Design to Promote Mindfulness Practice and Sense of Self for Vulnerable Women in Secure Hospital Services

**Anja Thieme[1], Jayne Wallace[2], Paula Johnson[3], John McCarthy[4], Siân Lindley[5], Peter Wright[1],
Patrick Olivier[1] and Thomas D. Meyer[6]**

[1]School of Computing Science/
[6]Institute of Neuroscience,
Newcastle University, UK
{anja.thieme@ncl.ac.uk}

[2]School of
Design,
Northumbria
University, UK

[3]Calderstones NHS
Foundation Trust,
LD Specialist Hospital,
Whalley, UK

[4]School of Applied
Psychology,
University College
Cork, IRL

[5]Socio-Digital
Systems,
Microsoft Research
Cambridge, UK

ABSTRACT
In the field of mental health care technologies, very limited attention has been given to the design of interventions for individuals who undergo treatment for severe mental health problems in intense care contexts. Exploring novel designs to engage vulnerable psychiatric patients in therapeutic skills practice and expanding on the potential of technology to promote mental health, the paper introduces the design concept of the *Spheres of Wellbeing*. A set of interactive artifacts is developed specifically for women with a dual diagnosis of a Learning Disability and Borderline Personality Disorder, living in the medium secure services of a forensic hospital in the UK. The women present a difficult to treat group due to extremely challenging behaviors and a fundamental lack of motivation to engage in therapy. The *Spheres* are designed to assist the women in practices of mindfulness, to help them tolerate emotional distress and to strengthen their sense of self, all of which are vital components of their specialist treatment Dialectical Behavioral Therapy (DBT). The Spheres are intended to supplement the therapy of the women and to contribute to our understanding of designing technology to enhance mental wellbeing and quality of life more generally.

Author Keywords
Mental Health Technology; Hospital; Mindfulness; Sense of Self; Mental Wellbeing; Interaction Design; Materiality.

ACM Classification Keywords
H.5.m. [Information interfaces and presentation] (e.g., HCI): Miscellaneous.

INTRODUCTION
Good mental health is vital to our general health, wellbeing and quality of life, enabling us to build resilience against everyday stresses, to work productively, have fulfilling relationships and to experience life as meaningful [40]. Recent surveys by the World Health Organization however, confirm a high and increasing lifetime prevalence of mental

disorders with estimated rates across many countries ranging from 12 to 47.5% of the population being affected by mental health problems at some stage in their lives [17]. Mental illnesses do not only severely impact people's wellbeing; they pose enormous burdens on the worldwide economy and society as a whole. The global impact of mental health problems has led to increased explorations as to how HCI research can valuably contribute to people's mental health. Research in this area is still new, with current technologies primarily targeted at improving access to and the outcomes of therapeutic services [10]. Existing technologies commonly range from online therapy programs (e.g., Computerized Cognitive Behavioral Therapy [11]) and self-help systems to designs that supplement psychotherapy, by providing additional contents to the therapy. These include for instance augmented reality systems to support exposure treatment [41], mobile devices to support the monitoring of clients [29] or game-like interfaces to promote communications between therapist and client [e.g., 7,27].

Seeking to expand the potential of technology to promote mental health and exploring new ways to engage individuals in therapeutic skills practice, this paper describes the design concept of the *Spheres of Wellbeing* (short '*Spheres*'). These are a set of interactive artifacts, specifically developed for a group of women on a medium secure unit (MSU) of a UK hospital, who suffer from a Learning Disability and Borderline Personality Disorder. To supplement the psychosocial therapy of the women, the Spheres are closely informed by their specialist treatment Dialectical Behavioral Therapy [21] and our close collaboration with hospital staff. The artifacts are targeted at supporting the women in the learning and practice of vital therapeutic skills. To promote engagement with the Spheres, we propose inviting each woman to creatively contribute to a personalized design of their set of artifacts.

It is important to note, however, that this paper only presents the design concept and rationale of the Spheres, with the artifacts not having been fully implemented or evaluated yet. As a design exploration, our work makes two important contributions to research and design in the field of mental health care and other areas in HCI, which focus on engagements with sensitive user groups in highly constrained design contexts.

Firstly, the paper introduces the interaction design and rationale of the Spheres as they are carefully informed by and respond to the complex mental health condition of the women and their specific intense care environment. We present our strategies for engaging the women in important therapeutic skills practice and discuss their relevance for other user groups and mental health interventions in HCI.

Secondly, we describe the importance of our relationship with health and research professionals at the hospital in designing for this specific user group and context, detailing how we overcame barriers in understanding each other's individual practices and how this collaboration helped identify and address important design challenges, against the backdrop of organizational and ethical constraints.

The paper begins by presenting background information on the complex mental health condition and specialist treatment of the women. It then outlines our collaborative process with hospital staff and the specifics of the design context that inform the design space, before introducing the detailed concept and rationale of the Spheres. Our proposed co-creative process of personalizing the artifacts with the women is described and reflected on thereafter.

BACKGROUND
Our research is targeted at a group of six women in the medium secure services of a UK hospital. The women are mainly in their twenties and have a dual diagnosis of a Learning Disability and Borderline Personality Disorder.

Learning Disability
Individuals with Learning Disability present a population most at risk for mental health problems with the prevalence of anxiety or mood disorders being twice as high as in the general public [28]. The lifelong disability usually causes difficulties in learning, understanding and problem solving, limits a person's attention span and impacts on interactions and communications with others. As a result, individuals frequently experience situations that they find frustrating or provocative, and they have greater difficulty in making life choices or developing a sense of independence [6]. The women eligible to take part in this research have a mild to moderate LD with full scale IQs ranging from 53 to 69. Some may have reasonable reading skills but can struggle to understand complex sentences, requiring some repetition of explanation when new concepts (i.e., mindfulness) are introduced; this is often mitigated by the use of pictures.

Borderline Personality Disorder
Individuals with Borderline Personality Disorder (BPD) have profound difficulties in regulating emotions, exuding on their behavioral performance, sense of self and ability to form and maintain stable relationships [21,26]. This emotion dysregulation relates to a high sensitivity and responsiveness towards emotional cues [22,42], such as an inability to inhibit inappropriate behaviors, to act mood-independent, to refocus attention in the presence of strong emotions and to self-soothe physiological arousal. When overpowered by emotional pain and hopelessness, people with BPD tend to show disinterest in engaging in coping exercises, which often do not provide an immediate sense of relief [18]. Due to the women's impaired ability to interpret, tolerate or regulate intense emotional pain, they tend to display outbursts of anger and violent behaviors (e.g., hitting or verbally attacking others) and attempting to engage in self-harming behaviors [21,22,42].

Individuals with BPD further show a variety of cognitive disturbances including thought distortions, whereby they overvalue the idea of being bad and do not believe that they deserve anything nice; they may feel that they have no control over a situation (depersonalization); hold onto false beliefs despite contrary evidence (delusions); and at times mentally disconnect pieces of memory, related feelings, thoughts or actions in order to temporarily escape mental fears or pain (dissociation) [19,21]. Such cognitive dysregulations disrupt the development of a sense of self. As a result, individuals tend to have a persistently unstable self-image and experience a feeling of chronic *emptiness of self* [2,19,22].

A stable sense of self and the ability to appropriately regulate one's emotions are also of crucial importance for the possession of positive, balanced relationships with other people [22]. Individuals with BPD, however, tend to suffer from a profound fear of abandonment and poor quality of close relationships, which can be the source of repeated negative emotions such as anger or fear [19]. Inevitably, interpersonal difficulties also impact on their relationships with members of their care team or therapists [26]. Since external social support through the community, family or friends is restricted, staff on the unit play a vital role in modeling pro-social behavior and creating a validating environment for the women, including a focus on assisting them in attending to their treatment targets [34].

Dialectical Behavioral Therapy
Dialectical Behavioral Therapy (DBT) is one of the few recommended specialist treatments for BPD; its effectiveness has been evidenced in controlled clinical trials [e.g.,33,36], and has shown to be successful in early studies with individuals with Intellectual Disability in forensic services [e.g.,18,30]. It is a very comprehensive treatment that combines a variety of therapeutic concepts and methods including Cognitive Behavioral Therapy (CBT), dialectical thinking and concepts and techniques primarily from Zen Buddhism (mindfulness), allowing it to resonate with current trends in mental health care [25,26,32].

The term 'dialectic' in the therapy refers to the persuasive dialogue between therapist and patient to facilitate change, and also reflects a philosophical perspective that emphasizes the consideration of reality as a whole and its parts as being interrelated [21,22]. It suggests that the learning of a new behavioral skill is not easily separated from learning other related skills concurrently, and can be either hindered or supported by the person's environment.

Reality is regarded as dynamic, whereby change results from finding syntheses of internal opposing forces, as opposed to extreme or dichotomous thinking. The fundamental dialectic in DBT is the syntheses between focusing on *accepting and validating* the person as she is, and simultaneously motivating her to *change* [4,22,26,36]. DBT usually encompasses a combination of individual psychotherapy and group skills training, teaching the mastery of four key skills: emotion regulation, interpersonal effectiveness, distress tolerance and mindfulness. These skills can be distinguished into those that promote *change*, such as improved emotion regulation and interpersonal effectiveness, and those that promote *acceptance* including mindfulness and distress tolerance [33].

Hospital Setting: Women in Medium Secure Services
The MSU is a new build of the hospital, developed to create a safe and airy space including large windows for daylight and views outside, with the different parts of the unit being described as discrete flats. The women's flat has six bedrooms with en-suite toilets and showers, which stretch across a corridor. There is a communal bathroom, a living room area with large chairs and a TV installation, close to a dining table and an integrated kitchen. At its center is the staff office, surrounded by glass windows, to allow for a constant observation of the unit. It also accommodates a high dependency area adjoined by a seclusion room, which is used to give the women space away from their peers to help de-escalate aggressive behavior and prevent the women from hurting themselves and others.

The women are referred to the MSU from either the prison system, mental health services or the community services. Their specific circumstances of requiring secured treatment means that they forfeit their liberty, and this often lasts for 3-4 times longer than their peers in prison or male counterparts [1]. The women usually stay in the MSU for a period of 6-12 months, until their condition has improved enough to be transferred to the lower secure services. The MSU is a transitory place and an environment which prohibits the possession of objects that could be of danger to the women or that are at risk of being damaged by them. Thus, the women are surrounded by only a few objects that could tell a story about them or connect them to things outside the unit (e.g., posters and pictures on the wall). This deprivation of personal possessions, of things that are unique to each woman, reduce expressions and personal affirmations of their individuality [cf. 14,24,38].

UNDERSTANDING THE SPECIFIC DESIGN CONTEXT
Our access to and the inclusion of the women in the early stages of the design process was restricted due to stringent ethical requirements, which constrained the application of established user-centered design methods. To gain an in-depth understanding of this specific design context, we therefore followed a *person-focused design* approach, whereby we collaborated with health professionals and staff nurses, who work closely with the women on the MSU, to

better identify and address their needs [cf.7,10]. Our collaboration involved mutual visits to each other's work places encompassing 6 visits of members of the research team to the hospital; 2 visits of hospital staff to our research lab; and meetings at 3 LD specialist conferences. These meetings were accompanied by a large amount of emails, phone conversations as well as an intensive joint process of writing the research protocol and ethics support documents.

Our visits primarily involved the R&D Manager of the hospital – a trained CBT Therapist who had been working in the women's services for more than 15 years; 3 Research Staff experienced in studies on the MSU; as well as 4 Staff Nurses, the Ward Manager and the Clinical Nurse Manager of the MSU; a Consultant Clinical Psychologist, who is the clinical lead for the DBT Team at the hospital; and the Medical Director. The researchers comprise a multi-disciplinary team of Designers, Computing Scientists and Psychologists, one of which is trained in CBT.

Visits to the hospital were organized and led by the R&D Manager and typically included a series of meetings, either on the MSU or in meeting rooms across the hospital. Different staff were involved to either brainstorm ideas or iterate initial design concepts (e.g. Consultant Psychologist, Staff Nurses, Clinical Managers), or to discuss issues around object safety, research governance and ethics (mostly R&D staff). Brainstorming activities typically included the sharing of materials by therapists (training manuals or therapy contents) and researchers (examples of previous projects; sketches or photos of early prototypes) to explain current practices and to illustrate ideas for the design. This process enabled us to gain important insights into the complex psychiatric condition of the women and recommended treatment approaches, while hospital staff became more familiar with commonly used methods in HCI (i.e., probes) and rich opportunities offered by digital designs. The initial concepts of the Spheres evolved through these conversations.

THE DESIGN SPACE
The design space and its specific design requirements respond to the challenging mental health condition of the women, their therapy, and the constraints of their secure care. It is informed by our close collaboration with staff at the hospital and the literature.

Safety of the Technology (and all Research Materials)
Whilst staff suggested our designs were something that the women could engage with in private and take with them when they leave the MSU, they emphasised that interactions with them needed to be *safe*. To address safety concerns in the context of the women's impulsive behaviors, the artifacts and their materials are required to be robust, in order to protect the technology and thereby alleviate risks of self-harm via sharp pieces or batteries. To this end, all artifacts designed for the women and any materials brought onto the secure unit have to withstand a careful suitability check by a safety officer at the hospital.

Engagement in Therapeutic Skills Practice
Importantly, the designs should supplement the therapy of the women by engaging them in practices of *mindfulness*, help them *tolerate distress* and to strengthen their *sense of self*, three vital components of DBT.

Design to Introduce Mindfulness
The key idea behind mindfulness is to bring 'awareness' to oneself and one's life as it unfolds. This requires us to stop, observe and accept whatever happens moment by moment [22]. Bringing full awareness to our actions and direct experiences in a non-evaluative manner, where we focus on one thing at a time [33, p.354], allows us to remain centered in the reality and fullness of our life [16], which helps us to find inner strength, to feel more in charge of ourselves [26] and to develop a sense of true self [33]. Meditation exercises can be directed towards inner experiences of the individual, like her breath, bodily sensations, thoughts and emotions, as well as external aspects of the environment, such as sounds or sights [16].

Mindfulness can be cultivated in many different ways, but is most commonly practiced through certain meditation exercises, guiding the individual in how to enhance their awareness [12]. Initially, exercises are often concentration-based, teaching the person for instance to focus her attention on a specific stimulus, such as breathing and to refocus their attention on the stimuli whenever they get distracted [4]. Once familiar with the concept of meditation, practices then proceed from cultivating one's attentional focus on particular objects or experiences, to bringing awareness to the broader stream of stimuli as they arise in everyday life [12,16].

Mindfulness meditation is becoming increasingly popular in the field of mental health [4] and for achieving psychological wellbeing more generally. Recently, first designs to promote meditative experiences also evolved in the field of HCI. Vidyarthi et al. [37] introduced the *Sonic Cradle*, a dark chamber in which the person can shape the musical soundscape through variations in the frequency and depth of their breathing, as assessed by respiratory biofeedback sensors. A related earlier design by Shaw et al. [31] presents the *Meditation Chamber* as a virtual environment installation that creates audio and visual content displayed through a head-mounted display, guiding an individual through various mediation experiences. An increased level of relaxation as indicated by a person biorhythm (e.g., heart rate, respiration, galvanic skin response), alters the presented visuals. Other activities instruct the person to mimic muscle relaxing body movements or provide guidance in breathing exercises.

These designs provide examples of technologies that introduce mindfulness to meditation novices in pairing biofeedback with subtle audio or visual content. Our design similarly aims to introduce the women to the concept of mindfulness, which they are not yet familiar with, and to invite continued engagement in such meditative practices.

Design to Support Distress Tolerance
Distress tolerance represents the ability to tolerate emotional pain when trying to overcome crisis situations [33]. At times, where change for the better may not yet feel possible, this enables the women to handle stressful moments without returning to behaviors that worsen their situation (e.g., self-harm) [8]. Our design in this regard should help the women to divert their attention from a pressing negative emotion in providing them with a means for self-distraction, which can prevent rumination or the emergence of emotional crisis [22].

Design to Promote Sense of Self
To strengthen the self-image of the women and to help them in the construction and maintenance of their identity, our design should enable them to explore and re-discover positive experiences and aspects of their self that are personally meaningful [5,14]. This builds on recent work by Wallace et al. [38], who explored the value of technology as a means for individual and social reflection, reminiscence, comfort and reassurance with people with dementia. Their work introduced the *Tales of I*, an interactive art piece that displayed videos relating to different themes. The places, groups or local culture represented in the videos displayed things that the person with dementia could relate to, thereby allowing them to define and re-connect to aspects of their self.

Accessibility
Considering the women's Learning Disability, the designs and their interaction concepts should be *accessible* to them. Thus, following recommendations for designing therapy contents for individuals with an Intellectual Disability by [18,25,28], our designs should make use of physical forms, materials and interaction concepts that are *visual* and *versatile*. Furthermore, the designs should avoid the use of heavy text, which is often disengaging [29]. If any written information is to be presented as part of the research (e.g., in information sheets, consent forms), or as part of our conversations with the women, easily accessible language should be used, supported by pictorial prompts and carefully explained to each woman.

Self-Soothing
For individuals with BPD, it is particularly important that they learn the ability to 'self-soothe', as they hold strong beliefs that they do not deserve any kindness and at times feel ashamed or guilty if they comfort themselves [22]. Thus, it would be desirable if the artifacts could be designed in a way that would invite the women to be gentle and kind towards themselves, or assist them in seeing themselves as being beautiful, to enhance their self-concept.

Personal Significance
In relation to the MSU being a transitory place and an environment that prohibits the possession of most objects, the artifacts should be designed to facilitate a personal appropriation. Invited interactions should further allow for experiences that are positive and meaningful to the women.

THE SPHERES OF WELLBEING

In response to the design space, we developed the Spheres of Wellbeing as a set of three artifacts: the *Mindfulness Sphere, Calming Sphere* and *Identity Sphere*. The term 'Spheres' however is not intended to imply a specific physical form but rather acts as a descriptive label for the design spaces they explore. The following presents the design and rationale of each Sphere. We then outline our creative process of personalizing them with each woman.

The Mindfulness Sphere

The Mindfulness Sphere is a tangible, interactive artifact that resembles in its design a crystal ball that, upon touch, assesses and reflects the person's heartbeat through colorful lights and soft pulsating vibrations (Figure 1). This allows for the observations of the person's heartbeat as it unfolds moment by moment [cf. 16]. As such, the Sphere is envisioned to cultivate a new, experiential way of bringing awareness to this bodily sensation. The idea for the Sphere came about in discussions with the R&D Manager, which unfolded around concepts of embodiment, difficulties to open one's hands when feeling tense, and opportunities for self-distraction through cold sensual experiences, e.g., when touching ice cubes or metal. Triggered thoughts on how to motivate the women to open their hands to touch cold surfaces like metal were then associated with possibilities to assess their heartbeat. Since the inclusion of biofeedback was considered particularly valuable by the R&D manager, the concept was developed further.

Configuration and Object Safety

The ball is 12cm in diameter and is made from transparent resin. Resin was chosen as a material following discussions with clinicians, who preferred its robust, solid surface to softer silicon, which can be destroyed with one's teeth (e.g., to get to the electronics inside). However, all individuals who work on the female MSU need to be aware of remaining risks, i.e., they have to watch out that the ball won't be thrown at somebody, and they need to adhere to the safety procedures in place (e.g. counting in and out of objects, supervision of the research activities).

At its left and right side, the resin ball safely encases small metal disk indents, sensing the heartbeat of the person touching. The ball houses technology at its core to interpret the electrical signals from both hands and translates them into a visual representation of the heart rate through 6 multicolor LEDs (Figure 2). The frequency, intensity and color of each LED can be controlled separately allowing for the creation of a constantly changing appearance of the visual feedback, enhanced by soft pulsating vibrations.
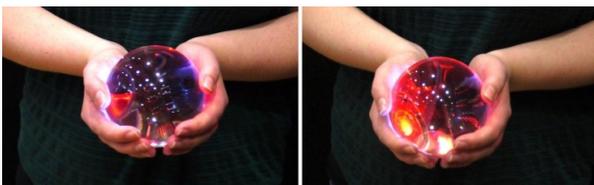
**Figure 1. Visual feedback from the Mindfulness Sphere.**
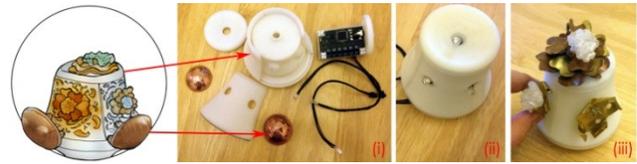
Figure 2. The inside of the Mindfulness Sphere: (i) the components of the core including a plastic housing, the circuit board and two metal contacts; (ii) the LEDs distributed around the core; (iii) core decorated with flowers and crystals.

After a few seconds of holding the artifact with both hands, the heart rate is sensed and calculated, which initiates the fade-in and -out of the LED lights in changing colors. A power socket enables the safe re-charging of the inbuilt battery, which is handled by staff in their office.

To motivate a continued awareness towards one's heartbeat and to allow for a gentle practice of mindfulness, the Sphere is configured to present a visual stimuli in the form of the LEDs sequentially lighting up if the Sphere is held relatively still for a prolonged period of time, for instance every 10, 20 or 30 seconds, as assessed by an inbuilt accelerometer. This promotes continued observation and practice [18,19], and invites a curious re-direction of attention to the Sphere and meditation exercise if the person's attention has been taken away [4,12,16], without risking any punitive thoughts or feelings of failure [cf.37].

Mindfulness Practice, Self-Knowledge and Self-Acceptance

The Mindfulness Sphere invites the women to direct their attention to their heartbeat and to carefully observe this externalized sensation of their body as it arises moment by moment [16,22]. The manifestation of this inner sensation in the ball, however, does not remove it from the body but enables the women to be in touch with their heart by closely holding the Sphere in their hands. The Mindfulness Sphere thereby may cultivate a new way of getting to know oneself. This offered opportunity to intimately connect the individual to her body is crucial for the experience and expression of emotion. In bringing gentle and kind awareness to the experience of one's heart, the individual may develop more appreciation and self-kindness for her body and can become more comfortable with herself [39].

Biofeedback: Potential for Self-Regulation

As a form of biofeedback, the Mindfulness Sphere allows the women to learn how they can regulate an aspect of their self and to better trust their own behaviors and emotions [cf. 18]. By way of example, the women may use the artifact to test if they can alter their heartbeat through certain relaxation exercises (e.g., slowed down breathing). This has two important implications: Firstly, the ability to regulate and control aspects of their self is particularly valuable for women with BPD, who often have difficulties in analyzing themselves and gaining control over their thoughts, emotions or behaviors [34]. Potential success in regulating not only one's attentional focus, but also one's heartbeat, can provide a sense of achievement and positive reinforcement that *change* is possible. Secondly, the

Learning Disability of the women contributes to their limited understanding of how to best practice skills in order to gain more control. Whilst the women often seek behavioral feedback, they are highly sensitive towards feedback that is negative or contaminated by other people's judgments [22]. By depersonalizing the feedback through the use of an object, the potential for interpersonal conflict and emotional hypersensitivity is reduced making the feedback perhaps easier to accept.

The Sphere has been presented in meetings with clinicians, who raised safety concerns about the material composition and the supervision of the object, as described above. Despite these concerns, they were positive about the design, thinking the object feasible for the women and presenting a suitable addition to their therapy. The Clinical Nurse Manager appreciated the physicality and visual presence of the object, particularly for women with LD, as it provides them with something that they can turn to, pick up and hold, that presents a visual reminder of the therapy they are in, and that they have ownership of. Other clinicians regard the Sphere as a 'way in' to introduce conversations about the concept of mindfulness with the women, but emphasized the need to carefully show and explain to them how they can use the ball in a mindful way.

The Calming Sphere

As an addition to the Mindfulness Sphere, we designed the Calming Sphere as a less complex, non-digital artifact, to provide the women with a very simple means to distract themselves. As a small bead bracelet, it reflects the concept of secular worry beads or prayer ropes. These are a selection of beads that are rolled between the fingers one after the other along a string [3]. The regular, repetitive activity can help release inner tensions, whilst the beads physically offer something to hold onto, providing a symbol of safety and calm [13]. Contemporary prayer beads, like the Scandinavian 'Pearls of Life', are also commonly used for spiritual exercises, self-control, relaxation or reflections about life [23]. The beads can be made from any material and the amounts added to each rope vary.

Staff nurses and clinicians working with the women told us that the women like jewelry, but, depending on their personal risks and history, some are very limited in what they are allowed to wear (e.g., no heavy or sharp metal pieces). We will therefore invite the women to make their own unique beads from lightweight materials such polymer clay, which are then attached to a short leather string long enough to just fit around the women's wrists to extinguish risks of self-harm (see Figure 3 for an example bracelet).

Figure 3. **Example of a Calming Sphere bracelet.**

While the women will understand and perhaps wear the bead bracelet as a piece of jewelry, we yet will have to introduce them to the use of the bracelet as a means for self-distraction when troublesome feelings arise, rather than engaging in self-destructive behaviors [8].

The Identity Sphere

The design of the Identity Sphere (Figure 4) resembles a female leather wallet that safely encases a small android smart phone (e.g., Sony Ericsson Xperia X10 mini), whose functionalities are removed. The phone is configured to recognize certain predefined pictures (*visual tags*) through its inbuilt digital camera, which acts as a 'scanner' for these visual tags. Once presented with a tag, it triggers the display of short personalized videos of 1-2 minutes on the screen of the Sphere. The contents of the embedded videos are co-created with each woman, and are sought to provide a lens into positive experiences and interests of the person. The underlying concept builds on previous work by Wallace et al. with people with dementia [38] and findings from our research with couples [35], whereby videos of personally relevant content served as a means to help define the person (or relationship), and to reconnect to aspects of their self.

With this in mind, the Identity Sphere is designed to resemble a personal possession and extension of the person's self, through which the women can construct, maintain or re-construct their identity. According to Belk [5] personal possessions are not restricted to the ownership of physical objects alone. They can include places one has been to, individual experiences or meaningful people in one's life, all of which are important parts of the person's self, contributing to and reflecting her identity. Moreover, treasured possessions are likely to be those that are associated with positive memories, that capture enjoyable experiences and happy moments of the person [5,14]. Thus, we believe it is valuable and reassuring for the women to be reminiscent of aspects of their self that are positive, reflect personal achievements or carry meaningful experiences.

Configuration and Object safety

The leather casing serves multiple purposes. As a material it is tear proof, can be turned into any shape, dyed in various colors and specifically tooled to allow for unique ornaments, thus providing an opportunity to personalize the wallet to the preferences of each woman. Smaller pockets inside the wallet also enable the inclusion of non-digital content such as photos (Figure 4). The Sphere interacts with visual tags, which come in the shape of *body transfers* – temporary, tattoo like pictures that can be placed as a decorative element on the body – and *stickers*. Each woman is involved in the creation of 3-8 colorful visual tags that get identified through graphical algorithms (e.g., SIFT, SURF) run by a software application on the smart phone.

Due to the women's cyclic mood, cognitive distortions in their self-image and impulsivity, there is a risk that the women may treasure something in one moment, but reject and destroy it in the next. In feeling self-hatred and

believing that they do not deserve nice things, they may try to break objects that they otherwise value. Certain objects (e.g., personal photos) could become damaged and lost forever. Motivated by this dynamic, transfers and stickers are safe to use, can be removed easily and reprinted if destroyed, with the videos they trigger being preserved.

Self-Soothing, Identity Performances and Space for Privacy
As beautiful images, body transfers can invite the women to engage more intimately with their body and can adorn whatever area of their body that they would like. If placed on the body the imagery can aids a woman to see herself looking beautiful, in a gentle and feminine way, thereby teaching the individual to take care of herself, to soothe herself. As stickers, visual tags can be attached to the wall or be used to decorate the furniture in the individual rooms of the women. The women are left with the choice of where they would feel most comfortable placing these images in their personal space. Moreover, the act of decorating presents a form of self-expression that changes not only the women's relationship to their bedroom, but, in being visible to others, can invite identity performances towards members of staff or other women on the unit, socially affirming the person's identity [cf.14,24].

In conversations with clinicians at the hospital, we have been told that the women are generally very computer literate, that they enjoy playing computer games, and are likely to be intrigued by the interplay of the Sphere with the visual tags. The R&D Manager further explained to us that the women – due to the risks they present to themselves and others at this stage in their lives – have only few precious possessions that they are allowed to keep, or that they have to themselves without others having a look at them too. She values that the women can keep their videos private, if they wish, so that neither the other women nor the staff can access them. The women decide with whom they want to share their visual tags, each presenting a unique visual key to a video, only identifiable by their own Identity Sphere.

Figure 4. Left: The wallet-like Identity Sphere with an incorporated phone and screen inside to display the videos. Right: Examples of visual tags as stickers and body transfers.

Empathic, Co-Creative Design Process with the Women
The design specifications of the Spheres described above form the starting point in a co-creative design process, whereby the women actively contribute to a personalized design of their artifacts. In 4-5 creative sessions with one of the researchers, the women will work with art and craft materials for the creation of visually attractive pieces for their Spheres. Considering the LD of the women, the creative activities offer a variety of sensory and tactile experiences to facilitate self-expression. Simultaneously, they promote a calmer and less threatening atmosphere when working with the researcher and can raise the women's self-esteem as they learn achievable skills or discover unknown strengths [20]. The activities are designed to be stimulating, enjoyable and relaxing.

In these sessions the women are encouraged to grow for instance beautiful crystals to be encased as decorative elements inside their Mindfulness Sphere (see Figure 2); to make their own clay beads for the Calming Sphere bracelet (Figure 3); to design or select tattoo images, and to color Mandala images – which hopefully captivate for the women in their beauty – for the visual tags (Figure 4). The women are further invited to capture photos, videos or sounds as part of an outdoor excursion for the videos of their Identity Sphere. Over a period of 5 weeks, these 2 hour sessions will be conducted within the women's familiar environment, to reduce any anxiety that they may experience during these activities, and are accompanied at all times by at least one regular member of staff, safeguarding both the women and the researcher. With a positive focus on accepting and continuously validating the women, the creative sessions are anticipated to enable a more empathic understanding of the women with a view to promoting a positive, empowering relationship between the women and the researcher.

DISCUSSION
HCI research on technologies to support people with severe mental health problems in intense care environments is extremely rare. This is often due to a lack of knowledge on the part of non-clinical researchers regarding specific mental health conditions and respective specialist treatments and also the nature of the clinical context, which demands necessary, yet complex and lengthy ethical approvals of clearly outlined research protocols. The medical environment offers little space for the conduct of person-centred design methods or incremental software developments common in HCI. The complexity of this and the restricted access to end users in the early stages of the design process highlight the importance for active collaborations with mental health care providers in these settings, as previously outlined by [7,10,11], and particularly when designing for vulnerable user groups.

Person-Focused Design: Our Collaboration with Staff
Following from this and considering the central role of staff in the women's care [34], the design concept of the Spheres is meaningfully informed by our close, continuous

collaboration with staff at the hospital, including members of the R&D department, staff nurses and therapists working with the women as well as their clinical managers. Conversations with staff enabled us to better understand the complex challenges related to the pathology of the women, their treatment regime and the specifics of their secure care. Staff also made valuable contributions to informal iterations of design ideations and the Sphere prototypes to assess their appropriateness for use in the women's services and as an addition to their therapeutic treatment. Although we cannot provide an evaluative study of the Spheres with the women yet, we regard our interactions with staff as a valuable contribution to the development of the Spheres.

It has been the support of the research staff at the hospital that was most important to our understanding of the safety regulations on the MSU (e.g., who introduced us to the safety procedures in place, arranged 'breakaway' training for us, brought us in contact with the safety manager), and with whom we've worked the closest to appropriately address the unique challenges and risks of this project regarding research governance and ethics. Here, we had to balance the safety, ethical and organizational issues of the research – as they were required by the clinical context to safeguard the women – with our more open-ended ideas and methods for the design. In this regard, it was very fortunate to us that some of the hospital staff were both clinically experienced and research-oriented in their work (e.g., the clinical background of the R&D Manager).

Whilst the close involvement of staff in the design process has been crucial to inform the design of the Spheres, we have to acknowledge that these engagements may impact on staff's acceptance and delivery of the technology, and can become a confounding factor in evaluations of the Spheres' effectiveness. This raises questions about the appropriateness of this approach and the need to consider alternative methods in the future.

Design for Engagement: The Spheres of Wellbeing
As a set of three artifacts the Spheres present specifications in response to design challenges such as object safety, accessibility, space for positive and personally meaningful interactions, and a means to engage the women in important therapeutic skills practice. Our design decisions in this regard reflect a series of trade-offs and opportunities driven by the extreme context.

In terms of object safety, robust, tear proof materials such as resin and leather were chosen to protect the technology and to alleviate risks of self-harm. However, there is a remaining risk that that the women may destroy or throw the artifacts at somebody at times of emotional stress. Thus, as with all other objects on the unit, some women with severe behavioral difficulties may only be allowed to engage with them whilst under additional supervision by staff. The tangible design of the Spheres, however, has been a deliberate decision for two reasons: (i) it gives the women the opportunity to engage with them in private thereby avoiding potential feelings of jealousy or embarrassment, as opposed to an inbuilt installation that is shared between the women; (ii) relating to the very materiality of the objects, it enables the women to hold the objects close to their body, to wear them on their skin or as a bracelet, thereby contributing to a more intimate relationship with the artifacts and possibly engendering a greater feeling of self.

The objects are designed to attract through their intricacy and in responding to each woman's personal feelings of beauty, which is of particular importance considering the low self-esteem of the women and their difficulties in perceiving themselves as beautiful. In many ways the women become part of the artifacts: The Mindfulness Sphere pulses and changes color in response to their heartbeat, the Calming Sphere, when worn as a bracelet, decorates their body, while the body transfers and stickers are more ephemeral and connect them intimately with their skin and personal space. Designs that adorn and beautify the person, that offer opportunities for identification and that reflect aspects of the individual can be powerful in supporting a person's sense of self. This raises interesting questions about the role of our material environment in contributing to performances of our identity and how technology can play a vital role in assisting people in the construction and maintenance of their identity [cf. also 14].

Through their physicality and emphasis on aesthetic appeal and personal significance – enlivened by the technology – the Spheres provide a novel means to engage the women in important therapeutic skills practices. Interactions are designed to be very visual, creative and practical (in response to the women's LD and low frustration tolerance) and invite experiences that are stimulating and calming. This may lead the women to perceive the artifacts differently to materials commonly used for skills training in formal therapy sessions, which can reduce stigma and lower motivational barriers to engagement. Since the Spheres depart in their design from any typical medical device this puts forth important issues as to how to introduce the artifacts and possible interactions to the women in order to not only nurture engagements with the objects, but to facilitate the learning of, and adherence to, mental health supporting abilities. We have to be both sensitive and critical about such dynamics and potential conflicts in the development and evaluation of our designs.

As digital artifacts, both the Mindfulness and the Identity Spheres offer opportunities to log data and to monitor any interactions with them. This functionality may provide valuable insights into evaluations of the Spheres' effectiveness. As a form of behavioral feedback, this information can prove useful to their therapist too [cf. 29]. It might also be interesting to explore the potential of the Sphere artifacts as vehicles to facilitate communication between the women and the therapist (e.g., when introducing new concept or skills) as mentioned by the clinicians and exampled in mental health designs by [7,27].

Creating Empathy in this Sensitive Context

The co-creative activities enable the women to actively contribute to a personalized design of their artifacts, invite creativity and potentially raise their self-esteem [20]. The sessions further aim to promote a positive and empathic relationship between the researcher and the women. This process, however, can be very challenging in the context of the women's emotional and interpersonal dysregulation, which can pose emotional burdens on the researcher [cf. 9]. In order for the researcher to respond sensitively and flexibly to the women's need, it may also be challenging to adhere to a pre-set research agenda. Moreover, the fostering of a close relationship with the women can lead to biases in their perceptions of the Spheres. To minimize conflicts with scientific standards for objectivity, our meetings with the women are part of a tentative, reciprocal process with sessions being distributed over a longer time span to give the researcher time to step back from the activities and to critically reflect on their own practices [15].

However, the co-creative engagements with the women are yet subject to our future work. We have received all necessary approvals by the responsible Research Ethics Committee of the National Health Services (NHS) and our collaborating hospital Trust for the conduct of the creative activities as well as a rich mixed-method evaluation of the Spheres of Wellbeing, which commences in January 2013.

CONCLUSION

This paper contributes the design concept and rationale of the *Spheres of Wellbeing*, developed specifically for a group of women with a dual diagnosis of a Learning Disability and Borderline Personality Disorder, who live in the medium secure services of a UK hospital. The design space is informed by the complex mental health condition of the women, their specialist treatment, constraints of their secure care as well as the ethical and organizational requirements of the clinical context. Being restricted in access to this vulnerable user group required our understanding of the design context to be informed by close collaborations with hospital staff.

In response to the design space, we developed the Spheres as a set of three artifacts, whose designs emphasize aspects of aesthetic appeal, creativity and personal significance, and gently invite the women to explore facets of their self. The combined focus on materiality, femininity and a connection to the body in both the physical and interactive design of the Spheres is anticipated to reduce mental health stigma and to lower the women's motivational barriers to engage in therapeutic activities.

The Spheres are specifically developed to assist the women in practices of mindful awareness, to help them tolerate distressful moments and to strengthen their sense of self, all of which are vital components of their specialist psychosocial treatment DBT. In providing insights from our close collaboration with staff, introducing the design specifications of the Spheres, and describing strategies for empathic engagements in this sensitive context, we open up the design space for future HCI research and developments in the field of mental health technologies.

REFERENCES

1. Aitken, G. and Logan, C. Dangerous Women? A UK response. In *Feminism & Psychology 14*, 2 (2004), 262-269.

2. American Psychiatric Association. Borderline personality disorder - *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR), 1994.

3. Arettam, J. *Dharma Beads: Making and Using Your Own Buddhist Malas*. Tuttle Publishing, 2000.

4. Baer, R.A. Mindfulness training as a clinical intervention: A conceptual and empirical review. In *Clinical Psychology: Science and Practice 10* (2003), 125-143.

5. Belk, R.W. Possessions and the extended self. In *Journal of Consumer Research 15,* 2 (1988), 139-168.

6. Chilvers, J., Thomas, C., and Stanbury, A. The impact of a ward-based mindfulness programme on recorded aggression in a medium secure facility for women with learning disabilities. In *Journal of Learning Disability and Offending Behavior 2*, 1 (2011), 27-41.

7. Coyle, D. and Doherty, G. Clinical evaluations and collaborative design: Developing new technologies for mental healthcare interventions. In *Proc. CHI 2009*, 2051-2060.

8. Clayton, P. From insecure attachment to (partial) inter-subjectivity (fearful aloneness to safely being with others). In *Journal of Learning Disability and Offending Behaviour 1,* 1 (2010), 33-43.

9. Dickson-Swift, V., James, E.L., Kippen, S., and Liamputtong, P. Doing sensitive research: what challenges do qualitative researchers face? In *Qualitative Research 7*, 3 (2007), 327-353.

10. Doherty, G., Colye, D., and Matthews, M. Design and evaluation guidelines for mental health technologies. In *Interacting with Computers 22* (2010), 243-242.

11. Doherty, G., Colye, D., and Sharry, J. Engagement with online mental health interventions: An exploratory study of a treatment for depression. In *Proc. CHI 2012*, 1421-1430.

12. Dunn, B.R., Hartigan, J.A., and Mikulas, W.L. Concentration and mindfulness meditations: Unique

forms of Consciousness? *Applied Psychophysiology and Biofeedback 24,* 3 (1999), 147-165.

13. Durbin, L.S. *The history of beads: From 100,000 B.C. to the present.* ABRAMS, 2009.

14. Galvin, M. Understanding and Designing Wellbeing in Relation to our Material Environment. In *DIS 2012 Workshop Designing Wellbeing*.

15. Johnson, R. Rogers, Y., van der Linden, J., and Bianchi-Berthouze, N. Being in the thick of in-the-wild studies: The challenges and insights of researcher participation. In *Proc. CHI 2012*, 1125-1144.

16. Kabat-Zinn, J. *Full catastrophe living: How to cope with stress, pain and illness using mindfulness meditation* (15th edition). Piatkus, 2009.

17. Kessler, R.C., et al. Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's World Mental Health Survey Initiative. In *World Psychiatry 6* (2007), 168-176.

18. Lew, M., Matta, C., Tripp-Tebo, C., and Watts, D. DBT for individuals with intellectual disabilities: a programme description. In *Mental Health Aspects of Developmental Disabilities 9* (2006), 1-12.

19. Lieb, K., Zanarini, M.C., Schmahl, C., Linehan, M.M. and Bohus, M. Borderline personality disorder. In *Lancet 364* (2004), 53-461.

20. Liebmann, M. *Art therapy and anger*. Jessica Kingsley, 2008.

21. Linehan, M.M. *Cognitive-behavioral treatment for borderline personality disorders.* Guilford, 1993.

22. Linehan, M.M.. *Skills Training Manual for Treating Borderline Personality Disorder*. Guilford, 1993.

23. Lönnebo, M., Welin, C., and Johansson, C. *Pearls of Life: for the personal spiritual journey*. Wild Goose Publications, 2007.

24. Miller, D. *The comfort of things*. Polity Press, 2008.

25. Morrissey, C., and Ingamells, B. Adapted dialectical behaviour therapy for male offenders with intellectual disability in a high secure environment: six years on. In *Journal of Learning Disability and Offending Behaviour 2,* 1 (2011), 10-17.

26. Palmer, R.KL. Dialectic behaviour therapy for borderline personality disorder. In *Advances in Psychiatric Treatment 8* (2002), 10-16.

27. Pykhtina, O. et al. Magic Land: The design and evaluation of an interactive tabletop supporting therapeutic play with children. In *Proc. DIS 2012*, 136-145.

28. Robertson, B. The adaption and application of mindfulness-based psychotherapeutic practices for individuals with intellectual disabilities. In *Advances in Mental Health and Intellectual Disabilities 5,* 5 (2011), 46-52.

29. Sa, M., and Carrico, L. Fear therapy for children – A mobile approach. In *Proc. EICS 2012*, 237-246.

30. Sakdalan, J.A., Shaw, J., and Collier, V. Staying in the here-and-now: A pilot study on the use of dialectical behaviour therapy group skills training for forensic clients with intellectual disability. In *Journal of Intellectual Disability Research 54,* 6 (2010), 568-572.

31. Shaw, C., Gromala, D., and Fleming Seay, A. The Meditation Chamber: Enacting autonomic senses. In *Proc. of ENACTIVE/07*, 2007.

32. Simpson, E.B., et al. Focus on women: Use of dialectical behavioral therapy in a partial hospital environment program for women with borderline personality disorder. In *Psychiatric Services 49* (1998), 669-673.

33. Soler, J., et al. Dialectical behaviour therapy skills training compared to standard group therapy in borderline personality disorder: A 3-month randomised controlled clinical trial. In *Behaviour Research and Therapy 47* (2009), 353-358.

34. Swenson, C.R. How can we account for DBT's widespread popularity? In *Clinical Psychology: Science and Practice 7* (2000), 87-91.

35. Thieme, A., et al. Lover's box: Designing for reflection within romantic relationships. In *International Journal of Human Computer Studies, 69,* 5 (2011), 283-297.

36. Verheul, R., et al. Dialectical behaviour therapy for women with borderline personality disorder: 12-month, randomised clinical trial in the Netherlands. In *British Journal of Psychiatry 182* (2003), 135-140.

37. Vidyarthi, J., Riecke, B.E., and Gromala, D. Sonic Cradle: Designing for immersive experience of meditation by connecting respiration to music. In *Proc. DIS 2012*, 408-417.

38. Wallace, J., Thieme, A., Wood, G., Schofield, G., and Olivier, P. Enabling self, intimacy and a sense of home in dementia: An enquiry into design in a hospital setting. In *Proc. CHI 2012*, 2629-2638.

39. Williams, M., Teasdale, J., Segal, Z., and Kabat-Zinn, J. *The mindfulness way through depression*. Guilford Press, 2007.

40. World Health Organisation Promoting Mental Health. *Concepts emerging evidence and practice. Summary report.* Geneva: World Health Organisation, 2004.

41. Wrzesien, M., Raya, M.A., Burkhardt, J.-M., and Botella, C. Mixing Psychology and HCI in evaluation of augmented reality mental health technology. In *Ext. Abstracts CHI 2011*, 2119-2124.

42. Yen, S., Zlotnick, C., and Costello, E. Affect regulation in women with borderline personality disorder traits. In *The Journal of Nervous and Mental Disease 100*, 10 (2002), 693-696.