Exploring the Feasibility of AI's Auxiliary Functions in the Field of Children's Painting

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Abstract

This paper aims to explore the feasibility of AI in the field of children's painting education and to design AI-assisted applications to guide children's painting. The group selected Liu Yichen, the younger brother of the group member Swan, as the research subject, and selected six of his paintings. Through interviews, we learned about his creative intentions and the details that he failed to complete due to his own limitations. Then, through AI technology, we would conduct image processing experiments on the six selected paintings (some are dominated by keywords, some are not). Finally, we would feed back the generated works to Liu Yichen, and found out through interviews whether these works meet his expectations and whether they can stimulate him to further creation. At the same time, Liu Yichen's relatives, friends, and strangers will evaluate Liu Yichen's original works and AI works through questionnaires to test the feasibility of applying AI painting to children's painting. The results obtained from the interview of the experimental subject Liu and the questionnaire of friends, relatives and strangers showed positive results. However, 12 per cent of the strangers showed extremely negative attitudes in the questionnaire. Therefore, the study concluded that the integration of AI into early art education is highly feasible in today's market. However, in the face of the arrival of AI, we still need to leave a buffer period for human society, so as to realize the symbiosis between human and technology in a more peaceful way.

Key words: cyborg; Human-machine collaboration; AI education; AI painting; StoryDrawer

1 Introduction

The starting point of this study is a great regret. The pity is that when we were children, we had unlimited imagination, but we did not have the skills to draw it. And when we grow up and learn the skills, we forget the imagination of childhood. A great regret with time interlacing. And we want to make up for this regret by applying AI to children's early painting education and even art education. In the colorful tapestry of early childhood, where each stroke of the imagination contributes to the unfolding masterpiece of a child's mind, the infusion of Artificial Intelligence (AI) emerges as a transformative brushstroke. At the same time, this research will also contribute to the popularization of personalized education for children and individual mental health monitoring. As we stand at the crossroads of tradition and technology, the marriage of AI and early childhood art education beckons us into a world where creativity is not only cultivated but nurtured with a touch of innovation. In this realm, algorithms dance alongside the vibrant hues of a child's expression, providing not only a canvas for artistic exploration but also a palette of possibilities for their future.

2 Background

2.1 Definition of the academic keywords

2.1.1 Cyborg

With the rapid rise of various public applications of AI-generated content (AIGC), the topic of AI has entered the public consciousness in 2023 in a big way: 2023 is now known as the "Birth Year of AIGC". Prior to this, human ontology has provoked in-depth discussion in the field of philosophy, and the fusion of the body with technological devices has been described by scholars such as Haraway (2013) in terms of "cyborg" relations, which aimed to eliminate the prejudice of "othering" and promote her view in feminism.

With the development of information technology and digital devices, there is a trend in changing mediation in communication, which affects how people see and *feel* the world. As Olivia Burgess put it: "Though people are separated in their personal cells, people are connected to thousands of others via screens that feed them images and audio, and the main source of passing the time is giving and listening to lectures about a world no one actually sees or experiences" (Burgess, 2015). It is an extension of the 'Pseudo environment' theory (Lippman, 1965), with the 'cyborg' living it.

2.1.2 Human-machine collaboration

Human-machine collaboration is a new concept born with machine intelligence. Human-machine collaboration in a broad sense refers to the collaboration between man and machine. It is the extension and development of the concept and research category of "human-computer interaction". In 1960, Licklider proposed the concept of "human-machine intelligent collaboration". He also envisages three stages in the evolution of the relationship between people and emerging technological devices. These are "Human-Computer Interaction", "Human-Computer Symbiosis" and "Ultra-Intelligent Machine" (cf. Sun et al., 2020). In the 1990s, Qian Xuesen and others first proposed the concept of "comprehensive integrated engineering", which is a highly intelligent human-computer interaction system. In 1994, Lu Yongxiang and Chen Ying first put forward the concept of a "human-machine system", emphasizing that through mutual cooperation between humans and machines, each gives play to its advantages, so as to efficiently complete tasks.

The research of Lu Hong, Shenyang, Zeng Haijun, and others (cf. China AI+, 2020) indicated that the cooperation between intelligent technology and teachers reconstructs the teacher ontology and forms a "new subject teacher" composed of machine tutors and human teachers, and drives man-machine cooperative evolution in the process of promoting orderly teaching activities and autonomy of teaching system. Gao Qiong et al. (2021) pointed out that Human-Machine Collaboration is not the simple addition of human intelligence and machine intelligence, but a human-machine integration of intelligence. The purpose of human-machine collaboration is to make machine intelligence an extension of human intelligence. Faced with the risk of "technology encroaching on the value of life", Mao Gang and Wang Lianghui (2021) based on human security, belonging and growth, put forward the principle of human-machine coordination, which is "man controls machine, machine adapts to man, machine empowers intelligence".

2.1.3 AI education

AI is widely used in the education of children. Along with "AI aesthetics", implementing of AI into the fields of education and art is very controversial. On one hand, people are arguing whether machines can understand human's activities. On the other hand, there's always the fear of handing over the children, the future of mankind and the nation, to nurture by AI. AI's non-knowledge and non-skill education for children has been debated. Olivia Burgess described how online education is changing the concept of "effective learning" back in 2015. In a 2020 paper, Attwood detailed how "social education" in children's education would change under the influence of AI (Attwood, 2020). He pointed out that we should place great importance on integrated technology environments that increase the strategic and systematic use of wearable devices, handheld devices, and embedded devices that are interconnected with wireless technologies and the Internet. Hu Jingyi (2021) advocated the intellectualization and intellectualization tendency of education. Zhang Yibo and Zhou Xingyu (2023) dialectically explored the advantages and disadvantages of artificial intelligence entering the classroom teaching of art design. Below are the topics of the relationship between technology and school education.

The result of their study shows that the development and application of artificial intelligence assisted education system is an unstoppable trend, but for art and design disciplines, a more comprehensive and multi-

YEAR	AUTHOR	CONTENTS
2014	Gleason	”Cyborg-like teaching”
2015	Deaton	”Change interaction”
2020	Statti&Torres	Technology integration in schools

Table 2.1: Relationship between Technology and School Education

dimensional evaluation system should be built to provide students with the most suitable classroom teaching content and achieve the effect of teaching students according to their aptitude, as well as suitable tools.

2.2 Marketing investigation and implication case

2.2.1 Policy support and market situation

In terms of policy support in China, in July 2017, the State Council released the Next Generation Artificial Intelligence Development Plan. The report also said that AI should be broadly applied in basic education, higher education, vocational education, and civic education, and that China must train a new generation of talent with AI skills.

The market is booming, funding is large, and personalized education is valued. The “China AI+ Education Industry Development Research Report 2019” also shows that the market combining artificial intelligence and education is booming. The personalized learning experience provided by the adaptive learning of artificial intelligence is favored by the market.

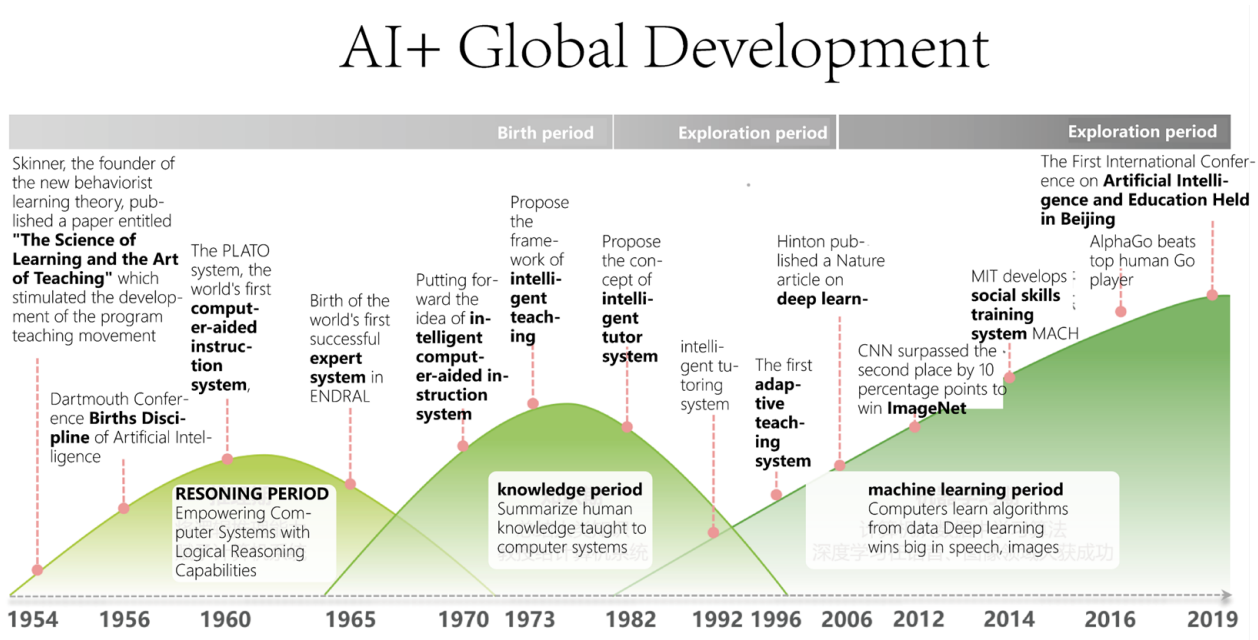

Figure 2.1: Comes from the 2019 China AI+ Education Industry Development Research Report

The figure shows the development of AI-assisted education, along with the AI technology, like the expert system and intelligent tutor system, which came out in 1965 and 1982 respectively. In the “machine learning period”, AI had the ability to gain experience and knowledge from human previous words and images, as well as dealing with complex problems that could only be solved by human in the past.

The first AI and education international conference was held in Beijing in 2019, in which Dewi Sari Wahyuni put out the new idea of a “chatbot” for learning foreign languages. Chatbots have advantages in flexibility, accuracy, and timely feedback in the absence of interactions using the foreign language in the classroom and in real life. This could be the same in the field of art education, such as the aesthetics cultivation

and the practice of basic painting skills. In real life, adults would quickly lose the patience to repeat the same words or talk to the child in a child-friendly and enlightening tone.

These are developments in the AI+ technology that indicate a future trend of introducing the tool, AI chatbots, to education, which inspires our project and research.

2.2.2 Implication case: Story Drawer-Analyzing children's paintings

Children's Drawing Psychological Analysis using Shallow Convolutional StoryDrawer is a child–AI collaborative drawing system to support children's creative visual storytelling (Chao Zhang, et al., 2022). This is an AI educational product that can be used for reference. It focuses on transforming children's stories into pictures, which is different from the application of assisted drawing envisaged in our research vision. The success of this product provides us with a business model for AI educational products that we can learn from. However, it is mainly focused on the "story", neglecting children's artistic sensitivity and unique creativity in the process of drawing (especially when given coloured brushes).

The children's drawing psychological analysis part of StoryDrawer uses a shallow Convolutional Neural Network (CNN). The classification shown in the experimental results section justify that the proposed shallow CNN model can assist psychologists in psychological analysis from children's drawings. This model indicates the promising potential role for Al tutors in monitoring child mental health.

2.3 Summary and Innovations

For years, there has been a research gap between "education" and "AI implements", especially in the field of creative drawing. However, there is still a dearth of experiments on AI use with child populations, and even rarer arguments for using AI to stimulate children's creativity and artistic productivity, thereby lowering barriers to the arts.

The policy in China has encountered great challenges. Whether AI technology should be introduced and how to treat it critically requires further investigation. This study can provide empirical reference for the interrelationship between AI technology and children's creativity.

2.4 Questions

The development of AI technology poses new challenges both technical and ethical. Sam Altman of Open AI said that until AGI (Artificial General Intelligence) arrives, the more responsible approach is to introduce AI technology into the world slowly, allowing more time for society, policymakers, and also the relevant organizations to react. For, who should be benefited by AI technology? Who can be empowered and with what kind of AI assistance? And how will AI affect people's aesthetics (especially for the mentally immature child population)?

We attempted to address the feasibility of using AI in child-assisted drawing and the related operational mechanisms using a qualitative case study of a child, as shown in figure 2.2.

3 Research Problems

1. Children's satisfaction with AI painting:
2. Evaluation of relatives and friends on AI improving children's painting; and
3. Feasibility of creating artificial intelligence in the field of children's painting education.

4 Methods

We designed the study in four parts, forming a set of controlled data collection. The main subject of the interview is Liu Yichen, the younger brother of Swan, a member of the research group. He is a child with a talent for drawing, but he has never used AI to process his own paintings before. So, we decided to use AI to recreate his work and design two interviews for him to compare and give his opinions. In addition, we designed two sets of questionnaires and sent them to Liu's relatives and friends in a family WeChat group and

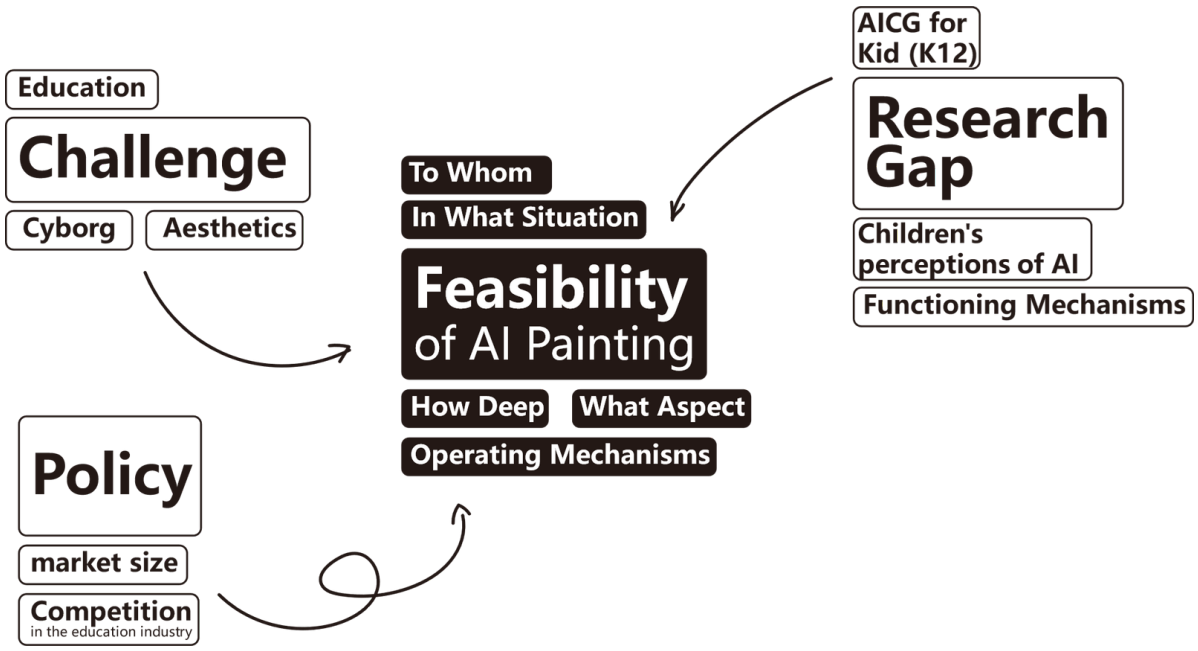

Figure 2.2: Structure

to Cambridge Summer Academic Programme (CSAP) students respectively. The former is used to investigate the surrounding environment of Liu's artistic creation, while the latter, as strangers and control variables, evaluate his paintings without knowing Liu in advance to preliminarily collect their confidence in Liu.

4.1 The generation in different variable

There are many models, platforms and datasets that can generate images from text or from existing images, such as Google Gemini, Midjourney, and Adobe Firefly. We chose the tool Stable Diffusion to allow us full control over the results and to explore the impact from different variables. Based on this open-source model, we have designed several steps to build the connection between the children and the AI.

First, the raw images from Liu were imputed into a module to explain what the machine could learn from human's paintings. The output keywords would reflect whether the algorithm could further help the child to draw or recreate.

Next, Canny (an edge recognition algorithm), keywords from step 1 and author's keywords were considered in a whole, to make up the independent variable. And of course, control subjects' groups are included as well. As the table shows, a two by three table was created to illustrate 6 possible directions that machine would implement on the raw images, which would also help us to choose the proper way to help children to draw and develop the applications in the future. Due to time constraints, we were not able to test all the variables related to image generation. But it is sufficient to continue our research.

Finally, these generated images were used to create questionnaires and re-send to Liu, for further research into their different reflections.

4.2 Interview

4.2.1 First interview

Due to time and a space constraints, it was decided that Swan and Liu Yichen would have a video chat via WeChat. The interview was conducted by showing him several paintings he had made and asking for his opinion. The online video interview was held at Liu Yichen's home, with his and his family's consent, and the camera was turned on and recorded.

The questions posed to him included: (1) the parts of the picture he had drawn and those he had not drawn; (2) the interference he received in the process of painting; (3) how the teacher taught him to draw these works; (4) his experience, mood, and feelings while painting; (5) his self-perceived degree of completion

Figure 4.1: Result of Original Picture

of painting.

These questions and indicators will be used to collect his initial impression and evaluation of his paintings and serve as an initial comparison for other interviews. In addition, this interview focuses on allowing him to express his feelings and recount his experiences to shape his ethnographic writing. This interview was conducted by Swan. As Liu's sister, Swan is a familiar and friendly member of the group. Given Liu's age and personality, interviewing with strangers will make him nervous and his expression ability will decline, which will make him unable to achieve the expected result of the interview.

4.2.2 Second interview

The second interview was an online video interview with Liu in the same environment. This time, he selected a number of representative paintings, we showed him works in which AI controlled keywords for these paintings and recreated them (there were six AI derivative works for each painting) and asked his opinion. Indicators include: (1) his favorite and least favorite works in each set of derivative works and his reasoning; (2) his attitude and feelings towards the re-creation of his works by AI; (3) his rating of these works; (4) his expectations for AI re-creation.

These questions and their metrics were used to gather his opinions on AI recreating his work, especially when compared to his originals. This will give us a more intuitive sense of his attitude towards AI art. And the deeper purposes of these indicators are: (1) to explore the feasibility of AI as a cyborg prosthesis for children and whether it could reflect children's formal ideas; (2) children's acceptance of AI's co-created art form and evaluation of AI's art as a whole; (3) to explore whether AI inspired children to create.

All questions were translated into children's language by panelist Ge Swan in Liu's familiar mode of communication. During the interviews, one of our team members with professional knowledge background in sociology provided some professional real-time guidance on Swan's interview methods behind the scenes, to ensure the interview results could meet the requirements of social science as much as possible.

	No-intervention	Canny
No-interv ention		
Author keywords		
Machine keyword		

Figure 4.2: Result of the Variable Adjustment

4.3 Questionnaire

The reason to survey the different opinions of relatives and strangers on the artist's work is that it can provide artists with more comprehensive feedback and help them better understand the impact and meaning of their work among different groups. Relatives may be more aware of the artist's background, emotions and life experiences, so their views may be more subjective. Strangers, on the other hand, may be more objective than relatives because they know less about the painter's life background and emotional state, and relatives and strangers may come from different cultural and social backgrounds. Finally, such a survey can cover a wider audience. Different audience groups may have different interpretations and feelings about the works, which helps the painters better understand the spread and acceptance of their works in society.

Moreover, we collected data from young CSAP students, all of whom are university students, to have a wider oversight on the public attitude towards AI painting with children. The intervention of artificial intelligence could change the way art is created, including the collaboration between painters and algorithms. Understanding the public's perception of this emerging creative approach can help to understand society's attitude towards technological intervention in the process of creating art.

During the questionnaire survey, we investigated the extent to which relatives' accompanied the painter and whether they evaluated the painting. The reason for this is that family support can be very crucial for the artist or creator. The accompanying degree of relatives and their evaluation of paintings may be important factors influencing the artist's creation. Understanding these factors can help researchers or organizations more fully understand the environment and social support of artistic creators in the creative process. And the result is that enough relatives' attention has strong connection to their scores. People who haven't taken part in Liu's work prefer lower scores, especially in the relatives' group.

4.3.1 Family and friends survey

Due to time constraints, a group of questionnaires for Liu's relatives and friends were also collected online. Taking into account the specific situation of the audience, the questions were designed to be very simple, intended to investigate the attitude of the people around Liu towards his painting, i.e., his creative environment (including, of course, the possible use of AI). Respondents are shown Liu's paintings and AI recreations and fill out questionnaires. Questions include: (1) Have they followed or observed Liu's painting? (2) How well they think Liu is drawing? (single dimension); (3) Whether they have ever evaluated Liu's paintings, and if so, what kind of evaluation they gave (both aesthetic and technical dimensions); (4) What is your attitude towards Liu's painting? (5) What is your attitude toward letting the AI participate in Liu's painting? (6) Their comments on AI re-creation.

For these questions, participants were asked to give a rating from negative five to five.

4.3.2 Stranger survey

We decided to use local materials and distribute the stranger questionnaire among CSAP college students. Although the population has a strong unity and homogeneity, the collection of data has become more convenient, and the complex variables within the population can be controlled. The survey sought to capture the environment Liu might have felt at the time of his painting and at the time Liu might use AI in the future (at least among CSAP college students). They were asked to answer only three questions: (1) (also with the dual dimensions of beauty and skill), (5), and (6).

For these questions, participants were asked to give a rating on a scale from negative five to five.

5 Results and data analysis

We conducted a questionnaire survey among 25 strangers and 25 relatives of Liu Yichen. The following are the data obtained from the questionnaire survey and the analysis of the data.

5.1 Interview

5.1.1 Result of interview

In our first interview with Liu Yichen, we asked him for some paintings that he was happy with and asked him to explain in detail what he wanted to express in these paintings. At the same time, his dialogue with us revealed examples of how he wanted to paint something in some of his paintings but was unable to do so. For example, when describing the painting "Piano", he said that he wanted to paint some beautiful nails on the girl's fingers playing the piano because the girl in his imagination was his sister and he wanted to create a painting based on his sister's usual manicure. This also gives us new ideas for exploring AI-assisted creativity for children, perhaps with the help of an AI to draw the picture that is in his mind's eye.

In the second interview we got feedback from Liu, he gave positive feedback on some of the works, such as "Hat" and "Tomato", he said "Even though the color of the tomato is a bit light, it achieved what I expected". But there was also some negative feedback, for example, on "Lotus", where he thought it was strange that the AI had expanded his painting and turned the lotus into a cake. Finally, when we asked him if the new paintings created by the AI gave him new ideas, he told us that he thought of "Potato" as a painting with leaves, and that if he created it next time, he would look carefully to see if the leaves existed in the actual object.

It is worth noting that when we asked him whether he would like to continue to create with AI, Liu Yichen gave an affirmative answer, saying that he very much wanted to use AI to help him paint the soon-to-be-demolished house in his hometown, and that he couldn't finish the painting very quickly, and he thought that with the help of AI he could paint the house in his hometown very quickly, which could then be deeply retained in his mind.

5.1.2 Conclusion of interview

From the interview results, we can conclude that Liu has a positive attitude toward the involvement of AI in his creation. He found it novel and interesting that the AI re-created his paintings, and that these re-creations gave him new inspiration, knowledge, and skills.

But at the same time, some of the AI's creative movements confused Liu. This is due to the functional limitations of the AI processing tools used in the current study. At the same time, this also shows that in the research and development stage of AI early education products, the combination of AI products with children's thinking and children's needs is very important.

5.2 Questionaries Analysis

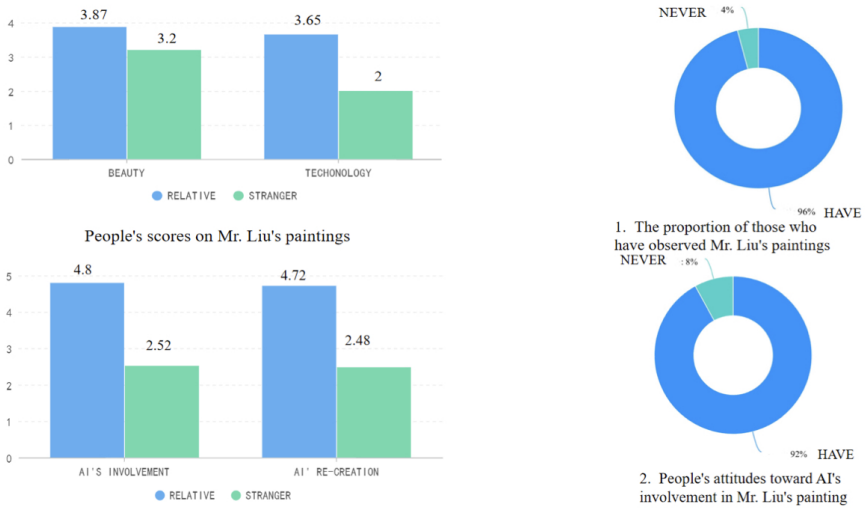

Figure 5.1: Figures of Surveies

5.2.1 Stranger survey's result and data analysis

Numbers	Beauty	Skill	Attitude to AI joining	Score to AI artworks
1	4	3	-1	3
2	5	5	5	5
3	2	1	4	4
4	5	5	-5	-5
5	3	0	2	3
6	-1	-1	-5	-5
7	3	3	4	5
8	1	-3	3	2
9	5	5	5	5
10	0	-2	1	1
11	3	3	3	2
12	1	1	3	2
13	3	1	-1	1
14	5	5	5	5
15	5	3	3	2
16	5	5	5	5
17	3	3	5	5
18	1	1	2	2
19	5	3	4	3
20	4	4	2	3
21	4	3	3	4
22	5	1	5	2
23	1	-1	5	1
24	5	1	3	5
25	3	1	3	2

Table 5.1: Survey Results to Strangers

First of all, through the questionnaire survey of 25 strangers and CSAP students, we can see the following situation. By asking participants about their aesthetic and artistic evaluations, researchers can gain greater insight into respondents' subjective experiences. This helps to collect different views and opinions to provide more comprehensive data for this study on double dimensions. When the full score is 5 points, the stranger's rating of Liu Yichen's paintings is 3.2 points for beauty and 2 points for technology, with an average score of 2.6 points.

With the highest score of 5, the support degree of the surveyed strangers for AI's participation in Liu Yichen's painting is 2.52 points, and the support degree of AI's re-creation of Liu Yichen's painting is 2.48 points. It's a modest positive attitude towards AI joining Liu's painting creation. While, in micro data, 16 per cent of participants hold negative opinions on AI joining Liu's painting creation, and 12 per cent of them hold extreme negative attitudes towards it.

5.2.2 Family and friends' survey's result and data analysis

Second, through a questionnaire survey of 25 of Liu Yichen's relatives, we can see the following situation: 96 per cent of the relatives have accompanied or observed Liu Yichen's painting, and 92 per cent of the relatives have evaluated Liu Yichen's paintings. When the full score is 5, the average score of the surveyed relatives for the beauty of Liu Yichen's paintings is 3.87 points, and the average score for the skill of Liu Yichen's paintings is 3.65 points. It's a modest positive attitude towards the young artist.

Given the full score is 5 points, the average score of the surveyed relatives' attitude towards Liu Yichen's painting is 4.84 points, the support degree of AI's participation in Liu Yichen's painting is 4.8 points, and the support degree of AI's re-creation of Liu Yichen's painting is 4.72 points. And from the personal data, all the relatives support AI joint creation.

Number	Total score	Beauty	Skill	Attitude to Liu's work	Attitude to AI joining	Score to AI artwork
1	5	5	5	5	5	5
2	1	-1	-1	5	5	5
3	1	2	2	3	2	4
4	5	5	3	5	5	5
5	5	(Skip)	(skip)	5	4	5
6	-1	-1	-1	5	5	5
7	5	5	5	5	5	5
8	4	(skip)	(skip)	5	5	3
9	5	5	4	5	5	5
10	5	5	5	5	5	5
11	5	5	5	3	5	5
12	5	4	3	5	5	5
13	5	5	5	5	5	5
14	5	5	5	5	5	5
15	5	5	5	5	5	5
16	5	5	5	5	5	5
17	4	2	3	5	5	5
18	1	0	-1	5	5	5
19	5	5	5	5	5	5
20	5	5	5	5	5	5
21	5	5	5	5	5	5
22	5	5	5	5	5	5
23	5	5	5	5	5	5
24	5	5	5	5	5	5
25	3	3	2	5	4	1
26	5	5	5	5	5	5

Table 5.2: Survey Results to Relatves

Compared to the evaluation towards Liu's original painting, the score of AI's joint creation is much higher.

6 Conclusion

Based on the comments of 25 students from Liu's relatives and 25 students from CSAP on his paintings and their attitudes towards AI participation in painting, we draw the following conclusions. We have come to four main conclusions.

6.1 Feasibility for AI to participate in children's painting education

Through the interview and questionnaires, we can primarily conclude that it is feasible and inevitable for AI to participate in children's painting education.

Firstly, as a representative of the child group, our experimental subject Liu showed great interest and positive attitude towards the participation of AI in his creation. In the co-creation experience with AI, Liu expressed a positive evaluation of AI's secondary creation. The positive feedback of the direct audience on AI co-creation provides the most important foundation and value support for the market use of this product itself.

Secondly, the results from the questionnaire survey show that relatives and friends have a positive attitude towards the participation of AI in Liu's co-creation. Parents will be the main consumption decision makers of children's educational products. The opinions of friends and family will also be an important influence. Positive feedback from friends and relatives has provided support for the positive profit expectations of AI painting early education products.

Thirdly, the vast majority of strangers have a positive attitude towards AI's involvement in children's painting creation. From this, we can preliminarily infer that the public's attitude towards AI's participation in children's painting creation is supportive.

Fourthly, AI can remarkably reduce the cost of child education. Individualized education resources for children are scarce and the cost is high. AI, with its autonomy and adaptability, can act as a private teacher for children. And the use of AI technology to fill this gap in the market can greatly promote educational equity.

Fifthly, the era of AI has arrived and exposing children to AI early in early education will help future generations better adapt to changing times.

6.2 The possibility of AI becoming a Cyborg prosthesis for children (or even all humans)

The insights gained from the interviews with Liu Yichen reveal a nuanced perspective on the integration of AI into childhood creativity and artistic expression. Liu's initial joy in sharing his artwork was met with an exploration of his unfulfilled artistic aspirations, offering a glimpse into the potential of AI-assisted creativity for children. The subsequent interview, featuring AI-generated derivatives of his paintings, provided a platform for Liu to articulate his thoughts on the collaborative process between human creativity and AI algorithms.

Liu's positive feedback on certain AI-derived works, such as "Hat" and "Tomato," underscores the potential for AI to meet or even exceed his expectations. However, instances of confusion and dissatisfaction, as seen in the transformation of the lotus into a cake in the painting "Lotus," highlight the current limitations of AI processing tools. This indicates the importance of refining these tools to align more seamlessly adapt to the nuances of children's imaginations.

Crucially, Liu's expressed eagerness to continue collaborating with AI, particularly for painting his soon-to-be-demolished childhood home, unveils the transformative potential of AI as a cyborg prosthesis for children's creativity. The prospect of AI aiding Liu in quickly capturing and preserving memories suggests a powerful synergy between human emotions and technological capabilities.

In conclusion, this exploration of AI-assisted creativity for children demonstrates both promise and challenges. The positive impact on inspiration, knowledge, and skill development is evident, yet the need for refining AI functionalities to better understand and align with children's artistic vision is apparent. Embracing such AI applications not only empowers children to adapt to the AI era but also represents a significant

stride towards nurturing holistic growth. This symbiotic relationship between human creativity and AI technology paves the way for a future where children seamlessly integrate technological tools into their creative processes, fostering a generation adept at navigating the complexities of the AI age.

6.3 The hidden danger of AI to human civilization

In the data analysis part, we can see that there are still a small number of people who hold extremely negative attitudes towards AI's participation in children's painting creation. This also shows the current society's hidden concerns and fears about the application of AI.

The development of AI technology poses new challenges at both the technical level and the ethical level. But much as Sam Altman has mused, AI could greatly help humanity or destroy civilization if it is abused. Elon Musk, co-founder of Open AI, also frequently voices concerns about the potential risks associated with advanced AI. In the face of the impact of new technology we should be brave, adapt to the times while reserving a certain buffer space for new integration, so as to achieve a better symbiosis between people and technology.

7 Application Demo

Based on the above research, we will propose an AI application model for early childhood education and illustrate the possibility of AI becoming a cyborg prosthetic arm and childhood companion for children in addition to personalized tutors.

7.1 Reason and feasibility

Children possess limitless imagination and creativity, but due to the limitations of their painting technique, they cannot perfectly express what they want while creating. And with age, the imagination gradually declines. Unrestrained imagination becomes a growing regret: this is the dilemma for children education. So, we wished to design a demo application, which can co-create with children, draw what they want, assist parents to carry out early childhood education, and open up a new path for future early childhood education.

Through the previous interview with Mr. Liu and the analysis of the collected questionnaire survey data, we found that the vast majority of people hold a positive attitude towards the participation of AI in children's painting and the secondary creation. With the bright future of AI co-creation with children in mind, we designed such an app.

7.2 Function introduction

7.2.1 Multifunctional assisted creation

This application can encourage children to continue to create by issuing voice and displaying inspirational words when children find it difficult to draw what they want. By entering keywords, users can generate multiple groups of pictures and works according to children's daily drawing practices, satisfying their rich imaginations. The online creation function also supports photo identification of different brush painting materials, targeted comparison of the speed of children's creation, and choice of corresponding rhythm to co-create with, and it supplements the creation where the child's own ability is not up to it. Thus the things they want can be drawn, and the child's creative intention can be fully expressed through AI technology. This provides a new conception for AI-assisted children's painting in future.

7.2.2 Mental health monitoring and guidance

For parents, the app can analyze a child's painting, judging the color, brush strokes, and composition of the pictures and other elements from which to analyze the child's current psychological condition and emotional needs. While drawing, the app can provide children a bunch of knowledge and ideas in different fields. Parents and children can also use the app to break down barriers and communicate not only in paintings, but

Figure 7.1: Application Diagrams

through art. This helps parents to better understand their children's inner worlds, establish emotional links with their children, and cultivate their artistic and aesthetic ability.

Figure 7.2: Application Diagram

7.2.3 Personalized early childhood experts

AI has autonomy and adaptability. AI systems are able to learn, reason, and make decisions to a certain degree autonomously, without human intervention and control. They can adjust and optimize their models and strategies according to changes in the environment and data to adapt to different tasks and scenarios. This also determines that AI early education applications can become cost-effective personalized products.

This application opens new ideas for AI-assisted early childhood education, which not only satisfies children's rich imagination and love for painting, but also helps parents better communicate with their children in the field of art and establish a good life relationship with their children. It shows that the essence of education is not one-way indoctrination, but two-way interaction. It is hoped that this application can bring positive influence, let more children and parents get happiness in painting creation, cultivate children's healthy and positive attitude, establish correct values, and grow into a creative person.

8 Future outlook

The integration of AI into early childhood art education presents a compelling avenue for enhancing the creative development of young minds and protecting children's mental health. And the dynamic synergy between technology and creativity has the potential to revolutionize the way children learn and express themselves.

As we look forward, collaborative efforts among educators, technologists, and researchers will be crucial in

harnessing the full potential of AI to create a future where children can not only use AI as a cyber prosthetic to better realise their talent but also have the right to equal access to personalized education. But at the same time, we should ensure that these advancements are ethically grounded, inclusive, and aligned with the holistic development of each unique young mind.

Ultimately, the vision is not just about teaching children how to create art; it is about instilling a deep and lasting appreciation for the boundless realms of human imagination. In this symbiotic relationship between technology and humanity, we aspire to cultivate not just skilled artists, but lifelong learners who embrace creativity as a cornerstone for innovation, empathy, and the continuous pursuit of knowledge. The future of AI in early childhood art education paints a masterpiece of empowered minds shaping a world of limitless possibilities.

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Conceptualization and literature review: Y.L. and P.R.;
Market research and conclusion: Y.L.;
Literature review and variables definition in the experiment: P.R.;
methodology: Z.R.;
Interview, results collation and language polishing: G.S.;
Data curation : Z.R., Z.T. and X.H;
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