

Mapping Graceful Interaction Design from Dance Performance

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Abstract. Graceful interaction is one of the several forms of aesthetic interaction that have been proposed to enrich the quality of user experience. In this paper we discuss the refinement of the concept of graceful interaction by mapping physical dance movement into graceful interaction. We argued that graceful interaction has deep roots in organic bodily rhythms and the social conditions which help structure them. To gain a further understanding of graceful interaction we compared physical dance movement with the conception of graceful interaction. We conducted a literature analysis on pertinent aesthetic concepts used in interface design, followed by an interview with an art performance expert to gain an understanding of pertinent graceful concepts in art performance. An interpretive analysis was then conducted to produce mappings of graceful interaction concepts from art performance to graceful interaction features based on an interaction quality framework.

Keywords: aesthetic experience, movement interaction, graceful interaction design, HCI.

1 Introduction

Research in HCI has shown that aesthetic factor in interactive products affect the user's judgment about usability in terms of the user perspective of the systems usefulness and the product appeal when considering the overall quality of experience offered [1], [2], [3], [4]. The concern for user experience is not limited to the production of quality user experience but also address the effort to foster core human values such as aesthetics in movement. It has been argued that interaction that involves movement design elements in graceful interaction is a form of aesthetic interaction [5],[6]. However the concept of graceful interaction in movement has not been explored further. This paper addresses the conception of graceful interaction from the artistic perspective.

2 Aesthetics in HCI and the Research Motivation

The pioneering work of visual aesthetics in HCI of [1] has led to other aesthetic research in HCI ranging from aesthetics appeal in information display to aesthetics of interaction. The concepts and vocabulary of aesthetics have much to offer to HCI since they emphasize qualities and issues that HCI is obviously concerned with in interaction design. This includes qualities of experience, beauty, enlightenment, form and meaning, taste and judgment and many others. This section discusses the literature on aesthetics in HCI and the motivation behind this research.

2.1 From Philosophical Perspective of Aesthetics to Technological Perspective of Aesthetics

As aesthetics is more dominant in the field of arts its subjective view is discussed heavily in the literature. According to philosophers, human pursuits can be fundamentally categorized into the pursuit of truth, beauty and good and right [3]. The pursuit of beauty falls under the subject of aesthetics where its issues are mainly discussed within the realm of aesthetics philosophy of arts until Kant's Critique of Judgment established aesthetics as a discipline [4]. Philosophers differ in terms of believing whether aesthetics judgment is independent or dependent of its utilitarian or instrumental value. Following the paradigm of pragmatism, [7] while agreeing with [8] argued that aesthetics is a particular kind of experience that emerges in the interplay between user, context, culture and history and should not be seen exclusively as a feature of either the artifact or the viewer and will lead to the firm foundation from which to explore concepts such as playfulness, surprise and enchantment. The pragmatist paradigm is also adopted by [9] to understand people's interaction with technology. Within the context of IT artifact engineering the subjectivity or objectivity of aesthetics needs to be addressed [10]. Subjective concepts of aesthetics such as aesthetics perception [2], perceived visual attractiveness/appeal [9],[10] and aesthetics experience [6] have been developed and used. Objective concepts of aesthetics are discussed in [11],[12] where aesthetics ratings based on semantic differential scale were used to show the relationship between aesthetics and usability of products. However the finding from these work are currently insufficient to illustrate how aesthetic values inform the process of functional engineering design and later be used to evaluate IT artifacts aesthetic quality. Here we argue that an understanding of the artistic nature aesthetics must be appreciated before hand.

2.2 Technological Determinism and Aesthetics Cultural Values

Advocates of technological determinism are concern with how a technology tends to dictate its users' behaviours which may slowly diminished the human agency. When considering the view on technopoly, [13] insist that culture should define tools and not vice versa. This view aligns with the humanist view on the changing intensities of habits that affect the life experience [14]. Value-sensitive design is premised on a growing consensus on the needs to also include criteria that embody or at least help

foster core human values [15]. This idea that revolves around how software can influence or persuade users by altering their beliefs about preferable conduct is a subject matter of value-sensitive design. Simultaneously the movement on slow technology is set to curb some of the damaging effects of excessive technologies in human life by trying to promote slower or less extreme interactions through reflection and moments of mental rest [16]. Since aesthetics is a kind of experience that emerges in the interplay between user, context, culture and history [7], it is interesting to consider how can a society retain and preserve its cultural values when its younger generation are fascinated by the technology of speed as seen for example in the use of computer games and other IT uses. For instance a society that treasures graceful mannerism may fear the erosion of this culture when their younger generation are exposed to technology that shapes them into global users thus forgetting their own cultural values. This interesting issue motivates us to explore different forms of interactions with the computer in particular on aesthetics interaction with a focus on gracefulness.

2.3 Aesthetics Experience and Aesthetics Interaction

Aesthetic experience is often associated with human experience with art performance like dancing, singing and other art performances. Aesthetic experience is defined by [17] as a particular state of mind that is characterized by a focus on a certain object which engages and fascinates a subject, whereas all other actions in the environment are excluded from consciousness. On the other hand, aesthetics interaction refer to the qualities of a design that lead to the feelings, emotions and the behaviours that result from bodily types of interactions [8]. In other words to project an aesthetic experience, an aesthetic interaction must be designed. Aesthetic interaction has been a subject of interest in the industrial design as reflected in the work of [6] and [18]. The importance of aesthetics in interaction design has been argued both from the philosophical stance and the psychological perspective [16]. As we have witnessed for a while aesthetics took a back seat to make way for usability in the early era of HCI as reflected in the work of [1],[2],[3]. The Vitruvian principle of *firmitas*, *utilitas* and *venustas* that originated from architecture has been argued to be the theoretical framework that can be used to understand the creation of digital space [19] where *venustas* can be addressed through concepts of beauty and delight. As the interest in experience design grows aesthetic interaction becomes an important subject matter when considering the design of aesthetics experience by product designers. Aesthetics interaction design cares about the aesthetics experience when users interact with an interactive system [20].

2.4 Motion-Based and Movement-Based Interaction

The HCI literature does not show clear distinction between the terms motion and movement except they seems to differ in terms of the context of use. Motion refers to general movement in the abstract disregard of efficiency or efficacy while movement refers more narrowly to the mechanics of how the human body moves. However in the past HCI literature the term motion and movement has been used interchangeably

in motion-based and movement-based interactions. For instance in [21] the interaction is known as motion-based but in actual the motion referred to here is the human movement in Tai Chi was the subject of the study in the interaction design.

Motion is a distinct element of digital media and is being used in the design of user interfaces, interaction and experiences. Within the usability paradigm, the term motion is used for instrumental purposes, such as giving feedback or attracting user attention for instance in the navigation through mobile devices [22]. However, motion is less understood in terms of a design element for affective quality. On the other hand, movement-based interactions are interactions where movements of the human body are direct input to technology and movement interaction was initially approach from a task-based perspective. The common movement interaction is the eye movement-based interaction [23] and body movement-based interaction in games [24] that takes place either through a flow or brute force movement [25]. Though movement-based interaction allows the user to control the interface due to body movement, research on movement-based interaction has explored further into the phenomena of immersion as a form of experience design [26] as movement is not solely functional but highly experiential [27].

2.5 Aesthetic Interaction in Gracefulness

Gracefulness is discussed in Plato's Republic as a quality of attractiveness that can be observed in buildings, living things and human actions and movement [28]. Gracefulness in human encompasses posture and movement. However, according to Plato though gracefulness can be faked, true gracefulness is a reflection of a harmonious soul which is a target of quality of life endeavours [28]. In presenting the idea of simple living, [29] presented the concept of graceful living where he considered gracefulness as an achievement of the aesthetic of being as argued out by. It is seen in the rhythmic flow that follows the human pace in either a slow or fast dance or in other human action of performing task such as having a meal that is not entirely due to hunger but also requires an appreciation of the food serve. The structure of gracefulness resides in the characteristic of the person and is exhibited through specific pattern of behaviours. The dimensions of gracefulness are not isolated but exist in interacting facets. Communities in the Asian culture relate gracefulness to body movement in the dance and mannerism. These communities remain enthusiastic towards preserving gracefulness for its cultural identity. In the context of value-sensitive design, the question that arises now is whether there is a similar situation of gracefulness when interacting with computers which allow the human users to indulge in so that a coherence of action is seen in the physical world and the computer world.

In HCI, the notion of graceful interaction was first discussed in the context of speech user interface where the subject is graceful speech [30]. Graceful interaction was also explored in the context of intelligent environment to understand how the human make sense of the disappearing user interface [31]. The Laban Movement Theory was applied for the design of movement-base interaction in [32] and human full-body movement as interaction modality in [33]. Graceful interaction meant for web user interface in the context of product emotion was first proposed by [5] using

the Laban Movement Theory. Later, a theoretical framework based on the Laban Movement Theory was proposed in [6] to determine possible design elements of graceful interaction. Graceful interaction in movement is argued to be a possible form of aesthetic interaction and thus can be added to the typology of aesthetic interaction extending from the work of [20]. The typology of aesthetic interaction is illustrated in Figure 1 after adapting the work of [20]. Nevertheless, more effort is needed to establish graceful interaction.

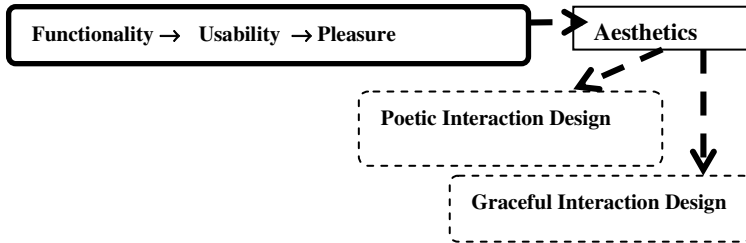


Fig. 1. Aesthetic Interaction Typology

3 A Refinement of the Conception of Graceful Interaction

An interaction model must have the capability in terms of its descriptive power, evaluative power and its generative power. Its descriptive power is the ability to describe a significant range of existing interfaces; its evaluative power is its ability to help assess multiple design alternatives and its generative power, is the ability to help designers create new designs. However to achieve that, a clear conception of the interaction model must happen first. This section describes the effort to refine graceful interaction through an artistic perspective following the method of design science. The refinement of graceful interaction concept was done through a literature review on aesthetics, an expert interview with an art performance academic who is also a choreographer and an interpretive analysis to produce mappings of art performance to graceful interaction features.

3.1 Review of Aesthetics Concepts Used in Interface Design

To gain the understanding on the relationship of aesthetics and interaction in interactive systems design, aesthetics in HCI is conceptualized in terms of the pragmatic account of human experience where feelings, emotions, and thoughts is the focus of design [5]. The literature on aesthetics is reviewed. Aesthetic concepts that have gained acceptance in interaction design are summarized in Table 1.

Table 1. Aesthetics Concepts in Interface Design

Aesthetics Concepts	Interface Design Concepts	Authors
Functionalism & Usability	Efficiency	[33]
Coherency	Coherency	[21],[34]
Emotion & pleasure	Emotion	[3]
Pragmatism	Sensing	[7]
Somaesthetics & Tangibility		[7], [9]
Provocation & Criticism	Criticism	[35]
Playfulness, Intrigue & Challenge	Playfulness	[8]

From the summary the interface concepts of coherency, emotion, sensing and playfulness appear is argued to be more aligned towards elements of gracefulness.

3.2 Interview with Art Performance Expert

In this work, the art performance of dance is used as the basis to understand movement for graceful interaction as dance performance is a form of aesthetic experience. The reason for choosing dance is because dance isolates dynamics more than any other performing art, but it also has a long tradition and a formal structure [37]. The clusters of criteria for good performance such as the flow of the movement, the choice of figures and formations used in the choreography, the complexity of the movement, the social interaction that takes place within the movement, the physical activity level of the movement and the quality of specialness or uniqueness exhibited by a movement can be used to gain an understanding of graceful interaction. This seems to have more resemblance to the interface concepts of coherence, emotion and playfulness.

An academic who is an art performance expert in dance and theatre was interviewed to gain an understanding of graceful interaction from the artistic perspective with a focus on dance. The theme, key questions asked and the response received are summarized and tabulated and shown in Table 2.

From the interview the following interpretation on beautiful dance movement that evokes emotion was made. The aesthetics of the dance performance lies in the beautiful movement of the dancers. In a beautiful dance, that dancer is able to express an emotion that can be felt by the audience. However the performer's ability to express emotion is dependent on the characteristic of the performer. It seems that beautiful dance movement can evoke emotion if the dancer is able to express the emotion he/she felt. This finding is in agreement with [17] who discussed the impact of the formal characteristics of the dance movement on the subjective experience of the dance performer that influence the success of the dance performance. Similarly, [36] discussed the criteria for good performance such as the flow of the movement, the choice of figures and formations used in the choreography, the complexity of the movement, the social interaction that takes place within the movement, the physical activity level of the movement and the quality of specialness or uniqueness exhibited by a movement. These clusters of criteria for good performance support the expert

answer on defining successful performance and aesthetic in performance. A further discussion of the interpretation is presented in the following section.

Table 2. Theme, Key Questions and Response

Theme	Questions	Response
Performance Art (Dance)		
Aesthetics	What is <u>aesthetics</u> in the art performance context?	<u>Beautiful in movement</u> / action and <u>emotion</u> in whatever character she/he performing (good or bad character, music, costumes, etc.)
Static vs. Dynamic	What is <u>static</u> in art performance?	There is no such thing as static in art performance. Although the performer is performing at only one spot of location his/ her body is still <u>moving</u> .
Component/ Object	Does an <u>individual or group</u> performance matter in aesthetics of dance?	Important element is the body of the performer. Body act as main tool in the performance since movement & <u>emotion/expression</u> in performance is perceived individually although it is a group performance
Factors	What are the <u>factors</u> that contribute to successful performance?	Performer must have <u>emotion</u> / expression & <u>movement</u> which can be <u>felt</u> by audience. Overall concept (inclusive of costumes)
Performer		
Emotion	What are <u>performer's feelings</u> when performing?	It depends on the <u>character</u> of the performer.
Audience		
Background	Audience background	Knowledgeable audience/have knowledge and experience about performance
Stickiness	When audience stay longer or comes back	Back to the successful factors of performance

3.3 Mapping the Dance Performance to Graceful Interaction

The concept of graceful interaction is now mapped accordingly to the dance performance and the mapping is shown in Table 3.

Graceful interaction is interpreted as the movement of a beautiful form (dancer, costumes) that evokes emotion of the audience. By taking the view of the Interaction Quality Framework of [18] three perspectives (Table 4) of graceful interaction is discussed.

Table 3. Mapping of Dance Performance and Graceful Interaction Features

Features	Art Performance	Graceful Interaction
Interaction	Dance movement	Movement of objects/ artifacts & users
Aesthetics	Character played, costumes, music, movement flow, choreography	Visuals, sound, movement quality
Performer	Performer	Interface object; User
	Emotion of performer	Emotional appeal
Audience	Audience	User
		Other audience/ observers
Success	Staying on	Stickiness
Indicators	Coming back for more	Repeat visit
Success factors	Performer must have emotion that can be felt by audience	User emotional style
	Overall concept	Holistic design

Table 4. Mapping of Dance Performance and Graceful Interaction Features

Perspective	Art Performance	Graceful Interaction
Product	Performer	IT artifact/ interface
Person	Audience	User
Unity	Performer & Audience	Graceful interaction

The first is the product perspective, the second is the person perspective and the third is the unity perspective (unity of product and person). The interpretation is performed while taking note that the aesthetics experience that emerges from graceful interaction will be the interplay between the user, the interface object (IT artifact) and the context according to [5] and this fits with the unity perspective. This means that graceful interaction should not be seen exclusively as a feature of either the IT artifact (interface) or the user or viewer. As expected, movement appears to be important in graceful interaction and it has an emotional appeal to its audience/users and is in agreement with interface aesthetics concepts of [5], [8], [9]. The movement performed must be felt by the user. In addition graceful interaction also needs to be supported by visuals and sound (context). A graceful interaction object must have an emotional appeal through its visual, movement, sonic and environment (other parts of the interface) to give a holistic effect of graceful interaction. It can be interpreted that graceful interaction is an emergence of the user, the artifact and their unity.

4 Mapping Graceful Interaction Design Features

In terms of movement quality, the design elements of [6] that are derived from Laban Movement Analysis are next used to describe the movement feature of the interface object and the user movement quality features. The graceful interaction elements of the artifact of interaction are rhythm, tempo, sequence and direction while the user movement quality is interpreted as three main quality concepts: balance in the uniformity and diversity of movements, the attention towards the interaction (leading to

stickiness) and expectation (ability to see patterns). Balance, attention and expectation can be related to interface concepts of coherence [22]. As graceful interaction involves the engagement of the user with the interface object graceful design elements can be translated accordingly and is shown in Table 5.

Table 5. Mapping of Graceful Interaction Design Elements into IT Artifact Movement and User Movement Quality

Design Elements	IT Artifact: Movement Feature	User: Movement Quality Features
Rhythm	{calm, dynamic}	Balance the uniformity and diversity
Tempo	{fast, slow}	Attention towards the interaction
Sequence	{animation, rotation, zooming} <i>cause-effect, ordered pattern of events</i>	Expectations which is the ability to see patterns
Direction	{{upward, downward}, {forward, reverse}}	Attention towards the direction of the interaction

4.1 Discussion

As discussed earlier, in pragmatist aesthetics experience emerge from the interplay between the user, the context and the culture. In our work we proposed that graceful interaction involves the unity of the user and the interaction. A movement of graceful interaction can only happen if there is an evocation of user's emotion. An important design consideration for graceful interaction is harmony of the artifact (interface) and the user/audience in the design to fulfill the unity criteria. As in the art performance, the knowledge of the audience on the performance makes a different effect on the performance. This implies the user emotional model cannot be ignored in the design of graceful interaction. However in this work we have not address the cultural context of the interaction.

5 Conclusion

In this work the conceptualization of the design method for graceful interaction is discussed based on interpretive work on the literature and expert interview. Graceful interaction features has to be integrated with the user affect model as graceful interaction is an emergent design. Future work on graceful interaction will involve empirical studies to validate the graceful interaction features and the incorporation of the user model in graceful interaction.

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