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Online social networks for health behaviour change: Designing to increase socialization

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ABSTRACT

Positive health behaviour by eating nutritious foods and performing physical activity has been shown to have significant benefit. Furthermore, theoretical models show that social factors contribute to health behaviour. However, social technology for health behaviour has provided limited social interaction. This paper presents an online social network for health behaviour change called *VivoSpace* that was designed from a theoretical foundation. The results from a field study ($n = 35$) are presented that include participants from both clinical and non-clinical settings. The results show that there was a significant change in some of the individual determinants for health behaviour change; however, social determinants did not change. Furthermore, the social features such as commenting were under utilized. Two follow-up focus groups ($n = 7$ and 8) were conducted to determine how the design should be iterated to increase socialization on *VivoSpace*. The results suggest that the posts need to add interest through system intelligence and allowing the user to add photos and other information to the post.

1. Introduction

Positive health behaviour has been found to prevent substantial illnesses. Positive health behaviour by eating nutritious food and being physically active can prevent chronic diseases such as type II diabetes (Anderson, Palombo, & Earl, 1998), yet this disease is reaching epidemic numbers in some populations (Young, Reading, Elias, & O'Neil, 2000). Furthermore, acute illness such a heart disease and stroke can be prevented by eating nutritious foods and an active lifestyle (Blair & Morris, 2009; Goldstein, Adams, et al., 2001). Myocardial Infraction (or heart attack) is the leading cause of death, and Stroke is the leading cause of disability in North America (Lloyd-Jones, Adams, et al., 2010). Despite this knowledge, obesity continues to increase in North America (Flegal, Carroll, Kuczmarski, & Johnson, 1998). By better understanding the factors or determinants that effect health behaviour, we can design computer technologies that can substantially change health behaviour.

Health behaviour theories show that the determinants for health behaviour include both individual and social factors. These theories include the Health Belief Model (Janz & Becker 1984), Social Cognitive Theory (Bandura, 2004), Theory of Reasoned Action (Ajzen & Fishbein, 1977), Theory of Planned Behaviour (Ajzen, 1991), and the Common Sense Model (Leventhal, Diefenbach, & Leventhal, 1992). All of these theories have been consolidated into the **Appeal Belonging Commitment (ABC) Framework** (Kamal, 2013; Kamal, Fels, McGrenere, & Nance, 2013), which includes the individually-based and socially-based determinants for health behaviour change. Furthermore, HCI (Human–Computer Interaction) researchers have identified the need for social technologies to promote health behaviour, and they have designed systems that include social features. However, the precise design strategies of the social features and their effect on health behaviour have not been investigated in detail. We address this gap by analyzing the design strategies that promote socialization.

In this paper, we present the design strategies in an online social network for health behaivour change that will promote socialization. By designing systems that have active socialization between the participants, we can provide designs that are able to change the socially-based determinants required for health behaviour change. In turn, greater and sustained health behaviour change can be observed through the use of social technologies that employ these strategies.

We will first discuss the related works in the area of HCI that have studied the design of social technologies for health behaviour change. Next, we describe the online social network that we

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designed called *VivoSpace*, whose design was based on the **ABC Framework**. The field study for the evaluation of *VivoSpace* is described afterward. Next, we describe and present the results from the focus groups that were conducted after the field study. We will close the paper with a discussion that provides the design strategies to promote socialization and concluding remarks.

2. Related works

There have been numerous studies that have explored social design aspects for eating healthy foods and/or increasing physical activity. We will review these systems and describe the social aspects to their designs.

2.1. Research for increased physical activity

We will first review works that have studied the design of technologies for increased step count or increased physical activity generally. The Houston system (Consolvo, Everitt, Smith, & Landay, 2006) used a pedometer to track step count and share progress towards a goal. This system allowed for the sharing of information with one other person (their "buddy"), and the social features for this system included the sharing of step count information, ability to comment on their "buddy's" progress, and the ability to view their "buddy's" progress towards a goal. No significant difference was observed in step count between the individual and social version, but those that used the social version were more likely to meet their goals.

The Stepping Up for Health (SUH) system was a large medical trial using a website that provided visualization of the user's uploaded pedometer reading, which was studied with and without an online community (Richardson et al., 2010). There was no difference in step count between the two groups; however, attrition was lower in the group that had access to the online community.

The Shakra system (Anderson et al., 2007) inferred whether a person was sedentary or active and shared the activity. Users shared their data with a small group, and the users had the ability to view their daily activity level in comparison to others in their group. The evaluation only provided the efficacy of automatic sensing, so the impact of the social features could not be verified.

The AHPC (American Horsepower Challenge) was a large scale American project, whose aim was to increase physical activity of school aged children aged 9–13 years old, and the impact of the project was evaluated by Poole et al. (2011). AHPC deployed 20 pedometers to 61 schools with over 1400 children using the system over 3 semesters. Each school had a base station, which automatically uploaded step counts, and a website where a school versus school game was displayed using the horserace metaphor. The evaluation was to provide guidance on introducing ubiquitous computer systems to school settings, so the impact of the social design features was not determined.

The Fish'n'Steps system (Lin, Mamykina, Lindtner, Delajoux, & Strub, 2006) utilized users' step count with a software application where the growth and happiness of the fish is linked to the step counts; it had a personal version and a shared version, where the size and 'mood' of others' fish was anonymously shared. There was no statistically significant difference in step count between the personal and shared version, but those in the shared group had a better attitude towards exercise.

2.2. Research for improving dietary intake

Next, we will review works that have studied the design of technologies for improving dietary intake. We start with the EatWell system (Grimes, Benar, Bolter, & Grinter, 2008), which was designed for the African American community. It was a mobile audio application, where users created recordings of their thoughts on healthy eating in their communities, and they listened to voice recording of others in their community. The results showed that EatWell empowered the community to eat more nutritious meals, and the participants shared their experiences through stories.

Building from the EatWell work, the Community Mosaic system was implemented for the same African American community (Parker et al., 2012). Community Mosaic allowed for the sharing of photos and texts through a community display at the local YMCA. The key finding from this work was to provide a shift in thinking around context in health behaviour change to one of health promotion through collective action.

The MAHI system was a mobile and website application designed for diabetics (Mamykina, Miller, Mynatt, & Greenblatt, 2010; Mamykina & Mynatt, 2007; Mamykina, Mynatt, Davidson, & Greenblatt, 2008). The system was a health monitoring application that provided social interactions with diabetes educators; it included a blood-glucose monitor that was linked to a mobile phone, and it provided the ability to record text notes or questions, take pictures, and make audio notes. These records were linked to their blood-glucose levels, and allowed for asynchronous communication with their diabetes educator. The results show that newly diagnosed patients that used MAHI achieved their diet goals more than those that did not use it; furthermore, by sharing records with their diabetes educators (Mamykina et al., 2008). For those users who had been diagnosed with diabetes for more than one year, no behaviour change was observed; however, MAHI became a means to construct identities through the entry of records.

2.3. Research on health behaviour generally

There are also a couple of studies that designed technology for health behaviour change more broadly. The Lifestyle Coaching Application was designed to promote both nutritious eating habits and physical activity (Gasser et al., 2006). This application was deployed as both a mobile and a web version, and it had an individual version and a team version, where the health information (logs of meals and physical activity) was shared between team members and between teams. The results found that there was no difference in behaviour between the individual and team version.

The VERA system was not specifically designed for diet or physical activity, but VERA's central design principle was "open-ended social awareness" as apposed to prescriptive persuasion to promote positive health behaviour (Baumer et al., 2012). The VERA system was a collaborative photo-sharing site, where users took pictures and provided annotations at moments when a user needed to choose between options that had health implications. The results found that VERA built group identity and individual accountability, but there was confusion among the participants on what was healthy due to the "open-ended" (rather than prescriptive) nature of the system.

2.4. Summary of related works

HCI research described in this section provides an overview of the social systems that have been designed and evaluated to motivate health behaviour change. Generally, the systems include sharing of information with some providing the ability to communicate through such means as commenting (Houston), through an online community (SUH), or through communication with one's diabetes educator (MAHI). However, none of these systems evaluated the level of socialization that was occurring, or provided specific design strategies to promote more social interaction.