

MoodLine and MoodMap

Designing a Mood Function for a Mobile Application with and for Young Patients

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Abstract—Tracking mood or emotional experiences over time is a popular function found in mobile health applications. In this study, young patients with chronic health challenges consider this also an important function of a multifunctional app supporting them in the transition to adult care. At the same time they expressed the need to be seen as a young person, not a diagnosed body. A lifeworld-led design approach, based on a Participatory Design methodology, resulted in a mood tracking and a mood mapping design, which was meaningful to the young persons' everyday experiences. Photos tagged with colors representing different emotional states were chosen as the best way to represent their moods. An overview of moods, by day as well as by color, gives an understanding of the wider context in which these moods appear and can play a motivational role in dealing with a difficult day or episode in their lives.

Keywords—Mobile health application; lifeworld; Participatory Design; teenagers; transition

I. INTRODUCTION

The KULU research and design project¹ focuses on the design and use of interactive technologies with and for young people (15-25 years old) with chronic health challenges. Mobile applications are popular among young people, but a systemic review showed that there is no empirical evidence for their beneficial use in the personal health management of young patients [1]. The review did emphasize the value of involving young patients in designing these apps [1].

This paper addresses the design of the mood function in a multifunctional mobile application (app). The aim of the app is to support young patients in the transition from pediatric to adult healthcare. Mood is often differentiated from acute emotional states, such as being angry, sad or happy. They last longer and are often not related to an immediate trigger: “mood state appears to be an integrative function of the organism's acute emotional experiences over time” [2]. In the field of IT health, e-health, and m-health (health IT), this differentiation disappears when describing or designing mood technology. This becomes for example clear in [3], which categorizes mood technologies into *Technology that measures mood*; *Technology that expresses user mood*; *Technology that adapts to user mood*; and *Technology that influences user mood*. Another categorization of mood

technology is diagnosis-based versus general mood. For example, mood apps can address specific mood disorders, such as bipolar disorder [4], anxiety disorders [5], and depression [6], or have a more general approach, such as happy apps [7].

Research focusing on apps for adolescent mental health report that the participation and adherence rate to treatment was higher for mobile phone apps than on paper [8][9], rating mood was seen as most useful [10], and “the ability of mobile phones to offer personal space is also considered to increase levels of perceived autonomy, control, and self-esteem in young users” [11]. Young people with chronic physical health challenges are more likely to have mood-related issues, ranging from emotional problems to mood disorders [12].

On the question about the preferred functions of an app that would support them in their transition to adult health care, a group of young chronic patients participating in KULU research proposed, among others, a mood tracking function. This paper presents and discusses the design of an app-based mood tracking functionality with and for young patients. The aim of the paper is to explore how we can design with and for young patients, while taking their whole being, as a teenager or young adult and as a patient, into consideration.

The contribution of this paper is threefold. It contributes to designing interactive technologies from the perspective of young people with health challenges. A *lifeworld*-led design approach, combined with a participatory design methodology, enables patients to be met as co-designers and experts of their own lives and facilitates patient contributions to the design of health IT. Secondly, it contributes to understanding young patients' lifeworlds. It shows how they value moods in their lives and the importance of taking a holistic perspective when tracking moods. Lastly, it contributes to understanding the role of technology in the lives of young people in general. Teenagers and young adults' technology preferences and use are often very different from those of the researchers. Designing with the future users of a technology increases the chance that the technology reflects the values and needs of that particular user group.

In Section II, we will first explore some concepts that support a holistic patient perspective in the design process of a lifeworld-led design approach. This is followed, in Section III, by a brief presentation of SHARM (Situation-based learning; Having a say; Adaptability; Respect; Mutual

¹ KULU is a Norwegian acronym for Cool Technologies for Youth with Long-term Health Challenges (www.kulu.no/en)

learning), our Participatory Design approach. In Section IV, we present the design process, the methods used, the different stages in the development of the mood tracking function, and the final results. In Section V, we discuss the design process and its results through the lens of the lifeworld concept and we evaluate the SHARM approach. In the final section, we present our concluding remarks and outline future research.

II. CONCEPTUAL FRAMEWORK

Teenagers and young adults with chronic health challenges have made clear that they want to be met as young people, not as patients. Their wish to push their 'patientness', the quality of being a patient, to the background is also confirmed in the literature [14]–[16]. Young patients use the terms *normal* and *regular* to express how they want to be perceived and treated by the world around them [14][16]. They acknowledge their illness, but want to have lives like their peers and they do not want their caregivers to see only their diagnosed bodies: "the doctor should be interested in me, all of me, not just my diagnosis" [17].

This particular positioning by the young patients can be explained with the notion of the *lived body*, the body as experienced by the self and as being-in-the-world, as described in phenomenology [18]. The concept that encompasses both the lived body and its experiences in the world is the notion of lifeworld. Lifeworld can be described as "the world of lived experience or the beginning pace-flow from which we divide up our experiences into more abstract categories and names" [19]. Lifeworld theory describes five intertwined dimensions in which these experiences become meaningful: temporality, spatiality, intersubjectivity, embodiment, and mood [19]. Mood, in this context, is described as a "messenger of the meaning of our situation" or our being-in-the-world, "mood is complex and often more than words can say" [19].

Lifeworld-led care is a particular perspective on healthcare, which focuses on the wellbeing of the whole person, not just the illness or diagnosis [19][20]. This perspective is both a deepening of the understanding of patient-centered care and a critique on the dehumanisation and depersonalization of care, not the least through the use of technology [19][20]. The aim of a lifeworld-led design approach is to let the young patients' *lived experiences* of everyday life, diagnosis, and technology use, guide the design of new technology that supports them in living their everyday life with their health challenges [20].

In order to provide an enabling environment in which young patients can build forth on these experiences, KULU implements its design activities within a participatory methodology called SHARM, which is based on Participatory Design [20]. The participation of young people as co-designers of their own healthcare technologies enables a design space in which the young participants can position themselves in the way they perceive themselves and how they want to be perceived by others. The SHARM approach is based on five principles [22]: 1) *Situation-based action* locates the design activities in the lifeworld and relationships

of the participants; 2) *Having a say* is about creating real opportunities for participants to share the decision-making power; 3) *Adaptability* is about applying tools and methods in the design activities that can easily adapt to the participants' changing physical or emotional state; 4) *Respect* is about treating the young participants as experts on their own life and body; and 5) *Mutual learning* refers to choosing methods and tools that enable the participants to lean as much from us as we do from them.

III. RESULTS FROM THE DESIGN PROCESS

The design of a mood tracking functionality was part of a larger design project with the Youth Council of the Akershus University Hospital (AHUS) in Norway. The Youth Council had made a wish list of issues and technologies they wanted to address in the design project with KULU. The transition to adult healthcare was one of the main concerns of the Council and they wanted to explore how a mobile phone application (app) could support them in the transition process.

We will report here on the design of the mood tracker functionality for a multifunctional transition app. The design process consisted of four workshops and an online prototype evaluation. The workshops took place in two large meeting rooms and were attended on average by seven Council members. In total, ten young patients participated, five male and five female participants, who were between 14 and 21 years old. They had a variety of chronic diagnoses. The project was evaluated and approved by the data authority for universities in Norway and the privacy officer of AHUS. All participants had given their consent to participate. Additional consent was sought from the legal guardians of the participants that were younger than 16 years old. Further details of the design process can be found in [22].

A. Identifying functionality

During the first workshop, the functionality of the transition app was explored with a brainstorming technique [23], resulting in a two lists: *Cool-to-have* and *Must-have* [24]. The *Must-have* list consisted of functionalities that the app needs in order to be used, such as calendar for doctor appointments, alarm for taking medicines, checklists, and *registration of the general state* of the user (e.g., mood, energy level), but also attributes, such as *colors* and *privacy*. Color preferences were perceived as very personal and one of the participants proposed that colors could be used to personalize the app. A password or pass code was proposed to keep the content of the app separate from other apps [24]. The *Cool-to-have* list mentioned aspects and functionalities that made the app extra attractive for young people, such as an 'Instagram'-like environment, music play-list (similar to 'Spotify'), and film and tv tips [24]. An analysis of the group discussion of all proposals resulted in the identification of three categories: to have an *overview* (medicines, appointments, routines); strengthen *autonomy* (registration of general state, checklists); and *entertainment* (music; tips).

B. General State

During the second workshop, the *registration of the general state*, was one of several functions further explored.

In a collaborative prototyping session, three design proposals were presented in the form of both paper-based and digital prototypes. Collaborative prototyping enables the translation of values and needs into design requirements [25][26]. The three proposals reflected different ways of mapping their energy levels and mood. The registration of the general state through images was perceived as more creative and personal. In the discussion that followed, the difference between taking your own photos and finding images on the net was explored, with one participant expressing the concern that finding and uploading images from the net needed focus and energy, which was not always available. Another participant mentioned “when you are really down, you can go back and look at the photos and see that there is one that makes you happy. For example, when you are admitted to the hospital, you can *go back* and look for what gives you energy, and look at the photos” [24].

C. Mood

The discussions of the three prototypes evolved around the use of photos, colors, and mood. The next iteration of the function for mapping the user’s general state focused on these three aspects and consisted of three low-fidelity digital prototypes, which were also produced as plasticized paper printouts. In order to enable the user to “go back”, we used the concept of timeline as an organizing principle for the photos. Each photo could be tagged with a colored frame, which would be an expression of the mood associated with the photo. During the third workshop the different prototypes were explored and discussed (Fig. 1). The participants preferred the option to scroll up and down through the list of photos. Secondly, they preferred photos of the same size to the option to have different sizes, because this gave a better overview of the photos in the timeline. The timeline itself should be based on the date, not on photos, so it would be clear to them on which days they were too tired or sick to add a photo to the timeline. Colored small dots on the side, based on the colors selected for the images, would give a quick overview of mood over time (Fig. 2).

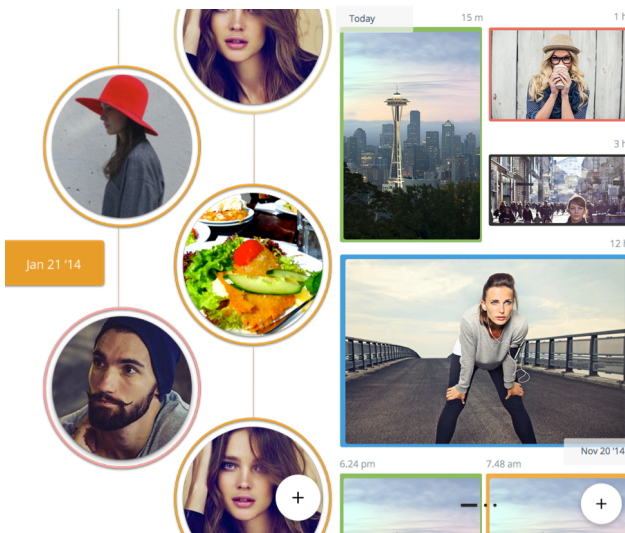


Figure 1. Prototypes of MoodLines

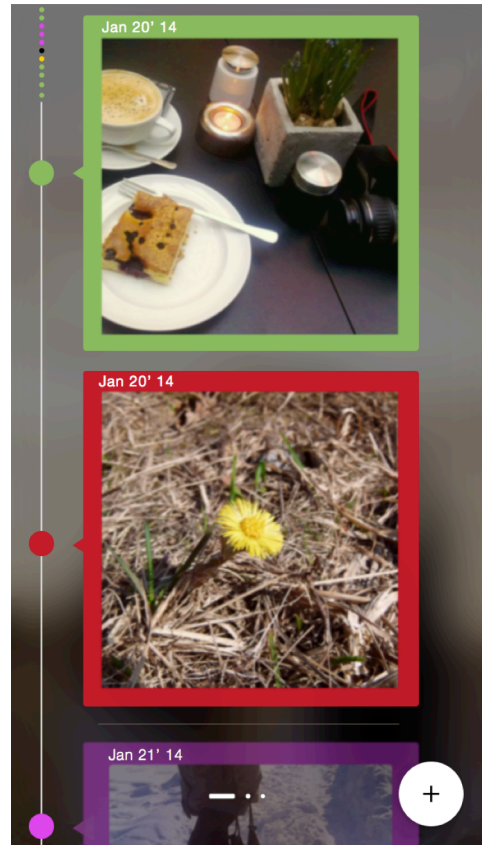


Figure 2. MoodLine with dots

The timeline of photos with different color-tags inspired a discussion of what they could do with the colors. One participant proposed to add a new option to the mood tracker, namely the possibility to see only photos tagged with one color, similar to Instagram. For example, on a sad day, the user could scroll through photos tagged with the color-tag happy, in order to get through the day and inspire or motivate oneself with photos that presented happier times or moods. We also explored different options for personalization through colors [27]. The option to allow the user to configure the colors and their associated meanings was chosen over option to use a default set of colors with associated moods (See Fig. 3). The combination of images and colors enabled a focus on tracking their mood, not on taking pretty pictures. This option also expresses the wide variety of color associations found among the participants, which were the result of age, gender, and personal preferences [27].

D. Final iteration

The final iteration of the mood function was produced in InVision, an online prototyping software for clickable, high-resolution prototypes. During the last workshop, our co-designers were invited to access what was now named the KOOLO app on Invision, in order to click through the different options, such tagging colors with a mood, adding a photo, color-tagging the photo, scrolling through photos, and accessing the mood map to select a collection of photos

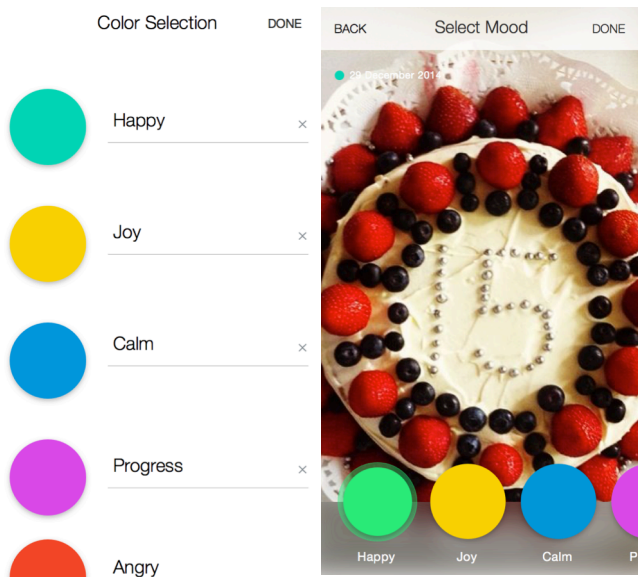


Figure 3. Color tags

tagged with the same color. All the participants received information on how to access the online prototype and were invited to use and evaluate the prototype.

IV. DISCUSSION

“Lived experience is coloured by mood” [18]

The KOOLO app, including its mood function, has now been fully developed for both the Android and iOS platform. The co-designers’ preferences and needs form the core of the mood function (see summary in Table 1).

TABLE I. IMPLEMENTATION OF DESIGN SPECIFICATIONS

Requirement	Implementation
1. Registration of the general state	Photos in an ‘Instagram’-like environment
2. Time as organizing principle	<i>AMoodLine</i> organized by dates, including dates without photos
3. Color as organising principle	No default settings for tags
	Can be used for personalization of the whole app The photos can be organized by color via the <i>MoodMap</i> option
4. Privacy	Photos are stored in the app, which is password/code protected

In the discussions on the *registration of the general state*, the co-designers included their existing experiences with apps. This function therefore evolved very early in the design process into an image-based mood function. It could use the existing functionality of the mobile phone (the photo app) and was perceived as an intuitive, easy, and personal way to track one’s mood. Also, the shape of the images reflected the participants’ existing app use: square shape of the images was preferred over round-shaped ones, because of its similarity with square-shaped images of the popular Instagram app (see Fig. 1 and 2).

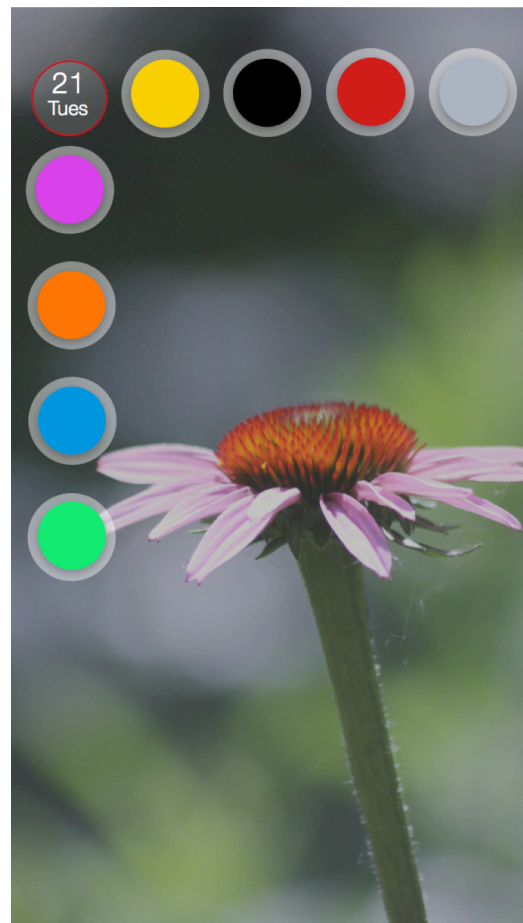


Figure 4. Calendar with color tag

Our co-designers also made clear that they wanted to track both positive and negative moods and did not want to favor one type of mood over the other by presenting them in different formats or styles. As an example they mentioned that a day with a negative mood could be a very important day, but that this could get lost in a design that would present positive mood images larger than negative mood images.

This example makes clear that the co-designers were able to find and explore connections between their *lifeworlds* and the specifications of the mood function. That they wanted to track their mood in relation to their lived experiences became also clear in the design of the timeline and the application of mood colors to other functions in the app. They preferred the *MoodLine* to track all days, not only the days in which a user added a photo. This way, a day without a photo has meaning as well, by evoking reflection on the reason for not adding a photo to the *MoodLine*, such as being too tired or too sick. Inspired by the color tags of the *MoodLine*, they proposed to use color tags in other functions of the app, such as the dates in the calendar function of the app. A date tagged with a color thus became a meaningful way to highlight days with doctor appointments or test results (Fig. 4).

The idea for the *MoodMap* (Fig. 5) came up in a discussion about keeping an *overview* of things. The larger the *MoodLine* would become over time, the more difficult it would be to find patterns that were meaningful in their lives. The proposal for a *MoodMap* was inspired by the Instagram

photomap, which geographically maps where a user has taken a photo and shows all photos taken on that same location. All participants perceived this as a fun and intuitive way of organizing their mood images. The *MoodMap* gives an indication of how many photos are tagged by a particular color. Selecting one color in the *MoodMap* (Fig. 5) results in a *MoodLine* (Fig. 2) with only images tagged with the selected color.

The young patients can use the mood function to keep an overview of their moods over time as well as per mood. In addition, they can use mood colors to in other functions of the app, such as calendar and date function. This can give them an understanding of the context in which their moods appear. Keeping an overview and looking for meaning are related to mastery, the experience of emerging stronger from a very stressful health condition [28]. The experience of mastery increases when young patients can participate in a meaningful way in decisions that affect their lives. The *MoodMap* allows the user to focus on one particular emotional state, which may effect motivation, inspiration, learning, and change.

Lastly, the *privacy* specification: the co-designers proposed a strict division on their mobile phone between general apps and an app focusing on their diagnosis or health challenges. The design of the mood function, and the app as a whole, are designed according to *Privacy by Design* principles [29]. Privacy is default, as well as integrated to the

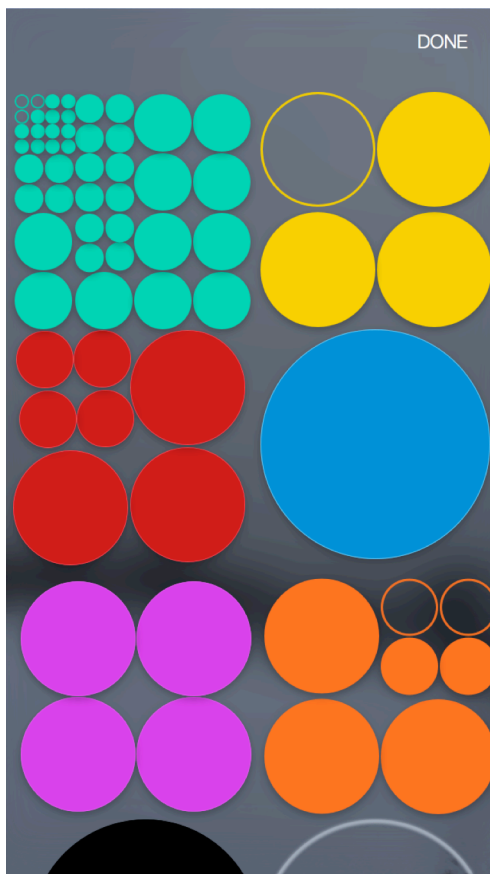


Figure 5. MoodMap – each dot presents one photo tagged with that color

system, without diminishing functionality. There is no communication between this app and the other apps stored on the mobile phone - data produced in the app, calendar events, photos, and checklist entries, are stored within the app – and there is no communication with a website or with third parties. The source code is open and available for investigation.

The five principles of the SHARM approach played a central role in creating a *lifeworld-led design process*. The design workshops took place in the hospital, providing them a safe place for reflecting on their experiences and needs as young people with serious health conditions (situation-based action). The iterative approach, in which the design preferences, ideas, and results from the last workshop were presented in a more designed and developed manner, providing real opportunities for the co-designers to take part in decision-making based on their expertise of their own life and body. The methods we used in the workshops enabled a mutual learning process that was at the one hand explorative and inspiring, and on the other hand based on research and experience.

V. CONCLUSIONS

A systematic review of apps supporting adolescents' personal management of chronic and long-term physical conditions [1] shows that the lack of large-scale studies makes it difficult to find empirical evidence of their benefit, but that engaging the adolescents contributes to changes in the mobile intervention's design. Our study confirms that the participation of young people with health challenges in the design of their own interactive technologies can result in creative and important contributions to the design process. A participatory and *lifeworld-led* design process, based on collaborative methods and an iterative approach, allows young patients to explore mood-related needs and values in a more holistic and relational manner. This resulted in very specific design requirements that were closely related to the young persons' everyday experiences with technology. The popular Instagram app was an important inspiration in the design process. Secondly, it resulted in a more meaningful mood tracking and mapping practice, such as personalizing the use of self-selected colors and self-produced images; the equal importance of positive and negative moods and days with and without images (*MoodLine*); and the organization of photos by mood (*MoodMap*).

The young patients were met as co-designers and experts of their own lives, which enabled them to be heard as well as to have a say in the design process. This allowed them to make important contributions to the design of health IT. In turn, this enabled the researchers to learn more about the young patients' lived bodies, their *lifeworlds*, and the role of technology in their lives.

The design of the mood tracking function resulted in two new design concepts for organizing mood data, the *MoodLine* and the *MoodMap*. The use of photos, framed with colors representing emotional states, enabled a meaningful registration of the young persons' mood in a visually pleasant manner (*MoodLine*) and in a meaningfully organized way (*MoodMap*).

Future work consists of making the transition app, including the mood function, available to a group of test users, with and without a diagnosis, followed by qualitative interviews with the users as well as health personnel.

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