

Interaction Design Issues: A Literature Review

D'oria Islamiah Rosli

Faculty of Technical Education

Universiti Tun Hussein Onn Malaysia

Johor, Malaysia

doria@uthm.edu.my

Rose Alinda Alias¹ & Azizah Abdul Rahman²

Faculty of Computer Science and Information System^{1&2}

Universiti Teknologi Malaysia^{1&2}

Johor, Malaysia

[& rosealias@utm.my](mailto:rosealias@utm.my) azizahr@utm.my

Abstract— This paper presents an analysis on a literature review findings in Interaction Design Issues Journals from the year 2006 to 2010. Due to the limited literature review reported on Interaction Design Issues, this study is aiming to provide some input on the current topics, methods and theories, interaction design elements and future trends of research in the field of Interaction Design. We employ content analysis technique as to select words, phrases or common sentences in the articles based on Topic Classification Scheme adapted from Zhang and Li (2005). Findings from this study are fully addressed to further explore Interaction Design criteria as to improve Man Machine Interaction in the future.

Keywords- *Interaction Design, Design Issues, Human Computer Interaction*

I. INTRODUCTION

In recent years, researchers interested in studying human blunders have risen, due to the increase in accidents involving complex interactions on human-machine system. Those accidents can have appalling consequences in a high technology world. For example a single incident such as a malfunction in a power plant, or a airplane crashes could affect a large number of people and this could prove costly for both individuals and organizations. As the tragic accidents involved mostly an interaction between human and system, an alternative for further research need to be done as to explore and expand the limitations of system interaction design.

In addition, the distinctive characteristics between human and the system showed a real problem as shown by Norman's notions of the gulfs of evaluation and execution [1], whereby the graphical user interfaces was seen as a problem in its own rather than looking on how a user could interact with the system interface design. Moreover, user interaction for successful system design and services enable users to access complex data and functions [2].

Numerous researchers highlighted the importance of user interface features in design as the design will help users to predict what will happen towards the system [3], [4], [5] [6] and [7]. Besides, the Human Computer Interaction research on

literature review [8] and System Engineering research literature review [9], both overviews also include perspective on research issues, directions of each discipline studies, research topics and development of sub-discipline. Although the existing literature reviews embrace the interaction design between human and technology, the discussion is still discussed in general.

Despite the fact that there are many design researches related to Interaction Design and complex technology products have occurred, still there are limited literature reviews highlights on the emerging themes in Interaction Design, the role of methods and theories, interaction design processes and criteria that leads to a successful design research activities.

Starting from 1999, Design Issues Journals received papers and structured reports presented in technical conferences around the world. Thus for this paper, we will review Design Issues research articles in five year period from 2006 to 2010. The reviewing process in five year duration, represent most recent reviewed articles prior to our research which started in early 2009 with the goal to enhance human decision making with the support of information system interface design.

II. TOPIC CLASSIFICATION

In this paper we have categorized the paper in accordance with Zhang and Li's topic classification which consider human interactions towards technologies [8]. According to Zhang and Li's HCI research in 2005, there were still few empirical studies addressed on motivational in human technology [10].

Therefore, as to pin point the interaction between human and technology, the topic classification for this study is divided into two main topics. Firstly, is related to IT Development and secondly is about IT Usage and its Impact for users.

Then, IT Development main topic is further categorized based on User Analyst Involvement, Software/ Hardware Development, Software/ Hardware Evaluation, User Interface Design and Development, User Interface Evaluation, User Training and Development Methods and Tools.

While for the IT Use and Impact Topic, the sub categories are Cognitive Belief and Behavior, Attitude, Motivation, Emotion, Performance, Trust, User Support and Skills (Table 1).

TABLE 1: TOPIC CLASSIFICATION SCHEME

Category		Description
IT Development		Issues that occur at the stage of IT development or implementation that are relevant to the relationship between human and technology
A01	User Analyst Involvement	User involvement, User participation, User analyst interaction.
A02	Software/hardware development	Programmer/ analyst cognition studies, Design and development specific or devices that consider some human aspects.
A03	Software/hardware evaluation	System effectiveness, efficiency, reliability, flexibility, and information quality evaluation that consider people as part of the factors
A04	User interface design and development	Interface metaphors, Information presentations, multimedia
A05	User interface evaluation	Instrumental usability, Accessibility, Information presentation evaluation
A06	User training	User training issues during IT development
A07	Development Methods and tools	Concerned with issues that occur when humans use and/ or evaluate IT
IT Use and Impact		Issues that occur when humans use or evaluate IT
B01	Cognitive belief and behavior	Self-Efficacy, Perception, Belief, Cognition, Mental process, Expectation, Intention, Behavior, Adoption, Resistance, Use
B02	Attitude	Attitude, Satisfaction, Preference
B03	Motivation	Motivation, (intrinsic, extrinsic), Expectancy, Incentives
B04	Emotion	Emotion, Affect, Hedonic quality, Flow, Enjoyment, Humor, Intrinsic, motivation
B05	Performance	Performance, Productivity, Effectiveness, Efficiency
B06	Trust	Trust, Risk, Loyalty, Security, Privacy
B07	User support	End-user computing support, general user support
B08	Other; Skills	Skills, Rules, Knowledge Cognitive Control Model

III. METHODOLOGY

In this study, we employ content analysis techniques in order to highlight research topics that are related to Interaction Design. Content analysis is defined as a research technique for making replicable and valid inferences from data to their context [11].

For this study, in the content analysis process, words, concepts, themes, phrases, characters or sentences within text or sets of text were identified based on two main categories; IT Development and IT Use and Impact. This process is also known as coding. It manifests the content of a text because the coded content is reliable and useful [12]. Latent Content is another alternative to analyze the content of a text. In using this technique, there is a need to read the articles in passages

and interpret the presence of a particular category. The selected topics then will be recorded in frequency and further analyzed from topic classification scheme from A01 to A07 and B01 to B08 using Microsoft Excel. Number of frequency is depends on how many times the topics are discussed in the articles.

Consequently, the author also record topics that are co-studied within the classification topics and current research topics discussed in the Interaction Design Issues journals. Hopefully results from this study will help other researchers to expand their research which will contribute to the success of Interaction Design field.

IV. FINDINGS

Starting from 2006 to May 2010, in a total of 220 articles were available in Design Issues Journals. From this selection, we managed to analyze and filter around 32 articles which mapped with the classification topics ranging from IT Development to the IT Usage and IT Impact. Figure 1 illustrates frequencies on how many times the topics discussed according to the topic classifications scheme.

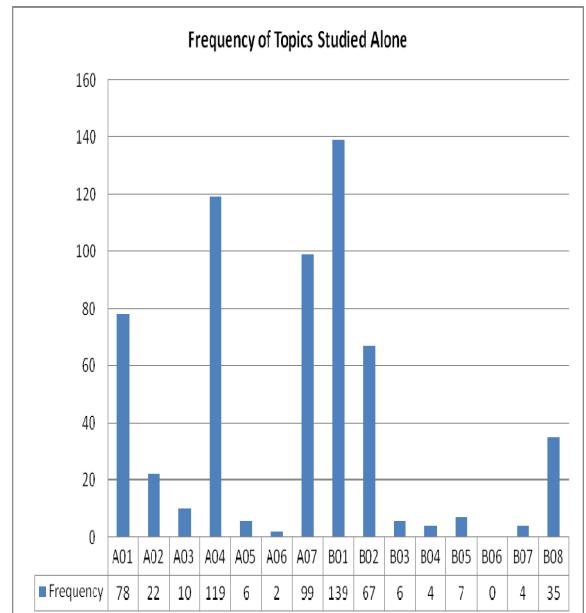


Figure 1. Frequency of Topics Studied Alone.

From figure 1, results shows that Cognitive Belief and Behavior topic were widely discussed and reported in the Design Issues Journals. This is followed by User Interface Design and Development topic and next is the study on IT Development Methods and Tools used in the Interaction Design process. However from the results, we have found that, there were still limited research on User Analyst Involvement, User's Attitude, Interaction that involve Skills, Rules, Knowledge and Cognitive Control Model.

A. Findings on IT Development

IT Development topic classification is concern with issues that occur at the stage of IT development process which concerned with the relationship between human and technology. Figure 2, depicts four critical topics that were commonly studied among researchers in IT development process. First is relating to User Interface Design and IT Development Process (A04) which includes sub topics such as Interface Metaphors, Information Presentations and Multimedia as to support user's interaction towards IT technology. Next was followed by IT Methods and Tools (A07), used in the IT development process. Subsequently, researchers also concerned about User's Involvement (A01), which includes user's Participation and Interactions in the IT development process. Finally, researchers were also interested in knowing the role of Software or Hardware (A02) that may be helpful in designing and developing systems which consider human characteristics.

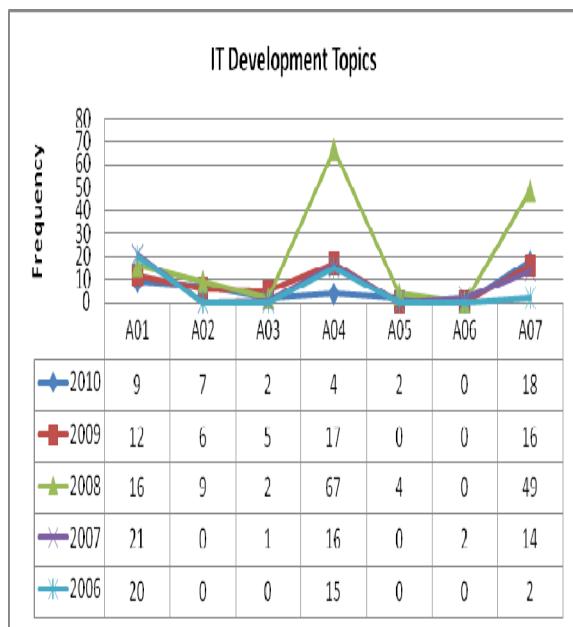


Figure 2. IT Development Topics.

For instance, in User and Interface Design and Development Process (A04) even though designers used general principles in doing their design, but there were still limited analyses on how the interface is designed in conveying information to users [13]. Perhaps in interface design principles, visual elements for an interface should be designed in an obvious way and can be seen by users [14]. To make the interface design obvious, designers can use pop out visual form, shape enclosure, landmark and visual form movement on the interface design [14].

System design will succeed if users are able to interpret information correctly [15]. Indeed, researchers argue that, designers not only concern on the physical layout of the systems, but also includes how it works, how the systems is

developed, how interaction flows and how the content provide meaningful information to users [16].

Since visual elements is a dominant cognitive process for users to process information [17], designers often embed artifacts with visual cues such as icons, metaphors, flashy interfaces that may appeal visually but often at the expense of user understanding and functionality towards the system [14]. Perhaps by incorporating visual metaphors also allow users to use their previous knowledge and experiences and this will help users to have better judgments in their interaction with the system. Definitely metaphors help user to trigger their memories and build association in a meaningful interpretation [14].

In relation to the selection of Methods and Tools (A07) in Interaction Design field, there are still ongoing debates on which methodological that seek to understand on how the technology is built and how the technology can be fully utilized in helping users in doing their tasks [18]. In order to study user's behavior, there have been important moments of exchange in Human Computer Interaction (HCI) whereby User Centered Design frequently include aspects of anthropological method [19]. On the other hand, Computer Interaction seldom quotes sociological theory in their premises [20].

Further analysis of interaction in the context of design showed that interaction can be understood either with reference to the design process or with reference to use human object interaction. [21].

For example, as to know more about how user interacts with the system, theories such as Participatory Design have justified methodology for user participation in design processes [22]. In the Participatory Design, user participation involved from the early project definition stages through conceptual design, concept testing prototype development, prototype testing, prototype review, full-scale implementation until the final project delivery and validation. In addition, participatory methods need to be complemented by a theory that explores the nature of people's lives and the relations between the many dimensions of well-being [22]. One of the related theories which discuss on uses behavior is the phenomenology theory which is also known as theory of experience that can highlight certain aspects of aesthetic related to the sensuous appearance and experience of users [23].

Despite the fact that, prototyping is a process that involve refining the product in cycles, the main purpose of using prototype is to locate problems in the design and to fix these problems as to make sure that users will use the product in more efficient and enjoyable way [24]. However, prototyping methods usually have narrow focus and tend to limit the discussion with user within the reality created by the prototype [25]. Consequently, other techniques that were used to study user's behavior towards man machine interaction are cultural probes and laboratory experiments.

Cultural probes approaches usually use imaginative techniques similar to postcards in order to collect information from users [24]. As to overcome studio based contemplation, a

social interaction experiment has to take place in a real context of system interaction.

In contrast with the laboratory experiments, the prototype should not be conducted in a laboratory experiment because the goal in observing user behavior is to monitor and interpret how user use and explore the technology and not to restrict them to use the technology in predefined ways [24].

However, conceptualization serves as an apt case in supporting Norman's discussion of good design in terms of fit between designer's conceptual model of the behavior of a product and the user's mental model [18]. In addition, conceptualization continues to be of great importance to the field and practice of interaction design. Perhaps, Preece et. al have categorized conceptual in two aspects. First is about what the product will do and second is how the product will behave in interaction design.

In relation to this, User analyst involvement (A01) in IT Development Process concerned about User Involvement, Participation and how IT system will be design to accommodate user's differences in terms of their behavior while interact with the system. The interaction not only engaged system and user alone but also the interaction with the society as a whole.

Interaction design research is concerned with design as a means for creating mindful interaction through the use of objects in social context [21]. In other words, artifacts can stimulate user's behavior via system functions that give meaningful reactions in using the system. Researchers argue that interaction design that employ universal applications need to be further explored and chastened as these will lead to the study of affordances which also influenced by users' cultural differences [15].

There is a need to have a systematic approach to understand the effects and dynamic interaction between users and the system. As to encounter this, a set of user requirements need to be established in design activities, followed by the design stages that is done iteratively and finally the evaluation process involving users as to ensure that the system or product helps the users in achieving their goal [26 & 20]. Researchers raised issues on how in principle, the system or product can be designed to raise awareness and quality reflection of activities from users and society [21]. In view of that, proliferation of graphics became a key characteristic of modern social organization in design culture [17]. This is by reason of graphical context may influence the practice and results of interaction design [17].

B. Findings on IT and Use Impact

IT and Use Impact topic classification concerned with issues that study both IT influence, and humans. From the results, we found that the most highlighted topics discussed and reported were on Human Cognitive Belief and Behavior (B01). Next, is followed by topic that concerned with Human Attitude (B02), whether users feel satisfied in using the IT system and as well as to know users' preferences when they interact with the system. Then, the results continued with the interest to know about Skills, Rules, Knowledge and Cognitive Control Model (B08). Nevertheless, there were still

limited studies related to human performance (B05), such as Productivity, Effectiveness and Efficiency. Similar with topics related to User Support (B07) which in association with end-user computing support or general user support (Figure 2).

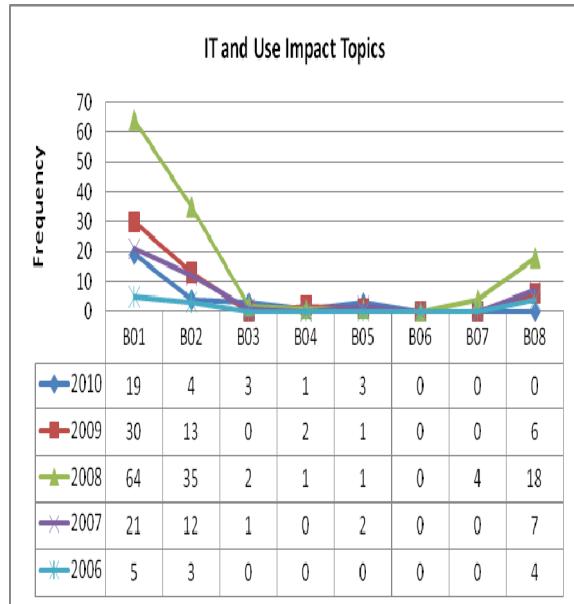


Figure 2. IT and Use Impact studied.

In a collaborative interdisciplinary research environment, there was still lack of design thinking perspectives incorporated into design participation research in HCI [26]. Therefore, there is a need to shift from studying the output in design and moving forward to study on human capabilities to achieve outcomes. This is due to the fact that human capabilities offer a richer understanding on how user behaves when they interact with the system [22].

Additionally, cognitive and human factors field are also interested to focus on individual's behavior and cognitive processors [24]. Looking on how user runs through series of specific tasks while manipulating the prototype.

Furthermore, researchers are also concerned with embedding content and action into artifacts so that the function of a particular system is immediately understood by user. To understand system functions, user formulates ideas about the system, ability to cognitively placing the ideas into contexts that allow user to utilize the system [27].

Cognitive is categorized in two ways. Firstly, Cognitive provide means to navigate the world to reach the goal and secondly serve the design processes without being part of the cultural learning.

Meaning also emerges from the interaction. As to understand interaction, user needs to master and knows how to handle and manages the system [16]. Moreover, with perceptual abilities to scan, recognize and recall images as well as to rapidly detect meaning in patterns and changes in size, shape, color, movement and texture [14]. For that reason, it is better to understand human characteristics and how to

employ it into system design function for better impact on design research [21].

For instance, movement feature is capable in attracting attention even in the periphery of our vision [14]. Furthermore, landmarks used in system design also support user's cognitive map and help users to navigate in searching and to understand the content of a particular system [14]. On the contrary, text requires more cognitive effort to understand content, since the relationship between form and meaning is arbitrary [14]. Proximity is important to integrate in design because human visual working memory has spatial component that remembers the positions of up to three to five specific objects [14].

In relation to the Attitude topic classification (B02), researchers argue that the focus should be on human capabilities [22]. In this context, capabilities have been described as what humans are effectively able to do and enjoy in doing every single task that they preferred. Consequently, user may produce their own behaviors, which lead to the reformation of the structure, expected behavior or function if user was be able to synthesize and evaluated the system functions [28].

Perhaps in general design principles, the interface design should match the content type and user intention [14]. Intentional states are centralized in terms of contents, but they are differentiated as kinds of psychological attitudes in terms of aim or direction of it [28].

As for the Skills, Rules, Knowledge and Cognitive Control Topic (B08), experience have encouraged researchers to extent conceptualizations of topics, and seek theoretical insight from fields beyond design research and HCI [18]. Researchers also pin point that design should addresses artifacts and the people who interact with them as its central focus [15].

In knowing the psychological components of interaction such as knowledge, skills, and values which comprises the technology that required to practice design [29]. From practice in design, user will be able to gain experience because experience is more pressing [27]. For example, experience prototyping allow designers, clients or users to experience it themselves rather than witnessing a demonstration or someone else's experience. Researchers may improve interface design by exploring and analyzing and defining desirable end-user experience [14].

C. Co-Studied Topic Classification

Table 2 depicts a research finding on co-studied topic classification. We found that the most Co-studied topic classification were Cognitive belief and behavior (B01) and user interface design and development (A04) topic. In order to design a system, researchers need to understand efficient functionality about the system [30]. This is because with this understanding, system provides a plan for action, which laid to system's function. In other words, researchers need to understand the relationship between design and use. Researchers were not only focus on studying the designers, analyzing products and understand design context of use, but researchers also need to know the association on each of these

elements because every elements has an important role to play in contributing to such understanding [18].

The next co-studied topics in Design Issues Journals were topics on Cognitive belief and behavior (B01) and topics on Attitude (B02). Buchanan defines the whole of interaction design more brandy as focusing on how human beings relate to other human beings through the mediating influence products [21].

The analyses also reveal how system comes to be as they are, while in use. It is a concern for the researcher whether user enjoyed, tolerated, unpredictable, frustrating or feels useful while using the system [18]. As a whole, Buchanan hypothesize that all design activity involves signs, things, action and thoughts [21].

The association between Cognitive Belief and Behavior (B1) topic and Skill, Rule, Knowledge and Cognitive Model (B08) topic were also a great concern for the researchers. Creativity relevant skills in design issues informed ways on how an individual perceive, comprehend, navigate, manipulate and otherwise consider issues and problems in novel and useful ways [27]. However, when the expectation is based on a memory of an actual experience, level of uncertainty is likely to be lower than when it is based on differences drawn from related experience [31].

Therefore, mental processing in design is of a priority, in identifying mental operators evident in expert designers. Next, is to spot patterns of reasoning by human and finally is to know how design knowledge might be mentally represented [32].

TABLE 2: CO-STUDIED TOPIC CLASSIFICATION

Topics Classification	A01	A02	A03	A04	A05	A06	A07	B01	B02	B03	B04	B05	B06	B07	B08	Total
A01 User analyst involvement																78
A02 Software hardware																22
A03 Software hardware evaluation																10
A04 User interface design and development							4									119
A05 User interface evaluation																62
A06 User training																2
A07 Development Methods and	1			2												39
B01 Cognitive belief and behavior	3		17		4											139
B02 Attitude	3	1	4	1	1	11										67
B03 Motivation																6
B04 Emotion																4
B05 Performance									1							7
B06 Trust																0
B07 User support																4
B08 Other, Skills	2	2		3	10	1	1									35
C01 Creativity																2
C02 Style				1												1
C03 Innovation			1		2											15
C04 Surprise			1				1									7
C05 Semiotic			1													2
C06 Education			1													1
C07 Mindfulness																1
C08 Branding				1												1
C09 Sustainability		1														1

Additionally from this co-studied topic's results, we have found several current topics discussed and reported in the

Interaction Design Issues Journals (Table 2). The most highlighted topic discussed from 2006 to 2010 is the importance of incorporating Innovation criteria in design process. Indeed, essential innovation in system design is believed to disrupt and challenge previously established skills, institutional arrangements, expectations and conventions. Researchers need to continuously improve interface design since interface design is a conceptual framework that can spur innovation [14].

Next, is about Surprise topic. Surprise reaction can draw attention to the system or product since surprise elements may help users to increase system recall and recognition [31]. Indeed, surprise reaction to a system can be beneficial to both designer and user. Therefore, for future research it is advisable for the researchers to aim at providing detailed knowledge into what causes a positive or negative surprise and how these surprise elements can be effectively be used as a design strategy [31]. Other current new topics discussed were Creativity and Style elements in design, Semiotics that give meaningful understanding on functions which leads to Mindfulness topic in design process. Same goes with the importance of Branding and how researchers can make a design that leads to Sustainability and finally how good design may help in Educational research field.

V. CONCLUSION

The articles we have reviewed represent an overview of recent studies that have contributed to the field of Interaction Design. In the five-year period Design Issues journals we analyzed 32 articles from the total of 220 articles that included in IT Development topic. The IT Development topic was further categorized based on User Analyst Involvement, Software/ Hardware Development, Software/ Hardware Evaluation, User Interface Design and Development, User Interface Evaluation, User Training and Development Methods and Tools. Meanwhile for the IT Use and Impact topic, the sub categories were Cognitive Belief and Behavior, Attitude, Motivation, Emotion, Performance, Trust, User Support and Skills.

Our analysis of trends showed that user Interface Design and Development topic was the most critical researched topic in the IT Development process. This is followed by IT Development Methods and Tools topic. As for the IT Usage and Impact, the results demonstrate that, there were a lot of research done and reported on Cognitive Belief and Behavior topic and Human Attitude topic and as well as topics that were less reported and need to be further discovered such as Skill, Rules, Knowledge and Cognitive Control topic, Motivation, Emotion Performance, Trust and User Support topics. Our review also indicated that, there were several future trends research topics in Interaction Design for instance Innovation and Surprise elements that can be applied into the system design which somehow may or may not influence human way of thinking and behavior.

We hope that by highlighting the emerging themes in Interaction Design, the role of methods and theories, interaction design processes and criteria discussed in this

Interaction Design literature review analysis may help other researchers especially in the field of Interaction Design research prospect.

ACKNOWLEDGMENT

This research is supported by the Faculty of Technical Education, Universiti Tun Hussein Onn Malaysia and the Faculty of Computer Science and Information System, Universiti Teknologi Malaysia.

REFERENCES

- [1] Norman, D., A. & Draper., S. W. *User Centered System Design*. Lawrence Erlbaum, 1988.
- [2] Marcus, A. in Jacko, J. and Spears, A. (Eds.), Chapter 18, *The Human Computer Interaction Handbook; Fundamentals, evolving Technologies and Emerging Applications*. Taylor & Francis Group, Madison Ave, NY. 2008.
- [3] Norman, D., A. & Draper., S. W. (1986). *User Centered System Design*. Lawrence Erlbaum, 1986.
- [4] Nielsen, J. & Molich, R. Heuristic evaluation of user interfaces. *Proceedings of the SIGCHI conference on human factors in computing systems: Empowering people*. Seattle, WA, USA. 1990.
- [5] Nelson, T. *The Art of Human Computer Design*. Addison Wesley, M.V. 1990.
- [6] Shneiderman, B & Plaisant, C. *Designing the User Interface*. Pearson Education Inc. USA. 2009.
- [7] Myers, B. (1998). Window Interfaces: a taxonomy of window manager user interfaces. *IEEE Computer Graphics and Applications*. 1998. pp. 65-84.
- [8] Zhang, P., Scialdone, M. J., Li, N., & Carey, J. The Intellectual Advancement of Human Computer Interaction Research: A Critical Assessment of the MIS Literature (1990-2008). *Transaction on Human Computer Interaction*. 2009. pp.55-107.
- [9] Glass, R. L., Vessey, I., & Ramesh, V. Research in software engineering: An analysis of the literature. *Information and Software Technology*. 2002
- [10] Zhang, P., & Li, N. The Intellectual Development of Human Computer Interaction Research: A Critical Assessment of the MIS Literature (1990-2002). *Journal of Association for Information Systems*. 2005. pp. 227-292.
- [11] Krippendorff, K. *Content Analysis: An Introduction to Its Methodology*. Newbury Park, CA: Sage. 1980.
- [12] McBurney, D. H. *Research methods (5th ed.)*. Belmont, CA: Wadsworth Thompson Learning. 2001.
- [13] Memoz, G. The Designer as Author: Reading the City of Signs-Istanbul: Revealed or Mystified?. *Design Issues*. 2006. Vol 22, No. 2, Spring.
- [14] Blair-Early, A and Zender, M. User Interface Design Principles for Interaction Design. *Design Issues*. 2008. Volume 24, Number 1.
- [15] Almquist, J. & Lupton, J. Affording Meaning Design Oriented Research from the Humanities and Social Sciences. *Design Issues*. 2010. Volume 26, No.1 Winter.
- [16] Fallman, D. The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration. *Design Issues*. 2008. Volume 24, Number 3, Summer.
- [17] Julier, G. From Visual Culture to Design Culture. *Design Issues*. 2006. Vol 22, No.1 Winter.
- [18] Matthews, B, Stienstra, M., & Djajadiningrat, T. Emergent Interaction: Creating Spaces for Play. *Design Issues*. 2008. Vol 24, No.3, Summer.
- [19] Ingram, J. Shove, E & Watson, M. Products and Practices: Selected Concepts from Science and Technology Studies and from Social Theories of Consumption and Practice. *Design Issues*. 2007. Vol 23, No. 2, Spring.

- [20] Preece, J., *Human-Computer Interaction* Harlow, England: Addison-Wesley, 1994.
- [21] Niederer, K. Designing Mindful Interaction: The Category of Performative Object. *Design Issues*. 2007. Vol 23. No.1, Winter.
- [22] Oosterlaken, L. Design for Development: A Capability Approach. *Design Issues*. 2009. Volume, 25. No.4 Autumn.
- [23] Folkmann, M. N. Evaluating Aesthetics in Design: A Phenomenological Approach. *Design Issues*. 2010. Vol. 26, No. 1, Winter.
- [24] Kurvinen, E. Koskinen, I. & Battarbee, K. Prototyping Social Interaction. *Design Issues*. 2008. Vol 24, No. 3, Summer.
- [25] Baranauskas, M. C. C. and Bonacin, R. Design-Indicating Through Signs, *Design Issues*. 2008. Volume 24, No.3, Summer.
- [26] Forlizzi, J., Zimmerman, J., & Evenson, S. Crafting a Place for Interaction Design Research in HCI. *Design Issues*. 2008. Volme 24, Number 3 Summer,
- [27] Wylant, B. Design Thinking and the Experience of Innovation. *Design Issues*. Design Issues. 2008. Vol 24, No.2 Spring.
- [28] Heylighen, A., Cavallin, H., & Bianchin Matteo. Design in Mind. *Design Issues*. 2009. Vol 25, No.1 Winter.
- [29] Pedgley, O., & Wormald, P. Integration of Design Projects within a PhD. *Design Issues*. 2007. Vol 23, No. 1, Winter.
- [30] Panero, J., & Zelnik, M. Human Dimension and Interior Design. D. A. Norman, *The Design of Everyday Things*. New York. 2002.
- [31] Ludden, G. D. S., Schifferstein, H. N. J., & Hekkert, P. Surprise As a Design Strategy. *Design Issues*. 2007. Vol 24, No. 2. Spring.
- [32] Dong, A. The Policy of Design: A capabilities Approach. *Design Issues*. 2008. Volume 24, No. 4 Autumn 2008.