TOWARDS A THEORETICAL FRAMEWORK FOR UNDERSTANDING WEBSITE INFORMATION ARCHITECTURE

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ABSTRACT

Website information Architecture (IA) is an emerging discipline which focus on the principles of design and architecture in the digital landscape. However, the discipline is broadly being addressed by IA community of practices known as information architects. Many design principles and evaluation criteria that had been proposed for the development websites IA, generally lack theoretical background and justification. Several suggested measures in the discipline were based on existing practices with no explicit construct. This paper attempts to give a formal treatment of website IA through theoretical grounding from the architectural domain. The framework of architectural building understanding is inspired by the fundamental ideas of Vitruvius Theory developed more than 2000 years ago used to validate the construction of a building. Drawing this architectural theory and upon related dimension of *IA studies, we argue that the theoretical grounding from* architectural domain may be further specified to frame out the loosely thread of IA website design methodology and development.

Keywords: Website Information Architecture, Architectural, Website Design

1. INTRODUCTION

In general, Information Architecture (IA) is the art and science of structuring and organizing information environments to maximize its accessibility and usefulness in assisting people fulfilling their information needs effectively [2, 5, 44]. The practice of IA development for website is broadly seen as the organization of website's structure and content, the labeling, categorizing and indexing information and the design of navigation system to support searching and browsing information [16, 17, 26, 35, 44]. Currently, IA is described as an emerging discipline, which focuses on the design principles and architecture of information in the digital landscape.

The term 'information architecture' was coined by Richard Saul Wurman since 1975 [51] but IA for the web is still relatively treated as a new field as it's been around for only few years back [10]. Basically, IA design methodology used by information architects is generally dependable on the user or sponsor vision or similar IA development cases that influence the practical selection of IA design principles for website development [20, 44].

However, the arbiter role of information architect in IA development process for a website is not fully

justified with user, sponsor vision, or even with simple practical selection of existing design principles as the building blocks for website IA solution. The process may be strongly supported if theoretical grounding support is used as the arbitrary platform in supporting the selection of design methods and principles [20]. In addition, the relationship of website IA to other related disciplines is quite ambiguous. Without its own tradition, standards and literature, it borrows heavily from information science, library science, computer science, knowledge management, interaction design, information design, graphic design, usability, content development and wayfinding [28]. Thus, website IA is primarily treated as an apprentice to existing discipline and seeks to benefits from establish practices and theories

This paper is aimed at addressing the aforementioned issues. Drawing upon the architectural theory called Vitruvius Theory, that is used to validate the construction of building in physical environment, the main objective of this paper is to identify and explain key factors influencing website IA development in the context of online information environment. Thus, the central research issue addressed is to extend the nature of architectural paradigm on the formation of website information architecture (IA). The theory building approach is used as a general research method for this study, in which inductive reasoning is chosen as part of the theory building process [25] towards forming the theoretical framework of understanding website information architecture.

The framework of this study is divided into several sections. First, the existence of architectural paradigm highlighted in the online information environment, will be presented in the literature of the next section. We then develop theoretical arguments for extending this research in the context of online environment. Subsequently, we present a research framework integrating architectural theoretical perspectives into website IA. Finally, we present future extensions and implications of our research.

The future extension of the framework may cater for localization process of the information artefacts or information products where culture dimension or cultural theoretical base may be further illuminated alongside the architectural framework of understanding website architecture. This may be done by using case study research as part of the theory building process to determine the significant of cultural context and influences to website IA [11]. Moreover, further work towards incorporating theoretical testing process for the established theoretical framework and theoretical propositions shown in this paper may be conducted by using general theory testing method. This may be done by using deductive reasoning as part of the theory testing process and seeks to see if the theory applies to a specific instances [25], in which the research method may also be achieved by using case study theory testing [34].

2. LITERATURE BACKGROUND 2.1. INFORMATION ARCHITECTURE: AN UNFOUNDED AUGMENTATION

There are several common perceptions relating to IA roles held by web development team. For instance, among the primarily key aspect of IA dimension is to enable ease of use and to design accordingly to user expectations and goals [10, 15, 44, 46, 50]. In addition, in almost all cases, information and navigation design, which are part of IA were initially done before the graphic design construction and had become a common practice in developing website architecture [39]. The widespread apprehension of the emerging field of IA had put forth the emerging field into significant limelight of guidance for the rest of web development team to adhere.

Shaped by history and circumstances, design methodologies for IA have evolved from skills-based traditions and are now moving toward more theoretical and scientific inquiry-based design methods [38]. Currently, design process of IA practices is relatively using a bottom-up approach, which focus on particular design problems that eventually generate the overall structure of design solution. The main reasons to this practice is due to the fact that IA does not have internal theory and therefore must proceed with bottom-up approach to support emergent phenomena of user experience [20]. Among the current technique suggested for the bottom-up approach is to decide conclusively the way you want the information to be found, the logical practice of organizing, gathering, maintaining information and the recognition of the psychological needs of the users as they receive the data [36].

Even so, the motion of IA methodology paradigm is gradually shifted towards the possibility of IA practically begins with a top-down approach. This approach may be properly guided from a theoretical framework and empirical grounding that fit the specifics and work inductively to fill gaps not addressed by theory [20]. The valuable known knowledge from architecture domain may probably be a rigor foundation to support the top-down approach as it provides powerful insights to further development and clarification of the emerging field of website IA.

2.2. INFORMATION ENVIRONMENT AND INFORMATION ARCHITECTURE

Information environment is a physical and computer mediated information space which context is defined by real and conceptual structure [38]. The concept of IA is being utilized inside information environment by the design of information environments and management design process that are moving towards the conceptualization of the information space itself [38]. The commonly used components of IA, which are presentation, organization and navigation scheme had become primarily interest in supporting the information space to be properly elucidated towards the creation of information space and ambience of information environment [38].

Information space has different connotation inside information environment. Information space as described by Andrew Trelor (1994) is the location where the human mind interacts with information or communicates it to another [38]. Moreover, Rikkan (1998) also noted that an information space's structure may be experienced as an environment where 'here' and 'there' and the 'spaces' are distinguish and have different connections by information artefacts [42]. Every information artefact that allow information to be stored, retrieved and possibly transformed, defines an information space as the symbols, structure and functions which allows information be stored, retrieved and transformed [3]. Hence, the inclusion of information artefact will formulate the existence of information space in placing inside information environment.

The relevance of the architecture phenomena with IA context is rather undeniable. The missing link of architecture and IA is possibly connected by culture and information space as the milieu, with the latter treated as the platform of contemplation, connecting physical and online environment. One of the reasons that contribute to this perception is that the attributes of IA appears to be everywhere in information spaces [18]. Thus, further illumination for IA may be delineated with architectural exemplar and formalism.

2.3. WHY ARCHITECTURAL CONSIDERATION

The dominant model for interface design for the first twenty years was architectural-based [27]. Buildings and their architectures provide us with great opportunities to make analogies about websites and their architectures [29, 44]. The reasonable desire for analogous between organic and digital had given way to an all-encompassing quest for a pure fusion of the two [27]. Although IA does not resemble physical architecture, there is a formal language and representation evolving for it [12]. The architectural analogy has been used to describe the complex multidimensional of information spaces. The usage of analogies will assist to establish the relationship between architecture and website IA into one parallel dimension of comprehension. For instance, a number of researchers have made analogy that navigating information spaces are like navigating in the real world [45]. With information space as the context of discussion, there follows few analogous related connotations to IA, such as place, information seeking behaviours and ecological cues.

2.3.1. PLACE

Place is analogous to hyperspace, exemplified by hypertext or hypermedia system that provides a structure in which the information nodes are linked and functions are provided [3, 8, 31, 45].

2.3.2. INFORMATION SEEKING BEHAVIOURS

The three archetype architectural analogies representing information seeking behaviours are wayfinding, exploration and navigation, which are based on the commonly used spatial metaphor "information space". These information seeking behaviours assist the user to achieve the information objective when searching or browsing for information in the website or in the sense of moving around the information spaces to arrive at a desirable location [3, 30, 47]. For examples, in information seeking processes, the breadcrumbs analogy that is being popularized by large directories likes 'Yahoo!', is being used to reinforce users in the 'right place' and educate the website structure [4].

2.3.3. ECOLOGICAL CUES

Ecological cues from the immediate environment may also provide architecture analogical cues to website IA. The knowledge development of the space over time and through the experience of interacting with it had resolved people in using tools of sign, map, guide or landmark that provide assistance in wayfinding and reaching the destination in the information environment [3, 24, 50]. Examples for ecological cues are shown as follows;

- Sign alone may provide analogical cues to support navigation and other aspect of being. There are three categories sign cues; informational (provide information on object), directional (provide route or survey information) and warning and reassurance (provide information on the actual or potential action within environment) [47].
- Such navigational tools are maps, guides and landmarks, were being conceptualized directly from physical architectural lexicon into web digital jargon such as site map, site guide, Frequent Ask Question (FAQ) and also highlighted main menu, that pose as primary landmark for the website.

In general, the three analogies to architecture, known as place, information seeking behaviours and ecological cues are only few of the related architectural analogies drawn from physical architecture to website IA. These concepts are included as among primary practices, apprehended and utilized quickly by web team.

The conceptualizations and visualization of an information space in the digital environment had been influenced by the organizational principles known to architecture all along [42]. The perception attached to the information space is still going strong to be predisposed by the sense of architectural paradigm. In fact, Louis Rosenfeld (2000), one of the scholar who popularized the 'information architecture' term, had broaden the definition and backed away from mentioning specific architectural system, such as organization, navigation, labeling and searching, as continually find more to architecture than those systems cover [1]. Therefore a proper architectural formalism is imperative to ensure website IA development is being conceptualized along with architectural paradigm, towards becoming a discipline of its own.

2.4. THE ARCHITECTURAL FORMALISM

As noted by Kruft, Scamozzi describe that "Architecture is the most worthiest and most important of the sciences as it gives order to all things" [6]. This perception may be properly followed by borrowing a theory from the field of architecture to provide a strong architectural construct for website IA methodology and development. One of the renowned architectural theories is the Vitruvius Theory which was formulated more than 2000 years ago by Marcus Pollio Vitruvius and come to light in the 15th century Renaissance to validate the construction of a building [40].

The Vitruvius Theory has been considered, used and adapted extensively in the field of architecture in the offline environment as among primary theoretical background [41]. Generally, *Utilitas* falls in the sociopsychological realm, *Firmitas* belongs to the engineering realm and *Venustas* as the experiential value of a building [40]. The original term were after a change in the order initiated by Alberti, interpreted by Henry Wotton as firmness (*Firmitas*), Commodity (*Utilitas*), Delight (*Venustas*) and have dominated architectural theory ever since (7). Three Vitruvius categories of *Firmitas*, *Utilitas* and *Venustas* are shown in Figure 1.



Figure 1: The Vitruvius Theory

The Vitruvius Theory is not considered as a new adaptation theory in the online environment as few other researchers in the information science field has addressed the significant of the architectural theory in the digital phenomena [22, 48]. However, the extensive theoretical propositions of this architectural theory may

be further benefited inside website IA realm. The following are descriptions of the primary elements of Vitruvius Theory, which will become related underlying principles of interest in the research framework towards forming the architectural theoretical framework of understanding website IA.

2.4.1. FIRMITAS (FIRMNESS)

The subject of structure may be imposed with *firmitas* (firmness). The term implies solidarity or durability of building construction. The durability in general can be related to foundation and materials [6]. An example of a book that concentrates on one of Vitruvius Theory, *firmitas*, is M. Foster, 'The Principle of Architecture', where he noted that "the emphasis of firmness rely on the soundness of the structure through the use of the materials like stone, timber, brick and steel" [7].

2.4.2. UTILITAS (UTILITY)

The second Vitruvius element, Utilitas (Utility) has been commonly divided between the overall function performed by the construction of the building and the particular function performed by the space it encloses [7]. The first property of the building is that they should be accommodated for their respective purposes and their value is measured by their convenience in usage. Thus, convenience is treated as a very important trait to be imposed for the building structure so that the functionality embedded present no hindrance of usage. This is because the functionality provided may not merely be practical but may also implies to be pleasant. It is clear that one fundamental aim of architecture is that a building should be working in all aspects and achieve general convenience of overall layout to the smallest details affecting everyday usage.

2.4.3. VENUSTAS (AESTHETICS)

The latin word Venustas was corresponded to Wotton's category of delight [6]. Delight here stands for ornamentation or beauty. Cicero noted the notion of propriety or décor may be brought by the two orders of beauty; appropriateness to Roman women (Venustas) and appropriateness to Roman men (Dignitas) [6]. Therefore, the appropriateness of a building is much depended on the user background and the underlying context of symbols and metaphors the building represented. Thus, it will create the delightful sense by presenting the recognizable elements to the users as the underlying surface for the user to comprehend. Thus, this will lead towards providing more appealing look and feel. The architecture theoretical consideration may provide a sense of order to the rapid development of IA by providing a strong grounding consideration, borrowed and aligned with the understanding of the architectural framework. This is essential to stimulate

further expansion of the IA field based on architectural framework and putting sense of order to IA augmentation and implementation based on architecture theoretical consideration. This section provides a descriptive approach that focus on the underlying principles of the Vitruvius theory. The next section will focus on describing the possibility of providing the theoretical proposition relating to Vitruvius Theory for website IA design methodology and development.

3. RESEARCH FRAMEWORK

The architectural formalism for website IA are based on two approaches taken as consideration from architectural paradigm. The following are the description of the approaches taken as consideration for this study to describe the possible relationship of Vitruvius theory to website IA.

- Analogies are the most common architectural approach that can be used. This is because, there is possibilities of analogies been drawn between IA and physical architecture [12, 38]. Even though the approach usually obscures the nature instead of revealing it, the analogy may prove to be a powerful tool as it can bring forward valuable knowledge from a known knowledge especially from architectural to IA dimension [15, 21]. Three broad classes of constrain to guide usage of analogy, which are; similarity of elements or isomorphism, structural parallelism and goals of what the analogy is intended to achieve [21].
- Certain architectural concept may be applicable to certain extend to define the possible correlation between architecture and website IA. The basic architectural concepts are descriptive and prescriptive concepts that may be invaluable for this study. In brief, descriptive concept, factually describes characteristics of existing artefacts. Prescriptive concept, in other hand, defines how artefacts should be realized from architectural context [23].

Both of these approaches may be used as the premise in proposing, the following framework (Figure 2) with Vitruvius Theory as the primary architecture theoretical grounding consideration of website IA. In general, for the purpose of this study, building in the physical environment is analogous to information represented in digital environment. Therefore the underlying principles describe in the Vitruvius Theory may be further represented in the digital environment. Thus, it is being explained in prescriptive manner, to provide principles and guidance that may be used to guide web IA design development. It is not seen as a normative restriction of freedom but more towards giving a proper IA guidance backed with Vitruvius Theory as the primary theoretical consideration.



Figure 2: Framework of Understanding Website Information Architecture

The framework of understanding website IA (Figure 2) provides implicit guidance to be taken as future notes of consideration, seen from a prescriptive perspective. The framework (Figure 2) might be referred as a reference for imitation or emulation, or a pattern for others to follow in the construction of website IA. Based on Figure 2, the three elements for website IA which are content, navigation and context are driven from existing IA studies and Vitruvius Theory which is being used as primary theoretical construct of consideration. The discussion of these elements are as follows.

3.1. CONTENT

Emphasizing the use and value of information content is the first priority should be taken as a full consideration before organization of information took place. It is therefore thorough a full understanding of the principles and dimensions underlying the usage of information that will denotes the key factors to be included in an IA [13]. As noted by Vitruvius Theory, the importance of building the site on solid foundations is often overlooked. The subject of structure may be imposed with *firmitas* (firmness). The term implies solidarity or durability of building construction. The durability in general can be related to foundation and materials [6]. With this in mind, by using architectural approach, a firm state (*firmitas*) in creating the information structure of the website may be further conceptualized with proper propositions related to content properties, content organization, content type and volume presented in the website.

First, we posit from the first element of Vitruvius Theory that the firmness or the durability features may be created by the properties of the material used for the construction. Thus, the information properties and dimension such as content truth, validity and relevance plays as important traits in forming a solid information structure. The second important element under consideration in creating a firm (firmitas) information structure may be indicated by the practical form of the content organization itself. The simplest form of content organization would be referring to the logical grouping of content [32]. However, the content organization is relatively using either bottom up or top-down approaches. The evolutions of top down approach are seen by the development of categorization schemes or standardized taxonomies based. Moreover, the bottom up approach is relatively seen as investigation of content, pattern and relation of chunk of information with certain priorities given to search logs, document template, metadata, controlled vocabulary and labeling content chunks [9, 14]. These methods used to create the structure of content are relatively driven from the information sciences and library science fields [14].

The final element to be considered in creating a solid information structure may be reflected by the type and amount of content being presented inside a website. This is because, one of the main differences in giving rise differences between library science and IA is that IA has the authorship to determine the type and amount of information presented [28]. Therefore the amount and type of information presented may need to be filtered and minimize to a certain level towards avoiding information overload occurrences and refocus the user attention back to the information content provided.

Thus, from this subsection of architectural understanding, we derived the theoretical proposition for website information architecture. The theoretical proposition for the first element of website IA, 'Content' is as follow: "The primary information properties, dimension and organization principle used in the construction of website IA will influence the possibility of the information structure to be solid as a firm foundation".

3.2. NAVIGATION

Navigation dimension is one of the important elements to be considered in IA development. This is because IA is also relatively seen as the process of designing the access of information so that the users can rely mainly on their intuition to navigate quickly and productively around the site [49]. Moreover, given the idea that an information space is navigable implies that there is some kind organized or unorganized structure [19].

The notion of navigation may be further characterized by the ambience of the information environment, information space structure and human factors. The current structure of hypertext information spaces or hypertext links, primarily concern on what information the site offers and what it meant to user in creating an information space that will allow the user to flexibility move through [15]. In fact, navigation elements help users know where they are and determine the content availability in the site. For examples, signpost and road maps helps the user to accomplish specific goals or browsing. Therefore, navigation element design and navigation system path becomes key indicants of architectural traits of influences to website IA. In this case, navigation element design is illustrated as the point of threshold need to be undertaken by the user. Moreover, navigation system design path is illustrated by the structure of user path in browsing and searching information.

The Vitruvius Theory second element, utility (utilitas) or functionality convenience suggest the theoretical proposition that the property of a building should be accommodated for their respective purposes and their value is measured by their convenience in usage [7]. Thus, this theoretical proposition may be applied to IA dimension. Thus, from this subsection of architectural framework of understanding, we derived the theoretical proposition for website IA. The theoretical proposition for the second website IA element, 'Navigation' is as follow.

"The convenience traits may be stressed on the design elements and system path structure towards the creation of information hypertext space that may allow user to navigate and follow the directions more effectively".

3.3. CONTEXT

The creation of information environment as computer mediated information space is depended on the layered context that can be defined by real and conceptual structure [38]. Patrick Lynch design director at Yale University School of Medicine noted that architecture is about organizing an experience within a space and this may be conceptualized with more emphasis being given towards the conceptualization of information environment itself [43]. The conceptualization may be realized with a proper contextual layer for website IA. In general, context development of information environment is commonly based on the requirement set by sponsors of website, in whom may be referring to the individual or organization that act as the client for the website IA development. Other contextual elements that may pose as the contributing factors are technologies, standards, disciplines and site genres [9]. However, culture dimension may be included as another significant factor to be included in the process of contextualizing the elements due to the benefits gained from attention to human factors [9, 14].

The third underlying element of Vitruvius Theory implies the level of appropriateness of a building is much depended on the user and the underlying context of symbols and metaphors it represents. The appropriateness dimension being suggested in this study may be further imposed in future work by incorporating cultural dimension as an extended version of the architectural framework of understanding website information architecture. The future extended framework version may add value for localization process of information artefact or information product.

The cultural influences suggested may be beneficial in affecting the contextual influence towards content and navigation, which much dependable on a particular aspect of the objectives to be accomplished. For example, the process of contextualization of the content may be achieved with the adaptation of culture theorist cross cultural variables that may have a direct impact on type of labeling, grouping system, colour and typography chosen for the cultural website towards creating the information structure of the website. The process may avoid user experiencing information overload and refocus the user attention back to the information structure. The potential effect has been reflected with the possibilities of Hofstede (1991) culture dimensions effecting web user interface based on cultural dimension towards IA [33, 37].

In addition, the contextualization process for the navigation element is also based on the contextualization objective which is towards reinforcing user location in wayfinding inside information hypertext space. This can be achieved with the contextualization process of sign, icon, symbol, layout, architectural nature (entrance and transition zone) that can further be illuminated with respective cultural dimension of cultural websites. Thus, from this subsection of architectural understanding, we derived the theoretical proposition for website IA. The theoretical proposition for the third website IA element, 'Context' is as follow.

"The delightful features may be imposed to the IA elements based on the context or the recognizable of the underlying surface it provided to support the appropriateness of the website IA created".

4. CONCLUSION

This research sought to understand the relationship between architectural fields to website IA. Our goals were to understand what does architectural building paradigms and influences may have on website IA, in which, the understanding and the theoretical propositions could bring forward valuable knowledge from a known knowledge into IA domain. The study attempt is progressing towards putting a sense of order to IA augmentation and implementation with existing architectural building paradigm and theoretical grounding that may further properly support IA design methodology and development. The attempt is justified with a theory borrowed from the field of architecture known as Vitruvius Theory that is being used to frame up the holistic conceptual understanding of web IA. An integrated framework, combining these perspectives is presented in Figure 2 as part of the theoretical building process of the framework. This is done by using reasoning research inductive method towards understanding the architecture framework of website IA.

There are several important implications of our research for research and practice. First, we used some existing concepts of website IA to understand this contemporary phenomenon of online information environment. Second we integrated internal and external perspectives related to architectural paradigm to offer a holistic view of strategically design website IA development by using theoretical propositions suggested by Vitruvius Theory in forming the theoretical framework of website IA.

Future work also implies that this architectural understanding of website information architecture may be further accommodated by the culture dimension influences for the localization process of the information artefact or information product of website IA. In addition, our framework could be further operationalized and empirically verified by researchers interested in this area of research. This may be done with the theoretical testing process research method by using practical heuristic IA design guideline relating to theoretical propositions highlighted in this study. Moreover, the theoretical building method reflected in this study that conducted by focusing on inductive reasoning may provide future empirical work toward validating the theoretical propositions for website IA.

Our research reflected in this paper is an effort to offer some theoretical understanding of website IA by the adaptation of architectural paradigm. Furthermore, our work could be used as a starting point for conducting empirical studies to uncover the dynamics of website IA.

REFERENCES

- [1] Anonymous, Information Architecture Practice: "An Interview with Lou Rosenfeld Argus Associates", *Bulletin of the American Society for Information Science*, 2000.
- [2] Beiers, H., "Information Architecture's Potential Contribution to an Asynchoronous Learning Environment", *International Workshop on Advanced Learning Technologies*, pp. 253 – 254, 2000.
- [3] Benyon, D., and Hook K., "Navigation in Information Spaces: Supporting the Individual", *in*

Proceedings of Human-Computer Interaction: INTERACT 1997, pp. 39-46, 1997.

- [4] Blustein, J., Ahmad I., and Instone K., "An Evaluation of Look-Ahead Breadcrumbs for the WWW", in Proceedings of the Sixteenth ACM Conference on Hypertext and Hypermedia, pp. 202 – 204, 2005.
- [5] Byrne, T., Enterprise Information Architecture: Don't Do ECM Without It, *EContent*, pp. 22, 2004.
- [6] Capon, D. S., *Architectural Theory Volume One*, John Wiley & Sons, 1999a.
- [7] Capon, D. S., Architectural Theory Volume Two Le Corbusier's Legacy: Principles of Twentiethcentury Architectural Theory Arranged by Category, John Wiley & Sons, 1999b.
- [8] Colomb, R. M., *Information Spaces: The Architecture of Cyberspace*, Springer, 2002.
- [9] Denn, S. O., and Maglaughlin K. L., "World's Fastest Modeling Job or Information Architecture: What Is it? The Multidisciplinary Adventures of Two Ph.D. Students", *Bulletin of the American Society for Information Science*, 2000.
- [10] Dijck, P. V., Information Architecture for Designers: Structuring Websites for Business Success, RotoVision, 2003.
- [11] Dooley, L. M., Case Study Research and Theory Building, *Advances in Developing Human Resources*, SAGE, pp. 335-354, 2002.
- [12] Engeli, M., and Mueller A., Digital Environments for Learning and Collaboration. Architecture, Communication, Creativity, in Ataman O. and Bermudez J., ed., *Media and Design Process Conference Proceedings*, 1999.
- [13] Evernden, R., and Evernden E., Third Generation Information Architecture, *Communications of the ACM*, vol. 46, pp. 95-98, 2003.
- [14] Farnum, C., Information Architecture: Five Things Information Managers Need to Know, *Information Management Journal*, vol. 36, pp. 33, 2002.
- [15] Garrett, J. J., *The Elements of User Experience*, Aiga New Riders Publishing, 2003.
- [16] Greunen, D. V., and Wesson J. L., "Exploring Issues for Information Architecture of Web-based Learning in South Africa", *SAICSIT 2004*, 2004.
- [17] Gulzar, N., Practical J2EE Application Architecture, McGraw-Hill Osborne, pp. 30-48, 2003.
- [18] Harvey, S., Robertson, T. and Edwards, J., "Towards Understanding Information Architecture: A Distributed Cognition Study of an IT Community of Practice", *in OZCHI 2004*, 2004.
- [19] Hauck, R. V., and Weisband, S., "When a Better Interface and Easy Navigation aren't Enough: Examining the Information Architecture in a Law Enforcement Agency", *Journal of the American Society for Information Science and Technology*, vol. 53, pp. 846-854, 2002.
- [20] Haverty, M., "Information Architecture Without Internal Theory: An Inductive Design Process",

Journal of the American Society for Information Science and Technology, vol. 53, pp. 839, 2002.

- [21] Heylighen, A., "In Case of Architectural Design: Critique and Praise of Case-Based Design in Architecture", *Katholieke Universiteit Leuvenm*, 2000.
- [22] Hong, S and Kim, J., "Architectural Criteria for Website Evaluation - Conceptual Framework and Empirical Validation", Behaviour & Information Technology, *Ebsco Business Premier*, vol. 23, no. 5, pp 337-357, 2004.
- [23] Hoogervorst, J., "Enterprise Architecture, Enabling Integration, Agility and Change", *International Journal of Cooperative Information System*, vol. 13, pp. 213-233, 2004.
- [24] Huberman, B. A., *The Laws of the Web: Patterns in the Ecology of Information*, The MIT Press, 2001.
- [25] Hyde, K. F. "Recognising Deductive Processes in Qualitative Research", *Emerald Library*, 2000.
- [26] Jadav, A. D., *Designing Usable Web Interface*, Prentice Hall, pp. 65-91, 2003.
- [27] Johnson, S., Interface Culture: How New Technology Transform the Way We Create and Communicate, Harper Collins, 1997.
- [28] Kalbach, J., "IA, Therefore I Am", Bulletin of the American Society for Information Science, 2003.
- [29] Kim, J., Architectural Metrics for E-Commerce: A Balance between Rigor and Relevance, *in* W. Suh, eds, *Web Engineering: Principles and Techniques*, Idea Group Publishing, pp. 132-160, 2004.
- [30] Large, A., and Tedd L. A., *Information Seeking in the Online Age: Principles and Practice*, K. G. Saur, 2001.
- [31] Lyman, P., Designing Libraries to be Learning Communities, in Criddle, S., Dempsey, L. and Heseltine, R., eds., *Information Landscape for a Learning Society*, Library Association Publishing, 1998.
- [32] Maloney, K., and Bracke P. J., "Beyond Information Architecture: A Systems Integration Approach to Web-site Design", *Information Technology and Libraries*, 2004
- [33] Marcus, A., Global and Intercultural User-Interface Design, *in* Jacko, J. A. and Sears, A., eds., *The Human-Computer Interaction Handbook*, Lawrence Erlbaum Associates, 2003.
- [34] Marcus, M. L., Case Selection in a Disconfirmatory Case Study, in K. L. Kraemer, *The Information Systems Research Challenge*, Harvard Business School, Boston, MA, 1989.
- [35] McCracken, C. S., "Bringing Order to Internet Chaos with Information Architecture: A Case Study", *University of North Carolina*, 2005.
- [36] McNay, H., "Information Architecture-Visual Display", in International Professional Communication Conference, pp. 5, 2003.
- [37] Mccool, M, "Information Architecture: Intercultural Human Factors", *Technical Communication*, vol. 53, no. 2, 2006.

- [38] Morrogh, E., Information Architecture: An Emerging 21st Century Profession, Prentice Hall, 2003.
- [39] Newman, M. W., and Landay, J. A., Sitemaps, Storyboard and Specification, in Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods and Techniques, pp. 263-274, 2000.
- [40] Ozkan, S. Development of Thinking and Theory in Architecture, *Center for the Study of the Built Environment*, 2001.
- [41] Palladio, A., The Four Books on Architecture, MIT Press, 2002.
- [42] Papanikolaou, M., and Tuncer B., The Fake.Space Experience - Exploring New Spaces, *in* Brown A., Knight M., and Berridge P., eds., *Architectural Computing: from Turing to 2000*, The University of Liverpool, Liverpool, UK, pp. 395-402, 1998.
- [43] Peek, R., "Report from the Field ASIS Summit: Defining Information Architecture", *Information Today*, vol. 17, pp. 14-18, 2000.
- [44] Rosenfeld, L. and Morville P., Information Architecture for the World Wide Web, O' Reilly, 1998.
- [45] Shum, S., "Real and Virtual Spaces: Mapping from Spatial Cognition to Hypertext", Technical EPC-93-115, *Rank Xerox Cambridge EuroPARC*, 1990.
- [46] Sinha, R., and Boutelle, J., "Rapid Information Architecture Prototyping", in Proceedings of the 2004 Conference on Designing Interactive Systems: Processes, Practices, Methods and Techniques, pp. 349-352, 2004.
- [47] Spence, R., in Hook, K., David, B. and Alan J. M., eds., Designing Information Spaces: The Social Navigation Approach, Springer, 2003.
- [48] University of Greenwich, "Website Architecture: Master Programme at University of Greenwich", University of Greenwich, 2000.
- [49] White, M., "Behind the Firewall: Information Architecture and Usability", *Econtent*, 2002.
- [50] Wodtke, C., *Information Architecture: Blueprints for the Web*, New Riders Publishing, 2003.
- [51] Wurman, R. S., Information Anxiety 2, Que, 2001