Artist Support Networks: Implications for Future Creativity Support Tools

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ABSTRACT

The artist as a solitary genius does not reflect the reality of art-making. To enable art-making, artists are supported by many other people—subcontractors, collaborators, etc.—who collectively form an *Artist's Support Network*. Through an interview of 14 artists, we map the space of relationship types, provided support, interactions, failures, and successes of human support relationships. Moreover, we identified the patterns by which these aspects relate to each other in different support relationships. As technologically-driven Creativity Support Tools (CSTs) emerge to augment and automate portions of the artist's support network, the detail of these interactions becomes critical. Existing sites of collaboration in support networks invariably shape artists' expectations. How a CST fits within existing interaction expectations will shape the design, the artist's understanding, and ultimately, acceptance. With this lens, we reflect on how a CST's design–and in particular, those support collaboration and AI-driven variants–will mesh with the artist's support network.

CCS CONCEPTS

• **Human-centered computing** → *HCI theory, concepts and models*; *Interactive systems and tools.*

KEYWORDS

creativity support, creativity support tools, art-making

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1 INTRODUCTION

While art-making is often treated as an individual activity, the reality is artists often benefit from many relationships in the production of their art. Artists leverage the labor, experience, expertise, vision, and efficiencies inherent in others [6]. These 'actors' fulfill many roles: muse, subcontractor, co-producer, critic, mentor, etc. Taken together, these individuals represent the *artist's 'support network'*. The artist and the support network ultimately influence the 'artifact' to be created, forming a broader *socio-artifact network*—a network composed of interactions between the artist, actors, and the artifact (and its components). In working with the support network, artists cede some power over their process and rely on their human partners. Such relationships are certainly not balanced or uniform in the creation of the artifact. There are extreme variations in the levels of trust, specialization, and power. Additional high-level values such as authenticity, originality, and personal aesthetics also shape the process of art-making. Our interest in support networks, and the larger socio-artifact networks, is motivated by the evolution of so-called Creativity Support Tools (CSTs) [16, 37]. CSTs support an extensive range of tasks, everything from coloring technology for black and white images to AI-based generative software that creates scenery, text, or music. New CSTs will likely influence the artist's support network by augmenting and automating the creation process. Thus, having a comprehensive understanding of the support network would aid the design of these CSTs.

Our goal in this work is to understand the unique nature of human-human art practice through a study of artists. Conventional art-making practice is complex and nuanced with a range of dynamics in power. In one extreme, an artist may simply subcontract some tasks, such as color correction or printing a photograph. Here, the artist has "dominant" power–the expectation is whatever they envision or specify will be produced. In contrast, some forms of support are acts of co-creation (e.g., co-authoring a book). These relationships would have a different set of dynamics, with more equal power structures. Disputes would require the artists to come to an agreement on what to create. In between these extremes, we might have a case where a movie director (one artist) collaborates with a music composer (another artist). The director may let the composer decide many details, or even the high-level direction of the score. However, even between these two artists, there are unequal power dynamics. The composer will often have the creative power of a limited facet (the score) of the completed artifact (the film). These are but a sample of the relationships that exist in art-making.

To understand the broader spectrum of human-human support, we conducted an interview study with 14 practicing artists from fields ranging from visual arts to music, creative writing, and game design (with a mean experience of over 9 years). Through semi-structured interviews, we focused on the artists' experience of working with others in their efforts to create art. Though we target broad artistic domains, we identify common patterns in the roles, dynamics, and success (and failure) stories across these interviews.

The relationships we observed can be viewed as a type of network centered on the artist. Elements of this network shape the specific

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piece of art and are often the targets of software designers (in both academic and industry). Perceptions of 'inefficiencies' lead to the design of software that automates or augments parts of the network. However, in art-making specifically, a tool solely focused on improving efficiencies may not be desirable. Based on our model of how human actors play their roles in the artist's support network, other aspects, such as power dynamics, ownership, or trust, need to be considered by designers. We hypothesize that CSTs that follow support patterns familiar to artists would be more likely to be accepted. Through this lens, we offer several insights into how a subset of CSTs, those that support human-human collaboration (collaborative CSTs) and artificial intelligence-powered ones (AI-CSTs), can be better integrated.

Our work contributes a novel perspective of human-human relationships in artistic contexts. This expands on past efforts, which were often explicitly grounded on technically-focused collaborations. For example, sites of prior work included collaborations between technologists and artists [33] or systems that support online-collaboration [30–32, 43]. From a wide spectrum of art-making domains, our analysis finds an array of relationship types ranging from *subcontracting* to *co-creation* to *mentorship*. Through our interviews, we identified specific mechanisms of how these relationships work—higher-level types of support (i.e., those that impact the art and those that impact the artist or process) and dynamics (i.e., whether the supporting actor can make artistic decisions). Finally, our analysis reveals patterns that lead to successful relationships. Using this analysis as a lens, we discuss the future of CSTs.

2 BACKGROUND AND RELATED WORK

Social environments influence creative actors in numerous ways [1, 2, 4, 15], both indirectly and directly. Indirect influence can include one artist influencing another stylistically [13], or art collectors shaping a domain through market forces [25]. Other actors more directly influence the artist and their creative process. The combination of direct and indirect forms parts of what Becker calls the "art world" [6]. Our goal is to understand those interactions in which an artist can request support. Thus, we restrict our definition of the artist's support network to only include those humans that have an aligned goal or in which the artist interacts intentionally and directly. We exclude elements that may influence the artist, but not intentionally (e.g., Mozart's influence on artists 200 years later).

2.1 Human Support for Art Creation

The idea that art-making is social is not new. Significant research has identified the various social, psychological, and economic processes in which an artist is embedded [5, 6, 24, 42]. In this broad "art world" [5, 6], there is a range of roles–everything from muse to mentor to collaborative partners to collectors to critics. Within this broad definition, Becker identified the "collective" process of art-making by which actors provide support in art-making through "division of tasks (or labor)" [5, 6]. In some cases, these actors may reflect specialists to which the artist allocates work (e.g., a color editor or music producer). However, these agents need not be "subordinates." For example, an artist's support network can include peers (e.g., co-authors, co-composers, etc.). The division of tasks in this context is often a cooperative allocation. Collective activities are natural for domains that involve many people in the creation, such as movies or stage plays [5, 6, 42]. However, even for those forms of art that are traditionally considered 'solitary', we can find support networks. For example, a poet may benefit from editors and even type-setters who can help shape the produced work.

There have been efforts to create finer-grained taxonomies within the HCI community around human support in art-making. The computational aspect in these taxonomies has often restricted these studies to technological contexts (i.e., artists working with technologists or technology as an intermediary between artists). However, some findings can be generalized to broader contexts. For example, Mamykina et al. [33] focused on types of provided support in the context of co-work between artists and technologists. The work identified three types of support: 1) creative concepts like the core ideas and visions about the art piece; 2) construction, like the execution of the artifact; and 3) evaluation, inspecting if the creation is done according to the vision. Within HCI, we also find targeted work on situations in which human collaborations are successful or can be enhanced. These include settings varying from online collaboration [31, 32, 43] to the co-work of artists and technologists [33, 56]. Generalizable findings within this research have identified lessons that lead to successful collaborations (e.g., common vision, knowledge sharing, systems that facilitate communication, or early planning). Compared to these efforts, we take a more general approach to understanding an artist's support network. First, we are interested in those common features that exist across a broad set of artistic domains. Second, we include support relationships that are not necessarily cooperative or collaborative. These can include a muse or mentor or even a commissioning agent. As long as these individuals broadly '*intend*' to influence the art or art-making process, and the artist *intends* to get support from them, we consider them as a part of the artist's support network. Notably, we expand beyond artifact-centered relationships. That is, we also consider relationships that can impact the artist *directly* but the artifact *indirectly*. For example, we include those relationships that shape the artist (e.g., mentorship) rather than the art.

Again, we have selected this area of focus as the individuals or roles involved are possible targets for CSTs. While our interviews are only loosely structured, our probe questions and our analysis were focused on identifying and classifying these types of roles and interaction dynamics.

2.2 Creative Support Tools

CSTs form a part of the landscape by which artists make art [7] and influence the artist's support network. To shape and motivate our qualitative analysis on the artist's support network, we briefly map the taxonomies of CSTs [9, 17, 44, 45]. Moreover, as we build a model of human-human interactions in the art world, we return in Section 5 to relate this to computer tools. While tools, in the broad sense, may include the analog variety—brushes, canvases, musical instruments, etc.— our focus is technological tools.

Numerous efforts have attempted to taxonomize CSTs. A high-level partitioning, due to Nakaakoji [37], identified three roles of CSTs through metaphors: 1) running shoes–CSTs that support the artist's current creative practice to make them faster; 2) dumbbells—tools that strengthen the artist by supporting learning activities; and

3) skis—objects which had no direct analogue at the time of creation, thus enabling new creation experiences. Finer-grained taxonomies are also possible. For example, one can focus on the part of the creative process in which the CST operates [9, 17]. Alternatively, taxonomies can target roles, interactions, technologies, or users of CSTs [9, 17], and even how these intersect to form the design space [9]. As we describe, aspects of these taxonomies map to human support networks, though sometimes indirectly.

3 RESEARCH METHOD

Rather than focusing on a single type of artist or art-making practice, we explicitly sought to interview across domains–visual arts, music, creative writing, etc. Our goal was to identify patterns and differences both within and between artistic domains. We specifically define art-making as *the activity of creating artifacts with aesthetic qualities* and define artists as those who participate in art-making. By focusing on a broader set of domains, we identify the wider range of facets of an artist's support network. Though we recruited professional artists for our interviews, we tried to vary seniority levels among our participants. Our hypothesis was that different seniority levels interacted with different types of support networks. We utilized an approach that mixed theoretical [36] and snowball sampling starting from word-of-mouth [22]. We strategically invited interview participants based on the intermediate results, focusing on interviewees who could offer alternative perspectives (e.g., by varying the domain, experience levels, etc.).

3.1 Participants

Table 1 details the 14 artists who participated in our interviews. As some artists worked in multiple mediums, our interviewees covered 20 unique domains. These range from music to visual arts, visual design, exhibition art, game design, and creative writing. All interviewees were active in at least one domain and had one or more years of experience in their 'primary' domain (experience across domains ranged from 8 months to 24 years). While we did not prefilter interviews based on collaboration experience, all interviewees had worked with others for part of their creative workflow.

3.2 Interview Protocols and Data Generation

We conducted semi-structured remote interviews (a mix of audio and video calls based on the interviewee's preference). On average, interviews lasted an hour and ranged between 35 and 100 minutes. Interviewees were paid with a $20 gift card. Interviews were recorded and transcribed with additional notes taken by the interviewer during the call. Interviews were analyzed using constructivist grounded theory (detailed below).

While we allowed our interviewees to largely direct their focus, we specifically probed human relationships as part of the artist's networks. Specifically, we were interested in the dynamics that artists have with other people[1]. We specifically asked about motivations, mechanisms, successes, and failures from support experiences.

While we primarily focused on situations when the artist was 'central', our participants were also free to describe occasions when they fulfilled supportive roles *for* others (e.g., when they acted as a sub-contractor). We consider both dynamics important. As we describe below, the notion of centrality in this network, or of being the 'main' artist, relates to power dynamics. One can view the artist support network as an egocentric social network centered on the *main artist* (i.e., the "ego" in an ego-network). In our definition, the main artist carries more decision power and gets the majority credit for the art piece (often receiving top billing or 'solo' credit). To simplify our naming, we will use *actor* to refer to those people in the artist's support network (these are referred to as the "alters" in an ego-network). In the pair of *main artist* and *actor*, the actors most often have less power, less creative control, and less credit (though in some rarer cases both individuals may have equal power or credit). We limit actors to those individuals who have some bi-directional interaction with the main artist. This excludes people who might be an influence on the main artist but are in a different artistic generation and have never interacted. In this model, it is often the main artist who 'activates' the engagement with the actor. While we use the simplified 'artist,' we note that some individuals did not regard themselves as such, preferring *designer*, *creative*, etc. Also note that how participants frame themselves and how their roles are constructed may also impact their support networks.

3.3 Analysis Method

We used constructivist grounded theory [20] to analyze the interviews and derive a theoretical model that can explain the artist's support network. While traditional approaches of grounded theory allow little prior knowledge [19], the constructivist version allows researchers to bring in prior perspectives when making interpretations to construct theories [53]. Adopting constructivist grounded theory, we considered prior work on support provided by actors when conducting data collection and analysis. We also considered our scope of support network and actors that we discussed above. While our prior knowledge of CST systems likely influenced our interview analysis, we did not use taxonomies from that space explicitly. Instead, we focused on those roles and dynamics highlighted by the participants from their existing support networks. For the analysis, two of the authors conducted the theoretical coding. Specifically, we conducted open coding, axial coding, and selective coding in different stages. Different artist comments were first placed on cards. We grouped these comments according to each art-making experience that artists had with actors. Within each experience, the authors collaboratively performed low-level coding. Different experiences were compared, and those with similar codes were merged, forming categories of experiences. These categories resulted in a set of relationship *types* within an artist's support network. Relationships that only exist in a single domain have been excluded as we aimed to identify support patterns general across art domains. Through analysis, we identified patterns of interaction shared between relationship types (e.g., similarities between subcontractors and featured artists). From these, we determined higher-level codes about provided support and success conditions. We conducted this process while continuing our interviews, testing intermediate theories against new data [36]. We noted patterns of interactions between artists, actors, artifacts, and provided support for different support relationship types. As we describe in a

[1]Note that we did not use the phrase 'support network' during the interview. We did not want our participants to fixate on the idea of a social network or only those individuals that met some restricted model of 'support'.

	Domain	Experience	Current Occupation	Examples of Created Artifacts
I1	New Music	24 years	Composer	Commissioned compositions; Personal compositions
		2 years	Harpsichord player	Accompaniment for other performers
I2	Classical Music	10 years	Composer	Music for musicals, plays, and other performances
I3	Metal Music	8 years	Composer	Metal songs and albums
		15 years	Guitarist	Metal stage performances; Featuring on songs of other artists
I4	Metal Music	18 years	Composer	Metal songs and albums
		22 years	Guitarist	Metal stage performances
	Screen Printing	4 years	T-shirt printer	T-shirts for own and other bands
I5	Choral Music	+20 years	Composer	Commissioned compositions for choirs; Personal projects for performances
	Showbiz Music	23 years	Music Editor	Editing on TV or film music and sound
I6	Video Exhibition	5 years	Video/Music Creator	Commissioned exhibitions for galleries
	Indie Electronic Music	7 years	Composer/Performer	Electronic music songs and albums; Electronic music performances
I7	Visual/UX Design	3 years	Visual/UX Designer	Visual designs for software applications
I8	Visual/3D Design	2 years	Visual/3D Designer	Visual designs for software applications; 3D modeling work for other artist's project
I9	Independent Animation	3 years	Animator	Independent animations for film festivals
	Visual Design	8 months		Visual designs for book covers; Animated emoticons
I10	Video Art Exhibition Art	1 year	Fine Artist	Arts for exhibitions, including drone video arts
I11	Visual Art	2 years	Visual Artist	Toreutics (metalworking); Visual arts for exhibitions; An illustration book
I12	Games Art	3 years	Games Artist	Graphic assets in games
	YouTube	3 years	YouTube Creator	YouTube videos
I13	Game Design	3 years	Game Designer	Mechanics and level designs in game
			Game Developer	Programming and implementation of game
I14	Creative Writing	12 years	Creative Writer	Novels; Interactive novels
	Indie Pop Music	6 year	Composer	Indie pop songs and albums
		12 years	Guitarist/Vocal	Indie pop performances

Table 1: Background of interviewees.

later section, these interactions could be modeled as a socio-artifact network (i.e., the people and artifact components) with a 'support network' at its core (the human social network). As such, adopting formats of social-technical software network [54], we decided to model these interactions in graphical format (see Figure 2). We derived the specific format based on the analysis.

4 RESULTS

Our analysis revealed a range of relationships between artists and members of their support network. Within these relationships, we focused on four broad facets: 1) The specific 'support' provided within the relationship (e.g., implementation, ideas, management, etc.); 2) the relationship types (i.e., real-world categories, like 'subcontractor,' which are often determined by the artistic community); 3) the dynamics of the interaction (e.g., power dynamics, ownership, etc.); and 4) the conditions for success. While taxonomized separately, these facets interact in complex ways. Clearly, any particular relationship can consist of multiple types with a spectrum of provided support and/or dynamics. For example, one type of relationship (e.g., 'featuring'[2]) could provide multiple types of support (e.g., skills *and* ideas–in this case, lyrics and vocal support).

[2]In music, 'featured' artists are often those providing vocal or instrumental support to a track created by another artist. A featured artist may be famous in their own right.

4.1 Support Provided in the Network

Our participants described various supports provided when interacting with other actors. These fall into two main categories: *artifact-influencing support* and *artist-influencing support. Artifact-influencing support* impacts the art piece itself and include *implementations* and *ideas*. An alternative way to view these specific categories is from the artist's perspective. They are things that are often limited or exhaustible for the artist when creating an art piece. We contrast these to *artist-influencing support* which includes *managing* and *teaching*. *Artist-influencing support* can be viewed as more 'meta' as it influences the properties of the artist (e.g., enhancing their skills or teaching them new techniques) or impacts the artistic creation process (e.g., managing the relationship and interaction among subcontractors). Within each of these categories, we observed a few specific sub-categories based on what form the influence actually took. Actors sometimes provided support in the combination of types (e.g., implementing while also giving some ideas). Figure 1 summarizes our high-level categories.

4.1.1 Artifact-influencing: Implementation. Artists indicated that when they could not do an *implementation* task due to a lack of resources, they would recruit from their support network. Participants mentioned two types of specific *implementation* support: *expertise* and *labor*.

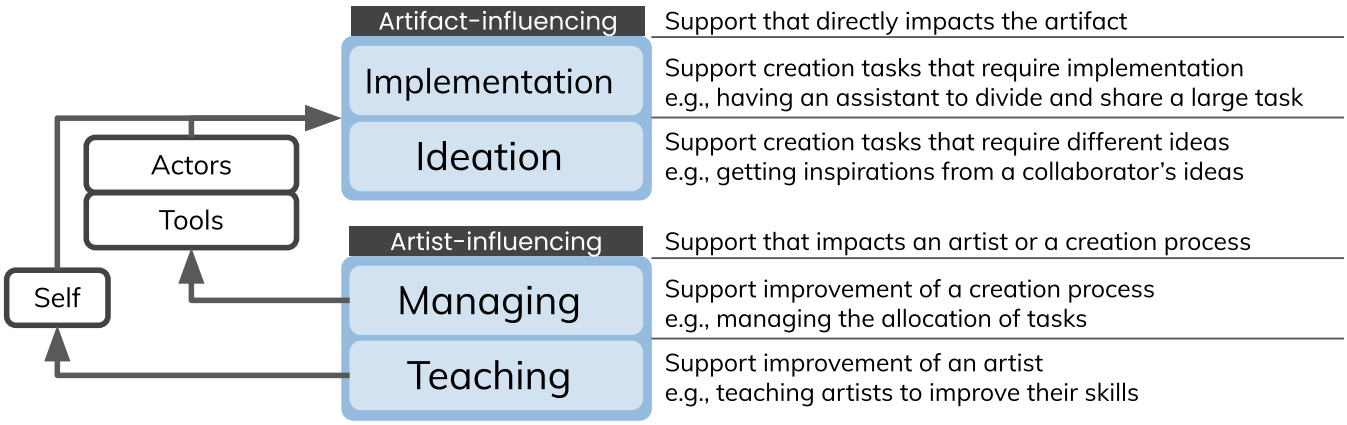

Figure 1: A summary of the support types identified through our study. Artifact-influencing support directly contributes to artifacts, while artist-influencing support impacts the artist or the creation process. The arrows on the left indicate possible feedback and controls. Though the dynamics vary, artifact-influencing support (i.e., implementation and ideation) are influenced by the artist (self), their collaborators (actors), or tools around artists and the actors. Among the artist-influencing support, managing impacts creation through the management of actors and tools (a meta-role), while teaching impacts by artist's self-improvement.

First, artists leveraged support from others when they lack specific, specialized expertise. When expertise-wise support was required, often, our participants were involved in interdisciplinary efforts, such as games or videos. For example, when I10 needed to use a drone to take a video of a drawing on the beach, they drew on help from a specialist who *"had more experience working with a drone"*.

Even when an artist themselves possesses the *expertise* to do something, they might lack the time or other efficiencies (i.e., a comparative advantage). In this case, the *expertise* becomes a substitute to the artist's own skills. We refer to these relationships as providing *labor* support. In many situations, artists wanted other people to do a task if it required a lot of human effort. Our interviewees indicated that this happened frequently in industrial settings. I12, a game artist, noted: *"I guess regarding, specifically for collaboration, in the industry, collaboration is absolutely necessary just because, the amount of work, like, there is no way you could get through everything by yourself."*

4.1.2 Artifact-influencing: Ideation. In our interviews, *ideation* was often described as support that was distinct from *implementation*. Artists described *ideation* as providing exposure to novel ideas and generating *inspiration*. For instance, I14 described how their close exchange of ideas with others can lead I14 to reach *"interesting junctions"* and *"surprising things"*, that I14 *"wouldn't do normally"*. Related support leverages others' opinions as a type of critic to provide *feedback* on a specific artifact. For example, I13, who is working in a game company, used in-company feedback to decide which parts of the game needed to be improved most quickly, and which projects were worth continuing. The relation between *ideation* and *implementation* would seem analogous to that of supporting designer's 'thinking' and artifact-wise 'outcome' from Stolterman and Selvan [52]'s work on designerly support. While Stolterman and Selvan considered that 'thinking' does not contribute to the artifact outcome, we took a different perspective that 'ideation' also contributes to the formation of the artifact.

4.1.3 Artist-influencing: Managing. The *managing* support category is often centered on organizational help. For example, I13 noted how the CEO in their game company makes major decisions about who works in which team. The CEO was not necessarily the main game designer (the central artist in this scenario). However, they helped organize the artist's support network to execute the vision. This may be in dividing, or enabling the division of providing of labor, expertise, and ideation to certain individuals in the network. Those who provide *managing* support can also recruit other people or acquire tools, expanding the artist's network. For example, I9 mentioned the role of an animation production studio as follows: *"They support me with things that I need. For example, ...I ask if they can support me with the creation of the file, then the producer says like 'oh I can try to find a person who can work on that in the studio'"*.

4.1.4 Artist-influencing: Teaching. The second *artist-influencing support* is *teaching*. This support was often in the form of educating the artist on a new technique, tool, or style. As the result, artists may gain *expertise*, efficiency for *labor*, and *ideas*. Artists described that learning would sometimes happen through demonstration. For example, I5 recalled learning composing techniques from a mentor, who demonstrated how various styles could be applied to one theme.

4.2 Relationships and Dynamics

Having defined the provided support, we now introduce the cross-cutting *relationship* types in the artist's support network (Figure 3). Some of these were the formal names or job titles of the people that formed these relationships, which were used for crediting purposes. For example, a 'featuring' relationship has a specific meaning in

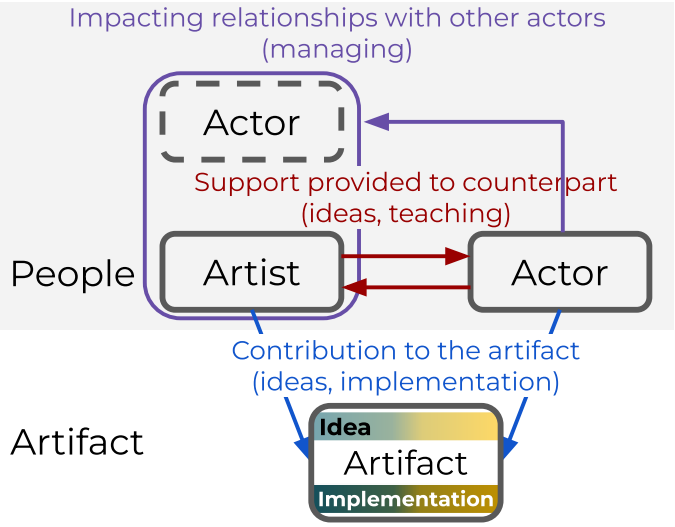

Figure 2: We describe socio-artifact networks with relational graphs of People and Artifacts. Artists and actors provide the support that impacts artifacts (ideas and implementation, with blue edges) or each other (ideas and teaching, with red edges). Actors also can provide 'managing' support to the artist and other actors (purple edges). The amount of an idea or implementation each person provided to the artifact is color-coded in the artifact diagram. The contributions made by the artist are in light teal for ideas and dark teal for implementation. For contributions from the actor, we use light yellow for ideas and dark yellow for implementation. The gradient indicates a 'range' of values.

the context of music production (another artist that acts as a guest performer). These names often have a constructed, or even legal, meaning to different artistic communities (e.g., 'compilation' is something different in music and literature). As such, we highlight the different dynamics that emerged in our interview with artists when reflecting on relationships.

We attempt to graphically represent each relationship type (Figure 2): which types of support are provided by whom (artist or actor); how much is each individual providing (and in what form–idea or implementation) towards the artifact; and is the support directed at the artist or artifact. The pieces of this socio-artifact network were partially adopted from social-technical software network [54]. Our models include the artist and the support network (composed of actors) as People nodes. They also include Artifacts to be created. These models indicate support relationships with the People nodes and edges from them. Artists and actors are connected with edges based on which types of Support are provided from one to the counterpart (red and purple edges in Figure 2). Red edges stand for providing *ideation* or *teaching* to the counterpart. On the other hand, purple edges indicate *managing* support. Note that the artist would also provide Support to the actor, in order for actors to accomplish Support that the artist wants.

Artifacts are usually of one type. Though we could conceivably break the artifact into sub-pieces—as one might do in a socio-technical model—we did not find this kind of modularity informative (e.g., how does one modularize a printed photograph? or music recording?). The only exception is when multiple Artifacts from multiple artists aggregate to form a meta-artifact, an idea we return to. Artifact nodes are connected to People according to the direct contributions to the creation of the artifact, which can be *ideation* or *implementation* (blue edges in the figure). The blue edge from actors represents Support to the artist. The width of edges indicates the amount of support or contribution made from the tail of the edge to the head. The colored glyphs inside Artifacts nodes indicate how much of the *ideation* or *implementation* was contributed by the artist or actor. Teal indicates contributions from the artist and yellow indicates those from the actor. These colors are expressed in a gradient in glyphs to show that there can be a range of values in contributions. For example, subcontracting may include more or fewer changes to the artifact based on the kind of subcontract. While we focus on describing relationships between one artist and one actor, multi-actor situations can be described with the combination of one-on-one relationships. While we identified the sense of ownership felt by the artist or the actor, we did not indicate it in the diagram. Note that the concept of ownership is relevant to other artistic values such as authenticity [38] and authorship [35].

4.2.1 Subcontract. A *subcontract* is a relationship where the main artist has a 'target' artistic idea, but needs *implementation* support such as *expertise* or *labor* to realize it (Figure 3a). Subcontractors are often specialists (e.g., a film editor), but they need not be. In subcontract interactions, artists convey their ideas about what to create to actors, and the actors directly implement the requested part of the artifact. From the actor's (i.e., the subcontractor's) perspective, they are given a specific and separable task. For example, I11 described the experience of asking material shops to do a task for toreutic (metalworking) pieces: *"To a certain stage, I do things by myself, then, I bring those and explain to people there [material shops], things like, 'I need this, this, and this, so please work on these processes'."* In the final artifact, only a small portion of the implementation is perceived as coming from the actor. More critically, they are not perceived as contributing much to the idea/vision of the artifact. While creative freedom is limited for the actors, sometimes, they provide feedback to the artist (e.g., technical feasibility). It is particularly true when the actor may have more expertise than the artist. I11 reflected: *"There are cases where I thought the thing would work, but the thing actually does not work from the engineer's perspective …If they tell me technical conditions like 'this should be done in this way', I try to fit into those conditions, or I revise my own plan."* In this support relationship, the actors tend to have a weak sense of *ownership*. For example, I9 did not feel a sense of ownership when they participated as a subcontractor on a specific project. The participant reflected on how they had no freedom and could be replaced by anyone with similar expertise.

4.2.2 Featuring. In *featuring* relationships (Figure 3b), the main artist asks the actors (often another artist) to create their own part within the main artist's piece. The artist anticipates (and expects) actors to create elements that artists cannot due to lack of *expertise* or differences in styles and *ideas*. Unlike subcontracts, featuring

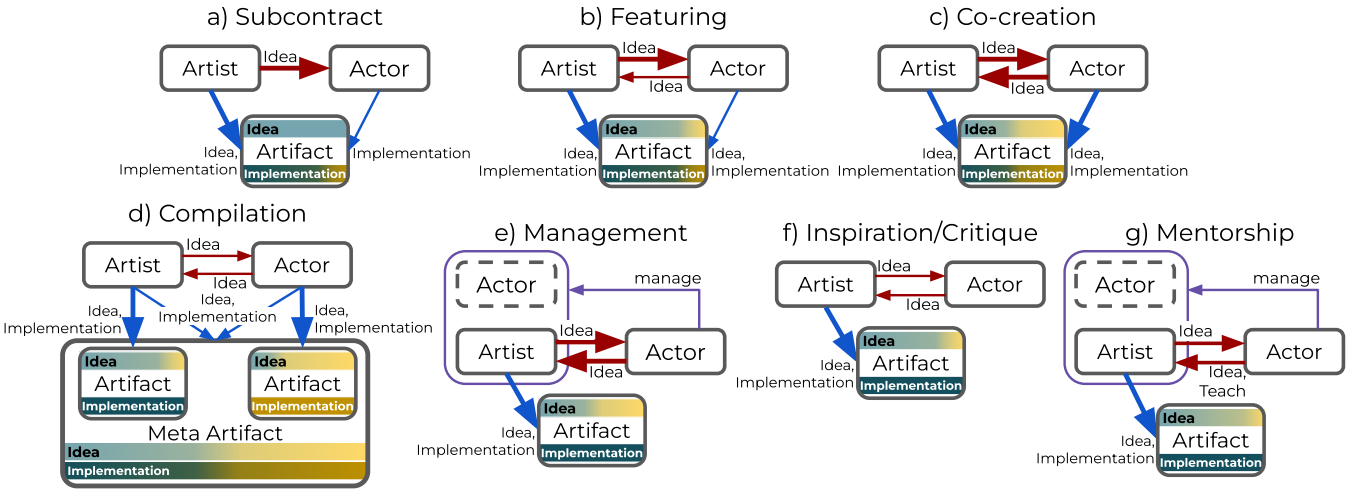

Figure 3: Diagram of relationships in support network. Support relationship types are described as relational graphs between artists, actors, and artifacts. The width of edges indicates the amount of provided support. The amount of idea- and implementation-wise contributions made by the artist and the actor to the artifact is denoted with gradient glyphs.

relationships mean that while the artist leads the overall idea and implementation of the artifact, actors will be given a small section of the artifact where they can exert their ideas and implementations. In the cases where the 'guest artist' (i.e., the featured actor) might be more famous than the 'main artist', the actor's power may be significant. In featuring relationships, the main artist often benefited by dividing *labor*. While the idea of featuring, or guest artists, is most common in music, there are analogous relationships in other domains. These most often included cases where interviewees viewed themselves as *designers*. While in this role, participants indicated that they had their own styles or could make some decisions by themselves. However, the overall direction tended to be made by other people who hold more power. For example, I8 shared the experience of working in a web-application company as a graphic designer: *"The overall plan and design are done first, like, UI designers and directors do that first. . . . For decisions like 'where to put which graphics', I do not carry much decision powers. However, in terms of 'how to express the graphic in which way', I could make more decisions."* We note that the specific name ('featured') was rarely used outside of music. Additionally, we found that analogous relationships tended to provide less freedom to actors in non-music domains. However, a key distinction of this relationship that was both common across domains and also distinguished it from subcontracting was that the actor's ideas tended to influence and shape the 'vision' of the final artifact. While the actors did not contribute to the whole art piece, they did retain some *ownership*, at least for parts they contributed. For example, I12 noted the attachment towards game artwork on which I12 contributed core ideas and manual effort, even though that was a small portion of the final game.

4.2.3 Co-creation. *Co-creation* is a type of support relationship where there is little to no distinction between the main artist and the actor (Figure 3c). Artists involved in *co-creation* thought of it as a form of close collaboration. They collaborate for many reasons, including complementing each other's *expertise*, dividing *labor*, and exchanging *different ideas*. All team members contribute to the ideas and implementation of the artifact, to a similar amount. Hence, all members tend to work closely throughout the whole creation process. This is not to say that team members don't sub-divide the work or focus areas (due to differing levels of expertise, experience, interest, etc.). As artists and actors work closely, they actively communicate ideas to each other. For example, I14 mentioned the experience of writing a story on an interactive art that includes 3D modeling of fairytale characters: *"So, it begins with talking with them [3D modelers] about how they're thinking about the project . . . And then once you see the model, you kind of see like, how aesthetically they're thinking about the creature that we picked . . . Then, you can start to write a story that will fit the aesthetic that's present. So it goes back and forth like that. So, one person makes something, one person explains it, they try to fit and then they adjust them until they come together better."* Artists generally mentioned that they shared *ownership* with team members. It was sometimes hard to draw a specific line that distinguished if a relationship was a subcontract, featuring, or co-creation. For example, how much of the artifact's final vision should come from the actor to make 'featuring' into 'co-creation? Though in music, these may be resolved through a legal definition, this is not always the case. An alternative view is that even though the extremes are obvious, these three types can be viewed on a spectrum with fuzzy boundaries.

4.2.4 Compilation. *Compilation* is another relationship type without a clear distinction between the main artist and the actor (Figure 3d). Artists also thought of this support relationship as a close collaboration. In *compilation*, artists with similar *ideas* or *styles* gather together and present their creations in one *meta-artifact*, which includes all artists' artifacts, such as an exhibition or performance. In this relationship, artists can exchange *ideas* to agree upon the topic of the meta-artifact or how to structure it. While

each artist work on their own artifact, they can collaboratively contribute their *ideas* and *implementation* efforts to weave individual artifacts into one meta-artifact. On each individual artifact included in the meta-artifact, the artist would receive idea "contributions" from the actor while the artist would implement their own artifact. For example, I10 exhibited a piece with another artist, only collaborating for *"figuring out the common theme for the show"* or exchanging ideas, but not for the artwork itself. A meta-artifact, on the other hand, would receive a similar amount of idea- and implementation-centered contributions from all involved. As each piece in the meta-artifact is presented under the name of a single artist, the sense of *ownership* for their specific piece would be high.

4.2.5 Management. In *management* relationships, the main artist gets *managerial* support from the actor (Figure 3e). For example, I9, who is an independent animator, got support from a producer to raise funds and manage necessary human resources. Note that *managing* in Section 4.1.3 is a category for a type of support, while *management* is a type of relationship that include *managing* as one type of provided support. As such, actors in management roles might also make *idea*-focused contributions. This contribution from the management actor usually made a significant impact on the artifact. For example, I9 described the experience of working with the animation producer. I9 had *"the leading power"*, but *"had to also consider the producer's interest, taste, and options"*. The amount of support would decide how much power actors carry. However, the actor would rarely make direct contributions like implementing the artifact. The significant contribution on *ideas* also affected the sense of *ownership*, the actor taking some portion of it from the main artist.

4.2.6 Inspiration/Critique. Support also happens when the main artist seeks *inspiration* or *critique* from others (Figure 3f). *Inspirations* and *critiques* can happen by the actor giving *ideas* to the artist. For example, I1 noted that exchanging *ideas* with other composers could be helpful as they have *ideas* on *"totally different directions, from which you can get benefits"*. In this support type, main artists can decide whether to accept provided ideas or not, while actors would have freedom on which ideas to give. For example, I13 mentioned that when analyzing feedback on developed games, as there are *"many types of users"*, I13 tries to identify from which types of users the feedback is helpful. As the actor does not directly contribute to the artifact and as the artist makes decisions on whether to accept the actor's ideas, the actor would have almost no sense of *ownership* of the main artist's piece. Unlike inspiration, critique requires the actor to observe the artist's artifact, as the actor needs to give feedback on it. Note that, in these interactions, we only considered cases where the actor intended to help the main artist (and the artist solicited this advice). This is in contrast to a newspaper critic. In that situation, the critic is providing unsolicited feedback. Moreover, the target of their advice is not the artist specifically, but their readers, generally.

4.2.7 Mentorship. Mentorship (Figure 3g) is the support relationship type where the main artist seeks skill-, career-, and creation-wise development from the actor, or the mentor. The support usually happens in the form of transferring knowledge (*teach*) or giving feedback and suggestions on directions (*ideation*). For this support type, specific dynamics can differ a lot based on how much authority the actor has. For example, I1 mentioned that in classical music performance, as *"there are more standardized styles and conventions"*, mentors would tend to *"have the authority"* to give feedback to students. On the other hand, for cases where peer colleagues do a single-time session to teach each other, due to less authority from peers, the actor's power on the creation would be much smaller. In this relationship, the actor can contribute ideas (to a varying degree based on the authority the actor has), but not implementation-wise contributions to the artifact. As the powers of the main artist and the actor largely depend on the extrinsic factors, the sense of *ownership* would also depend on it. In some cases, through mentorship, artists shift the 'bundle' of people and tools in their network, which is a type of *managing* support. For example, I4 learned T-shirt printing by attending a local workshop on screen printing. This mentorship experience might lead to new people and tools being integrated into the support network. For example, having learned screen printing, the artist might want to recruit help to produce multiple versions of the shirt. Unlike a critique interaction, a mentorship is often long-lasting. However, as with subcontracting/featuring/co-creation, these relationships may fall on a spectrum.

4.3 Frictions and Conditions for Success

Given the various combinations of supports, our interviews revealed various frictions and solutions that made these relationships fail or work. We found that frictions were largely due to two categories 1) having different styles, values, or levels of knowledge, and 2) external factors, such as social dynamics.

4.3.1 Artistic Frictions: Different Artistic Values and Knowledge. Artists often have different artistic styles, expertise, ideas, and perspectives. While an actor's diverging perspective can be inspirational, our interviewees noted that it also can be the source of disagreement and blur an artist's own vision. For example, I7, a visual designer, mentioned the difficulty in collaborating with another designer: *"If we discuss ideas only based on our own design styles and tastes, the process of giving feedback fundamentally becomes subjective. Furthermore, if we have some sort of pride in our own designs, it would be harder to exchange opinions."* Similarly, I11 noted critiques from diverging perspectives can negatively affect a work: *"When there are too many people giving critiques, my direction can change to an unintended way. Like, I assumed that a certain thing is important, but there can be people who mention other things as important. So, such things can be a difficult case."* Our interviewees suggest a number of approaches for this friction type.

Trust in Understanding Styles and Values. A common theme described by artists to resolve friction was building trust and understanding of each other's styles and interests. Styles and values underlying art pieces are crucial to the artist, as they are closely relevant to one's originality and personal aesthetics. Artists build this shared understanding by having repeated co-work experiences. For example, after doing some rounds of collaboration with a friend, I10 *"knew that it would be super easy to collaborate"*. Sometimes,

artists described converging on a similar taste or color. This approach was mostly mentioned for support relationships where the main artist and the actor exchange ideas about the artifact for a extended duration of co-work (*featuring*, *co-creation*, *compilation*, *management*).

Trust in Skills and Quality. Artists mentioned that having an actor with better skills and more experience would sometimes positively influence the interaction. In particular, familiarity with the other artist's work helped to manage expectations. For example, I5 indicated that when a chorus gives commission to composers, they prefer those with known skills and experience. That is, they would not hire someone who does not understand *"technical problems"*, or would write a piece that *"cannot be sung"*. This solution was frequently brought up for relationships where the actors directly contribute or impact the artist's artifact (*sub-contract*, *featuring*, *co-creation*).

Communication. Most support types benefited from communication. Through effective communication, artists could define and scope the relationship and reach agreements. For instance, I7 indicated that when disagreements arise within a team, the team *"had an open discussion and listened to others, to reach the agreement"*. However, there could still be difficulties in communicating the direction of art. As verbal language can be ambiguous to communicate artistic ideas, people could perceive one idea differently. While artists can *use jargon* to overcome this challenge, they would not be able to express all ideas. Moreover, jargon is limiting when artists from various fields work together. For example, I2 noted the difficulty of communicating musical ideas: *"When musicians are talking to each other, 'Increase half key', like this, we communicate with musical languages . . . However, apart from that, we frequently use adjectives to explain things. Like, 'let's go a bit shy', 'this part should be raving', or, 'let's go with tight sound'. Then, everyone somehow has some ambiguous images about these words . . . If collaboration happens with other genres, I think this problem can be even bigger."*

One approach to overcome the challenges of ambiguous language is to *use references* or *sketch ideas*. For example, I3 mentioned that when recording a guitar track for others, I3 would *"record as many things as possible"* to reach the agreement. If it did not work well, I3 and collaborators would *"bring references"* and *"play as much similar as those [sic]"*. However, these approaches can be difficult when the cost of finding references or creating sketches is highly significant. I12 described a situation in which the game company asked people to implement many ideas about the game arts. This led to *"so many extra artworks generated but never get used in the final game"*. Furthermore, references can still be perceived ambiguously. For instance, I2 mentioned the experience when a movie director shared a video as a reference for composing background music: *"What the person got was more about the combined image of all factors within the video. . . I would only refer to the music of it, and I would create a music piece based on it. But when the reference is separated in such a way, it can be perceived in a very different way."*

Concentrating Power. A solution to frictions caused by value and style differences is to concentrate decision power on one artist. One mechanism is to allow the main artist to explicitly filter decisions and *selectively accept other ideas* based on their own criteria. This approach is common when there is a significant *critique* or *inspiration* by a collaborator. For instance, when I13 was designing a casual game for a broad set of the audience, I13 did not consider feedback from a hardcore gamer as critical.

Another mechanism for concentrating power is *dictating*. With this approach, one artist would give clear specifications and highly constrained authority to actors. For example, I9 mentioned that when asking others for manual tasks, I9 would hand out *"a method sheet"*, or *"a manual"* about how the task needs to be done. This specific approach would work for tasks that do not require creativity from actors (*subcontract*). Based on how much authority each artist has, the level of control that can be imposed on the support relationship would differ. For example, I1 stated that in the classical music domain, conductors' power to performers is *"absolute"* and they usually *"carry all the power"* about the interpretation of the song, and thus have ultimate say on what each performer does.

A final alternative is to simply relinquish all decision-making power to the actors. This approach would be most effective when the actor contribute both ideas and implementation on a co-created artifact (*featuring*, *co-creation*). Artists tended to use this approach when they had clearly different expertise or tasks. Power can be distributed in such a way as to reduce overlap. For example, I6's exhibition team had few conflicts as *"the separation of the roles is quite clear"*. It is important to recognize that moving power–either to the main artist or to the actors–may often make matters worse when working with other people.

4.3.2 Extrinsic Frictions: Additional Factors. Some frictions emerged from extrinsic factors. We identified three types of non-artistic frictions: 1) unfair relationship, 2) insufficient resources, and 3) personality. While interviewees mentioned problems caused by non-artistic factors, they did not mention many solutions for them.

First, *unfair relationship* can lead to imbalanced work-credit allocation (too much work, too little credit; too little work, too much credit). For example, I9 reflected that freelance visual designers are vulnerable to unfair contracts, which do not specify *"how many rounds of iterations are allowed"* for the requester. In these situations, freelancers would often overwork, as requesters might ask for revisions until they are satisfied. Likewise, I12 mentioned that in the game industry, even though artists do *"a lot of things in the company"*, only *"the tip of the iceberg"* would be released, and artists would not have clear credit for what they did.

Second, *lack of resources from actors* also causes problems. An actor might not be able to invest enough resources to help the main artist. For example, I14 mentioned he did not get much help from his mentor in the educational program as the mentor was *"busy"* and had *"a lot of stuff going on in his life"*.

Third, each artist's or actor's *personality* also can be a source of friction. For instance, I4 mentioned that it was hard to collaborate with a band member who had a different work ethic, who *"does not appear on the concert day"* and *"does not come to the practice sessions"*.

Limited Solutions. While interviewees brought up problems caused by non-artistic factors, they did not describe many solution approaches for them. In many cases, the solution may have just been to sever the relationship and not work together in the future. In some situations, the required changes were outside the scope of

the support relationship, requiring higher-level changes (teams, societal, etc.). For example, I9 mentioned that the fair contract for freelancer visual designers should note that *"the price would be different according to the rounds of feedback"*. I9, however, was less optimistic about it due to the entrenched convention of paying artists little. The only realistic approach that could be done by the artist was to 'give up' on certain things. For example, I12, who works in the game industry, mentioned: *"As for my, like, personal value, I do like drawing stuff from the beginning to the end. But in order to work in the industry, that's something you cannot have, or acquire."*

5 DISCUSSION

5.1 Comparison to Previous Models

Our analysis of artistic support resonates with taxonomies and findings from previous work. While our novel contribution is mainly on identifying dynamics in different types of relationships, we also extend the taxonomy of support[3] and frictions. As we cover a wide set of art domains, we identified taxonomies that encompass those from previous work. This resulted in more structured taxonomies, while not being necessarily "complete." Due to broader scope, we might have missed more specific patterns in more scoped domains.

By explicitly articulating the support dimension in the artist support network (Figure 4), we have identified aspects that may not only apply to human supports but to tools as well. Our taxonomy categorizes types of support into two higher-level groups, *artifact-influencing support* and *artist-influencing support*, which tell us different mechanisms of getting support. On the other hand, previous work lacked this distinction and represented support as a 'flat' structure. Previous taxonomies also did not cover the full range of *artist-influencing support*, while we identified both *managing* and *teaching*. This may be due to the different focus: we tried to consider all supports that artists get from other actors that are intended to help. With this scope, we could comprehensively identify types of support, even those that do not directly contribute to artifacts. Similarly, while some of the previous work did not consider commonalities between critique and inspiration, we grouped them under the higher class of *ideation*. This approach is similar to Chung et al. [9]'s approach. Compared to Chung et al. [9], our taxonomy further identified specific types of *implementation*, which are providing *expertise* and *labor*.

For solutions to friction (Figure 5), we identified a large set of approaches. In our interviews, we observed solutions that were identified in previous taxonomies. Moreover, we also found an additional category, *selectively accepting other ideas* within the solution of *concentrating power*, which was missing in other taxonomies. Furthermore, our work could find to which relationship types each solution would work well. This difference would be because we investigated diverse art-making settings, while prior work focused more on a specific one. Another interesting aspect to note is that Settle et al. [43] found that stylistic similarity does not necessarily lead to success in support. On the other hand, our closest category, *trust in understanding styles and values*, indicates that understanding and trusting different actors' styles is more important than having the same style in artistic production.

As our analysis identified a spectrum of interaction dynamics in human-human support relationships, we can draw connections to previous taxonomies in interactions with CSTs. For example, in our previous work [9], we identified interactions in three dimensions: 1) input directness—whether an input is close or far from the artifact form (e.g., a portion of the artifact as an input vs. high-level instruction inputs), 2) output—whether the tool is working directly on the artifact or only influencing the user, and 3) predictability—how closely the user's expectations of the output matches the tool's actual output. Here, we see analogous connections when considering actors and CSTs as "the source of support". Extending the analogy, 'input directness' and 'output type' describe whether an artist or an actor is contributing to the counterpart or the artifact. For instance, the artist giving ideas and instructions to the actor would be equivalent to 'indirect inputs.' The other way around—actors influencing artist—would be analogous to 'influencing output.' Similarly, the artist contributing to the artifact would be similar to 'direct inputs' in CSTs. In contrast, the actor's contribution on the artifact would correspond to 'implementing output' in CSTs. Unlike CSTs, we observed that most support relationships include unpredictability. This might be because in human support relationships, there are many relationships where artists are provided with idea-focused support. Due to the unpredictable nature of human support, artists tend to adopt strategies to minimize risks from unpredictability (e.g., communication). In this past work, which was based on looking at research systems, we identified a taxonomy of CSTs based on the intersection of of roles, technologies, and users. Through our interviews, we found an array of support relationships where these dimensions are realized in a nuanced spectrum. Potentially, our findings could inform designs of CSTs that can provide more fine-grained variation in support.

We also relate our findings to broad collaboration research within HCI. In the literature on shared leadership [57, 58], researchers identified four types of leadership behaviors, from giving positive or negative feedback to directing and promoting social engagement. Some are relevant to our solution approaches. For example, being directive would be relevant to *having communication* and *concentrating power*. However, other aspects of leadership behaviors would be more relevant to non-artistic frictions discussed in Section 4.3.2. For example, artists giving adequate feedback and engaging socially with actors would be solutions for non-artistic frictions.

Elements of our findings also can map to those of more general collaboration theories, such as activity systems [14]. In activity systems, supporting artist would be an "object", the goal of the activity systems, with actors being "subjects" who support the object through intentional and direct interactions. Roles of managing can be interpreted as providing "rules and norms" within the support system, while ideas, implementations, and teaching can be "instruments", concrete means of supporting artist. While informing specific patterns, our findings do not illuminate all aspects of these theories. For instance, as our focus was more on human-human relationships, how "tools" impact their relationships was less explored. These indicate there can be future work directions that can be identified by relating our findings with existing theories.

[3]We note that our idea of "support" is sometimes expressed as "roles" or "activities" in some previous work.

<table>
<tr><th colspan="3">Our work.</th><th>Nakakoji. [37]</th><th colspan="2">Frich et al. [17]</th><th>Mamykina et al. [33]</th><th colspan="2">Chung et al. [9]</th></tr>
<tr><td rowspan="4">Artifact-influencing Support</td><td rowspan="2">Implem-entation</td><td>Expertise</td><td rowspan="2">Running Shoes</td><td rowspan="2">Implementation</td><td rowspan="3">Iteration</td><td>Construction</td><td>Skills</td><td>Implementation</td></tr>
<tr><td>Labor</td><td rowspan="3">Vision</td></tr>
<tr><td rowspan="2">Ideation</td><td>Feedback</td><td>Critique</td><td>Evaluation</td><td>Evaluation</td></tr>
<tr><td>Inspiration</td><td>Skis</td><td>Ideation</td><td>Creative Concept</td><td>Ideation</td></tr>
<tr><td rowspan="2">Artist-influencing Support</td><td colspan="2">Manage</td><td></td><td colspan="2">Project Management</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Teach</td><td>Dumbbell</td><td colspan="2"></td><td></td><td></td><td></td></tr>
</table>

Figure 4: Comparison of taxonomies on types of support.

<table>
<tr><th colspan="2">Our work.</th><th>Mamykina et al. [33]</th><th>Luther et al. [31]</th><th>Luther et al. [32]</th><th>Settles et al. [43]</th></tr>
<tr><td colspan="2">Trust in Understanding Styles & Values</td><td>Common Artistic Intentions & Visions</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">Stylistic Similarity Does Not Directly Affect Success.</td></tr>
<tr><td colspan="2">Trust in Skills & Quality</td><td rowspan="2">Share Knowledge</td><td rowspan="2">Reputation & Experience</td><td rowspan="2">Problem solving</td></tr>
<tr><td colspan="2" rowspan="2">Communication</td><td>Share Common Language</td><td rowspan="3">Communication & Dedication</td><td rowspan="3">Informing & Monitoring</td><td rowspan="3">Communication</td></tr>
<tr><td>Engage in Extensive Discussion & What if Sessions</td></tr>
<tr><td rowspan="3">Concentrating Power</td><td>Selectively accepting other ideas</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Dictating</td><td></td><td rowspan="2">Planning & Structure</td><td rowspan="2">Planning & Clarifying roles/objectives</td><td rowspan="2">Balance Effort</td></tr>
<tr><td>Relinquishing power</td><td></td></tr>
</table>

Figure 5: Comparison of taxonomies of approaches for successful support relationship.

5.2 Informing the Design of CSTs

Our analysis work identified different aspects of artist support networks: the types, provided support, dynamics, and success conditions of relationships. Our interest in these features is specifically motivated by how they might inform CST design. In some situations, a CST may be designed to replace, partially or in full, a human actor that was previously part of the support network. In those situations, it is useful to understand the dynamics and function of these existing relationships. In other cases, a novel CST may augment or automate some work the artist currently does. Here, it is valuable to acknowledge the mechanism by which agents come into an artist's support network and what makes those relationships work. Finally, though it may not be the goal of a CST designer to directly map to an existing human actor, there is always the potential that artists will evaluate these technologies through an anthropomorphic lens. Thus, human-human interactions in a support network are highly likely to shape the artist's perceptions and acceptance of a technological tool.

To make this more concrete, we focus on two CST types: collaborative CSTs and AI-CSTs. Collaborative CSTs enable the involvement of multiple individuals in the creative process. The tools directly act on the artist support networks themselves. Thus, patterns found in support networks can inform how technologies should be designed to have the highest chance of success when embedded in those networks. The second category of interest is AI-CSTs, or CSTs powered by AI. As these CSTs can potentially automate some roles played by actors, the artist might expect these tools to have interaction patterns similar to human actors.

5.2.1 Informing Design of Collaborative CSTs. We briefly offer ways in which our understanding of human support networks can inform the design of collaborative CSTs[4]. CSTs in this space are already designed to fit within, or enhance artist-support networks. These CSTs focus on improving the fluency of social interactions for collective art-making. However, such tools often assume equal power among participants. As described in our findings, and as supported by past work, shared or equal power is not often the case in actual human-human collaborations. Given this, tools that consider the asymmetries of real artist support networks are more likely to succeed. CSTs of this type can include pairs of 'artifact creator' and 'feedback giver' [26, 39]; leader and crowd [27, 32]; or highly specific relationships such as dancer and choreographer [48].

Understanding artist support networks can also give us insight and inspiration for the design of collaborative CSTs. For example, consider the artistic frictions found in real networks (Section 4.3.1). We found that nuanced frictions are caused by gaps in: *trust in understanding styles and values*, *trust in skills and quality*, *communication*, and *concentrating power*. In this context, collaborative CSTs can address the gaps by creating (or being) boundary objects [28, 50, 51], thus serving as a means of translation between artists and actors. For example, learning about another person's artistic styles and values takes a significant amount of time and interaction (e.g., when developing a subcontracting relationship). CSTs can accelerate this process. For example, we might imagine a tool that summarizes an artist's style or work process by mining their work or log data and then presenting the information to the other party. Analysis of this type can also help in situations where collaborating artists and actors might not be aware of all knowledge and skills required for fluent collaboration. We could imagine a CST that supports a vocalist and composer's collaboration by analyzing and describing the performer's vocal range. In situations where the artistic languages of the collaborators are different, CSTs can enhance communications by building spaces for shared 'models' to represent what each artist means when they say something. For example, we might imagine a 'surface' where artists can collect instances of what they mean when describing 'dark' or 'light' concepts. Finally, as collaborative friction can come from implicit power structures between users, CSTs can facilitate the awareness by making them more explicit. For example, CSTs can require participating artists to specify their roles and build more explicit 'contracts' and workflows.

5.2.2 Informing Design of AI-CSTs. Our analysis of human-human networks can inform us of how artificial agents should be designed to replace or supplement human collaborators. This is critical, as designing AI tools has led to long debates on how automation and control should be balanced in human-AI systems [23, 29, 41, 46]. To help designers resolve these tensions, researchers have proposed various high-level guidelines for developing human-AI systems [3, 40]. Many of these are inspired by experiments in various forms of automation (e.g., [23, 41]). While art-making is one of the domains where AI technologies (e.g., generative algorithms) are expected to add values [8, 10, 18, 21], it is not entirely clear if these guidelines apply in the artistic space. Prior analysis of the 'value of artifacts' in this space depends on 'artistic values' (e.g., authenticity [38], authorship [35], and novelty [34]). This is confirmed by some of our analyses–and suggests that automation and guidelines that ignore these values will be problematic.

A few specific efforts have sought to characterize the intersection of human-AI systems and CSTs. Speculative and theoretical work [11] hypothesized ways in which artists may interact with AI-CSTs (e.g., as colleagues with which we collaborate over interactive 'rounds'). This anthropomorphization is possibly reflective of how artists do, or should, interact with machines. However, this presents only one possible approach. Other efforts studied specific interaction techniques of existing AI-CSTs and found design patterns in controllability [9], and the 'split' of the creative process between human and machine [12, 49]. However, no effort was motivated by user needs or expectations in art-making.

All this suggests that existing literature and guidelines have limitations to inform the design of AI-CSTs. For example, existing AI design guidelines emphasize scoping the AI's capabilities (e.g., 'Set the right expectation' [40] and 'Make clear what the AI systems can do' [3]). This is reasonable, but leaves unstated the implied need that the AI's capabilities should align with what specific user populations would expect from them. Our analysis of artist support networks concertizes these expectations. Second, while some guidelines resonate with our findings, they may not be detailed enough to convey specific advice in art-making. For instance, when describing good ideation support, we saw that artists hope for novel ideas. However, a good support partner knows that ideas that are too distant are distracting. The need for this balance can inform AI-CST design as the uncertainty inherent in AI systems can be a double-edged sword: proposing both inspirations or distractions. Existing guidelines do not suggest specific design approaches for these situations. At best they may hint at providing controls to align uncertain machine behaviors to user expectations (e.g., 'Encourage granular feedback' and 'Provide global controls' [3]). In many cases, these control interfaces use terminology and affordances appropriate for AI and GUI design. However, this may be undesirable, as it is an open question at which level of details controls and feedback should be provided for art-making AI tools. Understanding how humans do communicate or expect to communicate their needs to other humans can help in designing appropriate interfaces.

We suggest that our findings can help clarify and refine broad design guidelines. To reflect on what artists expect from AI-CSTs, we can assume that situations in which artists have successfully found human collaborators may be amenable to replacement or augmentation with CSTs. The 'sites' of interaction between artist and actor (i.e., the edges in our graphical model) are potential locations into which a CST can be 'spliced.' That is, these locations have already been indicated as opportunities for an artist to utilize other actors. Furthermore, our articulation of relationship dynamics implies a complexity to certain relationships. That is, some interactions (e.g., subcontracting) may be fairly simple and thus more amenable to CST augmentation. We can hypothesize that where sites of human-human relationships exist and where the dynamics of those relationships are simpler, it may be easier to add a CST. For example, automatic comic flatting tools (the process of creating areas for different colors on line art [55]) could be easily accepted by comic artists, as its interaction with the artists would

[4]Note that while this category is broad and can extend beyond art (e.g., crowd ideation [47]), we mainly focus on variants for collaborative art-making

be a simple subcontract relationship (Figure 3a). This adheres to the model where the high-level artistic vision (e.g., selection of colors, specification of colors in each cell) is decided, controlled, and implemented by the artist, and the tool implementations a facet of that vision. In contrast, an AI coloring tool that is broad and imposes its own style would lead to an unexpected configuration (e.g., a Featuring relationship as Figure 3b) that deviates from the expected subcontract model. Or perhaps worse, the CST would not fit any known support model.

With a knowledge of artists' expectations on support patterns, we can give more specific design guidelines for AI-CSTs. For example, when artists communicate their intentions, the level of details varies based on relationship types. For instance, they would be less detailed in 'featuring' than in 'subcontract' relationships, as the artist would not want to limit the actor's creativity with concrete directions. Such dynamics might transfer to the artist's expectations on AI-CSTs, with more fine-grained controls for "subcontract"-like AI-CSTs.

We emphasize that our findings are based on an analysis of what works within human-human support networks. Thus, we can only speculate on how artists will interact with AI-CSTs—they might interact with actors either similarly or differently. We expect our findings to most likely apply to tasks and domains where the artists already have a strong convention on the creation and support process. In such domains, the artists are more likely to expect that support dynamics of the tool mimic their human counterparts. Deviations from this may be tolerated if the benefit of the tool is high, but we hypothesize some difficulty in incorporating the tool into existing work practice. On the other hand, if AI-CST designers offer completely novel support, with no basis for comparison, the tool may be better accepted.

5.3 Limitations and Future Work

We purposefully studied support patterns in a wide range of art creation domains. However, this approach limits our ability to learn detailed support patterns in a specific art domain. Thus, one future direction can be to extend our analysis further in one specific domain. This will enable us to find specific sub-categories that may be of interest and importance within that domain.

Again, due to focus, there may be rarer types of relationships that our taxonomies might not fully explain. For example, take the case of a writer finishing a book for a deceased author. In this case, the living writer, like a *subcontractor*, is expected to follow the style and outline of the deceased. At the same time, because there is no absolute guidance, like a *featuring* writer, the writer is also expected to make some creative decisions that shape the work. Though rare, this type of relationship is rather unique and does not as cleanly fall into one of our high-level categories.

In our work, we focused on supports that are intended—either by human actors who are willing to help or by tools that are designed with intended support functions. However, there may be other types of supports that are not intended, but still influence artists. Receiving inspiration from an artist who died 200 years ago is one example of such a case. As these types of support might show different dynamics, investigating them is worth studying in future work.

As mentioned in Section 5.2.2, we presented a possible use of our framework in the design of CSTs. A more formal study on CSTs and their connection to the artists' support network is an important next step. This would help identify situations where mapping can be made directly and where it can not. For example, many CSTs are much more focused on their functions than human actors. Further research would also help us examine whether and how an artist's expectations for AI-CSTs relate to their analogous human roles. This type of analysis would allow us to extend our model to account not only for human actors but CSTs as well.

6 CONCLUSIONS

In this work, we investigated various types of relationships within the artist's support network. We conducted interviews with fourteen artists from a wide range of domains to understand common types of relationships, their dynamics, the general roles filled by support actors, and the reasons and problems (the frictions) inherent in these relationships. Additionally, we identify patterns of how these factors relate to each other in different support relationships. We motivate this investigation with the design of CSTs, which automate and augment the artist's support network. We believe that perceptions and expectations of effective human support are likely to influence the way artists view the design of CSTs. Based on our interviews, we offer implications for designs of two specific types of novel CSTs, CSTs for collective users and AI-CSTs.

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