Understanding Visual Artists' Values and Attitudes towards Collaboration, Technology, and AI

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ABSTRACT

Artificial Intelligence (AI) tools have recently gained widespread interest for image creation, but tool developers have largely focused on technical capabilities or specialized domain uses, rather than visual artists as users. We collected survey data from 89 practising visual artists and conducted follow-up interviews with 30 of them, to better understand their diverse needs and values. Through reflexive thematic analysis, we explored visual artists' attitudes towards collaboration in art creation both with human artists and with AI- and other technology-based support systems. Our results suggest that the focus of popular AI tools on high-quality, finished images does not meet the needs of visual artists. Instead, they wanted reference images, ideation support, and variant exploration. We identified similarities and differences between how visual artists view collaboration with other artists or with machine support, enabling designers of new tools to adopt a more user-centered approach.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative interaction**; **Empirical studies in HCI**; • **Applied computing** → **Media arts**; **Fine arts**; • **Computing methodologies** → *Artificial intelligence*; • **Social and professional topics** → *User characteristics.*

KEYWORDS

Visual Art, Collaboration, Artificial Intelligence, Creativity Support Tools, User Experience, Generative Research

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1 INTRODUCTION

Visual artists have been incorporating digital technology into their art practice for decades, including Cohen's AI drawing program, AARON [9], Molnár's geometric plotter drawings [22], and Sim's AI evolution animations [28]. Recent advances in AI image generation (with tools like Midjourney [20] and DALL-E 2 [24]) have allowed digital technology to adopt a larger role in image production, raising questions and concerns about the role of visual artists in that process. While much recent work has improved these tools' technical capabilities, they remain understudied in terms of human-computer interaction, and particularly from the perspective of practising visual artists. Understanding artists' practices and attitudes towards technology in an art context is critical to designing new tools in a user-centered way. While some visual artists have integrated AI and other digital technologies into their art practice, many have not [2]. To reach more diverse audiences, we need to understand the concerns of those who are reluctant to use assistive AI technology.

Through a survey and interviews, practising visual artists shared their preferences, current and expected benefits, and concerns regarding both human-human collaboration and human-machine collaboration. Although our primary research interest is human-AI collaboration, our study aims to understand artists' experiences with a wider range of assistive technology, as many artists have only limited experience with AI systems. We pursued two research questions (RQs): **RQ1:** What are visual artists' attitudes towards human collaboration and assistance (or the absence of it) in their art creation? **RQ2:** What are visual artists' attitudes towards technological or AI collaboration and assistance in their art creation?

After describing related work and our methodology, we present our results, covering the benefits and challenges of collaborating with other visual artists and the benefits and concerns related to using technology and AI in art. We discuss how our developed themes can inform future work and outline relevant limitations.

2 RELATED WORK

Prior work has investigated human-human collaboration [8, 16], AI and other technology that supports art creation [6, 10, 11, 17, 19, 29, 31], and attitudes towards this these forms of art support [2, 15, 25, 27, 30]. We study visual artists as users to more deeply understand their habits and values as they relate to these topics.

2.1 Human-Human Visual Art Collaboration

There is limited work documenting how artists collaborate with other (human) artists. John-Steiner described different patterns of collaboration among famous artist groups and collectives [16]. While the work included some direct artists quotes, most of the data was not obtained directly from the visual artists, in contrast with our survey and interview data. Chung et al. explored artist support networks and how related roles might inform the design of Creativity Support Tools (CSTs) [8]. They analysed data from 14 artists across art creation domains and developed categories of support, relationship types, and frictions and conditions for success. While their work describes the forms that artist support can take, it does not investigate artists' values and preferences for these different forms of support and collaboration, nor towards CSTs.

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2.2 Technology Supporting Visual Artists

Much prior work has explored creativity-supporting technologies, but less has focused on visual artists, specifically. D'Inverno and McCormack outlined the benefits of collaborative AI, considering artists, AI researchers, and audiences [11], but did not study artists directly. AI tools have also changed dramatically in the nine years since publication. Zhuo proposed human-machine co-creation model and outlined its advantages in painting, but did not investigate artist values towards the collaboration [31]. Chung and Adar developed PromptPaint, an AI system for artists based on a paint colour-mixing metaphor [6], and Lu et al. created a painting assistant [19], but neither work explored artists' broader attitudes and experiences beyond prototype testing. Through a systematic literature review, Then et al. examined the impact of AI on art [29]. They highlighted a need for further study of human-AI collaboration.

2.3 Attitudes towards AI and Technology for Art

Research has targeted specific artist audiences' use of technology. Creed studied artists with disabilities [10] and Li et al. explored how tech-savvy artists work with software [18]. Palani et al. studied creative practitioners' (including artists') values related to CSTs [25], targeting the tools as opposed to the users. Specific to AI, Allred and Aragon investigated an online artist community's rejection of AI image generators via member characteristics and values [2]. Sanchez studied 64 AI art hobbyists to understand their motivations for text-to-image generator use and the problems they encountered [27]. In contrast, our study encompassed a wider range of visual artists, beyond AI artists. Through a literature review and case studies, Yusa et al. explored social and ethical aspects of AI art and its production, highlighting creative benefits, but raising concerns about artist agency and society [30]. We investigated artists and their attitudes toward collaboration directly. Jiang et al. studied potential harms to artists and recommended regulation and restrictions around training data. [15]. They advocated for consultation with visual artists when developing supportive tools, motivating our present work.

3 METHODOLOGY

3.1 Study Design

To obtain a rich dataset for analysis, we collected data from: 1) an initial survey and 2) semi-structured interviews; we invited some willing survey respondents for follow-up interviews. Triangulating data across these sources allowed us to confirm, enrich, and better explain our findings. Procedures and materials for the survey and interview were approved by our institution's research ethics board. We targeted English-speaking adults (aged 18+) who practised some form of visual arts for at least two hours per week. The survey initially asked about age and art-making hours to filter respondents based on our criteria before proceeding with further questions.

We designed our survey and interview questions to help answer our research questions (Section 1). Relevant survey and interview questions are included in the results section (4). . We also organize them by research question in Section A of the supplemental materials. The survey (Section C of the supplemental materials) included multiple choice, multiple response, and short-answer questions, covering participant demographics, attitudes, and habits related to collaboration, AI, and other technology in their art practice. The survey was anonymous, with the option to share name and email for potential follow-up interviews. We developed an interview guide (Section D of the supplemental materials) with questions on the same topics as the survey. We tailored some interview questions based on participants' survey responses, specifically, questions related to experiences and interest (or lack thereof) in working with other artists and in collaboration with technology. We also asked personalized follow-up questions, both to seek clarification and to gain insight deeper insights relevant responses. To identify any potential gaps in our initial understanding of what participants deemed important, we gave interviewees an opportunity to share any additional insights, experiences, suggestions, or other information that was pertinent to their art making.

3.2 Recruitment and Data Collection

3.2.1 Survey. We used Qualtrics to conduct the survey online, obtaining data from 89 visual artists as respondents. The survey took approximately 10 minutes to complete. We did not offer any compensation and as such, did not take any special measures to avoid fake survey responses, beyond Qualtrics' built-in bot detection and multiple submission prevention features. We shared the survey with our social media networks and with several artist groups via Facebook and email. Some local artist groups were willing to re-share our survey via their own mailing lists. We posted survey flyers in three buildings across our university campus and in several regional art schools and community spaces.

We attempted to recruit a diverse mix visual artists and received responses from artists across all of the categories listed: Collage, Conceptual Art, Crafts, Design/Architecture, Digital Drawing, Traditional Drawing, Film/Animation, Generative/Algorithmic/AI Art, Digital Painting, Traditional Painting, Photography, Print-making, Sculpture, plus additional write-ins for 'Other' (Table B4 of the supplemental materials). However, we did not collect a demographically representative sample, particularly across race (Section 3.2.3). We attempted to address this by contacting local indigenous and black artist groups online. Several organizers shared our survey, but these channels didn't result in many additional responses.

3.2.2 Semi-Structured Interviews. We invited respondents who shared their contact information for individual interviews. After achieving our goal of 30 completed interviews from the first 53 invitees, we ceased sending invites. Each hour-long, semi-structured interview was conducted via Zoom, typically with audio and video, though three participants chose audio-only. We recorded all interviews for transcription. As compensation, we gave each interview participant an Amazon gift card worth approximately $20 CAD.

3.2.3 Participants. Our participants had ages from 18-79 (mean 43.7, std. dev. 16.7). A majority (53%) identified as women, 29% men, 8% non-binary, 2% gender-fluid, and 1% for each of 'another answer' and 'prefer not to answer'. 79% identified as White, compared to 70% of Canadians in the 2021 Census [13]. Participants were a mix of hobbyist (47%) and professional (39%) artists; 14% included a combination or other. See Section B of the supplemental materials for more detailed information, split by survey and interview data.

3.3 Data Processing

We automatically transcribed the interview audio data using Microsoft Word 365, then made manual corrections. Following Braun and Clarke's approach to transcription, we left the data as unfiltered as possible, to capture the nuance of verbal responses [3]. Survey responses did not require any processing.

For data collection efficiency, we asked some survey and interview questions that were unrelated to this paper's topics. Here, we extracted only the responses to the survey and interview questions that respond to RQ1 and RQ2 (Section 3.1).

3.4 Data Analysis

We used a mixed methods approach, analyzing quantitative (survey) and qualitative (survey and interview) data. We were guided by Braun and Clarke's six-phase Reflexive Thematic Analysis (RTA) process, including: 1) data familiarisation 2) data coding; 3) generating initial themes; 4) developing and reviewing themes; 5) refining, defining and naming themes; and 6) writing the report [4]. RTA is a post-positivist approach, which emphasizes the researchers' role in knowledge production. In contrast with many other approaches to qualitative data analysis, RTA requires themes to be developed inductively and actively. Though initially analyzed separately, we combined the survey and interview data as the interviews were conducted with a subset of survey participants and provided depth to the same topics studied in the survey. We describe how our experience and perspectives might have influenced our analysis next, followed by details of our analytical process.

3.4.1 Researchers' personal positioning. In qualitative analysis, it is common to describe the researchers' personal positioning and professional experience, since they can influence data interpretation [5]. Researcher 1 (R1) is a white, cisgender woman PhD student. She previously worked as a user experience designer and strives to follow a user-centered approach. R1 has experimented with AI and generative art and optimistic about its potential, but sympathetic to the concerns and interests of the artist community. Researcher 2 (R2) is a white, cisgender man who has worked as a university faculty member for over a decade, studying interactions between people and AI systems. He has strong concerns with the reliability and trustworthiness of contemporary AI image generators.

3.4.2 Analytical Process. R1 conducted all interviews, corrected transcriptions, and re-read the survey responses and interview transcripts familiarize herself with the data. R1 coded the selected survey response and interview transcript data pertaining to our research questions, processing one survey or interview question at a time. R1 created an initial set of codes per selected question, iterating through responses to add new codes as needed. R1 then collated all of the codes with supporting data and read through excerpts by code to develop a deeper understanding of the codes and refine them. With the data still split by survey or interview question, R1 identified relationships and grouped codes into preliminary themes that responded to our research questions. R2 reviewed the themes, supporting codes, and participant quotes. R1 and R2 reviewed and discussed the preliminary themes and narratives. This peer debriefing was not aimed at shared consensus, but rather to develop a richer understanding through varied perspectives and highlight any implicit assumptions, providing a more nuanced analysis. We evaluated and revised the developing themes and attempted to demarcate boundaries and outliers. We refined theme names to better reflect their data, merged similar themes, and removed themes that either did not directly respond to our research questions, or lacked relevance or supporting data. Finally, we collated resulting themes with explanatory quotes (Section 4). To clarify our presentation of the quotes, we edited them to remove false starts, phrases such as "like" and "you know", and similar conversational breaks. We have taken care to preserve all original meanings.

4 RESULTS

We organize our results into subsections by research question: RQ1 in Section 4.1 and RQ2 in Section 4.2. See Sec. 4.3 for key findings.

4.1 Attitudes towards human collaboration and assistance

We present findings towards answering **RQ1: What are visual artists' attitudes towards human collaboration and assistance (or the absence of it) in their art creation?**

4.1.1 What forms of human collaboration and assistance are of interest to visual artists? We explored this question because human-human artistic collaborations can inspire the design of future human-machine collaborations. We began the survey with a screening question: Are you generally interested in working with other visual artists (including assisting other artists or receiving assistance)? Approximately 69% of survey participants responded "Yes", 24% responded "No", and 8% responded "I don't know" (Table B5 of the supplementary materials). We asked those who responded "Yes" what types of co-working interested them; the results are in Table 1.

"Artists having informal involvement in one another's work, lower investment, shorter duration (e.g., occasionally providing and receiving support and feedback)" received the most (49%) selections. Chung et al.'s analysis of 111 CSTs found that feedback roles

Table 1: Percentage of visual artists' stated interest in types of co-working, across survey (S) and interview (I) respondents.

Which forms of co-working interest you?	S	I
Having another artist (typically an assistant or apprentice) to whom you can delegate tasks in service of your goals	20%	23%
Supporting another artist (typically acting as an assistant or apprentice) from whom you receive specific tasks in service of their goals	26%	23%
Artists having informal involvement in one another's work, lower investment, shorter duration (e.g., occasionally providing and receiving support and feedback)	49%	60%
Artists each having different skills and dividing up a task into separate parts	39%	47%
Artists merging into a unified force, melding not only skills but identities	27%	33%
Other	7%	7%

(including "Understanding", "Critique", and "Curation") were less common, representing 17.1%, 9%, and 9% of CSTs, respectively [7]. If these preferences transfer to artists' machine-support preferences (as we propose in Section 4.3.1), it could be beneficial for CST developers to offer more feedback-related features for artists.

"Having another artist (typically an assistant or apprentice) to whom you can delegate tasks in service of your goals" was least frequently selected (20%). This is somewhat surprising, as this style of collaboration appears to closely match the support offered by popular AI image generation tools like Midjourney and DALL-E 2. Similarly, Chung et al. found the "Producing" role to be relatively uncommon, while "Execution Assistance" was the most common role category in their CST review (73% of the CSTs they studied) [7]. Recent advances in text-to-image systems may have further increased the number of "Producing"-focused tools, since Chung et al.'s CST collection ended at 2020. To meet the needs of visual artists, we should explore forms of support beyond task delegation.

4.1.2 What do visual artists value about human collaboration and assistance? For interview participants who indicated prior artistic collaborations, we analyzed their responses to the following interview questions: What (if anything) did you gain from the collaboration? What appeals to you about that kind of human artist collaboration or assistance? For those who didn't recently collaborate on art: Are there any challenges or limitations to creating art by yourself? We found that visual artists value collaboration as a means of personal development and for providing practical execution support and rewarding social connections.

Artist development. Many visual artists valued working with and observing other artists. One participant highlighted the educational benefits: "I learned so much from seeing the work that they do and sharing ideas and stuff." (P80) Timely input from another artists can be helpful. A participant explained: "If you've been looking at something for a long time to have someone else come in and then have a sort of 'fresh perspective' and they can just help you out in that way." (P86) Some artists who worked predominantly alone felt the lack of feedback and outside perspective. One participant said: "There's definitely a limitation to self instruction where you get stuck, you have to figure out what's not working and then research 'how do I make it work' instead of having somebody more experienced – or even just another pair of eyes – tell you." (P34) Technological solutions could conceivably provide some of these benefits, but their organic, passive, and personalized ways of arising between human artists could require significant effort to replicate.

Practical execution support. Most artists identified at least some part of their process they didn't want to perform. One participant described the potential benefit of an assistant:

> "There is grunt work. If I could say, listen, I'm going to have to spend the next 4 hours removing dust and defects out of this image, can you please do that for me? That would be lovely, because then I could dive into the crunchy stuff." (P27)

A student noted the benefits of dividing tasks for a project: "It reduced both of our workloads [...], but then also I feel like we each had different strengths." (P10) Artists who primarily work alone end up doing more themselves. One person noted the time burden: "[...] every step of the process you need to oversee yourself, which is very rewarding, but it's time consuming. It can be exhausting, it can be tedious, it can be boring, frankly, and a lot of time." (P24)

Existing CSTs offer practical execution support (Section 4.1.1), but the tasks that participants wanted to delegate rarely corresponded with the capabilities of available CSTs. None of the visual artists interviewed mentioned a desire for a system that could generate an entire finished artwork on their behalf, despite this being the primary function of modern AI image generation tools. Designers should consider which tasks should be left in the hands of artists, versus those that are completed by technology.

Social connection. Collaboration can provide artists with social benefits like community and accountability. One artist shared:

> "Art can be really lonely.[...] Having a community that I would see once a week at our figure drawing and then be able to support each other in our pursuits or create some accountability for each other, I think that's probably the most valuable." (P28)

Another participant found that art-making provided an excuse to get together with friends he no longer saw on a regular basis: "A big reason why I wanted to do this was also as a way to see my friends." (P36) Not all of the visual artists who we interviewed shared this value. Though the benefits of collaboration are not exclusive to extraverts, they may be more likely to seek out certain forms of collaboration. As one participant put it: "I think it's a personality thing. I really love working with other people. [...] I'm very happy when I'm in the company of other people. [...] There's the company aspect and the social aspect." (P83) Attempting to replicate the social benefits of human collaboration with technology would be challenging. It may be more practical to instead target visual artists who derive satisfaction and enjoyment from their solitary art practice, some of whom we describe in Section 4.1.3.

4.1.3 What are visual artists' challenges with human collaboration and assistance? To better understand the challenges visual artists face when collaborating with other artists, we analyzed responses to the following interview questions: (For participants who indicated prior artistic collaborations): What challenges did the collaboration introduce? (For participants who didn't have recent examples of art collaboration): Why do you typically create art alone? We also analyzed responses to the survey question: Please briefly describe why you generally prefer to work solo (e.g., what aspects of working with others are unappealing to you). Participants found it challenging to deal with collaborator availability, loss of control, and navigating differences in approach and personality of other visual artists. Some participants struggled with insecurities and others did not want to give up their relaxing solitary practice.

Lack of collaborators availability. Finding time together was a common challenge among interviewed artists. One participant explained that busyness contributed to this problem: "Sometimes you will engage, but people are busy and so maybe they won't actually have time for you at that moment. And so then the more that happens, the less likely you are to turn to that as a resource." (P28) Despite the recent proliferation of online collaboration tools, some visual artists preferred in-person meetings. One artist described the challenges of not being co-located with a collaborator:

> "[…] communicating via Instagram messages and sending photos and videos and chatting and obviously if we'd been in the same studio and being able to be hands on […] learning her method and everything and being able to trial and error some things together would have been a lot easier." (P04)

One participant noted a lack of opportunity: "I haven't really had a chance to paint with other people. I would love to paint with other people. I just haven't really arranged that." (P75) Technology tools are well-positioned to address this issue with 24/7 availability, but many visual artists still desire in-person collaboration.

Accepting loss of control. Many artists like to maintain creative control. One participant explained: "I also like having a lot of freedom in myself to do my own thing instead of a subordinate versus a leader person. And I find that kind of difficult because I like to be in charge first of all. And I also like to go my own way […]" (P68) Collaboration partners may be inflexible. An artist elaborated: "Sometimes it's hard to work with someone when they're not willing to do that sort of leniency. If they're really set in a specific way they like to make stuff or work, it can be kind of challenging […]" (P86) Working with others can reduce feelings of ownership and authorship. As one person put it: "There is something special about knowing that you've done everything yourself. I think there's something cool to be like, 'I did that and nobody helped me'." (P24)

In developing tools for visual artists, designers and developers should consider how to preserve the user's sense of control, particularly where AI is leveraged. Oh et al. found that drawing tool users wanted control over decision-making and felt human users should have a privileged role, maintaining responsibility for important aspects like decision-making, whereas they felt the AI system should deal with the follow-up of more tedious tasks [23].

Navigating differences. Challenges can arise from navigating the social dynamics of artistic support. It can require additional work to align art styles, as one artist explained:

> "[…] that was a bit trickier in terms of just matching, not having one set of scenes be super, super detailed and the other set be minimally animated, we wanted to balance that. So we had to check in, 'OK, here's my scene for this. Is this what you had in mind?' And then kind of calibrate like that." (P10)

Several participants described efforts to remain tactful and preserve a collaborative relationship. A participant shared: "It sort of restricts your ability to say, 'that's not gonna work'. Nobody wants to hear that, so you have to be a little more diplomatic when you're dealing with… especially people that are putting their own self in it." (P01)

As current AI systems do not have human feelings, artists could enjoy the benefits of artistic support without worrying over building or preserving social relationships. There are additional benefits from avoiding the anthropomorphization of AI systems, and Hertzmann cautions against describing shallow AI systems as artists [14].

Struggling with insecurities. Working with other artists can lead some visual artists to feel insecure. One artist explained the anxiety involved in a group drawing exercise: "It was pretty nerve-wracking to draw on someone else's work. […] people had spent some good time on it and done some nice work, so you don't want to ruin their drawing with your contribution. So that was a bit stressful." (P69) Negative feelings may arise when visual artists compare themselves to others, as one participant confessed: "[Drawing] with other people, I've definitely experienced jealousy or resentment or something." (P40) CSTs could support visual artists with creation, while preserving a sense of privacy and not exposing them to the risk of (human) artist judgement. Technology could also help visual artists reach beyond their comfort zone in a more controlled setting.

Missing the peace of solo practice. Some visual artists described group work as "tiring" (P19) and "generally tedious" (P36). In contrast with some artists' desire for social connection (Section 4.1.2), many enjoyed the benefits of solitary work. One artist described it: "I can work at my own pace, in my own head, with my own ideas and inspiration, in my comfortable studio, listening to my own music. I can get into a flow state without interruption." (P58) Other artists appreciated the contemplative aspects of solitary art creation. One participant explained: "I do more of my work alone and in silence to preserve the reflective, contemplative quality of my creative time." (P74) Technology could allow visual artists to preserve this peace and flow, while offering support "on-demand".

4.2 Attitudes towards technological or AI collaboration

We present findings in response to **RQ2: What are visual artists' attitudes towards technological or AI collaboration and assistance in their art creation?**

4.2.1 Are visual artists open to technological or AI collaboration and assistance? If so, in what forms? The survey asked: "Are you generally open to either collaborating with or receiving assistance in your art creation from technology or automation tools?" 66% responded "Yes" and 11% responded "No". 22% participants responded "I don't know", suggesting respondents lacked sufficient context to answer confidently (see Table B6 in the supplemental materials). Only a minority of participants were uninterested in technological support, but tool designers should remain aware of this subgroup.

For survey participants who indicated openness to technological or AI collaboration and assistance, we asked a follow-up question: What aspects of the creation process would you be open to assistance from technology or automation tools? We provided seven possible options, as well as "Other". Table 2 shows the results.

All options were selected by at least 19% of survey respondents, suggesting a diverse range of preferences for different types of technological support. Interestingly, while Midjourney, DALL-E 2, and other popular text-to-image tools offer high quality finished images or renderings, participants were generally more interested in ideation support, preliminary sketches, and variant exploration. "Other" responses are included in supplemental materials Section B.

4.2.2 What appeals to visual artists about technological collaboration and assistance? We referred to participants' survey selections when asking, "What appeals to you about those kinds of technological collaboration or assistance?" Many participants, primed by their survey responses, highlighted the importance of idea-generation and reference images. Some artists expressed interest in using technology to explore artwork variations. Several were eager to receive recommendations from AI systems, though unsure of the specifics.

Table 2: Percentage of preferred forms of technological assistance, for survey (S) and interview (I) respondents.

What aspects of the creation process would you be open to assistance from technology or automation tools?	S	I
Idea-generation and brainstorming	40%	57%
Preliminary sketches, thumbnails, or other early work	40%	53%
Variants or alternatives	36%	43%
Recommendations (providing feedback, suggesting areas for improvement)	31%	37%
Finished images or renderings	19%	27%
Image enhancements (lighting adjustments, noise removal)	45%	53%
Curation (identifying promising images or items based on certain criteria)	26%	30%
Other	3%	3%

While not all participants extensively incorporated technology into their art practice, those who did found it valuable in extending their capabilities and completing unwanted tasks.

More convenient reference imagery and ideation support. Technology can aid in initial idea development. Many artists use online reference images. One artist shared: "That's one of the specific things I like, is seeing what the options are, what other people are thinking about it and can I incorporate that into my work somehow, without copying, just give me the general idea of it." (P15)

Reference images were also mentioned by participants who considered themselves to be "low-tech"; they currently use Google Image Search [12] or Pinterest [26], but expressed a desire for greater control, customization, and integration into their workflows.

Broader exploration of variants and alternatives. Many participants wanted to use technology to explore a wider range of possibilities. A visual artist/designer explained the potential benefit: "But where I do think it could be definitely helpful in kind of the flaring idea generation phase of coming up with potentially hundreds of different concepts or alternatives." (P04) Another participant was eager to complete a breadth of exploration to get to a better end result, but it isn't possible given limits of time and resources:

> "If I could make 10 versions of every spread, I could pick the best spread. But I don't have that kind of time.[…] If I had assistance or had the ability to generate more options, then I could be more of a creative director, I can say, 'this the style I want, please generate me different compositions'." (P28)

Midjourney, DALL-E 2, and other popular text-to-image tools have "variation" functionality that could be conceptually helpful in addressing this user need [21]. Notably, participants were typically interested in exploring in their own artistic style, as opposed to how current AI image generators take over the whole process.

Feedback and different perspectives. Many participants were eager to receive critique and some were open to technology-based feedback, particularly as it could be available on-demand. As one visual artist commented: "[…] just getting that outside perspective without all of the concerns, without the scheduling conflicts, without the time investment. It's a quick and easy way to help you along in your art process at various stages that might be helpful to different people." (P09) Another artist also felt it could be valuable to identify aspects that might otherwise go unnoticed: "If I could, while I'm working, just get automated feedback, that would allow me to consider other opinions or just things I potentially miss, because sometimes I feel like I'm so close to my own work that I can't assess it at that point, so just having some external feedback of any kind seems useful." (P10)

Practical execution support. Many artists saw the potential of technology to help across a wide range of tasks, freeing up time to focus on the parts they enjoy. It can also help artists overcome physical limitations, as one participant explained:

> "[…] now that I've gotten older and I have a little bit of carpal tunnel that I'm dealing with, I'm physically limited by how many hours I can work on something, not to mention the time and the energy. I just don't have enough to explore as deeply or broadly as I might like on a particular area." (P28)

Another artist was eager for support narrowing in on a direction: "There's a lot of grunt work that I'm usually not willing to put the effort in, so I hope that the AI can help me do that and then when I have a concrete idea, then I don't mind actually rendering that in oil." (P75) Technology can also help eliminate unsatisfactory options quickly, as a participant explained: "It's fast. You can see right away this isn't going to work. You don't like it, or I would rather not have that bit, or this isn't what I was thinking." (P01)

4.2.3 What are visual artists' concerns about technological or AI collaboration and assistance? In the survey, we asked respondents who were not interested in collaborating with or receiving assistance in their art creation from technology or automation tools to briefly describe why or what aspects were unappealing. We asked all interviewees: Does anything concern you about AI and other technology for art-making? After discussing benefits, we asked: Do you have any additional concerns or limitations about working with technology or automation tools? We analyzed responses to these questions together.

Artists we interviewed expressed concerns about the use of art images without consent in training data for image generation systems. While few felt directly impacted, many feared technology replacing art-based jobs. Some artists emphasized the importance of maintaining art ownership. The learning curve of technology was seen as a barrier by some, while others viewed technology as an optional tool they were not concerned about.

Tools using artists' work without permission. Many visual artists expressed ethical concerns that the data used to train popular text-to-image tools were collected without the consent (or in some cases even awareness) of the artists. As one participant explained: "My biggest issue is the ethical thing of how is the AI being trained and where is it getting the images and was there permission given by the original artist to train on those images." (P35) Several participants also identified a lack of regulation as contributing to this problem. A participant remarked: "I think my main concern with AI and art is really […] scraping artists' work for training models

without any sort of regulation or protection." (P13) It is possible, though currently uncommon, for CST developers to address these dataset concerns. For example, Adobe Firefly is a text-to-image model that is trained on only licensed content [1].

Fear of being replaced by technology. The artists we interviewed did not disclose any personal employment losses, but some shared fears about AI systems replacing artists. The vulnerability of concept artists was noted by one participant:

> "Art generation can make concept artists redundant, I feel. It's very early and I think with that it's hard to tell what impact AI is gonna have on artists. I feel that currently the lack of regulation on AI has allowed certain parties to take advantage of that before regulation gets instilled. It's a wild west, and they're taking advantage of it." (P13)

Some visual artists expressed that AI image generation tools were not designed for their benefit, but rather to save money for companies who currently hire artists. One participant who spoke of this issue also noted the negative impact on the resulting art:

> "I think the problem with this new technology in particular is that it's not being developed to help us make better art. It's being developed to make art cheaper. [...] It consolidates the power into the people who own the software and they don't have to hire illustrators or artists. And so we're gonna get a lot of crappy art for the next little while." (P17)

Restricting corporations is the domain of policy experts, but designers and developers can nonetheless prioritize visual artists' needs and create tools that better integrate into their existing processes.

Preserving a sense of ownership. Although visual artists were often willing to accept help from technology, it was important to most that they maintain their role in the art-making process. It was not necessarily a clear line as one participant explained:

> "There's a certain element of 'I did enough' that even though I'm using technology in this way to help me, I still feel like it's my work. And I think there would be a point at which, if AI did all the work, I was literally copying what it made as a painting. I feel like that's somehow different. I don't know exactly where the threshold is, but the way that I use tools currently, to me, feels like it's still part of an artistic process that's a lot of me." (P34)

These feelings extended beyond artists' own work. One visual artist described concerns with people treating AI-generated art as final pieces, as opposed to using them for reference or building off them: "It's more that if people are kind of presenting [a generated image] as a final piece of art, I feel that it's not the same as a human-made, even if it's a digitally-made piece of art, because it's not coming from a human's mind, and that the creativity is not the same." (P35)

The desire for control within artistic collaborations (Section 4.1.3) extends to technology. Designers should consider not just what role visual artists want to play themselves, but also how to help them feel ownership over the resulting works.

Learning technology can be difficult and requires an investment. There can be a learning curve to adopting any new technology. One participant explained the lack the time and energy necessary to learn how to use a new art application: "[...] sometimes the technology is hard to grasp, like this new Procreate program. I'm not entirely sure I'm going to have enough time and energy and effort to actually understand it." (P54) Some artists (often those working in more traditional mediums) lacked technological awareness. An artist explained: "I do not know enough about technology tools to really understand how I could incorporate them in my art-making." (P83) Designers should consider tool awareness and adoption when targeting visual artists artists.

No concern; treat it as a tool you're not forced to use. Many participants saw technology as an option they could take or leave, depending on its usefulness. One participant suggested ignoring technology that isn't helpful: "[...] there's not really any downside to creating it, any downside to using it. It's just an extra, helpful tool in your toolbox for art." (P09) Another artist expressed frustration by the negative focus on AI relative to other tools:

> "The problems we've had with ethical use and encouragement or suppression of creativity and productivity [...] – we've been having those issues since people made looms. So, I'm not one of these people who's really worried about artificial intelligence in particular. In fact, it gets me a little bit cranky the amount of time that people spend wasting on all this stuff." (P74

Artists outside of the realm of digital media were sometimes less concerned about issues with technology. A stained glass artist said:

> "[...] if the artificial intelligence thing did something I didn't like, I don't have to do it. It's not like my work is a finished computer thing or a finished piece of writing that may be taken over or turned into something that I don't recognize or I don't want." (P01)

These results highlight the range of opinions related to technological and AI support in art creation. Designers and developers should carefully consider their audience as it would likely be impossible to satisfy all visual artists with a single solution.

4.3 Key Findings

We organize our key findings into three topics: the applicability of insights about human-human collaboration to CSTs, opportunities to explore new forms of human-machine collaboration, and the promise of focusing a CST's design on a specific subset of visual artists, toward better meeting their desires and needs.

4.3.1 Applying insights human-human collaboration insights to human-machine collaboration. We cannot draw direct conclusions about human-machine collaboration from our findings on human-human collaboration as human and machine support is not interchangeable. Even so, there are some noteworthy similarities in how artists perceive the value of human and technological support, which suggest that future work may be worthwhile. "Practical execution support" was a common theme among artists working with humans (Section 4.1.2) and technology (4.2.2). AI text-to-image tools provide execution support typically by taking over image generation. Aspects of the "Artist development" theme in human-human collaboration (4.1.2) are evident in "More convenient reference imagery and ideation support", "Broader exploration of variants

and alternatives", and "Feedback and different perspectives" from technology-based support (4.2.2, 4.2.2, and 4.2.2). These overlaps suggest that our work (and prior work) on human-human collaboration may inform CST developers. Some challenges in human-human collaboration (4.1.3) can be addressed with AI support, but not all of the same benefits of human collaboration would be conferred. Artists who value social connection (4.1.2) may not be satisfied with technology-based alternatives. Work is needed to develop a nuanced understanding of what does and does not translate from human to machine collaboration. Our study of visual artists' attitudes towards human-human collaboration and machine support provides a starting point.

4.3.2 Novel forms of human-machine collaboration for art. Survey participants expressed interest across all proposed collaboration types and more (Table 1). This highlights the value of exploring more diverse forms of visual art collaboration and assistance, particularly given the limited role artists are granted by today's popular text-to-image systems. Giving human artists more impactful roles (4.1.3) could help address visual artists' feelings of being replaced (4.2.3) and support a sense of ownership (4.2.3). Tool adoption by visual artists may still be limited if developers continue to rely on artists' work for training data without obtaining consent (4.2.3).

Visual artists may appreciate early ideation (Section 4.2.2) and exploration (4.2.2) support, including more convenient reference images and variant generation. Creating exploratory tools with AI image generation technology has practical advantages. These generated images, while part of a broader art process, need not perfectly reflect the user's initial concept. Participants could also benefit from machine-driven feedback and alternate perspectives (4.2.2). Chung et al. classified CSTs and found the subset including Feedback, Critique, Scaffolds, and Analysis represented only 35.1% of the those studied, suggesting opportunities in this area. This approach could also satisfy artists' desires to lead (4.1.3).

4.3.3 Understanding artists' motivation with regards to technology and AI art. While many participants expressed interest in using technological tools for support, some noted the learning required to do so (4.2.3). It is not yet clear to what extent traditional visual artists would be motivated to use CSTs in their art practice. Demographic data collected by Sanchez revealed that over a third of the text-to-image users they surveyed were men working in Information Technology [27]. While these participants might also consider themselves to be art hobbyists, this data indicates that AI image generation tools have thus far been adopted by a narrow, presumably technology-savvy, slice of potential visual artist users. Not all challenges are considered problems. Our work provides leads for the types of tasks that artists might want to "offload" to technology (4.1.2), and how this could impact artists' sense of ownership (4.2.3). Work is needed to confirm the specific tasks visual artists want to delegate. There are overlapping visual artist needs across widely varied art mediums (3.2.3), but focusing on a specific subgroup of visual artists (e.g., who might be more receptive to AI support or reap more benefits from its use) could lead to more effective designs for that audience (4.2.3).

5 DISCUSSION AND FUTURE WORK

In response to Jiang et al.'s call to integrate visual artist consultation into the tool building process [15], we studied the values, hopes, and concerns of visual artists with respect to technological support. We identified similarities to (and differences) from receiving human artist support (Section 4.3.1). This provides a first step towards designing collaborative tool for artists, which center their needs. We also uncovered artists' interest in other forms of technological collaboration support, which are largely lacking in popular AI image generation tools and other CSTs (4.3.2). Our foundational work supports further research in this area by helping to design and develop a new generation of tools that provide visual artists with more diverse (and more desired!) forms of collaborative support.

5.1 Limitations

Our study has some limitations. It was restricted to English-speaking participants. Recruiting at our university, art schools, and groups likely biased towards artists from our city, with higher-incomes, and more open to collaboration. Retirees and those with more free time may have been over-represented. We attempted to recruit from diverse arts groups, but black and indigenous artists remained under-represented. We studied a mix of professional and hobbyist artists, and further work to understand their distinct goals. Some participants were not technical, nor familiar with current AI systems. This limited both their capacity to imagine possible uses and awareness of concerns and limitations. We deliberately targeted participants from diverse visual art disciplines, limiting result specificity. To enhance our design recommendations, we could consider values of other stakeholders like CST designers, developers, art mentors, teachers, or audiences. Our themes do not encapsulate all visual artists' beliefs and needs. Despite encouraging all artists to participate (even those who identified as "anti-AI"), some may have opted out due to the involvement of AI in the research.

6 CONCLUSION

AI Image Generation tools are gaining popularity, but their focus has been on technical aspects rather than artists' needs. We surveyed and interviewed visual artists and used reflexive thematic analysis to identify the benefits and drawbacks of human and machine collaboration. Despite current controversy surrounding AI image generation, artists see potential in technological assistance. We mapped the similarities and differences between artists' experiences collaborating with other humans versus with technology. Future work should continue to explore the nuances of these different collaboration types to better understand the differences between humans and machines as artistic collaborators and design more useful CSTs. We documented promising human-machine collaboration forms, suggesting system interaction designs beyond current text-to-image approaches. Understanding artists' motivations towards CSTs could help tool designers target this audience more effectively. Our work assists researchers, designers, and developers in addressing artists' nuanced needs with new technical solutions.

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