Gestalt Theory, Engagement and Interaction

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Abstract
This paper presents a design exploration [5] research project in which principles derived from Gestalt theory were applied as a framework for guiding human-computer interaction (HCI). The analysis contained within examines how a Gestalt approach to HCI can be used to enhance engagement and promote user interaction. The concepts discussed in this analysis are supported by a series of informal user observations.

Keywords
Gestalt theory, user interfaces, design

ACM Classification Keywords
I3.6. Methodology and Techniques: Interaction

General Terms
Design, theory

Introduction
The project described in this paper explores how Gestalt principles can be used to target human perceptual and cognitive processes in HCI. We argue that the result of this approach is an enhanced sense of engagement for the user, as well as an interface that promotes user interaction. For brevity, we adopt Laurel's [8] definition of engagement, as having

"cognitive components, but it is primarily understood as an emotion" (p.113). Likewise, user interaction is defined as any physical action of a user with a designed object or environment. The remainder of the paper proceeds with a description of our methodological perspective and research context, and then a brief introduction to Gestalt theory and survey of related HCI research. Following this, the paper contains a theoretical analysis of an example graphical user interface (GUI)[1] with implications for practice. Finally, we conclude by addressing areas for future research.

Methodology and Research Context

Design exploration research differs from both design practice and conventional design research in that it "typically is driven neither by how well the product fits into an existing or expected future market, nor based on the observed needs of a group of users. Rather, design becomes a statement of what is possible, what would be desirable or ideal, or just to show alternatives and examples" [5] (p.7). The exploratory aspect of this project investigates how principles derived from Gestalt theory could be applied to guide HCI.

The research context for our investigation stems from an interactive composition in which Gestalt theory served as the primary factor for content selection. Specifically, the content of the composition is a product us considering how an oft-cited tenet of Gestalt theory – *the sum of the parts is different from the whole* – could be used to convey one's sense of self. To support our efforts, we engaged Gestalt principles as means to structure the user's interaction with this content.

[1] Link to example GUI: http://robertfraher.com/SelfPortrait/

Gestalt Theory and Related Research

Gestalt theory originated in the field of psychology and attempts to describe how humans make sense of their perceptions and cognition [11]. A fundamental Gestalt principle is the Law of Prägnanz, described as "when people are presented with a set of ambiguous elements (elements that can be interpreted in different ways), they interpret the elements in the simplest way" [9] (p.120). Gestalt principles have guided research in many fields of study including education, visual communication, business management [7,1,2,10].

Within HCI, much recent research has explored applying Gestalt principles to improve screen layout [4,6,12]. Chang, Dooley, and Touvinen [4] applied ideas related to the Law of Prägnanz (symmetry, continuation, closure, proximity, similarity, etc.) as means for improving a multimedia interface for nurses learning about wound care. Yang and Klemmer [12] developed a software tool to automatically generate screen layouts for hand-held devices based on the associated concepts of simplicity, structuring (proximity), and proportion. While both of these projects investigated Gestalt principles as means for improving the perceived aesthetics of an interface, little consideration was given to how users' cognitive processes might be benefited. Flieder and Mödritscher, however, propose Gestalt theory as a foundation for a visual language that could be used to align users' perceptions and cognition during interaction [6]. This research expands upon the ideas mentioned above by combining Gestalt theory with pattern methodology and linguistic categories. While yet incomplete, this visual language intends to offer a structure in which Gestalt principles can be employed deliberately to enhance meaning and improve understanding.

Analysis and Implications

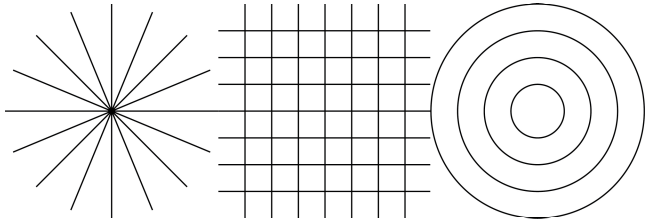
The example GUI analyzed in this paper demonstrates application of Gestalt principles as a framework for targeting human perceptual and cognitive processes. The analysis progresses chronologically through two phases of the GUI's development in an attempt to highlight how theory is activated through method. The first phase focuses on applying the Law of Prägnanz [9] as a means for engaging the user. The second phase examines how Arnheim's theoretical framework of centric and eccentric systems can be used to promote user interaction [2].

The first phase of development dealt only with static design. This involved layout of the four images that make up the GUI's main collage (Figure 1). To guide this process, we researched Gestalt principles that offered insight on the arrangement of related objects. We identified the Law of Prägnanz as a tool for achieving an interesting juxtaposition of these images. Lidwell, Holden and Butler [9] describe the visual influence of this principle as "a tendency to interpret ambiguous images as simple and complete, versus complex and incomplete" (p.120). The effect of this principle accounts for the experience that test users described regarding their tendency to try to unify two or more of the images that comprise the collage. The result of this effect is an enhanced sense of engagement for the user. This engagement is a function of what Gestalt psychologists describe as the human tendency toward sense making. By deliberately targeting this instinctive process, designers can leverage the resulting engagement to facilitate communication of a product's message or bolster a user's emotional response to an interface. As Barry [3] explains, "Given [an] inherent bias toward accepting what we see as true, it is not so surprising that we should also have developed a sense of play around it: […] we delight in perceptual riddles" (p.25).

Figure 1. Main four-part image collage.

The second phase of development involved transferring the static design of the first phase to a dynamic interactive medium. This included conceptualizing how the GUI would invite and react to the user. To guide this process, we researched theories of visual perception that showed promise for promoting user interaction. We identified Arnheim's theory of centric and eccentric systems as a framework for creating an environment that allowed for development of tension and resolution. The ideas of centricity and eccentricity each represent psychological perspectives. As Arnheim [2] explains, "The proper ratio between the two must be found for existence in general as well as for every particular encounter between the inner and outer

centers. […] The tension between the two antagonistic tendencies trying to achieve equilibrium is the very spice of human existence. […] Neither total self-centeredness nor total surrender to outer powers can make for an acceptable image of human motivation" (p.2). The fact that this composition is a self-portrait alludes to the self-centered attitude that characterizes centricity. More, the decision to organize the composition by externally contrived societal concepts speaks to the outward-looking nature of eccentricity. Visually, the concepts of centricity and eccentricity can be represented by sunburst and grid patterns, respectively (Figures 2 and 3). Alternatively, centricity can also be depicted through a series of concentric circles (Figure 4), the key being a unified source of origin. Whereas, eccentricity is defined by multiple points of interest, each dependant on others for its existence.



Figures 2, 3, and 4. Centric sunburst, eccentric grid, and centric circles.

Within the GUI's main collage, the tension inherent between centricity and eccentricity is leveraged to promote initial user interaction in two ways. First, informal user observations indicate that the strong eccentric arrangement of the collage consistently encouraged users to investigate with the mouse. Users who were exposed to a version that started with a centric arrangement (the collage being resolved to any one of the four images) either took significantly longer to initiate interaction, or refrained altogether, explaining their passivity as "expecting a video or something". Second, upon mouse-over of the collage, a conflict internal to the GUI is initiated between forces striving for a singularly focused field, and those preserving one of multiplicity (Figure 5). In all observed cases, use of centric-eccentric conflict as a feedback mechanism motivated users to click the mouse button.

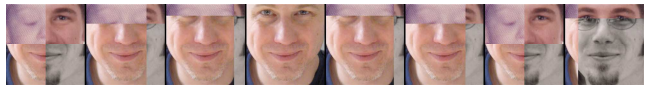


Figure 5. Centric-eccentric conflict.

The result of combining the two systems of centricity and eccentricity in an interactive medium is an exaggerated instance of what Arnheim [2] describes as "the viewer as influence". Thereby, the relationship between the properties of an interface "that are contributed by the work's inherent pattern [and] those effected by the viewer's own behavior" (p.44) can be dynamically affected. Thus, tension develops between users' centric motives and the GUI's eccentric relationship to those motives. The result is interaction as users seek to resolve and explore this tension. By deliberately targeting this inclination, designers have a device to both initiate and sustain user interaction in situations where users otherwise might lose interest.

Upon mouse-click of any of the main collage's images, the collage is dissolved and the entirety of that image is revealed. This change is accompanied by on-screen

buttons indicating linear navigation options, and supplementary text (Figure 6). By positioning these linear navigation buttons at opposing angles, the intended effect is to combine the visual conventions for forward and backward with the concept of centricity.

Figure 6. Linear navigation and supplementary text.

The resulting rotational navigation (Figure 7) emphasizes centricity, as the images now rotate around a common center. However, this unified point of origin is not within the field of the GUI. Instead, it is outside the boundaries of the interface, implicitly reflecting the centric motives of the user.

Figure 7. Rotational navigation.

As a means of contrasting this centricity, supplementary text is added to reinforce eccentricity. This effect occurs on two levels. Visually, the text supplies additional points of focus. As well, each block of text describes an abstract societal concept. In regard to the effect text has on imagery, Arnheim [1] asserts, "By such categorical names, language can codify changes of classification which an object undergoes in practice. […] Such a change in function is accompanied by a definite perceptual restructuring" (p.239). This perceptual restructuring emphasizes eccentricity, as it transfers users locus of consideration from an internal perspective, as related to the centricity of the rotational navigation, to an external perspective, as related to concept that is presented. Further, links are found within the text to external Web sites and extra images, reflecting additional eccentricity.

The resulting eccentric dominance can be equalized by user interaction in two ways. First, users can engage the GUI's centric rotation, and transition to the next image. Second, users can click the presented image, and return to the conflict of the main collage.

Test users consistently demonstrated intuitive understanding of the afforded interactivity. One user offered a particularly insightful observation, "When I clicked the forward button, it was obvious that system was in transition, giving me a breather, and then was going to give me more to do".

Areas for Future Research

As described above, a Gestalt approach to HCI offers a tangible benefit with regard to creating an enhanced sense of engagement for the user, as well as an interface that promotes user interaction. Immediate

future research will address applying this approach to guide the development of an interface with more conventional parameters than the example GUI discussed in this analysis. However, we believe that the implications of this style of approach go well beyond cultivating interaction.

Throughout our experience conducting this research, the concepts of centricity and eccentricity consistently emerged as having potential to function as a framework for analyzing many diverse aspects of HCI. For example, we believe these concepts could be used to offer a theoretical perspective on the relationship between an interface's user-centered and task-oriented characteristics. A preliminary investigation might consider any evidence of balance between these ideas across a range of common or successful products, such as Apple's iPod® click wheel. Other research might explore applying the visual patterns associated with centricity and eccentricity (Figures 2, 3, and 4) to represent the stages of task operation (initiation, feedback, cancel, completion, closure). The resulting graphics could be used to aid user understanding of system status and/or as a visual tool to assist a product's development team. Along these same lines, we believe the concepts of centricity and eccentricity have the potential to inform the interpersonal dynamics between the diverse members of multidisciplinary teams common in HCI. These ideas might be used at the beginning of a project to establish mutually agreed-upon standards for collaboration. As well, they could be used to arbitrate instances of conflict amongst team members.

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