



Diffraction, Creativity and AI: Towards New Methods for Design Research

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Abstract

My research explores the intersection of diffraction theories, creativity, and artificial intelligence (AI) to develop new methodologies for design research in Human-Computer Interaction (HCI). By employing Karen Barad's theory of agential realism and the concept of diffraction, I research how diffractive methodologies can offer deeper insights into the complex relationships between humans and AI. My aim is to contribute to the ongoing formalisation of diffractive methodologies for design research, demonstrating their potential to generate novel insights and design directions that may be overlooked by traditional user-centered approaches.

CCS Concepts

• **Human-centered computing** → **Interaction design theory, concepts and paradigms**; • **Applied computing** → *Arts and humanities*.

Keywords

creativity, AI, entanglement theories, diffraction, methods

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1 BACKGROUND AND MOTIVATION

The emergence of AI as a creative tool has fundamentally challenged our understanding of creative practice. Traditional user-centered approaches struggle to capture the complex dynamics when humans and AI collaborate creatively, as the boundaries between user and tool become increasingly blurred. This dissertation investigates these challenges through empirical studies of creative practitioners working with AI technologies. Therefore, as AI systems become increasingly sophisticated and pervasive, there is a growing need to re-conceptualize our understanding of the relationship between humans, technology, and the world around us. A handful of HCI researchers have therefore begun to engage with *Entanglement*

HCI [18] (an adoption of entanglement theories: actor-network theory, post-phenomenology, object-oriented ontology and agential realism), with a view to finding a pathway for the perceived shortcomings of HCI thinking [13, 15, 17, 28, 30, 32, 34, 42, 44, 45, 47, 48]. Entanglement HCI [18] offers compelling frameworks for exploring these complex interactions and their implications for AI research and development. Of the entanglement theories offered by Frauenberger [18], Karen Barad's theory of *agential realism* and object/methodology of *diffraction* [5] appear to offer new pathways towards understanding the world and our position within it. Agential realism can be briefly summarized as a philosophical framework that posits that entities do not have inherent boundaries or properties prior to their interactions. Instead, phenomena emerge through what Barad terms *intra-actions* within an entangled state of reality [5]. Diffraction is used as a conceptual and methodological tool to explore the entangled nature of reality and knowledge production. Barad [5] proposes diffraction as the method of "reading insights through one another in attending to and responding to the details and specificities of relations of difference and how they matter". Simply put, agential realism and diffraction suggest a more nuanced understanding of my research focus: the human-AI interaction, one that is mutually shaping. This mutual co-constitution is especially evident in the context of creative interaction, which can often function as an ill-defined, iterative and exploratory process.

Agential realism provides valuable tools for understanding how creative boundaries blur in human-AI collaboration. Rather than treating AI as a simple tool, this framework helps us examine how creative agency emerges through complex interactions between human and machine. The diffractive methodology offers specific analytical techniques for studying these interactions without reducing them to simple cause-effect relationships. Therefore, the work of my PhD operates within this space: diffraction and creativity with AI. I seek to cultivate connections between the spaces, finding where knowledge can be exchanged, and how one might inform a closer understanding of another. Understandably, there is uncertainty about the potential of entanglement theories for HCI. One of the significant criticisms is the challenge of converting entanglement theories to actionable design methods [42]. As such, the research of my PhD operates with two goals. The first: cultivating a better understanding of how AI impacts human creativity, understood and analyzed through the lens of diffraction. Secondly, using this knowledge to develop novel and actionable design methods that look towards cultivating better tools, technologies and interactions. The importance of this research is based on the premise that user-centered design, whilst often useful and important, leaves a number of questions unanswered. Frauenberger [18] suggests that in leaving user-centered design behind, we can develop "agonistic,

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participatory speculation methods to design meaningful relations", rather than optimizing for user experiences. I am steered by the questions asked within Entanglement HCI: what futures should we designing for ourselves?

2 Objectives and Approach

In defining my objectives, I first discuss the key related work in order to contextualize my questions.

2.1 Related Work

2.1.1 Creativity and AI. Creativity plays a crucial role in HCI [20], influencing both the design process and the development of tools (creativity support tools) to support creative work [19]. Advancements in AI technologies have allowed for the development of new human machine creative tasks. From an array of design tasks [23–25, 37, 56, 59] to considering AI as a design element [6, 10, 27, 55, 57], to stage design [24], drawing [39, 51, 58], performance [49, 53, 54], creative writing [16, 21, 36, 46] and exhibition [35, 38]. In particular, AI for artistic applications has received much attention, such as the political, cultural [40, 60], aesthetic [22] and socio-technical dimensions of AI in creative work [1, 3, 8, 11, 12, 26, 33, 50, 52]. Notably, AI for creative tasks because it often re-defines and reshapes the creative act, creating a new human-tool balance with the creative process. However as I will discuss, current research is limited in its ability to take stock of the ontological uncertainties generated by AI, and as such tends to approach the research task as a question of improving the user experience through iterative refinement of algorithms, which is a huge simplification of the ways in which humans live with technologies. Given this shortfall of the user-centered research method, I turn to diffractive theories.

2.1.2 Diffractive Theories and Methods. Entanglement HCI [18] discusses the ontological uncertainties generated by our changing relationship with technologies. Frauenberger [18] advocates that entanglement theories [43] such as feminism, post-humanism and post-phenomenology should be applied to the study of technologies, in order to understand how technologies become entangled with our bodies and lives. Among other theories, Frauenberger [18] adopts diffraction and agential realism [5]. Diffraction forms a central theory around which my PhD is built. Diffraction involves reading insights from different disciplines and approaches through one another to produce new understandings by exploring differences and interferences between perspectives. It moves beyond reflecting or representing the world to actively intervening in it [5]. There is an emergence of diffractive methodologies (DM) within HCI [2, 4, 14, 41, 42, 44, 45, 47], and often the utilization of DM facilitates a deeper and difference-attentive understanding of technologies, environments and people. Diffraction can also be investigated as an object: Sanches et al. [48] present an insightful study of *diffraction-in-action*, whilst others have applied diffractive studies to various sub fields [29, 31, 32].

2.2 Questions and Goals

Given these two foci briefly explained in Section 2.1, I now turn to the questions of my dissertation.

How do creative practitioners navigate and negotiate AI within their work? I believe in the value of gathering new data, and a focus

of my PhD research has been on cultivating connections with those in creative industries in order to closely understand their interactions with AI technologies, including building, breaking, changing and resisting. My publications under review report the findings of this data collection with diverse creatives. I have also worked extensively with the Bridging Responsible AI Divides (BRAID) ¹ programme at the University of Edinburgh to map the global landscape of creative action with AI.

What methodological tools can help us understand and design for human-AI creative collaboration? Simply collecting data does not answer any questions. It is the process of the analysis in which new ideas and results emerge. Therefore, the analysis process must be led by a framework that is able to account for the complexities of the data. In considering the countless ways creatives can use AI, it is especially significant to not flatten the data. A diffractive analysis or a diffractive reading should retain the dynamism and depth of the data, accounting for differences and instability of boundaries. *How can diffractive research be used to preserve the complexity of creativity, evaluate its forms and precipitate the development of better interactions?* The final question of my dissertation is to formalize the diffractive lens I began to work on in Study 2. In doing so, I aim to present a set of unique findings for creativity with AI. My work with diffraction as a tool for analysis and reading will be formalized into a diffractive methodology that challenges the notion of user-centered design thinking.

2.3 Approach

The approach of this PhD is qualitative; I am focused on gathering real world data of people using their technologies, and — in partnership with these people — developing new methods for thinking about these interactions. Simply put, many involved artistic interactions with AI are not viewed by the human as a simple user-tool engagement, so why should the user-centered approach be the most insightful way to investigate? I have chosen to engage with diffraction for a number of reasons. Firstly, it is ill-defined as a method and an object to investigate within HCI, not only by virtue of its characteristics as a philosophical concept that it is difficult to concretize into method, but in that the HCI field has seemed unwilling to undertake the task of converting diffraction to an actionable design method. In addition, it has been noted that in the process of converting the concept of diffraction to a method we would lose the flexibility that makes a diffractive view valuable. The HCI community has much to do to unpack the meanings of diffraction and entanglement, and their implications for design practices. My approach seeks to not prematurely close around diffraction as the only means to do future research in HCI, but rather to explore the potential for diffractive research within HCI.

3 Contributions

3.1 On the Generative Text-to-Image Model [7, 9]

During the first year of my PhD I focused on the complexities of text-to-image models as tools in the public domain. Within this, I looked at AI ethics. We conducted and presented a systematic

¹<https://braiduk.org>

examination of the anticipated and observed risks associated with modern text-to-image generative models [9]. We built a taxonomy of risk across six key stakeholder groups, identified 22 distinct risk types from data bias to malicious use. The investigation we conducted was intended to enhance the ongoing discourse on responsible model development and deployment and has subsequently achieved this goal, becoming the most cited investigation of the risks of text-to-image models. In addition, by highlighting previously overlooked risks and gaps we aimed to shape research and governance initiatives, guiding toward the responsible, secure, and ethically conscious evolution of text-to-image models. During this focus on text-to-image models, I conducted and published a study focused on exploring the ability to empirically evaluate the presence of creativity in human interactions with generative models [7]. In this work, I adopted evaluative frameworks from the field of computational creativity and applied them to the interactions that users can have with text-to-image models. We presented a number of failings in generative models such as pastiche and imitation, limited interaction and opaque process. Further, we showed the connections that can be drawn between the work of computational creativity and the mass use of deep generative models in a creative context, as these new interactions offer ripe opportunity to understanding the processes and interactions of the user with “creative” systems.

3.2 Study 1: Exploring the Practices of Creatives Working with AI [8]

In the second year of my doctoral studies, I designed and conducted a qualitative study that aimed to understand and explore the real-world experiences of artists interacting with AI in their creative practices. ‘AI’ encompasses a countless range of technologies, including text-to-image models, large language models, recommendation systems and computer vision tools. We specifically recruited artists who were both practicing professionally and who pursued new ways to use AI tools. We discussed their identity as a creative, their creative history, their practice with AI and their visions for the future. We uncovered a number of insightful findings that contribute to the growing body of knowledge around how AI can cultivate or dampen human creativity. We found a number of tensions around our participants choice to use AI and their identity as an AI practitioner, such as not being accepted by academic circles for using AI. Furthermore, we looked closely at the mechanics of their interactions, such as how they overcome TTI models not working as expected. We touched upon responsibility, and found that our participants had developed complex opinions on ‘being responsible’ with AI. For example, some felt troubled by their choice to present work made with AI, whilst others chose to allude to the presence of AI in their work but not expose audience to the technology. Based on our findings, and the feedback from presenting this work at CHI’ 24, we developed Study 2, discussed in Section 3.3.

3.3 Study 2: Investigating Diffraction as a Method for Design Research in HCI Using a Study of Creative Interactions with AI

Expanding on the results of Study 1, we designed and conducted a second phase. This phase was focused on expanding the creative

professions of our participants. We recruited a wide array of professions, including writers, performers, filmmakers, CEOs, musicians, choreographers and dancers. Currently in review is the paper presenting the results of this study. In this paper, we framed AI as a new design material, using the affordances of the technology to seek out the diffractive actions of our 20 participants. Particularly the paper articulated findings of diffractive action, or the ways creative practitioners shape projects diffractively. We answer the question: *how does diffraction play out in the process of creative interactions?*, articulating examples of how diffraction is practically enacted. We explored how creative practitioners engage diffractively with AI technologies, revealing insights that can inform future HCI research and design practices. By examining the ways in which artists, designers, and technologists interact with AI tools, we uncovered several key themes that demonstrate the value of diffractive methodologies in HCI: adopting the machine vision, reshaping teaching and learning processes, developing symbiotic relationships, intentional resistance, exploring entanglements with the human body, rethinking ethics and responsibility, and speculating on alternative futures that redefine our relationship with AI. The study reveals that when creative practitioners engage diffractively with AI, they embrace complexity and contradiction rather than seeking simple solutions or optimal outcomes. This approach surfaces alternative visions of technologies and new design directions that can help address the challenges of building for a world grappling with technological anxieties and uncertainties about the future. These findings highlight the potential of diffractive approaches to generate novel insights and design directions that may be overlooked by traditional reflexive methodologies. By attending to differences and exploring the entanglements between humans, AI, and the broader socio-technical context, diffractive practices can help HCI researchers and designers move beyond notions of human-centered design towards more nuanced, ethically-engaged, and transformative approaches. Our research also demonstrates the practical application of diffraction as a methodological tool in HCI research. By actively searching for diffractive actions in our participants’ practices, we uncovered insights that might have been missed through more traditional analytical approaches. This suggests that diffraction can be a valuable complement to existing HCI research methods, particularly when studying emerging technologies and complex human-technology relationships. Reflecting on our methods, we present four provocations that offer a starting point for integrating diffractive thinking into HCI research and practice. As AI technologies continue to evolve and permeate various aspects of human life, adopting diffractive methodologies may become increasingly crucial for addressing the complex challenges and opportunities that arise at the intersection of humans and intelligent systems. In recognizing the difficulty of translating theory to design methods and practice, we did not offer a practical guide to investigating diffraction, but rather use our findings of AI in creativity to investigate the realities of diffraction-in-action. We presented our findings across seven themes: the view from the machine, teaching and learning, symbiosis, breaking and resistance, the body, ethics, responsibility and safety, and shaping the future of AI. We found that in searching for the diffractive across these themes we uncovered valuable and timely results that would have remained hidden had we framed the human as simply ‘user’. Following our results, we turned to a

discussion around the process of searching for the diffractive, and identifying how these insights can assist us in developing diffractive methodologies for HCI practitioners.

4 Expected Next Steps

The future of diffractive design in HCI holds significant potential for advancing research methodologies and design practices. As the field continues to grapple with complex socio-technical challenges, diffractive approaches offer a way to engage with multiple perspectives and generate novel insights. By reading different analyses, theories, or disciplines through one another, researchers can uncover new patterns of difference and create more nuanced understandings of human-computer interactions. Therefore, by reading the nuances of creativity with AI through the diffractive lens, we can uncover new understandings of our relationships with technology. Subsequently, we can develop the diffractive methodology through our closer understanding of the new ways we are creative with AI (a complex and boundary challenging task).

Therefore, I plan to focus on the complexities and intricacies of interacting creatively with AI by 'zooming in' on the processes of a handful of participants, and working with them over the course of months. Specifically, I will focus on cultivating knowledge that takes stock of the complexity of the creative process life cycle by working closely with my participants to develop shared understandings and analysis of their experiences.

I will contribute a detailed understanding of the human-AI creative dynamic, and present —from these findings— a development and application of the diffractive methodology for HCI. Through my focus on longitudinal case studies with creative practitioners, I will document specific patterns of human-AI interaction and test new diffractive analytical tools. This work will produce concrete guidelines for designing and evaluating AI-enabled creative tools. I will focus on maintaining and developing the theoretical foundation while strengthening its connection to practical challenges and outcomes in human-AI creative collaboration.

Concrete Methodological Steps.

- Document specific patterns of human-AI interaction through detailed case studies of creative practitioners.
- Identify limitations of traditional methods in capturing these interactions.
- Develop analytical tools based on diffractive methodology for studying human-computer interactions.
- Validate and test tools through longitudinal studies with creative practitioners.

5 Dissertation Progress and Goals

I am a third year student at the University of Edinburgh in the Design Informatics department, under the guidance of Professor Ewa Luger and Doctor Caterina Moruzzi. I aim to present my dissertation by Spring 2027. At this stage I am working on planning and developing my next study. I have begun to draft my thesis and have my theoretical chapters sketched. I am also currently working as a research assistant on the BRAID (Bridging Responsible AI Divides) programme. The findings of Study 1, Study 2 and the defined next steps — alongside my publications in AI ethics — will form the body of my thesis. Post-graduation I wish to pursue an industry

role in research, focused on developing new ways to think about building technologies for humans, and engaging with users in novel ways. I would like to continue working in the field of creativity technologies, such as building better tools for artists, musicians and designers. Participating in the CHI '25 Doctoral Consortium would be immensely valuable to my progress as a PhD student, and will meaningfully and practically assist me in shaping the direction of my PhD by providing constructive conversations on how best to define analytical tools for user research and how to shape my results into insightful and valuable publications. I have not previously attended a Doctoral Consortium.

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