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Sprite Catcher: A Handheld Self-Reflection and Mindfulness Tool for Mental Healthcare

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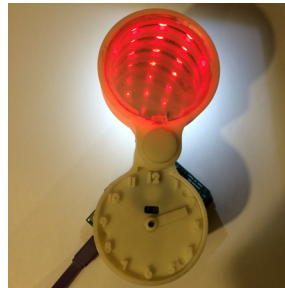


Fig.1 - The Sprite Catcher

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Abstract

This paper describes the rationale behind the ongoing development of Sprite Catcher – a handheld, tangible interactive tool for treating depression and anxiety. The current design, which is intended to encourage the user to practice self-reflection and mindfulness, is the product of participatory design conducted with counsellors from a local mental health charity and with a university psychology researcher. Through a review of previous work in this area, a description of a use scenario and an overview of the design's functions and concepts, we illustrate where the project is heading and which research questions we aim to respond to.

Author Keywords

Tangible, Reflection, Mindfulness, Depression, Mental Healthcare, Wellbeing, Embodied Interaction

ACM Classification Keywords

J.3.m. Life and Medical Sciences: Health

Introduction

This ongoing interaction design study has been initiated in response to a healthcare problem whose gravity is becoming increasingly apparent for healthcare professionals and HCI researchers. The most recent

mental healthcare demographic study by the NHS¹ calculated that 16.6%% of all men and 24.9% of all women in England have been diagnosed with depression at some point in their life. The outcomes of previous tangible technology design research have indicated that it might be feasible to design tangible interactive devices that help in the treatment of this mental condition. Drawing on this work and on the input of an expert participatory design team, we have developed *Sprite Catcher*: a mobile, tangible device that encourages self-reflection and mindfulness in-clinic and at home.

The participatory design team for this project has been composed of ourselves, a university mental healthcare researcher and a team of counsellors from a mental healthcare charity. We have been the designers and researchers and the other parties have been our consultants, helping us to shape design around the needs of the target users'. To establish the criteria for the design we organised a number of meetings between the stakeholders at various stages in the design and prototyping process. These discussions gave us the primary focus that our interaction design should encourage self-reflection and mindfulness. We start with a review of these elements in the paper. The more intricate outcomes of our discussions will be dealt with later on.

Literature Review

The following excerpt from a psychology research paper on cognitive behaviour therapy helps to convey

¹ National Statistics Adult Psychiatric Morbidity Survey: Common mental disorders 2014, p. 52

something of the role that self-reflection can play in therapy for depression: "When you find your interpretation of a situation is erroneous and you correct it, you probably discover that your mood improves, you behave in a more functional way and/ or your physiological arousal decreases." (p. 32) [3]. The notion that technologically aided self-reflection can enhance a person's life has received plenty of attention in HCI research in recent years but not necessarily as described above. Baumer's [2] review of self-reflection research in HCI defines *education*, *design processes* and/or *self-knowledge* as the three areas of focus that have been covered. Amongst those that target *self-knowledge* there are only a handful of studies that have covered tangible interaction modalities - *Emoti-meter* [14], *MyInnerLife* [6] *InternetOfSoftThings*[8], and *TOBE* [7]. Amongst these we could only find two examples of projects - *Emoti-meter* and *InternetOfSoftThings*, where the goal has been to design for mental health issues specifically.

Mindfulness has received less attention relatively to reflection in HCI research. Akama and Light [1] have claimed that where mindfulness in the past has been discussed, it has been misconceived. There has, they argue, been a certain level of ignorance about what mindfulness means and how valuable it can be. Drawing on discussions with our mental healthcare participatory design team, we have an understanding of mindfulness that is shaped by its meaning in the healthcare context. We conceive it as a state of mind, in which a person is brought to an awareness of their own thought stream. As described by psychology researchers Bishop et al. [4] mindfulness is "bringing awareness to current experience – observing and attending to the changing field of thoughts, feelings

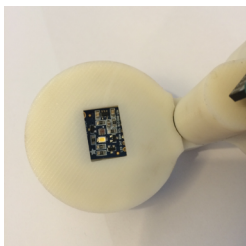
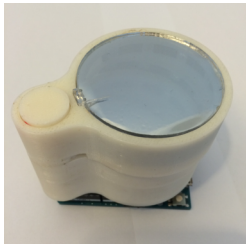
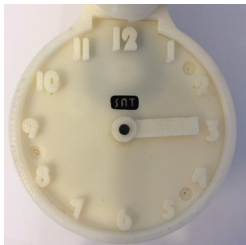


Fig. 2. Images of the latest sprite catcher prototype

and sensations from moment to moment...Rather than getting caught up in ruminative, elaborative thought streams about one's experiences and its origins, implications and associations, mindfulness involves a direct experience of events in the mind and body" (p. 235).

We have been able to find a small body of tangible interaction research that relates to this interpretation – *The Mindfulness Sphere* [13], *Mind Spheres* [10] and *Inner Garden* [12] all draw on mindfulness as an important health benefit. Only one of these, the mindfulness sphere [13], was appropriated for use in the mental healthcare context especially though.

Use Scenario

To convey how the final sprite catcher design (Fig. 2) manifests these two concepts – self-reflection and mindfulness, we now describe a use case:

Laura suffers from depression. She receives counselling for her illness and attends peer group classes. One day the counsellor gives her a sprite catcher device and instructs her in how to use it. Laura tucks it away in her handbag. The following day (Saturday) while she is at home, Laura begins to feel anxious. She finds that she is ruminating about something that she heard one of her colleagues at work say. She cannot seem to stop the cycle of negative thoughts tumbling over and over in her head and a feeling of hopelessness and self-dislike is starting to build. She remembers that she was given the sprite catcher device the previous day. She doubts it can help her but decides to dig it out of her handbag anyway. Laura opens it by sliding the display around and away from the clock face and then changes

the time on the clock to reflect that on her watch. Next, she looks around the room to find something that might reflect her current emotions. She sees an old, forgotten, purple shoe in the corner of the room under a pile of clothes and decides to make that her target. Laura walks over to the shoe, holds the sprite catcher up to it and then presses the button in the centre of the clock face. Suddenly, purple light begins to rush into the display and whizz around, like sprites dancing. She finds that the longer she holds the button down, the more the light rushes in. The feeling of sucking sprites from the shoe into the catcher is unusual but pleasant and it's starting to take Laura's attention away from her ruminations. She lets go of the button when she feels that she has enough. Now, holding the device back in front of her Laura begins to rock it gently backwards and forwards. As she does so, the wild sprites are soothed and begin to slow down into a more organised, more rhythmical dance. The more smoothly she rocks, the more relaxed they become, as if she is taming them – and her thoughts, rocking them to sleep. Laura finds her ruminations beginning to recede further as she focuses on the calming light display. When she is satisfied with this she closes the device and pops it back into her bag.

At various moments over the next few days, Laura does the same thing – capturing sprites in the device to reflect her experiences. As she does so she starts to notice more of the objects and items that are around her at home, on the bus, at work etc. She becomes curious about what kind of sprites they may produce. This sense of wonder about the world is positive and productive for Laura, it helps her to reactivate the dormant, creative part of her mind and stop focusing on her internal worries.

At the end of the week it's time for another counselling session. During the session, Laura takes the device out of her bag and begins to use it as a stimulus. She uses the clock hand to cycle back in time to the beginning of the week and then slowly scrolls back through to the present. As she cycles forwards, the sprites she has captured appear on the display. She talks about each one with her counsellor in turn, reflecting upon the experiences they represent.

Design Implementation

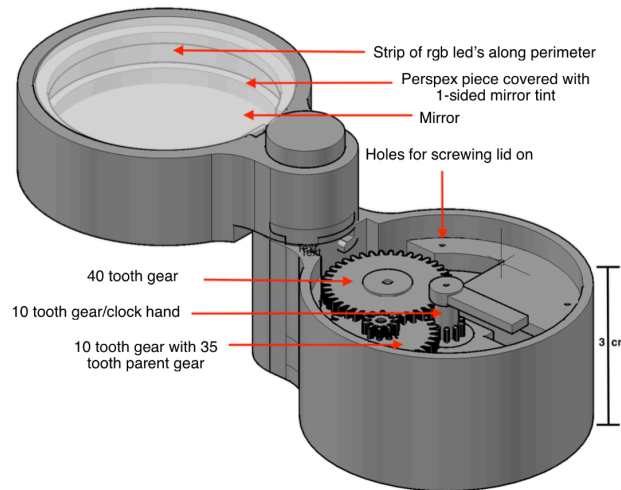


Fig. 3 - Internal workings of the display barrel (left) and clock barrel (right) seen from above

The design is composed of two main barrels which are connected by a hinge. Inside the clock barrel there are a series of gears (fig. 3) that connect the clock hand to a rotary encoder (this component has a built-in button). The gears ensure that the day corresponds

with the time. There is also an accelerometer, vibrating disc motor, battery and a microcontroller. Inside the display barrel (fig. 3) there is a mirror at the bottom and a piece of Perspex with a sheet of one-way mirror tint stuck to it at the top. The two mirrors face each other. A strip of LEDs runs around the perimeter of the barrel (fig. 3) and a colour sensor (fig. 4) sits at the bottom of the barrel facing outwards.

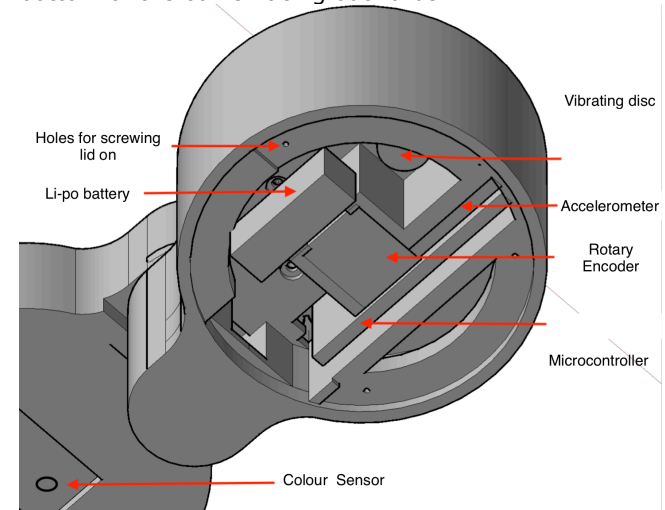


Fig. 4 - Internal workings of the display barrel (left) and clock barrel (right) seen from below

Functionality: To use the device, the user must select the time by moving the clock hands manually, hold the device up to a colourful object and press the clock face - i.e. the rotary encoder button. When the button is pressed down, the colour sensor detects a colour, the LEDs in the display barrel light up with the registered colour and the vibrating motor whirrs. The longer the button is held down, the brighter the lights become. In

the display barrel, the two mirrors reflect the light from the LED's backwards and forwards between themselves repeatedly. This gives the mesmerising impression that there is infinite depth in the barrel (fig. 2).

When the user depresses the button, the microcontroller records a *time stamp* (rotary encoder position) and associates it with a colour (colour sensor) and brightness (length of time for which the button was pressed). The device has been programmed to log as many of these events as the user likes – disc space permitting. Subsequently, whenever the user moves the clock hand to a time for which a colour has been registered, the colour is played back on the LED's. The amount of brightness entered by the user is also played back.

Discussion and Future Work

The sprite catcher captures and then plays back memory cues to the user to encourage them to self-reflect. Discussions with the co-design team informed us that we should try to minimise the amount of information in these memory cues and make them abstract. Firstly, it was felt that photographs and other forms of rich media contain too much provocative information for people suffering with depression. Recent research [9], has shown that in some cases self-reflection can actually increase rather than nullify a person's ruminations. Our approach is an attempt to marginalise these negative effects. Secondly, we felt that abstract representations might lead to more meaningful recollections as the ambiguity would force users to *search out* and *make sense of* the memory themselves rather than relying on the media to represent it.

Another notable aspect of the design is the fact that it has a tangible rather than digital form. The motivation for this partly comes from previous experimental HCI research by Whittaker et al. [11], who found that people are likely to create stronger emotional relationships with physical memento's than they are with digital ones. It is also, however, derived from psychology research around embodied cognition, which has had a strong influence on tangibles design research [5] and features as a fundamental part of the cognitive behaviour therapy model that is used in treatment of depression and anxiety by the NHS [16].

The aesthetic look and visual effects of the device are a third important factor to mention. Like other devices designed for mindfulness e.g. *Mind Spheres* [10], the sprite catcher uses visceral sensory stimulus to capture the attention of the user, jolt them out of their ruminations and stem their internal dialogue. Discussions with our participatory design team led us to the conclusion that it would not be enough to simply catch and hold their attention and suspend them in a state of flow. For in the process of absorbing their attention, we would shut out the external world. This could mean that the device becomes a tool for hiding from difficult life situations rather than confronting them.

We decided, consequently, that we should aim to design a handheld device that extends the user's focus beyond the bounds of their relationship with it alone. So, rather than shutting out the external world, the device should include the external world in the interactive scheme, making the user engage with objects in their local environment mindfully and reflectively.

One final design requirement of note was that it should be enjoyable, intuitive and easy to use. Our co-design team made us aware that depressed users are likely to become frustrated with technology very quickly and are often less resilient than others. For this reason, the sprite catcher has been given a single button for control and instilled with an element of fun in its interaction design.

Future work is both about further technological improvements and user studies. The next stage of the technological development is to programme the microcontroller so the user can change the pattern of the LED's by shaking the device rhythmically. The microcontroller will detect movement through its accelerometer. This will add another layer to the amount of information that the user can record and play back. We will also be fitting the device with a smaller microcontroller that can be slotted inside the clock barrel with the other components.

Following this we will be running some user studies. An important part of this will be finding out how well the device performs as a tool for memory recall. It captures very little information about the life events – only the time that it happened and the colour of an object in the local environment. Other memory cues collected by the device – brightness and movement of the lights – are more abstract, relating to emotions and feelings rather than tangible features of the environment. We will explore how effectively this abstract representation of an event can aid recall. *Pix* - a ring that can be used to take a picture and then display it in low resolution [15], has recently played with the idea that blurry images can hold emotionally meaningful information. We would like to take the opportunity to further explore this

concept. The majority of the user studies, however, will focus on exploring the impact that our design approach can have on mental wellbeing. We will be undertaking a qualitative analysis of the user-experience and a quantitative analysis of the colour sensor and accelerometer data registered by users. We will be looking to see if there are any emergent patterns in how the device is used and what impact they have. These studies will be carried out with the service users of the local community mental health charity.

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