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Artificial Intelligence Painting: A New Efficient Tool and Skill for Art Therapy

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Abstract. Since the 1950s, a significant number of clinical cases have confirmed the effectiveness of art in rehabilitation therapy and psychological interventions. With the advancement of artificial intelligence technology, AI painting software based on the Stable Diffusion algorithm model enables image creation through prompts and feedback. Therefore, whether AI painting software can positively impact human emotions becomes a critical factor for its application in art therapy. This study tracks and measures the emotional changes in patients before and after using the AI painting software Stable Diffusion WebUI using emotional vocabulary measurement methods. According to the experimental data of this project, artificial intelligence painting can leave a positive impression on human emotions. This result opens a new window for the integration of artificial intelligence with art therapy research. On one hand, it allows for the in-depth development of guided artificial intelligence painting software specifically designed as a dedicated tool for art therapy—a form of AI software for artistic healing. On the other hand, it encourages further research into the effectiveness of traditional painting versus AI-assisted painting in art therapy, aiming to explore the underlying principles and mechanisms of art therapy.

Keywords. Artificial Intelligence, Artificial Intelligence Painting, Art Therapy

1. Introduction

For a long time, art painting has been regarded as a cure for people's psychology. In Freud's psychoanalytic case, he analyzed the paintings of many patients, and in these paintings, he found the artist's "psychological" problems. Traditional painting is not easy to practice in today's society. An artistic professional who can create freely needs to undergo a lot of professional training. The emergence and popularization of artificial intelligence technology has greatly lowered the threshold of painting. At the same time, with the support of current digital technology and network technology, artificial intelligence painting has become so easy. But for the use of artificial intelligence painting tools, there are also different opinions. Some people think that artificial intelligence can subvert the traditional art and help teachers cultivate students' art appreciation knowledge and artistic creation ability in traditional art courses (Chiu et al. 2022). Some people think that it is only an extension of traditional art. So, can the

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works produced by the creator using artificial intelligence painting tools express the psychological state of the creator's heart? Whether it can play the same psychological healing effect as traditional paper painting, or even stronger effect. In this paper, we hope to verify these problems through research and experiments.

2. Background

2.1. The medium and development of art therapy

The exploration and integration of the application of art in health care began in the 1950s. In the past 10 years, art has become increasingly popular as a therapeutic intervention, particularly in patients experiencing life-threatening or disease-altering conditions (Fraser and Sayah 2011). According to the research literature in Art Therapy: Journal of the American Art Therapy Association from 1983 to 2014, art therapy includes five behavioral health practices. Including prevention, lifestyle management, wellness, treatment and rehabilitation. At the same time, art therapy has been extended to the scope of therapeutic practice assessment and social action.

Art media is an important part of the clinical practice of art therapy. This is because patients need to use the art medium to communicate their inner troubles through artistic expression. The various art forms currently used for arts-based approaches in health research include visual art, literary art, and performing art (Fraser and Sayah 2011). The visual arts mainly include photographs and paintings. As an effective way to gain insight into the participant's world, they can help the therapist identify the feelings and desires of the patient that cannot be expressed through words, thus gaining information about the patient's health and illness. Literary arts are also used in health research, most commonly in the form of poetry. Poetry helps participants "encounter, engage, and express perceptions of their inner and outer worlds, and translate these perceptions into written and spoken language.". The performing arts include dance, drama, and music performed in front of an audience. Performing arts such as these have been introduced into health research by qualitative researchers.

Different art media have been shown to evoke different feelings and behavioral responses in users. Drawing is the most widely used art medium/technique in art therapy assessment and intervention. In general, patients use pencils, markers, charcoal, oil pastels, and chalk for drawing. More fluid painting media, such as acrylic, watercolor and oil painting, are easy to arouse patients'emotions, so as to express their emotions and further activate symbolic images to recognize a part of the hidden self deep in individual consciousness (Malik 2022). For a long time, art therapy has included both clinical practice and theoretical knowledge, and has been trying to define itself as a clear profession. Amy Bucciarelli believes that today's art therapy should be a vibrant field, which is not necessarily limited by conceptual perspectives or theoretical methods, but embraces diversity, flexibility and innovation from an interdisciplinary perspective (Bucciarelli 2016).

2.2. The Creation Debate: Traditional Painting vs. Artificial Intelligence Painting

Artificial intelligence art is the product of artificial intelligence technology applied to art. Artificial intelligence can be regarded as the "agent" of art generation, and together with human beings, it constitutes the "actor network" of art. Artificial intelligence art

reflects the forced integration of intelligent technology and art, trying to get rid of the contingency, dialectics and negativity of art (Tao 2022). In 2005, the first humanoid robot capable of drawing human portraits was built. Many people think that the value of AI painting is lower than that of human painting, and the works created by AI are excluded from the category of artificial art.

Influenced by the concept of post-human, artificial intelligence and other non-human intelligence can be both independent creation and creative partners of human beings (Leonard 2020). Based on this point of view, the co-creation of visual art works by patients and artificial intelligence paintings is a feasible art therapy that can replace other art media. Pawe PawePa Fortun's research found that people use contextual clues when evaluating paintings made by humans and artificial intelligence. When information about the value of an AI-created painting is provided as a contextual clue, the perceived value of the painting increases (Fortuna and Modli Modliński 2021). Therefore, patients participate in the whole process of artificial intelligence painting creation, and provide the content, style and other core elements of painting. When the patient appreciates and judges his painting, he can fully enter the context of the work.

As some neutral scholars have judged, AI is unlikely to have a utopian or apocalyptic impact anytime soon. However, given Amara's law, we should be wary of underestimating the long-term impact of AI. Therefore, we need to actively try and verify the practical application of artificial intelligence painting technology for art therapy.

2.3. Theory of Art Therapy in a Multidisciplinary Perspective

Psychopathology, art context and understanding of visual language provide art therapists with an intuitive appreciation of the structure, function, and emotional qualities of artistic expression. Understanding these traits in relation to brain structure and function can provide a starting point for articulating the unique role and importance of art therapy in the areas of healing, recovery, and growth. Brain structures provide alternative pathways for accessing and processing visual and motor information and memory. Art therapy can take advantage of these alternative pathways and activate them through the various art mediums used in therapy. The clinical practice of art therapy offers the possibility to study different aspects of the brain's processing of information, the basic sensory modules of emotion, and the processing of visual information. Art therapy integrates cognitive, affective, and relational elements to induce or support change. Each of these processes requires the activation of well-defined biological networks. Interconnections between brain regions provide cortical and subcortical pathways for the integration of visual and sensory input, cognitive and affective processing, and motor output.

Neuroscience provides effective information support for clinical practice and discipline research of art therapy. Decades of clinical evidence have demonstrated the significance of art therapy in psychotherapy practice and intervention, and also shown that it is a complex, multi-dimensional and cross-cutting theory. With the continuous integration of art and neuroscience, its influence is also expanding. Art therapists are encouraged to accept scientific research methods and explore the systematic theory needed in this field through rigorous experimental design and testing. In the reality that art therapy is practice and exploration, qualitative research based on abstract philosophy is supplemented by rigorous and universal scientific experimental data. From the perspective of neurobiology, in the practice of art therapy, it may promote

patients' attachment and trust, and further activate the secretion of oxytocin. Oxytocin is a peptide hormone secreted by the posterior pituitary gland and synthesized by the paraventricular and supraoptic nuclei of the hypothalamus. It is generally believed that it can provide a remedy for those who suffer from attachment trauma and play an important role in psychotherapy.

3. Methods

This experiment is based on the Emotion Vocabulary Test Model (Vine et al. 2020) to test whether the use of artificial intelligence software to draw can achieve the effect of psychological healing it can more effectively help the testers who are depressed or show negative emotions to obtain positive emotions (Figure 1).

Our team uses the AI painting software Stable Diffusion WebUI in the

$$\text{Emotion vocabulary (EV)} = \left(\frac{\#\text{ Unique emotion words}}{\text{Total word count}}\right) \times 100.$$

Figure 1. Emotion Vocabulary Test Mode.

experimental process, primarily employing the recent algorithm model called Stable Diffusion. Stable Diffusion is a model of latent diffusion. This algorithm, like most algorithms, is built upon Artificial Intelligence neural networks (Liu Sijia, 2023). Stable Diffusion can be divided into two types: forward diffusion and reverse diffusion. Forward diffusion converts a specific image into an unrecognizable abstract noise image, while reverse diffusion can be understood as the opposite transformation of the former. In the development of AI painting software, the generation of a large amount of training data is crucial, and the aforementioned noise image is an important component. It doesn't operate in high-dimensional image space but initially compresses the image into the latent space. Compared to the original pixel space, the latent space is 48 times smaller, which allows for dealing with fewer numbers, making it faster. Stable Diffusion utilizes a Variational Autoencoder, whose neural network consists of an encoder and a decoder. These parts are used for compressing images into a low-dimensional representation in the latent space and for recovering images from the latent space, respectively. This algorithm has reached a level where users can directly input natural language text to generate artwork. This facilitates a more convenient user experience, aiding in the integration of this advanced technology into mainstream culture.

3.1. Experimental design

In the experimental design, this study will set up two control experiments. The first experiment mainly tests the emotional changes of the subjects at different time intervals; the second experiment is the effect of art therapy or psychological intervention on the audience through different painting methods at the same time interval. Firstly, the user inputs the desired text prompt received by a Tokenizer, which converts it into tokenized numbers. These tokens are then passed into an Embedding, creating 768-dimensional vectors. Subsequently, they are sent to a text transformer for

processing and finally provided to the Noise Predictor. The Noise Predictor is capable of estimating the noise to be added to the image. The user's input text information guides the image generation process by being fed into the Noise Predictor (Figure 2). In order to obtain ,effective changes in the mood of the subjects, The method is used to compare the initial emotional values of the subject with the emotional values after using the AI drawing healing method, and the difference between the two is interpreted as the subject's emotional fluctuations EV method is to simply judge the emotional changes of the testee by calculating the proportion of negative emotional words in a paragraph or an article, that is, the higher the proportion of negative words in the whole content, the lower the mood of the testee.

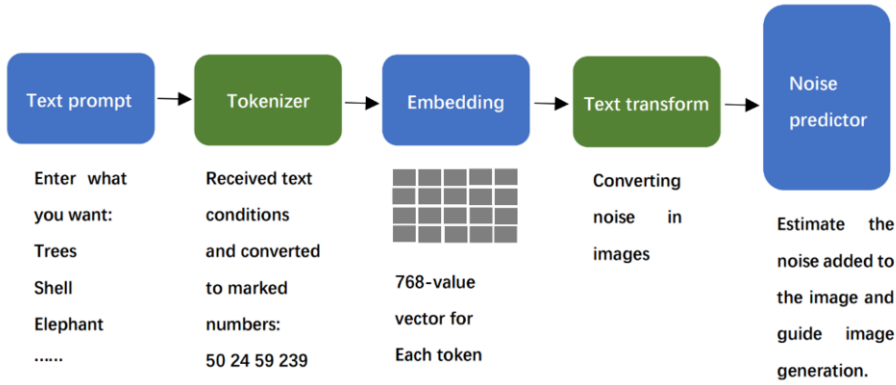

Figure 2. Workflow of Stable Diffusion Algorithm Model.

In order to improve the reliability of the experiment and increase the efficacy of the healing psychological tools, the research team repeated the experiment for different subjects. In order to eliminate the interference of external factors as much as possible in the test survey, the researchers guided the subjects to describe their current state, emotions or recent events without informing them of their purpose and problems, so as to get the true feelings of the subjects.

3.2. Experimental samples

The team mainly surveyed young people aged 18-28, including students and graduates. The reason is that students and office workers have representative social pressures, such as entrance pressure, employment pressure and post-employment pressure, in order to better ensure the reliability of the experimental results.

4. Results and Reflection

4.1. Data results

The purpose of this experiment is to intuitively see the effect of artificial intelligence painting on people's psychological healing. A total of 6 subjects were tested. Firstly, the six subjects were tested three times without any interference, with an interval of 10 hours each time. By observing the changes in the proportion of negative emotional words to the total number of words describing emotions, that is, the EV Test Model, the general emotional state and changes of the subjects were basically observed; Then, the testee provides the key words of the picture, creates the desired picture through the "Chuangshi" artificial intelligence painting software, and 30 minutes later, the same EV test method is used to obtain a set of data to observe the emotional changes of the testee.

Table 1. Emotional values of subjects at different times.

Respondents	Time	Total number of words used to describe emotions	Number of negative emotion words	The proportion of negative emotional vocabulary
A	T1	31	9	29.0%
	T2	26	5	19.2%
	T3	13	3	23.1%
	T-AI	17	3	17.6%
B	T1	12	5	41.7%
	T2	10	2	20.0%
	T3	20	8	40.0%
	T-AI	11	4	36.4%
C	T1	18	11	61.1%
	T2	24	5	20.8%
	T3	22	2	9.0%
	T-AI	27	5	18.5%
D	T1	18	4	22.2%
	T2	36	5	13.9%
	T3	29	7	24.1%
	T-AI	7	1	14.3%
E	T1	30	6	20.0%
	T2	24	2	8.3%
	T3	115	19	17.0%
	T-AI	48	5	10.4%
F	T1	19	4	21.1%
	T2	12	2	20.8%
	T3	30	9	30.0%
	T-AI	30	4	13.3%

4.2. Analysis

Before the use of artificial intelligence painting, there was an interesting and noteworthy phenomenon in the three tests every 10 hours. Five of the six subjects' emotional changes were in the shape of "U"-the proportion of negative emotional words first increased, then decreased, and then increased. This reminds the research

team that in this process, they need to consider the impact of the time period on the mood of the subjects, such as the often mentioned "night makes people emotional". The team considered scheduling the test at the same time every day in the follow-up work.

In addition, in the data obtained from the EV Test Model after using artificial intelligence painting, we can see that the overall mood is changing in a good direction. However, considering the possible impact of holidays on the mood of the subjects, the team chose to conduct multiple tests on the subjects on normal working days to improve the reliability of the experiment. When collecting the emotional changes of each subject, an interval of more than 12 hours was needed. In order to better see the process of emotional change, each respondent was required to answer the question at least three times.

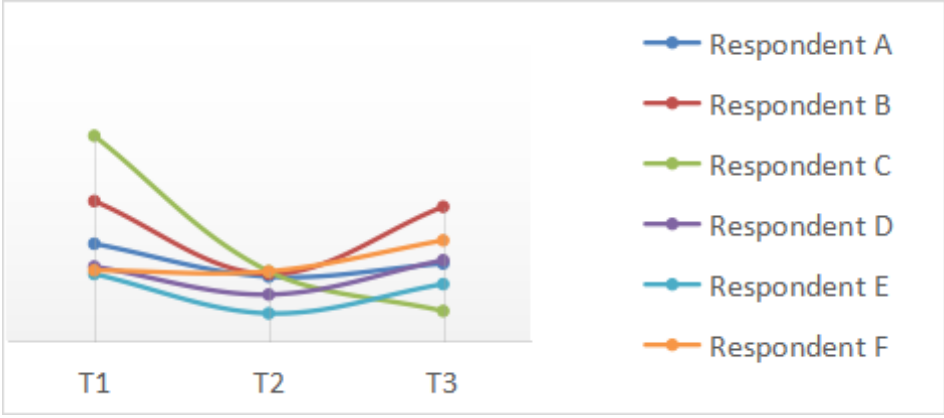

Figure 3. Emotional changes of Respondents in non-intervention state.

In addition, in the experimental test, the team found that the calculation of the number of half-words would cause some interference to the experimental results. For example, is it more accurate to divide "now making up homework" into three words: now/in/making up homework, or two phrases: now/in/making up homework. In addition, because emotion itself is subjective, researchers may have their own emotional tendencies when extracting words related to emotion, which will affect the experimental data. For example, the word "making up homework" may be considered a negative word in a context where the subject is depressed.

5. Conclusion

5.1. Artificial intelligence paintings are effective as art therapy

From the experimental results, it is obvious that AI painting is effective as a way of art therapy. Although, as artists and people with lived experience, we intuitively know that art therapy works. However, Sarah C. Slayton and Jeanne D 'Archer have combed and

studied the cases of art therapy from 1999 to 2007. Art therapy as a treatment modality has been demonstrated to be statistically significant in improving a variety of symptoms in people of different ages (Slayton et al. 2010). However, there is still a lack of clinical evidence whether it is more effective than other art therapies. When traditional painting is in progress, it will enter a short period of unconscious state, hand, or picture on paper inertia, but not completely irregular painting. The visual images produced by this part of the operation can be used to analyze his "inner unconscious". Alternatively, the process may be an unconscious release that does not involve reason. In artificial intelligence painting, there is no addition of this link. Perhaps, as Matthew W. Reynolds and others have argued. Art therapy appears to be effective but is generally no more effective than standard therapy (Reynolds et al. 2000). The same is true of AI painting. Compared with other treatment methods, artificial intelligence painting is relatively easy to implement as a way of artistic creation, and its popularization makes its research important for the development of the field of art therapy.

5.2. Artificial intelligence painting could be a skill for future art therapy education

For decades, art therapy educators have focused on identifying the content and skills that comprise art therapy education. Facing the challenges of the 21st century, how to build an adaptive knowledge system and transfer effective art therapy skills to future art therapists is an important topic in the field of art therapy research and development. In 2017, The Education Committee of the American Art Therapy Association conducted a comprehensive survey of the current situation and characteristics of doctoral education in art therapy. Argues that art therapy doctoral assignments require structures and learning environments that maximize the promotion of a culture of creativity, independent thinking, and self-directed learning to extend knowledge beyond existing theories and protocols. Each Doctor of Art Therapy program has its own unique approach to education. This contributes to the diversity, variety, scope and creativity of art therapy research. The Education Committee of the American Art Therapy Association believes that any doctoral training guidelines or regulatory recommendations are unnecessary in light of the current state of art therapy doctoral education. This may undermine the fundamental purpose and nature of the degree (AATA 2017). This shows that the development of art therapy education and its research are still in an open state. With the increasing demand for art therapy in society, the demand for art therapists is getting higher and higher. This requires further research to define and evaluate best practices in undergraduate art therapy education and to expand the scope of practice in the profession to include sub-professionals. Artificial intelligence painting can provide an adaptable tool for art therapists who are not art professionals. Therefore, AI painting can be integrated into the undergraduate or vocational education system as a professional skill. At the same time, it can also be used as an innovative pilot for the application of artificial intelligence technology and art therapy. With the development of artificial intelligence technology, we have reason to expect that in the future, artificial intelligence music art, artificial intelligence performing arts and so on will be extended to the field of art therapy.

5.3. Other factors influence art therapy: cultural, gender, moral

Members of the project also noted that even if artificial intelligence painting tools are used to intervene in art therapy, its standardization is still a challenging problem. Because many factors, such as cross-cultural, gender and so on, will affect the artistic sensitivity of the subjects. Men, as a discrete disciplinary group, are extremely sterile in their visual expression compared to their rich, extremely detailed verbal expression. In the field of art therapy, gender nuances in visual expression and perception are a relatively little-explored topic. On the other hand, art therapy, as an approach to psychotherapy different from other traditions, has become a progressive and moral enterprise in its critical self-reflection and conscious attempts (Hocoy 2002). At present, these factors, which transcend the system of art therapy itself but have a great impact on individuals, are still difficult issues for future research in the field of art therapy. The application of artificial intelligence painting to art therapy has not effectively solved this problem.

6. Acknowledgements

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