Aesthetic Emotion Measurement Methods for Painting

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Abstract. Emotion reactions play a crucial role in the experience of art. In recent years, art information processing models have increasingly emphasized the importance of aesthetic emotions, leading to empirical studies and applications. This paper aims to provide an overview of the emotion measurement methods for paintings and their applications. According to previous studies, self-report methods are considered a fundamental tool for assessing aesthetic emotions and experiences in paintings. In addition, studies based on behavioral and physiological data are also available due to the use of EEG and pupil diameter in art experiments. The measurements of emotions can also contribute to the creation of emotion analysis resources, which can be utilized in the development of art emotion annotation systems.

Keywords: aesthetic emotion · measurement · application · painting

1 Introduction

The importance of emotions in art has been widely acknowledged since ancient times, as evident from early Greek and Latin literary treatises. Emotion reactions are often regarded as the cornerstone of experiential art, and the creation of emotional experiences has always been considered the primary objective of artistic expression [1]. Furthermore, research has demonstrated that the neurological mechanisms involved in perceiving art differ from those involved in recognizing ordinary objects [2]. The psychology of art has extensively explored the connection between art and emotion, given that viewing artworks triggers brain areas associated with emotional experience and goal setting.

Since Berlyne's (1971, 1974) pioneering study of "the new experimental aesthetic" marked a turning point in the field of experimental aesthetics, shifting the focus of the artistic investigation to the concept of "interest". In contrast, the term "emotion" has received less attention due to its vague definition and limited development in the early stages of the new experimental aesthetic. However, the concept of "aesthetic emotion" has been studied by some artistic information processing techniques up until the 21st century, albeit without offering comprehensive definitions or addressing the nature of aesthetic emotion. Examples of these techniques include visual art [3], literature [4] and music [5].

1.1   The Definition of Aesthetic Emotion

The definition of aesthetic emotions can be traced back to Burke and Kant. Kant, for example, defined aesthetic emotions as follows: 1) Aesthetic emotions are completely independent emotions that include an aesthetic evaluation or appreciation of the object or event under consideration. 2) Each aesthetic emotion reflects specific adjustments and predictions for aesthetic virtues. These attributes are often derived from emotional categories such as "moving", "fascinating", "surprising", "shocking", and "suspenseful". 3) As an effect on subjective aesthetic appreciation, aesthetic emotions are related to the subjective pleasure or displeasure during the emotional episode. 4) Aesthetic emotions are a crucial predictor of liking or disliking.

Building on Kant's ideas, Armstrong and Dwelle Biddle [6] believe that beauty reflects the thrilling "prospect of understanding something novel and especially meaningful". Inspired by Chinese poetics and philosophy, Nico Frijda and Louise Sundararajan [7] suggest that aesthetic emotions are "emotions with refinement". In the latest model of defining aesthetic emotions, Meninhaus [8] proposes that aesthetic emotions comprise multiple components and are influenced by aesthetic judgments. In conclusion, aesthetic emotions are multi-component, multi-level, fine-grained composite emotions regulated by individual aesthetic judgments and preferences.

2   Aesthetic Emotion Measurement for Painting

New theories and research show that the study of aesthetic emotions and experiences is gaining increasing attention in various art-related fields, which are being studied empirically through experiments. These fields include Music, dance, literature, theater, film and television, painting and sculpture, modem art pictures, fine art museum exhibitions, multiple art forms, advertisements, consumer products, full-service restaurants, built and natural environments, urban landscapes, Tourist destinations, etc. [9]. Given the breadth of the fields involved, this paper focuses on painting for a more detailed examination.

Based on the literature review on aesthetic emotions of art, this paper classifies three methods of measuring emotions in painting: 1) self-report methods based on questionnaire scales; 2) measurement based on behavioral data; and 3) measurement based on physiological data.

2.1   Emotion Measurement Based on Self-report Method

The Self-Report Method (SRM), a widely used approach for collecting data from research participants through interviews, diaries, and questionnaires, was an early and influential method for measuring emotions [10].

In the context of studying the aesthetic emotions and experiences of painting, the self-report method is typically implemented through a questionnaire, in which participants are asked to express their emotions and experiences on a rating scale or with adjectives.

For example, Israeli [11] developed a list of 23 emotions corresponding adjectives to describe emotion reactions to painting reproductions, such as calm, depression, fatigue, and anger. Rowold [12] conducted a "Survey for the Assessment of Aesthetics (SAAP)"

from three perspectives: cognitive, emotional, and self-congruency. Hagtvedt & Patrick [13] proposed "a measure of the affective and cognitive components involved in the perception of visual art" from emotional and cognitive perspectives. Hager [14] constructed the Art Reception Survey (ARS) based on six dimensions: cognitive stimulation, negative emotion, expertise, self-reference, artistic quality, and positive attraction. Markovi [15] proposed the List of descriptors of the aesthetic experience and emotional content of paintings from two perspectives: emotional tone and aesthetic experience. Lin [16] proposed the Aesthetic Model for Popular Illustration based on three dimensions: perception, cognition, and emotion. Ortner and Panagl measured modern art diagrams in three dimensions: liking or interest, negative impact, and rejection or aggression.

In addition, some scholars explored questionnaire scales that applied to multiple art domains. Stamatopoulou [17] developed the Aesthetic Experiences Scale (AES), which measured five perspectives, including cognitive synesthesia and elaboration, emotional closeness, experiential emotional detachment, spectator mode, and expressive perception. Silvia et al. [18] created the Aesthetic Experiences Scale/ Unusual Aesthetic Emotions Scale (UASES). Finally, Schindler [9] created the Aesthetic Emotions Scale (AESTHEMOS), which comprised 21 subscales, each with two items. This tool aimed to analyze the emotional signature of reactions to the stimuli perceived as aesthetically appealing in a highly differentiated way.

2.2 Emotion Measurement Based on Behavioral Data

Pupillometry, the measurement of pupil diameter in psychology, enables us to understand various aspects of participants' attributes to artworks, such as the location of the first gaze point, the distribution of gaze points, gaze duration, gaze frequency, and gaze trajectory. By assessing participants' psychological and behavioral responses to artworks, we can obtain objective data on the assessment elements.

For example, Kuchinke et al. [19] found that in the appreciation of paintings, high processing fluency was associated with increased pupil dilation, which can explain aspects of aesthetic emotions following the explicit categorization of artistic stimuli proposed in the "Model of Aesthetic Appreciation and Aesthetic Judgment" [3].

However, pupillary responses indicating pleasant and emotionally exciting images may be confounded by the positive and negative arousal of emotions. Therefore, a protocol analysis of the emotional state is required when eye movement experiments are performed [20].

2.3 Emotion Measurement Based on Physiological Data

The measurement of physiological arousal in humans, which includes heart rate, blood pressure, respiration, and skin conductance responses, among others, can provide objective information about changes in emotional states. These physiological indicators are often difficult to control voluntarily and can reveal changes in emotional activation that may not be apparent through subjective self-report. Therefore, they can offer valuable insights into the level of emotional changes or the mechanisms related to emotional and physiological changes, thus obtaining more accurate emotional information than subjective evaluation. The following physiological activation measures are currently used: 1)

Electromyogram (EMG), 2) Skin Conductance Responses (SCR) and Electrocardiogram (ECG), 3) Electroencephalography (EEG).

EEG signals were also used to investigate emotional applications in art. For instance, Kawabata & Zeki [21] used EEG techniques to discover that images rated as beautiful triggered activity in the reward-related area, such as the medial orbitofrontal cortex, and had a higher reward value compared to images rated as ugly. Cruz-Garza et al. [22] utilized mobile EEG technology in an art museum.

3   Emotion Analysis and Applications

Emotion analysis can provide a means of bridging the gap between individuals from different groups, such as those based on culture, age, education, and sensory characteristics, and the study of emotion reaction in artworks will help generate referable resources for emotion analysis.

For example, Wiki Art Emotions [23] dataset contains 4, 105 artworks from Wiki Art that have been annotated with emotional labels by crowdsourcing in English for one or more of 20 emotion categories. The Mona Lisa, for instance, is labeled as evoking happiness, love, and trust, with an average rating of 2.1 (on a scale of -3 to 3). Wiki Art Emotions has paved the way for extracting emotions from text and tags to create emotional art recommenders such as Ars Emotica [24] or DEGARI [25], which classify art items far beyond Ekman's standard six basic emotions [26], encompassing a richer and more nuanced model. Furthermore, the Art Emotion Map project has recently conducted experiments on emotions evoked by art [27]. 1300 people have been asked to describe their feelings about 1500 paintings by choosing different words. The results show that people have associated 25 different emotions with the shown artwork. The authors have plotted these emotions on an interactive map that groups artworks evoking specific emotions.

However, artworks exhibit great diversity in terms of style, complexity, formal characteristics, values, historical context, representational quality, genre, and content, all of which may affect the aesthetic experience. To address this challenge, Fekete et al. developed the Vienna Art Picture System (VAPS) [28], comprising 999 fine art paintings by 347 European painters in five genre categories: scenes, portraits, landscapes, still lifes, and paintings with increasing levels of abstraction. The dataset contains rating information for five variables (based on a sample of 60 female and 60 male German-speaking students): liking, emotional valence, emotional arousal, visual complexity, and familiarity. VAPS provides a standardized set of fine art images that can serve as a useful tool for researchers in the fields of empirical visual aesthetics and experimental psychology.

4   Conclusion

In conclusion, the study of aesthetic emotions and experiences of art has gained increasing attention, and researchers have employed questionnaires, behavioral data, and physiological data analysis methods to capture the emotion reactions. This paper suggests that the aforementioned three methods can be used to analyze the aesthetic emotions and experiences of paintings, and then establish an emotion analysis system of the painting.

However, given the diversity in paintings in terms of style, complexity, formal characteristics, historical context, expressive quality, and content, and the diversity in individuals' professional backgrounds and experiences, emotion measurements require continuous updates to accommodate a larger and broader set of paintings and personal information. Such updates may aid researchers in conducting more standardized and comparable studies in the rapidly expanding assessment of artistic experiences.

References

1. Fellous J M. A Mechanistic View of the Expression and Experience of Emotion in the Arts[J]. 2006.
2. Cupchik G C, Vartanian O, Crawley A, et al. Viewing artworks: contributions of cogntive control and perceptual facilitation to aesthetic experience[J]. Brain and cognition, 2009, 70(1): 84-91.
3. Leder H, Belke B, Oeberst A, et al. A model of aesthetic appreciation and aesthetic judgments[J]. British journal of psychology, 2004, 95(4): 489-508.
4. Jacobs A M. Neurocognitive poetics: methods and models for investigating the neuronal and cognitive-affective bases of literature reception[J]. Frontiers in human neuroscience, 2015, 9: 186.
5. Brattico E, Bogert B, Jacobsen T. Toward a neural chronometry for the aesthetic experience of music[J]. Frontiers in psychology, 2013, 4: 206.
6. Armstrong T, Detweiler-Bedell B. Beauty as an emotion: The exhilarating prospect of mastering a challenging world[J]. Review of general psychology, 2008, 12(4): 305–329. P305
7. Frijda N H, Sundararajan L. Emotion refinement: A theory inspired by Chinese poetics[J]. Perspectives on Psychological Science, 2007, 2(3): 227-241.
8. Menninghaus W, Wagner V, Wassiliwizky E, et al. What are aesthetic emotions?[J]. Psychological review, 2019, 126(2): 171.
9. Schindler I, Hosoya G, Menninghaus W, et al. Measuring aesthetic emotions: A review of the literature and a new assessment tool[J]. PloS one, 2017, 12(6): e0178899
10. Yuan Jiang, Chongde Lin. A review of self-report methods for measuring emotions [J].Journal of Captial Normal University(Social Science Edition),2010(6):135–139.
11. Israeli N. Affective reactions to painting reproductions: A study in the psychology of esthetics[J]. Journal of Applied Psychology, 1928, 12(1): 125.
12. Rowold J. Instrument development for esthetic perception assessment[J]. Journal of Media Psychology: Theories, Methods, and Applications, 2008, 20(1): 35.
13. Hagtvedt H, Hagtvedt R, Patrick VM. The perception and evaluation of visual art. Empir Stud Arts. 2008; 26(2):197–218.
14. Hager M, Hagemann D, Danner D, et al. Assessing aesthetic appreciation of visual artworks—The construction of the Art Reception Survey (ARS)[J]. Psychology of Aesthetics, Creativity, and the Arts, 2012, 6(4): 320.
15. Marković S. Aesthetic experience and the emotional content of paintings. Psihologija. 2010; 43(1):47– 64.
16. Lin Y C. An Aesthetic Model for Popular Illustration[J]. Empirical Studies of the Arts, 2023, 41(1): 108-134.
17. Stamatopoulou D. Integrating the philosophy and psychology of aesthetic experience: Development of the Aesthetic Experience Scale[J]. Psychological Reports, 2004, 95(2): 673-695.

18. Silvia P J, Nusbaum E C. On personality and piloerection: Individual differences in aesthetic chills and other unusual aesthetic experiences[J]. Psychology of Aesthetics, Creativity, and the Arts, 2011, 5(3): 208

19. 20. Kuchinke L, Trapp S, Jacobs A M, et al. Pupillary responses in art appreciation: Effects of aesthetic emotions[J]. Psychology of Aesthetics, Creativity, and the Arts, 2009, 3(3): 156.

20. 21. Powell W R, Schirillo J A. Hemispheric laterality measured in Rembrandt's portraits using pupil diameter and aesthetic verbal judgements[J]. Cognition & emotion, 2011, 25(5): 868-885.

21. 22. Kawabata H, Zeki S. Neural correlates of beauty[J]. Journal of neurophysiology, 2004, 91(4): 1699-1705.

22. 23. Cruz-Garza J G, Brantley J A, Nakagome S, et al. Deployment of mobile EEG technology in an art museum setting: Evaluation of signal quality and usability[J]. Frontiers in human neuroscience, 2017, 11: 527.

23. Mohammad S, Kiritchenko S. Wikiart emotions: An annotated dataset of emotions evoked by art[C]//Proceedings of the eleventh international conference on language resources and evaluation (LREC 2018). 2018.

24. Patti V, Bertola F, Lieto A. Arsemotica for arsmeteo. org: Emotion-driven exploration of online art collections[C]//The Twenty-Eighth International Flairs Conference. 2015.

25. 26. Lieto A, Pozzato G L, Zoia S, et al. A commonsense reasoning framework for explanatory emotion attribution, generation and re-classification[J]. Knowledge-Based Systems, 2021, 227: 107166.

26. 27. Ekman P, Friesen W V. Constants across cultures in the face and emotion[J]. Journal of personality and social psychology, 1971, 17(2): 124.

27. D. Stamkou, E.and Keltner, R. Corona, E. Aksoy, and A.S. Cowen. 2022. Emotional Palette: A Computational Mapping of 25 Emotional Experiences Evoked by Visual Art. (2022).

28. Fekete A, Pelowski M, Specker E, et al. The Vienna Art Picture System (VAPS): A data set of 999 paintings and subjective ratings for art and aesthetics research[J]. Psychology of Aesthetics, Creativity, and the Arts, 2022.