Fostering Positive Connections Through Interactive Messages: HAPPI

This document outlines the structure and methodology behind HAPPI, a system designed to foster emotional well-being and community connection through personalized, interactive messages in public spaces.

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ABSTRACT

Loneliness is on the rise, accelerating during and after the COVID-19 Pandemic [16]. Loneliness contributes major costs from higher mortality rates and economic costs where individuals lack human connection in natural settings [5]. Pursuit to the UN Sustainable Development Goal 3.4 to promote mental health and well-being, our project, “HAPPI” is a facilitator to create togetherness by sympathizing parts of the shared human experience through (1) responding to prompts that harmonizes with each other's lives and (2) receiving these responses through printed pamphlets made for each unique individual user. HAPPI is to be used in natural settings such as at a college campus. Our design is formulated on psychological and cultural studies on loneliness, positivity/happiness, and social connection, along with interviews with students of different backgrounds and working psychologists. HAPPI is a robot-like device that takes an input from a user through an iPad, outputs a printed message through a printer, and has a body that takes the shape of a robot! In this article, we describe our steps in creating HAPPI to foster positive connections through authentic messages.

1 INTRODUCTION

In today's fast-paced public spaces, individuals often experience feelings of disconnection and overwhelm, lacking meaningful and positive interactions with those around them [2]. Emotional well-being is crucial for overall health and happiness, yet opportunities to foster positivity in everyday environments remain scarce [8]. While digital platforms aim to connect people, they frequently fall short of creating authentic, in-person experiences that encourage genuine emotional engagement [3,13]. We aim to address the U.N. Sustainable Development Goal 3, Good Health and Well-Being, specifically sub-goal 3.4, which seeks to 'promote mental health and well-being' by finding ways to encourage spontaneous acts of kindness and foster a sense of community within these shared spaces [9].

Our approach involved conducting interviews with participants to explore how technology could foster positive interactions in public spaces. Through thematic analysis of the data, we identified key insights into user preferences for technology as a connector. These findings shaped the design of HAPPI, focusing on themes such as community and connection, rewarding positive behavior, exploration and engagement, and authenticity.

HAPPI (Fostering Positive Connections Through Interactive Messages) addresses these themes by encouraging positive interactions through personalized messages. By enabling individuals to share uplifting notes—either as handwritten messages or digital uploads—HAPPI promotes emotional wellness and community connection. Research indicates that random acts of kindness and positive reinforcement can significantly enhance happiness and productivity [7]. This study seeks to leverage technology as a facilitator of genuine human connection, rather than a substitute, to cultivate a more connected and positive public atmosphere.

2 RELATED WORK

As per the Centers for Disease Control and Prevention (CDC), the number of individuals experiencing “persistent feelings of sadness or hopelessness” increased to 42% in 2021 from 28% in 2011 [17]. The COVID-19 pandemic has led to an estimated increase of 28% in major depressive disorders and 26% in anxiety disorders [16]. Additionally, both perceived and objective social isolation significantly elevate mortality risk, comparable to the risks associated with obesity and smoking. In the United States, 162,000 Americans deaths are related to social isolation which exceeds the deaths from cancer or stroke [5]. At the same time, loneliness causes an economic cost with at more than $3 billion annually in the United Kingdom [5].

While the internet has been perceived to increase connection, “more frequent internet use and excessive screen time has been found to be associated with poorer mental health outcomes” [6]. HAPPI strives to support people in natural settings for others in taking a step and does not directly address the domain of mental health. The importance of emotional well-being and positive social interactions has been extensively studied in psychology and human-computer interaction (HCI). Positive psychology emphasizes the role of happiness and well-being in enhancing various aspects of life, including productivity, engagement, and social relationships [12].

Baumeister and Leary [2] argue that a sense of belonging is a fundamental human motivation, and fostering community connections can significantly impact individual happiness. The problem is that digital platforms aim to connect individuals, but they fall short in replicating the authenticity of in-person interactions. One of HAPPI’s goals is to build on Baumeister and Leary’s [2] findings by facilitating spontaneous, meaningful interactions in public spaces.

Previous research in HCI has explored the use of technology to promote happiness and well-being, but there are multiple aspects that the related work cited here has fallen short in addressing happiness and well-being which motivated the idea of HAPPI. For instance, Somanath et al. [14] emphasize fostering happiness in workplace technologies, but

workplace are considered structured environments where spontaneous interactions and emotional engagement are limited. Their work discusses the potential of designing work technologies with employee happiness as a central goal, suggesting a shift from merely emphasizing productivity to fostering positive emotions. HAPPI aims to build on their work by fostering positive emotions in public settings.

Safdar et al. [11] and Uchida and Yamasaki [15] mention that East Asian cultures stigmatize emotional expressiveness. Anonymous and personalized interactions are key aspects of HAPPI works, and this will help create a platform that encourages emotional engagement without breaching social norms.

3 LYUBOMIRSKY ET AL. [7] HAVE STUDIED THE BENEFITS OF POSITIVE ACTIONS, LIKE ACTS OF KINDNESS, CAN INCREASE HAPPINESS. HOWEVER, THEIR STUDY FOCUSES ON INDIVIDUAL INTERACTIONS AND DOES NOT ADDRESS SYSTEMS THAT CAN PROMOTE THESE KINDS OF BEHAVIOR IN PUBLIC SPACES. HAPPI ASPIRES TO CREATING A SENSE OF COMMUNITY THAT ENHANCES EMOTIONAL WELL-BEING ON A LARGER SCALE.[1,4,7] FORMATIVE METHODS

3.1 Gathering Data

To gain a comprehensive understanding of positivity and happiness, we conducted semi-structured interviews with nine stakeholders. To guarantee that the points of view were thorough and representative, our approach for choosing stakeholders involved carefully choosing a varied group of participants spanning many age ranges, career backgrounds, and student statuses. These stakeholders included psychologists, psychiatrists, professors, and students from diverse demographics such as age, gender, class year, international status, and student status that can be seen in the following chart.

Table 1: Participants' demographics and occupations

#	Gender	Age Group	Occupation	Student Status
P1	Male	65+	Psychiatrist	N/A
P2	Female	18-24	Psychologist	N/A
P3	Female	18-24	Research Coordinator	N/A
P4	Female	35-44	Professor	N/A
P5	Male	18-24	Freshman Student	International Student
P6	Female	18-24	Freshman Student	Domestic Student
P7	Female	25-34	Lab Manager	N/A
P8	Female	18-24	Sophomore Student	Domestic Student
P9	Male	18-24	Senior Student	International Transfer Student

[a] 'N/A' in the 'Student Status' column indicates that the participant is not a student.

The purpose of these interviews was to explore what happiness and positivity mean to different individuals and how they interact with these emotions. With the meaning of these interactions with happiness, positivity, and emotions,

these findings can propagate a design that promotes positive and genuine social engagement for personal mental wellbeing [1]. Having such purpose in mind, we developed a set of open-ended questions focusing on four key areas that were based on findings from related work. The following sub-sections elaborate on the four question categorizations that were designed for the interviews.

3.1.1 Sharing Happiness and Positivity

Understanding what happiness and positivity mean to people is crucial for promoting emotional well-being. We asked participants how they become happy and positive, what affects their mood, and how they share these emotions. This information was essential for targeting ways people already interact with the emotions of happiness.

3.1.2 Interacting with Others' Happiness and Positivity

Others' actions have profound effects on us, influencing self-esteem and mood. We explored how people react after receiving positive messages, what types of messages resonate most, and how they would share happiness with a larger audience.

3.1.3 Design

We investigated how people interact with current technology in relation to their mood. We asked about the mediums and technologies they use to send positive messages to people in their lives, aiming to incorporate these methods into HAPPI.

3.1.4 Exploration

We sought participants' input on what to include or avoid in a device designed to promote positivity and happiness. These insights were crucial for our design phase.

3.2 Interview Procedure

3.3 Before conducting the interviews, we obtained approval from the Institutional Review Board (IRB). During each interview, we also obtained informed consent from participants and audio-recorded the sessions for transcription purposes. All recordings were promptly deleted after transcription to maintain confidentiality. Every interview lasted between thirty and forty-five minutes, which gave plenty of time to probe every participant's experience, ideas, and emotions. The semi-structured approach gave us freedom to follow up on exciting concepts while yet keeping consistency in the fundamental questions.Data Analysis

To evaluate the data, we followed a qualitative analysis approach. Our goal was to analyze data from the interviews that were conducted to identify underlying themes that would inform our design, rather than focusing on a specific solution.

We began by transcribing all interviews into text for ease of analysis. After transcription, we used the qualitative data analysis technique of **open coding** on all the transcribed interview texts so that we can accurately record the key ideas that arose from each participant's answers and reactions. This technique helped us to transform the unprocessed raw text of the interviews into 194 unique codes With the descriptive codes, we formed the basis for our themes by grouping the codes into meaningful clusters through the usage of **affinity mapping** and the principles of **thematic clustering**. Such approach identified patterns among the codes which resulted in 23 clusters whose codes were inherently related with each other, such as "how people act" and "definition of emotion."

This iterative data analysis strategy enabled us to obtain thorough, real insights in line with the objectives of our research—that is, to comprehend the social dynamics of happiness and create a tool capable of really promoting positive involvement. Furthermore, our data analysis approach was able to preserve objectivity and reduce bias as during data analysis stages of open coding and thematic clustering, the qualitative data was split into parts and was processed by different team members. After the data was processed, our team members reconvened to go over and balance any differences.

4 DESIGN IMPLICATIONS OF THEMES

To address the U.N. Sustainable Development Goal of Health and Well-being, focusing on emotional wellness and awareness, HAPPI incorporates the themes of Technology as a Connector, Not a Substitute, Authenticity, Rewarding Positive Behavior, Community and Connection, and Exploration and Engagement.

4.1 Technology as a Connector, Not a Substitute

Technology is "the application of scientific knowledge to the practical aims of human life" [18]. It is meant to support us, not replace us. Participant responses reflected that they did not want technology to substitute their social connections with another but rather support interpersonal connections. For example, P2 reiterated this, emphasizing that technology should act as "a facilitator between humans," supporting genuine human interaction rather than replacing it. The system design needs to facilitate genuine human connections rather than creating or replacing them. A platform that supports authentic interactions over those that merely simulate connection. Similarly, P4 stresses the consequences of such a situation where technology acts as a substitute. They emphasize that “things on social media aren’t always authentic as it is often/staged” conveying this loss of authenticity due to the employment of technology. In contrast, texting was highlighted as a medium for positive communication by P7, who noted how it can support meaningful exchanges and strengthen bonds. Together, these insights illustrate how technology should foster community and genuine interactions rather than diminish them.

4.2 Authenticity

Authenticity is crucial in fostering meaningful connections and promoting emotional well-being. For example, P9 stated, "I love hearing personal stories," indicating that genuine, personal messages have a significant impact. The idea of authenticity is further reinforced by P5, as they describe “compliments are associated with positivity” emphasizing how genuine affirmations can instill feelings of trust and connection among individuals. This expression of appreciation between individuals establishes a sense of openness and authenticity. Moreover, P8 conveys that “physical letters are used as a medium to send positive messages”, describing the nature of handwritten messages that instill this sense of personal touch that digital messages often lack. Importantly, we discovered that the method of spreading positivity was not unanimous as P2, describes that they use technologies including “texting, calling, in-person talks, and Instagram as means to send positive messages to people in their life ”. This contradiction elicits that authenticity can be conveyed through diverse mediums and the term authenticity varies between individuals. Moreover, the importance of establishing authentic interactions is conveyed by P1 as they pointed out “strong interpersonal relationships make them happy and positive”, emphasizing the importance of real connections in enhancing emotional well-being. Together, these insights convey that authenticity is multi-faceted in the way it is understood and shared in the community.

4.3 Rewarding Positive Behavior

"Paying it forward" creates upstream reciprocity, where an unrelated third-party benefits after someone has been helped [3]. By utilizing upstream reciprocity, a device can empower users to spread positivity beyond the immediate interaction. This can also include emphasizing the importance of personal growth such as with P6, "learning new things is the biggest source of happiness,". Moreover, we discovered spreading positivity instills a sense of happiness in not only the recipient but also the giver. P3 specifically describes that “the person sharing positivity to others get happiness themselves”. Such interactions are vital in establishing a reciprocal relationship in the community and forming these ripple effects as conveyed by P6 that “Making me happy wants me to make others happy” accentuating the act of paying it forward.

4.4 Community and Connection

The intrinsic need to belong requires genuine changes in one's social connections to elicit positive emotional responses [9]. To illustrate, Participant 1 (P1) mentioned that "strong interpersonal relationships make [me] happy and positive." Similarly, P3 noted that "spending time with people that I love makes me happy." These insights elicit that spending quality time with loved ones plays an immense role in establishing a sense of belonging, further reiterating the importance of community in instilling happiness within individuals. As individuals engage in a community, they establish this network that aids in supporting one another to achieve well-being. Moreover, the immense diversity within this community is stressed by P4 as they state, “Positivity isn't a one fit model, everyone desires different types of positivity”. Recognizing this diversity is vital to creating an inclusive community, welcoming various recipients and givers to interact in their unique ways. This allows deeper relationships and enhances overall emotional wellness, ensuring that each individual feels valued and understood in their unique journey toward happiness.

4.5 Exploration and Engagement

Opportunities to explore and engage with the environment in fresh and stimulating ways are vital for maintaining interest and promoting positivity. For instance, P8 was skeptical about the idea of a device facilitating positivity, questioning, "What would prompt anybody to do that? Like why?" They expressed concern that "there needs to be a motive to interact with the robot," suggesting that without personal relevance, the device might not be effective. In another perspective, P4 stated incorporating "an element of playfulness" and "discoverability" would make the device more engaging. In order to serve the previous themes, people need to first become users by interacting with the device. P4 further iterates "incorporating an element of exploration into the robot will give more meaning to the messages." Instilling this sense of curiosity accentuates engagement which is essential in ensuring users find personal value in their interactions.

4.6 Self-Determination

We are our own motivators. Self-Determination Theory assumes that individuals have natural psychological needs for autonomy, competence, and relatedness, which drive their motivation and well-being [10]. Each user has personal perceptions of what happiness, pride, and positivity mean to them. For example, P2 expressed that they resonate with "encouragement and funny stories," and receiving such messages leads to feelings of "happiness, excitement, and engagement." Meanwhile, P5 associated compliments with positivity, saying that it means "someone recognizes my effort and my progress.". The diversity in what positivity means to each individual is conveyed by P4 as they describe “Positivity isn't a one fit model; everyone desires different type of positivity”. The subjectivity of positivity elicits the importance of personalized interactions and its role in shaping a supportive community where individuals can explore their meaning of positivity and happiness.

5 SYSTEM DESIGN

Addressing the U.N Sustainable Goal 3, Wellbeing and Health in the realm of personal mental wellbeing, we want to make people happy and positive. To reflect that, we named our design, HAPPI. Our initial study cultivated six central themes that will serve as design requirements shown in Table 2. Our design centers on an interactive, medium-sized robot named HAPPI that fosters positivity and connection among individuals in public spaces.

Table 2: Design Approaches

Design Requirement	Requirement Description	Feature
Technology as a Connector, not a Substitute	HAPPI should act as a tool to facilitate genuine human connections rather than creating or replacing them. HAPPI will strengthen social bonds and foster a sense of community among users.	A public message board robot that promotes interactions between those at the place of deployment. Users will respond to visible prompts, and those responses will be shared.
Authenticity	Users' interactions should be sincere and personal. HAPPI should enhance the depth of communication between individuals.	Users will write digital handwritten responses that showcase their penmanship and thoughts.
Rewarding Positive Behavior	HAPPI should utilize upstream reciprocity to spread happiness beyond the scope of immediate interactions with the device.	Prompts will focus on responses that spread positivity, such as "Write a compliment for someone."
Community and Connection	The device should enable users to foster a sense of belonging that reflects the shared human experience.	Users receive printed responses that share the story of another peer that they may resonate with.
Exploration and Engagement	The device should attract users, like a beacon of happiness, to engage and discover interactions that cultivate positivity.	Happy's bright and cheerful design acts as a beacon of happiness, inviting passersby to engage with it.
Self-Determination	The device should empower users' intrinsic motivation to determine their own course of action. The device should promote positive realizations rather than negative ones.	We understand users have freedom to react differently and portray their responses in their own way.

5.1 Technical System Design

The backend of the HAPPI device is hosted on a physical Raspberry PI board. Overall, the backend must manage six different functionalities as outline below:

1. **Hosting the Front-End Website:** The first functionality is to host the front-end website that users interact with to send their responses.
2. **Hosting API Endpoints:** The second functionality involves the API endpoints which are used in the system design to provide a way for the responses from the website to be sent over to the server through a POST request [4].
3. **Storing Users' Responses:** The third functionality stores the user response. When the server receives a response through the API endpoint, it stores the response in its database.

4. **Running a Discord Bot for Moderation:** The fourth functionality of the server is to run a discord bot that manages a discord server designed for the HAPPI server. A Discord bot was utilized in the system design to allow verification of user responses as whenever the server receives a response; the Discord bot sends the user response to a Discord channel where at least one of the moderators needs to verify or disprove the user response. The moderators of the HAPPI device are the 5 authors of this paper, who are also the only ones with access to the discord server.
5. **Printing a Random User's Response:** The fifth functionality is to print a random user's response. This was one of the most complex aspects of the backend and involved several steps:
    a. Connecting the Raspberry Pi to a thermal printer.
    b. Maintaining that connection in a separate thread.
    c. Using a Python script to format the response before sending it to the thermal printer for printing.
6. **Managing the Display:** The **final functionality is** to manage the display connected to the Raspberry Pi.

Figure 1: HAPPI Prototype

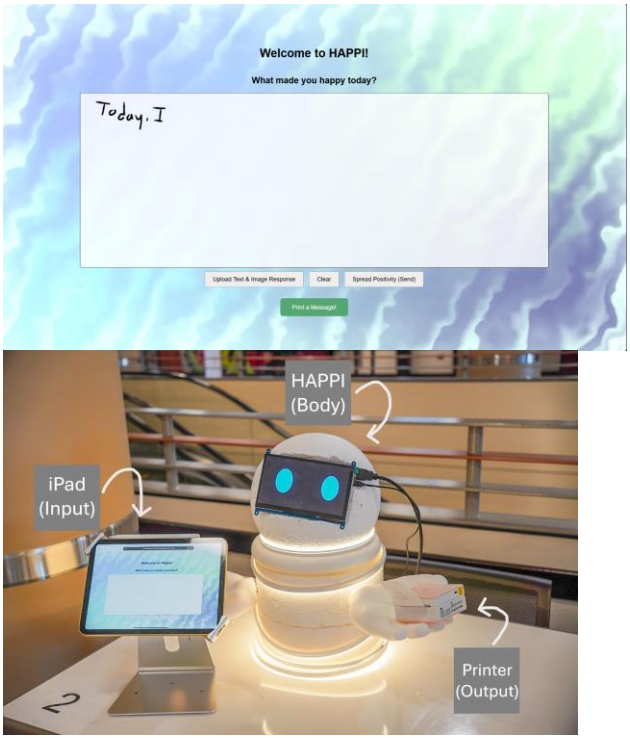


Figure 2: Kiosk Display

5.2 Using the HAPPI Device

Step 1: Approach the Kiosk: Approaching the HAPPI device, one will discover an iPad set atop a kiosk next to a robot-like figure called HAPPI. On its "head," HAPPI's design features a welcoming screen with expressive eyes that lend a friendly and interesting interaction.

Step 2: Choose an Option on the iPad: The iPad UI presents few interaction choices. Users can:

- The iPad UI presents a number of interaction choices. Users can either:
- **Write a Message:** Select this option to send a nice note. They might handwrite a note with the stylus that comes next to the iPad. HAPPI's database will save this message for enjoyment by the next users.
- **Print a Message:** This choice lets the user get an arbitrary positive message created by another person. Once selected, the message will be printed on the HAPPI hand-held printer, providing the user with a little, physical gesture of positivity [2].
- **Upload an Image:** For those wishing to contribute a significant picture, the user can choose "Upload Image." The screen will show a QR code which they can scan to submit an image from their device. HAPPI's database will house this picture.

Step 3: Receiving Printed Messages or Images: Print a Message or Print a Random Image can print either a randomly chosen message or an image shared by another user upon choosing either. Users get individualized tokens of happiness when the messages are printed from one printer and graphics from a different one, positioned on HAPPI's opposite hand, create a unique experience.

Step 4: Optional Engagement: Users who send a message could also print one for themselves so they may feel the optimism others inspire. Because users may both send and receive positive remarks, this dual feature motivates ongoing participation.

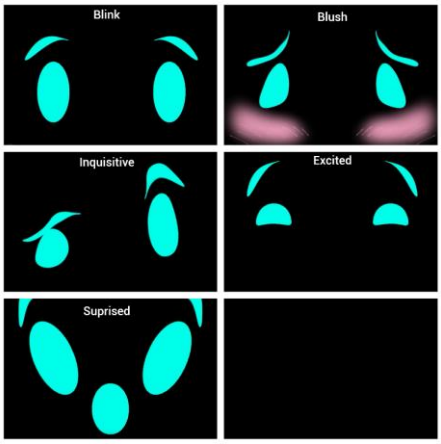
Step 5: Final Thought on Interaction: Following any engagement, the individual could decide to keep investigating the possibilities or end their experience with HAPPI, carrying with them a little bit of positive shared knowledge. This cyclical interaction supports the community-centric design by letting every member share and get good emotions.

5.3 Deployment and User Feedback

We tested two deployments to attain user feedback and to later implement that feedback. With the first deployment, we looked for how people reacted and interacted with HAPPI. The design of HAPPI's body is the main attractor for many people to approach the device and interact with it. Users called it "cute" and were attracted with the lights. Some users wished that more animations to the face would be added to connect the body more with the iPad and printer. These added animations were added for deployment two, shown in Figure 3.

To enhance connection and encourage upward reciprocity, we added animations to HAPPI's functions. For example, HAPPI blushes when sending a message and shows excitement while printing. During the second deployment, users appreciated these animations, feeling more rewarded for their interactions. Across both deployments, lasting about 45 minutes, users consistently smiled while interacting with HAPPI and when receiving printed messages, demonstrating the principles of "Technology as a Connector, Not a Substitute" and "Rewarding Positive Behavior." For instance, in response to the prompt "What are you excited for Thanksgiving?" users enjoyed hearing about others' plans.

Figure 3: Animations for Deployment Two


Blink
Blush
Inquisitive
Excited
Suprised

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