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A User-centred Methodology for Designing an Online Social Network to Motivate Health Behaviour Change

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Abstract. Positive health behaviour is critical to preventing illness and managing chronic conditions. A user-centred methodology was employed to design an online social network to motivate health behaviour change. The methodology was augmented by utilizing the Appeal, Belonging, Commitment (ABC) Framework, which is based on theoretical models for health behaviour change and use of online social networks. The user-centred methodology included four phases: 1) initial user inquiry on health behaviour and use of online social networks; 2) interview feedback on paper prototypes; 2) laboratory study on medium fidelity prototype; and 4) a field study on the high fidelity prototype. The points of inquiry through these phases were based on the ABC Framework. This yielded an online social network system that linked to external third party databases to deploy to users via an interactive website.

Keywords. health behaviour change, online social network, user-centred design, ABC framework, prevention

Introduction

Leading a healthy lifestyle and making positive health behaviour changes have been found to be key to preventing illness and managing chronic diseases. In fact, self-management of ones health has been shown to be of key significance in achieving positive health outcomes for all people, healthy and sick [1, 2, 3]. Furthermore, we intuitively understand that our life choices are heavily influenced by family, friends, colleagues and other connections we have. A significant factor in health behaviour is one's close and distant social networks, which have been found to be a contributing factor to health outcomes, where ones social networks can be used to improve health behaviour through facilitating social integration and social support [4].

There is recent interest in the field of Human-Computer Interaction (HCI) to explore online social networks and health behaviour change [5, 6]. Further, HCI researchers have looked at designing technologies to promote a more active lifestyle [7, 8] and a more nutritious diet [9].

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Existing research has not looked specifically at designing online social network and online social games to motivate health behaviour change. For this reason, we explore the design space for an online social network system for positive health behaviour change through a user-centred design process. User-centred design is a methodology used in Human-Computer Interaction (HCI) as a process of interaction design [10]. We base the user-centred design process on existing theoretical models on health behaviour change and participation in online social network. These theoretical models provide specific behavioural determinants that yield the *Appeal Belonging Commitment (ABC) Framework*. The determinants from the *ABC Framework* provide the points of inquiry throughout the user-centred design methodology. We use this methodology by first completing an initial user inquiry and developing prototypes with increasing fidelity for an online social network system that we call **VivoSpace**. The prototypes that were developed included a low-fidelity paper prototype, an interactive medium-fidelity prototype and fully functional high-fidelity prototype.

1. User Centred Design Methodology

The user-centred design methodology that we used to develop **VivoSpace** is shown in Figure 1. The methodology starts with a literature review of existing theoretical models for motivating health behaviour change and participating in online social networks to yield the ABC Framework. The determinants of behaviour then provide the points of inquiry throughout the methodology. The user-centred design method begins with initial user inquiry that is evaluated through questionnaires and interviews to better understand motivations of health behaviour change and participation in online social networks. Based on the results of the initial user inquiry, paper-prototypes are developed that are evaluated through interviews. The design is iterated and a medium fidelity interactive prototype is developed and evaluated through a lab study. Finally, the design is iterated again into a working high-fidelity prototype that is evaluated through a field study.

1.1. Appeal Belonging Commitment (ABC) Framework

The **ABC Framework** was developed through the distillation of 13 theoretical models. The theoretical models for health behaviour change included in the **ABC Framework** are *Health Belief Model*, *Social Cognitive Theory*, *Theory of Reasoned Action*, *Theory of Planned Behaviour*, *Common Sense Model*, and *The Transtheoretical Model*. The theoretical models for participation on online social networks included in the **ABC Framework** are *Uses and Gratification Theory*, *Common Identity Theory*, *Common Bond Theory*, *Social Identity Theory*, *Organizational Commitment Theory*, *Behaviour Chain for Online Participation* and *social network threshold*. These theories yield a framework that provides: individually-based determinants (**appeal**) that include self-efficacy, knowledge, social enhancement and expectations about outcomes; socially-based determinants (**belonging**) that include sense-of-belonging, subjective norms and social categorization; and temporal stages (**commitment**) [11, 12].

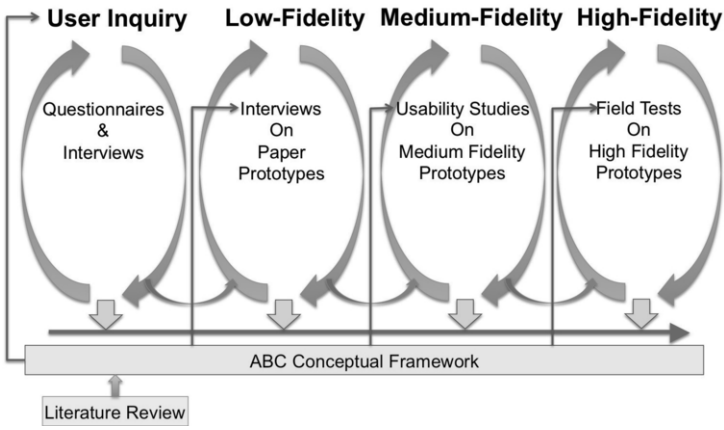

Figure 1. User-centred design method by using the ABC Conceptual Framework to form the inquiry through the iterative evaluation techniques.

1.2. User-Inquiry

The initial user inquiry for this methodology used online and paper questionnaires. The questionnaires inquired about demographic information such a gender, age and ethnic identity. The inquiry then used a 5-point Likert Scale to inquire each respondent's agreement to the determinants from the **ABC Framework**. The results yielded good agreement to the **ABC Framework**. Generally respondents felt that they were living a healthy lifestyle, understanding how to live healthy, eating healthy food and exercising regularly. However, interestingly, the majority of respondents felt that they are capable of living a healthier lifestyle. Most respondents also recognized the social influences on their health. Furthermore, older respondents (over 65 years old) felt that they ate healthier food more than young adults. Furthermore, Chinese and South Asians used online social networks for *social enhancement* (a determinant from the **ABC Framework**) more than Canadians. Generally, respondents felt stronger about connecting with similar individuals than belonging to a group or community, but both showed strong motivation [13, 11].

1.3. Paper Prototypes

Based on the determinants from that **ABC Framework**, an initial design for **VivoSpace** was developed. The paper prototypes were developed using Adobe Illustrator. There were 14 pages in total. The paper prototype was evaluated through individual in-person interviews with 11 participants. They were shown each page of the prototype and described the key functionality of the design. Participants felt that they did not want to have their health data in the same place as other personal digital assets. However, they liked the idea of social interaction with their health information and the dashboard. They also wanted to see a greater focus on goal setting and gamification [13].

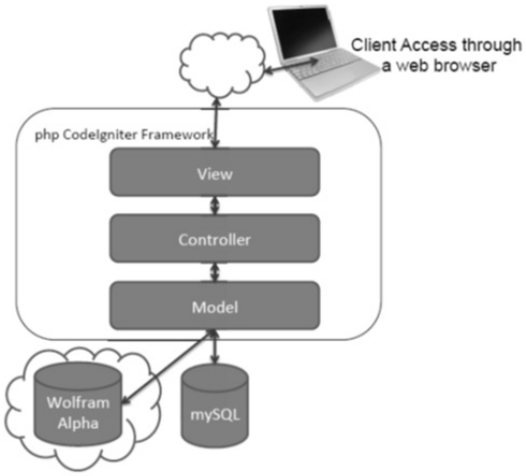

Figure 2. VivoSpace application's system architecture.

1.4. Medium Fidelity Prototypes

From the results of the interviews conducted on the paper prototype, an interactive medium fidelity prototype was developed for **VivoSpace**. The medium fidelity prototype was developed using HTML, CSS, Javascript and jQuery with the vision to develop a realistic interactive representation of our system. In total there were 32 HTML pages, 1 CSS file, and 2 javascript files. The medium fidelity prototype was evaluated in a laboratory with 36 participants. There were 6 groups of tasks that participants were asked to complete; after each task group, they were asked to complete a questionnaire that was based on the **ABC Framework**. *Belonging* was evaluated using indirect inquiry through the adaption of the *Helping Game Experiment* from behavioural economics. Similarly, *Commitment* was evaluated through the *In-Group Experiment* from social psychology. The results showed good agreement with the **ABC Framework**; however, the design should provide greater motivation for users to provide information [14].

1.5. High Fidelity Prototype

Based on the previous designs and evaluation, a fully functional high fidelity prototype has been developed for **VivoSpace**. The system architecture for the high-fidelity prototype is shown in Figure 2. The online social network system was developed in PHP using the CodeIgniter [15] web application framework. The CodeIgniter web application framework enforces a Model-View-Controller (MVC) development pattern, which separates the application logic from the presentation: the *model* represents the data structures; the *view* contains the code for presenting the information to the user; and the *controller contains* the bulk of the application logic and processes. The database used was MySQL, and nutritional information for food was obtained from an external database, Wolfram Alpha [16], through an Application Programming Interface (API). The high fidelity prototype is then used to allow people to use **VivoSpace** in

their day-to-day lives.

2. Conclusions

The user-centred methodology augmented by the **ABC Framework** provided a means to engage users in the design through a methodology that has theoretical underpinnings. This methodology can be used for similar systems that have an end objective beyond usability, as it allows the inquiry to be based on a conceptual framework that is validated in the context of the system being designed.

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