

A RELATIVE EVALUATION OF AESTHETIC VALUE FOR CONTEMPORARY ABSTRACT ART CREATED BY COMPUTER CREATIVITY

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ABSTRACT

Research of Computational Creativity is one of the most challenging fields in artificial intelligence of computer systems. Contemporary artists have been created various kinds of visual art based on artificial intelligence such as neural networks, machine learning and so on. However, there is a controversy about whether the artwork created by Computational Creativity has significant aesthetic value against artworks created by humans. In this paper, we evaluate aesthetic value of contemporary abstract artworks created by computer program that Versteeg developed based on neural networks. We relatively analyze the aesthetic value of Computational Creativity against the aesthetic value of human creativity. We conduct experiments with people that 10 pairs of paintings are presented that one is created by Versteeg's program and the other is painted by an artist of middle standing. The experimental results show that the relative aesthetic value of artworks created by the computer program is slightly lower than those of artists of middle standing. Also, similar to human artists, we found that Computer Creativity can create masterpiece or failure. As the results created by a human artist fluctuates, Computer Creativity also may create various level of artworks in the view of aesthetic value. Since Computational Creativity research in visual art is in the very early stage, creating artwork by Computational Creativity has potentials to be improved and to surpass human's creativity.

Keywords: *Aesthetic Value, Abstract Art, Artificial Intelligence, Computer Creativity, Neural Networks*

1. INTRODUCTION

Visual art had showed alternative ways of expressing visual experience to the artist and appreciators. However, from the end of the 19th century innovative artists begun to find fundamental need to create a different kind of art that would correspond to the revolutionary changes taking place in wide area of society. The fundamental sources of the innovative artists became diverse, and reflected the social, cultural, philosophical and intellectual obsession in all areas of Western culture at that time [1].

In [2], As hypothesized, high evaluation on total sensation seeking and subscales is positively correlated with preferences for abstract art and negatively correlated with preferences for representational art. The results are discussed in terms of the major determinants of preferences for art of different types. In other words, the aesthetic evaluation is closely related with one's personality and characteristics. Therefore, we have to evaluate

the aesthetic value of a specific artwork in consideration of the appreciator's personality and characteristics.

In general, lay people who do not have any art expertise have difficulties to appreciate abstract art. In [3], a study was conducted to determine the neuroanatomical correlates of aesthetic preference for paintings using fMRI. In the experiments, subjects were shown representational and abstract paintings in different formats (original, altered, filtered), and instructed to rate them on aesthetic preference. The experimental result shows that lay people usually prefer representational paintings to abstract paintings against experts. This is because the lack of expertise limits the appreciation of artworks.

In [4], another study shows that experts have better flexibility and differentiation in art appreciation than lay people, irrespective of the genre. The authors measured liking, elicited emotions, arousal, and comprehension, and

compared structural equation solutions for 2 groups of students with higher and lower levels of art expertise. Experts and lay people not only revealed strong effects of emotion in all conditions, but also confirmed that the inter-correlations between emotion and understanding were consistently higher for lay people. Moreover, experts generally provided higher ratings on nearly all scales. These results reflect experts' greater flexibility and differentiation in art appreciation. Therefore, we have to consider the expertise of the subject of experiment to evaluate the aesthetic value of artworks.

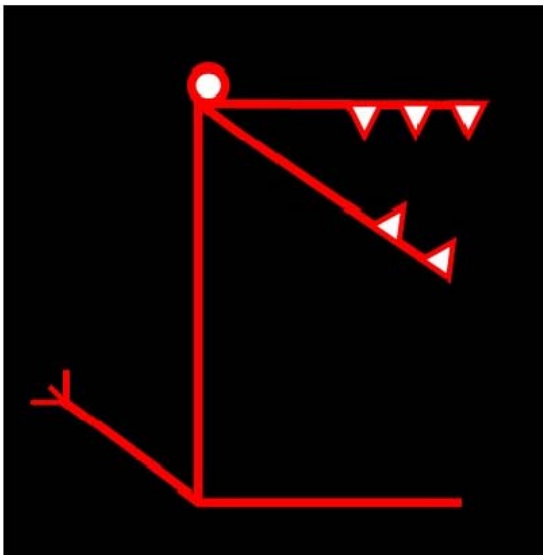


Figure 1: Figures for Test in [5]

There had been much controversy about abstract art that even abstract art is not art but fake of art. For example, the author insisted that abstract art grandmasters score like class D amateurs in the

view of quantitative analysis in [5]. However, since art is not a kind of formal game like chess, the author misunderstood that the difference of one percent point might be a huge gap in case of art. Also, the distinction by normal people does not guarantee the aesthetic value of artworks. As stated above, the evaluation of the aesthetic value is related with the expertise of the appreciator. In addition, the abstract artwork by children used in the experiment also can have great aesthetic value and have better aesthetic value than that of the artist according to the view of appreciator.



Figure 2: Collage by the Painting Fool, inspired by news from Afghanistan [6]

The field of Computational Creativity research has formed in the last dozen years to scientifically explore the potential of computer systems. As shown in Figure 2, the machine can create the artwork inspired news. The authors believe it is fair to characterize Computational Creativity as a frontier for AI research beyond all others—maybe, even, the final frontier in [7]. Especially, creating art by Computer Creativity is one of most challenging research area, because creating art is one of the most complicated and high-level creation that human can do. The final level of artificial intelligence could be the ability of art creation and the desire of art creation, as expressed in Professor Jefferson's Lister Oration for 1949, "Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain—that is, not only write it but know that it had written it." [8]

In this paper, we relatively analyze the aesthetic value of Computational Creativity against that of human creativity to evaluate the state and the possibility of Computational Creativity in art area. Especially, we deal with abstract art that is one of the most advanced form of visual art to evaluate Computational Creativity. It is because Computational Creativity already mimic human figurative art too well as studied in [9]. We also found that most of subjects in our study does not distinguish the figurative art created by the computer in [9]. They thought someone just mimic the masterpiece of great artists. It might not have significant meaning to evaluate figurative art created by computers. There might be little edge of humans against computers in the area of figurative art.

For example, since in the early of 2000s, since the edge between champions and computers in the game of chess had been narrowed and finally turned around, people have started to evaluate the artificial intelligence. Similarly, recently abstract art become more suitable to evaluate Computational Creativity in the field of visual art.

The paper is structured as follows: in Section 2 we explain the method to evaluate the aesthetic value of each artwork in this paper and the subject to be evaluated, then in Section 3 we present the experiment result and discuss about the result, and conclude with Section 4.

2. EVALUATION METHODS

In order to evaluate the aesthetic value of each artwork, we conducted a simple experiment which has questionnaires such as “which artwork has more aesthetic value to you?” It is very simple but clear method to evaluate relative superiority of aesthetic value. In [9], Hawley-Dolan and Winner had conducted a similar experiment with a renowned abstract expressionist and another by a child or by an animal (monkey, gorilla, chimpanzee, or elephant). The result shows win-loss rate of each pairs. In [5], the authors analyzed the rate in the sense of chess player’s level.

However, we insist that the difference does not mean the quantitative difference like level of chess players. Art and aesthetic value is not an area of win or loss game. Sometimes, the edge of 0.01% can make a huge difference in the field of art. In some cases, 50.01% of people can distinguish the genuine and 49.99% of people can be deceived by the forgery. However, it does not

mean the genuine has similar aesthetic value against the forgery.

2.1 Representative of Artificial Intelligence

Modern creativity support tools (CST) have been effective at helping users produce higher quality products or artworks by allowing them to explore creative possibilities, perform complex simulations, and record and track ideas [10, 11]. Some contemporary artists begun to utilize or develop CST to create his or her artworks.

Among them, we selected Siebren Versteeg as a representative digital artist, who have been explored abstract art and media art created or aided by computer with his most recent work: a series of “paintings” generated entirely or partially by computer algorithm. We selected his paintings as representatives of Computer Creativity because his artworks look like real oil painting against other artists using Computer Creativity.

As shown in Fig. 3, most of abstract art created by computer looks like just computer graphics because their texture does not copy brush touch of human artist or it is not printed on a real canvas like Versteeg’s. For example, you can create your own abstract art with a popular graphic software, Photoshop and AbstractCurves plug-in application [12]. In addition, people, especially non-expert have a prejudice that a digital art might not be preferred against traditional art [14]. For fair evaluation and avoiding the prejudice, we selected Versteeg’s artworks for the experiment.

Versteeg have developed computer program based on observed principles of abstract paintings created by human. According to his explanation, this program is interpreted by a computer which then begins to generate a picture, one layer at a time. At random intervals the computer will export a copy of itself, one of which Versteeg selects to be printed on to a canvas. Also, creating algorithmic programs that respond to and distort online imagery, Versteeg presents the results as still painterly abstractions, or displays the programs on monitors [15].

Since the artworks are picked by Versteeg, it can be arguable that the artworks are entirely created by the computer. However, human artists sometimes ask to pick out his or her paintings to others for objective evaluation and computer can pick out its paintings based on the function of self-evaluation. Versteeg’s program might not have no function of self-evaluation or Versteeg might want to have the role to make a final decision. In any cases, picking out by person does not change the fact that the artworks are created by a computer.



Figure 3: Example created by AbstractCurves [12]

2.2 Experiment

To evaluate the aesthetic value of artworks, we conducted experiments with 30 undergraduate students majoring in visual art, and 30 lay undergraduate students who do not have any expertise about visual art that each represents semi-experts and normal people. We excluded experts such as abstract artists and critics, since they might recognize the artworks Versteeg’s program or that of a human artist.

First we prepared 30 pairs of paintings are presented that one is created by Versteeg’s program and the other is painted by abstract artists of middle standing. However, from a preliminary examination we pick out 10 pairs from 30 pairs to avoid recognizing computer’s artworks or to preventing one’s preference. In some case of paintings, people can detect the artwork created by machine or manipulated by computer software. Also, as stated in Introduction, people’s preference and personality can affect the evaluation of the aesthetic value. Therefore, we try to make the pair of paintings with similar mood and theme.

In [17], we compared Versteeg’s program with great abstract artist. However, since the research of Computer Creativity in visual art is in the early stage and the subjects might recognize the

artworks of famous and great artist, it is pointed out that the comparison with great artists is not fair. Therefore, we selected various abstract artists of middle standing who the subjects cannot recognize.

We asked each student relatively to evaluate the artwork of each pair in the view of aesthetic value. For example, a subject can give 0.6 and 0.4 to each pairs, respectively. Table 1 shows an example of a subject’s evaluation in the experiment.

As studied in [18], the research demonstrates a link between personality and art preference, and indicates that certain traits may be particularly relevant to preferences for surreal art. To minimize the effect of one’s taste and preference of each subject of the experiment, we paired the artworks with similar mood and style as shown in Figure 4. We excluded some pairs of artworks to avoid the effect of preferences after preliminary investigation.

Table 1: An example of Evaluation in the experiment.

No.	Artworks created by Versteeg’s program	Preference ratio of Versteeg’s program	Preference ratio of Counterpart
1	Grand Ballroom	0.42	0.58
2	Quavers	0.47	0.53
3	Carlisle	0.32	0.68
4	Happy Endings	0.65	0.35
5	Oh, Superman	0.48	0.52
6	Clearcache33 - 1	0.54	0.46
7	Clearcache33 - 2	0.50	0.50
8	MAY29	0.22	0.78
9	locust	0.48	0.52
10	fountain	0.40	0.60
-	Average	0.44	0.55
-	Standard deviation	0.12	0.12



Figure 4: Example pair for evaluation, *Grand Ballroom* (2015) by Versteeg (up)[15] and *untiled* by Jason Twiggy Lott (down) [16]

3. RESULTS AND DISCUSSION

3.1 Experiment Results

As shown in Figure 7, both semi- expert and lay people evaluated that the artworks created by artists of middle standing are slightly better than the artworks created by the computer algorithm. On average, semi-experts evaluated 0.58 of artworks created by human abstract artists of middle standing prefer and lay people evaluated 0.52 of artworks created by human abstract artists of middle standing prefer. In other words, the difference of preference is larger in case of semi-expert. It might be the expertise about art helps to understand the aesthetic value of the artwork.

Figure 7 also shows that a certain semi-expert subject evaluates 0.88 of artworks created by human abstract artists of middle standing prefer (Maximum preference labeled). The result was a very singular case of the experiment.

Table 2: Aesthetic preference of each artwork created by Versteeg's program in the experiment.

No.	Artworks created by Versteeg's program	Preference ratio of Semi-expert	Preference ratio of Lay people
1	Grand Ballroom	0.46	0.48
2	Quavers	0.45	0.48
3	Carlisle	0.38	0.42
4	Happy Endings	0.6	0.73
5	Oh, Superman	0.42	0.49
6	Clearcache33 - 1	0.44	0.50
7	Clearcache33 - 2	0.46	0.46
8	MAY29	0.13	0.28
9	locust	0.44	0.48
10	fountain	0.42	0.46
-	Average	0.42	0.48
-	Standard deviation	0.12	0.11

Table 2 shows the average preference of each artwork created by Versteeg's program in each pair. In this paper, we do not present all artwork created by artists of middle standing in each pair because this work is not intended to evaluate the specific artwork but is designed to evaluate relative aesthetic value of Computer Creativity. In Figure 3, we present a pair of paintings in the experiment as an example. We have to clarify the fact that the result of the experiment never evaluates quantitatively aesthetic value. As shown Table 1, generally the preference of artwork created by Versteeg's program is lower than that of human's.

However, the preference about Happy Endings is distinguishingly higher than others. In addition, the preference about MAY29 is distinguishingly lower than others. This can be an error of the experiment. For example, we may make a mistake to select of the artwork created by artists of middle standing in the pairs. However, by conducting interview we confirmed that the result is not an error or an exception but an important discovery of this work. The details about the discovery presents in the discussion.

In [10], the authors relatively evaluated paintings by professionals and paintings by children and animals. Although the evaluation method in [10] is not exactly same with that of this work, we roughly compare the results of the studies.

First, the difference of aesthetic value between paintings by professionals and paintings by children and animals might be larger than that between paintings by professionals and paintings by Computer Creativity.

Second, in both studies students majoring in visual art can evaluate the difference of aesthetic value better than lay people. Those are consistent results in the previous works [3, 4]. The difference between students majoring in visual art and lay people is difficult to be quantitatively analyzed. However, the relative difference is clear in both studies. Also, since art is not a kind of formal game like chess, we should not analyze the difference of those works like [5].

Third, the effect of preference to artworks might not be considered in [10]. However, the sample pair depicted in the study show similar mood and theme.

3.2 Discussion

We assume that the subject who most underestimated painting created by Versteeg's program may feel those are different or she may just dislike the style of painting created by Versteeg. After the experiment, we interviewed the

subject to establish why she consistently underestimates the artworks created by Versteeg. However, we cannot find any clue she just dislikes the style of painting created by Versteeg's program. She explained that the artworks are unnatural and artificial.

After the experiment, we interviewed the subjects to establish why Happy Endings and MAY29 show the best and the worst results, respectively. We found that the subjects evaluated that Happy Endings is a masterpiece created by Versteeg's program and MAY29 is a failure of it. For example, subjects evaluated Happy Endings as follows. "It expresses positive energy." "I feel joyful and enjoyable." "I want to hang it on my bed room." "The balance of colors and curves are almost perfect."

However, overall evaluations about MAY29 are terrible. Subjects evaluated MAY29 as follows. "The selection of colors is a chaos." "I think it just mimic abstract art of some great artists like Jackson Pollock." "I think some touches in it are amateurish. I bet it is an artwork created by a student or an amateur."

The difference of two artworks is not originated from the mood or the theme of them. As stated in 2.2, we paired paintings with similar mood and theme. MAY29 is not underestimated against the other due to its dark and negative mood or theme.

In other words, similar to human artist, the quality of artwork by Computer Creativity also fluctuates. It is not clear that the fluctuation comes from the imperfection of the program or the essence of art. As no human artist always creates a masterpiece, Computer Creativity also may create various level of artworks in the view of aesthetic value.

The limitations of this work are as follows. First, this work deals with only one Computer Creativity by Versteeg's program. However, it is hard to find proper Computer Creativity which create high level abstract art. In near future, we expect to have more Computer Creativity to be evaluated.

Second, the number of subject in the experiment is a little short to find accurate result in the view of statistics. As conducted in [5], we need to deploy the experiment in the online for gathering more samples to evaluate. However, the experiment through online can be corrupted by uncontrolled and sloppy subjects.

Third, the selection of the artworks pairs in the experiment can be the cause of error in this

work. However, perfectly precise and fair selection for this kind of experiment is almost impossible.



Figure 5: *Happy Endings* (2015) by Versteeg [15]

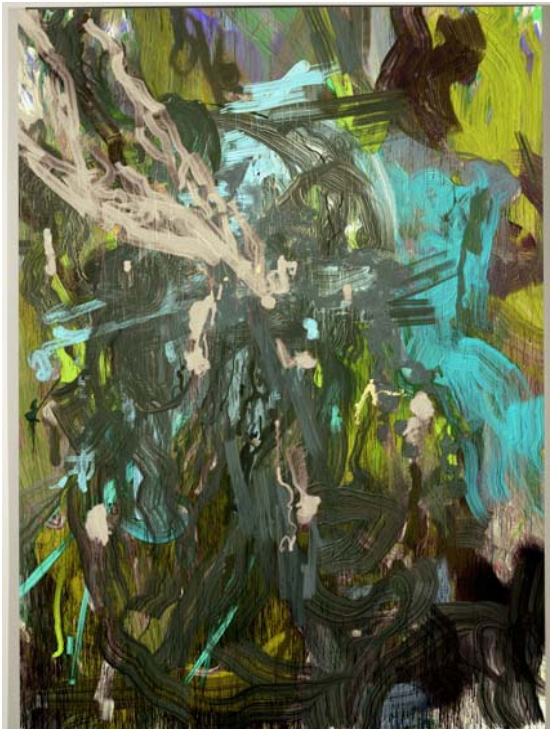


Figure 6: *MAY29* (2011) by Versteeg [15]

4. CONCLUSION

Recently, researchers and contemporary artists have been created various kinds of visual art based on Computer Creativity which is implemented by artificial intelligence such as neural networks, machine learning and so on. Creating art by Computer Creativity is one of most challenging research area, because creating art is one of the most complicated and high-level creation that human can do. However, there was little evaluation about the evaluated aesthetic value of contemporary abstract artworks created by Computer Creativity.

In this paper, we evaluated the aesthetic value of contemporary abstract artworks created by computer program that Versteeg developed based on neural networks. To evaluate the aesthetic value of artworks, we conducted experiments with 30 undergraduate students majoring in visual art, and 30 lay undergraduate students. We relatively analyzed the aesthetic value of Computational Creativity against the aesthetic value of human creativity. We conducted experiments with people that 10 pairs of paintings are presented that one is created by Versteeg's program and the other is painted by artists of middle standing.

The experiment results showed that the aesthetic value of artworks created by computer program is slightly lower than those of artists of middle standing. Also, we found that Computer Creativity can create a masterpiece or a failure. As the results created by a human artist fluctuates, Computer Creativity also may create various level of artworks in the view of aesthetic value.

As discussed in 3.2, this work has some limitations to evaluate the aesthetic value of contemporary abstract artworks created by Computer Creativity. However, since the study to evaluate artworks created by Computer Creativity is in an early stage of work, this work provides meaningful result and can be basic research for the future work.

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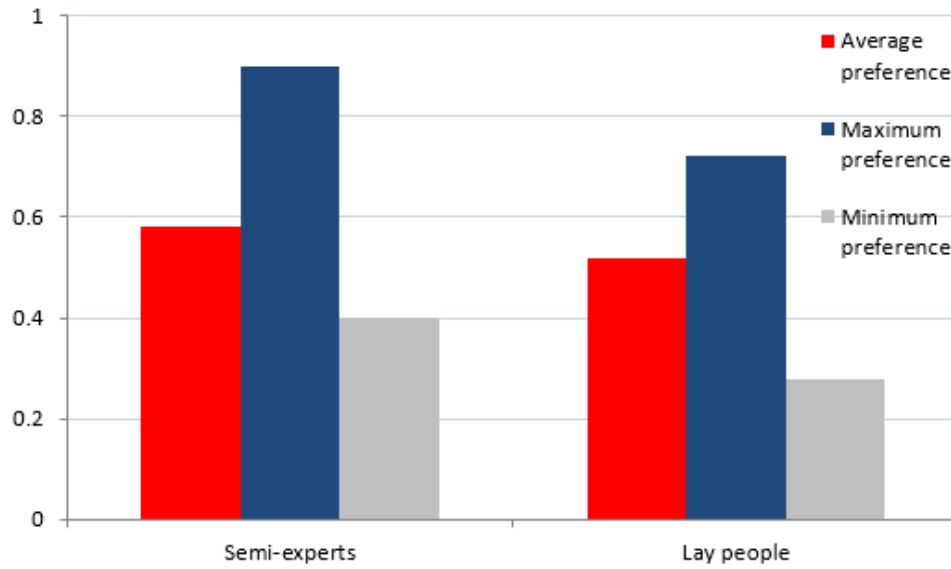


Figure 7: Aesthetic preference of semi-experts and lay people for artworks created by human