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Digital Art-Mediated Practices for Building Team Trust Over Distance

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***Abstract*—Self-expression and interpersonal sharing of emotion have been shown to strengthen groups. However, how to accomplish such interpersonal sharing in public settings is a challenge. In a pilot study of a prototype system, we sought to facilitate public self-expression and sharing of affective information. We followed five design principles around the concept of art-mediated self-expression and created a collective doodling installation. The pilot trial demonstrated positive results around engagement of end users. As we reflected on the results from this trial, we found implications for building trust and collaboration in teams.**

Keywords—interpersonal sharing; trust; collaboration; teams; socially engaged art practice

I. INTRODUCTION

Imagine we are working in a collaborative group. We greet people that we run into down the hallway, we talk to colleagues over lunch, we chat online with teammates for issues that we encounter at work, or just share gossip. We post or share on social networks to express joyfulness, frustration, or just boredom. This is a simplified image of how people working in the same organization frequently communicate with each other on a day-to-day basis. Indeed, there are other channels for people to express whatever is on their minds. However, for people who belong to the same group, there are limited ways for them to express their subtle and personal emotions; direct conversations may neither be desirable nor possible. Yet were they able to share such emotions, they could build stronger, more affective ties with people in the same group.

Self-expression and interpersonal sharing of emotions have been shown to strengthen groups. It helps promote positive emotions [1], increases the interpersonal awareness among a group [2], and facilitates group cohesion [3]. There are different ways how people express themselves and share opinions and feelings in the information era. As mentioned in the simplified scenario above, people can write blogs, chat over instant messaging, post photos on Instagram, or share feeds on Facebook. These are channels for people to explicitly draw a "selfie" through technology using multi-media. When they exchange texts or images with other people, they are telling and sharing part of who they are.

However, there still are challenges in supporting people to self-express within groups. In this paper, we are interested in two specific questions: (1) how to help people express themselves in a more implicit way around affective information such as feelings or, more generally, emotions; and (2) how to help them share their affective information visually within collaborative groups, and hence to strengthen groups. Simply put, we seek to support "safe" and effective self-expression and sharing.

While investigating these questions, we are inspired by how civic art has successfully acted as medium for people to express a broad spectrum of human beliefs and emotions, as well as how it engages people to perceive the embedded messages and thus facilitates sharing of affective information. Civic art has historically acted as a creative and reflective practice. It facilitates a variety of communications through embodiment engagement. Participants express and spread messages through their work. The different forms of creations make art a powerful way to engage people. Viewers and participants could perceive the message through visual, hearing, touch and other senses.

Besides appreciating appealing artwork, strange and even disruptive experiences also increase awareness. Artists can share information and draw people's attention to specific issues by pushing them to reflect and think. For example, Asian Field [4], a sculpture project by Antony Gormley was made and exhibited in China. Antony called for the creation of clay figures that stand for persons and hundreds of people from rural areas in Guangdong province participated in the creation of 210,000 clay figures. As described in Antony's book [4], during the process, participants started to reflect on "who they are" while making clay figures. Antony held the final exhibition to allow more people to read, experience, and reflect on the work. The exhibition was powerful. It pushed people to think about the questions of "who *they* are" and "who *we* are" in a way that only the 210,000 silent clay figures could inspire. This project is a good example of how civic art engages people in expressing themselves through a specific practice, and the different ways of perceiving information, interacting with physical reality, and connecting physical artifacts with their inner mental space.

Others have proposed applying the philosophy, inquiries, and practices from art into information technology. There are a couple of projects aimed at integrating the fields of information technology and art in regards to facilitating societal impact and creative thinking. Critical design [5] and socially engaged art practices [6] are among a number of trends that we will discuss in the discussion and related work section. Those trends are good examples of applying the kernel of civic art in human-computer interaction.

In this paper, we propose the concept of *art-mediated self-expression*, which is about using art practices to help self-expression and sharing of affective information visually within groups. The goal is to engage people in implicit expressions of their affective information and to strengthen a group by collectively and visually sharing its members' affective information. In order to demonstrate how to realize this concept in actual designs, we propose five design principles and report one specific pilot trial – Doodled "Us". We demonstrate our concept and the principles have positive influences on engaging members within a group. By synthesizing insights researchers have had in regards to interdisciplinary research on design in human-computer interaction, end-user development, information visualization in public spaces, and collaboration in distributed teams, we relate our research to the areas of human-computer interaction, computer-supported cooperative work, and VL/HCC, particularly around visual interfaces to mediate better team building. Finally, we describe how art-mediated self-expression could specifically benefit research in globally distributed teams.

The structure of this paper is as follows: section two is about five design principles around the concept of art-mediated self-expression. Section three is about the pilot study – Doodled "Us". Section four discusses the implications for and connections to related literature, particularly on interdisciplinary research on design in human-computer interaction, end-user development, information visualization in public spaces, and collaborations in distributed teams. Section five is an agenda for future research on art-mediated self-expression for globally distributed teams.

II. Design Principles

There are two goal statements in our concept of art-mediated self-expression. (1) Art-mediated self-expression encourages people to express themselves by supporting more implicit expressions through art practices when explicit expressions through texts or images are insufficient or not desired. (2) Art-mediated self-expression empowers people to perceive information and values through public visualization within a group. In order to guide how to design for the above goals, we came up with five principles described below.

A. Enable Implicit Self-Expressions Through Diverse Interactions and Gateways

We are proposing that a design should be able to support individuals to express their thoughts, feelings, emotions, among other subtle, personal, and affective information in an intuitive way. The design should support more mechanism of self-expression than what Facebook or Twitter has already offered. For example, how to help people get rid of temporary depression aside from letting them post on Twitter? How to help people share their excitement publicly within a group without broadcasting the message on all of Facebook? In particular, a design should: (1) provide mechanism and gateways to detect, or get users to provide multiple types of affective information and activities; and (2) be able to translate any abstract data input with measurable metrics and into representations that encourage further understandings and explorations publicly within the group.

B. Design for the Catharsis Process

A design should also be able to support emotion catharses by enabling people to confide, spread out, get connected, and find support. Different than creating, finding or joining an online support group, or a community of the same interests, the catharsis and satisfaction do not come from explicit interpersonal communication. Rather, it requires a platform, or mechanism to assist people in expressing in a less goal-oriented method. Thus we propose a design focused on the catharsis process should: (1) well support people's desires for the actual actions and process when they express themselves; and (2) well transcribe and document people's catharsis actions into manageable representations, in order to help people share their expressions and look for support afterwards if needed.

C. Reveal Group Patterns Through Socially Collective Artifacts

In terms of information representations, we propose that a design should have one visualization or dynamic visualizations that: (1) show all individual inputs; (2) reveal the patterns and social interactions among collective individual data; and (3) support explorations of meanings and affective understandings among people. To meet those expectations, the typical way of visualizing information through statistics may not be intuitive and provoking enough. Thus, we propose composing collective data into socially collective artifacts, which are surely consisted of individual inputs, but through certain computational compositions, the final result should be able to reveal themes, patterns and stories in a more visually intuitive and affective way that encourages further perceiving and reading.

D. Build Empathy Through Reading and Exploring the Social Artifacts

Since we are proposing information visualization as socially collective artifacts, it requires further interactions for participants to explore and interpret. For example, in collaborative art, reading, analyzing, and critiquing a piece of artwork require cognitive effort, and thus it could help people become aware of issues through reading the stories behind the piece of work that they create together. In order to ensure that the "reading process" is able to involve people rather than making them uncomfortable, scaring them, or pushing them away, we are proposing that a design should: (1) support the interactions between participants and the socially created artifacts; (2) encourage rich explorations of meanings; and (3)

be aesthetically attractive, enjoyable, provoking, or stimulating and, thus, could lead to engagement and reflection.

E. Embody Mechanism to Make Information Anonymous in Order to Protect Information Privacy

Privacy is a big concern for information visualization in public spaces, about which we will discuss more in the discussion and related work section. Building trust between participants and the design/system is a key factor in engaging people. Especially when the participants' original desire is to implicitly self-express, their privacy should not be sacrificed for exposure. In order to protect participants' identities, we are proposing the design should embody mechanism to make personal identification abstract and anonymous, by which to: (1) eliminate the exposure of self-expression if further sharing is not desired; and (2) serve the purpose of hiding personal identifications even if sharing is desired.

The five principles are high-level implications for design that aims at engaging people to self-express and share within groups. Next we will present a concrete pilot study of a prototype system that applied all of our principles under a specific context – expressing and sharing moods among people at a university.

III. DESIGN CASE – DOODLED "US"

A. Background

Doodled "Us" is the result of a course project for the advanced prototyping class in the HCI/d graduate program at Indiana University [7]. One of our authors was a key member of the 4-person design team. The goal of the design was to help increase awareness and build empathy of each other's mood among local members through collaborative mobile doodling.

The distributed and complex infrastructure in a local organization separates its members [8]. The lack of connection and the absence of community is a major factor that leads to many issues and is exacerbated by limited avenues for day-to-day interactions [9].

Doodled "Us" explores how technology enables users to share emotions and affective information beyond a "like" on Facebook in an intuitive and enjoyable way. It explores how interactive art could help members get to know more about the people living in the same area through subtle but effective ways. It also explores how to engage participants and reveal others' moods by data visualizations and thus to increase awareness and build empathy by the spiritual resonance the visualization would cause.

B. Design Concept

In order to achieve the above goals, the team came up with a concept of collaborative mobile doodling. The design concept is composed of two parts: an application for mobile devices, which provides a visual interface for users to express their moods; public displays around local areas, which will present the real-time collective drawings. Illustration in Fig. 1 presents the general design concept.

In the mobile application through a simple interface, a user can pick a color to stand for their moods at the moment and then click the screen to doodle. Doodling will trigger simulated firework animations consisted of dots of selected colors on the

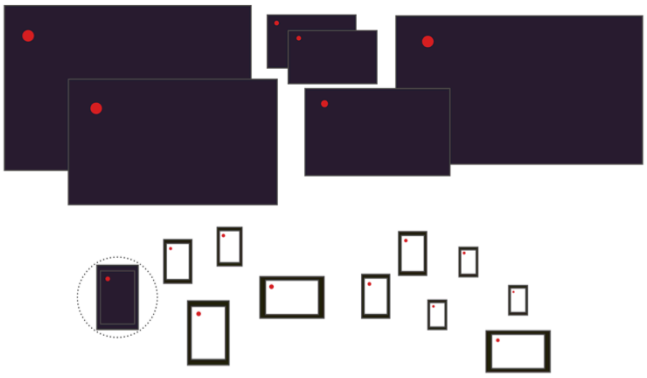

Fig. 1. The general design concept. Upper: public displays, bottom: individual mobile devices, phone in circle: the active user, red dots: synchronized doodles.

device screen, which are subsequently projected onto large public displays that are in public spaces (e.g., a plaza). Every new doodle will overlap the previous ones, so the more doodles are, the more crowded the canvas will look like. A collective drawing gets archived every 24 hours and users get a new canvas everyday. If in a local area where five thousand members participate and create six thousand doodles in one day, the daily drawing could be highly abstract with only hundreds of thousands of colorful animated dots on the canvas, as well as on the public displays.

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Users can express their mood whenever they want and wherever mobile connection is available. Meanwhile, the simultaneous collaborations with other participants bring them an unexpected visual output. The daily drawing is an abstract projection of mood of the local area. All archived collective drawings are permanent for downloading and appreciation. In this way this design engages people into collaborative practices anonymously and by displaying real-time drawings from all participants in public spaces, it enables people to "speak" out without actual text or oral messages. It resonates people's reflections through an abstract visualization, and facilitates the emotional connections among strangers.

In order to test this concept, the team built a prototype with popular visual programming tools Arduino and Processing [10]. The team did a pilot study in an area at Indiana University. To simulate the mobile interactions, the prototype system allowed participants to twist a button to select a color, and to doodle with the selected color on an iPad. The iPad screen was projected onto a 3*3 screen wall in a public area in the School of Information and Computer Sciences at Indiana University (see Fig. 2 and Fig. 3). The interactive demo lasted for 2 hours, with about a total of 30 participants.

C. Design Principles in Practice: Expression, Engagement, Emotional Resonance and Awareness

1) Enable implicit self-expression through diverse interactions and gateways

This design allows users to spread out their emotions through the practice of doodling with many others. Participants are active users, who intentionally create contents through the platform. Focused on visual representation of emotional information, participants no longer express how they feel by thorough descriptions, in a format of texts or images, but through a social activity that endures more abstract communications. Moreover, the real-time collaborative drawings show the dynamic social interactions. Participants observe, read and explore the visual results along their participation.

2) Design for the catharsis process

The design team did not predefine the mapping between colors and moods. While the subjective nature of the color selection precludes the project's use as a communal emotional barometer, Doodled "Us" aims to be reflective rather than representative. It does not matter whether blue stands for sad or peaceful, what does matter is the process that members "speak" their mood out in a public space and see how their feelings merge with the others, and how their diverse subjectivities come into a magic result.

3) Reveal group patterns through socially collective artifacts

By turning collective doodles into an augmented visual presentation, this design helps members living in the same campus get a holistic view of the mood of the area. Different than some other ways to broadcast the status of members' mental wellbeing, such as through official annual report or content analysis of social network, there is no single authority interpreting the data any more. Participants are the content co-creators and they are also the ones who define the meanings of the final drawings. Doodled "Us" does not intend to conclude, but rather to provide a platform for members to explore, interpret, and reflect on the stories they compose together.

4) Build empathy through reading and exploring the social artifacts

The tacit resonation when people see the diverse and collaborative fireworks is to increase members' awareness of how many others are making their subjectivities visible, when the other actions take place, and how their moods merge and become into something fun and aesthetic (see Fig. 4). The idea of fireworks blooming in public displays is to enhance this experience, which cannot be measured by quantitative metrics, but can support a reflection on the social intimacy among themselves and a number of others. One of the participants said: "... this is fun, interactive and engaging, ... I will pay attention if people are trying to say something (through doodling) to the screen in Times Square. ... That would be exciting."

Fig. 2. One user is interacting with the prototype system.

Fig. 3. Participants and spectators around the public display.

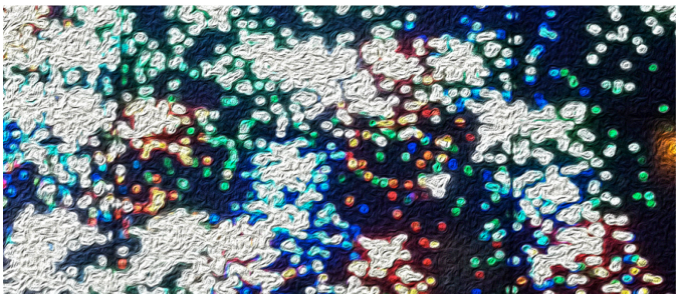

Fig. 4. The collective drawing at one moment.

5) Embody mechanism to make information anonymous in order to protect information privacy

In this design, the mechanism of interaction is pretty simple. It does not require any user information. The concept is about opening up a space for users to doodle whenever they want, without worrying about leaking personal identification. Making colors as the medium to communicate one's mood also helps people to "hide" their identities well. The designers intended to help people engage into the process as anonymous users, which may encourage more participation. Considering users could show specific messages through drawing out words or images, if there is anything improper for public display, getting overlapped by more doodles would be one way to resolve this concern in this prototype system.

IV. Discussion and Related Work

In addition to our personal intuitions inspired by civic art, our design principles also build upon ongoing research in a number of areas related to human-computer interaction and computer-supported cooperative work. In turn, our work could contribute to four research areas in this broad spectrum: interdisciplinary research on design in human-computer interaction, end-user development, information visualization in public spaces, and collaboration in distributed teams.

A. Interdisciplinary Research on Design in Human-Computer Interaction

Sorensen [11] discussed that the separation of art and science was problematic for institutional research and education while computer graphics bridged the gap between art and science. Computer technology indeed adapts inquires from both art and science. As a multi-disciplinary field, human-computer interaction has been applying theories and methods from a variety of fields such as art, science, design, and psychology, among others [5, 12]. It benefits the area of human-computer interaction by providing different angles for researchers to study, analyze, design, and evaluate the relationship between technology and humans.

There are diversified themes along such an interdisciplinary approach. Meta-design promotes using intentionally unfinished design work to engage users as co-designers, or using open-ended interactive artwork to engage participants as co-creators [13, 14]. Reflective design advocates that reflections on embedded values in computing should be the principle of technology design [15, 16]. Critical design, originated from industrial design and critical art practices, pushes users, designers, and researchers to critically reflect by provoking designs or practices supported by designed artifacts [17, 18]. Socially engaged art practices care both of how technology assists art practices with a broad group of participants, as well as how such social practices could stimulate new creativities and meanings [6, 19].

Research with those focuses above does not put emphasis on design or evaluation for efficiency, accuracy or usability issues, but rather on user engagement, values, reflections, emotions, aesthetics and experience [20, 21, 22]. For example, studies have shown that expressing one's internal states has positive psychological effects [1]. Some other research has also demonstrated how technology could effectively help build empathy [23], express emotions [24], increase awareness [25], persuade behavioral changes [26], and promote civic engagement [24]. Those studies are all focused on the enlarged research focus of social and affective impact that computing has on humans.

Meanwhile, it is necessary to develop more applications, mechanism, and methods to demonstrate how well those inquiries can help solve specific problems in areas of human-computer interaction and computer-supported cooperative work. Meanwhile the knowledge we gain through solving particular problems will help build the scaffolding and infrastructure. The concept of art-mediated self-expression and the corresponding design principles we presented above will contribute to the knowledge of how to facilitate self-expression and sharing of affective information within groups through an interdisciplinary approach.

B. End-User Development

The end-user development community promotes end users as content co-creators and system co-designers. The end users are no longer passive information receivers that merely comprehend designed artifacts, but rather the ones who actively engage in creating and critiquing the designs [13, 14, 27, 28, 29]. Research around end-user development aims at creating supportive socio-technical environment to encourage the culture of participation and to enable users as design co-authors [30, 31, 32].

While engaging participants as co-creators, "privacy and trust" is crucial. Involving end users, or participants indeed requires people to share their individual information, such as activity data, demographic information, emotions, and other personal data [33, 34, 35]. But not all the potential harm is transparent to participants. And even when participants understand how much personal information they are providing, the relationship between them and the spectators in the environment might also hinder their participation and decrease their trust towards the systems [22].

Our design principles intend to provide an alternative mechanism for involving end users as co-creators by encouraging them to engage in art-mediated practices in order to create, express and in this way to mentally connect to each other. Meanwhile, our principle of data visualization addresses people's concerns about information privacy: where does their personal information go, how are researchers, designers and other participants going to see it in public spaces, and will visualizing in public bring them any shame or embarrassment rather than relaxation and spiritual catharsis?

C. Information Visualization in Public Spaces

There are studies proposing using public data visualization to support social and civic purposes in public spaces. Researchers promote information visualization in public spaces as a way of improving perceptions and increasing awareness of specific issues. For example, researchers could show sustainable issues to call people's attention [26], reveal societal problems in education, poverty and health [38], encourage civic engagement [39], etc. Those studies help increase awareness of social problems, encourage discussions among a broad population, and facilitate behavioral changes [26, 39].

Researchers have applied a variety of visual technologies to collect individual data and then present data socially to make individual issues considered collectively. They explored different ways to present collected individual data in order to allow intuitive understandings of specific issues, as well as explorations of the meanings behind the dataset that people would not see in any other way. The intuitive visual technologies and stimulating visualizations as results also attract more participants for engagement and exploration.

Despite the progress researchers have made, questions that need deeper exploration include how to visualize data in public and how public data visualization could motivate participation and increase awareness. Together with the concern of information privacy we discussed above, we proposed a way to visualize affective information socially and to protect personal privacy by making personal identification anonymous through abstract and artistic visual metaphors.

D. Collaboration in Distributed Teams

We have also been motivated by previous research into building trust and improving collaboration in distributed teams in general [40, 41] and in global software engineering in particular [42, 43, 44, 45, 46]. Teams that build trust initially and swiftly are more likely to overcome inevitable crisis points as a project moves towards completion [47]. Making small talk or other types of informal conversations (e.g., [45, 48]) and having available personal information about collaborators [49] make for greater trust. We hypothesize that self-expression and sharing via artistic, collective visualizations can have a similar effect in engendering trust and strengthening the team.

Art-mediated self-expression's positive influences go beyond the development of trust. It also has the potential to improve collaboration in globally distributed teams in various ways. Identifying these ways would help researchers working on globally distributed teams, including us, to better leverage art-mediated self-expression in developing theoretical, empirical, and design work to support practitioners. In the next section, we propose three potential directions to apply art-mediated self-expression to improve team practices.

V. Roadmap for Future Research

We propose three ways that art-mediated self-expression can improve the collaborative practices in a globally distributed team. These three ways present concrete directions for the future.

A. Promoting Positive Personal Emotions to Reduce Social Conflicts

Researchers in positive psychology have a long history using art therapy to promote positive personal emotions, to create a favorable social environment, and to reduce interpersonal conflicts [3]. Recently, researchers started to use art to help with facets of organization/team practices, such as leadership [50], innovation [51], organizational learning [52], etc. Art benefits these practices by enabling self-expression [53]. Self-expression through art makes employees learn about themselves and their colleagues and be more passionate about their jobs, their company, and even their lives in general [54].

These positive emotions eventually would contribute to the reduction of conflicts that are caused by the lack of understanding and compassion among team members. It brings special benefits to globally distributed teams where conflicts are prevalent and have been a problem that is hard to solve [55]. Moreover, sharing art-mediated self-expressions creates shared identity, shared context, and spontaneous communication across multiple locations. All these interventions can help mitigate the conflicts caused by distributed teams [56].

B. Improving Interpersonal Relationships and Trust

According to social penetration theory [57], relationships develop further with the level of social penetration increases. When an individual expresses and shares about herself, she actually enhances the "depth" of her social penetration. The deep self-expression would help the other team members to develop a unique perception of intimacy by sharing feelings rather than information. Research has demonstrated that intimacy has a much larger effect than simply sharing information in organizations [58]. Therefore, we argue that art-mediated self-expression is potentially able to help relationship development and improvement among team members.

In our prior work [43], we show that developing predictable expectations is crucial to develop interpersonal trust. Sheldon [59] shows that people tend to assume an individual who proactively expresses herself is more predictable and, therefore, more trustworthy. Thus art-mediated self-expression would be able to help collaborators build trust towards each other. As we mentioned in section V.A, the reduction of social conflicts would also bring opportunities to enhance the interpersonal trust [58]. Moreover, art-mediated self-expression may be quite suitable for trust development in online collaborations for globally distributed teams where people feel more restricted on expressing themselves for the unprecedented diversity in the global team. Art, as often featured with indirectness and ambiguity, offers a resource for design that can be used to encourage self-expression within the team environment [60]. Hence, it provides an opportunity for team members of diverse background to develop close relationships and trust.

C. Encouraging Cross-Cultural Interaction

A prominent characteristic of globally distributed teams is the team members' diverse cultural backgrounds. Cross-cultural interaction presents particular challenges, and sometimes may even lead to unexpected cultural surprises [42]. Art-mediated self-expression provides a mechanism, rather than rules of social interactions, so it creates a non-destructive way for people from different cultures to express without consenting on norms. On the other hand, self-expression is culturally sensitive. Even for U.S. culture that usually encourages self-expression, people often hide their real feelings through verbal self-expression [1]. And in East Asian culture, people are conservative about self-expression. For individuals from these cultures, verbally disclosing oneself in a distributed team would be challenging. By providing mechanism to avoid identifications, art-mediated self-

expression provides a venue for people from these cultures to express themselves freely.

VI. Conclusion

In this paper, we are examining the problem space where current information technology has successfully helped people to express, share, communicate and connect through explicit methods, such as social media, instant messaging, online communities, etc. while less support exists yet to help people express and share their implicit feelings and emotions publicly within groups. We are trying to answer the question: how to help, encourage, and engage people to express their affective information, such as emotions, affections, and beliefs when implicit catharsis is desired, meanwhile how to help share people's expressions in order to build interpersonal connections without exposing their identification within groups.

We draw insights from the existing literature on interdisciplinary research on design in human-computer interaction, end-user development, information visualization in public spaces, and collaboration in distributed teams. We are also inspired by the inquiries, philosophy and practices surrounding civic art. Applying how civic art practices support people to express a rich range of human emotions, how civic art practices engage participants to explore and perceive embedded messages and values, and how civic art practices thus resonate among people and then build the interpersonal understandings, we came up with the concept of art-mediated self-expression to address our research question.

We proposed five design principles around art-mediated self-expression: (1) enable implicit self-expression through diverse interactions and gateways; (2) design for the catharsis process; (3) reveal group patterns through socially collective artifacts; (4) build empathy through reading and exploring the social artifacts; and (5) embody mechanism to make information anonymous in order to protect information privacy. We analyzed a pilot study of a prototype system – Doodled "Us" to showcase that the concept and five principles have positive influences for helping members self-express and share their moods in a university in order to help them build social awareness and maintain their mental wellbeing.

We discussed how art-mediated self-expression is a promising concept for research around collaboration in teams particularly globally distributed teams. We outlined three directions for applying art-mediated self-expression to facilitate collaboration in globally distributed teams: (1) promoting positive personal emotions to reduce conflicts; (2) improving interpersonal relationships and trust; and (3) encouraging cross-cultural interaction.

In this paper, we present and develop the concept of art-mediated self-expression along with five design principles. Additionally, the contributions of this paper include the implications for and connections to existing literature, along with a roadmap for future research in art-mediated self-expression for collaboration in globally distributed teams.

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