



**Figure 1:** To explore wellbeing-as-interaction, we designed a mobile app and an ambient display (MoodCloud) to support expressions, interpretations, and discussions of wellbeing between friends.

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## Designing for Wellbeing-as-Interaction

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### ABSTRACT

This paper introduces the concept of wellbeing-as-interaction. Instead of designing and evaluating technologies that locate wellbeing in the individual, this paper presents early-stage work on designing technologies for people to collaboratively express, interpret, discuss and enact wellbeing. To explore this concept, we examined the wellbeing of six pairs of university students through a 7-day deployment of a technology probe ‘MoodCloud’. MoodCloud consisted of a mobile app and an ambient display to share wellbeing updates through colour. We observed three patterns of wellbeing interactions: updates, follow-ups, and message chains. Wellbeing interactions benefitted from the ambiguity of colour and a clearly defined target audience, but students also communicated through other channels to make sense of updates and to enact support. The concept of wellbeing-as-interaction seeks to offer an analytic lens for the CHI community as well as inspiration for novel wellbeing technologies that emphasise meaningful interactions with friends.

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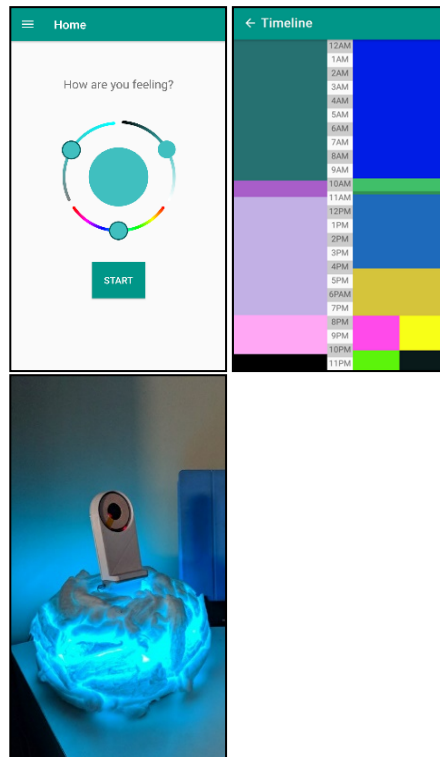
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## KEYWORDS

University students; college; wellbeing; interactions; technology probes



**Figure 2: MoodCloud** consisted of a mobile app (colour selection and timeline shown on top) and an ambient display in the shape of a cloud (bottom). Students could express their moods through colour animations, which got displayed on their friend's app and an ambient display in their friend's home.

## 1 INTRODUCTION

Wellbeing is a central theme across multiple areas of HCI. Positive computing examines how interactive technologies can be designed to support psychological wellbeing by promoting positive emotions, self-awareness, and motivation. Persuasive technology and gamification are often employed to motivate people to modify lifestyles and thereby improve their wellbeing [6, 7]. Wellbeing is central to personal informatics and the Quantified Self, where individuals harness data from mobile and wearable technology to track and enhance their own wellbeing [8]. In recent years, HCI has also started to explore the area of mental health, examining how human-centred design and emerging technologies might help those in mental distress.

This overview is by no means comprehensive, but it illustrates that wellbeing in HCI is predominantly framed as an individual concern. This is not surprising, given that wellbeing is often defined by an individual's life satisfaction, positive emotions, and the absence of unpleasant affects [2]. However, it is also well established that our wellbeing is influenced by our social connectedness and social support we receive [11].

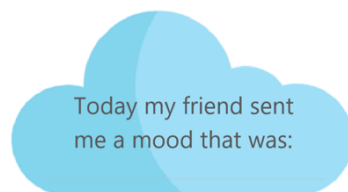
In this paper we seek to explore the approach of “wellbeing-as-interaction”. Going beyond individual wellbeing and how individuals are connected or supported, we contend that the very concept of wellbeing is at least to some extent socially constructed, meaning that our understanding of reality and our knowledge about wellbeing is the product of interactions with others and comparisons with collective norms of what constitutes a good life [13]. This approach is based on constructivist perspectives in HCI [1] and the sociology of health [13]. In taking this approach we do not deny that internal and affective states are important for wellbeing, but we wish to highlight that how we interpret and act upon such states depends on the social context.

An interactional approach leads to new design and evaluation strategies for HCI research. Designs inspired by wellbeing-as-interaction emphasise expressions and collaborative interpretations of wellbeing. The evaluation of such technologies does not hinge on whether wellbeing is measured correctly, but instead on how people interpret, discuss, and reflect on their wellbeing in a particular social context, both individually and collectively.

To explore wellbeing-as-interaction, we examined the wellbeing of university students. Students need to balance time demands for classes, assignments, exams, work and other extra-curricular activities, while sometimes also managing financial pressures [10]. Feelings of stress and isolation are particularly prevalent amongst first-year students who move away from home and adjust to a new social environment, and sometimes a foreign country and language [10]. In this paper we present the design and deployment of ‘MoodCloud’, a technology probe inspired by wellbeing-as-interaction to promote expression, interaction, and reflection upon wellbeing amongst university students. MoodCloud consisted of a mobile app and an ambient display to share updates through colour and animations (see Fig. 2). MoodCloud was deployed with six pairs of students for one week each. We observed patterns of wellbeing interactions emerging through MoodCloud: updates, follow-ups, and message chains. We discuss how students performed and collectively interpreted these wellbeing interactions, through MoodCloud, other digital media, and face-to-face.

**Table 1: Table of Participants**

Pair	Name	Age	Relationship
1	Allen	20	Friends; meet 5 times a week to play games
	Andrew	24	
2	Britney	21	In relationship; meet on weekends only
	Brett	21	
3	Chelsea	20	In relationship; separate homes
	Connor	20	
4	Daniel	29	Friends; enjoy parties together
	Debra	22	
5	Elaine	19	Friends; watch TV together
	Eric	19	
6	Frank	20	Friends; meet 3 times a week at university
	Fred	22	

**Figure 3: Word Clouds were used to elicit reflection on wellbeing, technology use, university lifestyle, and relationships.**

## 2 CASE STUDY: MOODCLOUD AND STUDENT WELLBEING

### 2.1 MoodCloud Design

MoodCloud was designed as a technology probe to explore wellbeing-as-interaction with university students. It consisted of a mobile app and an ambient display in the shape of a cloud (Fig. 2), which was inspired by expressions such as ‘being on cloud nine’ and ‘having a cloud hanging over them’. Through the app, students could express their wellbeing in the form of two colours, an animation for displaying the chosen colours (e.g., stormy, sunny), and free-form text which was only visible to the sender for their own tracking and to inspire open-ended interpretation. The colours and animation were sent to a fellow student, who could see them through a mobile phone notification and through an ambient display (see video appendix).

In the spirit of a technology probe [5], MoodCloud was a fully functioning system deployed to explore wellbeing interactions. It consisted of a custom-built Android app, a web server on a cloud platform, and a MoodCloud display for each participant. The display consisted of a cloud made out of cotton balls, an RGB LED strip to display colours, a 3D printed phone stand and wireless charger, and a Raspberry Pi computer to control the display and connect to the web server. As a probe, MoodCloud collected data about wellbeing updates through colours, animations, and text.

### 2.1 Case Study Design

The aim of this study was to explore how MoodCloud can promote interactions about wellbeing amongst university students. We were particularly interested in how pairs of students would use the colours and animations in MoodCloud updates to express their wellbeing and to make sense of each other’s wellbeing, and to what extent it would lead to conversations and reflections with peers. The study was approved by the university’s ethics committee.

MoodCloud was deployed into the homes of 6 pairs of university students for 1 week each. Participants were recruited through personal contacts. They were either friends or in a relationship who lived in different homes (see Table 1). Data was collected through interviews, MoodCloud, and text message probes. Each pair participated in two interviews. The first interview was conducted with each participant separately in their own homes to learn about their studies, relationships, wellbeing, and to set up MoodCloud. At the end of the 1-week deployment, each pair of participants was interviewed together to discuss their interactions with and through MoodCloud. Text messages were sent to participants each day during the week-long deployment to prompt reflection on MoodCloud interactions (through word cloud prompts, see Fig. 3), to share photos and songs that reflect their mood, and to interpret responses from their friend. Responses to these text message probes and the timeline in the MoodCloud app were used as prompts in the post-study interview to reflect on wellbeing interactions.

Interviews were transcribed verbatim and analyzed by the research team with the aid of the qualitative data analysis tool Saturate. Our analysis followed the principles of a thematic analysis: immersion into the data, several rounds of coding, and creating themes through diagrams and discussions amongst all authors that characterize patterns of interaction.

### 3 FINDINGS

#### 3.1 Wellbeing Updates

The first step in any interaction through MoodCloud is an update of one's status. Updates were triggered by various everyday life events, ranging from the mundane, e.g., feeling tired in the morning, to special events, including wellbeing interactions. For example, Debra's (pair 4) updates were in response to her moving out of her family home and into student shared accommodation during the deployment of MoodCloud. Hence, her updates reflected the support she received from a friend in moving her belongings (e.g., yellow and energetic animation), and the exhaustion felt after moving house (e.g., numerous 'sleepy' updates with blues and purples in use).

Some participants likened MoodCloud updates to status updates performed on social media. However, the crucial differences are that MoodCloud updates are expressed through colour (rather than text or images), and that they are targeted towards a clearly defined audience of one friend only. To illustrate, Eric (Pair 5) sent a dark red wellbeing update when his *"ex-girlfriend came in [to the university campus] ... I felt like I had to hide, so I was like ah! Dark red."* Eric would not have posted this on social media, but he felt comfortable sharing via MoodCloud because of the clearly defined audience and the cloak of ambiguity offered by colours.

It is also important to stress the notion of performance in the sense of Goffman's notion of self-presentation [4]. Expressing an experience did not come naturally to participants and required deliberation in terms of what colour would be understandable and appropriate for a friend, as Frank (pair 6) illustrated, *"having to think about what I was trying to [send] truthfully, it was like, 'What am I feeling?'"* Elaine (pair 5) was going through a difficult time due to balancing university with employment whilst living out of the family home. She reported that she was careful in her choice of colours to avoid worrying her friend *"by using colours that wouldn't convey distress or depression to an outside person - like pale colours."* She was aware that Eric would be a positive support, but *"didn't want to worry him, constantly updating him with worried moods."* Furthermore, Elaine also wanted to avoid conversation based on her negative moods to the point where, *"I was actually genuinely worried that Eric would send a message [outside of MoodCloud]."*

#### 3.2 Follow-Ups Outside MoodCloud

MoodCloud updates were interpreted both personally and collaboratively through follow up communication through various channels. To inspire open-ended interpretation, peers received MoodCloud updates only through a notification showing colours and animations on their mobile phone and their ambient display, but not any text their friend may have typed with it.

Updates through colours alone were often seen as ambiguous. For instance, Elaine (Pair 5) stated, *"I don't know what green means,"* as her friend Eric expressed all his updates through different shades of green. Elaine had a clear understanding of what green signified in her own emotions, stating, *"if I used green it was usually if I was in a good mood. I associate green with a good mood."* However, due to Eric's repeated use of green, this became difficult to interpret for Elaine. The ambiguity of wellbeing expressed through colours was both useful and limiting. On the one

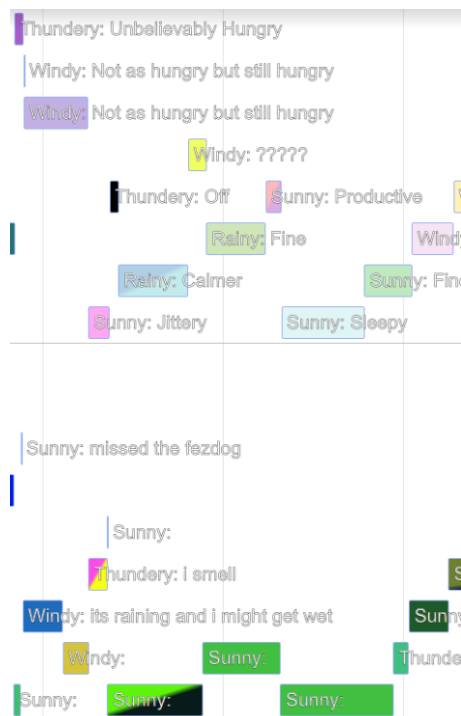


Figure 4: Message chain (pair 5). The top half are Elaine's MoodCloud messages, the bottom half are Eric's MoodCloud messages. The participants could not view each other's text, only the colours and animations.

hand, the ambiguity of colours helped to encourage reflection and mutual awareness, as recognized by other HCI researchers [3]. However, the ambiguity limited the scope of wellbeing interactions possible through MoodCloud. Participants often relied on other channels (private messaging, face-to-face) where they could use words and body language to make sense of each other's wellbeing. These follow-ups also led to social and emotional support, i.e., when colours were perceived as potentially negative. For instance, Chelsea found that *"if Connor put a colour that I didn't understand, I'd ask him what it meant, and console him if it meant something bad."*

### 3.3 Message Chains

A final pattern observed were message chains, a to and fro between friends through MoodCloud (see Fig. 4). These chains highlighted several interactional achievements with and through MoodCloud. Firstly, MoodCloud encouraged friends to respond to updates in order to acknowledge the wellbeing update that they received. In the case of pair 1, one partner was more proactive with their MoodCloud use than the other, but the acknowledgement through a MoodCloud response meant that the chain could continue. Elaine regularly checked her phone notifications throughout her day, *"I scroll down to look at my notifications like I do for most periods of the day, it's like Eric updated his mood and it's like 'OHOOH OKAY' and I look at his mood,"* her MoodCloud data shows frequent responses to these mood messages received (see Fig. 4).

Secondly, acknowledgements through MoodCloud required friends to share how they felt themselves, which made expressions of wellbeing reciprocal. For example, if Connor sent a mood, Chelsea would “*update mine to let him know how I’m feeling as well.*”

Thirdly, friends needed to be sufficiently aware of each other, in order to interpret updates and respond appropriately. Eight out of 12 participants were confident in their awareness of their friend's wellbeing. For instance, when Daniel saw an image of Debra's moving boxes through a text message prompt, he stated, "*I thought Debra was stressed from moving*" and that he was able to interpret her updates "*because I know her, and I knew that she was moving.*"

Finally, beyond the particular communicative intent, these chains can be interpreted as a commitment to the friendship, similar to the study of eMoto [12]. In fact, for some participants MoodCloud helped to elevate this commitment. Fred (Pair 6) described MoodCloud as unique experience as *“it was separate from everyone else. Only we’re getting the notifications.”* MoodCloud enabled Fred and Frank to connect on a different level to the rest of their peers.

## CONCLUSION

In summary, we have taken the first steps towards understanding and designing for wellbeing-as-interaction. Rather than viewing wellbeing as an individual achievement, this paper explores how technologies for wellbeing might be designed and understood in terms of how people collaboratively express, interpret, and enact wellbeing. In designing and evaluating technology to promote wellbeing amongst students, we learnt the following: (1) updates about personal experiences were enabled by a clearly defined target audience and by using colour, which provided

a cloak of ambiguity about the actual message; (2) to deal with the ambiguity of colour, participants often resorted to other channels that supported verbal and bodily communication; (3) chains of interaction signified interactional achievements in terms of mutual awareness, reciprocity, and commitment to the relationship.

We hope that these insights will inspire other researchers who investigate technologies and wellbeing with students, families, co-workers, communities, etc. Wellbeing-as-interaction offers an analytic lens to shed light on interactions on social media, private messages, and online counselling. In designing technologies, other researchers may benefit from framing wellbeing as a social concern and from our reflections on target audience and the use of colour. In closing, this paper echoes a key message of Epicurean philosophy: a key ingredient for a life in happiness lies in our interactions with friends [9].

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