Improving Health Information Access through Social Networking

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Abstract

Sustaining user participation is a challenge for even the most popular web sites. In this work we report on an effort to increase exposure to, and interaction with, a repository of health based information by coupling the repository with a social networking application. We hypothesize that we can sustain user interaction with a repository and increase nutrition knowledge through content browsing by reporting on the browsing actions of other users in a Social Networking System's activity feeds. We report on the findings of a live user study, which showed that coupling health content with a social networking system successfully increased content browsing and that highly engaged users are seen to have an altered attitude toward control over their health.

1. Introduction

The global epidemic of obesity affects over 1.6 billion adults worldwide and being obese is a common risk factor for many chronic diseases [1, 3]. One approach to battling the obesity epidemic is to increase nutrition knowledge through exposure to health related content. Knowledge is known to guide both users' perception and behaviour. Nutrition knowledge has been associated with positive dietary practices [23] and with lower consumption of foods away from home and better diet quality [7].

The processes used to educate the public about health have seen a shift in recent years from print media toward online resources and many practitioners are investigating ICT solutions to encourage and sustain change. Although many online health behavior change interventions have been developed, exposure rates to intervention content is still quite low [14]. Static and even feature rich Web sites often fail to attract users for a substantial period of time. Thus, in this work we wish to maximise user engagement with a digital repository to increase a user's nutrition knowledge and awareness about health and lifestyle by coupling content with a suitable and engaging platform.

Social Networking Systems (SNS) such as Facebook have in the past been known to be more popular than even Google in terms of web usage. Given their popularity and the frequency with which many users interact with SNS we feel this domain is an ideal platform with which to integrate a digital repository of health information in order to maximise user exposure and achieve sustained engagement and learning. We developed an online social network, SOFA [4], which provides users with a cohort of social features as well as access to a variety of health related content. We couple the content and social components of SOFA by providing easy browsing access from all sections of SOFA to the content repository and exposing the interactions of users with the content to the community. This exposure was achieved in the social network through *activity feeds* (See Figure 1). These feeds are common in social networking systems, they show users the activities of their friends from across the network and include actions such as friending, adding photographs, sharing content and commenting etc. In SOFA's activity feeds content browsing actions are also included.

Our hypotheses are two fold. Firstly, by coupling a digital repository with a social network, we hope that the engagement a user has with the system will be a combination of interest in the content and in the activities and features of the social network. With many individuals visiting social networking sites daily we hope to significantly increase individuals' exposure to and interaction with the digital content. Secondly, by highlighting the actions of others, in particular content browsing, through the activity feeds, we make users aware of the navigation trails of others and thus popular content amongst their friends and peers. We aim to achieve increased engagement with the health content, thus

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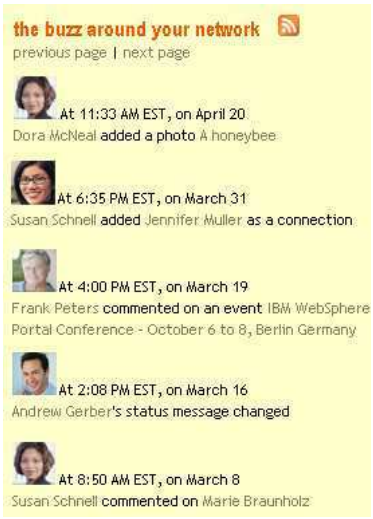

Figure 1. Feed Example from IBM Research's Beehive [12]

increasing nutrition knowledge, and in the long term, a positive attitude and behaviour change.

This paper presents results of a three week live user evaluation of an online social networking system designed for families who wish to achieve and maintain a healthy lifestyle. Results show that highlighting browsing activity in the activity feeds on SOFA resulted in increased browsing, thus increased access of health related web pages, illustrating the potential of activity feeds to drive user browsing and content access. Also, we show that highly engaged users feel that their health is less related to chance than users with low engagement, illustrating the potential for attitudinal change through interactions with SOFA.

The remainder of the paper is structured as follows. Section 2 describes the related work both in the areas of health and information retrieval. Section 3 describes SOFA and its features. Section 4 describes a 545 person user study. Finally, Section 5 summarises the work and outlines future research in this area.

2 Related Work

The World Health Organisation [1] predicts that by 2015 the number of obese adults worldwide will reach 2.3 billion and the issue is attracting increased attention. Much of this attention is being paid to online diet management systems, which have been replacing traditional pen-and-paper programs. The focus of many of these systems is on providing social support to those on weight-loss programs as this has been shown to affect success in lifestyle change [10].

The popularity of online social networks has recently exploded with the appearance of a large number of friendship (Facebook and MySpace), career (LinkedIn), and enterprise social networks (Beehive [12]) on the Web. The number, frequency and duration of interactions with various SNS varies but one of the most popular SNS, Facebook, reports over 400 million active members who on average spend 55 minutes on its site per day [2]. Thus SNS are playing a more and more significant role in the everyday lives of a large number of individuals.

One key feature of SNS that make them suitable platforms which can facilitate change are the presence of *family and friends and other like minded individuals* Several research groups propose that family and friends, and those with whom emotional ties are shared, are key to influencing the behavior of others around food and diet. These are people who are close to and have frequent contact with the target person [21, 24]. Given the focus of SNS is to facilitate online friendships primarily with close ties we see social networking systems as an online communication with these key groups. A second key feature is the presence of *activity feeds*, which detail the activities of individuals on the network, in hyperlinked text (see Figure 1). Research suggests that these feeds have the potential to impact on the behaviour of users of SNS. According to the Social Learning Theory [5], a person is more motivated to perform a target behavior if they observe others performing it. Thus the provision of a list of performed actions is likely to influence the likelihood of a user performing the same actions. Persuasive technologies are "interactive computing systems designed to change people's attributes or behaviors" [15]. A system that aims to encourage people to change their lifestyles is an example of a persuasive system. Social support has been categorized as one of the features that an effective persuasive system should provide [19]. SNS are persuasive in nature [20, 15] in that showing the users what others are doing in the community can influence their actions. Thus the actions which are carried out on an SNS and reported on in an activity feed should influence future actions.

Research in the area of social navigation has investigated harnessing the wisdom of communities to improve information access. Many existing social navigation systems such as KnowledgeSea [8], CoFIND [13] and ASSIST [11], exploit implicit and explicit user feedback on digital content by monitoring user interactions. They provide assistance to users in locating relevant content by overlaying links with social cues to highlight underlying content of interest or paths through the space. They provide social cues or explicit recommendations for content and navigation paths to users, based on the observed interactions of other users in the community. Each of these systems details the navigation interactions of others, while a user is interacting with the content in the repository. Thus, the user must make a

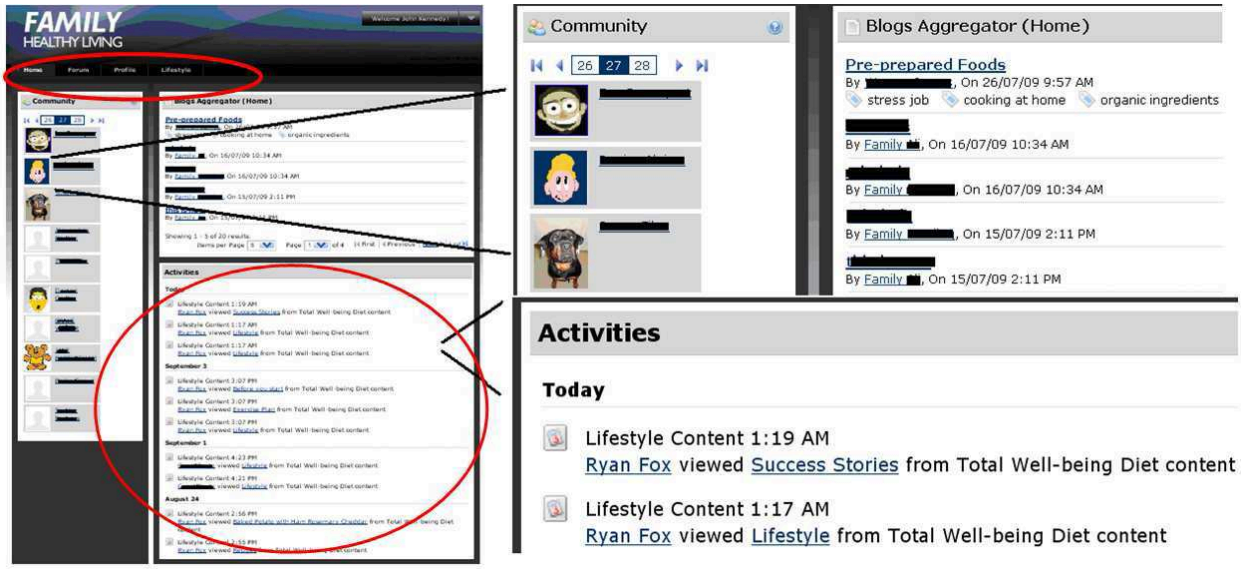

Figure 2. SOFA Home Page and Activity Feeds

conscious decision to visit the content in order to receive the suggestions.

All this leads us to believe that online social environments combined with high value content, in a platform where awareness is paramount, could facilitate attitude and behaviour change when used regularly over sustained periods of time. To this end we have developed an online social support platform called SOFA which is typical of many social networking systems. We built SOFA as a research platform but propose that the best instantiation of the types of interventions suggestion would be achieved as part of an existing social networking system, as an application or plugin rather than as a stand alone site.

3 SOFA

SOFA (*SOcial FAmilies*) is an online SNS similar to Facebook (www.facebook.com) and MySpace (www.myspace.com). SOFA targets individuals, who wish to achieve and sustain a healthy lifestyle. SOFA has many of the features included in a typical social networking system, including friending, photo sharing, commenting, and activity feeds. In addition to these features, SOFA also provides a platform for further social support in the form of blogs and forums, where users can record their experiences, ask questions, and initiate discussions with other users.

Similar to other SNS, each user has their own *profile* page which provides users with an environment, where they can contribute content and create their online identity. They can upload photographs and personal details, fill in an activity diary, report their food intake and physical activities performed, and maintain a message board.

In addition to the SNS features, users can access a collection of web pages relating to healthy living. The content provides factual information, to influence users' attitude and behavior towards adopting a healthy lifestyle and consists of scientifically validated information sourced from the CSIRO's Total Wellbeing Diet (TWD) books [17, 18] and the Better Health Channel (www.betterhealth.vic.gov.au). The content includes diet background and motivational information, 136 recipes, 22 exercises, menu plans and shopping lists, and other health-related links.

SOFA displays two types of activity feeds: *individual* and *community* feeds. The feeds include all publicly viewable actions, such as making friends, uploading photos, commenting, adding forum posts or blogs, etc. However, in addition to actions included by traditional activity feeds, SOFA includes browsing actions on the content repository in its feeds. Each feed item contains a number of hyperlinks, which provide single click access to the people and items mentioned, as seen in Figure 2. The first one is linked to the profile page of a user, who carried out the action. The second is linked to the item on which the action was carried out or to the page of content that was accessed or posted, e.g., the photo added or page browsed.

Each user has access to a personalized SOFA home page shown in Figure 2. This dashboard-like page facilitates single click access to the sections of the site, namely the *Forum*, *TWD Content* and *User Profile* sections. A key feature

of the home page is the presence of the *community activity feed* which displays the actions of all users on the site in a chronologically ordered list. This feed eliminates the need to view individual profiles of users in order to be informed of their actions and provides an awareness of the types and popularity of actions, active users, and popular content pages at a single location.

With the inclusion of the browsing activity into the activity feeds, we have orchestrated the key coupling between the content and the SNS. Firstly, users are made aware of the content accessed by others users and in particular their friends, who are likely to have more influence [11]. Secondly, the conscious browsing through the content section of the site is reduced and replaced with a single click, community driven access, which requires less effort from the users.

4 Live User Study

In order to answer research questions pertaining to the effectiveness of coupling social networking and content components, we embarked on a large scale user study in July of 2009. We recruited 545 users from across Australia, interested in changing their diet and moving toward a healthier lifestyle. Users were asked to interact with the system on a regular basis over a period of 3 weeks and all their interactions during this period were recorded.

4.1 Activity Feeds to Drive Traffic

63% of the observed user interactions were with the social networking components and 37% with the content. This shows that social features of SOFA were most attractive for the users. However, the content which is not usually found in social networking systems, attracted considerable attention. In fact, just over half of all sessions included some content browsing. Users interacted with the forum by viewing and contributing posts, as would be expected in a social network. 93% of forum posts were related to diet and lifestyle, while 54% of posts mentioned or provided links to the content of the repository. This shows that the social component provided a valuable platform for users to discuss the information that they had uncovered.

In order to ascertain the role of the activity feeds, we examined the navigation patterns of users. We were primarily interested in a user's entry point to the content component and their subsequent navigation. 1213 sessions contained browsing activity were examined. 78.1% of these were initiated by users selecting the content tabs and 21.9% were a direct result of following a link within the activity feeds. Thus more than one fifth of all browsing was initiated through the feeds.

browsing source	% browsing sessions	% tab selections	% feed selections
home	46.6	57.9	42.1
forum	17.5	100.0	0.0
own profile	32.1	100.0	0.0
other profile	0.3	68.2	31.8
overall	1213	78.1	21.9

Table 1. Content Access Entry Points

Table 1 shows the breakdown of browsing entry points. The *'% browsing sessions'* column shows the distribution of entry points from each section (source) on SOFA. As can be seen, 17.5% of browsing was initiated from the forum section of the site, 32.1% from a user's profile page, and 46.6% from the home page. The *'% tab selection'* and *'% feed selection'* columns show the percentage of browsing initiated through the tabs and feeds, respectively. In browsing sessions initiated from the home pages, a large proportion of browsing, 42.1%, was initiated through the feeds. Similarly, in browsing sessions initiated from other users' profile pages, 31.8% of browsing was initiated through the feeds. However, the occurrence of browsing from the other users' profile is very low. The proportion of traffic initiated from the home pages with the feeds is very encouraging. The feeds are highlighting pages of interest and users are curious to see the details of what is being read.

Examination of the browsing which occurred from each entry point uncovered a significant difference ($F(1, 861) = 4.083, p < 0.05$) in the navigation path lengths, *i.e.*, number of pages viewed. Paths initiated by tab selection included on average 3.88 pages in comparison to 2.42 pages in feed initiated paths. This finding supports that of Coyle *et. al.* [11], who noted that directed browsing, which occurs when a user makes a conscious decision to browse, results in longer navigation trails than browsing sparked by a social recommendation, which often occurs when a user is busy with another task, but is attracted to the social cue in the feed. Another practical explanation for the distinct path length, mainly dictated by the organisation of health content in SOFA, is that doe to the tree structure of the content, users browsing through feeds accessed the content sooner than through direct navigation.

We examined the effect of coupling the content with the social network on sustaining engagement of users. While a three week study is not sufficient to derive strong conclusions, we noted a high correlation (0.94) between the daily number of interactions on the social features of SOFA and the number of interactions with the content. This implies that the key to sustaining exposure to the content could lie in sustaining participation with the social network.

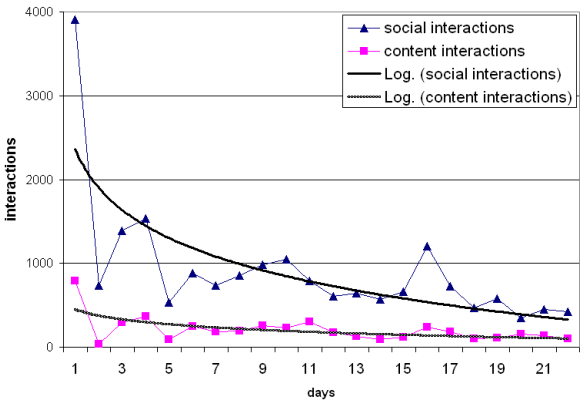

Figure 3. System interactions

As mentioned, many online health intervention systems as well as SNS suffer from high drop-out rates [16]. As we have integrated the health content and social network components, we were curious to investigate the dependency between content access and the activity of the social network. We monitored the participation and interaction rates of users on SOFA and the results are shown in Figure 3. The chart shows the observed amount of interactions with the social networking and with the health content components over 3 weeks, and their logarithmic regression curves.

The interaction with the social component follows the expected trend; peaking in the initial days, when users create accounts, make friends and explore profiles of others, and dropping steeply over time. However, we see a much more stable level of interactions with the health content over the 3 weeks. Thus, users continued to explore and read the content throughout the study. The ratio of page clicks in the social network versus in the health content component is 5:1 on day 1 but only 4:1 on day 21. Thus, while the interest in the social network and the content are closely linked, they are not highly correlated.

4.2 Engagement and Attitude Change

In order to judge the effectiveness of SOFA as a tool for affecting changes in health, we bring together both the social and content interactions to calculate engagement with the system and examine whether user engagement with the system leads to a change in attitude towards health control. To measure user engagement, we examined user interactions. The frequency, *i.e.*, number of times a user performs an activity i is denoted by f_i. Since the effort required to complete activities varies, weights w_i are introduced [9]. We assigned a weight of 1 to each page browse, 2 to small contributions such as wall messages, quizzes and commenting, 3 to larger activity diary entries, friending and blog posting and finally 4 to forum message posting. Using the frequency f_i and weight w_i of activity i, we compute overall engagement V_{oe} of user u_a according to Equation 1.

$$V_{oe}(u_a) = \sum_i w_i \bullet f_i \tag{1}$$

The attitude towards health was measured using a shortened form of the Health Locus of Control scale [6], which includes 9 statements taken from [22]. It measures whether people feel their health is determined by external factors (chance or others, such as health-care workers) or by internal factors. Participants indicate their agreement with each statements, such that higher scores indicate higher agreement. The questionnaire included statements like *'No matter what I do, if I am going to get sick, I will get sick'* (chance), *'Having regular contact with my doctor is the best way for me to avoid illness'* (powerful others), and *'If I take care of myself, I can avoid illness'* (internal). The attitude questionnaire was completed once before the study commenced and again after its completion.

We observed a significant association between the level of user engagement and the change in their feeling that their health was determined by chance, $r(31) = -.54, p < .01$. This indicated that as users became more engaged, they felt less like their health was determined by chance. The high engagement group ($M\Delta = -.73; SD\Delta = 2.99$) was significantly different in the change of this belief compared to the low engagement group ($M\Delta = 2.13, SD\Delta = 1.86$), $t(29) = 3.22, p < .01$. There were no significant relationships observed between other Health Locus of Control beliefs and user engagement. This means that users, who were highly engaged with SOFA, believed that their health was less determined by chance at the end of the study than those, who had low engagement with SOFA.

5 Conclusions and Future Work

In this work we have motivated our investigation into the effects of coupling health related content with an online digital repository, We detailed SOFA, a novel approach for coupling an education content repository with a social networking platform for the purpose of assisting users to change their lifestyle. By presenting users with a summary of the implicitly gathered interaction information, activity feeds highlight areas of interest within the system, in particular within a health content repository. This form of social navigation does not require users to consciously initiate a browsing session. They are made aware of actions as they interact with the social layer and are encouraged to explore and learn by actions of others.

Our three week study has uncovered several observations about the potential of coupling a social networking system with a health content repository and harnessing engagement

with the network to engage users with this content. We observed an increase in the number of browsing sessions and page views initiated through the activity feeds. The results further show that exposure to a repository of health related content through SOFA results in a significant change in attitude of highly engaged users regarding the feelings of control over their health.

This is a promising finding which motivates further investigation into the role of social technology in the battle against obesity. Future work in the area includes a longitudinal study, which will look at the longer term engagement levels of users with the health content repository and investigate the effects of various intelligent features on participation and engagement with the system. We are also looking into the effects of personalization on activity feed interaction. Traditional feeds are organised in ordered lists, typically ordered according to recency of activities. However, we hypothesise that determining the relevance of each feed item and presenting only highly relevant activities could increase the impact of the activity feed interactions.

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