Creative Art Practice in Response to Climate Change: How Art Transforms and Frames New Approaches to Speculative Ecological and Sustainable Futures

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Abstract-Climate change is seriously threatening human security and development, leading to global warming and economic, political, and social chaos. Many artists have created visual responses that challenge perceptions on climate change, actively guiding people to think about the climate issues and potential crises after urban industrialization and explore positive solutions. This project is an interdisciplinary and intertextual study where art practice is informed by culture, philosophy, psychology, ecology, and science. By correlating theory and artistic practice, it studies how art practice creates a visual way of understanding climate issues and uses art as a way of exploring speculative futures. In the context of practical-based research, arts-based practice as research and creative practice as interdisciplinary research are applied alternately to seek the original solution and new knowledge. Through creative art practice, this project has established visual ways of looking at climate change and has developed it into a model to generate more possibilities, an alternative social imagination. It not only encourages people to think and find a sustainable speculative future conducive to all species but also proves that people have the ability to realize positive futures.

Keywords—Climate change, creative practice as interdisciplinary research, arts-based practice as research, creative art practice, speculative future.

I. INTRODUCTION

CINCE the 21st century, climate issues have become Dincreasingly prominent due to the accelerated development of economic globalization. According to a study by the European Commission in 2016, human activities, such as burning fossil fuels, cutting down rainforests, growing livestock, and the spread of transportation, produce many greenhouse gases (GHG) into the air, leading to climate change [7]. This breaks the balance of various natural GHG in the original ecosystem and causes economic, political, and social chaos [16], [28], [36], [40], [44]. In response to climate change, countries passed the Paris Agreement at COP21 in Paris in November 2016. It requires all parties to do their utmost to reduce GHG emissions and limit global temperature increases under 2 °C of the level before the industrial revolution and try to control it within 1.5 °C [15]. Although there are some significant obstacles in global governance, such as the United States' withdrawal from the Paris Agreement in 2017, several developing and developed countries are actively working to mitigate and adapt for the long-term sustainable development of humankind [9], [31], [39], [43], [47].

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Climate change is impacting on all aspects of human life. It is like a "hyperobject", which not only exists in the past and the present but the future [3], [27]. It is everywhere. As a powerful visual language, the 'pre-appearance' of art represents the existence of objects which are 'not-yet-being'. It guides people's thoughts and souls to the sublime events and gives people the perspective to rethink and examine the future [3], [4], [19], [22], [24], [25], [27]. It can reveal reality and present the true appearance of the world to an audience. To fight against climate change, many artists have created visual concepts to challenge their views on climate change and global warming from various aspects, to guide people to think about ecological problems and potential crises after urban industrialization and explore positive solutions. In art practice, artists challenge their beliefs with their artistic language. This artistic language is the material existence of artistic conception, which effectively interprets climate change and conveys climate change-related knowledge to people [2], [6], [7], [12], [18], [27], [34]. Simultaneously, it is the only way to generate artistic works [46]. Indeed, due to the diverse types of art and the personality of artists, artistic languages are also different. Through different artistic perspectives and ways of thinking, artists regard art as a powerful means through which people face problems, question the current situation, and even explore sustainable and speculative futures.

This paper focuses on understanding the influence of visual language and media to change and inform ideologies, behaviours, and perceptions. Based on the study of artworks of influential artists engaged in climate and environmental surveys, such as Wheatfield - A Confrontation (1982) by Agnes Danes, Heat and the Heartbeat of the City (2004) by Andrea Polli, Rain Room (2012) by The Random International, Flight Patterns (2012-present) by Aaron Koblin, Wildfire Progression Series (2012-present) by Adrien Segal, Earth Works: Mapping the Anthropocene (2018) by Justin Brice Guariglia, Wake and Unmoored (2018) by Mel Chin, Natural Order (2020) by Edward Burtynsky, and Pollinator Pathmaker (2021) by Dr Alexandra Daisy, this paper interprets and presents how art as an ideological metaphor and a new method can produce creative changes in the space of climate change by artistic practice. Also, it has critically theorized and evaluated approaches concerning the research proposition, results, and impact to prove art as a visual language of ideas. Concisely, this project is carried out

through a practice-based approach, taking the ecological thinking on 'hyperobjects' of Timothy Morton and Ernst Bloch's concepts of 'speculative materialism' and 'ontology of not-yet-being' as the theoretical and philosophical basis. The purpose is to create a new framework of understanding through artistic practice that responds to climate issues and explores a sustainable and predictable future.

II. MATERIALS AND METHODS

This paper utilizes theory and artistic practice to respond to the themes and issues of climate change. The research object is art practice, focusing on how creative art in the digital media field can be employed as a framework for understanding climate change and exploring sustainable futures. The research parameter focuses on whether this project creates a new visual language responding to climate change. The research methods include creative practice as interdisciplinary research and artsbased practice as research. These two methods are conducted alternately. In this project, arts-based practice as research is a spiral process of research and development, including the overall planning of research tasks, research objects, theoretical underpinning, artistic creation, and reflective observation. This paper will record the research process and results, creative artworks, and participatory observational activities. The purpose is to respond to community and environmental problems and explore a sustainable and speculative future through specific creative digital art as research.

Stage 1: Initial Artworks to Explore Research Priorities

The early artworks of this project take artistic practice as a method to deal with the theme and problems of climate change. Invisible Inside (Fig. 1), Climate Trace (Fig. 2), and If the Weather Talks (Fig. 3) creatively express their thinking and understanding of the ecological environment and speculative futures, respectively, from the perspective of giving attention to climate change, giving attention to the environment for improving climate change, and using climate data to give attention to the climate crisis, preliminarily exploring and responding to the research question of this project [8], [13], [15], [32], [33], [37]. Concretely, based on the living environment and eye characteristics of endangered species affected by climate change, this project designed Invisible Inside (2019) using digital software to tell the stories of 12 endangered species. The eye is the soul's window, which can convey rich emotions. All its components work together to help humans obtain external visual information. It can be said that the eyes are like an ecosystem. If the function of one structure changes, it will affect the function of other structures. Although these changes are invisible to the naked eye, they do exist. Once damaged, human beings lose their visual contact with the outside world. Likewise, although the ecological environment of different organisms is different, it will change in the face of the threat of climate change. Some organisms may evolve, while others may be on the verge of extinction. This artistic practice hopes to establish the connection between people and other species through the medium of eyes.

Climate Trace (2020) comprises a self-making Chinese Xuan

paper and a short video. In this artistic practice, the Xuan paper was placed in dozens of scenes where people often go in their daily life (parks, bamboo forests, roads, lakeside, communities, and so on) so that this paper can experience the weather changes in the daily life of residents, such as sunny days, cloudy days, rainstorms, strong winds. In this work, the Xuan paper is a metaphor for humans, and the climate change that the Xuan paper has experienced is what human beings have experienced. In other words, this work attached its ecological thought to the Xuan paper, creating a narrative way of explaining climate change from daily life, calling people's attention to spontaneously think about the relationship between themselves and their surroundings and climate change. With the changes of weather patterns such as storms, the change in atmospheric pressure will have a notable consequence on the human body, particularly on some people who are especially sensitive to the climate.



Fig. 1 Invisible Inside (2019) Works by Wenwen Liu



Fig. 2 Climate Trace (2020) Works by Wenwen Liu

If the Weather Talks (2020) consists of five digital screens that visualize the real-time temperature data in Beijing, London, New York, Melbourne, and Singapore. The colours displayed on the screen are determined by temperature and weather phenomena. For example, when the weather is sunny, and the temperature is 18 °C to 25 °C, there will be warm colours. The weather is rainy, the temperature is 18 °C to 25 °C, and there

will be cold colours. This work aims to create an environment for the audience to connect with their daily life, encouraging audiences to think and question their connection with climate warming and the environment.



Fig. 3 If the Weather Talks (2020) Works by Wenwen Liu



Fig. 4 The Kubuqi Desert Ecological Investigation (2020) Photos by Wenwen: A week-long Kubuqi Desert Research Project, including dialogued with Xiwang Zhang, and processed a tree-planting tour

By and large, in terms of giving attention to climate change, this project attempted to create visual approaches to presenting the climate crisis, making people aware of the threat and vitality of climate change. In terms of giving attention to the environment for improving climate change, it attempted to design a social imagination through technology, exploring solutions that are conducive to the existence of all species. In terms of using climate data to give attention to the climate crisis, it developed an emotive language by visualizing climate data, enhancing people's awareness of climate change and raising the issue of future responsibility. Through exploring these three aspects, the art practice of this project has constantly been evolving from a personal perspective to a community perspective and then to a global perspective. These first art experiments established that digital media art is a field with diversity, creativity, interactivity, freshness, and exciting potential [20], [26], [42], [45], [46], [48]. It enables artists to give full play to their imagination, enrich their artistic expression, and enrich the expressive power of the digital within the conceptual space. Utilizing technology engages with innovation and integrates, promotes subject knowledge, and comprehensively displays a unique expression of the language of emotive value to the integration of art, science, and technology.

Stage 2: Creative Practice Informed by Observational Activities as Research

In 2020, this project conducted participatory observation research in the Kubuqi Desert (Fig. 4) to directly understand the process of environmental change, obtain environmental knowledge in ecological practice, and create a visual archival and primary knowledge base. In the Western Zhou Dynasty, the Kubuqi Desert was a human settlement. However, from the end of the Eastern Han Dynasty, due to the intensification of human activities and the arid and windy climate, it gradually evolved into the sixth-largest desert in China [10], [21]. Accordingly, it severely threatens the survival and development of residents and around cities. In 1988, with the strong support of the Chinese government, local enterprises and residents' associations, the Kubuqi Desert Ecological Restoration Project was launched. This creates not only a sustainable development model driven by the balance of desertification control, ecological restoration, economic development, and poverty alleviation but also an essential reference and of crucial significance for the improvement of the ecological environment [14], [21], [30], [38], [49]. This participatory observational research mainly carried out two tasks: a conversation with sandcontrol worker Zhang Xiwang to understand the impact of desert governance on residents and the environment, and a twoday tree planting tour to deeply experience the ecological environment of the Kubuqi Desert. The research results of this research became the content for this project's digital art practice in reframing sustainable speculative futures.

Speculative design is based on imagination, the ability to imagine other worlds and other choices [5]. This ability can be summarized in Utopia, which is people's imagination and assumption of future possibilities. These possibilities are not only a state of the existence of the world itself but also a state of the future existence of new things [3], [11], [17]. The Kubuqi Desert Greening Project is a typical case of China's fight against climate warming. It not only respects the desert ecosystem but also successfully governs the harsh ecological environment realizing the symbiosis between humans and the environment and promoting social and economic development. From this basis, this project developed the artwork *Climate Coding* (Fig.

5). It is a digital media artwork designed by Unreal Engine, algorithmic coding, and 3D computer technology. Specifically, with the help of Unreal Engine, this project built 744 small square rooms, placed by month and year. Every room is brightened with lights of distinct colourings, which are transformed by algorithmic coding of the Kubuqi Desert's temperature data. In real life, the temperature is closely related to people's emotions. Nevertheless, it is usually displayed in digital form, which cannot give people an intuitive feeling. However, different colours can directly prompt people's feelings about temperature and affect people's moods differently. Through these 744 small rooms, this project created an environment related to people's daily life. People live together in a room called the earth; people live together in a room called home [1]. After an occupied day, they will ultimately return to their own room, where they can unwind and rest. This space will make them feel safe and comfortable. Therefore, in this work, each small room represents a person's living space, and the temperature of this space is visualized through the colour of light to encourage people to think about the impact and feelings of climate change on themselves. The purpose of the work is to carry out speculative design through a specific ecological case study creating a digital and visual space of discourse where people can deeply understand the interaction and intervention between human behaviour and climate and experience a social dream existing in the past. This existence is not the present but a possibility for human beings to explore the future or the possibility of another world to reshape the present.



Fig. 5 Climate Coding (2021) Works by Wenwen Liu

Stage 3: Arts-Making to Transform an Understanding of Climate Change and a Speculative Future

Through expanding art practice and developing alternative social imagination of this project, it became committed to turning speculative making using a more significant global perspective to frame a global perception and understanding of climate change. Real-Time Climate Coding (Fig. 6) is a timebased artwork, that integrates algorithm coding, Arduino, and digital technology to display temperature data in real-time. It consisted of two digital screens and an online website. The regular dynamic shape was displayed on digital screen one, and its colour was visualized by real-time temperature data. Digital screen two was divided into 1440 digital squares representing 24 hours a day, i.e., 1440 minutes. The colour data per minute obtained from screen one were displayed from left to right and from top to bottom on screen two. When all squares of screen two were filled with colour blocks representing different temperatures, it would reset and start filling colour again. At the same time as resetting, the 24-hour colour data of this day would be uploaded to the online website for recording climate change. Through it, people can intuitively see the process of climate change in the past. In short, screen one showed the realtime observation of climate change, screen two recorded climate change in a day, and the online website stored long-term climate data. Through this work, people can better understand the relationship between man and the climate around them. In this work, the future is the critical point. It is a concept that does "not-yet-exist" but is always about to appear [3], [11], [23],

[27], [29], [35]; tomorrow is the future of today, while the present is the future of the past. Real-Time Climate Coding is a metaphor for the future; it is the future of the past. Through it, people can directly see their contribution to climate change, encouraging them to take action for an improved sustainable future. Simultaneously, it records the process by that humankind must constantly surpass; the existing social conditions to pursue a better life. People can also perceive a negative side to the future in Real-Time Climate Coding. That is, a future of inaction. Climate change is seriously threatening human security and development. Research shows that the GHG concentrations are expected to increase further by 2019. At this rate, GHG concentrations will force global temperatures to rise to dangerous levels [16], [44]. Through Real-Time *Climate Coding*, people can intuitively see the terrible pictures caused by the change in temperature rise and its impact on themselves. This work develops a real-time discourse in space related to daily life, where people can intuitively see the process of climate change. It connects human emotions with the surrounding environment, helps people observe and reflect on their impact on the environment, calls on people to pay attention to global warming and dialectically think about the relationship between humans and ecosystems. At the same time, as an alternative social imagination, it affects problem-based concepts and ideology through visual art display, redisplay and interpretation, responds to climate change and readjusts society to a sustainable future.



Fig. 6 Real-Time Climate Coding (2022) Works by Wenwen Liu

III. RESULTS AND DISCUSSION

Arts-based practice as research is a spiral process of research and development, including the overall planning of research tasks, research objects, theoretical basis, artistic creation, and reflective observation. It regards recording the research process and results, creating works of art and participatory observational activities as research materials. Through these two methods, this paper develops a digital media artwork: *Climate Coding*, responding to discussions including climate change and future development. As a successful climate restoration case, the Kubuqi Desert Greening Project has an exchange value that is cultural and socio-political and benefits society and the individual [14], [21], [41], [43]. It is a possibility that people explored over 30 years ago. With the joint efforts and positive intervention of the local people, companies, and government, it has become a reality. Taking the ecological experience and collected ecological data of the Kubuqi Desert as the creative language, with the help of the game engine, digital technology, algorithm programming, *Climate Coding* creates an ecological space where the audience can effectively communicate with climate change and deeply understand the

interaction and intervention between forest, humans, and climate. Thereby encouraging people to think about the impact and feelings of climate change on themselves and reflect on their behaviours and impact on the environment. Simultaneously, with the help of this successful ecological restoration case, Climate Coding encourages people to take active action to deal with climate warming. The art practice of the project has been recognized by some conferences such as AoMo 2022 in Liverpool, the 5th International Conference on Advanced Research in Education in Cambridge, and the European Conference on Arts, Design & Education, and exhibitions such as Boomer Gallery in London, CICA Museum in Seoul, and global arts initiative Micro Galleries, and magazines such as Haus A Reset and OcchiMagazine, and has been well promoted. This shows that this paper responds to global warming and explores a potential speculative future. Then, this project develops Climate Coding into a model: Real-Time Climate Coding to generate more possibilities and deeply explore the topic of the future. Concisely, this paper finds and creates a discussion space, developing alternative social imagination and encouraging people to think and find a sustainable speculative future conducive to the survival of all; concurrently, it proves that people have the ability to realize this future.

IV. CONCLUSION

In conclusion, climate change has become a significant global challenge that requires urgent attention and action. This paper has highlighted the impact of human activities on the environment, leading to climate change, and the efforts being made to mitigate and adapt to this issue, including the Paris Agreement. This paper has focused on the role of art as a visual language in understanding climate change and exploring sustainable and speculative futures. Through a practice-based approach, this paper has explored the use of creative digital art as a framework for responding to climate change and has developed the Climate Coding project as an ecological space for effective communication with climate change. This project has been recognized in conferences, exhibitions, and magazines, demonstrating the potential of art as a powerful means of generating social imagination and promoting positive action. The results and discussion of this paper have critically theorized and evaluated approaches concerning the research proposition, results, and impact to establish art as a visual language of ideas for the long-term sustainable development of humankind. It is hoped that this paper can inspire further research and art practice that contributes to addressing climate change and creating a better future for all.

References

- Art Lab. (2022) How Art as a Vehicle for Ideas-based Ideologies Can Facilitate the Understanding of Climate Change and Help People Explore a Speculative and Sustainable Future. Available at: https://www.an.co.uk/events/art-lab-january-2022/?cv=1 (Accessed: 2022/06/16)
- [2] Arts Council England. (2014) The value of arts and culture to people and society an evidence review. Manchester: Arts Council England.
 [2] Plack E. (2000) The grainit of Utania?
- [3] Bloch, E. (2000) 'The spirit of Utopia'.
- [4] Diderichsen, P. (1948) 'Ernst Cassirer: An Essay on Man. An Introduction

to a Philosophy of Human Culture', Theoria, 14(1).

- [5] Dunne, A. and Raby, F. (2013) Speculative everything: design, fiction, and social dreaming. MIT Press.
- [6] Dewey, J. (2019) Art as Experience. East China Normal University Press.
- [7] European Commission (2016) Causes of climate change. Available at: https://ec.europa.eu/clima/change/causes_en/ (Accessed: 2019/06/16).
- [8] Fallon, J.E. (2014) 'Confronting Consumption: Cadillac Ranch, Wheatfield, and the Tissue Culture & Art Project'.
- [9] Gong, Y. (2010) 'Global warming and China's response', Business China, (01), pp. 306-307.
- [10] Guan, C. et al. (2017) 'Historical Evolution of the Fluvial and Aeolian Landscape in the Hobq Desert', Arid Zone Research, 34(2), pp. 395-402.
- [11] Han, J.X. (2010) 'Debate on Ernst Bloch's Philosophy of Hope', Inheritance, (10), pp. 40-41.
- [12] Hai, L.B. (2011) A study of aesthetic cognition from the perspective of Art Anthropology', The Ideological Front (Yunnan University's Journal of Social Sciences), (5), pp. 6-10.
- [13] Hornby, L. (2017) 'Appropriating the Weather: Olafur Eliasson and Climate Control', Environmental Humanities, 9(1), pp. 60-83.
- [14] Han, Q. and Huang, X. (2018) 'The Sand-control Model of Kubuqi Desert: The vivid embodiment of Xi Jinping's thought of ecological civilization', Economic Daily, 2018/09/06, p. 13.
- [15] Hamilton, A.J. (2020) 'Land as Protagonist', Art Journal, 79(4), pp. 6-25.
- [16] IPCC. (2018) Global warming of 1.5°C: an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. The Intergovernmental Panel on Climate Change (IPCC).
- [17] Jin, S.T. (2018) The dreams of a better life: a study of Ernst Bloch's philosophy of Art. China Social Science Press.
- [18] Kagan, S. (2014) Art and sustainability: connecting patterns for a culture of complexity. transcript Verlag.
- [19] Li, X. (2017) 'Aesthetic Revolution and the Contemporary Construction of Utopia', Journal of Literature and Art Studies, 7(11), pp. 1401-1409.
- [20] Lei, Q. (2017) 'Discussion on the innovative application of digital media art in exhibition design', Art Education Research, pp. 75.
- [21] Liang, P. and Na, F. (2018) 'The era value and far-reaching significance of Kubuqi Desert management', Qiushi, (16), pp. 47-49.
- [22] Marx, K. (1844) 'Economic and philosophical manuscripts', Early Writings, 333.
- [23] More, Thomas, Sir, Saint, Logan, G.M. & Adams, R.M. (1989) Utopia. Cambridge: Cambridge University Press.
- [24] Margolin, V. (1997) The struggle for Utopia: Rodchenko, Lissitzky, Moholy-Nagy, 1917-1946. London; Chicago: University of Chicago Press.
- [25] Matravers, D. (1998) Art and emotion. Oxford: Clarendon Press.
- [26] Mao, J. (2003) 'Digital Media Art', Jiangxi Social Sciences, pp. 243-245.
- [27] Morton, T. (2013) Hyperobjects: Philosophy and Ecology after the End of the World. Minneapolis: University of Minnesota Press.
- [28] Mei, X.Q. (2014) 'Lessons learned from developed countries', Social Outlook, pp. 31-33.
- [29] Noble, R. & Whitechapel Art Gallery. (2009) Utopias. London: Whitechapel Gallery.
- [30] Nong, F. (2017) 'Kubuqi: desert turns green, ecology enriches people', Green China, pp. 59-65.
- [31] National Statistics. (2019) Annex: 1990-2017 UK Greenhouse Gas Emissions, Final Figures by End User. London: National Statistics.
- [32] Nathalie Miebach. (2018) The Burden of Every Drop. Available at: https://nathaliemiebach.com/ (Accessed: 2020).
- [33] Polli, A. (2006) 'Heat and the heartbeat of the city: sonifying data describing climate change', Leonardo Music Journal, 16(1), pp. 44-45.
- [34] Pitt, C. (2019) The Effect of Art and Science in Shaping Attitudes Towards Climate Change.
- [35] Resch, R.P. (1997) 'Utopia, dystopia, and the middle class in George Orwell's Nineteen Eighty-Four', Boundary 2, 24(1), pp. 137-176.
- [36] Swanborough, J. (2019) 6 things we learned about the environment at Davos 2019. Available at: https://www.weforum.org/agenda/2019/01/the-environment-was-highon-the-agenda-in-davos-but-what-actually-happened/ (Accessed: 2019/06/10).
- [37] Taylor, J.d. (2014) The underwater museum: The submerged sculptures of Jason deCaires Taylor. Chronicle Books.
- [38] Teng, L. (2015) "Kubuqi Model' creates desert miracle', Earth, (10), pp. 15-49.

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- [39] The Parliament of the United Kingdom (2008) Climate Change Act 2008. The UK: The Stationery OYce Limited.
- [40] UNDP. (2014) Human Development Report 2014: Sustaining human progress: Reducing vulnerabilities and building resilience. New York: The United Nations Development Programme (UNDP).
- [41] Wang, Y. (2008) 'Wang Wenbiao's ten years of desertification control, herdsmen from ecological refugees to rich people', Huaxianxinghuo, pp. 54-55.
- [42] Wang, A. (2017) 'Analysis of Digital Media Art', Ming Ri Feng Shang, pp. 179.
- [43] Wang, Z. (2017) "China plan" for combating desertification in the world - Analysis of Kubuqi model (1)', Northern Economy, pp. 4-7.
- [44] WMO. (2019) WMO Statement on the state of the global climate in 2018. Online: World Meteorological Organization (WMO).
- [45] Xi, L. (2018) 'Research on the presentation of digital media art', Charming China, (19), pp. 207.
- [46] Zhang, J. (2009) 'The generative function of artistic language in creative [10] Endig, G. (2007) The glutter is a second strain in the second strain is second strain in the second strain is second strain in the second strain is second strain in the second strain in the second strain is second strain in the second stra
- Countermeasures', New West: Late · Theory, (7), pp. 13.
- Zhou, X. M. & Shen, W. Q. (2017) 'Semiotic analysis of digital media [48] art', Min Yin Ke Ji, pp. 252.
- [49] Zhang, W., Gao, Y. and Zhang, X. (2018) 'Research progress of mobile dune control technology in Kubuqi Desert', Xiang Cun Ke Ji, pp. 113-117.