Rational Beauty in Computational Aesthetics

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Abstract. Given AI's growing importance, it has always been a hot topic in academic circles, with the main opposing views consisting of positive and negative sides. However, the debate on "unique human creativity," such as art, will be particularly heated. Some believe that AI will usher in a new art genre and a new way of creating, while others believe that AI's works of art will never be able to compete with those of humans. In this study, the artistic creation and evaluation of AI in computational aesthetics will be analyzed and discussed, but the discussion will not be limited to computational aesthetics alone. The creative creation analysis of AI can be traced back to the summit of beauty itself to express support for computational aesthetics and AI artistic creation.

Keywords: computational aesthetics; artificial intelligence aesthetics; aesthetic judgment; rational beauty; sensus communis.

INTRODUCTION

Aesthetics is usually regarded as a branch of philosophy involving two questions: "What is beauty" and "What is beauty like". When discussing the question "what is beauty," is usually referred to as meta-aesthetics, which is primarily the formalism of art theory advocated by Kant and studies the pure concept of "beauty"; when discussing the question of "what is beauty like," aesthetics is sometimes referred to as the philosophy of art, which is a question directly involved by the vast majority of art practitioners, that is, it studies the expression of beauty. Some scholars believe that aesthetics and philosophy of art should be studied separately, with the former studying beauty and taste and the latter studying artistic works. However, aesthetic research must examine works of art, and the creation of works of art must consider what beauty is, too. Since the German philosopher A. Baumgarten coined the term "aesthetics" in 1735, this opposing viewpoint has not reached a consensus. Even so, due to the artistic creation of modern artificial intelligence, this debate has become increasingly heated. New problems have emerged, propelling computational aesthetics, a branch of AI, onto the contemporary aesthetics stage.

An Overview of Computational Aesthetics

Computational aesthetics is a type of modern aesthetics and a subfield of AI research that has piqued the co-interest of mathematicians, engineers, psychologists, and philosophers. Computational creativity (a branch of AI research) is a more closely related field that aims to solve the problem of how machines display creativity. Aesthetics plays a role in AI research because it is an aspect in which creativity is reflected and evaluated. However, computational creativity research only sometimes involves creating or evaluating aesthetics. Furthermore, neither computational aesthetics nor computational creativity is inextricably linked to the field of artificial consciousness (another branch of AI research) because it has been demonstrated that machines do not need to be as conscious as humans to evaluate aesthetics or demonstrate creativity [1].

To better understand computational aesthetics, we must first examine its historical development. The field of computational aesthetics is not new. Mathematician G. Boekhoff [3] first articulated the idea of aesthetic measure (M) in 1928 and described it as the proportion between order (O) and complexity (C). Typically, this equation is written as Measure=Order/Complexity. Due to the use of computational methods, Boekhoff's application to the evaluation of pleasing polygons and elegant vases was regarded as the startup of

computational aesthetics [11]. This equation captures a person's perception of beauty when he exerts effort (C) while achieving a pleasing harmony (O). Although only some agree with Boekhoff's perspective on quantifying aesthetics and aesthetic experience, his ideas have expanded the field of aesthetic research and have been adopted by numerous researchers. Among them, German philosopher M. Bense is essential to contemporary computational aesthetics. Information Aesthetics is the term he coined for his point of view, which combined Boekhoff's original notion of aesthetic measurement with C. Shannon's information theory. This is the first time aesthetic theory and computer theory have been combined. Bens proposes Generative Aesthetics and Abstract Aesthetics to assess new artificially generated art as he argues that aesthetics can be linked with AI, a new discipline. However, information aesthetics is frequently criticized as "unnatural" because of an over-reliance on AI theory [15]. In the 1970, American psychologist D. Berlyne proposed Experimental Aesthetics, which is based on measuring the mass of an object and linking it with the audience's aesthetic perception and nonverbal reaction and insists on not isolating aesthetic perception from other psychological factors [2, 8]. Authors [10] inherited Ben's work in the 1970 and attempted to update Boekhoff's aesthetic model. Then, in 1993, authors [19] reviewed their predecessors' work in their papers and used the term Computational Esthetic to name this field for the first time. In the 1990, M. Leyton founded the International Society of Mathematics and Computational Aesthetics (IS-MCA). As a supplement to the disciplines, they are bringing together computer scientists from all over the world. The study covered computer-aided design and manufacturing, robot motion design, artistic works analysis, scientific theory construction and reasoning, and software design, among other topics, which drew the attention of computer and AI circles to design objects and aesthetic computational value. In 1998, authors [14] presented a new theory of computational aesthetics at the Brazilian Artificial Intelligence Symposium. According to this conference paper titled Computational Aesthetics, aesthetic judgment depends on the subject's biological and cultural background, which is the problem of visual image processing. In 2002, the author [17] proposed an unconventional form of computational aesthetics, incorporating intelligent collaborative systems (based on biological systems) into aesthetics and coining Emergent Aesthetics. The author [20] proposed Exact Aesthetics in the same year, defining it as a discipline that connects the visual art field with science by integrating computers into the design process and its objective criticism, to identify better works of art through algorithms based on the theory of exact aesthetics. Furthermore, in the Aesthetic Computing paper, authors [9] propose a computable aesthetic declaration, defined as "the application of artistic practice and theory in computing".

From the past to the present, the art of computer generation has been a hot topic for philosophers and scientists interested in computational aesthetics, owing to its status as the only test-bed for developing aesthetic theories and methods [12]. Because the experience of beauty is subjective, it cannot be defined in absolute terms. However, we can all know or feel what is beautiful to us individually; in this case, statistical physics and computer science are used to quantify and better understand what causes this pleasant feeling. What computational aesthetics do is re-examine aesthetic theory against a relatively objective and scientific backdrop.

RESULTS AND DISCUSSION

Rational Creation of Beauty

Traditional artworks are a rapidly developing field of modern AI research, which is critical for us to understand computational aesthetics better. Painting has been regarded as the pinnacle of human creativity in many parts of the world for thousands of years; in the West, painting is viewed as full of religious symbolism and is usually regarded as the purest and artistic expression of human beings [13]. However, this anthropocentrism of creativity is likely due to our inability to understand and explain the role of creativity at the moment; in fact, the process of human artistic creation appears to be more mechanical and procedural than we previously thought. The creative creation tool of modern AI challenges the typical irrational concept of "creation" and attempts to bring artistic creation into the rational category. Looking back through art history, the idea of "creation" was unthinkable in ancient times. According to the mainstream theory (Plato's aesthetics-recall theory), people can only remember, reconstruct, and reproduce what already exists. Artists, in this sense, are only discoverers, not creators. True creativity, in the

sense of "creation" in ancient and medieval times, is a sacred privilege; modern "creation" arose from the improvement of individual autonomy (Renaissance), and this improvement was only established with the enlightenment of the current scientific and rational spirit. As a result, advancing contemporary AI art will inevitably complicate philosophers, artists, art lovers, and the general public's understanding of artistic creativity and aesthetics. In this section, this paper will compare and analyze creative works created by humans with those of the same kind or theme (primarily images) created by AI, to express the fundamental view of computational aesthetics for the first time: artistic works can be created by reason.

DALL-E is an OpenAI deep learning model that generates digital images from natural language descriptions. In April 2022, OpenAI announced the release of DALL-E 2, a follow-up product aimed at developing more realistic ideas with higher resolution and the ability to combine concepts, attributes, and styles. Many scholars at home and abroad have studied it as a popular AI image art creation tool. In the following section, we will compare the images generated by DALL-E 2 to human photography images with the same theme and content via text input.

We use the simplicity principle in image content selection to highlight the main body. Nikon D5500 and Tamron 17-50mm f/2.8 VC are the human camera tools used, and the shooting parameters are f/2.8, 1/15s, ISO100, and 50mm. The image text's natural language description is an orange and white cat crouching in the grass (Figure 2). As a result, we enter the description in DALL-E 2 and get the image below (Figure 3)[1].

Image aesthetics can be classified as low-level or high-level, saliency-based, category-based, object-based, synthesis-based, or information-based [4]. Low-level functions for any image include colour, brightness, edge, and sharpness, which objectively and intuitively describe the image with relatively low complexity in time and space, whereas high-level functions include area and content.

Figure 1 – “An orange and white cat crouching in the grass" shot by human

Figure 2 – The images made by DALL-E 2

First, the five images are evaluated using the low-level function. UGC Photo Scoring is used to score them to eliminate subjective psychological factors in the comparison process and ensure the objectivity of the comparison process and content. Everypixel's UGC is an AI image-scoring tool. Its database comprises 347,000 Instagram images, and it evaluates the clarity, composition, exposure, framing, and other aspects of images using objective technical standards [21]. Figure 3 depicts the outcomes.

The image quality at UGC is classified into five categories: very bad (0-20), bad (20-40), good (40-60), very good (60-80), and excellent (80-100). Surprisingly, even though the cat's face and body structure are unnatural in the image generated by DALL-E 2, the overall score is higher than the actual image.

[1] The original Figure 2 and Figure 3 can see at https://www.jianguoyun.com/p/DTKydkkQxO3DChjqwucEIAA

Figure 3 – The images contrasted by UGC

However, P. 3 in Figure 3 has a particular gap with the actual image's quality, resulting in the lowest score. P. 4 received the highest score in this appraisal. As a result, we can draw a relatively reliable conclusion: AI-generated images can be more reasonable than human-generated images in the low-level function of image aesthetics.

The images from advanced functions are compared. Because the time information in each image cannot be determined, the spatial distribution is used as the comparison standard in this case. The "rule of thirds" is a common visual image rule (Figure 4).

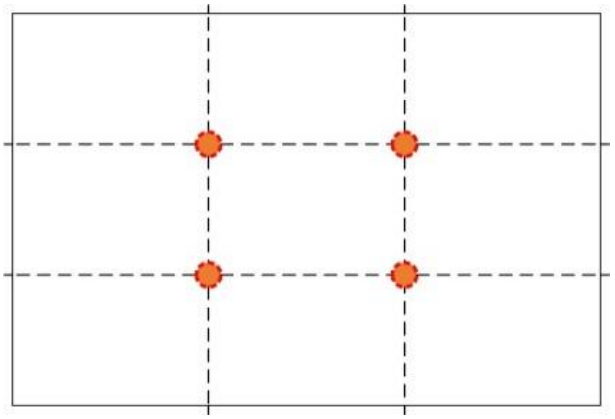

Figure 4 – "Rule of thirds"

It divides images into nine areas using two perpendicular lines and equal-spaced straight lines. The visual effects will be enhanced if the image subject appears on these lines or points. Figure 5 depicts the results.

Figure 5 – Use "rule of thirds" to contrast the images

The human-made image in Figure 5 places the intersection of the dividing lines as the cat's head's centre point. However, only P. 2 in Figure 3 makes some errors in the mapping space among the images produced by DALL-E 2. In contrast, all other pictures follow the spatial distribution law, and P. 4 also places the cat's head's centre point on the intersection point. Therefore, we can also make the following speculative conclusion: the AI-generated image can match human ability in the sophisticated function of image aesthetics.

Beauty is "rational"

Following the artistic analysis of computational aesthetics presented above, it is necessary to respond to the arguments raised in the introduction - why computational aesthetics makes the distinction between aesthetics and philosophy of art more apparent and what arguments computational aesthetics will bring to modern aesthetics.

Some philosophers and aestheticians believe that modern science and technology's artistic works only focus on objects of aesthetic design, even though their fields range from traditional art to scientific theory. In their opinion, this “view on beauty” is somewhat one-sided. Although this is a significant invasion and challenge of modern computer technology to the field of aesthetics, they still confine computational aesthetics to the category of philosophy of art and think that the works of art created twice can't reach the level of artists, let alone touch the core aesthetic question of "what is beauty". Contrary to conservatives (let's call them conservatives), some scholars believe that computational aesthetics can provide an objective and scientific explanation of aesthetics and aesthetics in the development of modern technology, as well as a glimpse into the future of generative art [1, 5].

It is undeniable that contemporary AI art has many flaws, such as the images created by DALL-E 2. As a field in continuous development, it still seems to have a long way to go before it can fulfil its dream of being a "digital artist". As a result, any criticism of AI art creation by philosophers and aesthetes at this time is justified, and only such criticism can better promote the discipline's development. However, reflecting on why computational aesthetics has attracted so much contemporary scepticism is also helpful.

First, most people regard "feeling beauty" and "thinking something is beautiful" as subjective psychological experiences. These feelings are similar to Descartes' "I think, therefore I am," and must all be related to the "I" in mind. Thus, this popular view must contradict computational aesthetics' statement that "the aesthetic feeling originates from the harmonious relationship within the object and is determined by the order relationship in the aesthetic object" [18]. But computational aesthetics is a contemporary development of aesthetic formalism, not something that just happens to exist. Formalism's roots can be found in the development of philosophy and art. Plato held that "goodness is beauty, which is related to the perception of objective laws, internal order, and forms" [6]; Kant's aesthetics is a typical example of formalism in modern times. According to him, the time and space we can all perceive are the sources of this objective and universal form [22]. According to formalists, we should only consider an object's state when appreciating it rather than its representation, emotional inclusion, historical significance, or social context. Formalism requires only the consideration of what is beautiful, and it excludes the external review of aesthetic objects. Although subjective and objective aesthetics have been at odds for a long time, there is one thing that cannot be denied. When we admit that an object or its expressed content is beautiful, we must acknowledge that we have some internal impressions in some aspects. Our psychological structure teaches us some fundamental elements and principles about beauty. If these principles exist only in the minds of different subjects, aesthetic research and comments will become highly subjective, even diverse and conflicting; however, if these principles can extend beyond the simple law of sensory stimulation and extend to the field of intelligence, they will become general facts of our psychological process. They will be available facts of the mind's perception of beauty rather than purely subjective experiences, so the beauty phenomenon must conform to them, and they will apply to all senses rather than minds using all phenomena.

Second, the perception and creation of beauty are frequently regarded as perceptual activities, and the rational aspect is frequently weakened in these activities. However, the cameraman can often see different scenes than others because his mind contains the basic cognition of constructing a beautiful image; improvised musicians' and dancers' performances are not arbitrary, but their minds already know how to express beauty through musical instruments and bodies. When beauty enters the academic field, the experience of beauty will no longer be limited to the perceptual category but will most certainly enter the rational type. In general, when we see a beautiful flower, a magnificent building, or infinite magical nature, our soul's feelings towards the aesthetic object (including conditioned responses to the content, emotion, history, and background of the aesthetic thing) will always be included in the perceptual category, consciously bringing beauty and aesthetics into it. However, the emotion for the aesthetic object is only a mental representation of beauty, not beauty itself. Kant believed that rational participation in aesthetics was necessary [7], so he distinguished two types of aesthetic judgments: sensory judgments (for example, "this is a pleasant smell"), which do not advocate universal validity and are entirely subjective; and review of taste (for example, "This is beautiful"), which requires the universal reality of beauty and objectivity that must be defended.

There will be "a thousand ways to interpret beauty" if the perception and expression of beauty are restricted to the perceptual realm. With *sensus communis*[2], beauty will be more objective and manageable to discuss and study as a serious issue. The popularity of computational aesthetics in modern society merely demonstrates that creative works based on logical perceptions of beauty and creation can appeal to people's *sensus communis*. Computational aesthetics' unfinished business, however, is to determine whether the perception and creation of beauty can be entirely based on modern rational machines. Philosophers and aestheticians should continue to debate this issue.

Finally, as a rational machine, AI art creation has sparked heated debate in academic circles, with creative tools such as DALL-E and Stable Diffusion drawing harsh criticism. These criticisms can be divided into three categories: 1) believe AI does not understand art or beauty; 2) defend the human uniqueness of art; 3) AI art creation is accused of plagiarism and application. Many illustrators and art practitioners have already felt the threat of AI and attempted to conclude that human art can be superior to others [16]. Undoubtedly, AI began infiltrating the art field like it entered human work in other industries. Art practitioners believe their jobs are more unique than those invaded industries, which they perceive to be simple mechanical jobs humans perform. However, even if they believe that AI-created artistic works only imitate human work, it should be remembered that human creative works begin by imitating others or nature, as humans also imitate living things. Without incredible achievements, the uniqueness of artistic work should not be attributed entirely to human creative work, and most artistic work is still the result of learning and experience imitation. If objective standards can measure human artists' works, then AI can easily create works that meet the criteria; if whether an artistic work is regarded as "artistic" or "beautiful" depends on subjective judgment, then any creation, including AI-generated work, has a chance to be considered as an artistic work.

CONCLUSIONS

This study is an analysis and discussion of computational aesthetics and an open-ended question that can attract AI practitioners to debate with philosophers, aestheticians, and artists. Although computational aesthetics is a subfield of AI research, it involves more current problems than other AI philosophical studies, such as creativity, uniqueness of people, and profound aesthetic topics. The computational aesthetics research method is computational, which means it does not aesthetically treat the computational system but instead uses computational methods to understand and explain some aspects of aesthetics. Taking AI as a research foundation may only provide some answers for aesthetics. Still, it gives a thinking angle that is, creating process models generatively to re-examine long-standing problems and disagreements in aesthetic research.

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[2] Kant used *sensus communis* to refer to aesthetic judgment based on reflection and shared by all rational beings. He contrasted it with a healthy understanding based on concepts and reason.

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