencies presented as percentages in Figure 7, was conducted to see if the two sets of definitions were different with respect to the

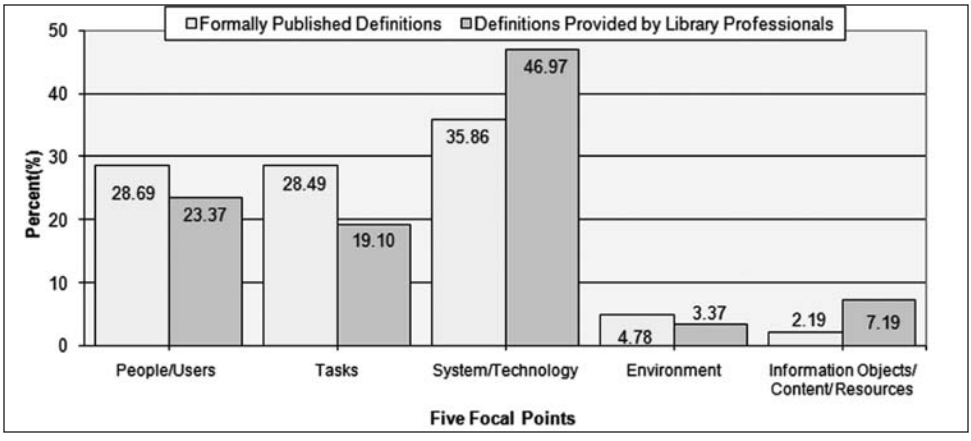

Figure 7. Percentage of terms from both sets of definitions by the five focal points derived from HCI frameworks and information behavior models

five focal points. This resulted in a statistically significant chi-square value ($\chi^2 = 32.387$, $df = 4$, $p < 0.001$).

Discussion

Definitions Provided by Library Professionals

According to the results, the library practitioners used more terms related to *User Characteristics*, *Learnability*, and *Effectiveness* attributes of usability (over 56 percent) than terms associated with the other eight attributes. They were interested in easy-to-learn information systems and, since terms relating to the *Attitude* attribute were rarely used in their definitions, seemed less attentive to users' affective concerns. While the authors applaud the library practitioners for their frequent mention of *User Characteristics*, they are concerned by the low level of attention given to the *Attitude* attribute, because this is contrary to the library objective of promoting positive experiences for patrons. The authors encourage libraries to more readily incorporate this attribute into their systems, so users will have more satisfactory experiences and will continue to return to use library services and resources. With increasing competition from information services, it behooves the library community to put more emphasis on user attitude and satisfaction.

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Similarly, as libraries have historically been key information providers, one might expect that the attribute focusing on content (i.e., *Usefulness*) would be frequently referenced. However, less than one-third of the participants noted terms relevant to this attribute in their definitions. Another important aspect relating to content is the supporting information environment (e.g., academic libraries provide scholarly materials;

public libraries facilitate access to more general information). In the library professionals' responses, the environment-related attribute (i.e., *Context/Purpose*) received very little attention with only nine of the 67 responses addressing this aspect.

In reviewing the ARL ranking and the attributes, the pattern became evident wherein as the rank increases, so does the frequency of terms associated with the *Learnability*, *Effectiveness*, and *User Characteristics* attributes. A study by Chen, Germain, and Yang indicated that there was a relationship between ARL ranking and available usability resources; that is, ARL libraries that have more resources tend to conduct more usability testing.[45] Based on this observation, the authors suspect that with increased resources and usability testing, practitioners in those libraries are better versed in user-related concepts. This may explain why these three attributes (*Learnability*, *Effectiveness*, and *User Characteristics*) gained additional attention from the top tier libraries.

Formally Published Definitions

The top five mentioned attributes (i.e., *Learnability*, *Effectiveness*, *User Characteristics*, *Attitude*, and *Efficiency*) accounted for approximately 77 percent of the 502 terms and appeared in over 60 percent of the 63 definitions, thus pointing to their importance in the literature. The authors were surprised that *Interface/Design*, *Control/Flexibility*, and *Memorability/Retainability* were among the bottom five since these are important aspects of HCI and have been advocated by scholars such as Shackle, Nielsen, and Shneiderman.[46]

Reviewing the attributes from the time of publication perspective, the authors interpret the 475 percent increase in the number of sources published during the second ten years (1999–2008) as an indication that literature paid closer attention to the subject of usability in the second decade, especially in light of the emergence of the World Wide Web, its popularity among users, and the importance of creating Internet resources that incorporate usability principles. In addition, the steady increase in the number of sources published in five-year intervals signals a growing trend in publications including usability definitions.

The five-year interval analysis indicated that *Learnability* was most emphasized during the second five-year period (1994–1998). This may be due to the transformation from text-based or GUI interfaces to Web-based applications. Definitions published between 1999 and 2003 contained more terms related to *User Characteristics* than any of the others, most likely a consequence of an increase in the use of e-commerce. While focus shifted for some attributes (e.g., *Learnability* spiked between 1994 and 1998), several, such as *Efficiency* and *Effectiveness*, received consistent attention across the time frames. An interesting observation was that during 1999–2003, while the *User Characteristics* attribute was highly emphasized, *Attitude* was not. If minimizing user frustration is a goal of a system designed to accommodate multiple user populations with different needs, attributes emphasized should reflect both *User Characteristics* and *Attitude*. As noted in several of the seminal definitions (e.g., Shackel and ISO), usable systems account for both target users and their attitudes toward the systems.[47] A general interest in accessibility issues during that time might have had some impact on the literature.

Over the years the inclusion of the *Low Error Rate/Error Tolerance* attribute within the definitions declined. The authors believe that the reasons are two-fold: 1) users have come to be more accepting of errors, for example, rebooting if necessary; and, 2) software

applications have become more sophisticated, detecting errors and prompting users with corrections (e.g., Google's spelling suggestions) or action confirmations (e.g., messages with queries, such as "Do you really want to delete this file?").

Comparisons of the Two Sets of Definitions

In comparing the two sets of definitions (see Table 6 Section A and Figure 3), the top five most frequently mentioned attributes were as follows:

Definitions provided by library professionals	Formally published definitions
1. User Characteristics	1. Learnability
2. Learnability	2. Effectiveness
3. Effectiveness	3. User Characteristics
4. Interface/Design	4. Attitude
5. Control/Flexibility	5. Efficiency

The top three attributes of library professionals were in line with those of the literature, which may indicate that the practitioners are cognizant of the trends in usability research. While this holds true, the order of the top three attributes differed in the two sets. As expected, the library professionals put *User Characteristics* as a top priority; however, terms associated to the user related attribute, *Attitude*, infrequently appeared in their definitions. In contrast, *Attitude* was ranked just below *User Characteristics* in the formally published definitions. This emphasis was significantly different from those provided by ARL library professionals ($p < 0.005$). In addition, there was a statistically significant difference ($p < 0.005$) in the *Efficiency* attribute, which addresses user productivity. These results indicate that user satisfaction and performance have a higher priority in the literature than among library professionals.

These results indicate that user satisfaction and performance have a higher priority in the literature than among library professionals.

The lack of emphasis on *Attitude* and *Efficiency* is contrary to the perception that libraries are user-centered information providers. Additionally, an inverse order of the *Efficiency* and *Interface/Design* attributes exists between the two data sets. *Efficiency* appeared less frequently than *Interface/Design* in the library professionals' definitions; while the reverse occurred in the formally published definitions (see Table 6 Section A). However, *Interface/Design* and *Control/Flexibility* were two of the top five attributes for the library professionals and yet did not reach the top five for the formally published definitions. The results showed statistically significant differences for these two attributes ($p < 0.05$ and $p < 0.005$, respectively). It is logical that when developing user interfaces or information systems, it is imperative to take user control and flexibility into account since it is important for the user to easily access, navigate, and manipulate the system. In a closer examination of the terms coded under the *Interface/Design* attribute, the authors learned that a majority of the terms submitted by the library professionals centered on usability testing. While testing the Web interface and design is important, it is also vital to address issues such as information architecture and task flow. For the *Control/Flexibility* attribute, the terms *accessibility* and *access* were frequently mentioned. Since libraries are public entities and user-oriented, it is appropriate that they would address issues

of universal design and usability testing to meet the needs of diverse populations. The emphasis on user study and accessibility put forth by library professionals is consistent with the placement of *User Characteristics* as their top priority.

When reviewing the less frequently noted attributes, the authors noticed that compared to the published definitions, the library professionals placed more emphasis on the *Usefulness* attribute ($p < 0.05$). The hierarchical cluster analysis confirmed this observation since *Usefulness* appeared more frequently and closer to the top three attributes in the professionals' definitions than in the formally published definitions. This seems appropriate since library practitioners are information providers and responsible for delivering content that is appropriate and useful for users' needs and tasks. However, even though there was a statistical difference, terms describing the *Usefulness* attribute received minimal attention from these primary content providers.

Usefulness was not the only attribute that received little attention. Terms relevant to attributes such as *Memorability/Retainability*, *Low Error Rate/Error Tolerance*, and *Context/Purpose* were hardly mentioned in either set of definitions. This situation, in conjunction with the use of fewer terms reflecting the attributes *Efficiency* and *Attitude*, seems to discount the importance of developing the kinds of truly usable systems compatible with users' cognitive capacities advocated by many researchers.[48] For example, systems that do not account for a user's working memory and cognitive process deter him/her from easily remembering functionality and smoothly navigating the systems as he/she needs to relearn a system at each encounter. Some systems provide so much information that it is difficult for the users to smoothly navigate and efficiently perform their intended tasks, causing frustration and dissatisfaction. Compared to the library professionals, the definitions in the literature focused more on these issues. This may be because for commercial and for-profit sectors, websites addressing users' affective needs will enhance profit possibilities and minimize the risk of losing customers. Although libraries are not profit-driven, they still need to be accountable for good usability or they are likely to lose current and potential patrons. Thus, usability definers should pay close attention to these low referenced attributes in order to avoid the aforementioned outcome.

For a holistic approach to defining usability, the authors believe it is vital to include five focal points of the HCI frameworks and the information behavior models: *People/Users*, *Tasks*, *System/Technology*, *Environment*, and *Information Objects/Content/Resources*. When comparing the two sets of definitions based on the five focal points, a chi-square test resulted in a statistically significant difference in three out of the five categories. The authors interpreted this as evidence that the published literature and library professionals emphasized different aspects of usability.

According to the outcome of the analysis, both sets of definitions showed a deficit in addressing *Environment* and *Information Objects/Content/Resources*. *Environment*, whether it is cultural, social, economic, political, or organizational, is integral to both information behavior and HCI. The support needed by users to carry out their tasks is context dependent; for example, companies create intranet Web pages for their employees and develop Internet websites for public use. As Shackel, and Zhang and Galletta noted, users need to achieve their goals by performing tasks in appropriate settings. Wilson, Ingwersen, Saracevic, and Belkin also stressed the value of the environment factor and the need to take into account various contexts.[49]

Useful content and resources within a supporting environment are vital to the interaction between users and information systems. Ingwersen, Saracevic, and Belkin highlighted the critical aspect of *Information Objects/Content/Resources*; yet it is often overlooked. Judy Jeng reiterated this point noting that *Usefulness* should be regarded as the primary evaluation criterion for usability.[50] The current study results reflect that both the published definitions and library practitioners failed to adequately observe this essential usability property. Information systems should present the appropriate content or resources to help end users with completing their tasks and finding needed information. For instance, to facilitate online shopping, a useful site will provide sufficient and relevant product details, ordering procedures, and payment options, so consumers can have a straightforward and satisfactory experience.

Useful content and resources within a supporting environment are vital to the interaction between users and information systems.

Proposal of a working usability definition

Based on the theoretical frameworks and the analysis of this study, the following working definition is an attempt to bring synergy between researchers and practitioners with regard to usability, and an invitation for others to engage in a conversation toward establishing a common vision:

> Usability means that a system has visible working functionality familiar to its users, maximum reliability, and useful content that is supported by its environment and aligned with context of use. In addition, a usable system accommodates the cognitive capacity and various needs of its users, so that they can easily understand, effortlessly learn, and dynamically interact with the system as well as its content, resulting in a satisfactory experience with a high level of productivity.

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One might argue that this working definition overlaps with the commonly cited definition enshrined in the ISO 9241-11 standard. Nevertheless, the proposed definition is distinct in several respects. First, it incorporates Donald Norman's idea of familiarity. For a system to be usable and easy to use, it is necessary to make its function obvious and similar to the design of everyday things. Second, it stresses "maximum reliability" which echoes the "low error rate with zero catastrophic error" dimension put forth by Nielsen, an attribute

that has steadily received declining attention. Third, it presents the concept of "useful content" which has been neglected by researchers and is not overtly presented in the ISO definition. It illustrates the interplay of content, context of use (e.g., fact-finding vs. in-depth research), and the nature of information environment (e.g., internet or intranet, public or academic libraries). Fourth, although ISO 9241-11 mentions "specified users," in addition to addressing the various user needs, the cognitive aspect of users stands starkly as a crucial user characteristic that has not been adequately addressed in the literature and by the library professionals. Fifth, Quesenbery criticized ISO's definition for excluding non-work contexts, such as information seeking and online services, thus, failing to capture non-tangible aspects like engagement and user experience. To avoid this oversight, the proposed definition draws in the concepts of dynamic interaction between the user, the system, and its information objects, in addition to highlighting a satisfactory experience with a high level of productivity.[51]

Limitations

This current research enabled the authors to determine how researchers and practitioners defined the term *usability*. Yet, this study does have limitations, including the likelihood of missing certain formally published definitions of usability. Since the authors utilized the scholarly ISI Journal Citation Reports to initiate the selection of sources for usability definitions, many publications containing some of the more practical, rather than theoretical, sources on the topic may have been excluded. By limiting the study samples to the CS-IS and LIS journals, the authors excluded other subject areas, such as business, which may present a different perspective on usability (e.g., possibly more focus on user satisfaction and usefulness). In addition, since ISI mainly indexes journals, other important HCI literature from conference proceedings may have been omitted. Furthermore, the selection of the library practitioners from ARL restricted the generalizability of the outcome. Future efforts would benefit from the inclusion of other college and university library professionals, for example, using Carnegie Classification of Institutions of Higher Education, or non-library specialists in the usability area, such as business and health professionals.

Summary and Conclusion

The purpose of this study was to identify usability attributes used in definitions provided by the ARL library professionals and those found in the formally published CS-IS and LIS literature. Through content analysis, 11 attributes were derived from these two sets of usability definitions. The authors explored the emphasis of the attributes for each set and then compared the two sets. For the library professionals, the top three attributes were *User Characteristics, Effectiveness*, and *Learnability*. This held true when the attributes were examined by the ARL library ranking. These three attributes were also referenced most frequently in the formally published definitions as a whole though their orders differed. However, the top three attributes varied when publication dates were taken into account. Both sets of definitions overwhelmingly brought in the main usability as well as information behavior principles put forward by Booth, Nielsen, and others.[52]

For the remaining eight attributes, there were significant differences between formally published definitions and those provided by library professionals, in terms of which were often mentioned and frequently co-occurred.

As indicated in the findings, the most discernible discrepancies fell in the *Attitude*, *Efficiency*, *Memorability/Retainability*, *Control/Flexibility*, and *Low Error Rate/Error Tolerance* attributes. Although the library professionals' definitions highlighted *User Characteristics* as the top attribute, they did not focus heavily on *Attitude*. This was contrary to the results found in the published definitions within which both of these two attributes received a high level of emphasis. *Memorability/Retainability* and *Low Error Rate/Error Tolerance* attributes were referenced more often in the literature than by library professionals.

Since usability is essential to the information seeking process, the authors further examined how these two sets of definitions addressed key elements of widely accepted HCI frameworks and information behavior models. Categorizing the 11 attributes based on five focal points derived from these theoretical stands: *People/Users*, *Tasks*, *System/Technology*, *Environment*, and *Information Objects/Content/Resources,* the results showed that formally published definitions concentrate more heavily on *People/Users*, *Tasks*, and *Environment*; while library professionals focused more on *Information Objects/Content/Resources* and *System/Technology*. *Usefulness* and *Context/Purpose* attributes, which mirrored *Information Objects/Content/Resources* and *Environment* in the five focal points respectively, received little recognition. Useful content and resources with a supporting environment are vital to the interaction between users and information systems. Overlooking these key elements in the definitions most likely implies that they are neglected in practice. In this digital information age, it is imperative that both usability practitioners and researchers address the five focal points of HCI and information behavior. Thus, a more comprehensive and robust definition would take into account these various aspects of usability. Since usability is a complex topic, a holistic definition would provide the ability to more fully explore the intricacies of this construct.

Through this exploratory study, the authors have identified the gaps in the basic understanding and meaning of usability that exists between library professionals and researchers. These gaps may be attributed to the divergent viewpoints on usability, and the lack of a universally agreed upon definition as noted earlier.[53] The findings of this research provide empirical evidence that in both the formally published definitions and those of the library professionals, critical aspects of information behavior and HCI were not taken into full consideration. This discovery will help bring more awareness to members of the usability community, so they will be more conscientious when defining usability. A working definition is proposed to make intrinsic concepts more explicit, so non-usability experts may have a better grasp of this construct, and both researchers and library professionals can attend to areas that have been overlooked. An all-encompassing definition will go a long way in helping craft appropriate and applicable usability policies/standards/guidelines that will assist future practitioners in their efforts to build better systems and websites. The realization of such a definition will depend on the collective wisdom of the usability community.

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