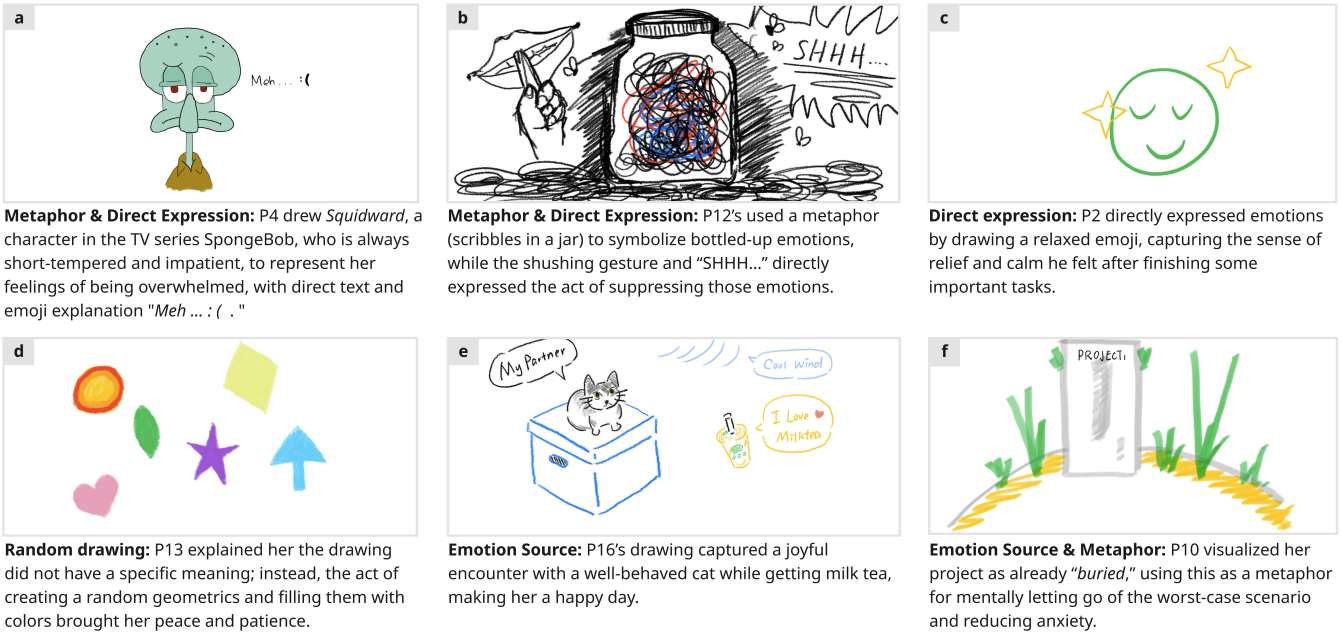
EmoFlow: From Tracking to Sense-Making of Emotions Through Expressive Drawing

Shannon Sie Santosa
Department of Computer Science
City University of Hong Kong
Hong Kong, China
sssantosa2-c@my.cityu.edu.hk

Wan Qian
Department of Computer Science
City University of Hong Kong
Hong Kong, China
qian.wan@my.cityu.edu.hk

Junnan Yu
School of Design
The Hong Kong Polytechnic University
Hong Kong, China
junnan.yu@polyu.edu.hk

Yuhan Luo*
Department of Computer Science
City University of Hong Kong
Hong Kong, China
yuhanluo@cityu.edu.hk



Metaphor & Direct Expression: P4 drew *Squidward*, a character in the TV series SpongeBob, who is always short-tempered and impatient, to represent her feelings of being overwhelmed, with direct text and emoji explanation "*Meh ... : (* . "

Metaphor & Direct Expression: P12's used a metaphor (scribbles in a jar) to symbolize bottled-up emotions, while the shushing gesture and "SHHH..." directly expressed the act of suppressing those emotions.

Direct expression: P2 directly expressed emotions by drawing a relaxed emoji, capturing the sense of relief and calm he felt after finishing some important tasks.

Random drawing: P13 explained her the drawing did not have a specific meaning; instead, the act of creating a random geometrics and filling them with colors brought her peace and patience.

Emotion Source: P16's drawing captured a joyful encounter with a well-behaved cat while getting milk tea, making her a happy day.

Emotion Source & Metaphor: P10 visualized her project as already "*buried*," using this as a metaphor for mentally letting go of the worst-case scenario and reducing anxiety.

Figure 1: Examples of participants' expressive drawings based on their emotions captured by *EmoFlow*, which exhibited different visual expression patterns.

Abstract

While previous research has attempted to link features of individuals' drawings to their emotional states, it often overlooks the deeply personal and context-driven nature of visual expression. To bridge the gap, we conducted a two-week diary study with 21 participants, who used a custom-built app to track daily emotions through free drawings, followed by interviews reflecting on their artwork. Among the 252 drawings gathered, we found no strong correlations between reported emotions and measurable drawing behaviors; instead, participants expressed emotions through diverse approaches, from illustrations of emotion sources (e.g., events, objects) and metaphors, to emojis, literal text and spontaneous, random mark-making. Participants developed consistent personal styles and described drawing as an intuitive, playful, and safe outlet, though some faced challenges with the ambiguity of visual expressions and interpreting their creations afterwards. With the lessons learned, we discuss opportunities for designing expression-centered emotion tracking technologies that embrace individuality and creativity.

*Corresponding author.

CHI '26, Barcelona, Spain

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CCS Concepts

• **Human-centered computing → Empirical studies in HCI**.

Keywords

Emotion tracking, creative drawing, sense-making, personal informatics, expressive visualization

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1 Introduction

Emotion recognition and tracking is a long-standing topic in science, with important implications for mental health assessment [11, 21] and interpersonal communication [8, 11]. Despite ongoing debates and the elusiveness around the definition of emotions [4, 15, 50], researchers have already developed a broad spectrum of technologies for emotion tracking, ranging from automatic sensing with physiological signals such as heart rate variability [12] and facial expressions [67] to subjective expressions through colors [1, 48], bullet journals [2, 60], and AI-assisted image generation [63]. Whereas the former are often valued in computing research for their perceived objectivity and accuracy, the latter underscore the importance of open-ended, expressive approaches that embrace nuanced subjectivity, personal meaning, and lived experience in emotion tracking.

The commonality across these subjective, expressive approaches is their reliance on visual representation: colors, lines, symbols, imagery, etc., which humans naturally utilize to externalize and communicate emotions [9]. Within this space, drawing stands out as a particularly promising modality. Compared to color filling or bullet journaling, which typically rely on predefined or semi-structured templates [1, 2, 48, 60], drawing is more open and free, offering individuals the flexibility to move beyond preset structures and creatively express themselves.

Understanding how people use drawing for emotion tracking is valuable not only for deepening knowledge of the relationship between visual expression (e.g., patterns, styles, and strategies) and mental experience [22, 49, 66], but also for expanding the design space of emotion-tracking technologies that support self-expression and emotional well-being [14, 16, 31, 32, 49]. While previous research has shed light on potential relationships between individuals' emotional states and their visual creations, these studies either focused on visualization of predefined emotional words and emotion categories [66], or therapist-facilitated interpretation [22, 32, 49, 66]. What remains underexplored is an understanding of visual expression patterns in drawing as an everyday emotion-tracking practice, such as what people choose to draw, how they construct their drawings stylistically, how these drawings are linked to their lived emotional states and contexts, etc. Equally important is whether these patterns can be generalized across individuals. Furthermore, for drawing to be effectively integrated as an input modality in future emotion-tracking tools, we need to examine the user experience of drawing-based emotion expression more closely, including the perceived value, usability, and the challenges it may pose for individuals with varying levels of artistic experience. Taken together, we set out to answer the following two research questions:

> ***RQ1:*** *When using drawing to track everyday emotions, what visual expression patterns do people employ and how do they stylistically construct their expressions?*
> ***RQ2:*** *What is the user experience of emotion tracking through drawing?*

To answer these two questions, we adopted a *Research through Design* (RtD) approach, which positions design itself as a method of inquiry for investigating complex user problems [69, 70]. Following this approach, we designed and built ***EmoFlow***, an iOS application built for iPad that enables digital drawing alongside lightweight data entry. Using EmoFlow as a design probe, we conducted a 14-day diary study involving 21 participants. During the study, each participant was asked to record their emotions (with both Likert scale of valence and arousal [50] and text descriptions) along with a free drawing on a daily basis. At the end of the diary tracking period, participants took part in a debriefing interview where we asked about the meaning of their drawings and their overall experience.

Guided by the two research questions, our analysis examined how participants' emotions were reflected in their drawing patterns and how they perceived drawing as a means of emotion expression and tracking. Our findings indicated that, aside from a moderate positive correlation between emotional valence and both the number of strokes and the time spent on drawing, no correlations were observed between participants' reported emotions and other measurable drawing behaviors (e.g., stylus pressure). Instead, participants employed a variety of strategies to express their emotions, such as visualizing emotion sources (e.g., environments or social events), using metaphors through symbols, natural scenes, or objects, directly expressing emotions with emojis or text, and creating random elements that blended concrete and abstract elements (as shown in the examples of Figure 1). Individual participants tended to maintain consistent personal styles, as reflected in their use of color, spatial layout, and strokes, which were not directly linked to the valence or arousal of their emotions. Occasionally, their shift of drawing style may signal unusual emotions. Reflecting on the experience, participants described drawing as a playful, safe, and personal practice for expressing emotions, though they noted that it sometimes posed challenges, particularly in making sense of their own visual creations afterwards.

Learning from these findings, we reflect on what we can tell from drawings to emotions and implications for designing expression-centered emotion tracking technologies, including how to promote creativity, facilitate mindful creation process, and enhancing emotion interpretation. Our paper makes the following contributions to the emotion-tracking and broader mental-wellbeing communities within HCI. First, we provided empirical evidence that challenges the notion of universal, objective mappings between visual features and emotions. In our study, drawings created by participants are shaped far more by individual style and meaning-making than by any consistent visual patterns; the same colors, symbols, or motifs carried different meanings for different people, and even for the same person over time. Second, we provided a nuanced account of how meaning is constructed and evolves: rather than relying

on stable associations, participants used drawing to explore, reinterpret, and reframe their feelings, which revealed that emotion tracking through drawing is a dynamic, personally situated process. Third, our discussions contributed to design implications for future emotion-tracking technologies that embrace self-expression, open interpretation, and creativity.

2 Related Work

In this section, we cover the ongoing discussions on what emotion is and how technologies are used to capture emotions. We then review works on visual expression of emotion, and emotion tracking research in HCI.

2.1 What is *Emotion*?

Over the past century, research on what emotion is has evolved through several theories and frameworks. While there is no single consensus, emotion is generally recognized as a dynamic process involving physiological, mental, and behavioral changes [40, 52, 53].

In psychology, one of the most widely known frameworks is the six basic emotions—anger, surprise, disgust, enjoyment, fear, and sadness, which were seen as universal, biologically hardwired, and distinct in terms of their appraisals, prototypical behavioral responses, and physiological fingerprint [15]. However, this categorical theory has been critiqued for oversimplifying the variability and contextual nuance of lived emotional experiences [44, 58]. As an alternative, researchers have developed dimensional frameworks that describe emotions along continuous axes [50, 54].

Schlosberg's early work mapped facial expressions onto a circular representation by pleasant-unpleasant and attention-rejection [54], which was later refined by Russell's Circumplex Model that positioned emotion around two dimension: valence (pleasant vs. unpleasant) and arousal (high vs. low activation) [50]. Mehrabian et al. further incorporated dominance as a third dimension, representing one's sense of control versus submission, establishing the PAD (Pleasure-Arousal-Dominance) model [42]. These dimensional models have been influential in affective computing, where they are used as a foundational structure for representing subtle variations in emotional states [26, 35, 36, 68].

More recently, constructionist perspectives—most notably Barrett's theory of "*constructed emotion*" [4, 5], have challenged biologically discrete models by emphasizing that emotions are not universal categories, but are socially and culturally constructed experiences. Rather than being hardwired, emotions are "learned" from one's living environment and social practice, emerging from the interplay of one's conceptual knowledge and situational context [4, 5]. This view aligns with the evidence that expressive activities such as drawing and painting, often lead people to interpret the same emotion concept in different ways [40, 46, 49], highlighting the promise of visual expression for reflecting individuals' emotional states without constraints [46].

In this work, we do not take a singular theoretical stance on what emotion is; rather, we integrated both dimensional and constructionist perspectives in our study to explore how emotions can be expressed and recorded through drawing. We used Russell's Circumplex Model to operationalize measurable dimensions of emotion (valence and arousal), and, guided by Barrett's constructed emotion theory, invited participants to freely create and annotate their drawings. This approach allowed us to examine both shared patterns—such as common color associations—and the diverse, personally meaningful ways emotions are visually expressed.

We noted that the terms "emotion" and "mood" are often used interchangeably, despite their conceptual distinction—emotion refers to a short-lived, intense, and object-focused state that arises in specific situations (e.g., fear of the dark, happiness about good news) while mood is a more diffuse, enduring affective state that is not tied to any particular object, and is often experienced as a general feeling [51]. This distinction is important for emotion-tracking research, as many studies (including ours) aim to specifically capture individuals' present feelings (i.e., the discrete emotional states experienced at the moment of drawing) rather than their general, enduring affective states. We recognize that the line between emotion and mood can be fluid in self-report, and therefore, interpret our findings with this nuance in mind.

2.2 Visual Expression of Emotion

Expressive activities that involve creative writing, drawing, and dancing, have been shown to facilitate emotional processing and regulation, allowing individuals to "*vent*" and organize their feelings that are otherwise difficult to verbalize [13, 32]. The development of art therapy was building on this idea, emphasizing that artistic expression, through imagery, movement, or performance, provides flexible and reflective pathways for individuals to access, externalize, and reorganize their emotions that often reside in the subconscious [16, 49]. In the meantime, artistic expression can also serve as a constructive force to help people cultivate resilience and achieve therapeutic benefits [32].

Among different expression modalities [59], visual creation such as drawing and painting is particularly helpful for conveying ineffable aspects of emotions [9]. Philosophers such as Susanne Langer argued that visual art serves as a symbolic expression of emotions, transforming personal feeling to shared, perceived, and reinterpreted socially [9]. Over the past decades, there has been a substantial body of research on analyzing the relationships between individuals' emotions and their visual expressions [22, 64, 66]. For example, Ho et al. examined drawings created by breast cancer patients, with the theme of "my cancer" as a prompt [22]. Their analysis revealed distinct patterns before and after a therapeutic intervention in patients' use of color, space, multiplicity, and symbolic representations (e.g., cancer, nature, and landscapes), which indicated shifting emotional states and mental well-being of these patients.

From a more technical perspective, Weng et al. sought to predict individuals' emotions from their visual expressions [66]. By analyzing digital drawings from 182 university students who were asked to visualize anger, happiness, sadness, and fear, they reported an average prediction accuracy of 71.3% with features derived from spatial composition and drawing styles. More broadly, Wang et al. provided a comprehensive review of advances in automated analysis of emotion in visual media, tracing the field from early studies of color and shape to current deep learning approaches that

leverage large-scale datasets to model both evoked and expressed emotions in photographs, paintings, and videos [64].

While much of this literature emphasized automated emotion analysis, there is a growing movement within cognitive science and HCI to understand *how* and *why* such expressions are made. Our approach builds on this direction by inviting participant to record their emotions through open-ended digital drawing, investigating the meaning-making process behind individuals' visual expression.

2.3 Emotion Tracking in HCI

Emotion tracking has becoming increasingly prevalent as people recognize that it is an important first step in managing mental well-being [23, 57], which has driven the HCI and healthcare researchers to design and build various tracking tools. Typically, this approach falls into two categories: automated sensing and subjective self-report. On the one hand, automated emotion tracking leverages physiological signals and behavioral data, such as heart rate variability (HRV) monitoring on wearable devices [12], Electroencephalography (EEG) sensing techniques [24, 55], skin conductance [11] and respiration [21] monitoring, and facial expression capture systems [67]. As reviewed in Section 2.2, technical advances in affective computing have also enabled automated analysis of emotional content in visual media, ranging from early feature-based approaches to deep learning methods for image and video emotion recognition [64, 66]. However, the accuracy of these approaches turned out to be inconsistent—several meta-reviews have compared the physiological fingerprints of different emotions across studies, and found little evidence that discrete emotion categories can be consistently and specifically localized to distinct bodily reactions [30, 56].

On the other hand, many researchers emphasize the subjective nature of emotion and the importance of raising individuals' emotional awareness, and therefore often relied on self-report approaches. Traditionally, instruments such as the Positive and Negative Affect Schedule (PANAS) [62, 65] have been widely used. While demonstrating consistency, these scales remain limited in accounting for the nuances of individualized and context-dependent emotional experiences [2, 25]. To create a more expressive space for individuals to capture their emotions, HCI researchers have designed and built a variety of creative tools that extend emotion-tracking beyond numerical or textual records [1, 29, 48, 60]. For instance, Rivera-Pelayo et al. supported users to capture their mood in a color-wheel characterized by feelings and energy level at workplace [48]; Ayobi et al. built Trackly, which enables patients with multiple sclerosis to define personally meaningful tracking parameters in their own words and then capture their feelings through filling these parameters with colors [1]. Focusing on promoting emotional awareness and reflection, other works explored emotion representation beyond digital screen, such as room light display [29], bullet journals [2, 60], and physical object construction [61].

Extending this approach toward expressive and reflective emotion tracking, our work focuses on visual drawing as the primary medium for capturing emotions in everyday life. Unlike prior tools using predefined templates [1, 2, 48], we invited participants to create free digital drawings and record the rationales behind their creations. Our analysis then examines these accounts to uncover individuals' expression patterns and meaning-making processes.

3 Method

Our study began with collecting data from participants who created drawings to express their emotions in a diary study, followed by debriefing interviews to explore their study experiences. All procedures were approved by the institutional ethics review committee prior to data collection.

3.1 Participants

Participant recruitment was conducted via advertisements distributed through the university mailing list and social media platforms. Interested individuals completed a Google Form, including questions regarding their experience with emotion tracking. Eligibility criteria required participants to (1) be at least 18 years of age, (2) own an iPad with an Apple Pencil, and (3) express an interest in emotion tracking. Of the 45 individuals who completed the screening form, 26 provided consent to participate, and 21 completed all study activities, including the drawing task and interview.

As shown in Table 1, our participants were all university students (15 female, 6 male) located in Asian regions, aged from 18 to 31 (M = 24). Participants came from different majors such as HCI, computer science, data science, biological science, fine arts, psychology, and finance. Fourteen participants had prior experience tracking their emotions through digital tools (e.g., mobile apps), journaling, or social media. Four participants had used artistic forms for emotional expression—two through drawing/painting and two through music creation. Regarding their drawing experience, two were professionally trained, four were hobbyist/casual artists, nine had no training background but enjoyed creating visual art, and the remaining six had no drawing experience at all. At the end of the study, each participant received compensation equivalent to USD 38 in their local currency.

3.2 Data Collection

3.2.1 EmoFlow: A Design Probe. In the *Research through Design* (RtD) approach, researchers often invite target users to interact with either existing artifacts or newly created ones, with the goal of moving design solutions from the "current state" toward a "preferred state." Artifacts in this process act as probes, eliciting insights and opportunities that can inform the evolution of design solutions [70]. Following this approach, we developed EmoFlow, an iOS application that enables digital drawing alongside lightweight data entry. Upon opening the app (see Figure 2), participants were first asked about their emotions in three questions: valence, arousal, and a brief text description. The valence and arousal metrics were drawn from Russell's Circumplex Model [50], which helped locate participants' emotions in standardized affective space and allowed us to later examine how individuals' drawing patterns may correlate with their emotional characteristics. The open-ended text served as a prompt for participants to recall and contextualize their emotions before drawing. Afterwards, participants were directed to a digital canvas, where they could select from different styluses and colors to create drawings that represented their current emotional states. After completing a drawing, participants were asked to explain how it reflected their emotions, and the drawing was then saved to their album. To capture additional context about the drawing process,

EmoFlow automatically logged metadata including drawing duration, stroke count, and Apple Pencil pressure to a secured database hosted on Firebase.

3.2.2 Diary Study. With EmoFlow, we conducted a two-week diary study. Participants were asked to submit at least one entry (consisting of one drawing, three pre-drawing questions, and one post-drawing question) per day and allowed to skip up to four days during the 14-day period to accommodate busy schedules. To support onboarding, we provided each participant with a PDF tutorial that guided them through installing the app via TestFlight and outlined the research goals, study procedure and timeline, participation requirements, and compensation details. In the tutorial, we emphasized that the study was not about evaluating the quality of participants' drawings, and there were no "good" or "bad" drawings. We also encouraged them to freely explore diverse ways of visual expression and to provide as much contextual information as they could to help us understand how their drawings reflected their emotions.

3.2.3 Debriefing Interview. Upon completing the 14-day diary study, each participant joined a debriefing interview which we presented their own set of drawings in chronological order. For each drawing, we asked participants to explain what they depicted, the emotions they felt at the time, and their rational for visual choices. Typical prompts included: "*Can you describe what did you draw?*", "*Why did you choose to draw it this way regarding the choice or color or use of space?*", "*What emotion were you feeling here?*", followed by clarifying questions.

After revisiting their drawings, we invited participants to share their experience in tracking emotions through digital drawings in the diary study, including their perceived values and challenges. The interview was conducted in the language that participants felt comfortable with (either English or Chinese) and took place on Zoom with an average of 60 minutes, which were later transcribed into text for analysis.

3.3 Data & Analysis

The diary study generated a multi-modal dataset, including participants' drawings, their corresponding emotion reports (valence and arousal ratings on a seven-point Likert scale, and text descriptions provided pre and post each drawing), and recorded debriefing interviews accompanied by screen captures of diary entries. Below, we describe how we analyzed these materials to examine: (1) participants' ***expression patterns***—*what* they drew to express different emotions, (2) their ***individual drawing styles***—*how* they stylistically constructed the visual expressions, (3) potential correlations between reported emotions and features of the drawings, and (4) insights from the transcribed interviews. The first three parts intended to address RQ1 (expression patterns and styles) and the last part intended to address RQ2 (emotion tracking experience).

3.3.1 Expression Pattern Coding. To better understand what participants drew to express their emotions and the meanings behind them in relation to emotions, we first need to establish a consistent codebook that characterizes the elements in the drawings. The procedure of building the codebook consisted of the following steps:

Table 1: Participants' demographic information, major of study, prior experience in emotion tracking, and drawing experience.

ID	Age/ Gender	Major	Emotion-tracking experience	Drawing experience
P1	24/F	HCI	Digital tools	No training background but enjoy creating visual art
P2	21/M	CS	Journaling, digital tools , social media	None
P3	22/F	HCI	Digital tools	Hobbyist/Casual artist in drawing/painting
P4	18/F	Data Science	None	No training background but enjoy creating visual art
P5	19/M	Data Science	None	No training background but enjoy creating visual art
P6	31/M	HCI	None	No training background but enjoy creating visual art
P7	19/F	Biology	None	None
P8	29/F	Theology	Social media	Hobbyist/Casual artist in drawing/painting
P9	21/F	EECS	Journaling, music or sound-based creation, social media	No training background but enjoy creating visual art
P10	23/F	Product Design	Journaling, digital tools	Professional training in drawing/painting
P11	20/F	Design	Journaling, digital tools	No training background but enjoy creating visual art
P12	20/F	Design	Visual art, social media	Professional training in drawing/painting
P13	26/F	Chemistry	None	None
P14	27/F	Material	Journaling	None
P15	24/F	Fine Arts	Social media	Hobbyist/Casual artist in drawing/painting
P16	25/F	Mechanical Engineering	Journaling, social media	No training background but enjoy creating visual art
P17	30/M	Civil Engineering	None	None
P18	25/M	Material Science & Engineering	None	No training background but enjoy creating visual art
P19	25/F	Material Science & Engineering	Journaling, visual art	Hobbyist/Casual artist in drawing/painting
P20	25/F	Finance	Journaling, music or sound-based creation, social media	No training background but enjoy creating visual art
P21	24/M	Psychology	Journaling, digital tools	None

- **Step 1. Initial Coding**: The initial coding began with two researchers independently reviewing 106 (42%) drawings from the nine participants who completed the study earlier. In this step, we did not use any pre-defined structure; instead, we adopted a bottom-up approach to document the elements we observed in each drawing (e.g., "*sun and tree over the wall with coffee and music inside*") and interpreted how these elements are linked to the emotion that participants expressed (e.g., "*indirect representations of relaxing atmosphere* "). During this process, we actively referred to participants' pre- and post-drawing descriptions as well as relevant quotes from their interviews. The two researchers then met to compare and discuss their codes, establishing an initial shared understanding of the drawings.
- **Step 2. Iterative Codebook Development**: After initial coding, the other two researchers joined the discussion on developing the codebook to review the initial codes, provided feedback on unclear areas, and met regularly to iteratively develop the codebook. In the early phase, we explored multiple different perspectives to characterize the drawings, such as the concrete level of representation (abstract vs. concrete) and the relationship between visual elements and the emotions (direct vs. indirect). However, as more drawings were analyzed, it became clear that participants' expressive practices were nuanced and highly individualized, making simple classifications insufficient and sometimes difficult to interpret. After rounds of discussions, we agreed to focus on the *techniques* that participants used to express their emotions (e.g., "*using ocean wave to express calmness*," "*drawing a pack of schoolwork to show stress*," "*random overlapping lines to express chaoticness*"), which later emerged as expression patterns such as *using weather conditions to symbolize emotional states*, *using symbols or visual conventions that are commonly understood within a culture to convey meanings*, and *spontaneous, repetitive or simple marks made absentmindedly*.
- **Step 3. Codebook Refinement**: The codebook was iteratively developed and enriched as new data was gathered and analyzed until data saturation was achieved, that is, when new drawings no longer revealed new expression patterns. To further refine and categorize these patterns, we drew on relevant literature to refine the framing of the developed codes, including established frameworks for visual representation in art therapy [22] and the characteristics of metaphors [6]. As a result, we developed four main themes from the expression patterns: *metaphorical expression*, *random drawing*, *direct expression*, and *emotion sources*. In addition, we noted that sometimes, participants chose to depict their coping strategies for managing their emotions rather than the emotion itself (e.g., illustrating an activity that could make them feel happier, such as going to the beach), which were noted in our codebook. During the process, we did not calculate inter-coder reliability, as our qualitative approach emphasized iterative discussion and consensus-building among researchers, which aligns with McDonald et al.'s [41] argument that reliability in qualitative coding is better achieved through collaborative meaning-making than through statistical measures alone.
- **Step 4. Codebook-guided Analysis**: Following the developed codebook, the first author completed analyzing the remaining data. In this stage, the research team continued to meet weekly to discuss the coding progress to maintain a shared understanding and actively reviewed the interview transcripts to ensure accurate interpretation of the drawings.

3.3.2 Drawing Styles Coding. Upon gathering the drawings, it became apparent that each participant exhibited a strong, consistent personal style, which they tended to maintain regardless of the specific emotions expressed. To systematically examine these styles, we conducted several rounds of drawing analysis following the steps below:

- **Step 1. Identifying Stylistic Features**: We began by cataloging key aspects that stood out in each participant's drawing styles. For color, we initially coded every color presented in the drawing and then refined them to overall color patterns (either predominantly black-and-white or multicolored) to highlight the distinctions' among drawings. Through a similar lens, we coded space utilization was described as centered, fully filled, or mixed. For the distribution of visual elements, we noted descriptive summaries such as "*dense sketchbook collages*" or "*monochromatic comic doodles*." To complement qualitative descriptions, we used the average total number of strokes per participant, providing an objective reference of the complexity in their drawings. This step was primarily carried out by the first author with regular discussions involving the corresponding author.
- **Step 2. Collaborative and Iterative Grouping**: After generating stylistic descriptions for each participant, we observed overlaps and similarities in their styling approaches. The first and second authors then collaboratively grouped these styles through regular meetings. Given the inherently subjective nature of style classification, we encountered several discrepancies that primarily due to differences in interpreting stylistic boundaries and, occasionally, the influence of inferred meaning from the drawings themselves. To address these challenges, we agreed to focus exclusively on the formal aspects of style, intentionally bracketing any assumptions about the drawing's underlying meaning or emotional content. We also acknowledged that while each participant generally maintained a consistent style, some occasionally shifted their approach.
- **Step 3. Wrapping-up**: The entire team reviewed and finalized the grouping of drawing styles, resolving ambiguous cases and refining the styling descriptions. Then the first author completed the coding by applying the finalized scheme across the dataset, ensuring consistency with the agreed-upon criteria.

3.3.3 Statistical Analysis. To understand the potential relationship between participants' self-reported emotional states and their drawings, we conducted a series of statistical analysis. First, we computed pairwise Pearson correlation coefficients between the self-reported emotion ratings (valence, arousal) and drawing behaviors (average stylus pressure, stroke count, and drawing duration) to assess potential linear relationships. Note that due to technical issues, two participants' (P6 and P14) pressure data were missing

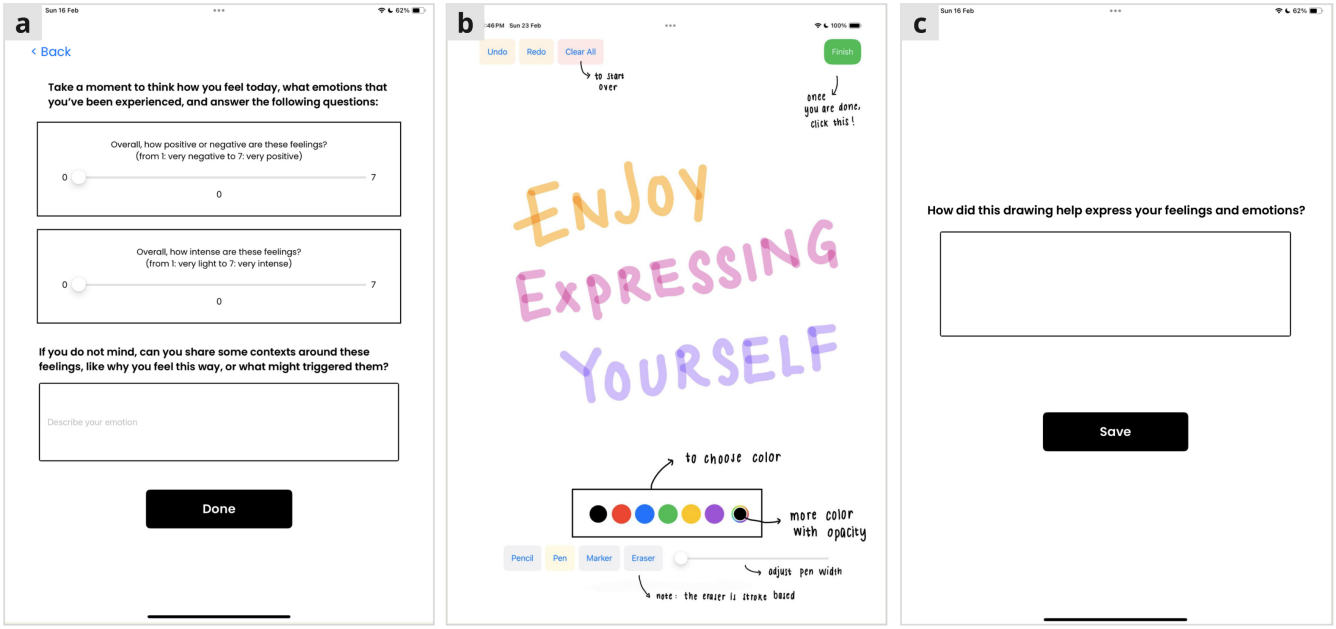

Figure 2: Interaction with EmoFlow: (a) pre-drawing description; (b) digital drawing canvas; (c) post-drawing reflection.

and thus they were excluded for analyzing the correlations between emotions and stylus pressure. Since each participant exhibited different ranges of drawing pressure, we normalized the average stylus pressure values using min-max scaling within each participant.

For expression patterns coded as categorical data, we grouped valence and arousal into three levels each (negative/neutral/positive and low/medium/high, respectively), and then used the Chi-square tests to examine associations between expression patterns and emotion combinations, with post-hoc analyses.

3.3.4 Interview Data Analysis. To analyze the interviews, we sought both depth and nuance in understanding participants' experiences with emotion tracking via digital drawing. Drawing on Braun and Clarke's reflexive thematic analysis framework [7], we followed a multi-stage, inductive process that allowed us to capture both anticipated and unexpected insights.

On the one hand, our analysis of the interview data is closely integrated with the analysis of participant's diary drawings. During the coding process, we referred to participant's interview explanations for each drawing, such as what they depicted, the emotions they felt, and their rationale for visual choices, to clarify ambiguous elements and ensure accurate interpretation. These interview thus served as supplementary resource to contextualize and deepen our understanding of the visual data.

Beyond these contextual explanations, participants also offered broader reflections on their experience with drawing-based emotion tracking, including perceived benefits and challenges. We extracted these evaluative and thematic comments (both positive and negative) from the interview transcripts and recorded them verbatim as sticky notes on a digital Miro board. Each sticky note captured a distinct participant perspective (e.g.,"*Drawing is easier to show feeling*", "*Drawing can be very free; doesn't need much thinking like text*", and "*Drawing need more tools and can give negative impact if it doesn't turn out well*"). We collaboratively grouped these into higher-level thematic clusters such as "*Safe and personal sharing space*" and "*Reflection dilemmas*." This clustering process allowed us to efficiently synthesize key insights about perceived value, strength, and challenges while keeping the interview data closely related to participants' direct experiences.

4 Findings

We collected a total of 252 drawings from 21 participants, with each participant contributing an average of 12 drawings (SD = 1.6). The time spent in each drawing varied considerably, with an average of 4.3 minutes (Min = 1 second, Max = 39.45 minutes, Mdn = 2.5 minutes, SD = 5.27 minutes), while the complexity—measured by number of strokes ranged from 1 to 918 with an average of 130.13 (Mdn = 77, SD = 149.75). In rare instances, two drawings from P9 and P17 were recorded just one second, consisting of a single stroke or quick line scribble.

The Pearson correlation analyses showed that emotional valence had moderate correlations with both the number of strokes (r = 0.32) and the time spent by participants on drawing (r = 0.35), indicating that participants tended to spend more time and put more effort into drawing when they felt positive. By contrast, correlations between valence and average stylus pressure (r = -0.02) and standard deviation of stylus pressure (r = 0.03) were negligible. Similarly, correlation coefficients between arousal and drawing features were all small: average stylus pressure (r = 0.02), number of strokes (r = 0.12), and time spent on drawing (r = 0.12). In addition, the chi-square test of independence (see analysis details in Section 3.3.3) revealed no significant associations between participants' drawing behaviors and their emotional valence or arousal.

Expression Pattern (# of instance)	**Enactment in our data** (# of instance)	**Example**	
Emotion Source (136) Illustration of the causes or triggers of the emotion	**Events** (69) Occurrences or incidents where the participant is typically the actor.	a	P2 drew his experience of being drenched in the rain as the source of his sadness and unhappiness.
	Objects (30) Specific non-human items contributing to the emotion.	b	P4 drew her dress and a pizza, two objects that brought her happiness that day.
	Environments (19) Settings or places associated with the emotion, where the participant is typically an observer.	c	P1 drew a bicycle after seeing people riding in the cozy spring wind on her way home, noting that it made her feel happy.
	Thoughts (28) Internal cognitions, reflections, or mental states experienced by the participant.	d	P9 illustrated her thoughts about not having a place to sleep and having to sleep outside, identifying this as the source of her worry.
	Physical factors (3) Physical or bodily conditions influencing the participant's emotions.	e	P16 pictured her headache and dizziness as the source of unhappiness.
Metaphorical Representation (88) Expressing emotion through symbolic or figurative imagery	**Natural Phenomenon** (39) Use of weather, landscapes, or other elements from nature to convey emotion.	f	P3 depicted her sadness and gloominess with a drawing of a cloud with raindrops and a sun.
	Symbol in communication Norm (30) Employment of cultural symbols or conventional signs as emotional metaphors.	g	P3 drew a scribble ball inside a heart to represent her annoyed and scared heart.
	Object/Character (22) Assigning metaphorical qualities to everyday objects or fictional characters.	h	P4 drew a purple minion, a character often linked to anger and stress.
	Personal Experience (11) Depicting specific past experiences as metaphors for current emotional states.	i	P5 depicted a figure crossing a bridge to symbolize feelings of relief and accomplishment.
Direct Expression (47) Explicit depictions of emotions themselves, without addition contexts or interpretations	**Emoji/Facial Expression** (32) Drawing emojis or faces on small graphics to display an observable emotion.	j	P21 used amused emoji to picture his excitement, noting that "*I get so excited that my eyes turn into stars*."
	Literal Text (19) Emotions expressed directly or indirectly through written words, letterforms, or typographic elements.	k	P2 explicitly described the feeling "*chills*."
Random Drawing (21) Drawings created spontaneously or playfully without intentional emotional expression	**Concrete Drawing** (12) Sketches made without conscious planning, often allowing the hand to move freely and sometimes resulting in recognizable forms.	l	P13 claimed that drawing spontaneously led her to draw many repetitive flowers, which was not explicitly linked to her emotion.
	Abstract Mark-Making (9) Spontaneous, and sometimes repetitive simple marks made absentmindedly—lines, shapes, or patterns with no attempt to represent anything.	m	P12 created an abstract drawing using repetitive curved lines while feeling "*boring*," and described it as "*just following the flow*."

Figure 3: Visual expression patterns identified in participants' drawings with description and examples. Note that one single drawing may contain multiple expression patterns.

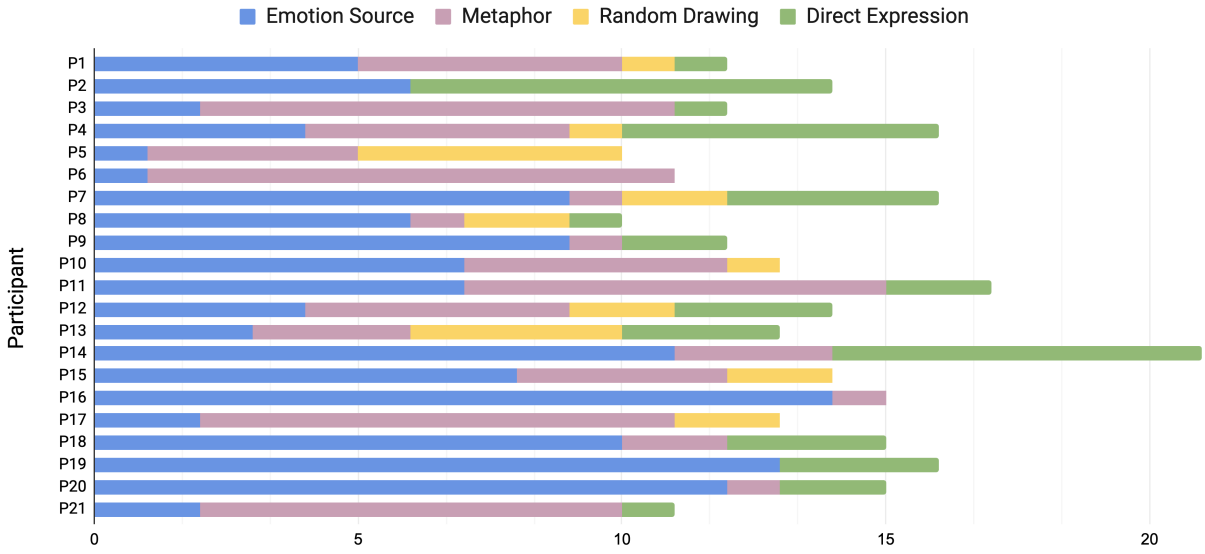

Figure 4: The distribution of instances regarding the visual expressions employed by each participant.

In the following, we focused on describing the diverse expression patterns exhibited in participants' drawings in relation to their emotions and similarities and distinctions in their personal styles (RQ1), and their overall experience of practicing emotion tracking through free drawing (RQ2).

4.1 RQ1: Expression Patterns & Individual Drawing Styles

Here, we first report our analysis results on what participants drew to express different emotions and then dive into their individualized approaches to stylistically constructing the visual expressions.

4.1.1 ***Visual Expression Patterns.*** Combining participants' drawings and their pre- and post-drawing descriptions, we identified four primary categories of visual expression patterns: ***emotion source***, ***metaphorical representations***, ***direct expression***, and ***random drawing***, as summarized in Figure 3.

Unlike prior work that primarily focused on depicting tangible (e.g., facial expressions, body language) and abstract visual elements [64, 66], our analysis offers a more contextualized understanding of the underlying strategies and emotional intent that drive the construction of the drawings. Note that these categories are not mutually exclusive, as a single drawing could incorporate multiple patterns. Figure 4 shows the distribution of these expression approaches across participants, from which we can see that all participants employed more than two approaches of expressions; nine participants used three approaches, and six participants incorporated all four approaches.

Emotion Source was the most prevalent pattern, centering on the origin or trigger of the emotion. Drawings in this category depicted the specific events, environments, objects, thoughts, or biological factors that participants associated with their emotional experiences. For example, P16 illustrated encountering a well-behaved cat that brought happiness (Figure 1 (e)), P2 showed themselves being drenched in rain to express discomfort or sadness (Figure 3 (a)), and P4 highlighted a favorite dress as a source of joy or confidence (Figure 3 (b)). In another case, P1's illustration was inspired by her surroundings, which she identified as contributors to her positive emotional states (Figure 3 (c)). In the pre-drawing description, she wrote "*I drew the scene from my way off work. It's blooming spring, everyone is happy and me too. People ride their bikes with the cozy spring wind and head to their lovely homes for a relaxing weekend.*" In addition to events, environments, and objects that participants experienced or interacted in their life, they also depicted internal emotion sources, such as physical states or negative thoughts. As shown in Figure 3 (d), P9 drew an image reflecting worries about not having a place to sleep, identifying this as the source of their stress. Taken together, these examples highlights the diversity of emotional sources that participants use to externalize and make sense of their emotional experience.

Metaphorical Representation involved the use of symbols and analogies that are indirect represent the emotional states. Rather than illustrating the source of an emotion, participants selected imagery that symbolized or stood for their feelings. Among the metaphors, natural phenomenon such as weather or landscapes were the most common across participants. For example, as shown in Figure 5, some participants drew a willow in spring to express calm, a cloud with raindrops to represent sadness, a sun to signify happiness, and a rainbow to convey hope.

We also observed metaphors grounded in communication norms, such as chaotic scribbles to indicate stress (Figure 3 (g)), flying balloons to express delight, and a question mark to show confusion. Notably, some metaphors are popular cartoon characters, conveying emotions with their culturally recognized attributes. For example, as shown in Figure 3 (h), P4 drew a purple minion, an iconic character strongly associated with anger and stress to signify her own experience of similar feelings. She explains: "Feeling crazy, like

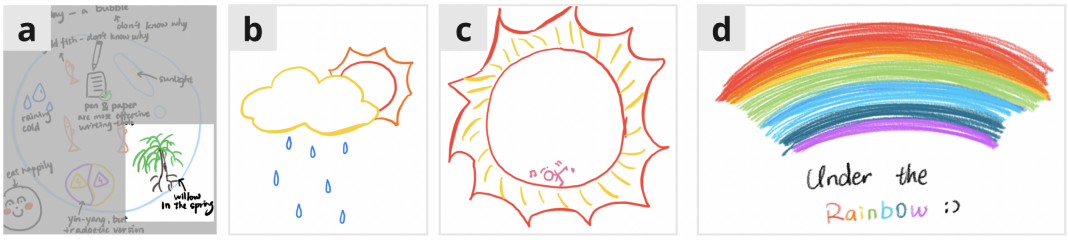

Figure 5: More examples of metaphorical representations: (a) a willow tree to express calm by P1, (b) a cloud with rain to represent sadness by P3, (c) a sun to signify happiness by P3, and (d) a rainbow to convey hope by P10.

Figure 6: More examples of random drawings: (a) P7 drew random red lines to express her anger, (b) P8 used abstract and repeated motifs in light and bright colors to express a feeling of relax, (c) P15 expressed tired feelings through random red and black strokes with an eye behind, and (d) P17 calmed himself down with random, colorful curves.

a monster." Other metaphors reflected more cognitive or socially oriented personal experience. In one case, P9 constructs a bar graph where each bar represents "people's life success," with her own bar—labeled "ME" —significantly shorter and shaded differently. This visual metaphor conveyed her feelings of inadequacy and falling behind. In her own words, P9 states, "*It just shows how I am very behind under everyone. I think it should be understandable? And I guess, usually it is hard for people to understand how I am feeling, and I think this drawing is straightforward.*" For P9, this metaphorical drawing was not only expressive but also communicative, making a difficult-to-articulate emotion more visible and understandable, both to herself and to others.

Direct Expression included drawings that conveyed emotions through explicit, straightforward visual cues, often featuring expressive facial features (e.g., smiles, frowns, or tears) or widely recognized facial emojis. For example, in Figure 3 (j), P21 drew a simple smiling face with stars in its eyes to express a feeling of excitement accompanied with his post-drawing description: "*when I see beautiful scenery, I get so excited that my eyes turn into stars.*" In several cases, participants supplemented their images with literal text, directly labeling their feelings (e.g., writing "*chills*," "*bored*," or "*tired*" within or near the drawing). P2 was a representative case, as several of her drawings contained bold, colorful text explicitly naming her emotions (Figure 3 (k)). Similar approaches were also adopted by other participants. For instance, P9 drew a stretching stick figure alongside a text note "*what I need to do*." In the pre-drawing description, she further explained "*long story short, I need to learn self love. Or, I am forever doomed.*" This example illustrates how text and imagery worked together to communicate nuanced, deeply personal feelings that might have been difficult to express through visuals or words alone.

Random Drawing encompassed visualizations that lacked clear emotional intent or consisted of abstract, nonrepresentational marks. In many cases, participants described their process as spontaneous or automatic, saying that they were simply following the flow of their hands or drawing whatever came to mind without deliberate emotional meaning. For example, P1 drew a vase and flower, and when asked about the emotions it conveyed, she responded: "*I am actually not sure how it helps me express my feelings. I don't have any strong feelings right now, so I just randomly drew something.*" Similarly, P13 drew multiple repetitive flowers, which did not seem to directly link to her emotional experience noted in the pre-drawing description "*I had quarrel with my friend, which made me sad*" (Figure 3 (l)). In other cases, the drawings were composed of abstract shapes or lines. As shown in Figure 3 (m), P12 filled the page with repetitive blue curves while reporting feeling "*boring*." It is noteworthy that the lack of clear emotional intent did not necessarily render these drawings meaningless. Instead, it highlighted diverse ways individuals engaged in this creative expression process. For some, random or abstract drawing may provide a psychological "breather," a way to occupy the mind or hands without the pressure of self-disclosure or introspection. As P17 remarked after drawing a combination of colored lines, "*colorful lines help me calm down*" Figure 6(d). Such drawings may also reflect moments of emotional ambiguity or numbness, when participants were unable or unwilling to articulate their feelings, consciously or otherwise.

While further investigating whether and how these patterns might relate to specific emotional states, our chi-square test revealed no significant correlations between reported emotions and the use of these expressive approaches ($\chi^2(24) = 17.65$, $p = 0.82$, *Cramér's V = 0.14*). This lack of statistical significance raises important questions about how such expressive behaviors should be interpreted and

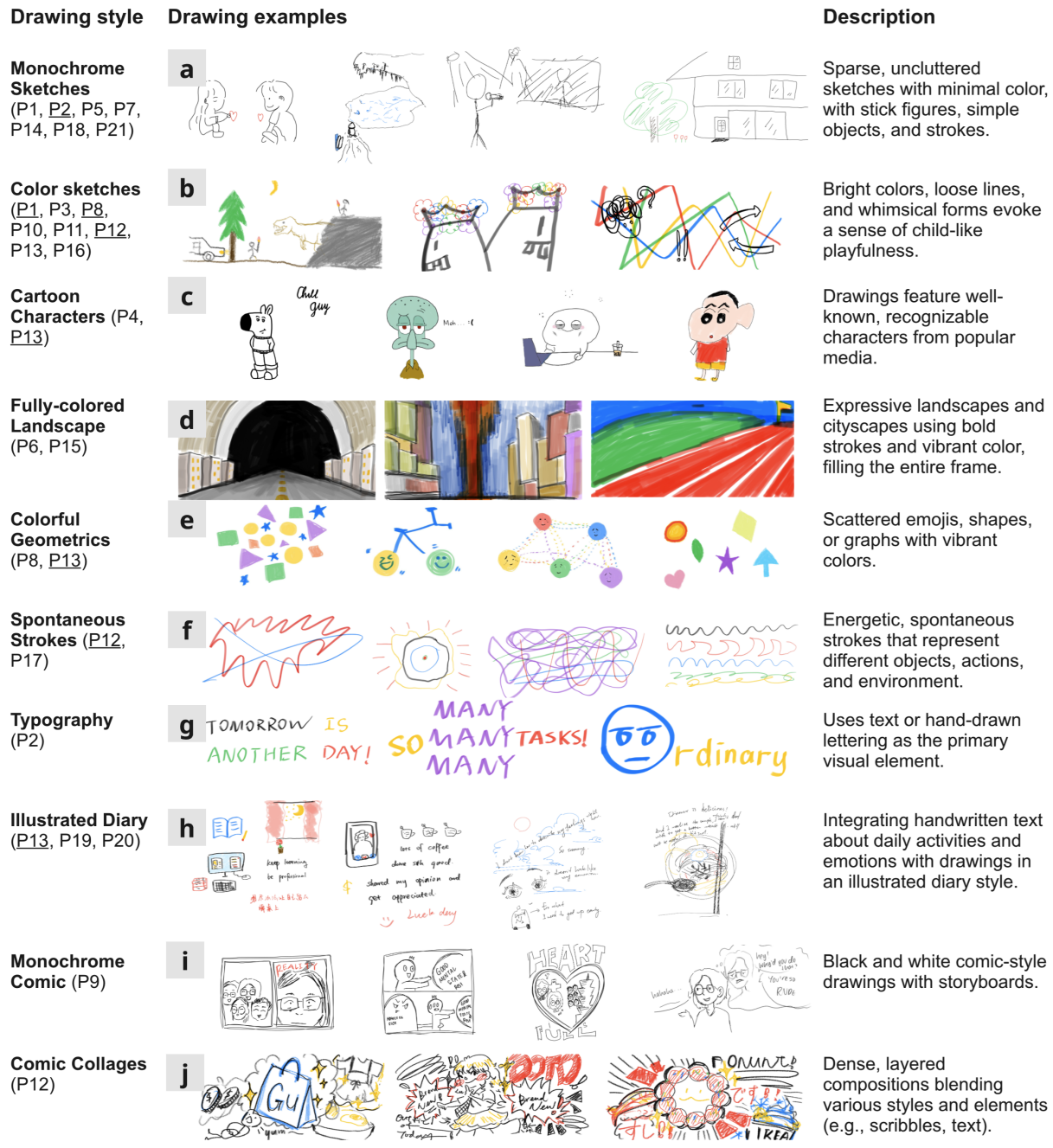

Figure 7: Personal drawing styles grouped based on their use of color, space, stroke, element organization, literal text, etc. Underlined participant IDs indicate cases where the style was not the participant's primary drawing style.

leveraged in designing expression-centered emotion tracking tools, a point we examine in greater detail in the discussion section.

4.1.2 ***Personal Styling Expression.*** Among the 252 the collected drawings, we observed both noticeable similarities and differences across participants' styling approaches. Our iterative analysis highlighted that these distinctions were most evident in participants' use of color (black-and-white vs. multicolored), line work (skeletal outlines vs. filled forms), organization of visual elements (spatial layout and density), and incorporation of narrative elements (use of text or storyboard-like sequences). While each drawing often combined multiple stylistic choices in color, line work, and element

organization, making strict categorization challenging, several recurring personal styles emerged.

As shown in Figure 7, the most common styling approaches are *monochrome sketches*, characterized by minimal or no color and skeletal outlines of figures and objects (P1, P5, P7, P14, P18, P21), and *colorful sketches*, featuring brighter tones and fuller compositions (P3, P10, P11, P13, P16). In more individualized cases, participants expressed their emotions through distinctive visual elements, such as *cartoon characters* (P4) and *fully-colored landscape* (P6, P15), as well as more abstract *colorful geometrics* (P8) and *spontaneous strokes* that were often randomly distributed on the canvas (P17). Several participants also integrated narrative elements to create drawings like *illustrated diary* (P19, P20) or comic-style illustrations, which were presented as *monochrome comic* (P9) or *comic collage* (P12) to add context and personal meaning to their emotional expression.

Color Choice and Emotion. In particular, many participants appeared to have a preferred or "*go-to*" color palette. For instance, P15 consistently used vibrant, saturated colors with high contrast, whereas P6 favored muted palettes, utilizing cool tones like blues and greens as well as warm hues such as oranges and yellows for prominent background. When it came to how color use might be related to their emotions, P8 and P13 perceived bright colors as expressive of relaxation and pleasant feelings, in the post-drawing description P13 explained: "*When I was drawing beautiful things with bright colors, it made me feel pleasant.*" Similarly, P1, P11, P12, P15 described using dark colors to convey negative emotion. However, some participants demonstrated contradictory associations: P6 and P17 mentioned using red to convey feelings of anger and stress, P20 associated red with positive emotions. Interestingly, several participants (P2, P5, P6, P16) reported that they intentionally incorporated their favorite colors when illustrating positive emotions such as happiness and relaxation.

Atypical Styling, Atypical Emotion. We observed that most participants maintained a consistent drawing style throughout the study period, although some of them occasionally shifted their approaches (P1, P2, P8, P12, P13). When asked about these shifts, P12 and P13 explained that they often occurred when they were experiencing "atypical" emotions on those days. For example, P12, who typically drew layered comic collages (Figure 7 (j)), switched to repetitive wavy lines when feeling bored (Figure 3 (l)).

Likewise, P13 demonstrated this tendency as well. While she typically employed a colorful-sketch approach to create child-like and playful drawings to express her positiveness and happiness in life (Figure 7 (b)); on days when she experienced atypical emotion, such as stress, she would adopt a very different drawing style. In one instance, P13 drew Crayon Shin-chan (the fourth drawing in Figure 7 (c)), a cartoon character instead of the usual sketches and claimed it was her favorite character which "*made me peaceful.*" In another instance, she created random geometrics (triangle, rhombus, and arrows) to expressed a sense of confusion and loss about the purpose of life (Figure 1 (d)). In the post-drawing description, P13 reflected, "*maybe drawing the content of knowledge would help me to focus on something beyond my negative emotion.*"

Variations in Expression Patterns Within a Consistent Style. While participants generally maintained a consistent styling approach, their emotion expression patterns mentioned in could vary greatly. For example, P4 consistently used cartoon characters to illustrate her feelings (Figure 4.1.2 (c)), but the specific character, poses, and scenarios changed depending on the emotional context: sometimes it was the facial expression of the character that conveyed her feelings (direction expression); other times, the character was a metaphor that indirectly linked to her emotions (metaphorical representation). Similarly, P12 formated almost all her artworks in a comic collages (Figure 7 (j)), but her emotion expression involved all four patterns (Figure 4).

For example, she used a heart-shaped panel with self encouragement to illustrate a happy memory in one drawing (metaphorical representation) and depicted her desire to go shopping in another (emotion source). These examples demonstrate that a consistent stylistic framework can serve as a vehicle for a broad spectrum of affective content, narrative strategies, and interpretive choices.

4.2 RQ2: Experience of Emotion Tracking Through Drawing

In this subsection, we report participants' overall experience of emotion tracking through drawing, including their perceived values of drawing compared to other modalities such as text descriptions and the challenges encountered.

4.2.1 ***Expressing Complex Emotions: Intuitive But Sometimes Ambiguous.*** Many of our participants mentioned drawing offered greater flexibility in recording emotions that are otherwise difficult to put into words. It could help "*present complex emotions*" (P12), and easily capture the intensity of emotions that were hard to communicate verbally (P17). Several participants (P4, P15-16, P20) described it as a more "*free*" and "*direct*" modality of emotion tracking that does not require much thinking process; a modality that allows for "free" expression. As P15 elaborated, emotions sometimes appeared in his mind as colors or shapes rather than words, making drawing a more natural way to record: "*drawing is more direct (compared to text), and sometimes my drawing is what I'm thinking.*"

Participants (P2, P17, P21) also emphasized the readability of drawings, since emotions conveyed visually could be understood in a single glance, while text required more cognitive effort: "*you just need one glance to know how I was feeling or what was the activity I had on that day, but for text you often need more time to read it. So like drawing is more intuitive than text*" (P2).

At the same time, participants acknowledged that drawing has its limitations in capturing emotion. P13 and P21, who had no prior drawing experience, pointed out that it could be challenging for them to depict emotions through drawings and sometimes became discouraging if what they drew "*doesn't look nice*" (P13). Even those who enjoyed visual art in their daily lives, such as P1 and P6, mentioned that the meanings conveyed through drawing could become "ambiguous", making them struggle to precisely express emotions, as further explained by P1:

> "*I don't have much ideas of how to express my emotion through drawing so mostly I draw some concrete things or myself and sometimes I even add some words besides my drawing to kinda like explain why I draw something like that ...*"

The ambiguity and interpretive uncertainty of drawing-based emotion expression were not limited to those with little artistic experience. P10 and P12, who were professionally trained in painting, echoed this concern, although they appreciated using drawings to express complex feelings difficult to translate into language.

4.2.2 ***Drawing as Playful Venue to Relieve Emotions.*** Participants reported that drawing was a lighthearted venue to record emotions. Compared to other forms of recording such as journaling or scale rating, drawing was characterized as "*interesting and relaxed*" (P10, P13, P16), while others seen as"*serious and monotonous*" (P7, P8), and "*boring*" (P13). P20 further explained that, "*writing is just like using words to express what you have experienced, express what you feel, but (with) drawing you can create something new, based on what you feel that day to show negative feelings, positive feelings.*" P10 recalled her diary-keeping practices, and mentioned that writing could be "*tiring*" that prevented her from "*keep doing (journaling).*" Furthermore, P7 highlighted that emotion tracking should not be bounded by rules: "*I don't like keeping it that serious*", because it was "*only for myself*," so "*I don't have to, I guess you can say, follow the rules.*" P10 further added that drawings could capture "*meaningful*" and "*unique*" parts of her emotions and hold therapeutic effects: "*when I see the picture I may feel happier.*"

Notably, we found that P10, P11, P13, and P14 explicitly used drawing as a coping strategy when dealing with difficult emotions, as reflected in both the visual elements they created and their post-drawing reflections. Their drawings often depicted imagined scenarios or incorporated self-encouraging words to help reframe negative feelings. For instance, to cope with the pressure and nervousness about presenting a project, P10 drew a grave for the project, explaining that she had *"mentally buried it"* as a way of preparing for possible failure (Figure 1 (f)). In another case, P14, feeling sad due to illness, drew a strong, muscular figure with a heart and the words *"be kind to myself,"* as a way to put a hopeful vision that encouraged herself to recovery from illness. These acts of visual reframings suggested that drawing provided participants with a space to externalize distress and symbolically transform it into positive thoughts, actions, and hopes. Even among those who did not intentionally use drawing for coping, some also reported stress-relieving effects of drawing, as P2 remarked: "*when I'm drawing, I can relieve some of my pressure.*"

4.2.3 ***Drawing as a Private and Safe a Space to Express Emotions.*** Participants noted that drawing as a emotion tracking modality felt safer and more private than other approaches that explicitly signal the positivity or negativity of emotions, or that rely on direct verbalization. P10 said it was much easier for her to track emotions through drawing than text; P6 attributed this to the "*ambiguity*" of drawing, which made the emotion expression process more "*dynamic*" and "*abstract*":

> "*I can't imagine using text, that might be embarrassing for me ... because language is so accurate and descriptive I might evaluate the privacy ... if (someone) read my emotion diary that would be so embarrassing ... If it's drawing it's more dynamic and it's more abstract so I think it's okay ... I'd be less worried about the privacy issue and I'm not embarrassed to see my drawing ... Drawing enables some ambiguity. Emotion is not a very accurate thing. It kind of match the drawing*"

While for some participants, ambiguity was seen as a limitation to accurately record complex emotions (Section 4.2.1), others (P7, P14, P20) pointed out that this vagueness protected their privacy. Several participants echoed these thoughts, highlighting that the visual elements in their drawings are less revealing than words, making drawing feel safer as a personal journaling practice and easier to begin without fear of exposure. For instance, P7 described that drawing as deeply personal such that even if accidentally disclosed, others would not know what the visual expressions meant:"*if you saw my drawing without me explaining you wouldn't understand.*" Likewise, P20 note that, "*you are the only one (who knows) what you have experienced that day.*", but would be embarrassed if others could "*read through the experience (via text).*"

4.2.4 ***The "Reflection Paradox": Instantly Understandable Yet Ephemeral.*** When revisiting their drawings and reflect on the emotions expressed, many participants (P2, P6, P9, P17, P20, P21) found themselves being able to immediately understand the meanings "*at one glance*," unlike text recordings that would additional effort to read and process. Several also found that their drawings acted as effective memory cues, helping them recall the emotions and contexts behind each entry and thus facilitating self-reflection. For example, P21 explained: "*it's more intuitive, just by looking at the picture you can immediately understand how you were feeling at that time.*" What is more, P20 noted that reviewing her drawings not only reminded her of the emotions she had felt but also revealed patterns in how she expressed them visually:

> "*I have preference of colors to show my negative feelings and positive feelings so I can see my feelings based on the color I used and picture. If I drew something positive like flower, I should have been happy.*"

In contrast to this perspective, two participants (P12, P16) noted that the emotions conveyed by drawings could be easily forgotten over time. P16 explained that, "*if I don't write down some sentence about my feelings sometimes when I look back I will forget what I wanted to express.*" Similarly, although P12 could remember what she drew during the interview, she said she might forget the emotions embedded in the drawings and rationales behind them in about a week. These seemingly opposing views paint a paradoxical picture of post-drawing reflection: on one hand, the meaning associated with drawings can be immediately accessible with little cognitive load; on the other hand, these meanings may fade gradually if not explicitly recorded, leaving the creator themselves even uncertain about the original intent. During the interviews, although most participants could remember what they had drawn, we did notice cases where some (e.g., P12) had difficulty recalling details without referring to their written descriptions, as P12 remarked:

> "*Actually, the painting, after I paint and when I am painting, I know what I am going to say, but a week later I forgot ... I need some texts to help.*"

5 Discussion

Our findings revealed four visual expression patterns that people employ to externalize their emotions: depicting emotion source, using metaphors, direct expression, and random drawing, with elaborations on different personal stylistic expressions in the use of color, space, text, narratives, etc. Importantly, we found the relationship between visual features and emotional states do not necessarily follow a universal mapping that can be automatically detected. Rather, the meanings behind the drawing-based emotion tracking are deeply personal and context-dependent. In addition to the drawings themselves, we report participants' experiences with drawing-based emotion tracking, highlighting it as an intuitive, playful, and safe expression channel, whilst noting challenges regarding its ambiguity for individuals to get started or interpret afterwards. In the following sections, we discuss what can and cannot be inferred from individuals' emotion drawings, and consider implications for the design of future emotion-tracking technologies.

5.1 How Do Drawings Reflect Emotions?

Although we observed moderate positive correlations between emotional valence and both the number of strokes and the time spent on drawing, these trends likely reflect participants' greater enjoyment of the drawing process when in a positive mood rather than systematic links between emotional intensity and drawing behavior. In other words, participants appeared inclined to linger on drawing when feeling good, whereas negative or neutral states often led to simpler sketches. This finding offers an empirical evidence for Fredrickson's theory regarding the role of positive emotions on positive psychology, which posits that the intention to dwell on and share positive emotions can drive people to invest more effort in expressive or communicative acts [18].

Beyond these isolated trends, our overall correlation analysis showed that neither the measured drawing behaviors (e.g., stylus pressure) nor the expression patterns (e.g., frequency of particular patterns employed) were related to the valence or arousal of participants' reported emotions. This finding suggests that the visual and behavioral features of drawing cannot be straightforwardly mapped onto emotional states, since they are highly subjective and context-dependent. While prior work has suggested potential correlations between emotional states and drawing attributes especially color use [37, 45, 66], we chose not to pursue such an analysis in our study, as it became apparent that color choices were driven more by personal preference and habitual styling than by differences in emotions. For example, some participants consistently produced monochrome sketches regardless of mood, while others habitually employed vibrant, colorful palettes. As participants themselves acknowledged during the interviews, they often had personal "favorite colors" for illustrating positive emotions (see Section 4.1.2). These findings share a similar ideology with self-tracking research that adopts expressive rather than quantified approaches [1, 2], such as bullet journaling and data physicalization. In these practices, visual elements serve as flexible building blocks that facilitate participants' unique self-expression, instead of structural representations of emotions.

In this regard, what can we infer about one's emotions from their drawings? Based on the findings, we propose three directions. First, ***objects and motifs can serve as entry points for emotional interpretation***, although their meanings are often shaped by cultural or personal experiences. As described in Section 4.1.2 and Figure 3, metaphorical representations frequently drew on common natural phenomena and objects. For example, participants frequently used suns or flowers to symbolize happiness, and clouds or rains to depict sadness. Similarly, communicative symbols such as chaotic scribbles were used to convey annoyance or stress, and popular fictional characters were used to embody emotions through their recognizable personas. Additionally, direct expressions through literal text or exaggerated facial features provided explicit feelings, serving as individualized markers of emotion.

Second, ***shifting in personal drawing styles may signal atypical emotions***. While many participants maintained a consistent personal drawing style throughout the study, we observed that subtle shifts in their approach (e.g., altering color palette, adopt a different expression pattern) often coincided with changes in emotional state, particularly negative emotions. These shifts may indicate that individuals were exploring new stylistic approaches as a way to process or cope with difficult feelings. This observation can be explained by prior research on emotion regulation strategies, where people deliberately or unconsciously modify how they express themselves to manage unusual emotional states [17, 20].

Last but not least, ***interpretation of drawings must be grounded in individual's own explanation and meaning-making***. The same visual element, whether a color, an object, or a random mark, may carry very different meanings. In our study, what looks like random mark-making may represent a coping mechanism or moment of ambiguity for one participant, while for another it might reflect boredom or playfulness. This complexity acknowledges the ambiguity of visual expression, while also highlighting the importance of situating interpretation within the creator's narrative. Such challenges have been observed in other modalities, including affective hand gestures [35], where meaning is context-dependent and resists universal decoding. Furthermore, our findings extended prior work that extracted emotional symbolism in drawing [22, 66], by revealing that people often reinterpret or repurpose common motifs in highly personalized and evolving ways, sometimes diverging from traditional or culturally expected meanings. Thus, it is essential that the interpretation of one's own creations remains dynamically tied to the creator's shifting internal context.

Taken together, our findings suggest that while drawings can carry valuable emotional cues, their interpretation cannot be reduced to surface-level features or universal codes. Instead, understanding emotions in drawings requires attending to personal, cultural, and situational contexts, as well as to participants' own interpretation. This perspective not only highlights the richness and diversity of expressive practices but also underscores the need for interpretive approaches that are flexible, participant-centered, and attentive to lived experience.

5.2 Designing Expression-Centered Emotion-Tracking Technology

Our study provides empirical evidence that drawing-based emotion tracking fosters personal reflection and self-discovery, as participants engaged in rich, evolving processes of meaning-making

around their emotions. Building on these findings, we identify important design opportunities for emotion-tracking technologies: rather than enforcing universal or automated classification, future systems should prioritize flexibility, interpretive openness, and user agency to better support these reflective practices. This approach was also advocated in a recent review of personal informatics literature [33], highlighting that self-tracking tools should shift the focus from producing standardized outputs (symbolizing what is superior versus inferior) to supporting personal reflection, self-discovery, and the evolving interpretation of one's personal data (i.e., emotion in our study context) over time. Below, we outline key implications for the design of future emotion-tracking technologies that center on expressive practices such as drawing.

5.2.1 Promoting Creative Expression. Our findings highlight that while many participants appreciated the value that drawings brought to their emotion expression, they sometimes faced challenged to get started, either due to limited art-making experience or struggle to precisely convey their feelings. Building on the expression patterns identified in the study, future emotion-tracking tools can be designed to promote creativity, which can be used to facilitate, but not overdetermine, such expressive practices.

First, drawing from the metaphorical representation, tools can help users discover and adapt visual metaphors that resonate with their current emotional states. For example, participants in our study used *natural phenomena* (e.g., sun, clouds, rain) or *fictional characters* as emotional symbols. Machine suggestions could leverage such patterns, offering prompts like symbolic imagery or contextual references, while still leaving room for personalization. Prior work has shown the utility of computational metaphor generation (e.g., [27, 63]), which could be adapted to encourage accessible and resonant representations of complex affective experiences. Second, because we observed that *subtle stylistic shifts* (e.g., changes in color palette, line quality, or composition) often coincided with emotional transitions, systems might encourage experimentation with alternative drawing styles. For instance, lightweight prompts could invite a user to vary line weight or explore new color schemes as a way of externalizing evolving emotions. Such features acknowledge that creativity itself can be an outlet for emotion regulation, providing opportunities to process difficult feelings through exploration rather than prescription. Finally, prior work in tracking personal productivity suggested that incorporating *speech inputs or loosely structured text capture* may help users articulate ineffable experiences alongside their visual creations [34]. Since our findings showed that participants frequently mixed abstract marks, recognizable motifs, and communicative symbols to convey emotions, a multimodal interface could extend this practice, allowing sketches to be enriched by informal descriptions, spoken reflections, or even fragmented words, which together enhance the expressive space. Third, computational support must remain secondary to the creator's sense of agency, control, and ownership [2, 14, 60, 63].

5.2.2 Facilitating Mindful Drawing Process. Previous work has already posited that creative activities are reflective processes [1, 2, 60]. Our findings extend this view by showing how participants not only recalled and visualized their present feelings and thought processes, but also used drawing to imagine alternative scenarios or to reframe past experiences as coping strategies. For instance, some participants depicted idealized or symbolic imagery (such as sunny landscapes or heroic characters) to counterbalance distressing emotions, while others deliberately shifted drawing styles to explore new ways of processing their states of mind. These practices suggest that drawing does not merely reflect current emotions, but actively supports mindful engagement, emotional exploration, and reframing.

Based on these insights, future emotion-tracking technology could be designed to facilitate such mindful processes. Rather than focusing only on visual structures alone, systems might attend to the *meanings, narratives, and imagined scenarios* embedded in drawings. By utilizing intelligent agents (powered by image analysis and generation models) to recognize personal metaphors, symbolic representations, and stylistic shifts, we can support users in becoming more aware of their emotional patterns and in reflecting on their lived experiences in mindful ways. This mindful process could promote affective awareness and provide opportunities for intentional reframing, like therapeutic principles of artistic self-expression. Moreover, agents may provide forms of existential support, guiding users toward mindful reflection on aspects of authenticity, purpose, values, and identity [28, 47]. For example, when a user repeatedly employs imagery linked to confinement or isolation, the system might invite reflective prompts such as *"What meaning does this image hold for you?"* or *"Can we explore alternative representations of this feeling?"* Such interventions can help users pause, reconsider their goals and values, and cultivate deeper awareness of their emotional life. Finally, we see potential for AI models to be trained not only to detect possible mental health risk factors, but also to provide *gentle and situated* interventions. For example, if a system identifies recurring motifs that align with maladaptive thinking patterns, it could encourage users to experiment with symbolic re-interpretations or suggest supportive techniques drawn from cognitive-behavioral or mindfulness practices (e.g., [43]). Importantly, such interventions should remain respectful of ambiguity and user agency, so that mindful drawing continues to serve as a safe, self-directed space for reflection rather than an externally imposed diagnostic tool.

5.2.3 Enhancing Emotion Interpretation Through Multimodal Data Fusion. In our study, while participants often used drawings to externalize emotions, the resulting artifacts were highly *ambiguous, subjective,* and *situated in personal context.* For some users, drawing felt like a "direct", intuitive, and easily understandable way to express ineffable experiences. For others, however, the meanings of their creations could not be easily conveyed or remembered without complementary modalities. This finding echoed with previous conceptualization of drawing as a "*presentational*" modality that is perceived as a whole, compared to"*discursive*" modalities such as text which are perceived sequentially [9]. The former is intuitive to grasp, while the latter is more logical to articulate. This tension highlights both the expressive power of drawing and the challenges of interpreting it in isolation without discursive modalities.

To address potential ambiguity in emotion interpretation, particularly in contexts such as art therapy where emotion-based drawings are shared with professionals like therapists [31, 39, 49], future creativity-based emotion-tracking systems could fuse multiple

modalities of expression by combining drawing with verbal or textual recordings of meaning. For instance, users could attach brief audio notes, reflective phrases, or free-form narratives to their sketches, thereby scaffolding interpretation while retaining the immediacy of visual expression. Our findings suggest that participants often generated their own interpretations through metaphors, symbols, or imagined scenarios. In such cases, prompting them to share even lightweight descriptions of these could improve system, personal, and interpersonal understanding of the recorded emotions. We can also augment traditional verbal or textual emotion recording with these personalized visual elements to enhance depth of expression. In this way people can make meaning in a diverse and creative manner [38], and others can easily emphasize with the results "*at one glance*" [63].

In addition, multimodal data fusion can help detect and contextualize subtle cues. While our study did not observe significant statistical relationships between emotions and drawing behaviors (e.g., stylus pressure), this may be due to differences in participants' individual drawing habits or the fact that we analyzed average stylus pressure rather than moment-to-moment variations. In the context of art therapy, therapists often attend not only to what clients draw but also to how they draw—the process itself—such as whether they hesitate, repeat strokes, or vary their pressure and speed [3]. Future technologies that capture more subtle, real-time behaviors, such as stylus angle, speed, or pressure dynamics, could link these micro-level features with visual elements and accompanying verbal accounts. Such integration would develop a richer picture of how users personally encode affect. Over time, this multi-modality may also help surface implicit preferences and recurrent themes in a user's self-expression and drawing behaviors, supporting reflection and self-discovery, and potentially adding to therapeutic effects of artistic expression [38]. In short, multi-modal fusion should not serve merely as a tool for automated decoding, but rather as an enabler of *diverse expressiveness*, *mutual understanding* and *situated meaning-making*. By drawing on the interplay between presentational and discursive modalities, systems can enhance both the expressiveness and interpretability of emotions, promote empathy and understanding among users, while preserving users' agency and the inherently open, creative qualities of drawing.

6 Limitations & Future Work

One limitation of this research lies in the small sample size and the predominance of Asian participants, which limits the cultural diversity and generalizability of the findings. However, we believe that as an exploratory step, starting with a focused, specific sample like prior studies [1, 22, 66], could enhance the depth and nuances of analysis. Nevertheless, just as research has long documented the influence of cultural background on color perception [10], the emotional meaning of visual motifs may also vary across cultures. Relatedly, generalizing the results of emotional visual expressions require studying people with neurodiversity. As shown in prior research with Autism Children, atypical sensory processing can lead to different preferences of visual elements (e.g., boys with Autism prefer green and brown more than their neurotypical peers) [19]. Understanding these variations holds promise for expanding the application of drawing-based emotion tracking to aid in the screening or assessment of individuals with certain mental or neurodevelopmental disorders where visual perception is affected. Therefore, further studies should aim to recruit a wider range of cultural backgrounds and neurodiversity.

We also acknowledge that participants' varying levels of drawing expertise may have influenced the outcomes. Individuals with more artistic experience might express their emotions more vividly or confidently, while those with less experience could be limited in their ability to visually communicate their feelings. However, since our study aimed to capture drawing as a free and natural practice for emotion tracking, this diversity of artistic expression enriched the dataset by reflecting a wide range of personal styles and strategies. Importantly, despite differences in artistic expertise, participants' drawings consistently fell within the four expression patterns we identified, suggesting that these categories capture shared approaches to visualizing emotions across individuals with varying skill levels.

Additionally, the categorization of drawings relied on human judgment and is therefore subject to potential bias and inaccurate interpretations. However, this bottom-up, qualitative approach is well-established in prior research focusing on artifact analysis, allowing for rich, context-sensitive interpretation that automatic approaches may overlook [22, 35]. To further strengthen reliability, we followed a set of rigorous, collaborative steps among researchers. This collaborative process enabled us to uncover diverse perspectives, minimize hierarchical bias, and enhance both the accuracy and depth of our analysis.

Going forward, we plan to continue exploring effective ways for individuals to track their emotions through expressive methods, such as the incorporation of other input modalities (e.g., speech input alongside drawing) and designing visualizations to help individuals reflect on both their drawings and emotions recorded.

7 Conclusion

By investigating how people track everyday emotions through drawings, we conducted a 14-day diary study and collected 252 drawings from 21 participants who showed interest in emotion tracking. Our analysis identified four key expression patterns: depicting emotion source, using metaphor, direct expression, and random drawing, while revealing that participants' visual choices reflected enduring personal style more than the specific emotion recorded. While prior work has highlighted the value of metaphor and symbolism, our findings extend this literature by showing that, in digital self-tracking, the meanings of drawing are highly personal, context-dependent, and evolve over time. Rather than aiming for universal or automated emotional decoding, our findings point to the need for flexible, and creativity-centered technologies that support ongoing reflection and personal meaning-making. These insights set a new agenda for expression-centered emotion tracking, emphasizing individual agency and interpretive openness in design.

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