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 [17]. Loneliness contributes major costs from higher mortality rates and economic costs where individuals lack human connection in natural settings [7]. 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 may experience feelings of disconnection and loneliness, 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 and togetherness in everyday environments remain scarce. While digital platforms aim to connect people, they frequently fall short of creating authentic in person-experiences that go against loneliness and human connection [3,14]. 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 [10].

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 [9]. This study seeks to leverage technology as a facilitator of genuine human connection, rather than a substitute, to cultivate a more connected, shared, and positive public atmosphere.

2 RELATED WORK

In 2019, 970 million people were living with a mental disorder [17]. At the same time, almost 25% of the world population feels lonely [6]. With the COVID-19 Pandemic increasing loneliness by about 5% [19] and an estimated increase of 28% and 26% for major depressive and anxiety disorders respectively [17]. With this trend in increasing loneliness and mental health rates continuing after the end of the pandemic, now is the most important time to address this trend.

Loneliness has significant human and societal impact, and one of its core factors originates from the need for meaningful connection [2]. Loneliness, or social isolation, elevates mortality risk comparable to rates with obesity and smoking. In the United States alone, 162,000 deaths annually are linked to social isolation, exceeding U.S. deaths from cancer or stroke [7]. In the United Kingdom, loneliness costs more than $3 billion a year [7]. Meanwhile, there is a direct connection that spontaneous and meaningful interactions with others in everyday settings can positively affect one's happiness [2,12].

Previous research has explored the use of technology to provide meaningful connections. For instance, social media allows people of different geographical and cultural backgrounds to interact with each other. At the same time, studies show that social media can increase feelings of loneliness. Social media has also been an outlet for those who are lonely with 51% of media users experiencing loneliness and 71% for heavy users [8]. What social media lacks is creating authentic connection by not using digital touch as a facilitation mechanism, in which can be used against loneliness [5].

Another example are message boards at school libraries, such as asking "what are you doing for break." These prompts are effective because seeing others' responses fosters a sense of connection. However, they may not engage passersby and limit how users can interact. For instance, you can add more elements of digital touch [5] or implement the themes behind experiential purchasing. To add on, in a study by Bingcheng Yang claims experienced-focused purchases, such as movies, promote social interactions that decrease loneliness [16]. While physical message boards do promote social interactions by seeing other's responses and writing a response in a few seconds, they lack a strong purchase for interaction (effort to spend) and stronger social interaction. We argue interaction time as the purchase.

Considering previous work in loneliness and technology, we propose to explore the implementation of digital touch, interaction time as a purchase, and stronger social interactions through technology that social media and physical message boards lack. We conducted a formative study on the topics of technology and happiness. The tool we present is HAPPI. HAPPI strives to support people's maintenance of mental health in more natural everyday settings, by encouraging them to take meaningful steps toward connection.

3 RELATED WORK

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, we carefully selected a diverse 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, and international 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

* '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. By understanding the meaning of these interactions with happiness, positivity, and emotions, the findings can inform a design that promotes positive and genuine social engagement for personal mental wellbeing [1]. With this purpose in mind, we developed a set of open-ended questions focusing on four key areas derived from findings in related work. The following sub-sections elaborate on the four categories of questions 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

Before conducting the interviews, we obtained approval from the Institutional Review Board (IRB). During each interview, we secured informed consent from participants and audio-recorded the sessions for transcription purposes. To maintain confidentiality, 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.

3.3 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 should support, not replace, interpersonal connections. Participants emphasized that it should act as "a facilitator between humans rather than substituting them." For example, P2 highlighted this need, while P4 noted the inauthenticity often seen on social media. Texting, described by P7, was seen as a medium for strengthening bonds. Together, these insights show how technology can foster community and genuine connections.

4.2 Authenticity

Authenticity creates meaningful connections and emotional well-being. For instance, P9 valued personal stories, and P5 emphasized how genuine compliments build trust. Handwritten messages, noted by P8, provide a personal touch often missing in digital communication. P1 highlighted the importance of strong relationships in enhancing well-being.

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 immediate interaction. P6 found happiness in learning new things, while P3 noted that sharing positivity brings joy to both giver and recipient. P6 further illustrated this ripple effect: "Making me happy wants me to make others happy," emphasizing the act of spreading positivity.

4.4 Community and Connection

The need to belong requires genuine changes in one's social connections to elicit positive emotional responses [10]. P1 and P3 noted that spending time with loved ones fosters happiness. Recognizing diversity, P4 stated, "Positivity isn't a one fit model," and this highlights the importance of inclusivity in creating a supportive community. This allows individuals to feel valued and understood in their 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. P8 questioned what motivates interaction with a device, while P4 suggested incorporating "an element of playfulness" and "discoverability" to enhance engagement. Instilling curiosity ensures 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 [11]. Participants had diverse perceptions of positivity. For example, P2 resonated with "encouragement and funny stories," while P5 associated compliments with recognition of effort. P4 mentioned that "Positivity isn't a one fit model."

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.

Table 2: Design Approaches

Design Requirement	Requirement Description
Technology as a Connector, not a Substitute	HAPPI fosters genuine connections through a public message board with prompts and responses.
Authenticity	Users engage in personal communication by writing digital handwritten responses.
Rewarding Positive Behavior	Prompts like "Write a compliment for someone" spread happiness beyond immediate interactions.
Community and Connection	Shared responses create a sense of belonging through relatable peer stories.
Exploration and Engagement	HAPPI acts as a cheerful beacon by inviting users to discover positivity.
Self-Determination	The device empowers users to express themselves freely to foster positive personal realizations.

5.1 Using the HAPPI Device

Step 1: Approach the Kiosk: HAPPI features an iPad on top of a kiosk with a friendly robot-like screen displaying expressive eyes. Both the iPad and screen are powered by a Raspberry Pi.

Step 2: Choose an Option on the iPad: Users can:

- **Write a Message:** Handwrite a note with a stylus, and the note is saved in HAPPI's database for others.
- **Print a Message:** Receive and print a positive note previously created by another user [2].
- **Upload an Image:** Submit an image by scanning a QR code; the database stores the image.

API endpoints send responses, saved in the database, to a server and forwards them to a custom Discord bot. Moderators (the authors) verify or reject responses.

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. This function is one of the most complex parts of HAPPI. This involved connecting the thermal printer to the Raspberry Pi, maintaining that connection in a separate thread, and using a Python script to format the response before sending it to the thermal printer for printing.

Step 4: Optional Engagement: Users can print a message for themselves after sending one. This helps encourage ongoing participation and foster optimism.

Step 5: Final Thought on Interaction: Users can explore further possibilities or end their experience with HAPPI. This cyclical interaction reinforces the community-centered design.

Figure 1: HAPPI Prototype

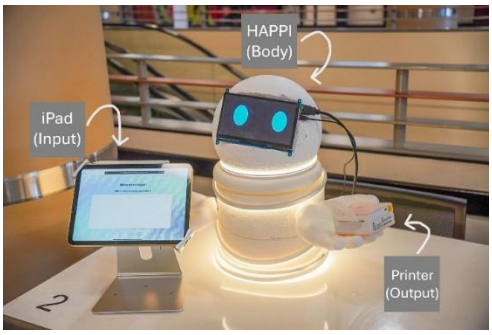
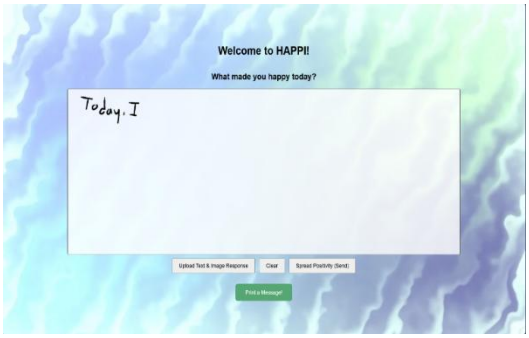


Figure 2: Kiosk



6 DISCUSSION AND CONCLUSION

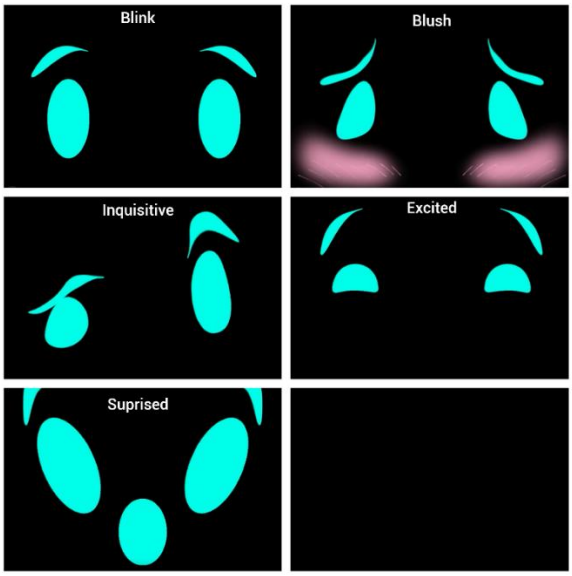
After carrying out three deployments of HAPPI, all users smiled and enjoyed the interaction. Users called HAPPI cute and were particularly drawn by the lights. In the initial deployment, users said they felt a disconnection between the body and iPad/printers. To address, we added more animations, shown in Figure 3, that correlate with specific user interactions. For example, when a user clicks, "send," HAPPI blushes, strengthening HAPPI as a facilitator (Technology as a Connector, not a Substitute). Moreover, users felt more rewarded with the additional animations and stayed longer interacting with HAPPI. The longer the interaction was, the more people that came to participate. Users were spending more time and engaging in more experiential activities.

HAPPI relies on people interacting with it. Improvements can be made that implement cultural contexts. For example, during deployment three, it was Thanksgiving, and we targeted prompts around the holiday. Another example is East Asian culture tend to lean towards emotion suppression and avoidant coping creating drastic effects, particularly in Japan. Japan has lower happiness and greater loneliness compared to the United States where reappraisal and problem-focused coping is more common. In the case of Japan, design features can be added that target emotional suppression and avoidant coping in a greater scope than the current design [13,15].

Another note is that we did not conduct any formal follow up with users following the initial interaction with HAPPI. In pursuit of UN Goal 3.4 to address mental health, in the context of loneliness, more research is needed in the long-term effects of interactions with Human Computer Interactions, such as HAPPI. We plan to have more deployments in more

cultural contexts and see if HAPPI has positive effects on mental health, happiness and loneliness, and economic costs, higher productivity.

Figure 3: Animations for the Second Deployment



REFERENCES

1. Elizabeth Bales, Kevin A. Li, and William Griwsold. 2011. CoupleVIBE: mobile implicit communication to improve awareness for (long-distance) couples. *Proceedings of the ACM 2011 conference on Computer supported cooperative work*, Association for Computing Machinery, 65–74.

2. Roy F. Baumeister and Mark R. Leary. 1995. The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin* 117, 3: 497–529.

3. Edward L. Deci and Richard M. Ryan. 2000. The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior. *Psychological Inquiry* 11, 4: 227–268.

4. Elizabeth W. Dunn, Lara B. Aknin, and Michael I. Norton. 2008. Spending Money on Others Promotes Happiness. *Science* 319, 5870: 1687–1688.

5. Lili Golmohammadi. 2023. Loneliness, touch, and its digital mediation. *Doctoral thesis, UCL (University College London).* Retrieved December 10, 2024 from https://discovery.ucl.ac.uk/id/eprint/10183779/.

6. Gallup Inc. 2023. Almost a Quarter of the World Feels Lonely. *Gallup.com*. Retrieved December 10, 2024 from https://news.gallup.com/opinion/gallup/512618/almost-quarter-world-feels-lonely.aspx.

7. Dilip V. Jeste, Ellen E. Lee, and Stephanie Cacioppo. 2020. Battling the Modern Behavioral Epidemic of Loneliness: Suggestions for Research and Interventions. *JAMA Psychiatry* 77, 6: 553–554.

8. Michelle H. Lim, Robert Eres, and Shradha Vasan. 2020. Understanding loneliness in the twenty-first century: an update on correlates, risk factors, and potential solutions. *Social Psychiatry and Psychiatric Epidemiology* 55, 7: 793–810.

9. Sonja Lyubomirsky, Kennon M. Sheldon, and David Schkade. 2005. Pursuing Happiness: The Architecture of Sustainable Change. *Review of General Psychology* 9, 2: 111–131.

10. Martin A Nowak and Sébastien Roch. 2007. Upstream reciprocity and the evolution of gratitude. *Proceedings of the Royal Society B: Biological Sciences* 274, 1610: 605–610.

11. Thomas Olsson, Pradthana Jarusriboonchai, Paweł Woźniak, Susanna Paasovaara, Kaisa Väänänen, and Andrés Lucero. 2020. Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches. *Computer Supported Cooperative Work (CSCW)* 29, 1–2: 29–83.

12. Esteban Ortiz-Ospina and Max Roser. 2024. Loneliness and Social Connections. *Our World in Data*.

13. Saba Safdar, Wolfgang Friedlmeier, David Matsumoto, et al. 2009. Variations of emotional display rules within and across cultures: A comparison between Canada, USA, and Japan. *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement* 41, 1: 1–10.

14. Ariel Shensa, Jaime E. Sidani, Liu yi Lin, Nicholas Bowman, and Brian A. Primack. 2016. Social Media Use and Perceived Emotional Support Among US Young Adults. *Journal of community health* 41, 3: 541–549.

15. Kanako Uchida and Katsuyuki Yamasaki. 2008. Social Support Mediating between Coping by Emotional Expression and Depression. *Psychological Reports* 102, 1: 144–152.

16. Bingcheng Yang, Hongyan Yu, and Yu Yu. 2021. More Experience, Less Loneliness? Exploring the Effect of Experiential Purchases on the Alleviation of Loneliness. *Frontiers in Psychology* 12.

17. 2022. *World Mental Health Report: Transforming Mental Health for All*. World Health Organization, Geneva.

18. 2024. Technology | Definition, Examples, Types, & Facts | Britannica. Retrieved October 14, 2024 from https://www.britannica.com/technology/technology.

19. COVID-19 pandemic led to increase in loneliness around the world. *https://www.apa.org*. Retrieved December 10, 2024 from https://www.apa.org/news/press/releases/2022/05/covid-19-increase-loneliness.