

# Activity Awareness in Family-Based Healthy Living Online Social Networks

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## ABSTRACT

Social relationships and family involvement play an important role in health management. Activity awareness is useful in decision-making and stimulating motivation and action. In this paper, we propose a novel user interface that provides activity awareness in the context of a family-oriented healthy living social network. It is intended to increase family members' interaction with healthy living social networks. The interface has elements through which family members can record, track, and view healthy living activities in the real world and on the online social network. A user study showed that the activity awareness interface increased interaction with healthy living content underpinning the social network, led to higher levels of learning in relation to healthy living, and impacted on specific healthy living activities. There was also considerable appreciation of and interaction with the activity awareness user interface elements.

## Author Keywords

Activity awareness, user interface, user interaction, online social networks, families, healthy living, evaluation.

## ACM Classification Keywords

H.5.2 User Interfaces: Graphical user interfaces (GUI), Evaluation/methodology.

## General Terms

Design, Experimentation, Human Factors

## INTRODUCTION

The World Health Organization predicts that by 2030, three-quarters of all deaths in the world will be due to chronic non-communicable diseases [10]. The lifestyle which people adopt has a bearing on their health and wellbeing. There is thus the need and opportunity for IT solutions that support people to manage their lifestyles. Prior research indicates that there is a positive correlation between social relationships and health, and that family involvement is important in health management [1].

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Awareness has been defined as “*an understanding of the activities of others, which provides a context for your own activity*” [2]. It is useful in decision-making [3] and can enable people to make sense of activity of others and tailor their own activity accordingly [2]. Prior research in activity awareness has mainly focused on the context of work and office environments [4]. There are some activity awareness efforts that have involved the family context [7,8]. These efforts, however, focus on strengthening the links between family members by supporting communication and connectedness.

In our research, we focus on ways to increase family members' interaction with healthy living online social networks and as a means of encouraging them to adopt a healthy lifestyle. We propose a novel activity awareness user interface integrated with a family-oriented healthy living social application supporting families to adopt a healthy lifestyle. The healthy living social application [5] consists of two main components: content component and social component. The content component provides access to health-related resources drawn primarily from the CSIRO Total Wellbeing Diet book [6]. The social component provides social support features, such as blogs through which users can publish messages visible to the community, forums for online discussions, activity feeds with updates on the features/pages users are using, visiting or viewing, and others.

To develop the activity awareness interface, we have adopted a design process that involves HCI experts, domain experts (health and nutrition specialists), and potential users. The interface comprises visual elements, through which family members can record and track their healthy living activities. It also comprises elements, through which family members can view their own performance of healthy living activities in the real world and on the online social network and compare it with the performance of other users. A user study involving 92 families showed that the activity awareness interface increased user interaction with the health-related content and led to higher level of learning about healthy living and impact on specific healthy living activities. There was also considerable appreciation of and interaction with the activity awareness user interface elements.

## ACTIVITY AWARENESS USER INTERFACE

The users of the family-oriented healthy living online social network application are families. We consider the set of all these users as the community. We represent the community by  $C=\{F_1, F_2, \dots, F_n\}$ , where  $F_i$  denotes family  $i$  and  $n$  is the number of families in the community. A family  $F_i$  is represented by  $F_i=\{fm_{i1}, fm_{i2}, \dots, fm_{ik}\}$ , where  $fm_{ij}$  is member  $j$  of family  $F_i$  and  $k$  is the number of family members in  $F_i$ .

The activity awareness user interface includes elements for supporting two categories of healthy living activities: online social activities using the system, and healthy living activities in the real world.

### Online social activities using the system

While interacting with the social network, users can perform various activities (see a partial list in Table 1). We have assigned a weight  $w_l$  to each activity  $l$ . The weights reflect the importance of activities to the sustainability of the social network and efforts involved in performing them, and are in line with the weighting schema proposed in [9].

Social activity identifier	Social activity	$w_l$
22	View forum post	1
1	Update activity diary	3
40	Write blog entry	2

Table 1. Sample social activities and their weights.

An individual user performance of social activities,  $s_{ij}$ , of user  $fm_{ij}$  is computed by

$$s_{ij} = \sum_{l=1}^{n_l} w_l * f_{ij,l} \quad (1);$$

where  $f_{ij,l}$  is the frequency (number of times performed) of social activity  $l$  weighted  $w_l$ . and  $n_l$  is the number of social activities supported by the social network. A family performance  $s_i$  of social activities is computed by

$$s_i = \sum_{m=1}^{k_i} s_{im} \quad (2);$$

where  $k_i$  is the number of family members in  $F_i$ . The community performance  $S$  is computed by

$$S = \sum_{f=1}^n s_f \quad (3);$$

where  $n$  is the number of families in the community. We use  $\max(s_{ij})$  and  $\text{av}(s_{ij})$  to represent the top and average individual user performances in the community. Similarly, we compute performances related to a specific social activity  $l$ . These will be denoted by  $s_{ij,l}$ ,  $s_{i,l}$ , and  $S_l$ .

In order to support online social activities, the activity awareness user interface comprises a *scorecard* (Figure 1-right) and *performance graph* (Figure 2-right) of social activities. The scorecard helps users track their performance in interacting with the social network, and compare their performance with the top and average performance in the

community. The performance graph shows the distribution of social activities across the entire community.

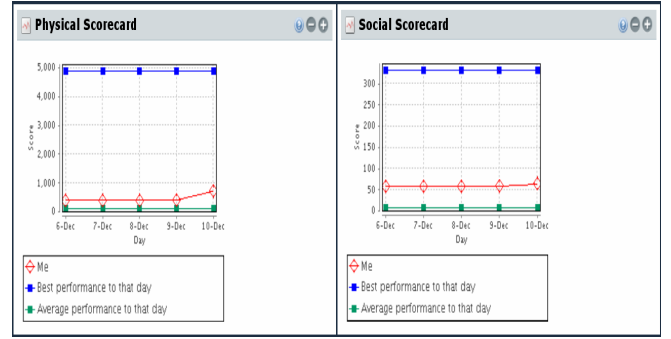


Figure 1: Scorecards.

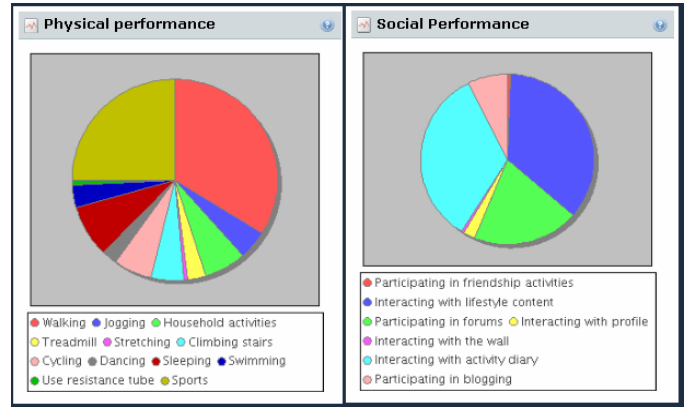


Figure 2: Performance graphs.

### Healthy living activities in the real world

In order to support healthy living activities in the real world, the activity awareness user interface comprises an *activity diary*, and a scorecard (Figure 1-left) and performance graph (Figure 2-left) of physical activities. The activity diary enables users to record their healthy living activities in the real world. Each entry in the diary is self-reported by the user and can have one of the following four intensity levels and corresponding weights: mild (1), moderate (2), moderate plus (3), hard (4).

An individual user performance of physical activities,  $p_{ij}$ , of user  $fm_{ij}$  is computed by

$$p_{ij} = \sum_{e=1}^{n_e} i_{ij,e} * d_{ij,e} \quad (4);$$

where  $n_e$  is the number of entries in the user's activity diary,  $i_{ij,e}$  is the intensity and  $d_{ij,e}$  is the duration of the activity.

Similarly to the online social activities, the following performances of physical activities can be computed: family performance  $p_i$ , community performance  $P$ , top and average performance  $\max(p_{ij})$  and  $\text{av}(p_{ij})$ , and individual, family and community performance of a specific physical activity  $m$ , respectively,  $p_{ij,m}$ ,  $p_{i,m}$ , and  $P_m$ .

## USER STUDY

We conducted a user study to evaluate the contribution of the activity awareness user interface in increasing user interaction with the healthy living social network. We were targeting families of 4 individuals (2 parents and 2 children) familiar with online social networks. We recruited 368 participants from 92 families. Participants were partitioned into two groups: group A - without activity awareness interface (177 users) and group B - with activity awareness interface (191 users). The study had 3 main stages. In the *pre-interaction stage* all the participants filled out a demographics questionnaire. In the *interaction stage* participants were asked to interact regularly with the social network over a period of 3 weeks (July-August 2009). The system logged data about users' interaction with the social network during this period. In the *post-interaction stage* participants filled out a user experience questionnaire. At this stage we got responses from 239 users (110 in group A, 129 in group B).

### Experimental results

In this subsection, we present the results of the study.

#### 1. Interaction stage results

*Interaction:* Users in the group B exhibited a higher interaction with the system ( $M=46.35^1$ ) than in group A ( $M=43.60$ ). It is worth noting that on the whole the interaction levels of parents and children were comparable, with an average interaction of 46.7 for parents, and of 45.1 for children.

*Usage of features:* Activity diary was among the most used features (see *Diary save* and *Diary add* in Figure 3). Users in group B had a significantly higher interaction with content ( $M=10.17$ ), than in group A ( $M=6.8$ );  $t(366)=2.336$ ,  $p=0.02^2$ .

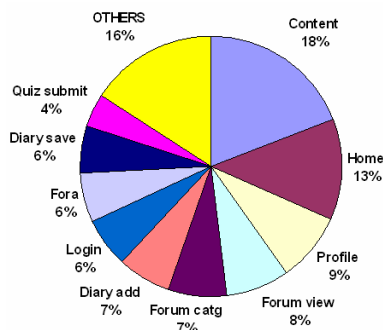


Figure 3: Usage of system features.

*Direct navigation to content:* Users in group B exhibited a significantly higher number of clicks on activity feeds on the social network homepage taking users directly to the

<sup>1</sup> We use M to represent the mean

<sup>2</sup> We use the notation to represent our independent-samples two-tailed t-tests

content ( $M=0.42$ ), than participants in group A ( $M=0.22$ );  $t(366)=2.385$ ,  $p=0.018$ .

*Interaction with specific types of content:* Group B exhibited higher interaction with all content types than group A (Figure 4). The difference was statistically significant for recipes ( $t(366)=2.386$ ,  $p=0.018$ ), and shopping lists ( $t(366)=2.607$ ,  $p=0.010$ ).

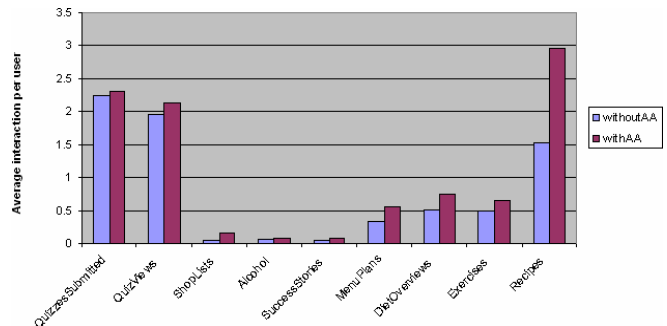


Figure 4: Interaction with specific content types.

#### 2. Post-interaction stage results

*Ease of access to health resources:* Users in group B reported a significantly higher ease of access to health resources ( $M=2.23$ ), than in group A ( $M=2.01$ );  $t(237)=2.290$ ,  $p=0.023$ .

*Learning about healthy living:* A significantly higher number of users in group B reported that using the system enabled them to learn about healthy living ( $M=1.9$ ), than in group A ( $M=1.69$ );  $t(237)=2.023$ ,  $p=0.044$ .

*Impact on healthy living activities:* A significantly higher number of users in group B reported that using the system had an impact on alcohol and smoking management in their families ( $M=0.29$ ), than in group A ( $M=0.14$ );  $t(237)=2.976$ ,  $p=0.003$ . A higher number was also observed impact on physical activities ( $M=0.46$  vs.  $M=0.34$ ). Although in the latter difference was not significant, it was very close;  $t(237)=1.908$ ,  $p=0.058$ .

*Most liked social features:* The graphs of physical activities were among the most liked social features. Other social features that were liked include: forums and updating profiles.

## DISCUSSION

Inclusion of the activity awareness interface increased interaction of users with the social network. Our research suggests that activity awareness is relevant to the following aspects of interaction:

*Influence on users' access to content:*

- Direct navigation to content from the homepage: showing the most frequently visited content in the activity feed inspired users to visit the content.
- Interaction with the healthy living content: showing scorecards and performance graphs motivated users to view the content.

To support this, group B reported a significantly higher measure of ease of access to resources than group A.

*Learning about healthy living:* The performance graphs and scorecards motivated learning. Users in group B reported that activity awareness interface enabled them to get feedback on their progress, set goals, compare with others, and discover new activities. As a result, users became more aware of themselves and others and could learn from this what to do to improve their health and lifestyle.

*Impact on specific healthy living activities:* Users in group B reported high measures of impact on smoking/alcohol management and exercise. Users indicated that the activity awareness interface helped them to identify areas they needed to improve and to see that other people were making progress.

*Feature usage and appreciation:* As was observed in the previous section, there was high utility of the activity awareness interface. The graphs of physical activities were among the most liked social network features.

### CONCLUSIONS AND FUTURE WORK

This paper has described an activity awareness user interface in family-based healthy living social networks. The interface added value to user interaction with family-based healthy living social network, increased interaction with content, and led to higher levels of learning about healthy living and greater impact on lifestyle activities. There was also significant appreciation and utility of the activity awareness interface elements.

In the future we will develop and incorporate interaction mechanisms for implicitly capturing real-world user activities. This will involve the use of devices with activity monitors in order to automatically sense and capture user's physical activities. We will also conduct further analysis of the data to establish whether there were gender differences

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