Hueman: Personalized Color-Forward Emotion Tracking and Adaptive Mobile Interfaces for Reflection and Regulation

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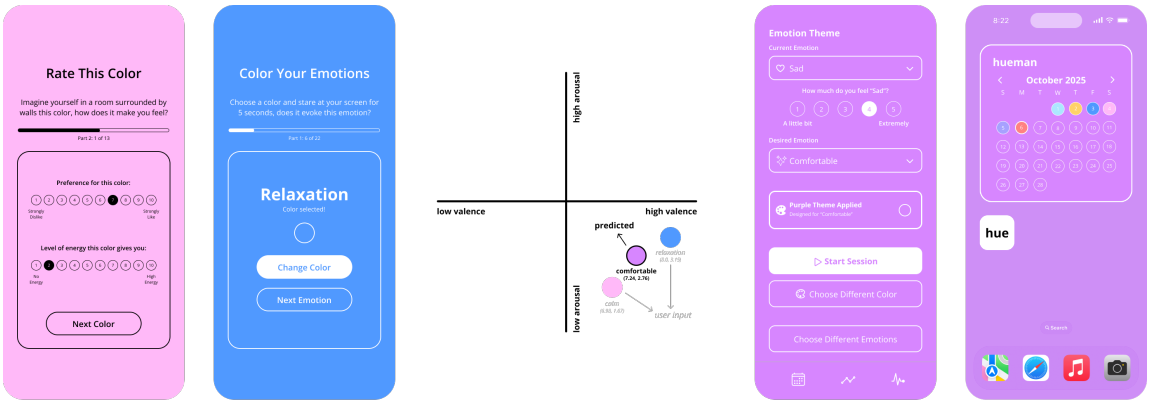

Onboarding: user creates initial color emotion mappings

Prediction: additional mappings created based on onboarding (adjusted with ongoing user logs)

Adaptive theme: app and phone reflect predicted emotion color

Fig. 1. Hueman is a color-forward emotion tracking and management system that learns from each user's unique color-emotion associations. Hueman creates initial color-emotion mappings (middle) from an onboarding survey (left). These mappings can be used for emotion management through adaptive mobile interfaces (right).

Emotional awareness and reflection through self-tracking can support mental well-being. Personal Informatics (PI) systems enable this practice through various methods and mediums of emotional expression. Existing emotion-tracking systems offer limited opportunities for personalization or adaptive support. In particular, color-integrated systems often either impose predefined color-emotion mappings that conflict with users' personal, cultural, or contextual associations or place the burden of defining these mappings entirely on the user. This makes it difficult for users to establish meaningful associations that evolve with their personal experience. To address this gap, we developed Hueman, a color-forward emotion tracking and management system that learns from each user's unique color-emotion associations. We use Hueman as a technology probe to explore how users engage with color-forward tracking as a medium of expression and how Adaptive User Interfaces (AUIs) can support emotional adjustment. Drawing on data from the onboarding survey and ongoing color logs, Hueman infers emotional states from the users' color selections and adapts mobile user interface (UI) themes to prompt emotional regulation. A weeklong evaluation with seven participants showed that Hueman can support meaningful emotional reflection and regulation, helping users question and refine their own color-emotion associations while enhancing engagement with self-tracking. This work contributes a novel design space for color-based personalization in PI and demonstrates the potential of AUIs for fostering emotional awareness and adjustment.

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1 Introduction

People are highly emotional beings, yet the ability to recognize, regulate, understand, and express emotions does not come naturally to many [56]. Individuals often struggle to articulate their feelings or even identify what they are feeling in the first place. However, emotional awareness plays an important role in our lives and may be an important factor in predicting life outcomes [56]. Personal informatics systems aim to address these challenges by helping individuals collect and reflect on personally relevant information to gain self-knowledge [48]. Prior work has shown that engaging in practices of emotional regulation and self reflection can improve happiness, enhance self-understanding, and contribute to overall quality of life [13]. Social and cultural trends have also emerged around personal informatics and emotion tracking. For example, the Quantified Self [77] movement, where users participate in lifelogging, and Year in Pixels [34], a technique where users color in a square on a calendar associated with their current mood for that day.

Color, specifically, offers a compelling medium for emotional expression and self-reflection as it is associated with affective experience and can communicate nuanced emotional states [22, 73]. However, existing color-integrated systems impose fixed color-emotion mappings, such as red for anger and blue for sadness, which may not align with individual preferences and experiences [72]. Other systems will give complete freedom to the user in creating defined color-emotion associations [6, 9]. It is difficult for users to create their own fixed definitions as they may not understand their own relationships with color, and their preferences are always evolving [9]. By learning and adapting with each user's dynamic associations between colors and emotions, systems can provide a more personalized and meaningful tracking experience. Such an approach could not only support reflective practices, but also enable adaptive interventions for in-the-moment emotional regulation, creating a design space that combines self-expression and personalization.

Adaptive user interfaces [12] offer a promising method for supporting personalized emotional experiences through dynamically responding to a user's current state. In contrast to static designs, AUIs can adjust visual elements such as color to align with individual preferences and contextual needs. Prior work has explored how adaptive interfaces can influence users' moods and evoke emotional reactions through changes in color themes [4, 42]. Applying these principles to emotion-tracking systems could allow interfaces to not only reflect a user's emotional state, but also guide and support emotional regulation in real time. By integrating color-based personalization, AUIs have the potential to create more engaging and impactful tools.

Considering these points, we developed Hueman, a mobile application for color-based emotion logging, reflection, and adaptation that combines personalized user color-emotion associations with adaptive mobile interfaces. During onboarding, users complete a two-part mapping process: first, they select colors corresponding to specific emotions, and second, they reverse-map by choosing an emotion associated with a given color (Figure 1). Hueman then constructs a customized color-emotion mapping across a broad range of emotions. Emotional states are quantified along the Valence-Arousal (VA) spectrum (Figure 5). In using the app, users can log their current emotion for a specific date and

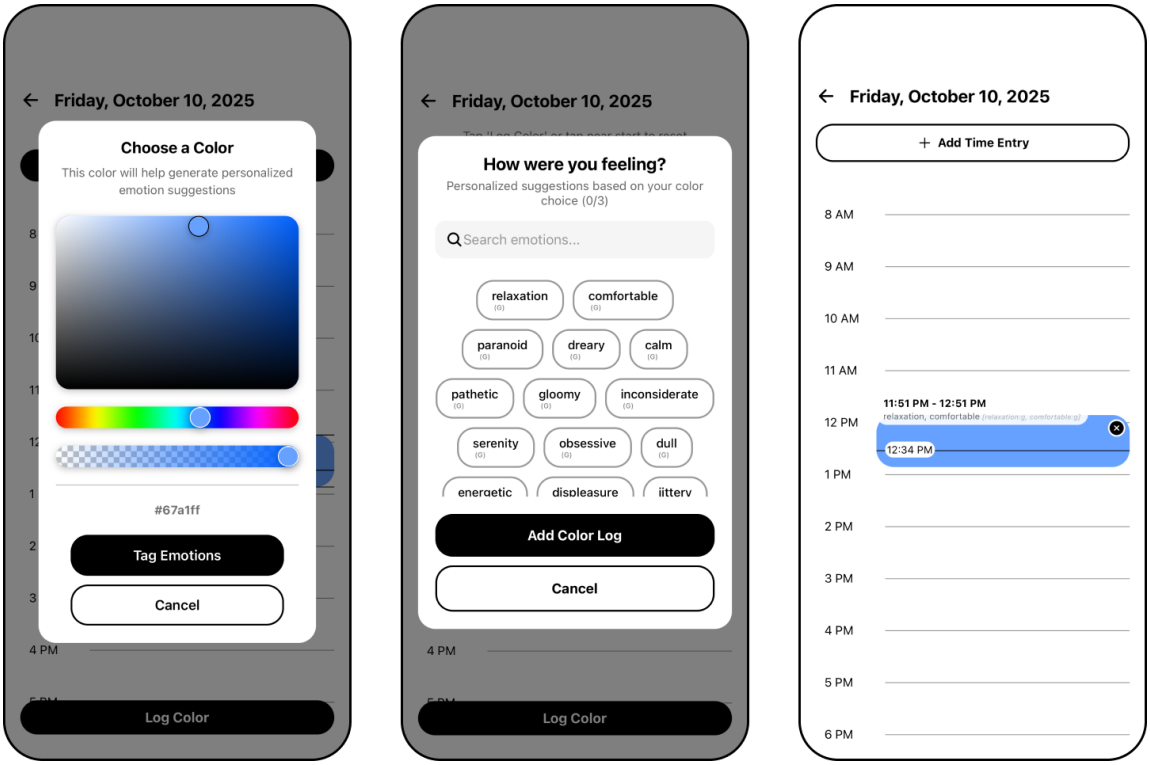

Fig. 2. Color-based emotion logging in Hueman: (1) users select the current date and a time range; (2) choose a color that represents their current feeling; and (3) select from system-generated, personalized candidate emotion labels.

time range by selecting a corresponding color. The system generates candidate emotion labels based on the user's onboarding logs and past entries, from which users can select to tag their entries (Figure 2).

Hueman supports reflective practices through simple, easily understandable visualizations, including color-to-emotion and emotion-to-color mappings, as well as summaries of top emotions experienced over a given period. Beyond reflection, Hueman facilitates adaptive emotion regulation: users can specify their current emotion and desired emotional state, the system then adjusts the app's color theme to support mood shifts through color-based interventions (Figure 1). The system also adjusts the user's mobile color theme through the application widget and background wallpaper. This is done through automated email notifications that trigger shortcuts in iOS devices. Hueman occupies a space between adaptive and adaptable interfaces. While it automatically adjusts the interface to support emotional regulation (adaptive), it also allows users to actively select their desired emotional outcomes and influence the system's color interventions (adaptable) [27].

Hueman is user-driven, enabling individuals to initiate features and adjustments according to their own preferences. Whether in emotion tagging or adaptive interface, the user maintains autonomy as the app provides options for manual input or changes after presenting the user with the system's recommendations [61]. In addition to the generated emotions that Hueman recommends, the user can self-select emotions from the larger database through a text-based search query. In adapting color themes, the system first allows the user to preview the recommended color for the their

Fig. 3. Seven shades of "happiness" which participants indicated in the evaluation of Hueman.

desired emotional state. The user is then able to make adjustments to the color if they require increased customization. Manual user inputs and adjustments are tracked and used to better train the user's personalized color-emotion mappings (Figure 4).

This paper evaluates the use of color as a medium for emotional expression and user experiences with color-based AUIs for emotional adjustment through a weeklong deployment with seven participants. In the evaluation of Hueman, we not only wanted to collect quantitative and qualitative insights about the design of the application, but also use it as a technology probe to provide insights for future HCI research regarding color as a dynamic medium of emotional expression and management. Our research questions are: (1) how personalized color–emotion mappings can support users in reflecting on their emotional states, (2) how color-based adaptive interfaces can facilitate emotional regulation, and (3) how predictive emotion systems can enhance users' awareness of their emotional patterns and states. Our results demonstrate that Hueman can support meaningful emotional reflection and regulation.

Our contributions are as follows:

- We developed Hueman, a mobile application that personalizes color–emotion mappings, predicts user emotions from color input, and dynamically adapts the interface and the user's mobile device to support emotional regulation.
- We validate Hueman's effectiveness and potential in emotional adaptation and reflection through a user study.
- We provide insights into how users interact with personalized color-based emotional tracking and adaptive interfaces for emotion logging, self-reflection, and emotional management.

2 Related Work

2.1 Personal Informatics for Emotional Well-Being

Within personal informatics, there has been continued development of new methods for expression and tracking to help people collect, reflect on, and manage their lives. Li et al. define PI systems as "those that help people collect personally relevant information for the purpose of self-reflection and gaining self-knowledge" [48]. This research further defined five stages of PI systems: preparation, collection, integration, reflection, and action. PI systems that support emotional insights approach these five stages through different methods. One notable way existing systems diverge is through types of data collection and system integration, or the method used to collect that data. The type of data used for indicating emotions can be derived from physiological or behavioral indicators such as heart rate, screen usage, or eye tracking [38, 51]. Data could also be sourced from users' own mental constructs of emotion, whether from an artistic expression of their emotion or selection of emotion to log how they are feeling [9, 45]. In the collection of data, we see automated tracking where systems automatically collect data to interpret and define users' emotional states [38, 53]. Other systems rely on user input for defined emotional states [6, 9, 45]. Methods of data collection and types of data collected within systems are not mutually exclusive and often intersect to support multi-dimensional emotion tracking for users.

We often see automated tracking approaches combined with physical and behavioral indicators. MindScope is an example of this, where researchers tracked users' screen use, physical activity, location, social context, and physiological indicators for stress prediction [38]. We see something similar in the increasingly popular Oura ring, a ring which can collect health metrics and insights, including stress monitoring and management from tracking biometrics [53]. Methods that rely on physiological indicators of emotion are limited in type of emotion identification, as many emotions cannot be inferred solely from physical conditions. However, other modalities such as facial tracking, vocal tone, and smartphone interaction metrics enable more multi-dimensional understanding of user emotions [59, 70, 81].

A different approach involves manual emotion tracking based on users' mental indicators. In these systems, users manually log their experiences through translating their internal state into a text-based emotion [72] or a method of expression [6, 9, 45]. Manual self-tracking systems help the user remain grounded within their own emotions and logging [1]. It allows for reflection-in-action [69] through recognizing and recording their emotions in the moment [9]. MindTracker, for example, enables users to model their emotions using clay figures and photograph them as a record, supporting emotional expression through tangible, artistic means [45]. Similarly, Chromatize provides a low-burden, in-the-moment color-based logging experience, allowing users to select colors that represent their emotions and optionally add contextual notes [9]. These systems tend to reflect aspects of analog forms of mood tracking, such as journaling or drawing [52].

Manual tracking with mental indicators are especially valuable because they preserve the user's agency in defining and interpreting their own emotional states, rather than relying solely on algorithmic inference or biometric data [1]. These systems recognize that emotions are not always physiologically legible, and that the act of logging, whether through words, colors, or tangible artifacts, can itself serve as a reflective and grounding process [1, 6, 7]. By prioritizing user expression, manual tracking enables individuals to build a personal vocabulary for emotions that may differ from cultural norms or standardized models.

Prior research highlights the value of flexible manual data entry as a meaning-making practice, showing that low-burden experience logging systems that generate symbolically-rich, self-defined data can support self-awareness, reflection, and regulation [9, 17, 24]. Prior work also shows that physical manual tracking, despite its benefits, risks abandonment because of the burden of repeated and high-effort input, which may be difficult to maintain or develop summarized insights from [1, 29]. This tension motivates the design of Hueman, which seeks to maintain the convenience of lightweight digital interaction while using personalized features to provide valuable insights to the users. Hueman focuses on color as a medium for emotion logging and reflection. It supports users in articulating their unique, personally meaningful associations between color and feeling. In doing so, it both empowers users to construct emotional self-knowledge and changes their relationship with this medium. Hueman can refine what colors mean to users, help them reject common associative definitions, and develop understanding in the emotional impact of colors in their lives.

2.2 Color and Emotion Associations

Color-emotion associations exist at universal, cultural, and individual levels [28, 33]. Universally, brighter, lighter colors are associated with positive valence, while darker colors are associated with negative valence [35, 44]. Warm hues (e.g., reds, oranges, yellows) are often connected with high-energy emotions, and cool hues (e.g., blues and greens) tend to correspond with lower-energy emotions [76]. The media further reinforces these associations [20, 55]. However, color meanings are not fixed. Red, for instance, can represent both anger (high arousal, unpleasant) and love (high arousal, pleasant) [35]. Beyond considering hue, value and saturation can play large roles in the emotional impact of a color. For

example, a study found that valence tends to be higher for blue compared to other hues, but only for highly saturated colors [76].

Cultural context also plays a key role in shaping color-emotion mappings [35]. For example, in China, red is strongly associated with joy, celebration, and good fortune, often appearing in decorations during Lunar New Year and other festivals [32, 35]. In contrast, in Western contexts, yellow is associated more closely with joy [8, 15]. These cultural associations are just examples and cannot represent the diverse ways in which these colors are used to represent meaning [2, 8]. Similarly, while brightness often aligns with positive valence in Western cultures, this may not hold true elsewhere. An example of this is in Beijing opera, where heroes wear red masks while adversaries wear white ones, reflecting an opposing symbolic relationship [16]. Numerous other cross-cultural studies demonstrate how color preferences and meanings vary worldwide [18, 64, 79]. From these examples, we can start to understand that it is difficult or even impossible to define color-emotion associations that mean the same thing to everybody.

Individuals, while they may follow preferences generally aligning with the environment they grew up in, can also hold unique and highly personal associations between color and emotion [28, 33] (Figure 3). Prior research demonstrates that personal preference and past experiences with a specific color significantly shape emotional interpretations of that color [36, 62, 63]. For example, the color red may evoke excitement or warmth for someone who associates it with festivals, but trigger anxiety in another who links it to danger [35]. This aligns with ecological valence theory [63], which suggests that the valence a color induces is tied to how positively or negatively people feel about objects associated with that color. However, cultural and societal norms of color-emotion associations have been so deeply ingrained in media and our environments that it's difficult to break away from these norms [33]. In Kushkin et al. we see that emotions which are commonly color associated showed consistent mappings while other emotions prompted varying color associations: "for some emotions, like anger, happiness, and disgust, participants demonstrated more consistent color selections, while for the others, like awe, confusion, and surprise, color choices show higher variability" [43]. In designing Intelligent User Interfaces (IUI) [25], this variability highlights the importance of accounting for both cultural regularities and individual differences. Systems that rely on color to communicate affective states may need to adapt dynamically, allowing for personalization or context-sensitive mappings rather than assuming uniform emotional interpretations.

2.3 Color-Emotion Affective Systems

Prior work within the field has leveraged color as a medium for tracking and communicating emotional states. However, many of these systems rely on either user-defined color-emotion pairs [6, 9] or generalized societal associations [72]. This approach places the interpretive burden on users, who must decide what colors mean to them. This process can be ambiguous or unstable over time. Moreover, color–emotion associations can shift as individuals' personal preferences, interactions with colors in their lives, and cultural contexts evolve [63]. These practices also do not support users in understanding how color can impact their emotional states, whether in their digital devices or surrounding environments.

Chromatize is a flexible and minimalist self-tracking application where users can log a color for emotion tracking through three methods: selecting a color from a palette of colors, choosing a color from a small set of pre-selected colors, and capturing a color from their current environment through a smartphone camera [9]. Although users are able to log colors in various methods through the app, the application provides limited color-based visualizations or summarized insights. This limits users in long term emotional reflection and development of understanding of evolving

relationships with color. In addition, without specific indications of color-emotion meaning in past logs, users may have a difficult time interpreting colors that do not mean the same thing to them anymore.

Trackly is another self-tracking application which uses coloring of pictorial trackers to visualize personal data. Users can define tracking parameters, customize color schemes, and choose from six tracker types, including text, time ring, body shape, matrix, origami animal, and mandala trackers [6]. While Trackly presents opportunities for users to engage in self-tracking in an expressive and customizable manner, it is limited in providing insights into users' personal interactions with color as a method of self-expression.

Similarly, MoodJam is an online diary that allows users to track their moods through colors [46]. Users can select colors from a color palette, associate these colors with words, and add a note to describe how they are feeling. Users can then visualize their moods in different ways. GoSlow is a mobile application designed to help users slow down through various methods of reflection including writing, taking a photograph, choosing a color, or diary [49]. These applications are able to support multimodal user input, such as color and text-based reflection, but less so focus on color as a continuously changing method of user expression. Other applications, like How We Feel, a journal app to help people better understand their emotions, predetermine color-emotion associations for users to choose from: yellow for high valence and high arousal, red for low valence and high arousal, blue for low valence and low arousal, and green for high valence and low arousal [72].

Across these examples, we can see that while color affords accessibility, expressiveness, and flexibility, current systems overlook the dynamic nature of color-emotion associations and utilization of these personal associations to help users adjust their emotional states. Most existing systems either hard-code color-emotion correspondences or offload the burden of definition to the user. This raises challenges for IUIs, where the goal is not only to sense or display but also to adaptively mediate. Building on these trajectories, our work explores the potential of systems that integrate color-based customization to more faithfully reflect personal meaning.

The use of color-based adaptive interfaces for emotion management and adjustment remains relatively underexplored. Prior work has demonstrated that color can influence and regulate emotional states, highlighting its potential as a medium for affective feedback [60, 78]. Previous research on AUIs has further shown their potential as catalysts for emotional state change. We see this in Emotioncontrol, a Model-Free Reinforcement Learning (MFRL) approach for adapting interface elements for emotional response [4]. Through Emotioncontrol, Alipour et al. studied how light and dark color themes, small and large font sizes, satellite and street view map types, and hidden and visible popups could cause emotional responses in users. The study found that various UIs could evoke specific emotions in users.

We also see the potential of color-based AUIs for emotion management through EChat, an emotion-aware messaging platform [42]. Through facial emotion recognition, EChat detects negative valence in the user's emotional state and changes the chat's UI color theme to reach the target emotion of neutral. In a pilot study, participants reported increased awareness of their emotions when interacting with the adaptive interface.

Building on this line of work, Hueman takes a personalized approach by adapting to users' desired emotional states and considering their individual color–emotion associations. Unlike prior systems that employ static or generalized mappings, Hueman dynamically modifies both the application interface and the user's mobile interface to support personalized emotion regulation.

3 Designing Hueman (Designing Human)

We developed Hueman, a personalized color-based emotion logging application which integrates color-based AUI for users' emotion management and adjustment. Specifically, we explored how users engage with a system that, given a

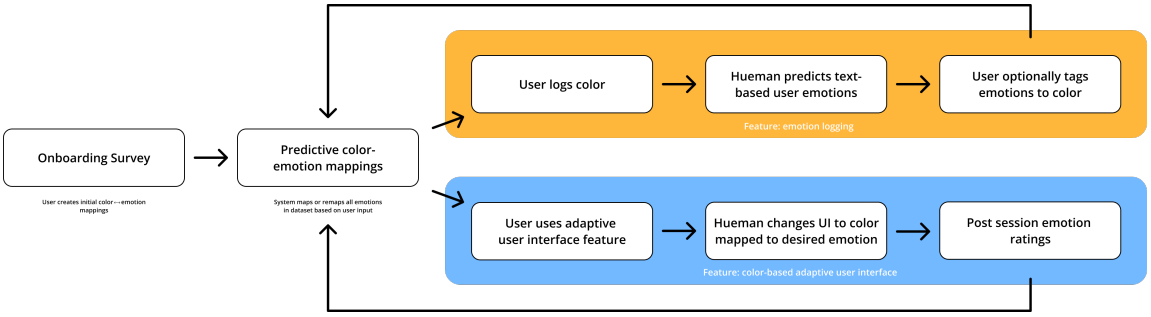

Fig. 4. System user interaction flow of Hueman

color input, suggests possible user emotions based on an initial onboarding process and subsequent color logs. We also explore how users interact with color-based adaptive interfaces on their mobile devices. This section offers the design rationale for Hueman and the results of a pilot study which informed design decisions in the version of the application used for user study.

3.1 Introducing Hueman

In designing the initial version of Hueman, we drew inspiration from existing digital [9, 37] and manual [34, 54] self-tracking tools and practices relating to emotions, color, and visualization. In exploring earlier works, we took note of maintaining use of systems [1, 48], difficulty in the action of self-tracking [1, 9], visualizations that users can easily understand [5], and preference for aesthetically pleasing interfaces [1, 5]. Based on these factors, we maintained several design considerations in creating Hueman, including personalization, the ability to prompt actionable insights, visual appeal, simplicity in design and navigation, and user-friendly visualizations. The main features of Hueman include (Figure 1 and Figure 6):

- A calendar-based home page where users can select a date to log emotions by choosing colors and adding emotion tags for specific time frames.
- Week and year views for browsing historical emotion logs.
- A data analytics page for visualizing relationships between emotions and colors, including "mapped colors for a given emotion," "mapped emotions for a given color," and "top emotions" within a selected time period.
- An emotional management page, where users input their current and desired emotions. The system then adapts both the app interface and the user's mobile phone theme to a color aligned with the desired emotional state.

3.2 Pilot Study

To inform the iterative design of Hueman, we conducted a short pilot study with three participants over a three-day period. This consisted of an initial onboarding session, and then a think-aloud walkthrough and an exit interview to understand participants' experiences, perceptions of functionality, and the app's emotional effectiveness. Each participant had some previous experience with self-tracking technologies (P1: social-media based logging, P2: fitness based logging and journaling, P3: social-media based logging).

Participants were first introduced to the Hueman app and its features. They then installed the application through Apple's TestFlight. They were guided through the setup process for the color-based adaptation functionality on their

mobile devices. In order to complete this process, participants were given 13 pre-designed wallpapers of different color themes, including red, yellow, orange, pink, purple, blue, sky blue, cyan, green, brown, gray, black, and white. For each wallpaper, they were asked to set it as a new wallpaper on their device and configure Apple Shortcuts for adaptive switching. For example, on receiving an email with subject "Red", a shortcut will run that switches their wallpaper to the red one. During onboarding, users were prompted to fill out the onboarding survey where they mapped and reverse mapped their color-emotion associations. They also added the application widget to their device (Figure 1).

Participants were asked to explore the application freely over three days, without a fixed quota for logs or adaptive sessions. This open-ended approach allowed us to observe the contexts and motivations prompting emotion logging and adaptive use. The home screen widget also aimed to encourage engagement throughout the study period.

3.3 Pilot Findings

Here, our findings are summarized into these main points which guided our design iteration of Hueman.

3.3.1 User Interface Context in Color Preference. In the onboarding survey, users selected colors that they associated with specific emotions. However, when these colors were applied as the app UI or mobile wallpaper, some participants found that their chosen colors negatively impacted device usability.

For example, P1 picked bright and saturated colors, such as bright red for "happiness" or "joy", but when a bright red was set as her wallpaper, it felt overly blinding due to the high saturation, and made it difficult for her to interact normally with her mobile device. To address this, we added a preview feature in the onboarding survey, allowing users to see how the selected color would appear as a full-screen background before confirming their choice. This gave participants a more realistic sense of how the color would affect the app and device usability.

3.3.2 Difficulty in Making Color-Emotion Associations. In the second part of the onboarding survey, users were presented with a color and asked to select an emotion corresponding to that color using a search functionality. This design aimed to address two concerns: bias toward selecting the first emotions visible in a scrollable list, and the overwhelming number of emotions available in the dataset. However, both P1 and P2 reported experiencing difficulty in choosing an emotion for a given color. In order to make this process more intuitive, for the second part of the onboarding survey, users could choose how much they enjoy seeing a given color (corresponding to valence) and the level of energy the color makes them feel (corresponding to arousal). Within the onboarding process, guiding prompts were also implemented to help users better interpret how they feel about a color and emotion pair. For example, "Imagine yourself in a room surrounded by walls this color, how does it make you feel?" (Figure 1).

3.3.3 Color as a Method for Recognizability on Mobile Devices. In the initial prototype, adaptive color themes extended to app icons, tinting icons to match the wallpaper color. In post-pilot interviews, P1 and P3 reported that this made it difficult to recognize apps. P1 specifically mentioned that she relied on default app colors and icon cues, including notification badges, to navigate her device. Based on this feedback, tinted icons were removed from the adaptive color theme to preserve usability.

3.3.4 User Agency. Participants noted that sometimes the app applied adaptive colors that did not match their desired current mood. This discrepancy could result from prediction inaccuracies or multiple colors mapping to the same emotion. In order to maintain user agency, we implemented an adapted color preview where the app adapts to the recommended color for the user's desired emotion, however, users are given the opportunity to modify that color before applying it system-wide (Figure 4). Maintaining adaptability and user control was a core design consideration, as both

emotional and visual preferences are highly personal and dynamic. This adjustment ensures that users can tailor the system to their current emotional needs while still benefiting from adaptive color-based support.

3.4 Defining Emotion

Santos et al. define emotions as short-lived feelings caused by contextual stimuli that can be represented across multiple dimensions, whereas moods are longer-lasting, either positive or negative, and often result from unclear factors, comprising multiple specific emotions [67]. For the purpose of this study, we define emotion as a short-lived, non-physical feeling that an individual can express in the form "I feel _____ ."

To quantify emotions, we used the Valence-Arousal spectrum (Figure 5). The VA spectrum was first introduced by James Russell and is a common method of quantitatively measuring emotions [66]. In the VA spectrum, emotions are measured two-dimensionally: through valence and arousal, where valence indicates the level of positivity or negativity an emotion gives to users, and arousal indicates the level of energy an emotion gives to users. Warriner et al. created a dataset of words with VA scores, each on a scale of 0-10 [75]. Based on our emotion definition, we extracted all emotion-related words from that dataset. This gave us 552 emotions, each with a valence and arousal score. Emotion valence ranged from 1.90 to 8.48 with "hateful" being the lowest valence emotion and "happiness" being the highest valence emotion. Arousal ranged from 1.67 to 6.95 where "calm" and "dull" represented the lowest arousal emotions, and "ecstatic" and "sexual" represented the highest arousal emotions.

3.5 Designing the Onboarding Process

Before accessing the app, users complete an onboarding survey designed to establish initial color-emotion associations [57]. In the first part of the survey, users are presented 22 emotions spanning the VA spectrum, including emotions in each quadrant, emotions between quadrants, and outlier emotions (Figure 5). For each emotion, users select a color using a color picker. Once a color is selected, the onboarding page updates to display the chosen color as a background, allowing users to preview it in a mobile setting and make adjustments as needed (Figure 1).

In the second part of the survey, users are presented with 13 colors representing common themes that broadly cover the color spectrum. Participants rate each color on two dimensions: how much they like it (corresponding to valence) and the level of energy it evokes (corresponding to arousal). The purpose of this survey is to determine an initial color-emotion mapping association for each emotion in the dataset based on a select number of colors and emotions that can broadly cover the emotion spectrum and the color spectrum.

3.6 Personalized Color-Emotion Mapping Algorithm

Hueman uses a hybrid machine learning approach that combines user-provided associations with VA space interpolation to generate personalized color–emotion mappings. During onboarding, users create a set of direct mappings $M = \{(e_i, c_i)\}$ where e_i represents an emotion and c_i its associated color. The system then constructs a complete mapping for all emotions in its dataset through k-nearest neighbor interpolation in VA space.

For an unmapped emotion e_t with coordinates (v_t, a_t), the system identifies k nearest mapped emotions based on Euclidean distance:

$$d(e_t, e_i) = \sqrt{(v_t - v_i)^2 + (a_t - a_i)^2}.$$

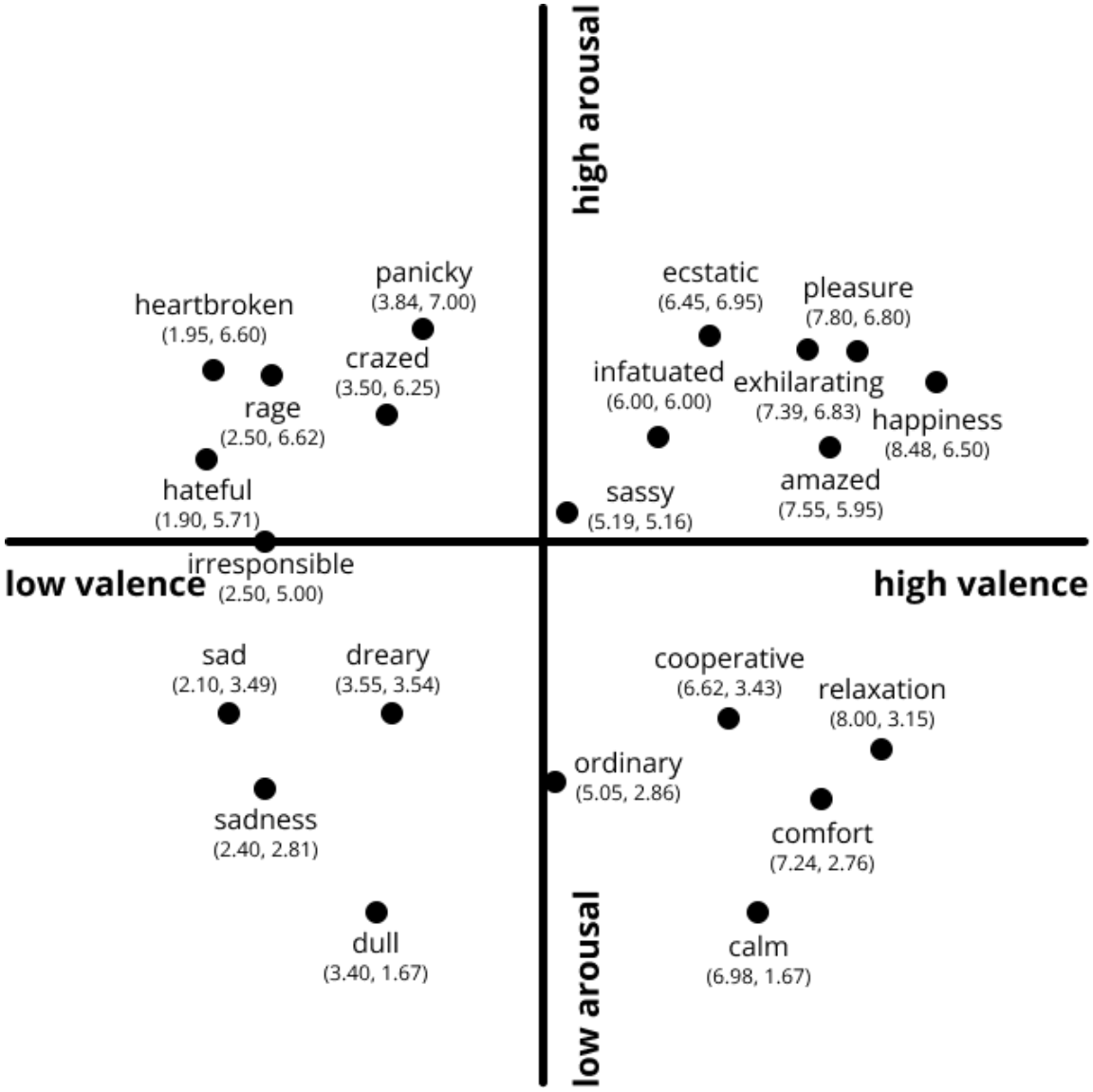

Fig. 5. Emotions presented in Part 1 of Hueman's onboarding survey mapped based on their scores on the valence-arousal spectrum.

The predicted color is computed through distance-weighted interpolation:

$$c_t = \sum_{i=1}^{k} w_i \cdot c_i,$$

where weights

$$w_i = \frac{\frac{1}{d(e_t, e_i)}}{\sum_{j=1}^{k} \frac{1}{d(e_t, e_j)}}$$

prioritize closer neighbors.

This interpolation operates in HSV color space to independently adjust hue (H), saturation (S), and value (V) components. As users continue logging emotions with colors, the system refines these mappings through incremental learning: each new color–emotion pair updates the mapping and triggers regeneration of predictions for related emotions.

To ensure visual distinctiveness when multiple emotions map to similar colors, the algorithm applies variations guided by emotion-specific seeds derived from string hashing. This approach balances the following goals: respecting users' explicit associations, adapting dynamically to new user data, and maintaining psychological coherence through VA theory.

There is continuous refinement of the user mappings. When a user selects emotions $E' = \{e'_1, e'_2, \ldots, e'_n\}$ for a given color c', the system first directly updates $M \leftarrow M \cup \{(e'_i, c') \mid e'_i \in E'\}$, then initiates a complete remapping phase for all unmapped emotions in the dataset. The system also implements cross-validation through bidirectional mappings, maintaining both emotion→color and color→emotion indices that are synchronized after each update to maintain consistency. The algorithm also applies adaptive diversity constraints during remapping to prevent convergence toward identical colors for similar emotions.

3.7 Color Logging and Viewing

The main page of Hueman consists of a month view which displays the current month and indicates the current day (Figure 6). By selecting a day, users can access a time-based interface with a scrollable 24-hour view. Users can add entries to the current day by selecting a start time and end time, and then choosing a color to represent the way they feel. Based on the selected color, the system predicts a set of possible emotions (e.g., 20) that the user may be experiencing (Figure 2). These are predicted based on past logs and the onboarding survey. In designing the logging method and views, we prioritized ease of use and opportunities for reflection.

Digital or analog journaling can be challenging for individuals with demanding schedules, limited cognitive resources, or those who simply forget what they felt or did on a given day [1, 48, 80]. Lowering barriers to entry is critical, as motivation strongly influences initial adoption and integration into daily routines [30, 61].

To address these considerations, Hueman uses a calendar-based input interface inspired by commonly used platforms such as Google Calendar and Microsoft Outlook [26, 58]. This familiar layout supports convenient logging and context-based reflection, allowing users to recognize time periods and associated emotions [5, 39, 40]. Using color as a medium for emotion logging further enhances expressiveness while remaining low-burden [9].

Hueman takes in user emotion data through manual entry. Manual entry, even through technology-mediated approaches has been associated with sense of agency, self-awareness, and increased mindfulness [1, 9]. Users maintain control in the data that they provide to Hueman and in utilizing information and tools Hueman provides to support their well-being. The way Hueman is designed is intended to make in-moment reflection easier for users by allowing them to easily log their feelings even within time-constrained contexts.

Logging is restricted to the current 24-hour period, with past and future days visible but locked for editing. This design encourages timely recording of emotions, reduces the likelihood of forgetting or reconstructing past experiences, and minimizes the pressure to retrospectively fill in logs—issues participants reported as frustrating in prior studies [1]. Additionally, the interface and visualizations are designed so that days without logged entries do not stand out, avoiding negative emotions such as guilt associated with missed tracking [1].

3.8 Data visualization

Reflection occurs when individuals attempt to make sense of their data and their lives [11, 48, 71], making it essential to provide tools that support reflection across different time scales [50]. Hueman offers a variety of time-based views, inlcuding short term detailed views (day, week) and long term summary views (month, year). Time based views have proven to be both aesthetically pleasing and easily understandable to users, supporting multiple forms of reflection and self-understanding [5, 31, 74].

Hueman acknowledges that some users prefer not to have their entire day represented by a single color and would want a more nuanced representation [68]. Through day and week views, users can easily observe the distribution of colors representing their emotions and patterns that may inform adjustments to their behavior or environment. In order to maintain long-term clarity. In the month and year views, each day is represented by the color most dominantly logged during that day.

Beyond time-based views, Hueman provides analytical insights into a user's color–emotion associations, including emotions associated with a given color, colors associated with a given emotion, and top emotions over a selected time period [21] (Figure 6). These insights allow users to leverage color for emotion management and adjustment in daily life, including applications in clothing, interior decor, and user interfaces. In addition, understanding dominant emotions given a specific time frame (days, weeks, months) can help users understand themselves better and have a broader view of their emotional life.

In designing visualizations, we prioritized minimalism and aesthetic appeal as this can make them more engaging [14, 23] and memorable [10]. Furthermore, casual and approachable depictions of personal data, as implemented in Hueman, support more frequent and comfortable self-reflection, aligning with ongoing explorations of aesthetically driven personal informatics [65].

3.9 Adaptive User Interface Functionality

In the adaptive interface feature, users can enter their current emotion, the level they feel it on a scale to 1-5, and their desired emotion. Based on the inputted desired emotion, the interface will adapt to a color which is mapped towards that emotion (Figure 1). The user can first preview the color through the application adaptation, and adjust if desired [41, 61]. Once the user confirms their selection, they can start the adaptive theme session, which is a 5-minute session of using the adaptive interface in both the application and their mobile wallpaper. The widget on the user's device will also adapt.

The way that AUI wallpapers work for iOS mobile devices is through Apple Shortcuts. When the user confirms their color for UI adaptation, the Hueman app categorizes that color into one of the 13 categories mentioned in 3.2 and sends an email with that color category to the user's email. When the user receives this email notification, a shortcut will run to adapt their wallpaper to the given color. Setting up shortcuts with wallpapers and associations is part of the onboarding for the app, and the reason adaptation is done this way is due to limitations in the permissions that Apple provides to applications in terms of user interface adaptation.

The 13 colors chosen for the themed wallpapers are based on Adobe's defined hex values for these colors and then transparency adjusted 50% towards the white direction [3]. The reason there is a 50% adjustment is for a few reasons. The first is because highly saturated colors, such as those provided from Adobe [3] make it difficult for users to use their mobile devices and causes overstimulation due to the saturation, which can decrease the impact of emotional adjustment. This was shown from the pilot study. The second reason is to maintain the wallpaper background as a

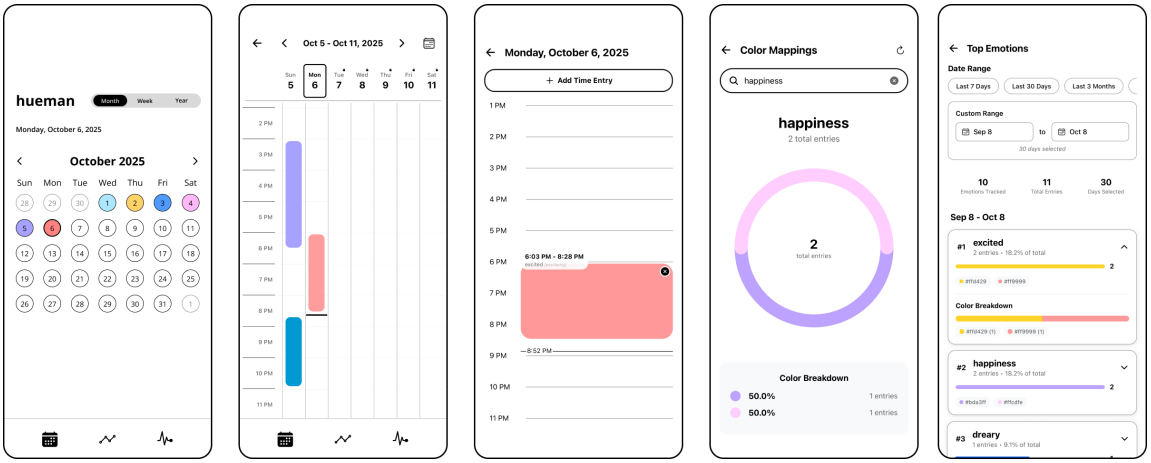

Fig. 6. Pages from the Hueman application, including (left to right) (1) monthly view, (2) weekly view, (3) daily view, (4) emotion to color mappings, and (5) top emotions.

theme rather than the central adaptive aspect due to the limitations in customization through iOS and amount of work necessary to initially set up wallpapers and shortcuts for this feature of the application. Due to the restricted customizability aspect of iPhone wallpapers, these color backgrounds stand out less in order for the application widget to stand out more. The widget, like the Hueman application, is able to completely adapt colors, and because the widget takes up ample space on the user's screen, it can act as support in more customized theme adaptation. This is one of the significant reasons for inclusion of a widget in addition to act as a reminder to log emotions.

After the 5-minute session ends, the user goes back to the application and scores both emotions again on a scale of 1-5. Based on these inputs the algorithm will adjust the user's color-emotion associations.

4 Evaluation

In evaluating Hueman we wanted to understand: (1) how it could support emotional awareness and reflection, (2) users' experiences with personalized, color-based emotional tracking and custom color definitions, and (3) how they engaged with a color-adaptive UI for emotional adaptation, including perceptions of its effectiveness. With IRB approval, we conducted a user study with seven participants who had prior experience with various forms of self-tracking, such as social media-based logging, automated biometric logging, fitness tracking, and journaling. We used the findings both to evaluate the application's design and to position it as a design probe for exploring relationships between color and emotion. Participants were compensated with a $25 gift card for participating in the study.

4.1 User Study Procedure

To explore the effectiveness of Hueman, we conducted a formative study with seven participants recruited from the researchers' social network. Participants expressed interest in gaining insight into their emotions, and were preferred if they had prior self-tracking experience. Ages ranged from 18 to 50, with an average of 28.4 years.

Participants were guided through the onboarding process via a combination of verbal instructions and a written onboarding guide. This included downloading the app, creating an account, and setting up the AUI. Participants then used the application for a week. They were encouraged to explore the app and interact with its features daily, but were

not required to log at specific times. Instead, they were instructed to log emotions when it felt natural or meaningful to them.

At the conclusion of the study, each participant completed a 30-minute exit interview consisting of qualitative and quantitative questions to gather feedback on the app's functionality, usability, and impact on emotional awareness.

5 Results

5.1 Can Hueman support emotional reflection and awareness?

Hueman supported emotional reflection both in the moment and retroactively. P1, P2, P4, and P7 reported that prior to using Hueman, they rarely reflected on their emotions. Through using Hueman, they became more aware of what they were feeling at a given moment and could also look back to analyze past emotional patterns. Some users, like P1, P2, and P5, used the logging feature of the application as they recognized emotional changes. Others, like P4, also used the app at the end of the day to reflect on their entire day: *"at the end of the day, it's time to wind down and reflect on emotions"*. P4 mentioned that using Hueman *"definitely validated the emotions [she] already had and brought implicit ones to life, it made [her] understand [herself] better in the way [she] perceives the world"*. Participants appreciated the manual logging feature, which gave them agency in identifying and processing their emotions: *"manual and mental tracking is so much better because I don't really agree that you should be trusting physiological things like because I was doing this, I was stressed. Mental is not always what your body is feeling, you need to make sure you feel ok, not through bodily indicators"*. They agreed that the simple interface made the app and its features easy to use, with P4 saying that the look of everything is *"simplistic and minimalist, it doesn't try to make it too much in your face and overwhelming"*.

Hueman's time-based logging format further supported context-based emotional reflection. Users reported thinking more about the causes of their emotions even without explicit prompts. For example, P4 noted that *"[Hueman] forced [her] to think about what [she] did that day. Certain social events made [her] happier and [she] reflected on how things made [her] feel"*. P5 mentioned that *"[her] emotions were more skewed towards excitement because it was the weekend, and back at school [she] was more bored and tired"*. Users pointed to the time based logging system as a method to see *"how emotions change throughout the day through a general color scheme"*. P6 added that she noticed *"[she] usually feels really happy after talking to someone [she] loves, and a lot more stressed or concerned after spending a long time alone"*.

5.2 Experience with Personalized, Color-Forward Emotional Tracking

During the onboarding survey, participants found it easy and natural to select colors for emotions. P5 explained *"I just picked whatever I vibed with at the moment, whatever I felt inspired to choose"*. Through using Hueman, users began to reflect on their existing color-emotion associations. P2, P3, P4, and P5 all cited the Disney Pixar movie Inside Out [20, 55] as the source of their initial color-emotion associations before using the app. P5 described that her main association before using the app was that sadness was blue, and that it was influenced by Inside Out and other media. P4 further mentioned that, to her, red meant anger and frustration, blue meant relaxation and sadness, and yellow is an energetic and happy color, citing these associations from Inside Out, which she watched when she was younger. P2 further emphasized on the impact of media on color-emotion associations, saying that *"When you see characters from cartoons come up from a screen, you can immediately tell if they're good or bad from the color of clothing they're wearing"*.

However, users reported that through using the application, they realized that media-influenced associations did not always match personal experience. P1, P2, and P4 felt that the colors they liked made them happier, which diverged from typical associations. P2 expressed that green and blue colors reflected positive valence for her, differing from the

common associations that yellow represents joy and blue represents sadness. P6 further mentioned that *"I realized sometimes I feel blue, but it doesn't really attach to any negative or sad feelings. I just want to get close to water"*.

Hueman encouraged participants to think more deeply about personal color-emotion associations. P4 said that to her, purple means collaboration: *"I don't know why exactly I thought that, but it kind of clicked for me that it was. I lean towards purple, and this was the case when I was logging my emotions. I haven't really seen this in another context so it was surprising"*. P4 also reflected on intrinsic associations revealed by Hueman's data visualizations: *"I didn't realize I used light pink for stress and frustration, I personally did not think that about myself, and I thought it was interesting"*. Participants reported that Hueman prompted them to question their assumptions. They asked, *"Why do I think this color is this feeling?"*, and brought connections in the brain to an explicit level, strengthening their own emotions and preferences. These experiences represent reflection through defamiliarization, making the mundane and everyday strange [65]. We found that Hueman led to defamiliarization of colors and how users interact with colors. P4 saw colors in a new way since she did not know she had these associations in the past. In addition, P6 said that using Hueman made her more sensitive to color and the differences between colors: *"I would say my color association with emotions becomes stronger now after using the app. Even if something has the same yellow tone, I will adjust how bright and light it will be depending on how strongly I feel"*.

An interesting finding is that using Hueman made users reflect on how their surroundings can influence their color-emotion associations and how their own associations change. P5 mentioned that she logged two shades of orange in the same day, but one as excitement and one as calmness. When logging orange as calmness, she was in a cafe. The cafe was orange and it made her feel calm. She realized this impact when reflecting on the representations of colors and emotions within the Hueman app and had made these associations more subconsciously in the moment.

Users further mentioned liking both detailed views of color logs and more general views of color logs. P4 liked how she could see the colors that spanned her day while P6 liked the monthly calendar view to see how her day progresses with colors.

5.3 Experience with Hueman's Predictive Emotion Generation

Users indicated that Hueman was generally able to predict their emotional state from their inputted color. All participants indicated that in the 20 or so emotions that Hueman recommended for each color entry, they were able to find at least one that accurately reflected their emotional state. P7 mentioned that the application was *"very accurate"* at identifying the emotions she was feeling. The distribution of tagged emotions that were generated versus user-searched was 65.2% to 34.8%. P5 mentioned that Hueman's predictive recommendations could lead her to find a word to describe her emotions that she couldn't have thought of herself, but believed was accurate. In addition, Hueman's emotion predictive system led users to use a broader variety of language in describing their emotional states. P1 said that *"Usually I would've said I'm happy, but if the app recommended joyful I might choose that instead. Similarly, I might choose comfortable or calm instead of relaxed, which I usually use"*.

However, prediction can be difficult as one color can represent many emotions. For example, similar shades of blue can represent both calmness and sadness, which P4 indicated. This can make it difficult for the algorithm to predict emotions even within one quadrant of the valence arousal spectrum. P5 also mentioned that when the Hueman app predicted emotions that did not resonate with her at the moment, it may have been due to conflicting logs she had entered in the past.

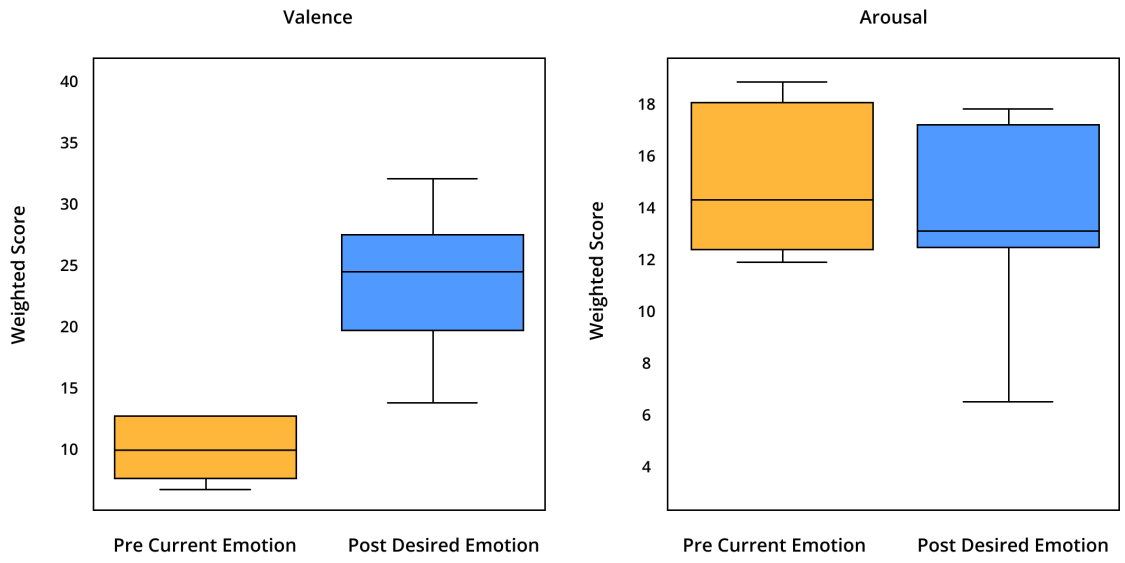

Fig. 7. Changes in users' valence and arousal states before and after using the color-adapted interface session.

5.4 Adaptive User Interface for Emotion Management

Hueman demonstrated the potential for adaptive, color-based UI to support emotion management and adjustment. While our study did not aim to establish causal claims, user experiences provide insights into how AUIs may support emotional regulation.

In helping users move away from their current emotions, participants rated their current emotions at an average of 3.11 before the adaptive emotion sessions and 2.00 afterward. Weighted scores (by extent to which users feel current and desired emotions) indicate that users' current emotions started at a mean valence of 11.96 and a mean arousal of 14.91. After the sessions, the weighted valence of users' goal emotions increased to a mean of 24.75, while arousal decreased slightly to a mean of 12.98, suggesting a shift toward more positive and slightly calmer emotional states (Figure 7).

We found that color-adaptive UI may be more effective for moving towards some VA emotional quadrants than others. For example, P5 used green to calm down and red to improve her energy. She mentioned that green helped her a lot, while red maybe not so much and this may be because she associates red with excitement and also anger. P7 mentioned that the app was effective both for moving towards high valence and low arousal states as well as high valence and high arousal states. Looking at Hueman's logs, the application was most effective for moving towards high valence, low arousal emotions such as calmness. We further noticed that color-adaptive UI works better for color-emotion associations where that color is associated with only one emotion, or one type of emotion for that user. P4 mentioned that her favorite color is light blue, so she connects it to calm and comfort. But the soothing aspect of blue can also mean sadness. She continued expressing that when one color is associated with multiple things, it's harder for her to feel one particular way. For example, yellow was more effective than blue in inducing positive valence emotions. This is because to her, yellow means energy, joy, and happiness. If yellow had meant both joy and anxiety it would be harder.

Users primarily used Hueman to move toward high valence, low arousal emotions such as calmness or happiness. Due to these use cases, maintaining a consistent color on a page with a simple UI could itself be a method of achieving

higher valence and lower arousal. In addition to the influence of color, turning away from the stimulation in mobile devices through staying on the color-adapted application page could help users reach higher valence and lower arousal emotions. For example, P5 used the app one night when she was feeling restless and wanted to feel calm. Shortly after starting the emotion theme session, she fell asleep. She also mentioned that staring at the color on the application was more helpful than having it on the home screen and using other features on mobile devices.

This leads to the misuse [47] of the application's emotion management page and timer as an oasis from other stimulating aspects of mobile devices. P4, for example, used Hueman's 5-minute timer as a time to calm down, breathe, and reflect on emotions. Stopping what she was doing helped her reach more positive and lower arousal states. *"When I used the timer, it allowed me to at the very least reflect on why I felt the things I feel and why I want to feel a certain way. A reflection of what I do to make my day better. It's a 5-minute timer, you can take five minutes in your day".*

6 Discussion

6.1 The Role of Color in Emotional Self-Tracking

We noticed a few different methods of reflection through the use of Hueman, which can be split primarily into two cases: reflection on contextual causes of emotions and defamiliarization of color-emotion associations as reflection. For example, participants such as P4 and P5 described reflecting on how specific contexts (e.g., weekends, social events, or physical environments) shaped their emotional states. This indicates that even a simple logging interface can surface cause-and-effect reasoning in everyday emotional life, extending prior work on reflection in personal informatics.

Hueman also invited users to question their implicit beliefs about color-emotion associations, bringing subconscious assumptions into awareness. Participants' initial associations were strongly influenced by cultural and media influences, but over time they diverged to develop more personalized schemas. This highlights a tension between culturally shared meanings of color, individually constructed associations, and psychological tendencies—both those ingrained through societal influence and those rooted in natural perceptions, such as associating blue with calm because of the sky. This suggests that future systems using color as symbolic representation should hold deeper considerations about how color is used and what representations are influencing users to think.

A pattern across participants was the tendency to associate brighter or lighter colors with higher-valence states and darker shades with lower-valence or more negative states. Users explicitly described lighter shades as "good" or "positive," reinforcing prior work in color psychology [44]. However, these associations were not absolute. Some colors shifted in meaning depending on context (e.g., orange as both calming and energizing), suggesting that while brightness and valence may be correlated, their relationship is mediated by personal experience and situational cues.

These findings indicate that color-emotion mappings in emotional self-tracking systems should not be treated as universal or fixed. Instead, designs could use color as a flexible design parameter. In addition, this points to the need for adaptive visual systems that recognize both common psychological trends and the deeply personal, contextual meanings that users bring to color.

6.2 Agency and Manual Logging in Emotion Tracking

One theme that we noticed was the importance of agency in self-tracking tools. Participants valued manual logging, describing it as a way to preserve their interpretation of emotional states. For example, P4 noted that *"mental is not always what your body is feeling"*. Users also prioritized agency in the color their device was adapted to. Sometimes the application would recommend color UI themes that the user did not believe to be ideal at the moment, even if the color

presented was associated with their desired emotion. Allowing preview of adaptive themes and user adjustment was a feature that was important to users as it allowed them to maintain interpretive control while engaging with suggested themes. Participants emphasized that the process of color adjustment helped them develop a deeper awareness of how their emotions fluctuate, highlighting the value of reflective, exploratory interaction in emotional self-tracking. In these ways, Hueman is aligned with approaches to personal informatics that emphasize self-determination and interpretive flexibility over algorithmic prescription [11].

Hueman also demonstrated the value of supporting multiple rhythms of reflection. Some participants preferred in-the-moment logging when they noticed emotional shifts, while others engaged in retroactive, end-of-day reflection. The coexistence of these practices suggests that effective systems should accommodate both immediate, situated reflection and longer-term, integrative reflection.

These findings highlight a key design implication: emotional self-tracking systems should be built to support diverse temporalities of reflection while maintaining users' sense of agency. Future designs could offer customizable rhythms (e.g., immediate prompts, daily summaries, or weekly reviews), enabling users to adapt the system to their personal preferences and evolving goals.

6.3 Expanding Emotional Vocabulary through Predictive Support

Hueman's predictive emotion suggestions demonstrated potential for scaffolding emotional articulation. Participants reported that the recommended terms helped them find words they *"would not have immediately thought of"* on their own, such as choosing joyful or comfortable instead of happy or relaxed. Beyond the predictive suggestions, Hueman preserved user agency by allowing participants to search the emotion database manually and select terms outside of the recommendations [41, 61]. This combination of predictive and manual exploration enabled users to actively learn and refine their understanding of their own emotional states, with several participants describing the process of identifying emotions as iterative and educational.

However, in using predictive algorithms, limitations remained, particularly where color-to-emotion mappings were ambiguous (e.g., blue representing both calm and sadness). This occasionally produced predictions that did not match the user's current state. These findings underscore the importance of framing predictive support as inspiration rather than prescription, allowing the system to facilitate learning without constraining personal interpretation. Future designs might adaptively refine recommendations while preserving user authority, supporting self-expression, reflective learning, and personal meaning-making in emotional tracking.

6.4 Our Phones as Tools for Emotional Management

Beyond explicit tracking and reflection, people often use their phones to regulate emotions in everyday life, sometimes intentionally and sometimes unconsciously. For example, individuals may pick up their devices to alleviate boredom or stress, to feel excitement or joy, or to seek calmness and a sense of social connection when anxious. This can occur through social media, gaming, messaging, or other forms of digital engagement. In this way, mobile devices act as ubiquitous tools for feeling or not feeling emotions. A study by Davis et al. examined how adolescents use Instagram for emotion regulation [19]. The findings revealed that while some teens engage with Instagram to improve their mood, by seeking out positive content or social support, others may experience negative emotions due to social comparison or exposure to distressing posts. This shows the complexity of digital platforms in emotional adjustment and the need for thoughtful design that considers users' emotional experiences.

Hueman extends this idea by making emotional management more intentional and reflective. By allowing users to log emotions, explore predictive suggestions, and adapt the color of the interface, Hueman transforms implicit interactions with devices into explicit opportunities for awareness and regulation. Participants reported that customizing colors or engaging with predictive emotion prompts helped them consciously shift toward higher-valence, lower-arousal states, or reflect on emotional fluctuations across time. Unlike typical smartphone use, which can be reactive or habitual, Hueman encourages deliberate emotional engagement.

7 Limitations and Future Work

Our study has several important limitations. Due to the small sample size and exploratory nature of the user study (seven participants over a week), we cannot make statistically significant claims about the effectiveness of color-adaptive interfaces for emotion regulation. In addition, our work consisted of participants based primarily in a specific geographic range. Future work with larger, more diverse participant populations is needed to validate the patterns we observed. Similarly, the context of application use was limited to short-term, voluntary engagement, which may not fully capture how users would interact with Hueman in everyday life over extended periods.

While Hueman allowed for personalization of color-emotion associations, these mappings are influenced by psychological tendencies as well as individual experience. For example, participants often associated blue with calmness or relaxation, a connection that may be shaped by environmental cues such as the sky or ocean. These inherent tendencies suggest that while color-emotion associations can be personalized, they are also constrained by broader psychological patterns. Future systems could explore adaptive mapping strategies that account for these tendencies while supporting individual differentiation. In addition due to the limitations of wallpaper and mobile phone theme adjustment, Hueman was limited in the range of colors it could change iOS backgrounds to, relying more on the application widget for complete color adaptation.

Although, Hueman enabled reflection on emotions, it may primarily capture surface-level reasons for feelings, such as immediate situational triggers, rather than deeper causal mechanisms. Users reported that logging and interacting with the app helped them recognize and articulate emotions, but understanding more complex emotional dynamics likely requires reflection on factors such as upbringing, worldview, and other psychological influences, areas that Hueman alone may not fully support. There is also potential for multi-modality in emotional awareness and adjustment. For example, combining music and color could be powerful.

There is design space for richer, more expressive interfaces and data visualizations. While Hueman focused on color-adaptive UI and simple predictive suggestions, future work could explore multi-modal feedback, complex visualizations of emotional trajectories, and interactive methods for self-reflection and emotion regulation. Such enhancements would allow users to engage with emotions in deeper and more nuanced ways, increasing the potential impact of personal informatics tools for emotional well-being.

Finally, Hueman is not designed for users with color vision deficiencies. The system relies on color as the primary medium for emotional expression, tracking, and adaptive feedback. Individuals who are color-blind may not perceive the color-emotion mappings as intended. This restricts the generalizability of Hueman's findings to users with typical color perception. Future work could explore other mediums to make the system more accessible and inclusive.

8 Conclusion

In this work, we presented Hueman, a personalized color-based emotion logging application that combines manual emotion tracking with adaptive color interfaces to support emotional awareness, reflection, and regulation. Through the

design and formative evaluation of Hueman, we demonstrated that color can serve as a meaningful medium for both expressing and understanding emotions, while AUIs can provide in-the-moment support for emotion management. Our findings highlight the importance of personalization, user agency, and context in designing emotion-focused personal informatics tools. Users valued the ability to map colors to their own emotional experiences, reflect on these associations over time, and engage with adaptive interfaces in ways that supported self-understanding. Hueman also illustrates how traditional self-tracking approaches can be extended through thoughtful integration of visual aesthetics, time-based logging, and adaptive technologies. Our study offers insights into the potential of color-adaptive, personalized systems for emotional support. Future work may explore scaling such systems to larger populations, integrating multimodal data sources, and refining adaptive algorithms to more effectively support a wider range of emotional states. Ultimately, Hueman demonstrates that personal informatics tools can move beyond static tracking to become dynamic, expressive, and supportive companions for emotional well-being.

9 GenAI Usage Disclosure

Generative AI tools (ChatGPT, Claude, DeepSeek) were used to support the writing and debugging of code for the Hueman application.

References

[1] Parastoo Abtahi, Victoria Ding, Anna C. Yang, Tommy Bruzzese, Alyssa B. Romanos, Elizabeth L. Murnane, Sean Follmer, and James A. Landay. 2020. Understanding physical practices and the role of technology in manual self-tracking. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 4, 4 (2020), 1–24. doi:10.1145/3432236

[2] Francis M. Adams and Charles E. Osgood. 1973. A Cross-Cultural Study of the Affective Meanings of Color. *Journal of Cross-Cultural Psychology* 4, 2 (1973), 135–156. doi:10.1177/002202217300400201

[3] Adobe Inc. 2025. Adobe Color (Adobe Express). https://color.adobe.com/. Accessed: 2025-10-06.

[4] Mina Alipour, Ramin S. S., M. Ali Babar, and R. S. 2023. Emoticontrol: Emotions-based Control of User-Interfaces Adaptations. *Proceedings of the ACM on Human-Computer Interaction* 7, EICS (2023), 1–29. doi:10.1145/3593227

[5] Bon Adriel Aseniero, Charles Perin, Wesley Willett, Anthony Tang, and Sheelagh Carpendale. 2020. Activity River: Visualizing Planned and Logged Personal Activities for Reflection. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20)*. ACM, 1–13. doi:10.1145/3313831.3376442

[6] A. Ayobi. 2020. A Customisable and Pictorial Self-Tracking App to Support Agency in Multiple Sclerosis Self-Care. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* 2020, 1 (2020), 1–13. doi:10.1145/3313831.3376809

[7] A. Ayobi, T. Sonne, P. Marshall, and A. L. Cox. 2018. Flexible and Mindful Self-Tracking: Design Implications from Paper Bullet Journals. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery (ACM), 1–14. doi:10.1145/3173574.3173602

[8] Ali Azer. 2019. The sun and how do we feel about the color yellow? Methodological concerns. *Journal of Environmental Psychology* 66 (2019), 101350. doi:10.1016/j.jenvp.2019.101350

[9] M. Barker-Canler. 2024. Flexible Minimalist Self-Tracking to Support Individual Reflection. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* 2024, 1 (2024), 1–12. doi:10.1145/3660339

[10] Scott Bateman, Regan L. Mandryk, Carl Gutwin, Aaron Genest, David McDine, and Christopher Brooks. 2010. Useful Junk?: The Effects of Visual Embellishment on Comprehension and Memorability of Charts. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*. ACM, Atlanta, Georgia, USA, 2573–2582. doi:10.1145/1753326.1753716

[11] Eric P. S. Baumer. 2015. Reflective Informatics: Conceptual Dimensions for Designing Technologies of Reflection. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, Seoul, Republic of Korea, 585–594. doi:10.1145/2702123.2702234

[12] Dermot Browne, Peter Totterdell, and Mike Norman. 1990. *Adaptive User Interfaces*. Academic Press, London. Also available as an eBook ISBN 978-1483294254.

[13] Rafael A. Calvo and Dorian Peters. 2012. Positive computing: technology for a wiser world. *Interactions* 19, 4 (2012), 33–37. doi:10.1145/2212877.2212886

[14] Nick Cawthon and Andrew Vande Moere. 2007. The Effect of Aesthetic on the Usability of Data Visualization. In *Proceedings of the 11th International Conference on Information Visualization (IV '07)*. IEEE, 6–11. doi:10.1109/IV.2007.60

[15] Kendra Cherry. 2023. The Psychology of the Color Yellow. https://www.verywellmind.com/the-color-psychology-of-yellow-2795823 Accessed: 2025-10-05.

[16] China National Tourist Office. 2020. Peking Opera Facial Masks. http://cnto.org.uk/the-culture4-2/beijing-opera.html

[17] Eun Kyoung Choe, Bongshin Lee, Matthew Kay, Wanda Pratt, and Julie A. Kientz. 2015. SleepTight: Low-burden, self-monitoring technology for capturing and reflecting on sleep behaviors. In *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15)*. Association for Computing Machinery (ACM), New York, NY, USA, 121–132. doi:10.1145/2750858.2804266

[18] Xerox Corporation. 2020. International Color Guide: Cultural Associations. https://www.xerox.com/en-us/small-business/tips/color-guide Accessed: 2025-10-05.

[19] Katie Davis, Rotem Landesman, Jina Yoon, JaeWon Kim, Daniela E. Munoz Lopez, Lucia Magis-Weinberg, and Alexis Hiniker. 2025. How Teens Use Instagram To Regulate Their Emotions. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*. ACM. doi:10.1145/3706598.3713844

[20] Pete Docter. 2015. Inside Out. Film.

[21] Malin Eiband, Hanna Schneider, Mark Bilandzic, Julian Fazekas-Con, Mareike Haug, and Heinrich Hussmann. 2018. Bringing Transparency Design into Practice. In *Proceedings of the 23rd International Conference on Intelligent User Interfaces (IUI '18)*. Association for Computing Machinery, Tokyo, Japan, 211–223. doi:10.1145/3172944.3172961

[22] Andrew J. Elliot. 2014. Color and psychological functioning: a review of theoretical and empirical work. *Frontiers in Psychology* 5 (2014), 978. doi:10.3389/fpsyg.2014.00978

[23] Chloe Fan, Jodi Forlizzi, and Anind K. Dey. 2012. A Spark of Activity: Exploring Informative Art as Visualization for Physical Activity. In *Proceedings of the 2012 ACM Conference on Ubiquitous Computing (UbiComp '12)*. ACM, Pittsburgh, Pennsylvania, 81–84. doi:10.1145/2370216.2370229

[24] Maria A. Ferrario, Will Simm, Adrian Gradinar, Stephen Forshaw, Marcia T. Smith, Thomas Lee, Ian Smith, and Jon Whittle. 2017. Computing and mental health: Intentionality and reflection at the click of a button. In *Proceedings of the 11th EAI International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth '17)*. Association for Computing Machinery (ACM), New York, NY, USA, 1–10. doi:10.1145/3154862.3154877

[25] Gerhard Fischer. 2001. User Modeling in Human–Computer Interaction. In *User Modeling 2001*. Springer, 5–19.

[26] Google LLC. 2024. Google Calendar. https://calendar.google.com. Accessed: 2025-10-06.

[27] Francesco Gullà, Luca Cavalieri, Stefano Ceccacci, Roberto Bevilacqua, and Riccardo Menghi. 2015. Design Adaptable and Adaptive User Interfaces: A Method to Manage the Information. In *Communications in Computer and Information Science*. Vol. 552. Springer, 1–14. doi:10.1007/978-3-319-19889-7_1

[28] Mitsuhiko Hanada. 2018. Correspondence Analysis of Color–Emotion Associations. *Color Research Application* 43, 2 (2018), 224–237. doi:10.1002/col.22171

[29] Daniel Harrison, Paul Marshall, Nadia Bianchi-Berthouze, and Jon Bird. 2015. Activity tracking: Barriers, workarounds and customisation. In *Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing (UbiComp '15)*. Association for Computing Machinery (ACM), New York, NY, USA, 617–621. doi:10.1145/2750858.2805832

[30] Dandan Huang, Melanie Tory, Bon Adriel Aseniero, Lyn Bartram, Scott Bateman, Sheelagh Carpendale, Anthony Tang, and Rob Woodbury. 2015. Personal Visualization and Personal Visual Analytics. *IEEE Transactions on Visualization and Computer Graphics* 21, 3 (2015), 420–433. doi:10.1109/TVCG.2014.2359887

[31] Dandan Huang, Melanie Tory, and Lyn Bartram. 2016. A Field Study of OnCalendar Visualizations. In *Proceedings of Graphics Interface 2016 (GI '16)*. Canadian Human-Computer Communications Society, Victoria, British Columbia, Canada, 1–8. https://dl.acm.org/doi/10.5555/2930668.2930673

[32] Smithsonian Institution. 2023. Red. https://asia.si.edu/explore-art-culture/art-stories/colors/red/ Accessed: 2025-10-05.

[33] Domicele Jonauskaite, Ahmad Abu-Akel, Nele Dael, Daniel Oberfeld, Ahmed M. Abdel-Khalek, Abdulrahman S. Al-Rasheed, Jean-Philippe Antonietti, Victoria Bogushevskaya, Amer Chamseddine, Eka Chkonia, Violeta Corona, Eduardo Fonseca-Pedrero, Yulia A. Griber, Gina Grimshaw, Aya Ahmed Hasan, Jelena Havelka, Marco Hirnstein, Bodil S. A. Karlsson, Emmanuel Laurent, Matti Lindeman, Lutz Marquardt, Pascal Mefoh, Maria Papadatou-Pastou, Ana Pérez-Albéniz, Niloofar Pouyan, Mariam Roinishvili, Lidiya Romanyuk, Antonio Salgado Montejo, Yona Schrag, Aygul Sultanova, Meelis Uusküla, Satu Vainio, Grzegorz Wasowicz, Slobodan Zdravković, Min Zhang, and Christian Mohr. 2020. Universal patterns in color-emotion associations are further shaped by linguistic and geographic proximity. *Psychological Science* 31, 10 (2020), 1245–1260. doi:10.1177/0956797620948810

[34] Bullet Journal. 2017. Year in Pixels. https://bulletjournal.com/blogs/bulletjournalist/deep-dive-year-in-pixels. Accessed: 2025-10-04.

[35] Claudia Kawai, Yang Zhang, Gáspár Lukács, Wenyi Chu, Chaoyi Zheng, Cijun Gao, Davood Gozli, Yonghui Wang, and Ulrich Ansorge. 2023. The good, the bad, and the red: implicit color-valence associations across cultures. *Psychological Research* 87, 3 (2023), 704–724. doi:10.1007/s00426-022-01697-5

[36] Neslihan Kaya and Helen H. Epps. 2004. Relationship between Color and Emotion: A Study of College Students. *College Student Journal* 38, 3 (2004), 396–405.

[37] Nanum Kim, Sangsu Jang, Hansol Kim, Dayoung Shin, and Young-Woo Park. 2025. Lino: An Interactive System for Daily Mood Recordings Supporting Meaning-Making through Single Stroke Drawing Approach. In *Proceedings of the 2025 ACM Designing Interactive Systems Conference (DIS '25)*. ACM, 2255–2269. doi:10.1145/3715336.3735675

[38] Taewan Kim, Haesoo Kim, Ha Yeon Lee, Hwarang Goh, Shakhboz Abdigapporov, Mingon Jeong, Hyunsung Cho, Kyungsik Han, Youngtae Noh, Sung-Ju Lee, and Hwajung Hong. 2022. Prediction for Retrospection: Integrating Algorithmic Stress Prediction into Personal Informatics Systems for College Students' Mental Health. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. ACM, New Orleans, LA, USA, 1–20. doi:10.1145/3491102.3517701

[39] Taewan Kim, Donghoon Shin, Young-Ho Kim, and Hwajung Hong. 2024. Momentary Stressor Logging and Reflective Visualizations. In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems (CHI '24)*. ACM, 1046–1059. doi:10.1145/3613904.3642662

[40] Kristin Kleinspehn, Marten Schellenberg, and Florian Alt. 2021. Understanding People's Use of and Perspectives on Mood-Tracking Apps. *JMIR Mental Health* 8, 7 (2021), e28346. doi:10.2196/28346

[41] Todd Kulesza, Margaret Burnett, Weng-Keen Wong, and Simone Stumpf. 2015. Principles of Explanatory Debugging to Personalize Interactive Machine Learning. In *Proceedings of the 20th International Conference on Intelligent User Interfaces (IUI '15)*. Association for Computing Machinery, Atlanta, GA, USA, 126–137. doi:10.1145/2678025.2701399

[42] Radha Kumaran, Viral Niraj Doshi, Sherry X. Chen, Avinash Ajit Nargund, Tobias Höllerer, and Misha Sra. 2023. EChat: An Emotion-Aware Adaptive UI for a Messaging App. In *Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology (UIST '23)*. ACM. doi:10.1145/3586182.3616698

[43] Andrei Kushkin, Alberto Giordano, Amy Griffin, and Alexander Savelyev. 2023. Cognitively Congruent Color Palettes for Mapping Spatial Emotional Data. *Cartographic Perspectives* 102 (2023), 1–29. doi:10.14714/CP102.1821

[44] D. Lakens et al. 2012. But for the Bad, There Would Not Be Good: Grounding Valence in Brightness Through Shared Relational Structures. *Journal of Experimental Psychology: General* 141, 4 (2012), 706–724. doi:10.1037/a0026468

[45] Kwangyoung Lee and Hwajung Hong. 2017. Designing for Self-Tracking of Emotion and Experience with Tangible Modality. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. ACM, Denver, CO, USA, 3057–3064. doi:10.1145/3027063.3053221

[46] Ian Li. 2006. MoodJam. https://www.ianli.com/projects/moodjam.html Accessed: 2025-10-05.

[47] Isabel Li, Ace S. Chen, Eric Rawn, Shm Garanganao Almeda, Bjoern Hartmann, and Jingyi Li. 2025. Reimagining Misuse as Creative Practice: Impressions and Implications of Usage Norms on Digital Artists. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (CHI '25)*. ACM. doi:10.1145/3706598.3714068

[48] Ian Li, Anind K. Dey, and Jodi Forlizzi. 2010. A Stage-Based Model of Personal Informatics Systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*. ACM, 557–566. doi:10.1145/1753326.1753409

[49] Ian Li, Anind K. Dey, and Jodi Forlizzi. 2011. GoSlow: Designing for Slowness, Reflection, and Solitude. In *Proceedings of the 2011 CHI Conference on Human Factors in Computing Systems (CHI '11)*. ACM, 2661–2670. doi:10.1145/1978942.1979332

[50] Ian Li, Anind K. Dey, and Jodi Forlizzi. 2011. Understanding My Data, Myself: Supporting Self-Reflection with Ubicomp Technologies. In *Proceedings of the 13th International Conference on Ubiquitous Computing (UbiComp '11)*. ACM, Beijing, China, 405–414. doi:10.1145/2030112.2030166

[51] Jia Zheng Lim, James Mountstephens, and Jason Teo. 2020. Emotion Recognition Using Eye-Tracking: Taxonomy, Review and Current Challenges. *Sensors* 20, 8 (2020), 2384. doi:10.3390/s20082384

[52] Katherine Lin, Juna Kawai-Yue, Adira Sklar, Lucy Hecht, Sarah Sterman, and Tiffany Tseng. 2025. Crafting a personal journaling practice: Negotiating ecosystems of materials, personal context, and community in analog journaling. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*. 1–13. doi:10.1145/3589248.3591181

[53] Oura Health Ltd. 2025. Oura Ring. https://ouraring.com.

[54] Giorgia Lupi and Stefanie Posavec. 2016. *Dear Data*. Princeton Architectural Press, New York, NY. https://www.dear-data.com/

[55] Kelsey Mann. 2024. Inside Out 2. Film.

[56] John D. Mayer, David R. Caruso, and Peter Salovey. 1999. Emotional intelligence meets traditional standards for an intelligence. *Intelligence* 27, 4 (1999), 267–298. doi:10.1016/S0160-2896(99)00016-1

[57] Nesrine Mezhoudi. 2013. User Interface Adaptation based on User Feedback and Machine Learning. In *IUI Companion*. ACM, 25–28. doi:10.1145/2451176.2451184

[58] Microsoft Corporation. 2024. Outlook Calendar. https://outlook.live.com/calendar/. Accessed: 2025-10-06.

[59] Ali Mollahosseini, Behzad Hasani, and Mohammad H. Mahoor. 2017. AffectNet: A Database for Facial Expression, Valence, and Arousal Computing in the Wild. In *IEEE Transactions on Affective Computing*, Vol. 10. 18–31. doi:10.1109/TAFFC.2017.2740920

[60] Leonhard Oberascher and Michael Gallmetzer. 2003. Colour and Emotion. *Psychology of Aesthetics, Creativity, and the Arts* (2003).

[61] Fredrik Ohlin and Carl Magnus Olsson. 2015. Intelligent Computing in Personal Informatics: Key Design Considerations. In *Proceedings of the 20th International Conference on Intelligent User Interfaces (IUI '15)*. Association for Computing Machinery, Atlanta, Georgia, USA, 263–274. doi:10.1145/2678025.2701378

[62] Liang Ou, Stephen Luo, and Angela Woodcock. 2010. A study of color emotion and color preference. Part I: Hue, lightness, and chroma. *Color Research & Application* 35, 1 (2010), 50–64. doi:10.1002/col.20510

[63] Stephen E. Palmer and Karen J. Schloss. 2010. An ecological valence theory of human color preference. *Proceedings of the National Academy of Sciences* 107, 19 (2010), 8877–8882. doi:10.1073/pnas.0906172107

[64] Youngsoon Park and Denise A. Guerin. 2002. Meaning and Preference of Interior Color Palettes Among Four Cultures. *Journal of Interior Design* 28, 1 (2002), 27–39. doi:10.1111/j.1939-1668.2002.tb00370.x

[65] Zachary Pousman, John Stasko, and Michael Mateas. 2007. Casual Information Visualization: Depictions of Data in Everyday Life. *IEEE Transactions on Visualization and Computer Graphics* 13, 6 (2007), 1145–1152. doi:10.1109/TVCG.2007.70515

[66] James A. Russell. 1980. A Circumplex Model of Affect. *Journal of Personality and Social Psychology* 39, 6 (1980), 1161–1178. doi:10.1037/h0077714

[67] Diana Santos, Alberto Simões, and Cristina Mota. 2022. Broad Coverage Emotion Annotation. *Language Resources & Evaluation* 56, 4 (2022), 857–879. doi:10.1007/s10579-021-09565-1

[68] Stephen M. Schueller, Martha Neary, Jocelyn Lai, and Daniel A. Epstein. 2021. Understanding People's Use of and Perspectives on Mood-Tracking Apps: Interview Study. *JMIR Mental Health* 8, 8 (2021), e29368. doi:10.2196/29368

[69] Donald A. Schön. 1983. *The Reflective Practitioner: How Professionals Think in Action.* Routledge.

[70] Sachin Shah, J. Narasimha Teja, and Samit Bhattacharya. 2015. Towards affective touch interaction: predicting mobile user emotion from finger strokes. *Journal of Interaction Science* 3, 1 (2015), 6. doi:10.1186/s40166-015-0013-z

[71] Aaron Springer and Steve Whittaker. 2019. Progressive Disclosure: Empirically Motivated Approaches to Designing Effective Transparency. In *Proceedings of the 24th International Conference on Intelligent User Interfaces (IUI '19).* Association for Computing Machinery, Marina del Rey, CA, USA, 107–118. doi:10.1145/3301275.3302322

[72] The How We Feel Project, Inc. 2025. How We Feel. https://howwefeel.org/ Accessed: 2025-10-04.

[73] P. Valdez and A. Mehrabian. 1994. Effects of color on emotions. *Journal of Experimental Psychology: General* 123, 4 (1994), 394–409. doi:10.1037/0096-3445.123.4.394

[74] Shimin Wang, Yuzuru Tanahashi, Nick Leaf, and Kwan-Liu Ma. 2015. Design and Effects of Personal Visualizations. *IEEE Computer Graphics and Applications* 35, 4 (2015), 58–66. doi:10.1109/MCG.2015.74

[75] Amy Beth Warriner, Victor Kuperman, and Marc Brysbaert. 2013. Norms of valence, arousal, and dominance for 13,915 English lemmas. *Behavior Research Methods* 45, 4 (2013), 1191–1207. doi:10.3758/s13428-012-0314-x

[76] L. Wilms and D. Oberfeld. 2018. Color and Emotion: Effects of Hue, Saturation, and Brightness. *Psychological Research* 82, 6 (2018), 1354–1367. doi:10.1007/s00426-017-0880-8

[77] Gary Wolf and Kevin Kelly. 2007. The Quantified Self. *Wired* (Oct. 2007). https://www.wired.com/2007/10/ff-quantifiedself/

[78] Sandy Wolfson and Gill Case. 2000. The Effects of Sound and Colour on Responses to a Computer Game. In *Proceedings of [Conference Name, if available].*

[79] L. Xu. 2023. Color2Vec: Web-Based Modeling of Word-Color Association with Natural Language Processing. *ACM Transactions on Computer-Human Interaction (TOCHI)* 30, 4 (2023), 1–29. doi:10.1145/3571816

[80] Tianyi Xu, Sarah Cook, Bryan Semaan, and Stephen A. Voida. 2025. Expression-in-action and Expression-on-action: A Systematic Review of Mediums for Expression in Mental Health. In *Proceedings of the 2025 ACM SIGCHI Conference on Human Factors in Computing Systems (CHI '25).* Association for Computing Machinery, 1–20. doi:10.1145/3706598.3713669

[81] Zhihong Zeng, Maja Pantic, Glenn I. Roisman, and Thomas S. Huang. 2009. A Survey of Affect Recognition Methods: Audio, Visual, and Spontaneous Expressions. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 31, 1 (2009), 39–58. doi:10.1109/TPAMI.2008.52