# Information Systems as a Reference Discipline for Visual Design


## Abstract

This paper proposes that information systems (IS) can serve as a reference discipline for visual design, and that visual design can reciprocate as a reference discipline for IS. This work offers a pluralistic framework of visual systems design (VSD), where the visual design discipline utilizes IS and systems development. Because the visual design discipline is part of the aesthetic paradigm and the IS discipline is contained in the positivist paradigm, we employ a multi-paradigm, theory-building approach to bridge these two paradigms and their constituent disciplines.

As systems become increasingly visual, we see benefits of an IS framework with visual components, such as in VSD. First, for visual designers who create systems interfaces, this approach provides a reference discipline with access to IS systems knowledge and resources, since the visual design discipline contains nothing comparable. Second, this approach can provide to IS a reference discipline of visual design, along with deep knowledge of visual designs and resources. Because the approach is bilateral, it provides a research setting where one can connect disparate areas such as visual design and IS, providing a useful way of more completely characterizing phenomena that cannot be explained adequately by a single paradigm.



**Keywords:** reference disciplines, framework, paradigm, bridge, pluralism, aesthetics, positivism, visual design, visual systems design

# Information Systems as a Reference Discipline for Visual Design

## Introduction

In IS there are two schools of thought in system interface design (Cyr, Head, Larios, & Pan, 2009). One holds that interface usability is the key, emphasizing a behavioral or cognitive focus (Venkatesh, 2006; Reber, Schwartz, & Winkielman, 2004; Teo, Oh, Liu, & Wei, 2003; Palmer, 2002). The second contends that attention to hedonic aspects of human-computer interaction, with human needs such as emotion, affect, and experience is important (Beaudry & Pinsonneault, 2010; Schrepp, Held, & Laugwitz, 2006; Agarwal & Karahanna, 2000). Hedonic IS research shows that the well-executed visual design of a website or any other information system has the potential to evoke responses in users, which subsequently impact their cognitive processes and behavioral intentions (Cyr, Head, & Larios, 2010; Cyr, Head, Larios, & Pan, 2009; Cyr, Head, & Ivanov, 2006). Because visual impressions are both instantaneous and persistent in memory (Lindgaard, Fernandes, Dudek, & Brownet, 2006), practitioners are encouraged to manage the visual impressions of their websites, because essentially, "… there is no second chance to make a first impression (Tractinsky, Cokhavia, Kirschenbauma, & Sharfib, 2006, p. 1080)." Together, visual designers and IT developers use their expertise to build more visually-appealing information systems.

Historically, visual design and IS were philosophically and functionally independent from each other (Tractinsky N. , 2006). Specifically, the former is rooted in aesthetics with loose links to science, whereas the latter is positioned as hard science, taking positivism as its dominant research approach. Examination of the visual design discipline produced insights.

First, aesthetics contends that people exhibit a fundamental preference for all things beautiful (Beryls & Lopes, 2006; Graham, 2003; Hofstadter & Kuhns, 1976; Runes, 1977; Copleston, 1962), where advocates have arrived at this conclusion through observation and reasoning. In practice, designers create visually appealing products based on classic principles derived from this innate human preference, conditioned by the personal taste and

requirements of the client (Krug, 2006; Lidwell, Holden, & Butler, 2003). When the visual designers are called on by IS developers to provide a visual interface, they apply the same aesthetic principles, conditioned by the requirements of the system user. User requirements are conditioned by the users' own experiences, and research indicates that users are continually increasing their visual sophistication through cumulative exposure to technology (Hartmann, Sutcliffe, & and De Angeli, 2008). As a result, a democratization of visual design has occurred through media exposure, because the public has gained a sense of the language of graphic design, delivered by technology (Postrel, 2002). The more visually sophisticated users become, the greater their demand for quality visual design (Tractinsky N. , 2006). Therefore, with the ever-increasing number of design-savvy users, research suggests it imprudent to overlook prospective users' informed visual preferences, lest the system fail to reach its potential (Cai, Yu, & Xu, 2008).

Second, aesthetics is theoretically and methodically different from hard science, even though many concepts are shared. By itself, aesthetics lacks the mechanisms needed to integrate visual design into IS research and the system development processes. Researchers familiar with aesthetics bemoan this deficiency, stating "(t)here is … an obvious lack of a scientific and theoretical foundation or framework to organize, communicate, and explain related ideas and concepts" of aesthetics—foundations necessary to achieve wanted user perceptions (Liu, 2003a, p. 1274).

The forgoing insights call for a guiding framework to help visual designers create systems that better serve user requirements and maximize system functionality, a framework that "elevates communication over expression, but without forsaking aesthetic values (Mullet & Sano, 1995, p. 9)." We recall the Baskerville and Myers (2002) proposition that the time has come for IS to become a reference discipline, and believe that IS could be a reference discipline for the visual design by offering the matured, rigorous, IS research and systems development methodologies.

Visual design research centers on a broad spectrum of visual concerns and characteristics, and its major contributions deal with appearance. When visual design

collaborates with technology, functionality is guided by the methods of an engineering component, such as IS (Rand, 1993). The method described by March & Storey (2008), enumerates six steps to achieving a IS research product: 1) identify and clearly describe a relevant organizational IT problem, 2) demonstrate that no adequate solutions exist in the extant IT knowledge-base, 3) develop and present a novel IT artifact (constructs, models, methods or instantiations) that can address the problem, 4) evaluate rigorously the IT artifact to enable the assessment of its utility, 5) articulate the value added to the IT knowledge-base and to practice, and 6) explain the implications for IT management and practice (p. 726). For the visual design discipline to enjoy a research process that can independently deal with functionality, it would need to embrace similar steps and include features such as experimental designs, technological measurement, sampling methodologies, survey design, interview strategies, statistical procedures and techniques (Germonprez, Hovorka, & Collopy, 2007). Currently, visual designers typically do not utilize the theory or the methodologies necessary to investigate the issues related to a systems product.

Therefore, this work posits that IS can serve as a reference discipline for the discipline of visual design. Conversely, researchers have suggested that the IT professions can benefit from the substantial knowledge of visual design in manipulating visual characteristics used in IT systems (Lavie & Tractinsky, 2004). To connect the disciplines, we believe a bridging framework is needed, thus relating aesthetics and science without jeopardizing either established visual design or IS guidelines. For this dual purpose, we propose a pluralistic research framework of Visual Systems Design (VSD) that embraces visual design and IS.

## Information Systems as a Reference Discipline for Visual Design

Conventional wisdom conceives of IS as a referring discipline where knowledge distilled from other fields are drawn upon to investigate IS- and IT-related phenomena (Baskerville & Myers, 2002). At this juncture, IS remains a relatively-young discipline for which mature theories, ideas, and methods borrowed from reference disciplines provide good guidance.

Current IS reference disciplines include management, computer science, engineering, management science, sociology, psychology, and others.

Over the past decade, IS has steadily built traditions and gained academic legitimacy, so that researchers now generally agree that IS no longer is a simple knowledge consumer, but has evolved into a recognizable discipline with core values and beliefs that distinguish it from other disciplines (Sidorova, Evangelopoulos, Valacich, & Ramakrishnan, 2008). Having matured into an autonomous discipline, some suggest that IS now is taking the next step, and has begun to emerge as a reference discipline that exports knowledge to other areas (Nambisan, 2003; Baskerville & Myers, 2002; Vessey, Ramesh, & Glass, 2002). Still, other authors claim that IS has not yet arrived at that stage of maturity. Wade, Biehl, & Kim (2006) are among those who claim that IS has yet to become an established reference discipline, although it has the potential to become one once it achieves the influence level (e.g., extra-IS citations) of other reference disciplines. Falling somewhere in between these two positions, Lee (2001) articulated that IS had assumed the role of a contributing discipline rather than reference discipline, because its influence level is not as high as that of a reference discipline.

We posit that in order to enhance the status of IS as either a reference or contributing discipline, IS needs to have something to offer—and IS research does have the potential to make such a contribution. In addition, the debate over whether IS has achieved the status of a reference discipline has begun. We can establish that IS has passed the milestone where it is now worth the research effort to explore where IS lies on the reference discipline continuum. With the debate in progress, two reference discipline qualifying questions arise: 1) has IS developed its own research tradition and perspective, and 2) does IS research have any interest and value for researchers in other fields (Baskerville & Myers, 2002).

Nambisan (2003) asserted that IS has the potential to contribute to new product development (NPD) research. First, he analyzed general motivations, qualifications, and implications with an implicit assumption that the emerging reference role of IS to NPD would be impossible or meaningless without satisfying these three conditions. Second, he maintained that the infusion of IT along the four NPD dimensions (process management,

project management, information/knowledge, collaboration, and communication) is a rich application area for IS theories, and could contribute to resolving NPD research issues when IS research solutions were applied (Nambisan, 2003).

We extend the frontiers of the IS discipline, and ascribe to the Bakerville & Myers (2002) proposal that IS has "come of age" (p. 1) and that it can now serve as a reference discipline for other fields. Nambisan (2003) has taken such a step. We similarly propose that IS can be a reference discipline for visual design, and we envision that the field's research outcomes could benefit visual designers.

Consistent with the forgoing evidence, the remainder of this section briefly explicates the general motivation, qualification, and implications of IS as a reference discipline to visual design. An in-depth discussion of where and how IS could bridge the disciplines is provided in a following section.

### Motivations

According to Nambisan (2003), one should understand the motivations that shape the market for knowledge exchanges between a reference discipline and a referring discipline. These motivations are comprised of demand-side factors and supply-side factors. The former emphasizes that a referring discipline, say visual design, needs to be motivated to embrace ideas from a reference discipline. The latter emphasizes that a potential reference discipline, say IS, needs to benefit from exporting knowledge to a new area. This perspective reveals that the flow of benefits between a reference discipline and its referring discipline are bidirectional. Similar to the NPD context, a reciprocal relationship is also necessary between IS and visual design, so that ideas may be exchanged in a long-term and stable discourse.

When IT (or IS) is necessary, visual designers need scientific insight to adequately address user requirements. Aesthetic beauty is an essential aspect of product design, adding value to the product (Hassenzahl M. , 2001). Although visual designers play a critical role in IS product development, their backgrounds typically do not include a deep knowledge of IS. The skills typical of a visual design and IS development team often contribute to a

communication disconnect, where the product suffers (Norman D. , 1998). When visual designers create IS products, an IS knowledge gap often exists--a gap which we believe could be filled by the IS tradition of rigorous theory and methodology.

Visual design has long been receptive to interdisciplinary collaborations due to its ubiquitous nature in products of all kinds (Norman D. , 1998). The German psychologist Gustav Fechner united science and visual design when he pioneered experimental aesthetics, developing methods for measuring sensory thresholds between physical stimuli and psychological responses (Fechner, 1876). More recently, marketing researchers embraced visual design research, investigating how design and product aesthetics influence people's product preference, purchasing decisions, and use behaviors (Holbrook & Huber, 1979). Further evidence of this collaborative tradition is provided by the establishment of the new research area of aesthetic engineering, which studies the integration of visual design into engineering (Norman D. , 2004; Liu, 2003a; Norman D. , 2002b). The cross-pollination between aesthetics and IS gives rise to visual system design where visual designers work in conjunction with IT developers to build visually-appealing information systems. The existence of such interdisciplinary relationships suggests that IS may serve well as a reference discipline to visual design.

### Qualifications

Maturity is necessary for a discipline to become a reference discipline (Wade, Biehl, & Kim, 2006). Baskerville and Myers (2002) state that IS has accomplished much in terms of internal development, maturity, and sophistication. For example, IS has its own recognized journals, professional societies, and academic conferences. As an indication of maturity, Nambisan (2003) observes that IS not only borrows theories and models from other disciplines, but it also adapts them to fit the IT context and, in so doing, often makes improvements. Thus, when other disciplines borrow from IS, they benefit from those improvements and the inherent rigor of the IS disciple. IS insists that interpretivist research manifest the same degree of deep knowledge and breadth of understanding as positivist research (Benbasat & Weber, 1996).

Interpretivism, which is an established research area of IS, shares a common base with visual design. Interpretivism posits that the methods of natural science are inadequate to social science; the interpretive researchers rely on their subjective expertise to interpret what they observe (Lee A. , 1991).

### Implications

While the interpretive approach is more popular in European IS scholarship, IS in the United States promotes interpretive studies in top journals (Markus & Lee, 2000a; Markus & Lee, 200b; Markus & Lee, 1999). The two approaches coexist in IS, which has explored a pluralistic, theoretical framework to integrate them. Inspired by this tradition, this paper proposes a pluralistic research framework where the positivism in IS complements the interpretivist area of visual design. IS can contribute its rigor and methods to visual design.

## Visual Design as a Reference Discipline for Information Systems

Just as we propose that visual design can benefit from IS theory, we also believe that IS and user-driven IS development approaches can benefit from a more thorough knowledge of visual design, which contains established visual methods that guide and respond to user perceptions. Without being trained in design attributes that contribute to visual appeal, some suggest that developers cannot systematically predict how perceptions affect user behaviors or how the users will respond (Liu, 2003a; Liu, 2003b).

### Speed and Persistence of Visual First Impressions

Research shows that individuals form strong opinions about visual displays almost immediately and that the associated evaluation can dominate the ensuing interaction. (Lindgaard, Fernandes, Dudek, & Brownet, 2006; Norman D. , 2004; Tractinsky N. , 2004; Pham, Cohen, Pracejus, & Hughes, 2001). Coltier (2001) observed, "The impression that your Website makes on a visitor in the first seven seconds can turn off a prospect for good… The initial amount of time (that users take to evaluate a site) drops as their expectations of sites becomes more fine-tuned (p. 49)." As a result, a visual system design must capture the potential customer's attention quickly and to hold it (Everard & Galletta, 2005/2006). The

speed that a visual impression is formed was established initially at 500 milliseconds (Tractinsky N. , 2004; Fernandes, Lindgaard, Dillon, & Wood, January 2003). In subsequent work, researchers lowered this time to 50 milliseconds—literally an instant—which suggests a pre-cognitive exposure effect (Lindgaard, Fernandes, Dudek, & Brownet, 2006). Furthermore, these findings showed a high correlation in the level of agreement between participants and the experiments (Lindgaard, Fernandes, Dudek, & Brownet, 2006). However, the authors stated that the difficulty of the task prevented them from determining what specific design attributes contribute to visual appeal. We believe that this difficulty is partly attributable to the absence of an IT framework of visual systems design. Lindgaard, Fernandes, Dudek, & Brownet (2006) emphasized that, because first impressions of visual displays form quickly and are consistent, system designers must learn to manage visual customer preferences to promote a buying transaction.

While aesthetic first impressions are instantaneous, affective, and precede cognitive processes, they are also long-lasting (Norman D. , 2004; Tractinsky N. , 2004; Pham, Cohen, Pracejus, & Hughes, 2001; Zajonc & Markus, 1982). Pham, et al. (2001) found that initial exposures to visual displays may have long-term effects on the viewer's impressions of the object, and may influence subsequent cognitive and interactive processes, resulting in a persistent, affective bias. Research also shows that users give more weight to negative visual attributes than to positive attributes, and that attributes have a strong influence on an individual's subsequent responses, even more than neutral items (Everard & Galletta, 2005/2006). Because negative visual impressions are more lasting, a poorly-designed visual interface can have at least two harmful effects: 1) failure to achieve the design objective, and 2) damaging the image and credibility of the visual system—possibly forever.

The required use of a system adds non-instantaneous, cognitive attitudes to aesthetic first impressions (Eagly, Ashmore, Makhijani, & Longo, 1991) because many factors potentially moderate first aesthetic impressions of an IT artifact (Tractinsky N. , 2004). In other words, individuals may view differently those systems of required use and optional use. For instance, company employees typically are required to use their company's systems.

Over time, system familiarity moderates the employee's memory of first impressions and numbs aesthetic sensitivity to the interface (Martindale & Moore, 1988). On the other hand, a prospective customer searching the web for a product implies different aesthetic requirements altogether. IT systems should attempt to carefully manage first visual impressions, because first impressions are critical (Tractinsky, Cokhavia, Kirschenbauma, & Sharfib, 2006, p. 1080)."

### Influence of Product Aesthetics on Consumers

Aesthetic beauty is an important asset for user products of all kinds. Marketing research found that the halo effect, triggered by a beautiful product design, positively influences a consumer's perceptions regarding additional product features (Cowley, 2000), thus confirming that aesthetics is a significant factor in the design of successful consumer products (Tractinsky, Katz, & Ikar, 2000). Marketing research has also demonstrated that aesthetics is relevant to all products, regardless of function (Holbrook & Anand, 1992; Holbrook & Zirlin, 1985). Consumers purchase the product that they perceive to be more aesthetically attractive, when given the choice between two products of identical price and function (Nussbaum, 1988; Kotler & Rath, 1984). Advertising research shows that photorealistic images communicate to the consumer in the same way that the physical product does, suggesting the importance for photographers of understanding the impact of aesthetics and impression (Artacho-Ramıirez, Diego-Mas, & Alcaide-Marzal, 2008). However, the broader association between aesthetics and overall impression suggests that product designers, sales people, and e-commerce/website designers should understand both the techniques and the limitations of product representation throughout the product design, development, and marketing processes (Artacho-Ramıirez, Diego-Mas, & Alcaide-Marzal, 2008). "The physical form or design of a product is an unquestioned determinant of its marketplace success. A good design attracts consumers to a product, communicates to them, and adds value to the product by increasing the quality of the usage experiences associated with it (Bloch, 1995, p. 16)."

Product aesthetics is often the only differentiating factor in crowded or mature markets (Artacho-Ramıirez, Diego-Mas, & Alcaide-Marzal, 2008; Tractinsky N. , 2006; Postrel, 2002). Norman (2002a) observed that attractive things were perceived by users to work better regardless of whether they really did work better or not. In addition, a customer's positive response to the design's aesthetics may improve his/her mood and overall impression of the system (Tractinsky, Katz, & Ikar, 2000). Not surprisingly, aesthetics and affective issues have become central to marketing and consumer behavior research. Visual aesthetics can influence consumer perceptions, which then affects the consumer's assessment of the product (Tractinsky & Rao, 2001).

Because visual design and IS overlap in the development of systems, both fields have something to offer each other. Hence, we believe it reasonable to foresee visual designers embrace IS theory and methodologies because they can improve the quality of the system. We also believe it reasonable that IS developers consider the benefits of the visual knowledge inherent in the visual design discipline.

## The Visual Systems Development Framework

This section describes a pluralistic research framework of visual systems design (VSD) that embraces aesthetic visual design and functional IT systems development. To construct the paradigmatic bridge, we take a theory-building approach by Gioia and Pitre (1990), based on formative paradigmatic research (Burrell & Morgan, 1979) and specific IT insight (Hirschheim & Klein, 1989), to bridge the aesthetic (visual design) and positivist (IT) paradigms Because visual design and IT are so different, we believe that this multi-paradigmatic theory-building approach affords a mechanism to study disparate areas such as visual design and IT. Our framework recognizes that bridging the visual aesthetic design discipline and the IT design discipline requires a transition zone.

The paradigms are continua, and the paradigmatic boundaries where they meet are blurred (Geertz, 1980). The transition zone is illustrated by the dotted vertical line, which is surrounded by a striped (blurred) region that extends for a short distance into the two

paradigms (see Figure 1). The boundaries are, limitedly, a permeable connection between two distinct philosophical areas: the ambiguous, subjective aesthetic design theory and the more precise, objective positivist IT systems theory. The distinct characteristics of the disciplines are not diluted but inform the contrasting discipline of concepts and techniques that are incomplete within one but present in the other.

Structuration theory provides a means to bridge the aesthetic (subjectivist) and positivist (objectivist) disciplines (Barley, 1986), and fills an intermediate position on the subjective-objective continuum, bridging the transition zone (Gioia & Pitre, 1990). Thus, the VSD framework bridges the aesthetic design construct, containing three ordered visual design dimensions, with the positivist systems development construct, containing three ordered IT systems development dimensions (Figure 1).

The problem of limited permeability at the transition zone is resolved when the two continua are overlaid with a common language and common methodology, thus forming the bridge. The three aesthetic dimensions of the VSD framework are fundamental premises of the visual design discipline and well-established in that literature: elements of visual design, principles of visual design, and factors of visual composition (Burrough & Mandiberg, 2008; Krug, 2006; Edwards, 2003; Mullet & Sano, 1995; Rand, 1993). The three positivist dimensions are premises of IT systems development (Iivari, Hirschheim, & Klein, 1998): factors of systems development, user outcomes, and owner value outcomes (Valacich, Parboteeah, & Wells, 2007; Valacich, Parboteeah, & Wells, 2006). The bridge is the philosophical mechanism that enables a free flow of concepts between the two paradigms, across the transition zone. Throughout the framework concepts flow effortlessly, bi-directionally, and are transformed as they move throughout the six dimensions. These flows extend across the transition zone, due to bridging layers of common language and methodology.

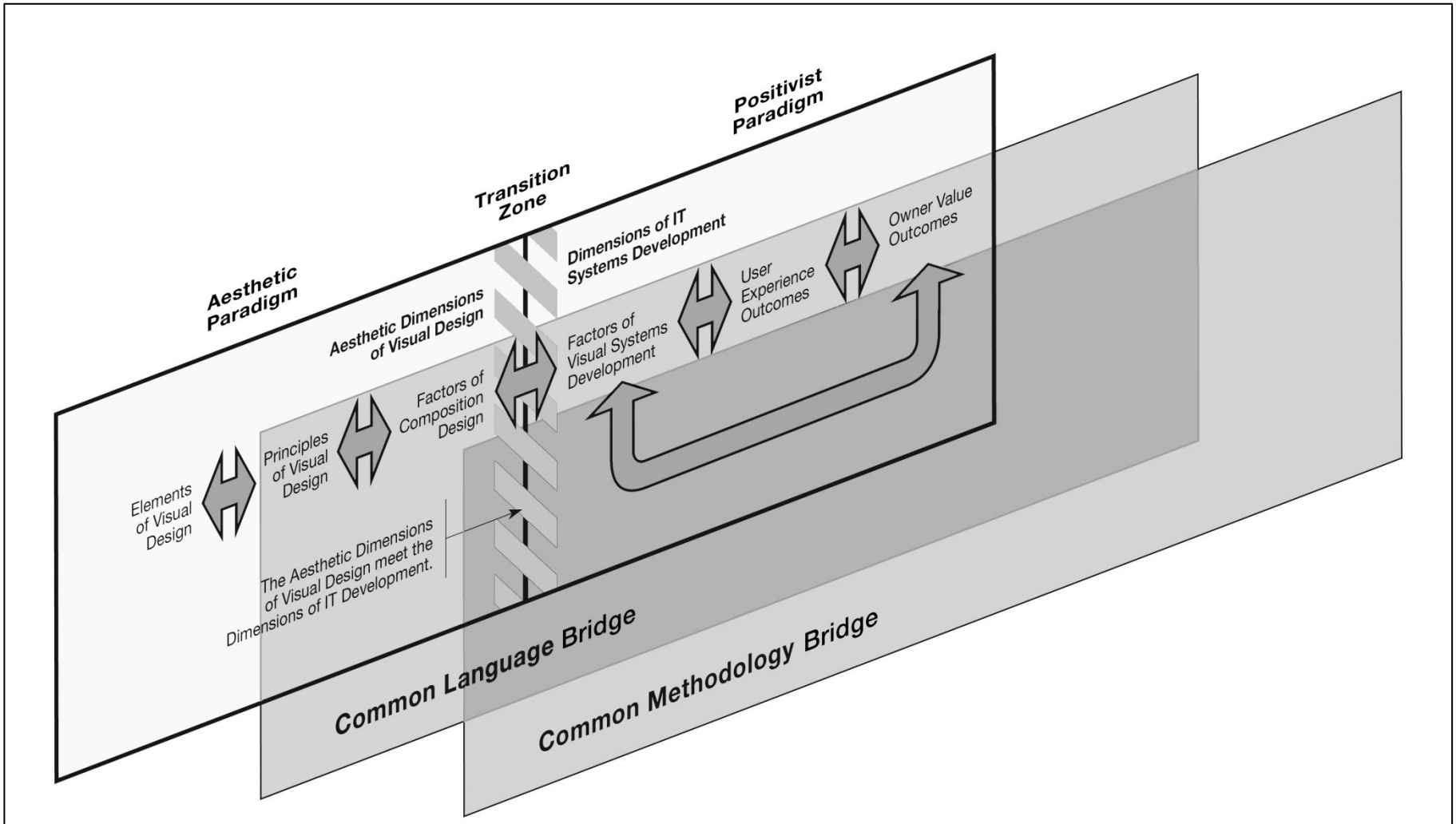


**Figure 1. A Pluralistic Framework of Visual Systems Design: Aesthetic and Positivist Paradigms Meet at a Transition Zone; 3 Aesthetic Dimensions and 3 Positivist Dimensions Bridged by Common Language and Common Methodology**

The common language bridge describes constructs, dimensions, and variables (the typology of variables is not included in this paper) in their native context, as well as their common language context. Accordingly, the native context of the framework descriptors is preserved, providing pluralistic insight into the original concepts as they are managed from the interpreted concepts. For example, color (an aesthetic element of visual design), has been studied as a design element by IT researchers (Cai, Yu, & Xu, 2008; Nadkarni & Gupta, 2007; Nass, Takayama, & Brave, 2006; De Wulf, Schillewaert, Muylle, & Rangarajan, 2006; Gruden, 2006; Hassenzahl M. , 2004; Rose & Straub, 2001), but primarily as a positivist variable primitive. Contrastingly, the aesthetic visual design context of color treats it as a complex element, rather than as a variable primitive; color has three primary qualities (hue, chroma, and luminance) and additional, related and occasionally-overlapping secondary qualities (tint, shade, saturation, complementary, associative, analogous, surface area occupied). In addition, visual designers do not consider elements, principles, and compositional factors of visual design to be dimensions, but they regard them instead as conceptual groupings of characteristics/tools that may be used alone or in combination to form higher order concepts and effects. Still, successfully testing color phenomena in positivism may require color being simultaneously classified as a positivist variable and contained within the aesthetic elements of design. Classifying color appropriately within positivism requires some basic aesthetic understanding of the nature of color, color theory, color qualities, and the effects of color as an element of design on higher-order design concepts. Ultimately, visual design effects initiated by color manipulations will transcend the transition zone to produce effects in the systems development dimension, and in user experience and owner value outcomes.

The VSD framework is characterized by ordered levels of increasing complexity, moving from conceptual primitives (elements of design) at the aesthetic extreme to synergistic outcomes (user experience and owner value) at the positivist extreme. This framework illustrates a connection between ambiguous, subjective, aesthetic design theory and the more precise, objective, positivist IT systems theory. This multi-paradigmatic

approach offers a way to study jointly disparate areas such as visual design and IT, and provides a useful way of characterizing phenomena that cannot be explained adequately from within a single paradigm.

## A VSD Framework Example

To illustrate the flow of concepts between framework dimensions, we briefly describe the effects of manipulating selected elementary variables as the concept effects flow through the framework. We number the dimensions from 1 to 6 (Figure 2), beginning with the dimension at the left end of the framework, the elements of visual design (dimension 1, or D1), and ending at the right end of the framework, with the owner value outcomes (D6). To illustrate a limited aspect of the common language bridge, we first note that the terms "elements," "principles," and "compositional factors" are native to aesthetic design, and used by artists and designers operating to identify the ordered, interactive, and often multiplicative characteristics of visual design. Similarly, the terms "construct," "dimension," and "variable" originate from positivist approaches and are used by IT researchers to develop theories and test hypotheses using the scientific method. While these two sets of terms evolved separately, in the framework they can be connected. Retaining the native aesthetic terminology (D1-D3), we also use the positivist terms "construct," "dimension," and "variable" to describe aesthetic characteristics. This provides a common language bridge between the two paradigms, as well as the visual design and IT disciplines.

For this example, we describe the research design of a simple experiment that we used during the development of the VSD framework. The purpose was to determine if visual systems users can detect effects of elemental changes at the aesthetic extreme of the framework in D1, through D2-D5, thus crossing the transition zone, and into D6 at the functional extreme of the framework. For this experiment, we selected a webpage from a commercial website for a small interior design firm. We selected this particular webpage because it showed characteristics of good visual design and because it was visually uncomplicated , had a low level of complexity, and a straightforward layout—characteristics

that we held constant during the experiment. Using the original webpage as the control, we created changed versions of the webpage using the D1 elements of aesthetic *value* (lightness or darkness) and *color* (hue and chroma) to test user perceptions of change from the original.

This conceptual experiment is important to illustrate the framework's flow of concepts, the increase of complexity, and the synthesis of elemental manipulation into product value, from the aesthetic beginning to the positivist end of the framework. We did not explore the associated typology of framework variables and sub-variables in this paper because it is important to make this initial link between IS and visual design. The following describes how the effects of manipulated aesthetic elements can bridge the transition zone and be detected in positivist *appearance* (D4), which in turn may affect *user experience* (D5), which in turn may impact the *system value* (D6) to an owner.

Concept flows between framework dimensions from left to right (from D1 to D6) would occur if the visual designer manipulated aesthetic *value* and *color* on the webpage (Figure 2). The independent variables, elements of design (D1) aesthetic *value* and *color,* are manipulated to produce a ripple of ordered effects on intermediate dependent variables through successive levels of the framework (D2-D6). Dependent variables affected are *contrast, emphasis,* and *balance* (aesthetic principles of design, D2), *focus* and *readability* (factors of compositional design, D3), *appearance* (a positivist factor of IT website development, D4), *user experience* (positivist outcome variable, D5) and *system value* (positivist outcome variable, D6). Because the starting location of this easily-perceptible visual change are outside the realm of traditional IT systems design methodology, requiring IT systems designers and researchers to acquire a basic understanding of all the affected terms is advisable. The variables' combined and often multiplicative effects strongly influence the *user experience* outcome and subsequently the *system value*.

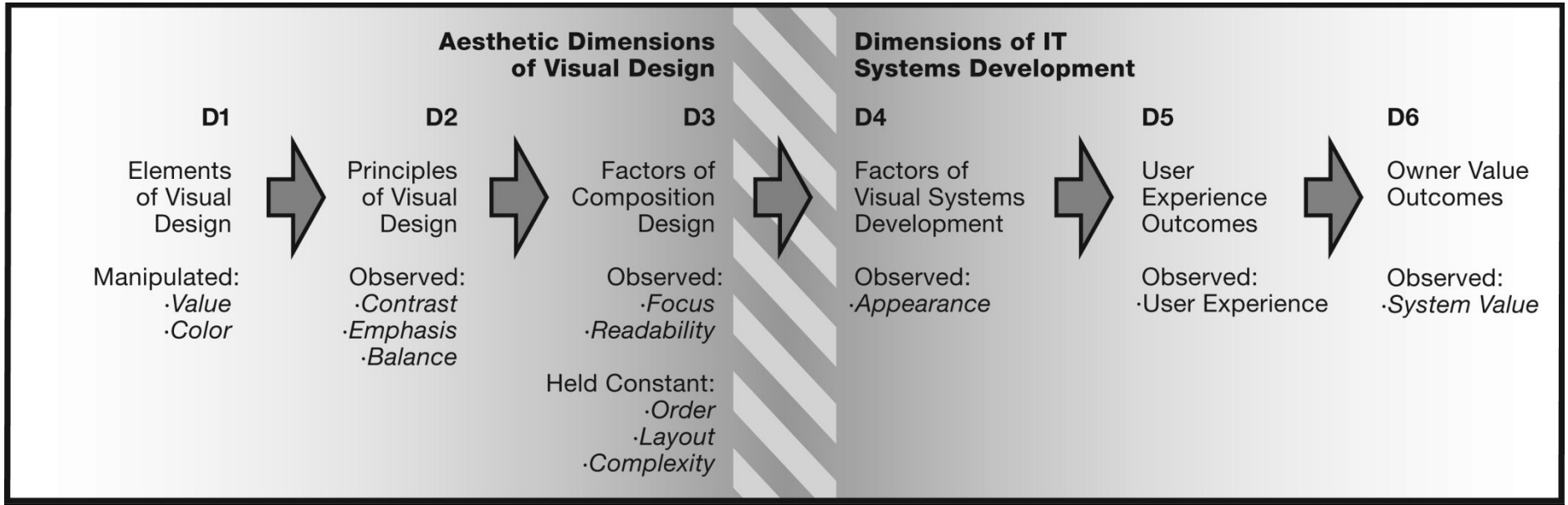


**Figure 2. A VSD Framework Example: Beginning with Aesthetic Dimension 1 (D1), Elements of Design Variables Aesthetic *Value* and *Color* are Manipulated; Concepts Flow through the Framework (D2-D6) and across the Transition Zone (D3-D4); Changes of Aesthetic *Value* and *Color* (D1) Ultimately Affect *System Value* (D6); the Owner Evaluates *System Value* and Can Dictate Additional Changes in Aesthetic *Value* and *Color* (and Intermediate Variables), reversing the Concept Flows**

Concept flows between framework dimensions in the opposite direction (from D6 to D1) would also occur if the system owner (D6) were to determine, based on concept flows from user experience (D5) input, that the webpage colors or values were unacceptable for any reason in various dimensions. One reason might be that the user perceived the webpage's *appearance* (D4) to be unsatisfactory, perhaps because of its poor *readability* or deficient visual *focus* (D3). The *appearance* and *readability* may have been adversely affected by the poor value *contrast* or misplaced *emphasis* on textual characteristics, or even the poor color *balance* of background images and foreground text (D2). To correct the perceived webpage inadequacies, the designer would be instructed by the owner, through the appropriate channels of the organization. The designer would iteratively adjust the aesthetic *value* and *color* (D1) on the webpage to achieve the directed result. The change process would also affect other intermediate dependent variables, and ultimately increase the economic *system value* (D6) of the webpage to its owner. The system owner would evaluate the *system value* primarily using positivist financial and technical measures, while the visual designer would manipulate aesthetic *value* and *color* based on sound aesthetic practice and theory. However, the system owner would exercise subjective assessment, as well. Both the subjective and objective ways of managing the integrated developmental processes and associated dialogue would be contained in the common methodology bridge. Ideally, the free flow of concepts throughout the framework is effortless and bi-directional, leading to an optimal Visual Systems Design.

## Discussion and Conclusion

This paper is a partial response to Baskerville and Myers (2002)'s view that IS now is emerging as a reference discipline. We take a step further and argue that IS can be a reference discipline to aesthetic disciplines that depend upon IS (such as visual design) by infusing its research tradition into the aesthetic domain. We offer the VSD framework as a research context because it bridges these two disciplines that have much to offer each other. We believe that the VSD framework functions as a starting point. As more and more visual

designers embrace a rigorous IS based research approach, the ideas behind this framework can be applied in a more general design context, exerting stronger external influences.

In this paper, we first analyze why IS should be the reference discipline for aesthetics. In terms of motivation and implication, professional visual designers need IS based research approaches to cater to users' requirements that are missing in their own fields. While we agree that IS needs to exert more external influences in pursuing discipline legitimacy, aesthetics appears to be a good option due to its interdisciplinary nature, which makes it easier for IS to step in. By exporting knowledge and having it examined in a new domain, the ongoing perfection of the field is ensured. From a qualification perspective, the internal maturity of the IS field is necessary for being a reference discipline. Moreover, while IS both embraces positivism and interpretivism, a high level of rigor has been achieved in these two approaches. Compared with other fields, IS has more advantages to be a reference discipline as it enjoys the tradition of reconciling and integrating these two schools of thought. We proposed a pluralistic research framework where the positivism in IT development functions is a good complement to the "interpretivism-like" visual systems design, a framework suggesting that IS could be referred by the aesthetics.

## Implications for Future Research

Because the VSD framework enables visual designers to better understand user experience and its subsequent outcomes (shown by the left-to-right flow), and to refine their design works based on user responses (shown by the right-to-left flow), it provides a foundation for theory and guidelines that will result in better visual systems. In future research, this VSD framework should be followed by a pluralistic typology of characteristics (variables) and qualities (sub-variables) to fill in the framework's six dimensions.

It is our desire that this paper encourage more IS researchers to engage in the intellectual discourse with the aesthetics. The positivist system development constructs such as system outcomes (e.g., use benefits), behavioral intentions (e.g., user attitudes, intention to use), user

beliefs and perceptions (e.g., trust, cognitive absorptions, perceived ease of use) are all potential interrelated topics brought into the new domain along with the positivism approach. The VSD framework is a first step at extending the frontiers of IS to the aesthetics. In this paper, aesthetic visual design is grounded in two dimensional theory and 2D illusions of three dimensions. In the same vein, the positivism approach in IS can further expand the discipline boundaries by being related to a 21st-century IT sensory systems design that involves 3D visual design, music and sound, animation, and other sensory framework additions.

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