BodyGuard: A Case Study of Telecare Product Innovation and Development

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Abstract
Telecare is personal and environmental sensors that support people to remain safe and independent in their own home for longer. Telecare plays an important role in addressing the challenges of an ageing population. However, many people do not wear the most common form provided, the community alarm, for reasons that include the way that it looks. In the UK, a contributing factor to this problem is that manufacturers cater to telecare service providers (e.g. local authorities) and as a result, service users are not involved in design processes. This paper describes a redesign of the community alarm by a leading manufacturer, involving participatory design activities with users and the wider public, and design internships. The main innovation of the new community alarm, called BodyGuard, is that it connects with the user's smartphone to enable it to work outside the home. We report insights and lessons learned during the innovation process, within the context of social care reforms giving people more control and choice over the services that they receive.

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Assistive technology; community alarm; community alarm service; participatory design; social care; telecare

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

Introduction

Telecare is personal and environmental sensors that support people to remain safe and independent in their own home for longer.

The most established form of telecare is the community alarm service, which typically comprises: a base unit; a community alarm (wearable alarm button) supplied with neck cord, wrist strap or clothing clip that should be worn at all times in the home; and 24 hour monitoring. The base unit is plugged into a home telephone line and incorporates an alarm button and two-way audio; pressing the button alerts the alarm monitoring centre that help is needed and the caller can communicate with the centre staff. Pressing the community alarm within 100 meters or so of the base unit also raises an alarm call (Figure 1). However, research has shown that while users view the service positively, many do not wear their community alarm [2,4,6,14]. Reasons include: fear of stigma; concerns over accidentally raising an alert; its unsightly appearance and signifier of old age; and simply forgetting to put it on.

In the UK, a contributing factor to community alarms not being worn is that manufacturers do not involve users in design processes because their main customer is seen as the local authorities, which provide funded services. In Scotland, manufacturers also sell to Community Health and Social Care Partnerships, which are partnerships between the local authority and the NHS. Limited interoperability between manufacturers' products has also contributed to a lack of innovation, as service providers are to an extent locked-in to a specific supplier; interoperability is important because many people have a package of care (more than two items). Elsewhere in Europe, [13] reported that Swedish

Figure 1. Community alarms currently on the market (top and bottom left) and a much earlier model (bottom right)

municipalities also order the same products over and again, due to a lack of service user engagement mechanisms and a complex procurement process. However, the UK social care system is undergoing substantial reform. In particular, from 2014, Self Directed Support (SDS) will give people who use social care services as much control as they want over the individual budget spent on their support, including the option to search and pay for solutions independently [12]. SDS is expected to lead to a more consumer-led telecare market, favouring those manufacturers that engage with users as well as providers.

This work contributes to the body of research within HCI on assistive technology and participatory design. The main contribution is a novel community alarm, called BodyGuard, which connects with the user's smartphone to enable alarm calls to be raised away from the home. We also describe insights and lessons learned during the innovation process.

Background

In 2009, Moray Community Health and Social Care Partnership (MCHSCP) surveyed its community alarm service users in Moray on their use and perceptions of the community alarm [14]. Almost one-third of respondents (240 people) reported that they wore it only some of the time or not at all. Building on the survey results, MCHSCP and the Glasgow School of Art (GSA) engaged in a project called teleWEAR that involved designers collaborating with community alarm service users to create novel designs for the community alarm that people *would* want to wear all of the time [15]. While the project had valuable outcomes, telecare manufacturers took none of the new designs up.

In 2013, a major UK manufacturer, Chubb [3], showed interest when its community alarm market research showed a lack of innovation and an issue of stigma. The result of conversations was to re-run the teleWEAR project. As before, it was incorporated into the Product Design Engineering Degree programme at GSA, which involves collaboration with industry as a real-life learning experience. The students worked on the project for two days a week for 11 weeks. Chubb sponsored the project and briefed the students, as the owner of the final designs. MCHSCP facilitated creative workshops to demonstrate the value of designing with users under the national Living it Up project [7].

Method

A participatory design approach was used [8], where key stakeholders are involved in design processes to help ensure that the result meets their needs and aspirations. Five teams of designers, service users, the wider public, and health and social care professionals, participated in two half-day workshops. Chubb's Business Development Manager also participated. The workshops were held at a GSA studio in Moray and spaced five weeks apart.

Workshop 1 was designed to discuss problems with the community alarm and to generate creative ideas. The designers used visual tools to gather peoples' perceptions and experiences of the device and identify opportunities for improvement. The groups then brainstormed ideas, which the designers sketched and mocked up using modeling materials. The workshop ended with all the groups coming together to share their insights and initial concepts. In addition, everyone's contact details were shared so that dialogue could be maintained in-between the workshops.

Back in Glasgow, each group of designers developed the thinking and generated five design concepts ranging from simple, practical ideas to more visionary or 'blue sky' ideas, which were presented to Chubb at an Interim Presentation. Chubb selected two ideas per team for development, but asked that the majority of effort be focused on the idea that it considered most realisable in the short-term. Decisions were based on: innovation (how original was the idea?); desirability (how marketable was the idea?); and relevance (how suited to Chubb as a business was the idea?).

Workshop 2 was designed to bring everyone back together to review and develop the design concepts. Each group of designers spent a short period of time with each of the other groups' participants in turn, before being reunited with their original team for the remainder of the workshop. The designers presented the ideas using a variety of media including sketches, physical models and video scenarios. The workshop

Figure 2. Visitors to the exhibition giving their feedback

ended with the groups sharing feedback and design developments. Shortly after, Chubb gave individual, detailed feedback to each group of designers.

Finally, the five concept designs and 3D prototypes were showcased to the public in a half-day exhibition near the workshop venue. Visitor feedback was gathered on comments sheets (Figure 2). At the end of the event, Chubb announced its preferred concept design and subsequently funded two summer internships at its head office to develop it ready for market. A group discussion was later conducted at the workshop venue with four workshop participants: two service users and two potential future service users. The focus was their perceptions of the design process.

Recruitment

MCHSCP identified participants from those that use its community alarm service and live local to the workshop venue. Members of a local telecare involvement group and health and social care practitioners with experience of the community alarm were also invited. In total, 21 people took part in the workshops: seven service users, three of whom were accompanied by their carer; four (other) members of the wider public; and seven health and social care professionals.

Related Work

Mobile Telecare

Prevailing community alarms only work within the home or garden. As older people today have more active lifestyles than previous generations, there has been a slow emergence of mobile solutions. E.g. dual SIM mobile phone with a telecare SIM that communicates with the alarm monitoring centre and a personal SIM; pressing a button on the phone sends an alert call over the mobile phone network. However, a general challenge for service providers is fitting the logistics of mobile care with the home-based logic of traditional community alarm services [5] e.g. who pays the insurance and monthly service fee. Also, the user may already own a phone, and phone plan.

Stylish Telecare

There has been some improvement to the appearance of telecare equipment. 'Click' is a prototype personal alarm system that includes a wristband, clothing clip, and alarm monitoring. It is the result of collaboration between a mobile location (tracker) company and an acclaimed product design studio [11]. Squeezing the button on the wristband or clip raises an alarm through the clip, which incorporates a SIM card, GPS locator, and two-way voice channel with the alarm monitoring centre. The wristband also features an in-built fall detector. The style of the Click is contemporary and discreet. However, the system requires the user wear *two* pieces of telecare equipment.

Wearable Technology

The market for wearable technology is growing fast. The popularity of wrist-worn activity trackers such as the Jawbone UP [17] and Nike+ FuelBand [9], which connect to a smartphone app and can be worn day and night, demonstrates a consumer market for stylish wearable technology that can support and motivate a healthier lifestyle. Not yet mainstream, smart watches are another example of wrist-worn technology that incorporates electronics and apps for health and fitness. While Chubb operates in the social care market, its vision is to broaden the appeal of wearable telecare, including lifestyle monitoring, which provides early warning of deterioration.

Results and Discussion

Five Novel Concept Designs

Five novel concept designs were created. For reasons of confidentiality, we only describe the design that Chubb plan to take to market, called the BodyGuard. BodyGuard is a wrist-worn alarm that, as a priority, aims to overcome fear of stigma associated with community alarms. At the end of the student project, the prototype comprised: a slap (or snap) bracelet, deemed easy and fun to put on; leather or PVC material options; white, black and tan brown colour options; a jewel-like alarm slider button, which when pushed would raise the alarm call; and a blue LED light as feedback that the call has been triggered (Figure 3).

From Concept Design to Rapid Prototype

The purpose of the design internships was to develop the BodyGuard concept. However, Chubb also wanted to incorporate elements identified by participants as highly desirable that featured in other concept designs:

- *Connection with a smartphone*. To enable an alarm call to be raised out of range of the base unit (i.e. away from home) and the user's location to be traced
- *Fall detection*. Automatically raises an alert to the alarm monitoring centre when the user falls
- *Visual feedback*. That an alarm call has been raised, registered and actioned, to provide reassurance while waiting for assistance
- *Tactile feedback*. That an alarm call has been raised. Vibration *is* available on Chubb's community alarm, but at an extra cost, which was viewed as discriminating people who are blind or visually impaired
- *Two-way voice communication*. With the alarm monitoring centre both at and away from home.

Figure 3. An early visualisation of the BodyGuard concept

The new BodyGuard incorporates all of the above (Figure 4). When the button is pressed, or if a fall is detected, there is visual and tactile feedback that an alarm call has been raised, through a pulsing blue LED light and vibration. The BodyGuard is usable outdoors. It incorporates a Bluetooth module to wirelessly connect with a (paired iOS or Android) smartphone with built-in Bluetooth and GPS technology; an app running in the background will automatically call the alarm monitoring centre or nominated responder as specified in the settings, provide the user's location, and enable two-way voice communication through the phone. The newly designed app also includes a 'geofencing' feature that enables an alarm call to be raised if the wearer wanders in or out a designated area. In addition, the material of the BodyGuard includes a silicone option because it has a perceived affordance of being waterproof and so it is potentially less likely to be removed prior to a bath or shower; many remove their alarm while bathing despite having been told that it is waterproof [6,14].

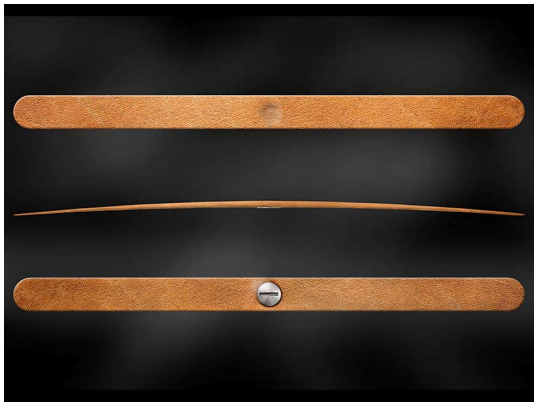

Figure 4. A last visualisation of the BodyGuard concept

The innovation is the connection with a smartphone, as well as the base unit, to enable the community alarm to work away from the home. Users will of course need to own a smartphone. Take up is increasing rapidly in the UK, with six in ten adults owning a smartphone, although ownership differs greatly by age with only 14% of those aged 65+ owning one [16]. However, while traditionally targeted at the oldest-old, telecare can be a source of support for younger adults e.g. with health or social care needs or a learning disability. And the solution aligns with the Scottish Government Telehealth and Telecare Delivery Plan that includes 'build[ing] on existing and increasingly familiar technologies… utilising users own technologies where and when practical to do so' [1].

The main challenge has been striking a balance between incorporating elements on the 'wish list', and keeping the style discreet for the wearer and the price competitive, all within the allotted timescale. Consequently, there has been substantial design development and compromise. E.g. the realisation that significant further investment and time would be needed to build and (break) test the electronic components in the flexible slap bracelet led to a design decision to use a more conventional strap. Battery size and life has also meant design trade-offs. Unlike the traditional alarm that only draws power when activated, the BodyGuard uses active components (e.g. falls detection sensor) that require to be continuously powered. So, e.g., a single colour pulsing light was implemented rather than different colour lights corresponding to the stages of an alarm call.

Designing With Users

Chubb particularly valued the mix of users and specialised professionals. E.g. occupational therapists working within community mental health services offered valuable insights into what their clients, particularly people with dementia, would and wouldn't wear. Users provided a richer appreciation of the design problem through personal stories. E.g. a lady with multiple sclerosis told how she encouraged her husband (carer) to take short breaks, as respite, but she never wore her community alarm when he did because she couldn't put it over her head due to tremor.

During the focus group discussion, the participants agreed that the participatory approach worked well: Chubb focused their minds on commercial viability e.g. one person commented 'Chubb's input meant that we weren't going for an all-singing, all-amazing product that no one would be able to afford'; the students bought an open mind and acted as visual translators e.g. one person commented 'because we had the ideas, but sometimes it's very hard… and the students were able to direct and guide us'; and the health and social care professionals bought practical knowledge of a

range of situations in need of an improved alarm e.g. one person commented 'they're dealing with things like that on a daily basis and they know what's required'.

The participatory design process is a dramatic change for Chubb: the business has never before designed *with* users. Normally, a design concept is produced in-house and then presented to local authorities for their feedback. While there was some initial cynicism within Chubb, the project has come to be viewed positively. As a result, Chubb has established a user group for its community alarm, as well as a user group for each of two other product lines. For the time being, user input will be channeled through the Sales team, who typically instigate the Design briefs.

Working With Art School Designers

In Design Meets Disability, Pullin reflects on the distinct cultures of teams of engineers and health professionals that develop assistive technology, and multidisciplinary teams of designers that create products for consumer markets [10]. He proposes that designers working from an art school culture should be included in teams that develop assistive technology to balance technical development with design sensibilities and open up new approaches to problem-solving.

The student internship has indeed had a positive influence on the engineering culture at Chubb. E.g. the designers set up a workspace where they used post-it notes to capture and organise their thoughts, such as insights and opportunities arising from the design workshops, and other wearable technology products. The notes made the creative thinking and rationale visible and accessible to passersby who were then able to offer valuable input. By contrast, the technical team at Chubb has dedicated roles and are used to working 'heads down' to a functional specification. It was refreshing to have visual material on display and the ensuing conversations and knowledge sharing; an approach that Chubb has since adopted.

During the focus group discussion, a participant commented that working with 'fresh blood' (the designers) was important because 'if you work with manufacturers and their own engineers, would they have turned around and said, "Oh, well that just won't work"?' Certainly, the technical team has long-standing members and a set way of working that can create a narrow outlook. The students bought different design approaches to the team and fresh ideas, which has highlighted the need for and value of an in-house product designer. Currently Chubb contract out product design work, but now plan to hire a designer in time.

The students also benefited from the placement. In consultation with Chubb's technical team and its design contractors, they repeatedly researched and reviewed the technical feasibility of the BodyGuard concept and iterated the design until it was manufacturable. At times frustrating and disappointing, this was an extremely valuable learning experience.

Exhibition Comments

In total, 74 comments were made. The majority (86%) was positive and focused on the appearance of the designs – *discreet* was the most commonly used word followed by *stylish* – and the ability to raise an alarm away from home. Negative comments were more wide-ranging, but included a too-small button, not wearable in the shower, and leveraging a smartphone to extend the range of the alarm, which the user may not own.

Conclusion and Next Steps

We have presented a case study of telecare innovation, involving the design and development of a novel community alarm, called the BodyGuard. The BodyGuard connects to the user's smartphone to enable alerts to be raised away from the home. It has a stylish appearance and incorporates falls detection and tactile feedback, features considered highly desirable by our study participants. We described insights and lessons learned during the innovation process including the value of including art school designers in the engineering team and the challenges in taking a novel telecare concept through to a reality. Rapid prototypes (scale models) have been ordered for demonstration and user feedback purposes, including presenting back to the study participants, and to ensure that everything fits and functions correctly. It is anticipated that the BodyGuard will be manufactured for sale in early 2015.

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