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1 AUTHOR:

Paul Locher
Montclair State University
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Contemporary experimental aesthetics: State of the art technology

Paul Locher
Department of Psychology, Montclair State University, Upper Montclair, NJ 07043, USA;
e-mail: locherp@mail.montclair.edu

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Abstract. The purpose of this essay is to provide the reader with a brief overview of several recent person-artifact-context relational models that explain the complex interaction of the processes that underlie an ongoing aesthetic experience with visual art forms. Recent progress towards a comprehensive understanding of these processes has been made possible in large part by experimental approaches that take advantage of recent advances in computer technology and electronic sophistication. To illustrate this point, three experimental techniques at the forefront of the field of experimental aesthetics are highlighted here. They include the investigation of viewers' body postural adjustments to depicted pictorial depth and movement in paintings; the use of hand-held computers known as personal data assistants to record audience members' on-going emotional reactions to live performances of dance; and the contribution of audio tour information to museum visitors' interaction with and aesthetic evaluation of sculptures and paintings. Finally, the eMotion: Mapping Museum Experience project, which has the potential to make a tremendous contribution to the understanding of the complex interaction of factors that contribute to a museum visitor's experience, is described.

Keywords: experimental aesthetics, aesthetic experience, posturography, personal data assistants, audio-augmented guided museum tours.

1 Introduction

Theoreticians and researchers working in the field of experimental aesthetics have in the last decade emphasized that the sensory, perceptual, and cognitive processes that underlie an aesthetic experience with visual art are driven by a complex interaction among characteristics of the art object, the viewer, and the physical, social, and historical contexts in which the experience takes place. Progress towards a full understanding of the nature of an encounter with art, therefore, depends on deepening our understanding of the complex interplay among these factors and processes. However, given the many factors known to contribute to the cognitive and emotional reactions to an artwork, one might assume that it would be very difficult, if not impossible, for science to subject aesthetic phenomena to rigorous experimental scrutiny and identify the underlying interactive processes involved. But, in fact, researchers in the field of experimental aesthetics have in recent years begun to make tremendous strides in doing just that due in large part to the application in aesthetic science of recent advances in computer technology and electronics. Neuroimaging techniques and other psychophysical methods have also provided insights into biology's interactive contribution to an aesthetic experience. This extensive body of knowledge has been used by theoreticians to create comprehensive information-processing stage models of aesthetic processing as well as frameworks describing the important variables that influence a viewer's interaction with art.

The purpose of this essay is to provide the reader with a brief overview of some of these recent person-artifact relational models. Additionally, I highlight three experimental techniques at the forefront of the field of experimental aesthetics to illustrate how contemporary aesthetic science is contributing to an evaluation, clarification, and extension of these frameworks. They include the investigation of viewers' body postural adjustments to depicted movement in paintings, the use of hand-held computers known as personal data assistants to record audience members' on-going emotional reactions to live performances of dance,

and the contribution of audio tour information to museum visitors' interaction with and aesthetic evaluation of sculptures and paintings. This article is a very truncated version of a much more detailed account of the state of the art of contemporary experimental aesthetics, including models, experimental techniques, and findings, published in two chapters by this author (Locher in press–a, in press–b).

2 Contemporary models accounting for aesthetic experience with visual art forms

Conceptual models and frameworks that have appeared in the literature to explain aesthetic judgment and appreciation of visual art tend to focus on either the factors that influence aesthetic experience or the underlying neural, perceptual, and cognitive processes involved in such an experience. Jacobsen (2006) has proposed a framework for the psychological study of aesthetic processing of artworks that consists of seven multilevel and highly interrelated factors that should be investigated when studying the nature of an aesthetic experience. These factors, which have been identified by a long history of experimental research, include: (1) the *Body* or biology's contribution to our understanding of aesthetics revealed chiefly by recent advances in cognitive neuroscience; (2) the structural qualities, or *Content*, of the artifact; (3) the *Person's* individual processing characteristics and preferences; (4) the time and place at which an aesthetic experience occurs, that is, the *Situation*; (5) changes in aesthetic behavior over time (*Diachronia*) from the perspective of evolutionary biology and cultural and ontogenetic development; (6) the vantage point of comparisons within a given time segment (*Ipsichronia*) with focus on social processes, cultures, and sub-cultures; and (7) the *Mind* as represented by contemporary psychological theories and models accounting for aesthetic experience with art. Of course, no one study can incorporate all of these factors into its research design, and many investigations including different combinations of the various factors are needed before a comprehensive explanation of how an aesthetic experience with a certain type of artifact can be achieved.

Bacci (2011) has recently written that the aesthetic object that one contemplates as an observer is the result of the complex interaction of many of the same factors included in Jacobsen's (2006) framework. She suggests that because of this complexity, it may in fact be virtually impossible to fully evaluate the behavior and aesthetic reaction of an observer in front of original art in a museum or an electronic or paper reproduction of it in a setting such as a research laboratory. One key reason for this according to Bacci is that the viewer of an artwork lacks a "period eye". This concept, introduced by the art historian Michael Baxandall (1972), asserts that people living within a certain historical time and culture share ways of thinking that influence how they perceive, understand, and respond to visual images, including art. Thus, Bacci asserts that we can be certain that the cognitive mechanisms of Rembrandt's contemporaries, to take one artist as an example, triggered by the perception of one of his paintings functioned in a significantly different way when compared with museum visitors looking at this work today. With respect to viewers interacting with art created in the modern period for which they have a period eye, a considerable body of research demonstrates that yet another similar factor, which might be called an "aesthetically fluent eye," influences the way viewers experience art produced during their lifetimes. Aesthetic fluency, a concept introduced by Smith and Smith (2006), is defined as the knowledge base that a person has about art and aspects of life closely related to art that has been acquired both formally (ie, through training in the arts) and through life experiences with art. Additionally, Bacci points out that researchers, for the most part, don't have art historical background information for the artworks they use as stimuli. These include such issues as an artist's intentions for creating a work and his intended message. Nor do they have the original

viewing conditions for an original artwork such as its final placement, lighting conditions, and distance from the observer.

Most of these and other limitations to the acquisition of valid findings in the field of experimental aesthetics outlined by Bacci, especially those related to art historical issues, have been addressed by the new and very innovative Parallellepipeda project describe by Wagemans (2011) elsewhere in this special issue. Experiments 3, 4, and 5 described in his paper illustrate very nicely the primary goal of this new form of experimental aesthetics, namely, collaboration between scientists and artists to generate research questions concerning the nature of an aesthetic experience with art and the art stimuli, procedures, and methodologies to implement their studies. Wagemans points out that this approach produces results that do full justice to the artworks used as stimuli and the artist's intentions for creating these works using traditional scientific methods of enquiry. While Bacci may still be right that it is impossible to fully evaluate the behavior and aesthetic reaction of an observer to art, the new experimental aesthetics typified by the Parallellepipeda project, and also by the eMotion: Mapping Museum Experience research project described below, will certainly bring us closer to a comprehensive understanding of the nature of an experience with art.

Other models of aesthetic experience focus on the underlying mechanisms responsible for aesthetic appreciation while taking into account the role of the factors that influence the interplay of these mechanisms. Leder et al (2004) have published a detailed multicomponent information-processing model that describes the interactions between a sequence of five perceptual and cognitive processing stages that occur across the time course of a viewer's encounter with abstract art. The model also incorporates the influence on these processes of several variables involved in aesthetic experience, including the affective state of an observer; observer characteristics such as personal taste, interests, and domain specific knowledge; and the museum as context. The two outputs of the model are aesthetic emotions and aesthetic judgments.

Some of the same frameworks used to explain an observer's experience with art have been applied formally to a user's interaction with and emotional reaction to a design product (see, eg, Norman 2004). Recently, however, the rise in development of interactive electronic products has been accompanied in the design field by a growing interest in the aesthetics of interactive systems—and not just of the appearance of artifacts, the traditional focus of the aesthetics of design. According to this view, the aesthetics of an artifact emerge out of a dynamic interaction between the user of an interactive product and the product and is an integral part of what has been labeled an aesthetic interaction. Recently, Locher et al (2010) published a theoretical information-processing framework for understanding the nature of a user's aesthetic interaction with design products that incorporates factors that moderate the processes that underlie an aesthetic experience with art described above. Additionally, because interaction with a product involves the simultaneous use of visual and haptic (exploratory touch) perception, the framework explains how handling an object can add to the perception and aesthetic evaluation of an artifact beyond vision's contribution. (Auditory qualities of many artifacts also contribute to the aesthetics of a multisensory interaction, but this modality is not incorporated in the model.) Thus, the notion of aesthetic interaction and the research studies it has generated that use the same techniques employed in the field of experimental aesthetics (see, eg, Frens 2006) deserve mention in this essay because they are expanding the understanding of the nature of an aesthetic experience with artifacts beyond art forms.

3 Studying the multifaceted processes underlying aesthetic experience

A primary goal of investigators working in the field of experimental aesthetics is to understand the components and underlying mechanisms responsible for aesthetic appreciation. This is achieved using empirical approaches and techniques that generate continuous response data across the time course of an encounter with art. The study of an observer's eye fixation patterns as he or she looks at and responds to an artwork has provided this type of data for many years, starting with the pioneering work in this field conducted by Guy Thomas Buswell (1935), which he described in his book *How People Look at Pictures*. Eye movement studies continue to make substantial contributions to the understanding of how viewers look at and respond to art (eg, Heidenreih and Turano 2011; Kapoula et al 2009; Locher et al 2007).

Neuroimaging techniques have been shown in recent years to be important tools in every area of the arts to help localize and connect the components of an aesthetic process with specific events in the brain (see reviews of this literature by Skov and Vartanian 2008 and Shimamura and Palmer in press). They have opened up a window into biology's contribution to aesthetics, and some (eg, Tallis 2008) have argued that the future understanding of aesthetics is to be found in neurology. Massey (2009) cautions, however, that neuroscience is more effective in the analysis of component processes than in their synthesis—that is, neural data can reveal the components of an aesthetic experience, but they are much less successful in understanding how these components interact to produce an aesthetic experience or why one artwork is perceived to be more beautiful than another.

3.1 Measuring viewers' reactions to art using computerized dynamic posturography

In addition to neuroimaging techniques, computerized dynamic posturography is a technique with great untapped potential to measure physiologically a viewer's reaction to art during an aesthetic experience. This is a non-invasive system that quantifies and records body sway in real time originally developed for use in the diagnosis of balance disorders and in physical therapy and postural re-education. The body is not perfectly still when one is looking at an object or some aspect of the visual world. Rather, continuous postural adjustments are made that involve the dynamic coupling of sensory, motor, and cognitive processes to control and maintain posture and balance. Time series data are recorded as a viewer stands on an instrumented platform, or force plate, connected to sensitive detectors that measure changes in the weight exerted on the surfaces of the two feet. Changes in excursion of the center of pressure of the body, instantaneously adjusted for a person's height and weight, distance from the source of stimulation, and base rate, are recorded in both the anterior-posterior and medial-lateral directions. Speed of body sway and the pressure on the soles of each foot are also recorded.

The study of postural adjustments to the structural elements and compositional organization of paintings can provide a physiological measure of a viewer's reactions temporally to these pictorial characteristics and artistic universals. To date, however, only one published investigation has tapped the potential of this technique for experimental aesthetics. Kapoula et al (2011) conducted investigations into the effects of pictorial depth in paintings on body sway. In one study participants freely explored two reproductions of abstract paintings by Maria Elena Vieira Da Silva (*Egypt* and *O Quarto Cinzento*), each of which provides a vivid perception of recessed space as well as an altered cubist transformation of each work that removed the sense of depth seen in the originals. Throughout the experiment participants were required to maintain a quiet, constant stance by holding their arms at their sides and refraining from speaking, clenching their teeth, or making body movements of any kind. It was found that viewing the original paintings significantly increased postural sway relative to their manipulated cubist versions: that is, greater sway was recorded for the works containing the greater intensity of visual depth cues—the originals. In a second experiment Kapoula et

al found a significantly greater increase in body sway when observers were asked to fixate the principal background area versus the foreground of Piero della Francesca's painting the *Annunciatio,* a work whose structural organization provides a powerful representation of perspective and a sense of recessed space in the pictorial field. Thus, pictorial depth cues in both abstract and representational paintings differentially produce postural instability in viewers.

To follow up on this line of research Professor Kapoula and I have recently conducted an investigation of the effects of another compositional property of paintings—depicted pictorial movement—on viewers' postural body movements. If any compositional feature of a painting should produce postural sway, it most likely would be depicted movement. Many methods are used to achieve movement in a painting and give it a sense of kinetic or dynamic energy. These range from the global properties of a composition, such as the scene or event it represents, to the lively character and direction of brush strokes employed (Cutting 2002). Our art stimuli consisted of two paintings by Monet entitled in English *Study of a Figure Outdoors—Facing Left* and *Study of a Figure Outdoors—Facing Right.* They differ in degree of depicted motion produced by the force of the wind but are very similar in content, composition, color, and image size. In both paintings a woman, who is the primary feature of interest in both works, is standing at the top of a grassy knoll and the wind is depicted as blowing from right to left as indicated by the pictorial cues for perceived movement generated by the clouds, the woman's scarf and dress, and vegetation. Each painting was shown in its original orientation and as a mirror-image reversal of it to examine the influence of the lateral organization of implied motion cues which has been shown to influence aesthetic preference of paintings.

Participants' body movements were recorded as they viewed an artwork shown in one of the four painting by lateral orientation conditions. They performed an attention-demanding task that consisted of examining the painting for as long as they wished to obtain the information needed to describe it to someone who had never seen it. The apparatus, procedure, and type of data collected were the same as those employed by Kapoula et al (2011). Additionally, participants rated the degree of depicted movement on a 10-point scale after viewing the painting and described its content, which was recorded. Preliminary analyses of the body movement data revealed that, as expected, body postural adjustments were significantly more pronounced for the composition containing a higher degree of depicted motion. It was also observed that participants' body weight was distributed differently across the two feet when viewing the original versus its mirror-image. A manuscript describing the complete set of results is under preparation for publication in a separate paper.

Results of the two studies demonstrate that posturography can provide insights into the effects of the applications of fundamental principles of pictorial composition, such as the use of depth and depicted motion cues as in the studies described, on the perceived qualities of artworks as measured by their physiological effects on a viewer. In so doing, they demonstrate that viewers can be figuratively "moved" by an artwork. In addition, these findings provide physiological support for the notion of "offline embodied cognition". There are several theories of the nature of embodied cognition (see Wilson [2002] for a review of these theories), but the underlying notion is that cognition relies heavily on bodily states—that is, cognitive representations and operations are intimately tied to the relevant sensory-motor processes required to interact with the environment. Cognitive activity that operates directly on real world environments with objects present is called "online embodiment". "Offline embodiment" occurs when processing is decoupled from the environment, as when modality-specific systems are engaged even when an object or situation is absent and represented by a symbol such as a picture, as was the case for the

paintings used in these studies. Finally, in future experiments we will simultaneously record continuous data of viewers' body movements and their eye movements as they look at a painting, thereby making it possible to determine with a high degree of spatial resolution the impact of specific pictorial features and the overall structural organization of an artwork on body sway across an aesthetic experience with it.

3.2 Hand-held personal data assistants

Individuals' responses to the temporally unfolding arts such as dance, theater, and especially music have received research interest for many decades. Most often, perceivers' perceptual, cognitive, and emotional reactions to these art forms were recorded in laboratory settings as they viewed pre-recorded stimuli. Results obtained using this research approach, while ensuring experimental rigor, do not capture viewers' continuous reactions to the art form in the presence of other perceivers or audience members in the naturalistic setting of a theater. An electronic technique to study real-time audience responses to temporally unfolding art forms involves the use of hand-held personal data assistants or PDAs. Recent developments in hand-held computers coupled with wireless technology enable a researcher to record psychological responses from individual audience members viewing temporally unfolding live artistic performances in naturalistic settings. PDAs now available are small, portable, relatively inconspicuous, programmable, and make it possible for the data collected to be collated and time-stamped for synchronization purposes with action on the stage. The participants in such studies move a hand held pen-like stylus or a joystick around a screen to generate input to the PDA as they view a performance.

One of the first studies to use this technique to study dance was conducted by Stevens and her colleagues (2009). They developed a portable audience response facility, a modified PDA system, to collect continuous response data from audience members during two live performances of dance works. Their goal was to investigate audience perceptions of structures and expressions in the dances and to compare these with the choreographer's artistic intentions for the choreography for his work. Continuous responses were measured in the first study from adults who had no experience in contemporary dance as they viewed a 60-minute live performance of a contemporary dance piece. Participants in the second study were accustomed to attending live dance performances and reported enjoying watching dance. They too viewed a full-length live ballet that varied in the amount of activity on stage reflecting the themes struggle, achievement, reflectiveness, and loss.

Participants in both studies were given a practice session prior to the performance to acquaint them with use of the system. It should be noted they reported that use of the PDA did not distract them from the performance, and they found it very user-friendly, potential drawbacks for use of such a system during live performances. The PDA recorded continuous data simultaneously for two dimensions of expressed emotion as the performance took place; a valence scale (positive–negative; happy–sad) and an arousal or activity scale (active–passive). Participants were asked to rate their emotions based upon their experience of the components of the entire performance, including the dancers' movements, the music, and the choreography. The continuous arousal data were mapped onto choreographic notes from the choreographers of the two ballets indicating the key moments and intended structural, musical, and emotional changes in the pieces. Stevens et al (2009) present a detailed comparison of the connection between these variables across the time course of segments of the ballet. In general, the researchers found that approximately 80% of the time, the choreographers' intentions with respect to the expressive aspects of the dance and the audiences' emotional responses were congruent. For example, greater activity by the dancers, such as acrobatics, and changes in musical material were associated with changes in arousal and emotional responses, demonstrating a connection between audience emotional

responses and the surface features of the dance and music as well as the expressive aspects of the dancers' movements. Thus, Stevens et al's findings enable choreographers, dancers and researchers to see for the first time audience responses to dance works made in real time during a live performance. The PDA is a tool capable of providing researchers and choreographers a new perspective in understanding the cognitive and behavioral processes during a temporally dependent visual art form.

4 The museum as laboratory

I turn now to a topic which I call *the museum as laboratory* and examples of the application of recent advances in computers and other technologies in two museum studies. Investigations of the perceptual and cognitive processes that underlie a museum visitor's experience with art have until fairly recently been neglected by the fields of museology and experimental aesthetics. Research conducted in museums using original artworks as stimuli is essential to provide the external and ecological validity for findings of experimental aesthetics studies, which typically present reproductions of art on computer screens and other presentation formats in laboratory settings. In this respect it is notable, and a relatively rare occurrence that the eye-movement studies conducted by Heidenreih and Turano (2011) and Kapoula et al (2009) mentioned earlier took place in museums. From a practical perspective, visitor-based investigations of the museum experience are critical because in the last 10 years museum culture has made a major shift from its traditional roles of collection and preservation of artifacts and of scholarship to museums as public educational institutions. Yet, despite this shift, Jacobsen (2010) points out in an article entitled "A research vision for museums" published in a recent issue of *Curator: The Museum Journal* that audience researchers continue to focus their in-house investigations on such factors as attendance numbers, visitor behaviors, and satisfaction with the permanent collection and special exhibitions. For the most part they continue to neglect studying the underlying perceptual-cognitive processes responsible for the pleasure which accompanies the learning experiences in art museums. As one example, an issue which has been debated among curators for decades is the amount and type of information which should be provided with each artwork. To enhance the likelihood that museum goers will obtain the most pleasure and knowledge from their visit, museums use several methods to provide them with insight, history, anecdotal information, and provenance about the works in its collection. The most commonly used methods to deliver information and interpretive content to enhance the aesthetic experience include textural information presented with each artwork, guided tours typically conducted by docents, and audio guide tours.

Research shows that most museum visitors like to have some organizing schematic information presented with works of art by these methods but not to be overwhelmed with information, and they also want freedom to interpret the art as they will. Furthermore, visitors desire a balance between the physical organization and "mental" structure of a gallery or exhibition and their freedom to explore the artworks according to their own organizing schematic notions about the art. The impact of these factors changes according to the style of a work of art viewed (eg, abstract versus representational works), the amount and type of information presented, and the characteristics and aesthetic fluency of a viewer. In the past, this complex interaction of factors could not be fully taken into consideration by a museum using the audio systems available; until relatively recently, the audio experience was structured for the "average visitor" in a linear, non-interactive fashion for a limited number of artworks. Recent technological advances with hand-held computers have made it possible for museums to organize audio guide augmented tours in such a way that they provide visitors with personalized choices in the amount, types, and depth of information

they receive about a work, as well as the freedom to navigate a collection of artworks as they choose. Thus, audio tours have the potential to strike a balance between freedom and structure in the visit of *each* museum goer.

4.1 Audio tour augmentation in museums

To date, there is relatively little empirical research on the contribution of audio augmentation to the museum experience using the new electronic technology available for such tours. A notable exception is one of a series of studies conducted by Jeffrey Smith and his colleagues (Smith et al 2004; Smith and Tinio 2010) at the Whitney Museum of American Art in New York, one of the world's foremost collections of 20th-century American art. This study examined the impact of the museum's approach to providing audio tour information in a controlled in-situ experiential fashion. Museum visitors completed a survey after experiencing one of four art works (two sculptures and two paintings) under three treatment conditions. The two paintings were George Bellow's *Dempsey and Firpo* and Arshile Gorky's *The Artist and His Mother* and the two sculptures were Chris Burden's *America's Darker Moments* and Yayoi Kusama's *Accumulation*. Burden's work consists of five separate pieces that represent events in American history (eg, events at Kent State and My Lai) using small metal sculptures. The Kusama sculpture is a white chair that has been covered with dozen of phallic-shaped white stuffed bags. The three treatment conditions were: standard (the museum's standard label consisting of the work's title, artist, date, and acquisition information), label (a label written expressly for the study to present typical art historical and stylistic information), and audio (information specific to each work and its artist). Data for several dependent measures evaluating participants' experiences with each artwork were obtained.

Smith and his colleagues (2004, 2010) report that participants spent up to three times longer in front of works when using the audio tour than was the case for the other two conditions. The researchers note that some of this difference can be attributed to difference in the amount of information presented, especially between the standard and audio tour conditions. Nevertheless, the important issue here is that use of the audio guide keeps the observer's visual input focused on the work of art as opposed to diverting his or her attention to read a label. Additionally, it was found that participants said they would like to see more of the works by a given artist when his work was experienced in the audio condition than when it was seen in the standard condition. This was especially the case for the Kusama and Burden sculptures, which are more difficult to understand than the paintings and probably require more interpretive help to be appreciated. The specific information presented in the audio guide for these works provided a cognitive schema or structure for looking at and understanding these works. It should be noted that the Burden piece commanded the longest stay in each of the three conditions, which the researchers suggest might be attributable to the amount of information in the piece if a viewer treated it as five separate works. Furthermore, visitors indicated that they enjoyed their visit much more because of the audio tour, that they did not find it too impersonal, and they would use it again during their next visit.

One negative influence of the audio guide approach was that it appears to focus attention on only certain features and aspects of a work and away from others. Participants were asked questions about some things that were not mentioned in the audio stop information. For example, those who saw the Bellows work were asked about the color of the ceiling in the painting. What was found was that with each of the four artworks, participants in the standard and label conditions were better able to answer questions about the works than people in the audio condition. Attention was directed toward certain aspects of a work, and away from others, by the information provided in audio stop. Thus, too much structure might not be optimal, at least in the present circumstances. Additional research is

necessary to identify the factors that must be taken into consideration to make audio guide augmentation provide a more successful museum experience, especially as it continues to advance rapidly from a technological perspective. From a practical perspective, it has the potential to provide an experience tailored to each visitor—one that takes into consideration his or her characteristics as well as the type of museum being visited (see Mastandrea et al 2009). From a theoretical perspective, studies of audio augmented tours can be designed to provide insights into the nature of the perceptual-cognitive and evaluative processes that underlie an aesthetic experience outlined in the frameworks mentioned above.

4.2 The eMuseum: Mapping museum experience

Finally, mention should be made about a project in progress called eMotion: Mapping Museum Experience, which has already shown its potential to make a major contribution to the understanding of the complex interaction of factors that contribute to a museum visitor's experience (described in Tröndle and Tschacher [2010] and Tschacher et al [2011] and http://www.mapping-museum-experience.com). The project, which uses innovative technical devices (described below), is designed to examine how the museum context, the art objects, curatorship, and the visitor affect his or her behavior and experiences. The large transdisciplinary team conducting the research project at the Kunstmuseum St. Gallen in Switzerland consists of collaborators with expertise in art psychology, art sociology, art theory, museum visitor studies, curatorial practice, industrial design, and technical programming. Visitors who volunteer to take part in the study are given a wrist band to wear that contains several measurement and signalling sensors. These make possible the precise quantitative measurement of the path each individual takes through the museum, his or her speed, the time spent in front of each artwork, and when and how strong an emotional arousal and a cognitive arousal occurred. Each person also completes qualitative questionnaires designed to enable the transdisciplinary team of researchers to interpret the vast collection of data obtained electronically. Another innovative feature implemented by the study is that participants have the opportunity to view moments of their own course through the eMotion installation played back through cartographic representation. This provides self-insight into their behaviors and enables visitors to reflect on the nature of their museum experience.

This research group has recently published results of one study and a list of many other manuscripts "in press" is contained in the project's website given above. Museum goers in Tschacher et al's (2011) investigation wore electronic gloves through which their locomotion, skin conductance, and heart rate were continuously monitored as they explored 76 works of modern and contemporary art in seven galleries. After completing their visit the 373 adult volunteers completed a 19-item questionnaire for each of six works, three artworks selected in advance by the researchers and three paintings in front of which a participant spent the most time. Items in the questionnaire assessed emotions evoked by a painting, aesthetic evaluation of it, and the viewer's general appraisal of it. Tschacher et al found that physiological responses recorded during perception of an artwork were significantly related to aesthetic-emotional experiences with a work. Specifically, the dimensions "aesthetic quality," "dominance," "surprise/humor," and curatorial quality" were associated with the cardiac measures heart-rate level and variability and skin conductance variability. The researchers point out that their findings provide the first evidence that aesthetics can be empirically grounded in viewers' physiology in an ecologically valid context, the fine art museum.

5 Conclusion

There is strong agreement among theoreticians and researchers working in the field of psychology of art that an aesthetic experience with a visual art form is the result of a

complex interplay of many factors and processes. The new experimental aesthetics—to borrow from the title of Berlyne's 1974 classic work—typified by the research techniques and projects described in this essay have already shown their impressive potential to deepen our understanding of the nature of aesthetic experiences and emotions with different visual art forms within different contexts. Bacci (2011) may be correct in her assertion that it is impossible to fully evaluate the behavior and aesthetic reaction of an observer in front of original art in a museum, given the complex interplay of factors involved. But this author believes that the state of the art of contemporary experimental aesthetics research will bring the field very close to this goal.

References

Bacci F, 2011 *"Eye-movements and Piero's gaze: An art historical perspective" Esthétique et Complexité: Création, Expérimentations et Neurosciences* (Paris, France: CNRS Éditions) ◂

Baxandall M, 1972 *Painting and Experience in Fifteenth Century Italy* (Oxford, UK: Oxford University Press) ◂

Berlyne D, 1974 *Studies in the New Experimental Aesthetics: Steps Toward an objective Psychology of Aesthetic Appreciation* (New York: John Wiley & Sons) ◂

Buswell G T, 1935 *How People Look at Pictures* (Chicago, IL: The University of Chicago Press) ◂

Cutting J, 2002 "Representing motion in a static image: Constraints and parallels in art, science, and popular culture" *Perception* **31** 1165–1193 doi:10.1068/p3318 ◂

Frens J, 2006 *Designing for Rich Interaction: Integrating Form, Interaction, and Function*, PhD Dissertation, Eindhoven University of Technology ◂

Heidenreih S, Turano K, 2011 "Where does one look when viewing artwork in a museum?" *Empirical Studies of the Arts* **29** 51–72 doi:10.2190/EM.29.1.d ◂

Jacobsen J, 2010 "A research vision for museums" *Curator: The Museum Journal* **53** 281–289 doi:10.1111/j.2151-6952.2010.00029.x ◂

Jacobsen T, 2006 "Bridging the arts and sciences: A framework for the psychology of aesthetics" *Leonardo* **39** 155–162 doi:10.1162/leon.2006.39.2.155 ◂

Kapoula Z, Adenis M S, Lê T T, Yang Q, Lipede G, 2011 "Pictorial depth increases body sway" *Psychology of Aesthetics, Creativity, and the Arts* **5** 186–193 doi:10.1037/a0022087 ◂

Kapoula Z, Daunys G, Herbez O, Yang Q, 2009 "Effect of title on eye-movement exploration of cubist paintings by Fernand Léger" *Perception* **38** 479–491 doi:10.1068/p6080 ◂

Leder H, Belke B, Oeberst A, Augustin D, 2004 "A model of aesthetic appreciation and aesthetic judgment" *British Journal of Psychology* **95** 489–508 doi:10.1348/0007126042369811 ◂

Locher P, in press–a "Contemporary experimental aesthetics: Procedures and findings" *Handbook of Economics of Art and Culture* (Amsterdam: Elsevier/North Holland) ◂

Locher P, in press–b "Empirical investigation of an aesthetic experience with art" *Aesthetic Science: Connecting Minds, Brains, and Experience* (Oxford: Oxford University Press) ◂

Locher P, Krupinski E, Mello-Thoms C, Nodine C, 2007 "Visual interest in pictorial art during an aesthetic experience" *Spatial Vision* **21** 55–77 doi:10.1163/156856807782753868 ◂

Locher P, Overbeeke K, Wensveen S, 2010 "Aesthetic interaction: A framework" *Design Issues* **26** 70–79 doi:10.1162/DESI$_{a0}$0017 ◂

Massey I, 2009 *The Neural Imagination: Aesthetic and Neuroscientific Approaches to the Arts* (Austin, TX: University of Texas Press) ◂

Mastandrea S, Bartoli G, Bove G, 2009 "Preferences for ancient and modern art museums: Visitor experiences and personality characteristics" *Psychology of Aesthetics, Creativity, and the Arts* **3** 164–173 doi:10.1037/a0013142 ◂

Norman D, 2004 *Emotional Design* (New York: Basic Books) ◂

Shimamura A, Palmer S (Eds), in press *Aesthetic Science: Concerning Minds, Brains, and Experience* (Oxford, UK: Oxford University Press) ◂

Skov M, Vartanian O, 2008 *Neuroaeesthetics* (Amityville, NY: Baywood Publishing Co) ◂

Smith L, Smith J, 2006 "The nature and growth of aesthetic fluency" *New Directions in Aesthetics, Creativity and the Arts* (Amityville, NY: Baywood Publishing Company) ◂

Smith J, Tinio P, 2010 "Audio augmentation of museums visits: Talking the walk" (Unpublished manuscript) ◂

Smith J, Waszkielewicz I, Potts K, Smith B, 2004 *Visitors and the Audio Program: An Investigation into the Impact of the Audio Guide Program at the Whitney Museum of American Art* (New York: The Whitney Museum of American Art) ◂

Stevens C, Schubert E, Morris R H, Frear M, Chen J, Healey S, Schoknecht C, Hansen S, 2009 "Cognition and the temporal arts: Investigating audience response to dance using PDAs that record continuous data during live performance" *International Journal of Human-Computer Studies* **67** 800–881 doi:10.1016/j.ijhcs.2009.06.001 ◂

Tallis R, 2008 "License my roving hands" *Times Literary Supplement* **11** 13–15 ◂

Tröndle M, Tschacher W, 2010 "Design research as an artistic way of knowledge production" Paper presented at the XXI Congress of the International Association of Empirical Aesthetics, Dresden, Germany ◂

Tschacher W, Greenwood S, Volker K, Wintzerith S, van den Berg K, Tröndle M, 2011, "Physiological correlates of aesthetic perception of artworks in a museum" Psychology of Aesthetics, Creativity, and the Arts doi:10.1037/a0023845 ◂

Wagemans J, 2011 "Towards a new kind of experimental psycho-aesthetics? Reflections on the Parallellepipeda project" *i-Perception* **2** 648–678 doi:10.1068/i0464aap ◂

Wilson M, 2002 "Six views of embodied cognition" *Psychonomic Bulletin & Review* **9** 625–636 doi:10.3758/BF03196322 ◂