

Aesthetics Perspectives in Information System and neighbor fields

-Research in progress-

Abstract. The historical perspective of art and the science of designing computer artifacts in the IS field has its roots back in the late sixties. Despite the fact above the aesthetical approach has gotten little attention in the system development process. Aesthetic has a major impact on our private, social, and business lives. An aesthetic environment improves quality of life and prepossesses the human in it. Few journal articles with aesthetic as concept or keywords are published in the information systems' basket of journals. The aesthetic dimension has been neglected in information technology research. There is a need of investigate the role of aesthetics in the IS field and develop a common definition of aesthetics.

Keywords: aesthetics, information system, aesthetic computing, aesthetic approaches, interaction aesthetic, experiential, and interaction design

1 Introduction

It is not any news that the aesthetics dimension has a significant impact in the information systems (IS) field. Former researchers Checkland (1990), Ehn (1998), Schön (1983), and Simon (1996) have over thirty years ago pointed out and insisted that aesthetics/esthetic is an important dimension, and has a major impact of the information system. The historical perspective of art and science of designing computer artifact has its roots back in the sixties (Ehn, 1989) (Fishwick, 2003). The early school of IS in Scandinavian come from a mathematical and natural science background, in the end of the eighties Ehn pointed out the difficulties to transcend the traditions from the natural science (Ehn, 1989).

According to Redström (2007) the attention on aesthetics and how things are designed get more attention as the pervasive computing, ubiquitous computing and ambient intelligence enter the field. The new ideas have different aspects in focus than personal computing's usability and utility aspects and the new ideas also open up for other opportunities such as whether to use mouse, keyboard, and screen (Redström 2007). Aesthetics becomes more in focus now; we are getting closer to other design traditions when designing everyday things as the technology is not in the center (Redström 2007).

Today we see information technology everywhere, when we talk, listen to music, drive our car or take pictures, and computers are part of our everyday activities and surround us constantly (Yoo, 2010). The computer has changed from being a beige box that provided computing experience to corporate user, to being part of our everyday activities (Yoo, 2010). The world we live in is surrounded by digital artifacts that are shaping our everyday life, and the artifacts needs to be developed not

only to their functionality and structure, but also with the ethical and aesthetics functions as well in consideration (Löwgren & Stolterman 2004). Fig. 1. illustrate the movement from an organizational perspective to everyday computing.

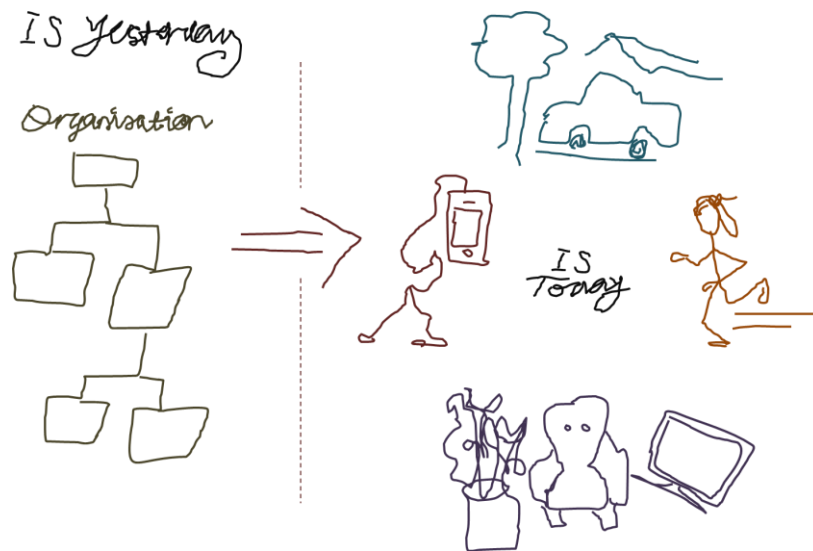


Fig.1. Information System, Yesterday & Today

Information technology research has neglected the aesthetics dimension, despite that the aesthetics aspects play a major role in our private, social and business lives (Löwgren & Stolterman 2004; Tractinsky 2004). Tractinsky (2004) also mentions why aesthetics are relevant for information technology research and practice “(1) For many users, other aspects of the interaction hardly matter anymore. (2) Our evaluations of the environment are primarily visual, and the environment becomes increasingly replete with information technology. (3) Aesthetics satisfies basic human needs and human needs are increasingly supplied by information technology. Aesthetic matters for practical reason as well: it is here to stay.” (Tractinsky 2004, page 11).

Due to the important of aesthetics I want to explore the current state of different aesthetic perspectives within the area of information technology. I will therefore start my explorative study within the IS field and then expand it into its related areas such as interaction design.

1.1 Structure of the Paper

The paper is structured as follows; first there is a methodology part where the criteria for the literature review is introduced, next a summary of the result from the literature study of *aesthetic/aesthetics* in IS basket of journals; European Journal of IS, Information Systems Journal, Information System Research, Journal of Management IS, MIS Quarterly, and Journal of Strategic IS is presented. Thereafter the literature review of different perspective of aesthetics in neighboring fields is illustrated. In the end of the article the different perspective of aesthetics is and my conclusions are presented inform of research areas.

2. Methodology

The literature review initially follows a systematic literature review approach into the concept of aesthetics in IS field, the review has been conduct in IS basket of journals. The systematic literature review tries to identify all high quality research evidence to a research question in a systematic way, and with predefined criteria for the search (Hart 1998). In this case the search term used was aesthetic/aesthetics in article's title, abstract, and keyword, excluding European journal of IS and Journal of Strategic IS where the search term was within the abstract and title, the keyword was excluded from the search because of the missing search field. The search years have varied from 1977 to 1999, the different search year depends on the journals availability and when the first year for searching was possible. My aim is to investigate the perspective of Aesthetics in itself according to the IS field, therefore the search term has been aesthetic/aesthetics and no other search terms have been used. The literature review in IS basket of journals ended up with 7 articles, see table 1.

Table 1. Published Articles on Aesthetic in IS Basket of Journals

Journal	Search field	Search year	Articles founded	Published year
European Journal of IS	Title, Abstract	From 1999	0 article	
Information System Journal	Title, Abstract, Keywords	From 1995	2 articles	1995, 2009
Information System Research	Title, Abstract, Keywords	From 1990	1 article	2012
Journal of Management IS	Title, Abstract, Keyword	From 1992- until 2001	1 article	2012
MIS Quartely	Title, Abstract	From 1977	3 articles	2004, 2007, 2009
Journals of Strategic IS	Title, Abstract, Keyword	From 1995	0 article	

The identified articles are classified into low-, medium-, and high relevance dependent on how aesthetics is presented or discussed and thus its contribution to the information systems field. The relevance scale can be seen in table 2.

Table 2. Relevance Scale

Relevance	Definition
Low relevance	Use the word aesthetic in order to describe something, gives some indication to the IS field.
Medium relevance	A brief explanation of aesthetics, and/or give some results that concerns the aesthetics according to IS.
High relevance	Presents aesthetics approaches, theories or concepts to the IS field, and/or describes the idea of aesthetics in detail. The paper's main topic is aesthetics according to the IS field.

To gain understanding of aesthetics in neighboring fields as interaction design and human-computer interaction a literature review according to “the snowball method” has been conducted. I have been searching for articles in IS and neighboring field with aesthetic/aesthetics within the title, keywords, or abstract in database as Scopus, Web of Science and Google Scholar. From selected articles I have been scanning for interesting references to continue my literature review with, and used my judgment to decide whether to pursue these further. The literature review according to the snowboll method is compiled and presented under heading 4. Different Perspective of Aesthetics.

3. Prior Research in IS

All the articles from the literature review in the IS basket of journals had other topics and focus than aesthetics, such as ISO 9001(Braa & Øgrim 1995), game development process (Stacey & Nandhakumar 2009), trust in revisit website (Liu & Goodhue, 2012), website usability and psychological ownership (Lee & Chen 2012), knowledge of graph constructions (Kumar, & Benbasat 2004), art of living through social-technical change (Avgerou & McGrath 2007), and human image in website design (Cyr, Head, Larios & Pan 2009). The articles relevance was at different levels, and varied from low- to medium, none of the articles had high level of relevance, see table 3.

Table 3. Summary of Published Articles

Author, Article, Journal, Year	Purpose of the paper	Aesthetic definition/discussion	Relevance
Braa, K., and Øgrim, L. “Critical view of the application of the ISO standard for quality assurance” Information system journal, 1995	The main objective of the paper is to bring light to the quality assurance and the application of the ISO 9001 in the system development field and start a debate. Aesthetic is one of five quality aspects that are identified in order to design and evaluate the quality of information system.	The paper is discussing that the aesthetic qualities has almost always been neglected in software development, and one reason to that could be the design	Medium

	They find that the standard “ <i>solely emphasizes technical quality. The standard promote the ideal of linear, phase-oriented system development, based on a fixed requirement specification and a document driven process</i> ” (p. 253).	of user interface. To increase aesthetic quality questions like; Is the system well designed? Is it aesthetical pleasant? Is it overcomplicated? A conclusion in the article is that the standard ignores the aesthetic quality.	
Stacey, P., and Nandhakumar, J. “ <i>A temporal perspective of the computer game development process</i> ” Information system journal, 2009	The article gives the reader a view into the games software development process and point at; there will be not much space for creativities as aesthetic and learning if all the development activities are predefined.	The aesthetic term is not well defined in the article but they “ <i>think of aesthetic as a surrogates for the intended and unintended outcomes of the actors development activities</i> ”(p. 491)	Low
Liu, B. Q., and Goodhue, D. L. “ <i>Two Worlds of Trust for Potential E-Commerce User: Human as Cognitive Misers</i> ” Information System Research, 2012	The article aimed to explain the role of potential user’s trust in creating intention to revisit a website from bounded rationality perspective. Relationship between web aesthetics, trust and task-technology fit. “ <i>This perspective results in very different recommendations for website designers as to the likely payoff from improving task-technology fit, aesthetic appeal, or trustworthiness, depending upon where their existing website stands relative to the trust tipping point.</i> ”(p. 1)	The authors do not define the aesthetic term closer, but they find that a positive affective reaction and sense of goodness for a website is a result of high aesthetical appeal and it has an impact on the revisit of a website.	Medium
Lee, Y., and Chen, A. “ <i>Usability Design and Psychological Ownership of a Virtual Word</i> ” Journal of Management IS, 2012	In the article they “ <i>apply concepts of website usability and psychological ownership to develop a model that illustrates the relationships between seven usability factors (legibility, firmness, coherence, variety, mystery, classic, and expressive visual aesthetics).</i> ”(p. 269)	In the article they make two classification of visual aesthetics of interface and these are classic- and expressive aesthetics. “ <i>Classic aesthetic refers to the visual clarity dimension of a web site, including the following design attributes; aesthetics, pleasant, clean,</i>	Medium

		clear, and symmetrical. Expressive aesthetics, in turn, capture the visual richness of a site, referring to users' perception of the creativity and original characteristics. Research has found a positive influence of visual aesthetics on user's affective appraisals of a site." (p. 284)	
Kumar, N., and Benbasat I.	"Most of the recent research in data visualization has focused on technical and aesthetic issues involved in the manipulation of graphs..." (p.255) The paper identifies a gap in the existing knowledge of graph constructions.	No definition or explanation of aesthetics. The authors just mention aesthetic in the abstract as a history to the topic.	Low
MIS Quarterly, 2004			
Avgerou, C., and McGrath, K.	"The authors address the ambivalence of the IS field with regard to technical/rational knowledge and practice." (p.295)	Aesthetics of existence is defined as "individual strives to transform their lives into an existence that carries certain aesthetic values.... formation of individual's reasoned moral stances within the power dynamics of their social context, art of living" (p.300)	Low
MIS Quarterly, 2007			
Cyr, D., Head, M., Larios, H., and Pan, B.	"Effective visual design of e-commerce websites enhances website aesthetics and emotional appeal for the user. Gain insight into how Internet users perceive human image as in element of website design,"(p. 539)	"Aesthetic, visual design elements refer to visual qualities that lend a sense of attractiveness or pleasant appearance to the website. This concept is encapsulated by codes like pretty, valuable to designers, and may colorful and	Medium
MIS Quarterly, 2009			
	"Exploring Human Images in Website Design: A Multi-Method Approach"		
	"Application of various typologies (aesthetics, symbolic, affective, functional) can be valuable to designers, and may		

<i>serve as categorizations for design of website both within and across culture."</i> (p. 557)	<i>bright"</i> (p. 552) The article use the aesthetic term as a concept that emerges from the interview.
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4. Different perspective of Aesthetics

Aesthetic has its roots from the Greek word *aisthēta* which means the 'the sensible', 'sensory perception'. Today the aesthetic is used in many different meanings such as; *1. perceptions, and attitudes concerning appearance, 2. the knowledge of sensation, the doctrine of beauty and its modification, 3. philosophical studies of a problem, concepts and conditions according to art and art experience, 4. empirical studies of factors affecting aesthetic preferences and aesthetic experiences, and 5. expression in art, nature, and everyday setting* (National encyclopedia). The meaning of aesthetic can also have an understanding in which way we experience things in a more general sense and not just about beauty. (Redström, 2007) According to Hummels & Overbeeke (2010) the aesthetic term relates to ethics, because the aesthetical approach is connected to culture, what people find valuable differs between different cultures.

Historically the aesthetic qualities have not been given much attention when designing digital artifacts and this is not only the way in the interaction design field, it is like this in almost all design fields that have their heritage from a technical tradition (Löwgren & Stolterman 2004). The attention has been on functionality and effectiveness of a product (Löwgren & Stolterman 2004). The aesthetic qualities have often been seen as something superficial that mainly focus on shape and color (Löwgren & Stolterman 2004). Instead Löwgren and Stolterman (2004) argue that we need to have a broader view on aesthetics since the design process as such is an aesthetical activity. Artifacts are not only affecting us by their functionality but also through how we experience the artifacts shape, use of properties, and as well as beauty (Löwgren & Stolterman 2004). Löwgren and Stolterman (2004) also pointed out the importance of aesthetic in a design situation that cannot be underestimated.

Oftentimes aesthetic qualities refer to the static appearance of a product as a screen layout or device which is a narrow and limiting view of the concept (Löwgren 2009). To broaden it and to understand what beauty in interaction might be, four aesthetical interaction qualities; Pliability, Rhythm, Dramaturgical structure, and Fluency have been developed by Löwgren (2009). He argues that these aesthetic qualities can be a ground for further discussion and that they can play an important role to understand users' impressions and actions while designing interactive products and services. In table 4, these aesthetic interaction qualities are presented more closely.

Table 4. Aesthetic Interaction Quality

Aesthetic Interaction Quality	Implication
Pliability	Refers to how it feel to use the interaction, products, and/or services, high pliability is for an example when the interaction feels like an extended part of your hand (Löwgren 2009). <i>“sense of malleability and tightly coupled interaction that makes the user of an interactive visualization captivating” (Löwgren 2009, page 1)</i>
Rhythm	Refers to the way we live with the digital media. (Löwgren 2009). <i>“is an important characteristic of certain types of interaction, from the sub-second pacing of musical interaction to the hours-scale ebb and flow of peripheral emotional communication” (Löwgren 2009, page 1)</i>
Dramaturgical structure	Refers to tension of using the interaction, products, and/or services. An example is the tension when using the ATM machine; the line behind you is long, it take some time to get answering from the machine, you start to think if you have some money left on your account?, or is the machine clean, are there any skimming devices? (Löwgren 2009). <i>“is not only the a feature of online role-playing games, but plays an important role in several design genres from the most mundane to the more intellectually sophisticated.”</i>
Fluency	Refers to decrease the demands for our conscious attention and information processing, an example of that is the traffic lights. <i>“is a way to articulate the gracefulness with which we are able to handle multiple demands for our attention and action in augmented space”</i>

Udsen and Jorgensen have identified four aesthetic approaches to the human computer interaction field, these four approaches are Cultural, Functionalistic, Experience-based, and Techno-futurist (Udsen & Jorgensen 2005). The cultural approach mainly refers to non-informational spaces such as digital art, literature and games; the academic tradition comes from humanities and new media, and theorists in this area are Laurel, Johnson, Manovich, Bolter & Gromala, Walther, and Pold (Udsen & Jorgensen 2005). The cultural approach expects that it is more to the interface than the visible screen and that the different position in the cultural approaches describes the interfaces as an aesthetic form (Udsen & Jorgensen 2005). The computer’s interface can be seen as a theatrical performance it do not necessary have to be a functional tool (Laurel, 1986).

The main summation of the functionalistic approach is; the products increase their usability of aesthetic appearance (Udsen & Jorgensen 2005). Udsen and Jorgensen (2005) refer to Norman’s mantra: *“Attractive things work better”*, but there are some problematic aspects within the aesthetic and functionalistic dimension together, the theory formation and practical application. When the theories of functionalist search beyond the usability they often maintain their original agendas and the methods of

quantifying the user experience, but the aesthetic turn is a positive development and the aesthetic experience should command a higher priority with design (Udsen & Jorgensen 2005). Their academic background of aesthetic functionalism comes from traditional HCI and usability, with informational interfaces (Udsen & Jorgensen 2005). Theorists as Tractinsky, Jordan, Norman, Karonen, and Desmet represent this approach (Udsen & Jorgensen 2005). Tractinsky made the conclusion that *“perceptions of interface aesthetic are closely related to apparent usability and thus increase the likelihood that aesthetics may considerably affect system acceptability”* (Tractinsky 1997, page 121)

The experience-based approach comes from the academic tradition of interaction design and has a strong practical view which is the opposite to the cultural approach, theorists are Blythe et al., Dunne, Gaver et al., Löwgren, and McCarthy & Wright (Udsen & Jorgensen 2005). The experience-based type of interface is post-optimal electronic objects, and their ambition is to find new way of communicate (Udsen & Jorgensen 2005). Two things that characterize this approach are challenge of aesthetical aspect of technological design and use, and to minimize the concerns of practicality and functionality within the prioritization on experiences, emotions and poetic aspects (Udsen & Jorgensen 2005). The experience-based approach ambition is to find new ways of communicate

The techno-futurist approach has its roots in the academic tradition of philosophy-based perspectives, and are interested in how human are experiencing things in a surrounding that become more technological, theorist in this field are Dourish, Hallnäs & Redström, and Ishii & Ullmer (Udsen & Jorgensen 2005). Ubiquitous computing environment represent the techno-futurist approach and they want to organize information in an aesthetic arrangement, their thought is that this approach can bring new dimension to everyday life (Udsen & Jorgensen 2005). Hallnäs & Redström (2002) argued for when the changing focus from being a tool for specific use to become something in our everyday life, the demands shift from the design of computer systems to be designed as something meaningful instead of being something efficient. Hallnäs and Redström (2002) also talked about aesthetics as something in the center of the design because of the shifting focus, the artifact to be specifically used for something to be expressing something.

In interaction design Preece (2002) is talking about aesthetically pleasing as one of ten user experience goals, the user experience goals has developed because of the new technologies offering increasing opportunities for supporting people in their everyday lives. What is included in the term of aesthetically pleasing is not further described. Preece (2002) also refer to Nielsen and his colleagues' main usability principles where aesthetic and minimalist design is one of ten principles which aim to *“avoid using information that is irrelevant or rarely needed”* (Preece 2002, page 27)

One attempt to look at the complementary area of applying aesthetics to computing was a seminar held in 2002 that focused on alternative, cultural and aesthetically motivated representation for a computer science model. This seminar attracted attendees from both the artistic and academic fields (Bertelsen & Fishwick, 2002). The purpose of the seminar was to highlight differences in the perception of the two fields, bringing light to key aspects and defining the area (Fishwick, Diehl, Prophet & Löwgren 2005). The seminar ended up in an Aesthetic Computing Manifesto with a new term Aesthetic Computing which can be defined as the application of art theory

and practice to computing where the aim is to strike a balance between cognitive and material aesthetics (Fishwick, Diehl, Prophet & Löwgren 2005). This manifesto has had impact in research since many authors refers to it (e.g. Tractinsky 2004; Udsen & Jorgensen 2005)

5 Discussion

The IS basket of journal had alarming few articles with aesthetics as main concept or articles where the authors discuss the term and the implication of it according to the field of IS. As earlier mentioned in the introduction part; the concept of aesthetics is not new to the IS field, but a deeper explanation of the meaning of aesthetics or a common definition of the term into the field was not discussed in IS basket of journals. It is not widespread what the meaning of aesthetics is to the IS field. The aesthetics term oftentimes is used without a closer definition, or a further explanation of the concept, and/or how to reach “aesthetics”, examples of that can you find from the article “*A temporal perspective of the computer game development process*” (Stacey & Nandhakumar 2009) and in the book “*Interaction design: beyond human-computer interaction*” (Preece 2002).

The computer has changed from being a beige box that provided computing experience to corporate user, to being part of our everyday activities (Yoo, 2010). At the same time new way of using information system and information technology demand new- or enriched theories (Redström 2007). As well as in the field of IS, the aesthetic/aesthetics term has several definitions and different impacts in neighboring areas.

The term aesthetics is used as substantive, adjective and verb in the literature, I believe that this multilateralism makes the concept of aesthetics in information system and information technology a bite blurred and hard to grasp, see table 5.

Löwgren (2009) tries to broaden the aesthetics term to four qualities that compiles more than just beauty. I believe that these four aesthetic qualities also meet the new way of using information systems and information technologies in everyday life in a more suitable way than using aesthetics as a quality that only examine the beauty in an interaction.

Table 5. Aesthetic as substantive, verb, and adjective

Word class	Examples from literature
Substantive	Aesthetics can be a shape of a digital artifact/interaction (Löwgren & Stolterman 2004; Löwgren 2009)
Verb	Aesthetic can be activities in the design process (Löwgren & Stolterman 2004; Preest 2002; Stacey & Nandhakumar 2009)
Adjective	Aesthetic can be seen as something that describe how an artifact/interaction/system looks or feels like (Cyr, Head, Larios & Pan, 2009; Tractinsky 2004; Udsen & Jorgensen 2005)

The aesthetic term is also used as a prefix to already existing research areas or research subfield, an example is aesthetic computing (Bertelsen & Fishwick, 2002).

The research of information system and information technology has a heritage from a technical tradition and not much attention has been on softer qualities. An example is the ISO 9001 standard where the aesthetic is one quality aspect that should had a significant impact on a system, but Braa and Øgrim (1995) find that the standard solely emphasizes technical qualities.

6 Conclusion

That the information technology research has neglected the aesthetics dimension have several different researcher already pointed out (Löwgren & Stolterman 2004; Tractinsky 2004; Braa & Øgrim 1995), despite that, the aesthetics aspects play a major role in our private, social and business lives (Löwgren & Stolterman 2004). Tractinsky (2004) say that “*There is abundant evidence to suggest that aesthetics matter in almost every aspect of human thought and behavior*” (p. 17). The field of IS need to address a new agenda where the aesthetical perspective gets larger focus.

The literature review from neighboring research field shows that interaction design, human computer interaction, and computer science have started to investigate the aesthetic/aesthetics term and the meaning of the concept to their field, but still there are many different meanings, definitions and ways of using the term.

There is a need of investigate the role of aesthetics in the IS field, to be able to do that IS need to develop a common definition of aesthetics and what impact the aesthetics perspective should have.

References

1. Atkinson, R., Flint, J.: Accessing Hidden and Hard-to-Reach Poulations: Snowball Research Strategies. Social Research Update, Issue 33, Summer (2001)
2. Avgerou, C., McGratg, K.: Power, rationality, and the Art of living through socio-technical change. MIS Quarterly, 31(2), 295-315 (2007)
3. Bertelsen, O. W., Fishwick P.: Aesthetic computing. Dagstuhl Seminar Report N° 348 (2002)
4. Braa, K., Ogrim, L.: Critical view of the application of ISO standard for quality assurance. Information system journal, 5(4), 253-269 (1995)
5. Checkland, P., and Scholes, J.: Soft system methodology in action. John Wiley & Sons Ltd, Chichester (1990)
6. Cyr, D., Head, M., Larios, H., Pan, B.: Exploring human images in website design: a multi-method approach. MIS Quarterly, 33(3), 539-566 (2009)
7. Ehn, P.: Manifesto for a Digital Bauhaus. Digital Creativity, 9(4), 207-216 (1999)
8. Ehn, P.: The art and science of designing computer artifacts. Scandinavian Journal of Information System, 1, 21-42 (1989)

9. Fishwick, P.: Aesthetic computing manifesto. *Leonardo*, 36(4), 225 (2003)
10. Fishwick, P., Diehl, S., Prophet, J., Löwgren, J.: Perspectives on aesthetic computing. *Leonardo*, 38(2), 133-141 (2005)
11. Gaviria, A. R.: When is information visualization art? Determining the critical criteria. *Leonardo*, 41(5), 479-482 (2008)
12. Hallnäs, L., Redström, J.: From use presence: On the expressions and aesthetics of everyday computational things. *ACM Transactions on Computer-Human Interaction*, 9(2) 106-124 (2002)
13. Hart, C.: *Doing a literature review*. SAGE Publications, London (1998)
14. Hummels, C., Overbeeke, K.: Special issue editorial: aesthetics of interaction. *Internal Journal of Design*, 4(2), 1-2 (2010)
15. Kumar, N., Benbasat, I.: The effect of relationship encoding, task type, and complexity on information representation: an empirical evaluation of 2D and 3D line graphs. *MIS Quarterly*, 28(2), 255-281 (2004)
16. Laurel, B.: *Interface as Mimesis*. In Norman, D. and Draper, S. (eds) *User centered system design: new perspectives on human-computer interaction*. Lawrence Erlbaum Associates, New Jersey, 67-86 (1986)
17. Lee, Y., Chen, A.: Usability design and psychological ownership of a virtual word. *Journal of Management IS*, 28(3), 269-308 (2012)
18. Liu, B. Q., Goodhue, D. L.: Two worlds of thrust for potential e-commerce user: human as cognitive misers. *Information System Research*, 23, 1087-1092 (2012)
19. Löwgren, J.: *Towards an articulation of interaction aesthetics*. New Review of Hypermedia and Multimedia (2009)
20. Löwgren, J., Stolterman E.: *Design av informationsteknik – materialet utan egenskaper*. Studentlitteratur, Lund (2004)
21. Preece, J., Rogers, Y., Sharp, H.: *Interaction design: beyond human-computer interaction*. Wiley, New York (2002)
22. Schön, D.: Designing as reflective conversation with the materials of a design situation. *Knowledge-Based Systems*, 5(1), 3-14 (1992)
23. Schön, D.: *Designing: rules, types and worlds*. Butterworth & CO (Publisher) Ltd, 9(3), 181-190 (1988)
24. Redström, J.: Aesthetic Concerns. In: Giaglis, G. and Kourouthanassis, P. (Eds.) *Pervasive Information Systems*. 197-209 Armonk, New York: M. E. Sharpe (2007)
25. Schön, D.: *The reflective practitioner: how professionals think in action*. Temple Smith, London (1983)
26. Simon, H.: *The sciences of the artificial*. The MIT Press, Cambridge, Massachusetts, London. (1996)
27. Stacy, P., Nandhakumar, J.: A temporal perspective of the computer game development process. *Information system journal*, 19(5), 479-497 (2009)
28. Tractinsky, N.: Aesthetic and apparent usability: Empirically assessing cultural and methodological issues. *Proceedings CHI'97*. ACM Press, New York, 115-122 (1997)
29. Tractinsky, N.: *Towards the study of aesthetic in information technology*. Twenty-Fifth International Conference on Information Systems (2004)
30. Udsen, L. E., Jorgensen, A. H.: The aesthetic turn: unraveling recent aesthetic approaches to human-computer interaction. *Digital Creativity*, 16(4), 205-216 (2005)
31. Wiberg, M., Robles, E.: Computational compositions: aesthetics, materials and interaction design. *Internal Journals of Design*, 4(2), 65-76 (2005)
32. Yoo, Y.: Computing in everyday life: a call for research on experimental computing. *MIS Quarterly*, 34(2), 213-23 (2010)