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TOWARD THE STUDY OF AESTHETICS IN INFORMATION TECHNOLOGY

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Abstract

This paper argues that an increasingly important dimension of the human-computer interaction is missing from the MIS and the HCI research agenda. This dimension—esthetics—plays a major role in our private, social, and business lives. It is argued that aesthetics is relevant to information technology research and practice for three theoretical reasons. (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. Aesthetics matters for a practical reason as well: it is here to stay. We propose a general framework for the study of aesthetics in information technology and provide some examples of research questions to illustrate the viability of this topic.

Keywords: Aesthetics, beauty, design, human-computer interaction, information technology, visual appearance

Introduction

The first known systematic theoretician of architecture, Vitruvius (first century BC), argued that architecture must satisfy three distinct requirements: *firmitas* (strength)—which covers the field of statics, construction, and materials; *utilitas* (utility)—the use of the building and its functioning; and *venustas* (beauty)—the aesthetic¹ requirements (Kruft 1994). Although architectural theories have since evolved considerably, Vitruvian principles still hold much intuitive and theoretical appeal to this date (Kruft 1994). Consider, for our purpose, the field of information systems. Much of the work in this field relates to the soundness and the robustness of the artifacts created by professionals in the field (*firmitas*). Traditionally, the various computing and information technology disciplines have emphasized areas related to the firmness, correctness, stability, and internal logic of their products.

A second requirement, *utilitas*, is addressed by a certain stream in MIS research and by a large segment of the human-computer interaction (HCI) community. It deals with the ways in which information technology can be designed to meet individual and organizational needs with regard to the systems' functionality and ease of use. A sizeable body of research in the field of MIS has dealt with the effects of IT on users. This stream of research can be traced back some three decades ago to the Minnesota experiments (Dickson et al. 1977), where the utility (i.e., efficiency and effectiveness) of an information system was measured mainly by objective means (e.g., decision quality and speed). Subjective evaluations of the information system played a minor role in the Minnesota experiments, but gained more attention during the next decade. Davis's (1989) technology acceptance model (TAM) is perhaps the best known example for a stream of research that focuses on users' subjective evaluation of IT and their

¹The term *aesthetics* was introduced into philosophical terminology in the 18th century by Baumgarten. It has evolved through the years and has different meanings for different schools of thought (see Lavie and Tractinsky 2004). Here we are interested in its common meaning as “*an artistically beautiful or pleasing appearance*” (The American Heritage Dictionary of the English Language), or as “*a pleasing appearance or effect: Beauty*” (Merriam-Webster's Collegiate Dictionary). A more encompassing view of aesthetics in IT can be found in Stolterman (1994).

intention to use it. Later, researchers began including aspects of subjective experience that go beyond mere utility valuations (e.g., Webster and Martocchio 1992). Almost in parallel, but with somewhat different emphases, the field of HCI emerged as a counterforce to the traditional *firmitas*-oriented computing disciplines. Here, issues of usability and the degree to which the system can facilitate achieving users' goals were brought to the fore. The main emphasis of these research efforts has been on studying and promoting efficiency (e.g., Butler 1996).

Until very recently, however, the third Vitruvian requirement, *venustas*, was almost completely absent from research in the various IT disciplines. This absence is particularly glaring in studies of interactive systems. While some schools of thought in other design disciplines may reject the importance of aesthetics, these disciplines have nonetheless paid much attention and spawned lively debates on this issue. This has not been the case in either the field of MIS or in HCI. Texts in these fields hardly make any reference to matters of aesthetics. Whenever aesthetic issues are discussed in the HCI literature, they are likely to be qualified by warnings against its potentially detrimental effects (Tractinsky 1997). There may be a couple of reasons for the neglect of aesthetics in the computing disciplines. One reason may stem from resentment of attempts by some in the computer industry to oversell glitz and fashion in lieu of substance and usefulness. Another reason may lie in the computing disciplines' origins in disciplines that emphasize hard science, efficiency, and utility. Thus, other aspects of the interaction were not recognized as belonging in the field (Tractinsky et al. 2000).

There is little doubt, though, that, in general, the aesthetic criterion is inseparable from effective design of interactive IT (Alben 1996). The importance of beauty, or aesthetics—terms that are used interchangeably in this work—has been recognized since antiquity. Following Vitruvius, Alberti defined beauty as the wholeness of a body, “a great and holy matter” (in Johnson 1994, p. 402). Modern social science has established the importance of aesthetics in everyday life. In a seminal paper, Dion, Berscheid, and Walster (1972) demonstrated that a person's physical appearance influences other aspects of the social interaction. Better looking people earn more (Hamermesh and Biddle 1994) and receive higher teaching evaluations (Hamermesh and Parker 2005). People are affected by the aesthetics of nature and of architecture (e.g., Nasar 1988; Porteous 1996) as well as by the aesthetics of artifacts (Coates 2003; Norman 2004a; Postrel 2002). Aesthetics was found to play an important role in new product development, marketing strategies, and the retail environment (Kotler and Rath 1984; Russell and Pratt 1980; Whitney 1988). Bloch (1995) concluded that the “physical form or design of a product is an unquestioned determinant of its marketplace success” (p. 16).

Interest in visual aesthetics (as distinguished from abstract elegance) is growing in the computing community as well. For example, the Aesthetic Computing community (Fishwick 2002, 2003) is targeting the application of art theory and practice to computing in an attempt to augment existing representations and notions of aesthetics in computing by capitalizing on creativity and innovative exploration of media.

The robust findings regarding the importance of aesthetics in most walks of life make its absence from the agenda of the IT disciplines even more conspicuous. Lately, evidence in support of the importance of aesthetics in HCI has started to emerge. This evidence encompasses both hardware and software issues. For example, Apple's iMac was heralded as the “aesthetic revolution in computing,” and an indication that the visual appearance of IT has become a major factor in buyers' purchase decisions (Postrel 2001). Recent empirical studies have found a prominent role of the aesthetic aspect of various computing products in general and specifically in the context of the Web (Kim et al. 2002; Schenkman and Jonsson 2000; van der Heijden 2003). Other studies have found aesthetics to be of importance, though not in a dominant way, in affecting users' perceptions (Tarasewich et al. 2001; Zhang and von Dran 2000). Although not measuring aesthetics directly, some studies indicate that Web site design is a major determinant of perceived credibility and trustworthiness of e-commerce sites (Fogg et al. 2002; McKnight et al. 2002). Research suggests that aesthetics is an important determinant of pleasure experienced by the user during the interaction (Jordan 1998). It was found to be highly correlated with perceptions of the systems' usability both before (Tractinsky 1997) and after (Tractinsky et al. 2000) the interaction, and with user satisfaction (Lindgaard and Dudek 2003).

Despite the paucity of scientific evidence regarding the role of aesthetics in interactive systems, there is enough theoretical, practical, and anecdotal evidence to support the proposition that such a role exists. We present this evidence in the next section.

Why Does Aesthetics Matter?

In this section, we will argue that the time has come for incorporating the aesthetic element into considerations in the processes of developing and managing information technology. In addition to the empirical studies reported above, in which aesthetics was shown to have a role on users' interactions with information technologies, we present below three theoretical and one practical

argument as to why researchers and practitioners who are concerned with the design, development, and use of interactive systems need to devote more attention to aesthetics in IT. A few words of caveat are in place here: our thesis does not imply that considerations of aesthetics should become the most important factor in those activities or in their products. Obviously, aesthetics matters differently for different types of systems, users, tasks, and contexts. Rather, the premise is that while aesthetic issues have thus far been ignored in IT research, there are compelling arguments as to why they should receive more attention in the future.

Level of Performance Exceeds Most Users' Needs

The advances in information technology have, to a large degree, exceeded the requirements and needs of many users and organizations. A growing body of literature indicates that this might be the case for both individuals (e.g., Norman 1998) and organizations (e.g., Carr 2003). Norman (1998) suggests that as the functionality of new IT products exceeds users' needs, and as the price of systems decrease, the competition becomes more oriented toward enhancing the users' experience rather than toward improving functionality. Once IT provides all the required features at ever-decreasing prices, considerations of convenience and reliability, and, later, of appearance and symbolic ownership, become more important. Norman compares this process to the state of the watch industry, which long ago passed users' technological requirements: watches are now often marketed as objects of fashion or emotion.

Carr (2003) indicates that basically similar developments occur at the organizational level: price reduction, sufficient functionality, and more sophisticated consumers lead to the commoditization of IT. While Carr's prescriptions for IT strategy have been heavily debated, his description of the developments in the field applies to many organizations. Many of Carr's critics indicate that it is not IT per se that creates strategic advantage. Rather, it is how organizations harness its potential that helps differentiate them from the competition. This does not diminish the potential contribution of aesthetic design. A notable example of differentiating by aesthetics is the success of the iMac, which is attributed to the shifting emphasis in product features—from performance and reliability to aesthetics and style (Postrel 2002). In fact, given recent and foreseeable developments in IT, one can also argue that a new role is forming for IT, which is becoming a designer and a carrier of aesthetics. Today's IT expands the possibilities of sensory expression, and is particularly friendly to aesthetic applications (Postrel 2002). In the last decade, the aesthetically rich entertainment industry has been transformed by IT in general and by the Internet in particular.

To a large extent, the use of aesthetics as a differentiating factor resembles similarly crowded markets where "aesthetics is often the only way to make a product stand out" (Postrel 2002, p. 2). According to this view, aesthetics may not overcome bad usability, unreliable systems or significant lack of features, but it matters when all else is equal. And, allowing for a slight over-generalization, "all else is equal" is becoming the state of affairs in the rapidly commoditized IT market.

Some Aesthetically-Based Valuations Are Immediate and Hard to Overcome

Recent research into the potential effects of emotions generated by artifacts has yielded several theoretical frameworks. Norman and his colleagues (Norman 2002, 2004a; Ortony et al. in press), suggest a three-level theory of human behavior that integrates two information processing systems: affective and cognitive. In each level, the world is being evaluated (affect) and interpreted (cognition). The lowest level processes take place at the visceral level, which surveys the environment and rapidly communicates affective signals to the higher levels. The routine (or behavioral) level is where most of our learned behavior takes place. Finally, the reflection level is where the highest-level processes occur. The important role of affect in human behavior stems from the fact that it can color subsequent cognitive processes because our thoughts normally occur after the affective system has transmitted its initial information. It is important to note that the affective system and the cognitive system are intertwined (Bargh in press; Ortony et al. in press; Russell 2003). Thus, while previous research in MIS and in HCI largely presumed that human decision making relies entirely on cognitive processes, current research on decision making portrays a different picture.

One of the key characteristics of the affective system is that some of its reactions are very rapid (Norman 2004a; Pham et al. 2001). Other affective responses often involve considerable cognitive mediation and are decidedly slower. Aesthetic evaluations may take place on all three levels of the Norman model, but there are some hints that first aesthetic impressions are affective and are formed immediately at a low level and thus precede cognitive processes (Fernandes et al. 2003; Norman 2004a; Pham et al. 2001; Zajonc and Markus 1982). Hence, the immediate affective reactions may color and potentially sway successive cognitive processes (Duckworth et al. 2002; Pham et al. 2001).

The phenomenon of aesthetic perceptions of an object coloring other perceived attributes of the same object is familiar in the social sciences. Cowley (1996) suggests that “we’re designed to care about looks, even though looks aren’t earned and reveal nothing about character” (p. 193). Thus, in what is known as the “beautiful is good” stereotype, a person’s attractiveness was found to affect how people perceive other attributes of that person (Dion et al. 1972, Eagly et al. 1991). Hamermesh and Biddle (1994) found that more beautiful people earn more on the marketplace, and better looking university instructors receive higher teaching evaluations (Hamermesh and Parker 2005). Under certain conditions, those immediate aesthetic impressions may affect how people perceive and use other system attributes. For example, more aesthetic systems were perceived to be more usable than less aesthetic systems (Tractinsky et al. 2000). We still do not have direct evidence that the aesthetics of IT impact decision processes, but evidence regarding the influence of affect on decision making exist in other fields (e.g., Isen 2001).

Thus aesthetics may set the tone for the rest of the interaction. A strong evidence for the immediacy of first aesthetic impression in IT was provided by Fernandes et al. (2003). They found that attractiveness evaluations of Web pages to which participants were exposed for only 500 milliseconds were very highly correlated with attractiveness evaluations of the same pages under unlimited exposure. We have recently replicated and validated these findings (Tractinsky et al. 2004).

It is important to note that the fact that some aesthetic evaluations are formed immediately does not imply any deterministic consequences. This is for two reasons: First, as mentioned above, some aesthetic evaluations are also made based on more elaborated cognitive and affective processes. Second, there are many potential moderators that can affect the relations between aesthetic characteristics of an IT artifact and the attitudinal or behavioral consequences of the interaction (some of these moderators are referred to briefly in the next section). Thus, some responses to aesthetic stimuli are innate and relatively invariant, but some are learned and depend on culture, education, other experiences, and acquired tastes.

Aesthetics Satisfies Basic Human Needs

The degree to which aesthetics considerations gained (or should gain) importance in the industrial landscape remains a contested issue. Designing aesthetic information systems may be viewed by some as manipulative, or a gratuity at best. In his seminal book, *The Psychology of Everyday Things*, Norman (1988) suggested that the pendulum might have swung too much in favor of putting aesthetics ahead of practical features of the artifact, such as usability, utility, and functionality. Recently, however, with the increased recognition of the role of emotion in decision making, it has been argued that modern design has placed too much emphasis on performance issues and not enough on emotional aspects, such as pleasure, fun, and excitement, which are fundamental motivators of human behavior, and which are clearly affected by aesthetics (e.g., Coates 2003; Green and Jordan 2000; Hassenzahl 2003; Norman 2002, 2004a).

According to Maslow’s (1970) self-actualization theory, the need for aesthetic pleasure is one of the higher order (growth) needs, which are manifested after the lower level, more basic needs have been fulfilled to a satisfactory degree. Moreover, Maslow suggests that, contrary to basic needs, the need for aesthetics increases the more it is satisfied. In a sense, aesthetics may also be viewed as a motivator (as opposed to a hygienic factor) to use Herzberg’s terminology (Zhang and von Dran 2000). Postrel suggests that aesthetic pleasure has intrinsic value: “People seek it out, they reward those who offer new-and-improved pleasures, and they identify with those who share their tastes” (2002, p. 75). Users of IT are not different. They strive for a more complete and satisfying interactive experience; an experience that not only achieves certain well-defined goals but also involves the senses and generates affective responses (Bly et al. 1998; Venkatesh and Brown 2001).

Fogarty et al. (2001), claim that since computer technology has moved beyond the confinements of the work environment and into the rest of our lives, its use has expanded into wider aspects and its requirements have shifted as well. If once the value of computing technology was measured mostly by its usefulness for solving problems and by its ease of use, additional requirements, such as desirability, have now emerged. Issues of visual appeal and aesthetics have become an integral part of interactive system designs. Indeed, in stark contrast to the principles and the guidelines advocated by usability researchers and gurus, any random perusal of Web sites would suggest that aesthetic considerations are paramount in designing for the web. One of the interesting phenomena of current IT usage is the personalization of the application’s appearance. The growing demand for personalized user interfaces seems to spring from the quest for richer and more affective experience (Blom and Monk 2003). The desire expressed by users to tailor their applications’ appearance according to their tastes is epitomized by the proliferation of skins—alternative interfaces to commonly used applications—that allow users to change the appearance of their applications while preserving their functionality (but not necessarily their ease of use). Recent trends in PC-based application design indicate that “skinnability” (the ability to tailor the application’s appearance) has become a common feature in many types of personal computing applications.

Our studies indicate that the choice of skins by individual users has much to do with their aesthetic properties (Tractinsky and Lavie 2002; Tractinsky and Zmiri in press).

Practically, Aesthetics Is Here to Stay...

The idea that style overcomes substance or influences perceptions of seemingly unrelated attributes of people, objects, or interactive systems may sound appalling. It can be argued on ethical or moral grounds, but we cannot deny its existence nor can we ignore the positive effects of aesthetics on our affective *and* cognitive well-being (see Isen 2001; Norman 2004a). But, more importantly, we cannot ignore the fact that aesthetic matters become more pervasive than they used to be. Postrel argues that “sensory appeals are everywhere, they are increasingly personalized, and they are intensifying” (2002, p. 5). According to Postrel, today’s aesthetics pleases and liberates the masses. IT is increasingly becoming a vehicle to provide aesthetics; in fact, one of the unintended results of IT is that it is particularly friendly to aesthetic applications. Users can create, edit, transmit, and receive aesthetic designs in almost any imaginable domain. Designers in industries such as fashion, mass media, art, business documents, and Web development are equipped with applications that offer many more design options, and much more time to explore them. This argument is echoed by Schroeder (2002), who suggests that “web design has brought visual issues into the mainstream of strategic thinking....The Web mandates visualizing almost every aspect of corporate strategy, operations and communication” (p. 22).

Moreover, Postrel suggests that “the computer-driven democratization of design has made more people sensitive to graphic quality. Bit by bit, the general public has learned the literal and metaphorical language of graphic design. Carried by computers, aesthetics has spread to places and professions that were formerly off-limits to any such frivolity” (2002, p. 55). An aesthetic cycle is in the working, where aesthetic supply creates more demand, which in turn feeds even more supply. “Over time people learn. They discover more about what’s aesthetically possible and more about what they like” (Postrel 2002, p. 55). And, as proposed by Maslow, the more aesthetically aware people become, the greater their need for aesthetics.

Toward a Research Agenda of Aesthetics in Information Technology

Aesthetics has never been studied systematically in the context of IT. The research potential here is quite unlimited as can be attested by the various studies of aesthetics in other contexts throughout the years (for a short review, see Lavie and Tractinsky 2004). The ideas presented in this section do not purport to be comprehensive, certainly not exhaustive or detailed, as the study of aesthetics is “fraught with difficulties” (Norman 2004b). The proposed framework is presented in the next subsection in a manner that conforms to the traditional experimental paradigm in IT. It treats aesthetics as a variable on par with other frequently studied variables in IS: in its core is an evaluative construct that is affected by some design characteristics of the IT artifact; it may, in turn, affect other IT-related variables; and those effects are moderated by still other conventional IT variables. The idea is to present the pervasive relevance of aesthetics to IT. An anonymous reviewer correctly commented that this framework is quite restrictive and may miss some of the more distinct contributions of aesthetics. Introducing a broader vision of aesthetics in IT, however, would require considerably more space, would be much more speculative in nature, and would probably necessitate delving into realms that are beyond “core IS” (Benbasat and Zmud 2003). Still, some ideas in this spirit are presented later.

A Research Framework...

Figure 1 depicts a general framework for the study of the effects of aesthetics in IT. Five categories of variables are presented in the framework as follow.

Design Characteristics. The framework begins with the design characteristics of interactive systems as independent variables. Researchers may study those characteristics as objective or perceived variables. The histories of aesthetics and IT research are filled with studies of both types, and the choice of which type to use should be left for the researcher to decide. For example, research on graphics in MIS has concentrated on objective design features (e.g., Benbasat et al. 1986; Jarvenpaa and Dickson 1988) whereas much of the research on technology acceptance is based on perceived system characteristics (e.g., Venkatesh and Davis 2000).

Aesthetic Processes. Based on the design characteristics of interactive systems, users perceive and evaluate various attributes of the system (e.g., ease of use, usefulness), including its aesthetics. As mentioned earlier, some of these aesthetic evaluations

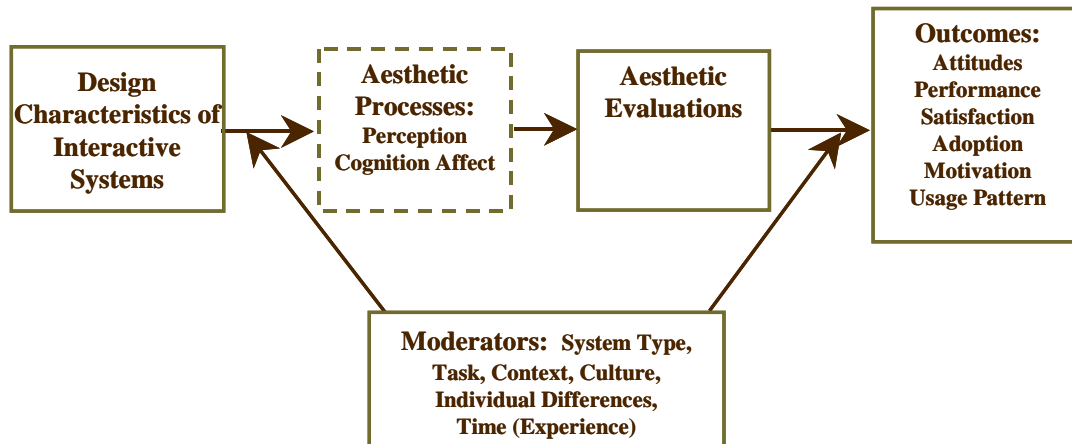


Figure 1. A General Framework for the Study of Aesthetics in Information Technology

are likely immediate, strong, and stable and may dominate the ensuing interactive experience (Cowley 1996; Fernandes et al. 2003; Norman 2004a). These perceptions and evaluations are tied to affective and cognitive processes, which are not yet fully understood (Norman 2004a). The specifics of these processes are only tangential to IT research in the sense that they increase the distance between the IT constructs and the final outcome variables of interest (Benbasat and Zmud 2003). They are depicted in the framework, however, for their central role in eventually generating a range of IT-relevant outcomes: they may form (or change) users' attitudes toward the system, improve (or worsen) their performance, affect their satisfaction, and influence their willingness to buy or adopt the system. Thus, while the "black box" processes may not lie at the core of IS research, the study of aesthetics in IT requires familiarity with reference disciplines that do study those processes. This group of variables is depicted in Figure 1 within a dashed box, to indicate their auxiliary role in IS research.

Aesthetic Evaluations of IT. Whereas the low level of aesthetic processes may remain concealed in IS research, higher level aesthetic evaluations are of great interest. This type of measures is the most accessible to behavioral research methods and can convey a decent degree of information about the IT antecedents of aesthetic perceptions and evaluations and about the consequences of such perceptions. To date, most studies of aesthetics in IT have employed a general measure of aesthetics. Such a measure was sufficient in demonstrating the relations between aesthetic perceptions and their IT antecedents and consequences. For example, Kurosu and Kashimura (1995) and Tractinsky (1997) found that manipulating the layout of objects on an ATM machine affects evaluations of the machine's beauty. In turn, the aesthetic evaluations affected the evaluation of other system attributes, such as its ease of use (Tractinsky et al. 2000). Hassenzahl (2004) found that perceived beauty was related to the perceived goodness of a system. Lindgaard and Dudek (2003) found that using aesthetic Web sites yielded higher satisfaction, and in Schenkman and Jonsson (2000) aesthetics was related to overall preferences of web sites. Perhaps of even more interest is the ability to identify various IT-related dimensions of aesthetic evaluations. This can help in finer-grain analyses of what link certain design characteristics of interactive systems and their behavioral consequences. Example of such higher-resolution measures are the emotional dimensions of Web pages (Kim et al. 2003), their aesthetics (Lavie and Tractinsky 2004), and aspects of the hedonic attributes of products (Hassenzahl 2003). Finally, methodological issues are always of concern when studying affective constructs. Thus, the study of aesthetics reactions to design calls for novel evaluation techniques (e.g., Desmet et al. 2000).

Outcome Variables. In the proposed framework, the range of potential outcomes can span virtually the whole gamut of outcome variables employed by behavioral IS researchers. Possible outcome variables affected by aesthetics include problem solving and decision-making processes (see Isen 2001; Norman 2004a); general attitudes toward the system; various psychological states such as flow, trust and fun; usage behavior and performance; and preferences and willingness to pay for the system.

Moderating Variables. Obviously, the effects of aesthetics are moderated by various factors. A partial list of potential moderators include the type of system used (e.g., a hand-held entertainment system vs. an ERP system); the task(s) to be performed with the system; the context in which the system is used; cultural (organizational, societal, national) and individual differences; and motivational factors and the degree of experience with and exposure to the system. One especially intriguing question is whether the impact of aesthetics is confined to voluntary use of IT. While I am not familiar with direct evidence regarding the effect of aesthetics in mandated environment, research suggests that such effect exists. For example, in reviewing

the literature on the effects of positive affect, Isen (2001) found that decision makers' performance improves when positive affect is induced in various settings (e.g., medical decision making). Given that aesthetics generates affective responses, it would not be surprising to find similar effects of aesthetic IT even under mandatory use (see Rafaeli and Vilnai-Yavetz in press).

Within the experimental tradition of studying how IT affects user behavior, the proposed framework allows for testing hypotheses regarding how design elements of the IT artifact and the usage context affect the dependent variables of interest. These issues are relevant to our understanding of how individuals use IT. To illustrate the type of studies that can be carried out, consider trust in Web stores. McKnight et al. (2002) found that consumers' perceptions of Web site quality (including design elements) were a very strong predictor of trusting beliefs in the retailer and of consumers' intentions to buy from the site. In a survey of 2,684 Web users, Fogg et al. (2002) found that users use the design look of a site as the most prominent cue in evaluating the site's credibility. Unfortunately, neither of these studies had obtained separate measures of visual attractiveness or aesthetics. However, given the prominence of visual stimuli in human judgment and the demonstrated effects of IT aesthetics on users' perceptions of other system attributes, it would not be an outreach to propose that the aesthetics of a Web site has an effect on the perceived credibility or trustworthiness of the Web store. An even more interesting question, perhaps, is what kind of aesthetics, or which aesthetic features, affect trustworthiness. This will require us first to tease out the aesthetic elements in IT. Some of these elements may be shared with other visual media or artifacts, some may be unique to IT, and some, may be unique to certain types of IT (e.g., a Web page vs. a PDA application). Some promising work has already been done in this latter area (e.g., Kim et al. [2003] and Lavie and Tractinsky [2004], on Web sites; Hassenzahl [2004] on MP3 players), suggesting the viability of this research route.

...and Beyond

Not less interesting, though, are the possibilities and issues for research in areas that go beyond the traditional experimental paradigm. For example, Postrel (2002) raises the idea of IT as a vehicle for aesthetic creation and communication. IT has considerably augmented our ability to copy, produce, reproduce, and distribute aesthetics. Digital photography, editing equipment, scanners, powerful and easy-to-use graphic applications, and Internet-based communication methods are just a few examples of how this is done. What are the psychological, organizational, economic, and societal impacts of this IT-based aesthetic revolution? Does the aesthetic use of IT promote self-presentation of individuals (Tractinsky and Meyer 1999) or of organizations? How do organizations and industries use aesthetics in their IT to create value and to compete in increasingly crowded markets?

A related question centers around how individuals and organizations use aesthetics to create, change or preserve their identity. Several studies have been conducted on this role of aesthetics in organizations (e.g., Rafaeli and Vilnai-Yavetz in press). One of the most fascinating behaviors on the Web is the downloading of skins in order to personalize one's applications, whether on desktops, PDAs, or cell-phones. Koepfel (2000) estimates that by the year 2000, more than 50 million skins had already been downloaded from the major skin sites. Current research in this area suggests that aesthetics plays a significant role in this domain as well (Blom and Monk 2003; Tractinsky and Zmiri in press).

The opening statement of this paper refers to theoretical notions from architecture, the oldest design discipline. The idea that architecture can serve as a reference discipline for MIS is not new (e.g., Lee 1991), but it is quite surprising to note how small of an impact architectural theory has made on the study of IT. A study by Kim et al. (2002) demonstrates the viability of this research direction in explaining online customer satisfaction and loyalty by the three Vitruvian principles. Clearly, IT research can benefit considerably from judicious use of theories in architecture and its related disciplines (e.g., urban and landscape planning).

Finally, aesthetic considerations should eventually be translated into actual blueprints for design activities. This will not be easy. Much effort had been invested in order to transform design activities in organizations to accommodate *firmitas* and *utilitas* requirements. Methods and techniques to advance user-centered design have been proposed, but attempts to integrate them into mainstream development methodologies in industrial settings were met with only limited success (Stewart 2003). Many still mistakenly treat interaction design as an afterthought. Appropriately adding another element (aesthetics) to the list of requirements will not be trivial. But the rewards may be worth the trouble: after all, "attractive things work better" (Norman 2004a, p. 17).

Conclusion

This paper identifies aesthetics as a neglected dimension of research in the area of information technology. There is abundant evidence to suggest that aesthetics matters in almost every aspect of human thought and behavior. The rapid proliferation of IT

and the increasing migration of applications from corporate and academic settings to everyday activities necessitate a much more rigorous attempt at understanding how IT and aesthetics relate. The research framework proposed here is far from being exhaustive. In the tradition of empirical research in IS, it identifies key variables and proposed relationships between antecedents and consequences of aesthetic evaluations of interactive technologies. However, many other research directions are also possible, some of which are outlined above. It is important to reiterate that the purpose of this work is not to suggest the predominance of aesthetic considerations over others. Rather, it is to advocate better balance of major design dimensions in IT, a balance that is much more pronounced in other design disciplines.

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