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## ***Engaging Families in Lifestyle Changes Through Social Networking***

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Previous research has shown that providing family engagement and social support play important roles in weight management success, helping to achieve long-term lifestyle changes. Traditionally, the support provided by online health communities is primarily targeted at individuals and does not involve their families. SOFA (*SOcial FAmilies*), a novel approach for engaging, motivating, and persuading families to adopt a healthy lifestyle, is proposed. SOFA is an online social network for families coupled with a repository of health-related educational content. This article reports the results of a live user study aimed at investigating how user profile representation and system-assigned tasks influence users engagement with the system and change their attitude toward a healthy lifestyle. The results show that representing family members as individuals increases the number of active members per family as well as their retention, contribution to, and engagement with the network. The results also show that family-based social networks positively change the attitude of family members toward a healthy lifestyle.

### **1. INTRODUCTION**

Poor diet and lifestyle choices are common risk factors for many diseases. Much research is being carried out into improving people's lifestyles and well-being, with a focus on weight management, exercise, and other lifestyle intervention programs, including innovative use of information technologies. Many popular weight management programs (e.g., Weight Watchers<sup>1</sup> and Jenny Craig<sup>2</sup>)

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<sup>1</sup><http://www.weightwatchers.com/>

<sup>2</sup><http://www.jennycraig.com/>

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have extended their service to provide online tools for planning, recording diet and exercise, and tracking goal progress. They also typically offer peer support to individuals through bulletin boards, discussion forums, and/or chat rooms. Health care research has recognized the profound and supporting role of families in health promotion and disease prevention (Doherty, 2004; Doherty & Campbell, 1998; Heimendinger et al., 2007). Furthermore, a family-centered approach to health care was found to be more cost-effective than most of the approaches, which focus on individuals (Doherty & Campbell, 1998). Clinical studies have also shown that social support has consistently been related to an increase in physical activity (Cohen, 2004). Despite these findings, the current online environments are mainly targeted at individuals (Colineau, Paris, Mareudy, Bhandari, & Shu, 2009), neglecting the role of families in the weight management process.

Our goal in this work was to explore the effect of providing both family and social support, through an online social networking system, on engagement with the system and change in attitude toward healthy lifestyles. We specifically wished to investigate the impact of two representations of family members, as individuals or as a family unit, and the presence of tasks. To this end, we designed, engineered, and evaluated the online social system *SOcial FAMilies* (SOFA), which integrates a corpus of health-related educational content with a social networking system, in order to expose users to healthy living knowledge and social support in an online environment. The key novelty of our work is that it focuses on the family unit, investigating the effect of coupling social technology with healthy living content in the family context.

Here, we present a 3-week live user evaluation of SOFA conducted in July 2009. The results obtained showed that representing families as individuals on the network results in significantly higher retention, contribution, and engagement with the system and increases the chances of multiple family members interacting with the system. Moreover, our results suggest that family-based social networks positively impact the health attitude of family members.

The contributions of this work are (a) proposing a novel approach to address both family and social support in helping individuals to adopt a healthy lifestyle; (b) evaluating the effect of different profile representations and tasks on user interaction; and (c) evaluating the effect of a knowledge rich, family-based social networking system on users' attitude toward healthy living.

The article is structured as follows. Section 2 describes the related work. Section 3 describes the details of SOFA, followed by an evaluation study described in section 4. Section 5 presents the results. Finally, section 6 concludes the article by summarizing the findings and outlining future research.

## **2. RELATED WORK**

In adopting a healthy lifestyle, some people suffer from lack of motivation to change their diet or exercise routines. Persuasive technologies, that is, "*interactive computing systems designed to change people's attributes or behaviors*" (Fogg, 2003), can potentially support them and increase their engagement. A system that aims

to encourage and support users in adopting a healthy lifestyle by changing their attitudes and/or behaviors is a good example of a persuasive technology.

Persuasive technologies are able to influence user behavior by applying principles that are recognized in the field of social psychology (Fogg, 2003). The following principles have been described in social psychology and persuasive technology literature (Fogg, 2003; Oinas-Kukkonen & Harjumaa, 2008; Weiksner, Fogg & Liu, 2008)—we refer to them as the social support framework:

- **Social learning:** Users will be more motivated to perform a task if they can observe others performing a similar task.
- **Normative influence:** A system can provide a means for gathering together people who have the same goal in order to increase the likelihood that a person will adopt a target behavior.
- **Self-expression:** Users will be more motivated to perform a target behavior if they are given ways to express themselves and are observed by others.
- **Social comparison:** Users will be more motivated to perform a target behavior if they can compare their performance with that of others.
- **Competition:** A system can motivate users to adopt a target behavior if it provides means for competition.
- **Recognition:** Users will be more motivated to perform a task if they are offered recognition by other users.

The past few years have seen the explosive rise of web-based social networks, online social media sites, and large-scale information sharing communities, which are all part of the Web 2.0 paradigm (Caverlee, Liu, & Webb, 2008; McCown & Nelson, 2009; Utz, 2010). The popularity of social networking websites has exploded with sites for recreation (Facebook,<sup>3</sup> Orkut,<sup>4</sup> and Myspace<sup>5</sup>), career networking (LinkedIn<sup>6</sup>), and enterprise use (Beehive; DiMicco et al., 2008). Friendship social networks, such as Facebook with its more than 750 million active users (Facebook, 2011), have provided researchers with an opportunity to study the cues that result in behavior change (Rosenfeld, 2008). In contrast to traditional friendship-driven networks, passion-centric networks (BodySpace<sup>7</sup>), which connect people with no previous off-line connections, have also come into existence. There, the connection depends on activities related to a shared interest rather than to off-line connections (Ploderer, Howard, Thomas, & Reitberger, 2008).

Research has been done on the persuasive aspects of online social networks (Fogg, 2003; Weiksner et al., 2008; Ploderer et al., 2008; Rosenfeld, 2008) and how they can provide the means for social learning when integrated with educational content. Being exposed to actions of others (both the contribution of content and the browsing habits), users can be made aware of the experiences of others on a similar journey to theirs.

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<sup>3</sup><http://www.facebook.com/>

<sup>4</sup><http://www.orkut.com/>

<sup>5</sup><http://www.myspace.com/>

<sup>6</sup><http://www.linkedin.com/>

<sup>7</sup><http://bodyspace.bodybuilding.com/>

There are some social networks in the context of health, such as TuDiabetes,<sup>8</sup> PatientsLikeMe,<sup>9</sup> and Leimeister and Krcmar (2005), where people can share their experience, find similar patients, and learn from others. This social support, however, is outside the family context and is designed for individuals. Relatively few health intervention studies incorporating a family-based component exist (McLean, Griffin, Toney, & Hardeman, 2003). Finding effective ways to engage the whole family is still an issue (Colineau et al., 2009). Research indicates that the family plays a fundamental role in the health of individuals and that health care could be improved by supporting and strengthening the family role in health promotion and disease prevention (Doherty, 2004; Doherty & Campbell, 1998). Research has also shown that there is an increased probability of an individual becoming obese if other family members are obese (Christakis & Fowler, 2007). Jones, Beach, and Jackson (2004) reported that patients diagnosed with Type II diabetes might be more likely to change their diet and exercise patterns if the family members supported these changes and if the family collectively followed through with a plan to establish a healthier lifestyle. A study intended to increase fruit and vegetable consumption and physical activity in families showed that coaching together with family activities engaged families in the process of change and movement toward the achievement of their nutrition or physical activity goals (Heimendinger et al., 2007).

An online social networking system in itself might not be sufficient to sustain user engagement for an extensive period. Despite users' perceived usefulness of the support and resources provided by health-related online systems, user engagement and retention are often low (Leslie, Marshall, Owen, & Bauman, 2005). Prespecified tasks can serve as entry points, that is, cues or structures that invite users to enter/use particular aspects of the system (Rogers, Lim, Hazlewood, & Marshall, 2009). Entry points encourage users to enter and explore particular functionalities of the system, thus sustaining their engagement in the long term. They are intended to minimize barriers to entry and to encourage users to use or explore the features supported by the system. Prespecified tasks can also be useful to users in achieving their goals. They may direct users' effort to particular achievements, energize this effort over a period of time, and encourage the users to persist until their goals are met (Locke & Latham, 2002).

Based on previous research indicating that family support can positively influence health (Cohen, 2004; Randell, Wilson, & Fitzpatrick, 2010) and on the growing popularity of online social networks, we feel that there is an opportunity for researchers and practitioners to leverage online social networks to support families in managing their lifestyle.

### **3. SOFA—ONLINE SOCIAL NETWORKING FOR FAMILIES**

SOFA (Baghaei et al., 2009) is a family-oriented social network, integrated with a repository of health-related educational content, which aims to provide

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<sup>8</sup><http://www.tudiabetes.org/>

<sup>9</sup><http://www.patientslikeme.com/>

motivational and emotional support to influence families' attitude and behavior toward adopting a healthy lifestyle. Unlike existing social networks targeting individual users, SOFA aims to engage the whole family who would like to learn about healthy living or make any changes to their lifestyle. The design of SOFA was informed by previous research on designing for families (Hutchinson et al., 2003), social and persuasive technologies, and a previous exploratory study (Colineau et al., 2009).

SOFA has a static content component and a dynamic social networking component. The social networking component of SOFA consists of three core areas: a *Home* page, a user *Profile* page, and a discussion *Forum*.

A profile page is a customizable page where family members can create their online identity. To investigate questions relating to the impact of family and individual profiles, users were exposed to these two representations. In the individual representation, each family member has his or her own profile and is seen on the network as an individual. In the family-based representation, each family has a single shared profile and interacts with others on the network as a family unit, rather than separate individuals (see Figure 1). Whether the profile page represents a family or an individual, it contains space for a profile photograph and personal details, as well as a blog, an activity diary (can be used to report food intake and exercise), an image gallery, and a message board (or Wall, as it is known in SOFA).

The home page (Figure 2) provides users with summary information pertaining to the activities of others. These include social networking activities such as friending, commenting, blogging, and forum input, as well as the physical activities of users reported in the activity diaries. Unique to SOFA is the inclusion of browsing activity of community members within the healthy lifestyle content through an *Activity Feed* panel, seen in Figure 3. The list of activities is hyperlinked, such that each activity is linked to the relevant page or component of SOFA and the profile of the user that performed the activity. Hence, through the activity feed users are made aware of popular content and can access pages browsed by other users in the community and their profile pages (Freyne, Berkovsky, Kimani, Baghaei, & Brindal, 2010).

The forum page provides a platform for social support from community members. It was the intention of the forum that the discussions should center on a healthy lifestyle and that users could ask questions, provide support, seek advice,

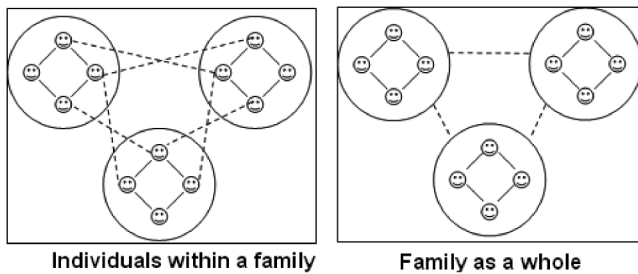
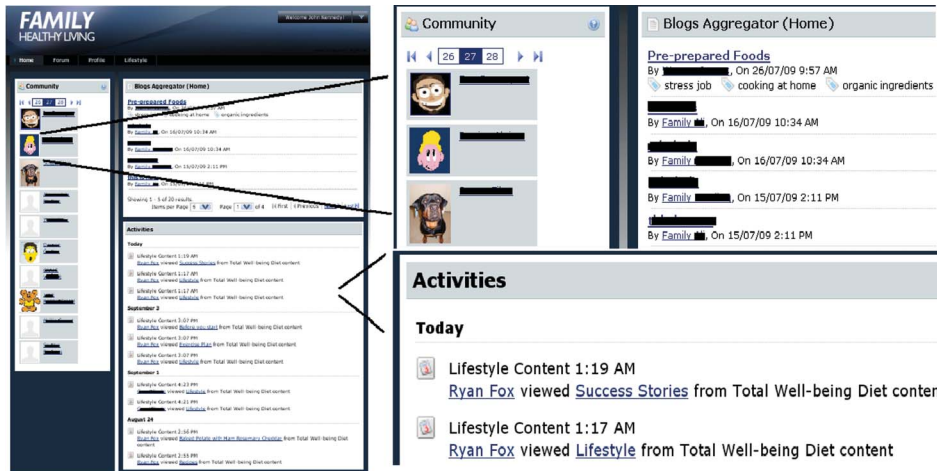









FIGURE 1 Family versus individual representation.



**FIGURE 2** Screenshot of the *SOcial Families* (SOFA) home page (color figure available online).

-  Lifestyle Content 2:37 PM  
[Michael Star](#) viewed [Shopping Lists](#) from Total Well-being Diet content
-  Lifestyle Content 2:37 PM  
[Michael Star](#) viewed [Lamb Biryani](#) from Total Well-being Diet content
-  Lifestyle Content 1:30 PM  
[Michael Star](#) viewed [Exercise Program Timetable](#) from Total Well-being Diet content
-  Lifestyle Content 1:30 PM  
[katrina colem](#) viewed [Chest Press](#) from Total Well-being Diet content
-  Lifestyle Content 1:30 PM  
[katrina colem](#) viewed [Stir-fried King Prawns](#) from Total Well-being Diet content
-  Lifestyle Content 1:29 PM  
[katrina colem](#) viewed [BircherMuseli](#) from Total Well-being Diet content
-  Lifestyle Content 1:29 PM  
[katrina colem](#) viewed [Recipes](#) from Total Well-being Diet content

**FIGURE 3** Sample feed segment (color figure available online).

and discuss ideas and thoughts with the community at large. We seeded the forum with sample relevant threads to encourage this. The forum was monitored by a system administrator and by domain experts, who answered specific health-, exercise-, and nutrition-related questions posted by participants.

The educational component of SOFA consists of scientifically validated information on diet and lifestyle taken from the CSIRO's *Total Wellbeing Diet* book (Noakes & Clifton, 2005) and quizzes from the Better Health Channel.<sup>10</sup> It covers

<sup>10</sup><http://www.betterhealth.vic.gov.au/>





FIGURE 4 Social Families (SOFA) content (color figure available online).

information on the diet, 160 recipes, 22 exercises, menu plans and shopping lists, alcohol management recommendations, success stories, quizzes, and other health-related links.

The content was segmented into chapters as per the book layout—diet details, recipes, menu plans, exercise plan, shopping lists, and success stories—and linked using a tree structure for ease of navigation as shown in Figure 4. By clicking on each section, the users were taken to a separate page broken into subsections. For example, the recipe page was broken into Breakfast & Brunch, Soups & Salads, Seafood, Chicken & Pork, Beef and Veal, Lamp, Vegetables, and Desserts.

SOFA implemented three persuasive features described in section 2: social learning, normative influence, and self-expression. Social learning was supported through an activity feed (Figure 3) that allowed users to observe actions of other users, such as reading health-related content, submitting quizzes, posting messages to forum and blogs, writing on each others’ walls, updating profiles, and so on. Being exposed to actions of others, people were made aware of the experiences of others on a journey similar to theirs. Normative influence was supported by recruiting families, who were interested in adopting a healthy lifestyle



and facilitating their interactions in the forum and blogs. Self-expression was supported through the user profiles and blogs, as the users were able to express themselves online by contributing content to their profile and to be observed by others on the network.

To investigate the effect of system-defined tasks on user engagement, we integrated a task panel, which displayed a list of weekly tasks to users. Each task specification was hyperlinked to the area of the site where this task could be completed. In particular, users were asked to update their profile, input their daily activities in the activity diary, write about their thoughts and feelings in the blog, ask questions and share information on the forum, view users' activities, and read health-related resources. The tasks were updated on a weekly basis. In the shared family profile representation, only one member was required to populate the profile, but all the other tasks could be done by each individual member. A sample set of tasks is shown next:

- *Update your profile by adding hobbies*
- *Record what you eat for lunch everyday this week*
- *How are you feeling this week? Would you like to add it to your blog?*
- *Consider doing two quizzes*
- *Did you know that SOFA has a forum? You might like to visit the forum and post a message*
- *Visit the content section of SOFA and find three interesting recipes for you and your family*
- *You may consider sharing a recipe you read, on the forum or your blog*

SOFA was implemented using Liferay Enterprise Portal,<sup>11</sup> which is an open source Java-based portal technology that supports many social networking features.

#### **4. LIVE USER STUDY**

The aim of this study was to examine the effect of profile representation and system assigned tasks on user engagement with SOFA. We were also interested to know if increased engagement with the system would result in users' change of attitude toward healthy living. Three research questions were investigated.

- **How to balance the representation of family members and family unit in SOFA?**

The goal of our work is to include the entire family in lifestyle change. Previous research illustrates that the profound role of engaging family members, thus we facilitate family involvement in SOFA through family profiles. In this way, one family member sets up the profile, which can be used by all members. Thus, the barrier to entry for less motivated family members is lowered. Family-based profiles also provide a level of anonymity, as they

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<sup>11</sup><http://www.liferay.com/>

represent the families as family units on the network rather than as separate individuals. However, given that the motivation for social media includes increased efficacy, reputation, and sense of contribution through participating in the social network, the family profile may reduce individuals' motivation to engage.

- **What is the effect of providing prespecified tasks on interaction with SOFA?**

SOFA in itself might not be sufficient to sustain user engagement for an extensive period. Prespecified tasks expose users to the whole range of functionalities provided by SOFA. They may assist users to focus their effort and attention to particular achievements and encourage them to persist until they meet their goals. Prespecified tasks are, therefore, likely to sustain user engagement with SOFA. We hypothesize that families who have been provided with prespecified tasks have a higher level of engagement with SOFA than those who have not been given any prespecified tasks.

- **How will engagement with the system affect the attitude of users toward control over health?**

Online social network users are likely to learn from actions of others through activity feeds (e.g., blog messages, forum posts). Moreover, users might gain knowledge by directly accessing the health-related content. We hypothesize that exposure to other users' actions and the health-related content through the social networking system will provide users with the skills to change their lifestyle. We hypothesize that users who engage more with the system will gain greater knowledge, which could result in changes in attitude toward health control.

#### **4.1. Experimental Setup**

A 3-week live user evaluation on the SOFA was carried out in July 2009. Participants were recruited through print media and a market recruitment company and required to have basic knowledge of computers and the Internet and to have previously used or be familiar with social networks/online communities. We recruited a cohort of nuclear families, consisting of two parents and two children between 10 and 17 years of age, all residing in one household. This age group was chosen because such children predominantly live with their parents and are usually familiar with Internet technologies.

To investigate the effects of family-based and individual profile representations, we created two conditions: *individual* and *family*. Families assigned to the individual condition were supplied with four individual user profiles, whereas families in the family condition were represented by a single family profile. To investigate the effects of user tasks, we created two more conditions: *individual+tasks* and *family+tasks*. These are similar to the individual and family conditions, but in both conditions users were provided with a set of tasks aimed at increasing user engagement with SOFA.

In total, 96 families were invited to participate in the evaluation study and 24 families were randomly assigned to each experimental condition. The average

**Table 1: Participant Details**

<i>Conditions/Groups/Communities</i>	<i>No. of Individuals Partaking</i>	<i>No. of Families Partaking</i>
Individual	38	16
Family	31	20
Individual+tasks	43	21
Family+tasks	27	16

adult age was 41.4, and the average child age was 13.1. The number of participants who took up the invitation and participated in the trial (i.e., logged into SOFA at least once) is shown in Table 1.

Note that participants in each condition were segregated from other conditions and could see neither the profile pages nor forum content contributed by those in other conditions. In effect we created four separate social networks. The segregation avoided intercondition influences, for example, users with individual profiles viewing family-based profiles and vice versa. However, as a result of this segregation, users were exposed to different network dynamics.

Participants were asked to interact with the system on a regular basis over a period of 3 weeks. They completed pre- and posttask questionnaires, and all interactions with the system were recorded. To bootstrap the social network, we created two fictitious users for each condition and uploaded a set of social content (initial forum posts, blogs, activities, and profiles) for each fictitious user uniformly across all the conditions. E-mail reminders were sent every 5 days to all participants and included some statistics on the usage of the website and some quotes the participants had left on the forum and blogs.

#### **4.2. Evaluation Metrics**

The engagement of users with SOFA is the main dependent variable for our research questions. To measure user engagement, we used the approaches proposed by Cheng and Vassileva (2005) and Farzan et al. (2009), which look at the actions a user carries out and their importance to the sustainability of the system. Cheng and Vassileva deemed important actions to be those that are likely to spark further engagement, that is, those that are likely to generate further contributions from others. Farzan et al. (2009) used a similar justification but considered important actions to be those that require user effort and work, as they showed that users were sufficiently engaged with the system to carry out the work required. Because posting forum messages requires explicit work and is likely to generate responses from other users, we gave forum posting high weight. Similarly updating a blog, activity diary, or profile, posting messages and friending are also considered important, as they require effort and may spark interest from other users, but they are not deemed as important as posting messages to the forum. SOFA users can perform 24 activities, as shown in Table 2.

The number of times a user performs an activity  $i$  is denoted by  $F_i$ . Because the importance of the activities varies, weights  $W_i$  were introduced. In addition, a

**Table 2: Different Weights for User Activities**

<i>i</i>	<i>Activities</i>	<i>W<sub>i</sub></i>
1	Login	1
2, 3, 4, 5, 6, 7, 8	View forum posts, blog entries, profile pages, Homepages, images, image folder, Total Wellbeing Diet content	1
9, 10, 11, 12, 13, 14	Image add, image update, image delete, image folder add, image folder update, image folder delete	1
15	Update profile	2
16	Write blog entry	2
17	Comment on a blog	2
18	Complete quiz	2
19	Update activity diary	3
20	Save food preferences	3
21	Save recipe preferences	3
22	Write wall messages	3
23	Add friends	3
24	Write forum message	4

user’s engagement with the system is influenced by the size of their community (*N<sub>c</sub>*). For example, users in individual+task condition with 43 members would have had more actions happening in the network than users in family+task condition with 27 members. In an effort to reduce this effect of the community, we factored in the size of each community. An overall measurement of an individual’s engagement “*V<sub>oe</sub>*” is, therefore, calculated as follows:

$$V_{oe} = \left( \sum_{i=1}^{24} W_i * F_i \right) / N_c \tag{1}$$

It is worth mentioning that there are other ways of normalizing a community, for example, by the amount of activities performed in that community. We noted that the number of activities performed in each community is correlated with the community size and that is why we normalized the scores by the community size.

We divided the activities into *contribution* actions, which include submitting quizzes; adding to the activity diaries; and posting forum, blog, and wall messages, and *consumption* actions, which were primarily viewing actions on the content and profiles of others. A consumption score for a user is measured by counting all their viewing activities (i.e., activities 2, 3, 4, 5, 6, 7, & 8), and contribution score is measured by counting the activities where content was contributed.

In addition to contribution, consumption, and engagement, we also looked at user retention and the intensity of the retained period in terms of the number of days that the user was active on the system. Retention is measured by calculating the percentage of users in each experimental condition that stayed with SOFA for a given number of days or more, and days active is the number of days in the 3-week study that each user visited SOFA.

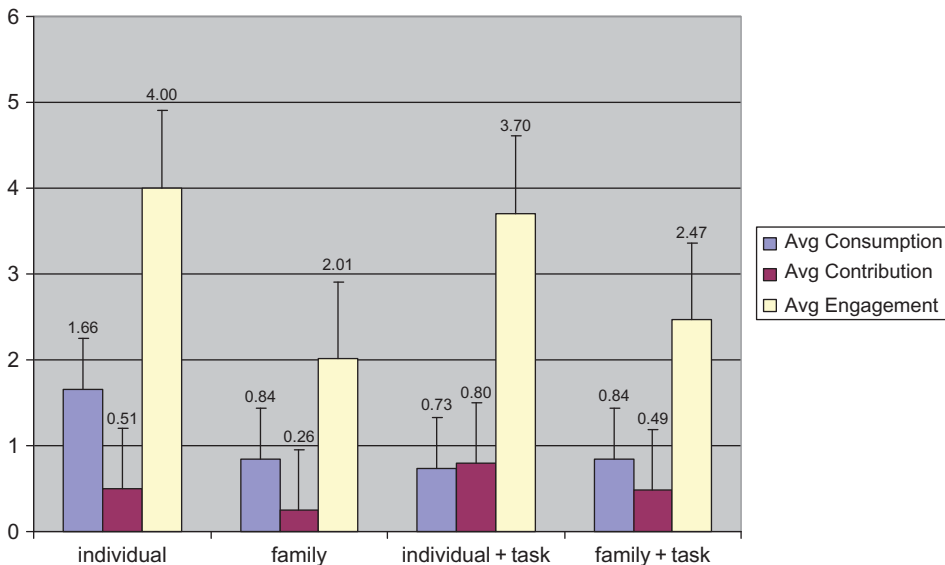
To measure change of users' attitude toward healthy living as a result of engaging with SOFA, we used the Health Locus of Control (HLOC) scale (Wallston, Wallston, & DeVellis, 1978) as part of our pre- and posttask questionnaires. The scale includes nine questions, which measure whether people feel their health is determined by external factors or by internal ones.

## 5. RESULTS

In this section we report on findings relating to the overall system use and particular activities of participants in the four experimental conditions.

### 5.1. Profile Representation and Task Inclusion

**User interaction.** We hypothesized that profile representations and the presence of tasks would affect user interaction with SOFA. Figure 5 shows the average contribution score, consumption score, and engagement of the users across the experimental conditions. The contribution score of users represented as individuals (individual = 0.51, individual+task = 0.80) are significantly higher than of those represented as families (family = 0.26, family+task = 0.49). This finding was verified using a two-way analysis of variance (ANOVA)  $F(1, 138) = 4.00, p < .05$ . In both cases, the contribution of users represented as individuals is approximately twice than of their counterparts represented as family units. This suggests that the motivation to contribute is weakened when the family is represented as a unit. The



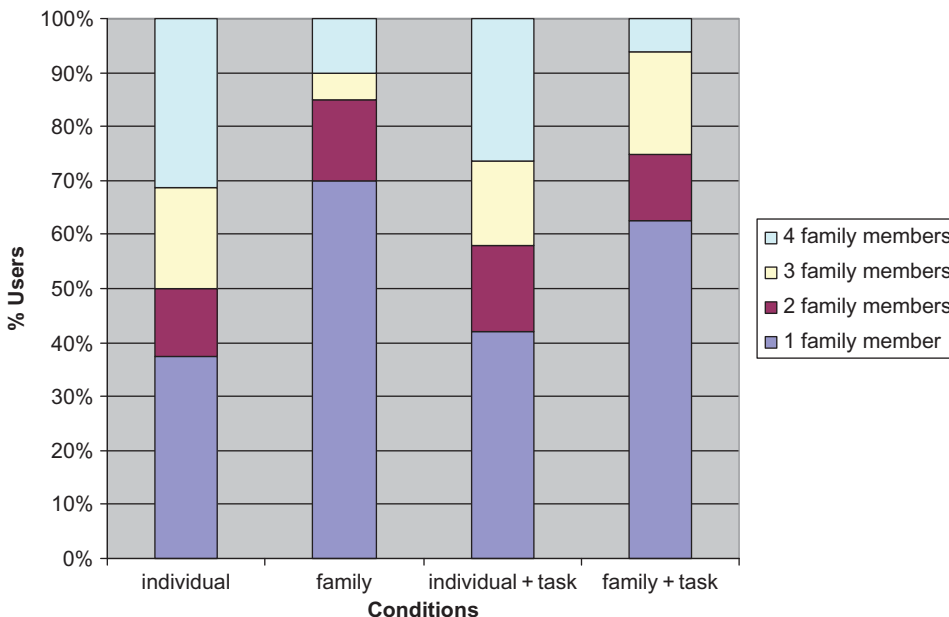
**FIGURE 5** Average number of consumption, contribution, and engagement (color figure available online).

presence of tasks did not significantly affect the rates at which users contributed to the site.

Users' consumption score was not affected by either profile representation or the presence of tasks. There was a borderline effect on consumption when tasks were provided to users in individual and individual+task conditions,  $F(1, 138) = 3.96, p = .049$ . Users' overall engagement (weighted combination of contribution and consumption) was affected by profile representation. Users in the individual and individual+task conditions were significantly more engaged than those represented as family units,  $F(1,138) = 5.04, p < .05$ . The presence of tasks did not have a significant effect on engagement.

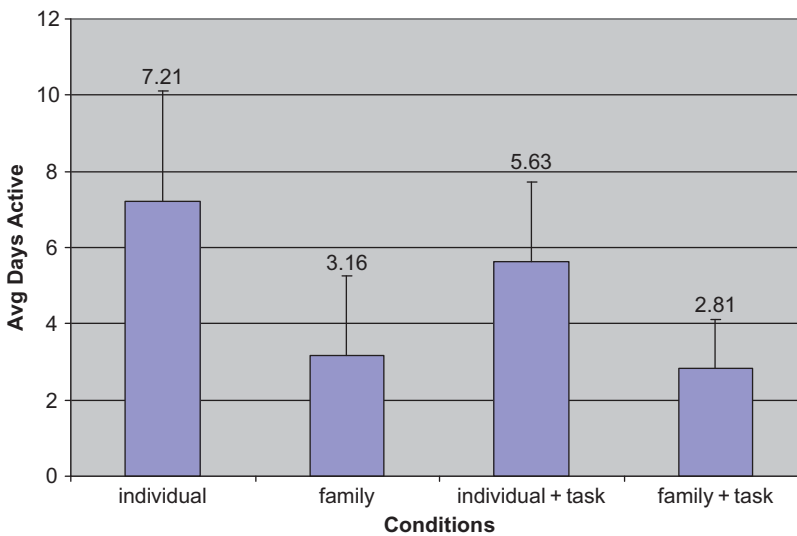
We also examined the percentage of families in each condition which had one, two, three, and four active members (shown in Figure 6). We observe similar distributions between the individual and individual+task conditions and between the family and family+task conditions. More than 60% of families represented as family units had only one family member active, in comparison with about 40% of families represented as individuals. Similarly, in individual-based representations, about 30% of families had all four family members active in comparison with less than 10% of families represented as family units.

**User retention.** In addition to site interaction, we also examined the effect of tasks and profile representation on user retention and intensity. Figure 7 shows the number of days where a participant visited the site during the study. We clearly see that participants in the individual and individual+task conditions visited the



**FIGURE 6** Percentage of active family members (color figure available online).





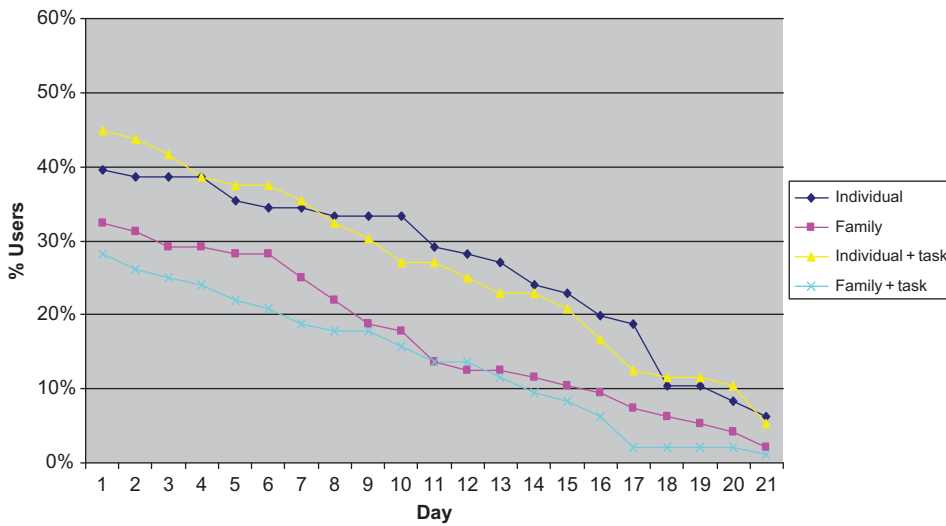
**FIGURE 7** Average number of days active (color figure available online).

site more often (7.21 days and 5.63 days, respectively) than those represented by the family unit profiles (family = 3.16 days, family+task = 2.81 days). Once again this was verified using a two-way ANOVA,  $F(1, 138) = 18.42, p < .05$ . The presence of tasks did not have a significant effect on the number of days that an individual visited SOFA.

Figure 8 shows the percentage of all users in each experimental condition that stayed with SOFA for a given number of days or more. Across all four conditions the number of active users falls with the number of days. The number of users steadily decreases as the day count increases, which is a common pattern observed in social networking systems (Martin, 2009). The lowest number of users is observed for the family+tasks condition, followed closely by the family condition. The individual+task condition is comparable to the individual condition and the family+task is comparable to family condition. The individual condition is the stickiest condition with 24% of members returning after the 2nd week. So, the family-based conditions lost more users than the individual conditions. After 21 days, the individual and individual+task conditions maintain more than twice as many users (6.3% and 5.2%, respectively) as the family-based conditions (2.1% and 1.0%, respectively). This finding was verified using a two-way ANOVA,  $F(1, 138) = 7.62, p < .05$ . The presence of tasks did not significantly affect the number of users.

## 5.2. Change in Attitude

Our final measure addresses the change in attitude of the participants of our study. We are interested in knowing whether high engagement with the



**FIGURE 8** Retention rate for each condition (color figure available online).

health-related content through the social networking system would positively affect health-related behavior. Because the behavioral change is unlikely in a short period of interventions, we examined the effect of engagement with the system on users' change in attitude as an indicator of possible future behavioral change (Torning & Oinas-Kukkonen, 2009). Attitude was measured using the shortened HLOC scale (Bennett, Moore, Smith, Murphy, & Smith, 1995), which includes nine items taken from the original scale (Wallston et al., 1978). This scale (the appendix) measures whether people feel their health is determined by external factors (chance; Items 1, 5, 8 or powerful others such as health-care workers, Items 2, 3, 4) or by internal factors (Items 6, 7, 9). Summed scores for each construct range from 3 to 18, with higher scores indicating higher agreement that external (chance, powerful others) or internal factors determine health.

Change scores for each HLOC construct were calculated by subtracting baseline scores from follow-up scores. Table 3 presents mean change scores for those participants who completed both pre- and posttask questionnaires (95 users).

We observed a significant correlation between the level of user engagement and feelings of chance, when the effect of the experimental conditions was controlled for,  $F(1, 94) = 5.09, p < .05$ . The unstandardized parameter was  $-0.23$ , indicating that for every increase in engagement, there was a 0.23 decrease in change

**Table 3: Change in Health Locus of Control Constructs**

	<i>M</i>	<i>SD</i>	<i>Range</i>
Chance	-.24	2.82	-7.00 to 6
Internal	-.05	2.57	-8.00 to 6
Powerful others	.15	3.15	-7.00 to 7

in the feeling that health was determined by chance. This finding indicates that reductions in the feeling that health is determined by external factors were related to increased user engagement (or vice versa). Engagement was not significantly associated with changes in the feeling that health is determined by internal factors.

### **5.3. Subjective Analysis**

We provided users with a postevaluation questionnaire to ascertain their feedback on the site in general and on specific features included. Overall, 58% of users reported that SOFA was fun to use, 74% that it was an easy to use system, and 85% that the content was easy to access. The positively received aspects of SOFA in descending order of popularity were the forum (69%), presence of family members (64%), the activity diary (52%), and the blog features (37%), with the least liked feature being the photo gallery (7%). We were encouraged by users' high regard for the family inclusion offered by SOFA, with 64% of participants listing the presence of their family members as one of the features they liked the most.

The aim of SOFA was to provide an access method allowing families to engage with healthy living information to promote healthy living. The questionnaire showed that use of the system prompted 63% of respondents to have off-line discussions relating to healthy living with family members. When asked in which (if any) aspects of their lives users noted a change as a result of using the system, 45% of users noted a change in diet, 40% in exercise, and 40% of adults reported a change in their smoking habits. More parents than children reported that using SOFA resulted in a change of their perception toward healthy living, they learned more on healthy living from SOFA, and they would recommend SOFA to other families. This suggests that adults are conscious of and concerned about health issues (keen on learning, perception) when they interact with social technology (Kimani et al., 2010), as they bear the primary responsibility for the health of their family.

Interesting data regarding user retention were gathered after the user trial completed. Due to several requests, the website remained available to all families, and they were notified of this. In the 4 weeks from the study completion, 84 users from 40 families (60% of the total number of families participating) logged in more than 300 times and continued interacting with the website.

### **5.4. Discussions**

The results show that individual profile representations significantly increase user contribution, engagement, duration, and intensity of participation with the system compared with to the shared family profile representation. Furthermore, individual profile representations increase the participation rates within families. Content consumption, however, was comparable for both profile representations. The difference in consumption and contribution can be explained by how user profiles were implemented in SOFA. In the individual representations, each family member created and maintained his or her own identity and was seen on the

network as an individual, hence his or her contribution was recognized, which leads to a sense of influence and impact. Our intuition for providing family-based profiles was that they would allow family members to participate without having to each create a profile representation, thus lowering the boundary for entry for the remaining family members and resulting in an increased contribution. However, they provided a level of anonymity in that members within a family were perhaps not recognized for their individual contributions. Hence, they may not have been as motivated to contribute information as people in individual profile conditions were.

The results show that individual profile representation increases the participation rates within families. The majority of families with only one active member were in the family-based representation conditions. This can be explained by theory of social loafing, that is, "*the tendency of individuals to expend less effort when working collectively than when working individually*" (Karau & Williams, 1993). The tendency of family members relying on one member in online environments has also been reported in a study by Kiesler, Zdaniuk, Lundmark, and Kraut (2000). They found that family members would heavily rely on a member with comparatively high technical skill or enthusiasm to provide them with technical help when using the Internet and to make external technical support requests.

The presence of tasks did not have any significant effect on user contribution, consumption, engagement, and days active across the four experimental conditions. We hypothesised that users, who were encouraged to explore the system under guidance, may be spurred to do further exploration unguided and become more engaged with the system. However, the results revealed a similar pattern for consumption, contribution, and engagement across the family profile representation and no significant difference in contribution for individual profile representation. The tasks were optional, with no rewards offered to users for their completion. With the inclusion of an incentive scheme, such as that implemented by Farzan et al. (2009), we may have obtained different results. More studies are needed to examine the effect of providing tasks.

The relationships between the change of attitude and user engagement with SOFA were promising. External feelings of control (chance) indicated that increasing user engagement can have positive outcomes for HLOC constructs. There is some evidence that varying levels of the feeling that health is determined by chance interacts with feelings of internality to alter health behaviors (O'Hea et al., 2005). It is important that future research assesses how user engagement acts to alter changes in attitudes as changes in attitudes may be related to changes in health behavior.

## **6. CONCLUSIONS AND FUTURE WORK**

This work aimed to exploit the popularity of social networking technologies in an attempt to impact the health of families. The overall objective of our study was to explore the effect of providing family and social support through an online social networking system on user engagement and change in attitude toward a healthy lifestyle. Within the social network we were specifically interested in investigating

the impact of two representations of family members, as individuals or as a family unit, and the presence of tasks. The results show that individual profile representation increases the chance of multiple family members participating and results in significantly higher retention, contribution, and engagement with the network. In addition, higher engagement with SOFA results in a significant change in users' attitude regarding the feelings of control over their health.

The future plan for the SOFA system is to enhance it to reflect the outcomes learned from this study, including the content integration and profile representations. Given that more than half of the users listed the presence of their family members as one of the features they liked the most, a balance must be struck between preserving the family unit in order for people to include their families in their lifestyle change and encouraging participation from those included. Thus, although individual profiles should be the preferred representation, each family member should be given the opportunity to associate him- or herself with other family members. This could be expressed by a family "friending" model, which associates family members differently to regular friends (e.g., allowing users to directly link their profiles to their family members', family-related feeds, etc.).

Given the usability feedback, we aim to refine the system and include additional functionalities. These functions fall into the broad categories of Content, Motivational Features, and Social Features. Requests were made for supplementary content in the areas of exercise, diet, and help features with calls for the addition of medical information relating to allergies, drug and medicine safety, and information specifically targeting children. The motivational content requested included personalized goal monitoring tools, tips, and inspirational ideas. Last, the social features requested included the ability to rate the healthy lifestyle content, receive updates on family members' activity, interfamily competitions, gaming, and the inclusion of an instant chat component. We also plan to conduct a longitudinal study on the effect of the system on participants' diet compliance, weight loss, engagement, and healthy living attitude/behavior.

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## APPENDIX

### Attitude Measurement Scale

To what extent do you agree or disagree with the following statements?

Statements	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
1 No matter what I do, if I am going to get sick, I will get sick						
2 Having regular contact with my doctor is the best way for me to avoid illness						
3 Whenever I don't feel well, I should consult a medically trained professional						
4 Health professionals control my health						
5 My good health is largely a matter of good fortune						
6 The main thing which affects my health is what I do myself						
7 If I take care of myself, I can avoid illness						
8 If it's meant to be, I will stay healthy						
9 If I take the right actions, I can stay healthy						