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The challenges of delivering validated personas for medical equipment design

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ABSTRACT

Representations of archetypal users (personas) have been advocated as a way to avoid designing in isolation. They allow communication of user needs and orient teams towards user experience. One of the challenges for developers of interactive medical devices is that most devices are used by a wide variety of people, and that developers have limited access to those people; personas have the potential to make developers more aware of who they are designing for. But this raises the question of whether it is possible to deliver useful, valid personas of interactive medical device users. The aim of this research was to develop and test a rigorous, empirically grounded process of constructing personas, with the objective of reflecting on that process. Many challenges were encountered: we found that directly linking the personas to a user population was not possible and although personas were a useful tool for supporting communication and elicitation across disciplines, it was hard to make them representative when picking details that were relevant and checking accuracy. Checking the content resulted in disparate, possibly incommensurable, views. Despite this, the personas proved useful in supporting the transfer of knowledge across professional perspectives.

1. Introduction

1.1. Overview

From the perspective of healthcare providers, safe, usable, well-designed, medical equipment underpins quality of care. The problem is, it is not always clear what constitutes 'well designed'. There may be a lack of clarity regarding who the user is, what they need or how needs differ (Money et al., 2011). It can be hard for designers to step into the shoes of the patient or clinician when hospitals are extreme, protected, often closed, environments. The design of medical devices provides a challenge, in terms of representing the user and incorporating this into the product (Martin et al., 2008; Vincent et al., 2014). A variety of guidance is available (e.g. (AAMI, 2009; FDA, 2011; IEC, 2007; NPSA, 2010a, b; Sawyer, 2009)), but traditional forms of user representation may be challenged, given a broadening of application and generalisation of technology (e.g. generic products used by different types of individual such as anaesthetists and agency nurses).

Taking infusion devices as an example, the variability between users can be great. Those controlling the pump may have minimal training (on how to use the pump), may be patients themselves, or may have extensive training and have undergone occupational selection. Similarly, there may be varying levels of procedure, process, monitoring or control associated with use. There are multiple and diverse interests that need representing during design. This paper is about the feasibility of defining the characteristics of a typical user (as a step in a "user centred design" process) in this context.

1.2. The origins of the persona technique

Our aim was to understand how the use of one HCI/HF/Ergonomics technique (personas), adapts to support the development of a common class of medical equipment (infusion pumps). We assume a broad variation in the skills and background of users and devices that cater for multiple contexts (as described in Obradovich and Woods (1996)). Cooper outlines the use of personas in the context of software design as follows:

> "*A persona is a single, specific but representative, hypothetical user archetype based on a study of the user community. We distil the distinctive characteristics of that user community to just a few personas… We use them as tools to describe and articulate the*

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views of the user, that becomes the standards for writing software" (Cooper, 2000)

Personas include definitions of user goals; they describe what users want to accomplish and why. Typically, they are created during the design of consumer products and websites, and are described in papers and textbooks such as those of Cooper (2004; 2007), Pruitt and Adlin (2006) and Pruitt and Grudin (2003).

1.3. The benefits of using personas

Personas can be employed to represent the user during design, without requiring that development teams gain first hand experience of the environment of use. They support reasoning about the mental state of another (e.g. theory of mind (Pruitt and Grudin, 2003)). For example, User Interface (UI) designers need to provide a representation of the system, which communicates function and status to users, without necessarily communicating the internal workings. Norman (1998) argues the need to support the match between the *design model* (e.g. conceptualisation that the designer has in mind), *system image* (e.g. UI), and a *user's model* (e.g. conceptual understanding developed to explain the operation of the system). Personas support this match and provide a way to help designers infer the user's point of view (e.g. their goals, skills and needs).

For UI design, personas have been shown to play a role in supporting organisation wide design input and communication amongst mixed teams (for a review of the benefits see (Miaskiewicz and Kozar, 2011)). In theory, personas allow multidisciplinary teams to incorporate the needs of users together, at an early stage in the design (Nieters et al., 2007). Personas help designers focus on user goals (Pruitt and Grudin, 2003), and encourage extrospection and confrontation of unfamiliar design constraints (Noessel, 2012). They reduce the need to include users in design teams, and allow development personnel to work at a distance (Salmi et al., 2012). Personas can be used to support communication; create empathy amongst the design team; broaden focus; allow clarification of the position taken by a team-member and provide a linguistic approximation to the end user (Matthews et al., 2012). Personas help the articulation and resolution of design decisions in a context where design reasoning may be tacit. They provide a vehicle to make explicit the "why are we building it like this?" Many of these benefits can apply to safety critical contexts, for example as a way to fill gaps across multiple independent risk analysis activities (Björndal et al., 2011).

For Human Factors and Ergonomics practice, uses are diverse and varied, with personas being applied to support: the development of simulation and training systems in the automotive industry (Setia and Glyn, 2013); user requirements for car design/inclusive design (Marshall et al., 2014); the design of Personal Fall Arrest Systems (PFAS) (Liu et al., 2009); and the design of audit management systems for aircraft maintenance (Dharwada et al., 2007). This variation in application can be positive as it shows flexibility in adapting to various needs. For example, within healthcare personas have been useful for: making data anonymous (Jay et al., 2012); supporting inclusive design (Busch et al., 2013); and allowing for consideration of wider socio-technical or system-wide factors (HealthFoundation, 2012).

The use of personas in an applied context has been well explored; however, there has been comparatively little research seeking to understand the inherent constraints and limitations of the technique, and challenges associated with constructing content. This topic needs addressing in order to provide an understanding of how researchers and practitioners can get the most out of the technique, and make sense of a mixed literature regarding the overall utility.

1.4. The drawbacks of personas

In domains outside medical equipment manufacture, research has identified several issues concerning the use of personas. For example, during industrial software design, personas are invoked less often than expected (Matthews et al., 2012). Researchers have questioned whether they substitute for the involvement of real users (Bodker et al., 2012). Designers may bypass personas, instead using an appeals based process based on their own opinions or stories relating to hypothetical interactions with a product (Friess, 2010). Benefits are limited if the information contained within a persona conflicts with other statements of user need or provides false constraints on the design problem (Matthews et al., 2012). Even if content is correct and in agreement with other sources, there may be issues of trust. For example, student designers were shown to lack trust in a persona if they did not participate in the original user research themselves (Long, 2009). There is also the possibility that use becomes politicised or result in infighting. For example, once a product is under development, there may be a resistance to defining who the user is. Marketing and sales professionals may avoid adopting a user archetype when clients have already stated their priorities (Ronkko et al., 2004).

Added to these concerns, the process for creating a persona may vary. The technique has been adapted, depending on what people want to accomplish and why. This occurs despite textbook descriptions (e.g. those that provide advice on the planning, creation, deployment, use and reuse of personas) being very clear. For example, textbooks such as (Adlin and Pruitt, 2010) support practice by: breaking down the technique down into a staged process; illustrating typical content; and giving examples from practice (Cooper et al., 2007; Nielsen, 2013; Pruitt and Adlin, 2006). At one extreme, personas may be produced in seconds, as part of a caricature exercise during a design focus group. At another extreme, Pruitt and Grudin (2003) describe a persona exercise that lasted for 10 months and involved 22 people, to support the development of a Microsoft product. The differing types of output falling under the persona banner are so different that they cannot be fulfilling the same aim.

1.5. The use of personas to support medical device design

Research is required, because: for medical devices, the application of personas is in its infancy (e.g. not referenced by standard practice such as (IEC, 2007)); in other domains there is scepticism about their value (Chapman and Milham, 2006); and their use to support the design of healthcare technology has received little attention (Lerouge et al., 2011). Although there is potential for personas to provide a broad representation of user requirements, there is a tension between the need to "design for just one person" (Cooper, 2004), and standardised medical device practice (e.g. (Keay and Callander, 2004)), where equipment such as infusion pumps needs to adapt to suit the needs of many. During the design of medical technology, personas might be applied to prevent misunderstanding and/or encapsulate a broad range of user needs, but there is still much to be learnt about how this technique can be applied.

We wanted to understand the practicalities of generating persona content for infusion devices, when the aim was to communicate multiple and varied needs that would not easily lend themselves to formal requirements (e.g. social factors). The aim was to test whether it was feasible to create personas to represent user needs. We were not aiming to design our own device or evaluate the use of personas in a development context, but to work through the process of generating representative persona content. No previous studies have examined how personas can be constructed for