Interactionist Approach to Visual Aesthetics in HCI

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Abstract. Visual Aesthetics has gathered interest among scholars in HCI research. The growing interest stems from examinations of the aesthetic-usability effect ("what is beautiful is usable"), and possibly vice versa. Thus, numerous studies focus on understanding how we make sense and experience visual entities in interacting with technology. However, theoretical, and methodological stances vary, which impact conclusions of the studies conducted, and thus, affect design implications. Visual experience research in HCI lacks detailed conceptualizations of the constituents of visual experience and understanding of how these conceptualizations affect the overall research results through implicit methodological stances taken. In this paper, an overview of methodological stances to visual aesthetics in HCI research is presented and an interactionist approach is discussed which combines objectivist and subjectivist methodological stances and enriches our understanding of current research of visual aesthetics in HCI. In addition, methodological grounds of interactionism are described and extended from cognitive processing fluency paradigm to take into account the overall complexity of visual experience. Moreover, conceptualization of visual experience from cognitive-affective perspective in line with interactionism is discussed, following with metodical considerations of interactionism, and issues related to the role of visual stimuli in examining visual aesthetics in HCI.

Keywords: Visual aesthetics, Visual experience, Methodology, Interactionism, Human-computer interaction

1 Introduction

Visual aesthetics in human-computer interaction (HCI) is a growing sub-discipline within HCI research. As a sub-discipline of HCI, visual aesthetics started to gain interest from the mid-nineties. Often referred publication by Kurosu and Kashimura [41] indicated a positive relationship between aesthetics and usability. Noam Tractinsky continued this line of research with a publication titled "What is beautiful is usable" [83]. Since then, vast amount of research has been devoted in understanding the relationship and dynamics between aesthetics and perceived usability in technology-interaction, also titled as the aesthetic-usability effect. However, differing research results have been presented of the interplay between these constituents of visual experience.

Many different disciplines have concentrated on examining the dynamics of visual experience. Still, visual experience remains an intriguing research topic, despite of the multitude of research devoted to examination and explication of it. Different methodologies have been presented to disclose the contents of visual experience. However, it is not unambiguous how the contents of the visual are formed and how these are represented in different contexts. Visual experience is a complex phenomenon involving different underlying cognitive and affective processes, contributing to the formation of an overall experience. Visual representations elicit aesthetic, affective and, symbolic meanings [e.g., 9, 11, 38, 40, 63].

Visual experience as a cognitive-affective process considers visual experience as a conscious mental phenomenon involving various cognitive and affective processes, such as, attention, perception, creativity, apperception, and mental representations with information contents [69], as well as aesthetic appraisal [76]. The conceptualization of visual experience as such is in line with contemporary accounts to philosophy of aesthetics, where visual experience involves cognitive and affective processes, and the experience process is seen as an interpretative play with various stages [8]. According to traditional accounts of aesthetics, aesthetic experience is considered as an immediate response without intervening reasoning [e.g., 49, 71, 82]. This line of thought represents a different paradigm in examining visual experience than the contemporary one.

The formation of visual experience includes both top-down and bottom-up information processing [e.g., 74, 32]. In the core of visual experience are mental representations consisting of mental information contents, which can be of non-perceivable kinds, such as timeless and imaginative [66-69, 77]. Represented mental information contents are informed by the properties of the encountered technological artifacts and can be seen as the parts of experience that makes the encounters meaningful to the users [74]. To represent something as, for example timeless, requires a process of seeing something as something. This refers to the concept of apperception [27, 34, 68, 69].

Apperception integrates already existing mental information contents and new information into meaningful mental representation. Visual experience is not only formed on the basis of 'perceivable' sensory information, but also on existing mental information obtained in prior experiences [66, 68, 69]. Therefore, apperception is not mere perception, but unifies experiences. Visual experience differs from the concept of aesthetic experience in that it does not posit experience qualities (e.g., aesthetic experience as an exceptional state of mind), but indicates that visual entities are capable to elicit different experiential contents.

Several studies in HCI approach visual experience from an objectivist point of view, focusing on visual entities in technological artifacts as determinants of aesthetic experience [e.g., 4, 36, 46, 57, 84]. Another viewpoint to visual experience research approaches the phenomenon from subjectivist perspective [e.g., 43, 54], in which visual experience occurs in top-down processes of the perceiver. However, according to the definition of visual experience stated above, an interactionist approach combining objectivism and subjectivism is necessary.

Visual experience occurs in the intersection between the objectivist and subjectivist approaches. Visual experience as a process is informed by the components of visual representations with an interactionist approach that expands the traditional view of the information processing paradigm to visual experience as a cognitive-affective mental phenomenon. Theoretical and methodological research positions need to be explicated because these fundamentally affect operationalization of the studied phenomenon, metodical choices, as well as the results from which visual design implications are derived from. Thus, interactionist approach combining the objective and subjective accounts to visual experience in HCI is required to investigate the underlying dynamics of visual experiences, and to inform visual technology-design enabling understandable and experiential encounters with technology.

Structure of this paper is as follows, next objectivist, subjectivist, and interactionist approaches are presented. Then, methodological and metodical considerations are discussed following a discussion concerning the nature of stimuli on HCI research. Lastly, conclusions are presented.

2 Objectivist, Subjectivist, and Interactionist Approaches

Recent research approaches examining the relationship of visuality of technological artifacts and visual experience include two main approaches: objectivism and subjectivism [e.g., 1, 32, 73, 74]. Objectivism (also titled as screen-based design approach) is utilized in discovering bottom-up design factors affecting aesthetic experience and identifying design elements and their structural relationships in technological artifacts (e.g., web pages) that influence user experience [4, 26, 36, 57, 61]. If research is grounded on the object properties as the focus of attention, then the research approach is objectivist [e.g., 5]. Thus, objectivist, bottom-up approach to visual experience [e.g., 20] emphasize properties of visual stimuli in guiding visual attention (e.g., saliency of the stimuli) [28], and the Gestalt laws [37, 86].

Objectivist approach can be utilized in designing for usability and has been beneficial in outlining usability design guidelines [e.g., 19, 43] but is questionable of examining visual experience including aesthetic appraisals. If objectivism is utilized as an approach to detect visual design properties as determinants to create aesthetic experiences, the design would need to address a vast number of design combinations and solutions with a wide range of individual differences in preferences.

At least since Plato, critical contributors to beauty have been examined and specific visual features have been suggested to elicit aesthetic experiences, which has led to identification of some visual constructs that often contribute to perceived beauty, such as symmetry and balance [2, 21]. Plato's view to beautiful objects includes a combination of proportion, harmony, and unity. According to Aristotle universal dimensions of beauty are order, symmetry, and definiteness. Gestalt psychologists proposed, for instance, symmetry and balance as contributors to beauty [2, 21].

More recently, researchers of visual aesthetics in HCI have studied visual experiences with objectivist approach [30, 52, 53, 57, 58]. Research indicating formal, objective attributes that determine aesthetic appeal to be used for automatic composition

of displays have been conducted [e.g., 57]. For example, symmetry and balance in images affect appraisals of aesthetic appeal but the positive relationship between aesthetic appeal and symmetry weakens when examined with more realistic, context-dependent stimuli [4]. Research area of computational aesthetics can be considered to follow the objectivist approach in detecting visual user interface elements and compositional structures (e.g., symmetry and visual clutter) essential to be acknowledged in designing for pleasing visual experience [30, 53, 65].

Several dimensions of aesthetic appeal have been presented. Dimensions range from visual elements [e.g., 12, 35, 55, 75], higher-level attributes [e.g., 23, 24, 26, 62, 85], multisensory experiences [48, 59] to experiential contents [e.g., 33, 74]. These dimensions include for example, overall impression, meaningfulness, and beauty [72], classical aesthetics (aesthetic, pleasant, clean, clear and symmetrical), and expressive aesthetics (creative, using special effects, original, sophisticated and fascinating) [43], and simplicity, diversity, color, and craftsmanship [54].

Objectivist approach has been criticized as universalistic due to its theoretical grounds that aesthetic laws are engrained in objects [39], and thus, would not have explanatory power in explaining visual experiences in different individual and cultural contexts [39, 50]. In addition, formal aspects of objects can be considered as secondary issues in experiences, as for example, Csikszentmihalyi [10] argues that formal features only seldomly make objects valuable to their owners, as people do not perceive formal attributes (e.g., order or disorder in composition) according to mathematical principles. Despite the evident subjective and context-dependent nature of visual and aesthetic experience, research continues examining formal features of aesthetic properties in technological artifacts.

The second approach in examining the relationship of visuality of interactive artifacts and visual experience is from top-down perspective [43, 54]. This subjectivist approach can be described with the saying 'beauty is in the eye of the be-holder'. Different to the objectivist approach, subjectivist approach is often studied with self-reports, such as questionnaires [73]. Majority of visual aesthetics in HCI research approach visual experience from subjectivist accounts. Different questionnaires have been developed in examining subjective contents of aesthetic experience [e.g., 43, 54].

The third approach, combining the objectivist bottom-up and the subjectivist top-down approaches is interactionist approach. This approach has not been utilized as much as the other two in examining the interplay of technological artifacts and visual experiences [73]. Interactionism in examining visual experience is based on cognitive processing fluency paradigm: “beauty is grounded in the processing experiences of the perceiver that emerge from the interaction of stimulus properties and perceivers' cognitive and affective processes" [64], Thus, visual experience is to be considered as a relationship between an object and a subject, rather than an essence to be grasped or determined by on object [16].

3 Methodological Considerations

What research issues are emphasized in different eras represent current values of that time. This also affects methodological decisions through which constructs, and concepts of different phenomena are examined and measured by. In addition, technological artifacts are affected by the experiential interaction goals valued and pursued in the time of their creation. Currently, visual experience research in HCI focuses on aesthetics of interaction and emotional design with emerging interest on the role of multiple senses in user experiences.

The complexity of visual experience and aesthetic appraisal research is affected by the instability of aesthetics and the difficulty of measuring it. Aesthetic experiences, appraisals, and values change in time, which also have an impact to the concepts with which visual experience is examined [e.g., 8]. Thus, value and belief systems of different eras influence the operationalizations of studied phenomena. A change in measurement unit indicates a change in belief and value systems, which further affects what is designed and how, and to whom. Changes in measurement units lead to new views on design implications and therefore has an impact on research practices. For example, in urban environment design the measurement unit has shifted from cars to humans, which has emerged a new design paradigm.

In HCI research different methodological positions can be explained with intentionality (relating to ontology) and causality (relating to epistemology), in terms whether intentionality and causal explanations are expected. This way of defining methodological positions can lead to four different positions: behaviorism, cognitivism, neuroscience, and subjectivism (Figure 1) [31]. Intentionality is a feature of mental state that represents something and is about something [14]. Thus, intentional mental states include mental contents of what is represented [67]. Objects can be seen differently in terms of intentionality. For example, what is in the focus of a perceiver. Same technological artifact can be mentally represented with various mental contents by different people, depending for instance, on personal goals and desires. Causality explains events via cause and action. In HCI research, the concept of interaction refers to a causal relationship between a technological artifact and a human [31].

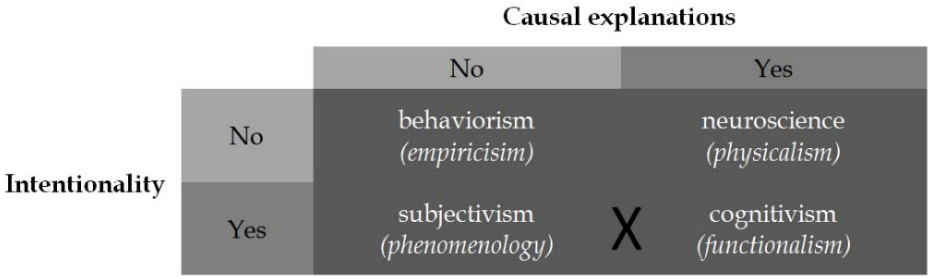

Fig. 1. Four methodological positions in HCI [31].

These methodological positions can be utilized in HCI research to explicate underlying assumptions of studied phenomena. Without explication of methodological position phenomenon under investigation can lead to contradictory results and not to measure the phenomenon actually in question.

In behaviorism the focus is on observable and objectively measured events [78]. Explication of a studied phenomenon follows explanations from stimulus to response, not focusing on what happens in the mind of a subject. In visual experience in HCI research behavioristic stances are often conducted (also not explicitly indicated as such). Behavioral approaches can be utilized in studying mental events, such as visual experiences, if strong cognitive theory functions as the basis formulating research problems. Thus, by explicating the phenomenon under investigation, the strength of the solutions to the problem is dependent on the capacity of the utilized constructs of concepts, facts, and laws [31, 42, 69, 70].

Traditional accounts to cognitivism conceptualize human mind as a computer [e.g., 18]. Paradigms of capacity and cognitive information processing fluency have originated from the metaphor of mind as a computer. The mind processes information similarly to a production system such as a computer with sensory input and motor output responses [56]. Neuroscience takes a physicalist stance to human thinking in terms of the brains. Intentionality is considered as a physically observable function in human nervous system. A contrasting stance to neuroscience is presented by subjectivist approach based on phenomenology, which indicate that scientific ontologies depend on how we experience the world. According to Heidegger [22] and Husserl [27] the core idea in phenomenology is to examine the structure of experience. The methodological position in line with phenomenological view is referred as subjectivism because it emphasizes the importance to focus on the experience of the subject. In subjectivism intentionality means that people have mental representations, and these representations have mental information contents [68]. Human behavior and experience can be examined and explained by studying represented mental information contents.

A stance originating from phenomenology is constructivism. In the core of constructivism is an understanding that experiences are not passive observations but involves active interpretation. In HCI, and especially from the viewpoint of visual experience, both cognitivism and phenomenological positions are intertwined in experience research. It seems that the most suitable form of subjectivism in the study of visual experience is in line with Fodor's [15] notion of cognition being saturated with perception, and thus, all that can be known is determined by one's own epistemological framework. Interactionism is thus methodologically positioned between phenomenology and cognitivism (illustrated in the Figure 1 with an X-mark).

4 Metodical Considerations

A solid investigation of visual experience in HCI as cognitive-affective phenomenon necessitates an interactionist approach, combining the objective and subjective accounts to visual experience. Interactionist approach can advance HCI research to un-

derstand experience formation in more detail, bring more predictability in connecting design decisions to experience goals [32] and to inform technology design enabling understandable and experiential encounters [74]. Examining mental information contents of visual experiences with an interactionist approach, objectivistic accounts can be utilized in detecting visual elements of object properties as a starting point in eliciting certain kinds of experiences. Explicating experiences solely from objectivistic perspective does not provide sufficient explicatory basis for visual experiences due to the deterministic and universalistic foundations of objectivism.

Visual representations constructed of perceivable elements elicit different mental information contents in people interacting with technology. However, this diversity of represented mental information contents in visual experiences does not posit that knowledge of visual experiences in HCI could not be obtained. Even though represented mental contents are highly subjective (i.e., meaningful information contents apperceived in technology interaction affected by already existing information contents [e.g., 74], with careful operationalization of the constructs, qualitative dimensions (also non-perceivable kinds, such as timelessness and imaginativeness) attributed to the properties of technological artifacts can be examined.

Although experience is subjective (and often private) it can be approached and explicated by verbalization and obtained with interviews and protocol analysis [3], and with questionnaires [13]. To study and explain visual experiences of technological artifacts different methods can be used to obtain knowledge of visual experiences from different perspectives. In terms of interactionist stance acquiring objective and subjective data is desirable to avoid interference of metacognitive processes and to be able to connect artifact properties and experiential contents.

The need for strong theoretical underpinnings of visual experience is two-fold. In scientific research, only theoretically sound basis for operationalizing measures and discussing the results can yield useful understanding, which goes beyond single case studies. The same applies to design pursuits. Although examining how specific technological artifacts are experienced on a case-by-case basis has its benefits in informing design, this benefit is often limited to the narrow context of a certain object in investigation and on specific experience goals. Therefore, it is important in HCI design to understand the concepts of design and visual experience.

Various overlapping concepts have been used to conceptualize and operationalize measurements of visual experience. Often in HCI research the operationalization of aesthetics to be measured is conducted with a one-dimensional construct (especially in examining the aesthetic-usability effect), for example, as 'low' or 'high aesthetics' [83], pleasant or unpleasant [79], or non-appealing or appealing [80]. In these examples, the methodological grounds of visual and aesthetic experience are also unexplicated. Due to methodological lacks contradictory research results are to be reported, which also affects understanding of the phenomena and future research. It is, however, possible to posit methodological grounds from which the concepts studied are defined from and then operationalized to be measured. Thus, explicit operationalizations of utilized concepts with methodological positions are needed to advance theoretical and methodological grounds of HCI research and to produce reliable results of visual experience.

For example, dimensions of visual experience can be extracted with an Osgoodian method, where participants report their impressions of stimuli using Likert or semantic differential scales containing various adjectives. The responses are analyzed using factor analysis, which reveals latent dimensions of affective experiences [60]. Overall. different methods are needed, both objective (e.g., reaction times, eye-tracking data) and subjective data. Deductive, theory-based hypotheses can reveal certain aspects visual experience and inductive explanatory approaches can reveal other aspects. For example, a set of affects can be posited as measurement units based on results of previous research indicating elicitators of visual properties appraised as pleasurable in some specific design contexts. Through a combination of objective and subjective data visual experiences can be understood and explained in more detail.

5 Considerations of Stimuli

In addition to the theorical and methodological considerations presented, the role of visual stimuli affects visual experience research in HCI. Often in visual aesthetics in HCI research visual stimuli are websites and mobile user interfaces. However, it is to be considered whether the stimuli can be titled as an aesthetic stimulus or should be comprehended as visual stimuli. Often the starting point is that the stimuli is titled as aesthetic, even though visual would be a more descriptive conceptualization if the formation process of visual experience is considered. If the selected stimuli would be titled as an aesthetic stimulus, it would be judged on its aesthetic qualities via some criteria or labelled as a stimulus that is considered to belong the aesthetic artifacts determined by the art world. In addition to user interfaces, visual stimuli in HCI research include maps [44] and, for example, icons [29, 51]. These visual representations are not commonly considered as "aesthetic stimuli", for instance in the research area of psychology of aesthetics [81]. However, the research approaches utilized in examining visual experience in HCI often follow similar research procedures as in empirical aesthetics (to which research in psychology of aesthetics often is based on). Therefore, classifying some visual stimuli as objects of design, art, or hybrids (between art and design, or combining these), plays an important role in selecting procedures and partly determines the research paradigm to which the research belongs to.

In models explicating the process aesthetic appraisal and aesthetic judgement [e.g., 45] the starting point of the process is the recognition of the stimuli as an object of art, for an aesthetic experience to occur. Majority of research conducted in visual aesthetics in HCI research is (whether implicitly or explicitly) in line with procedures undertaken in empirical aesthetics and psychology of art. However, the operationalizations of the studied phenomenon are not explicitly linked to the methodological foundations of empirical aesthetics [6, 7], even though the research problems and settings are similar. Thus, due to the nature of visual stimuli in HCI research, visual experience research in HCI would not be considered to belong to this research paradigm. This is partly explainable of the industry relations of HCI [47], which does not emphasize needs for basic research.

Recently, discussions of the role of aesthetic stimuli between ‘art with a lower-case a’ (e.g., popular culture) and ‘art with upper-case A ‘(e.g., fine arts) have emerged. These considerations include views of examining experiences of technological (design) artifacts and representations of belonging to the research paradigm of empirical aesthetics [45, 81], or to philosophy of design aesthetics [17]. At times, design objects (not technological ones per se) have been studied as representatives of aesthetic stimuli [e.g., 25] similarly as objects of fine arts.

However, according to methodological stance of interactionism technological artifacts in HCI can be experienced as aesthetic and elicit similar appraisals as in encountering objects of art, because the experience is not in the object but occurs in the interaction between the user and the technological artifact. To put in other words, visual experience does not lie in the physical properties of an object but occurs in perceiver’s mind informed by the properties of an object in attention. A stimulus is not therefore the sole determinator of the formation of visual experiences.

6 Conclusion

What visual experience is conceptualized to be determines the methodological position of the research. The explicated methodological position in examining visual experiences functions as a determinator to further research positions, operationalizations, and the chosen methods in investigating the phenomenon. Interactionism as a methodological approach to visual experience research in HCI combines objectivist and subjectivist approaches.

From an objectivist point of view (i.e., bottom-up approach), visual experience formation focuses on visual entities and their relations as determinants of aesthetic appeal [e.g., 4, 57, 84]. Visual experience from subjectivist perspective (i.e., top-down approach) posits top-down processes as the core experience occurrence [e.g., 43, 54]. Interactionist approach is based on the view that ‘beauty is grounded in the processing experiences of the perceiver that emerge from the interaction of stimulus properties and perceivers’ cognitive and affective processes’ [64]. Thus, interactionist approach combines objective and subjective accounts to visual experience. Interactionism is extended from cognitive processing fluency paradigm with the explication of visual experience as a mental phenomenon [74]. In addition, interactionist approach to visual experience research does not differentiate between the nature of the stimuli, because aesthetics is not within the object, but occurs in the interaction between the stimuli and the perceiver.

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