

Understanding Development and Usage of Social Networking Sites: The Social Software Performance Model

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Abstract

Social networking sites such as MySpace and Facebook thrive on energetic social interaction, but the factors that assure this are not well understood. There is a lack of theory that can describe and predict the successful adoption of new social computing systems. This paper introduces the Social Software Performance Model, and uses it to interpret the evolution and usage of social networking sites. Drawing from socio-technical systems theory, task technology fit, and structuration theory, this model identifies the components of social software, and describes their role in the evaluation and adoption of these systems. The results of three studies are presented, providing initial empirical evidence for the model.

1. Introduction

The Internet supports social interaction that is scalable from the micro level (two way conversation) to the macro level (creating a global online social network). Internet users indicate an increasing willingness to create a persistent digital identity that enables long term social interaction [1-3].

Internet enabled communication is possible on many levels: synchronous versus asynchronous; anonymous versus authenticated; text versus multimedia; individual versus group; mobile versus situated. Internet users switch among modes, often within the same conversation [4, 5]. The Internet can function as a multi-modal, continuously open channel for social contact and connectivity.

As recently as 2000, these various communication modes were supported by stand alone tools. Email was separate from instant messaging and blogging. Sharing photos first required the creation of a static web page with HTML tags referencing each picture file, followed by an e-mail publicizing its location.

Functionality was needed to more effectively support ongoing conversations (with the same

person) across multiple modes. It is more consistent with the nature of human communication to organize communication by contact, rather than by tool [6]. An integrated solution with persistent identities for conversation partners and multiple communication modes increases the ability to maintain continuous social connectivity.

This functionality is delivered by social networking sites, which simplify communication by integrating digital communication and publishing. Social networking sites support an individual's construction of their persistent digital identity. In addition, they provide single point access to various communication tools, enabling an intuitive and effective management of digital communication across time, space, and platform shifts [7].

The tremendous success of these sites is demonstrated by their membership rolls and web traffic. MySpace, which is currently the most popular, came on line in 2003 and now has over 180,000,000 members, ranking fifth overall in global web traffic¹. This success was not predicted by research on virtual communities. Analyses of virtual communities identify lurking and low participation as a persistent problem [8].

There is a lack of theory that can explain the difference between success and failure by social networking sites, or provide advice to developers [9]. The questions we address here are: What theories are relevant to the usage and acceptance of social networking sites? How can these theories be supported with empirical evidence?

To answer these questions, we review applicable theories and prior research on social networking sites, and present a description of how these sites are used. The starting point for our theoretical model is the Fit Appropriation Model, presented by Dennis et al. in [10]. The Fit Appropriation Model combines task technology fit [11-14] and structuration theory [15-17] to explain what

¹ www.alexacom.com, as of June 6, 2007

Pre-Conference Draft

appears to be inconsistent results for Group Support Systems (GSS).

This paper builds on the Fit Appropriation Model by adding an explicit feedback loop to explain how usage over time can result in changes to the system itself. This feedback cycle is adapted from socio-technical systems theory [18].

This combination of theories is integrated into the Social Software Performance Model. This new model uses task technology fit to define fit and performance with respect to social networking sites. The model uses appropriation support to define how social networking sites encourage pro-social behavior and discourage anti-social behavior. Finally, the feedback cycle is applied from socio-technical systems theory to describe how usage and adoption patterns influence the continued evolution of the site.

The remainder of this paper is organized as follows. Section 2 presents a review of relevant research and theory. Section 3 presents the Social Software Performance Model. Section 4 describes preliminary empirical evidence that supports the model, based on studies of users of social networking sites, especially MySpace and Facebook. Section 5 presents the discussion and conclusions and describes ongoing research.

2. Literature Review

This paper presents a model combining three theoretical perspectives. In order to justify this approach, we will present a brief introduction of prior research and a description of the role of profiles on social networking sites. Each member of a social networking site creates a personal profile, displaying identifying information (such as a photo) and contact information (such as an email address). We argue that a focus on the profile brings up social, personal, and technical factors that can best be explained with an integrated model.

One of the earliest examples of social networking sites is Friendster, described by Donath and Boyd in [19], and Boyd in [2, 20, 21]. In Friendster, Boyd et al. report that members create profiles with the intention of communicating news about themselves to others.

Dwyer [26] found that people use social networking sites to maintain existing

relationships and develop new ones. Members described an increase in their social productivity and reported the use of social networking sites to re-establish connections with lost friends and to view friends through their profile. Subjects described how they can “keep up” with little effort [22].

Several researchers have studied Facebook, a social networking site that began with a focus on colleges and universities, but now includes high schools and other organizations [23-25]. These studies collected profile information from Facebook through the use of a web crawler, as well as through surveys of members. The results show that Facebook members reveal a lot of information about themselves in their profiles, are not very aware of privacy options, and often do not know who can view their profile [23].

2.1 Profiles on social networking sites

The profile plays a critical role in the use of social networking sites. Profiles are the cause of much public concern with respect to the use of social networking sites, due to their exposure of private information to unknown audiences [3, 26-32]. Nevertheless, despite clearly expressed privacy concerns, members of social networking sites routinely reveal many types of personal information [33].

Members are willing to disclose information in the face of privacy concerns because of two factors. First, social interaction is often initiated by collecting information from a new communications partner [34]. If interaction is the goal, then for social networking sites, a profile is the pre-requisite. Members create a profile because it allows communication partners to authenticate each other in a digital space. For example, if Alice wants to begin a conversation with Bob, she has to tell Bob who she is. She does this with her profile, which is linked by the site to her message. Without her profile, Bob won't know who is trying to send him a message, and may ignore it. A study of use of social networking sites by teenagers found that a considerable number of teenagers were contacted by “strangers,” and mostly ignored them [7].

Secondly, your profile includes a representation of your personal social network, those individuals whom you have identified as “friends.” A friend on a social networking site is simply anyone you pre-authorize as a potential

communication partner. This status is binary (yes/no), and can be terminated by either party [19].

Within social networking sites, your personal network is represented as a linked set of profiles, allowing you to browse through images of your friends, and initiate communication in an intuitive, low key way. Just click on a link and you can send a message or post a public comment on a friend's profile.

Since your network of friends is a public component of your profile, then how many friends you have and who they are is a visible and easily captured status metric. This provides incentive for members to expand their network (and appear more popular), and customize their profile (to catch the attention of potential new friends).

The creation and maintenance of your profile, hence, is an important part of participating within a social networking site. The profile serves as a mechanism for digital self presentation, and a portal to all your friends. As described by Goffman in [34], people make a conscious effort to craft their self presentation to influence the opinions others form of them. However, members of social networking sites have no easy way to determine who makes up the audience for their profile [1].

Therefore the technology supporting the creation, representation, and availability of profiles must be designed to address both individual and social concerns. Individual concerns include privacy and control over access to information. Social concerns include accurate representations of social networks and curbing anti-social behavior. This complex combination of personal, social, and technical requirements is not explained by one theoretical perspective. In the next section, we will summarize three theoretical approaches that will be combined to form the Social Software Performance Model.

2.2 Three Theoretical Perspectives

Three theoretical perspectives form the components of our theoretical model: task technology fit, the Fit Appropriation Model, and socio-technical systems theory. These perspectives provide the foundation for the model described in section 3.

Task technology fit is a theory that describes performance impacts of an information system. It defines fit as the degree to which a technology provides features that support the requirements of a task and the abilities of an individual ([14], p. 214). Fit, or goodness of fit, is a predictor of performance benefits derived from the use of information systems.

2.2.1 The Fit Appropriation Model

The Fit Appropriation Model as described by Dennis et al. in [10] extends task technology fit theory by combining it with "appropriation" theories, such as Adaptive Structuration Theory [15]. The motivation for combining these approaches is to explain inconsistent results with respect to the impact of group support systems (GSS).

The Fit Appropriation Model begins with the components of task technology fit [10]. The model then adds the appropriation construct, which is the process by which people apply and adapt technology to their tasks. DeSanctis and Poole define a "faithful appropriation" as one where the group uses the technology as intended by its designer. An "unfaithful appropriation" is one where the technology is not used in ways intended by the designer [15].

How well the tool fits the task does not matter if the tool is not used properly [10]. Therefore, it is important to look at what support technology provides to guide users. Dennis et al. label this as appropriation support, or the degree of training, facilitation, or software restrictiveness within a system that encourage faithful appropriation, i.e. using the system as intended by its designers [15]. Dourish has described appropriation support as an important consideration in the design of collaborative systems [35].

For GSS, Dennis et al. identify three ways of providing appropriation support. The first is facilitation, through a group leader or an external

facilitator. The second is software restrictiveness, referring to the extent to which a system constrains individual behavior. For example, for GSS systems, items not related to the group's agenda may be blocked for discussion by the system. The third factor is appropriation training. This involves training in the use of the technology, to reinforce the benefits of using the technology in an appropriate way [10].

Dennis et al. apply the Fit Appropriation Model to a meta-analysis of GSS studies. This model predicts that when there is task technology fit, the existence of appropriation support will lead to greater performance (such as improved decision quality, more ideas/alternatives, and improved participant satisfaction with the outcome).

Dennis et al.'s meta-analysis found that task technology fit (the match between the requirements of a task and the technology used to carry out that task) explained some but not all GSS research results. Their results suggest that both task technology fit and appropriation support are factors that can predict outcome.

However, there is an assumption within the term "faithful appropriation" that the intent of the designer is correct. In addition, the Fit Appropriation Model does not represent how use of the system (appropriation) can lead to a change in the technology [16]. This is not consistent with current software development practices. For example, agile methods emphasize continuous delivery of small increments of functionality based on intense feedback from the users [36].

Models based on appropriation are lacking a feedback cycle because of the presumed validity of the initial design. This limitation will be addressed by adding a feedback cycle, adapted from socio-technical systems theory [18]. The next section will describe Socio-technical Systems Theory and how feedback leads to changes in the system.

2.2.2 Feedback Within Socio-technical Systems

An understanding of the structure of socio-technical systems theory, particularly feedback loops, helps explain how patterns of usage influence the development of a system.

According to Thomas P. Hughes, large technological systems are complex, messy problem solving systems with ill-defined boundaries [18]. Technological systems are both socially constructed, and also help shape social structures. These systems consist of components, which are social structures, and artifacts, which are technical elements that contribute directly or through other components to a common system goal.

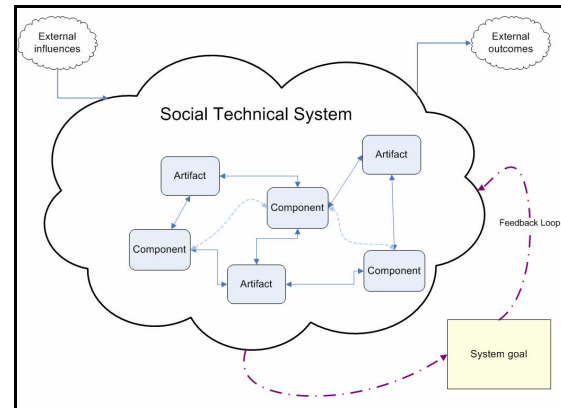


Figure 1: The structure of a socio-technical system, based on Hughes (1989).

The relationship between artifact and social structure can also be seen in the impact of new communications technologies, such as e-mail, cell phones, and the internet, on the organizational structure of companies. The type of communication technology used can affect the structure and success of virtual teams [37-39].

Figure 1 is a graphical representation of Hughes's description of social technical systems. The system's boundary is depicted with an irregular shape, representing the blurred borders of social technical systems. Within the system are components and artifacts that interact.

The key part of this theory being adapted for this paper is the feedback loop, represented in Figure 1 as a dashed line. Hughes maintains that people within a technological system have a critical role, which is to **complete the feedback loop** by perceiving the gap between system performance and system goals. Hughes argues that it is only through this feedback loop that errors are caught and corrected, leading to improvement in system performance.

This feedback mechanism continues throughout the life of the system. System builders design

Pre-Conference Draft

artifacts and components in order to fulfill the system goal. People using the system compare the actual performance to its goal, and this feedback leads to adjustments in the artifacts and components of this system. This cycle continues, as the system expands in size and complexity.

3. The Social Software Performance Model

The goal of this research is to apply theoretical frameworks to more accurately describe and predict the structure and use of social networking sites. The Fit Appropriation Model is a useful starting point because it divides the system into two parts: one focused on supporting the task, and the other focused on supporting the social processes involved in completing the task.

Separating appropriation support from the task model allows designers and researchers to focus on components that address social requirements, and helps determine how effective that support really is. Following the language of the Fit Appropriation Model, successful appropriation support would result in a faithful appropriation of the technology.

The Social Software Performance Model is shown in Figure 2 in the Appendix. It adapts the Fit Appropriation Model to social networking sites. It includes the same basic components, but extends the Fit Appropriation Model by adding a feedback loop, connecting performance, through habitual routines, to system design processes. The Fit Appropriation Model makes the assumption that the goals of the system designer are correct, and should be adopted as is by users.

In actual practice, there is frequent feedback between members and designers, resulting in changes to the system. Technology updates can be rejected, requiring revised functionality. In the next paragraph is an example of an addition to the social networking site Facebook that was revised in response to feedback from members.

In 2006 Facebook introduced a “news feed” feature. The Facebook news feed is a log of members’ daily activity on the site. The news feed is prominently displayed on each member’s profile, and distributed to everyone within a member’s social network. So if Alice posts a comment on one of Bob’s pictures, all of her friends are informed that she did so. This act was

in a sense public because anyone could happen upon the comment if they were looking at Bob’s pictures. However, the news feed broadcasts everything you do to all of your “friends,” greatly increasing the visibility of actions.

While Facebook’s designers intended to facilitate social connections, members perceived it as an invasion of privacy and loss of control of their personal information. Within days, over 700,000 members expressed their concern by joining a group “Students Against Facebook News Feed.” In response to vocal protests and media attention, the founder of Facebook, Mark Zuckerberg, explained the purpose behind the news feed: “This is information people used to dig for on a daily basis, nicely reorganized and summarized so people can learn about the people they care about.” Members were unswayed. Angry Facebook members had made their unhappiness felt, and the site was changed to add privacy controls to the distribution of news feed information [40].

The news feed example illustrates how quickly members of social networking sites can express their unhappiness, triggering functional changes. The news feed is an example of strong negative feedback that resulted in a change to the site. To represent the causal influence of feedback, the Social Software Performance Model extends the Fit Appropriation Model by adding a feedback loop to the design process. The rapid evolution of social networking sites makes it clear that a feedback loop is in place. The news feed example illustrates that in order to understand the nature of social networking sites, there must be an attempt to follow the feedback from evaluation of task technology fit, performance and patterns of appropriation, back to the design process.

The Social Software Performance Model has four layers: design processes, system features, user behavior, and system effectiveness measures. Each of these layers is labeled in the key provided (see Figure 2 in the Appendix).

Design processes influence the building of basic system functionality, appropriation support, and the development of the task requirements for social interaction. The task requirements include the following:

- self presentation – individuals must be able to present a representation of themselves, in order to communicate news to friends, and

Pre-Conference Draft

- stimulate interest from others who are seeking new relationships
- relationship initiation – members must be able to learn about others, making initial contact, sharing common experiences/interests, and then perhaps initiating a stronger relationship
- management of ongoing relationships – members must be able to contact others, learn about their activities, and make available information about their activities.

In addition to task requirements, a social software system must define social requirements. Social requirements include privacy and setting expectations and standards for member behavior and site usage. For example, many sites allow other users to report inappropriate content (such as pornography), resulting in its deletion.

Next is the implementation layer, where designers build systems features based on an understanding of the task model. In order to support social interaction, social networking sites provide the following functional components:

- digital self representation through profiles
- communication tools for both synchronous and asynchronous contact
- linked, visual representation of ego-centric social networks.

Also within the implementation layer is appropriation support, which encourages faithful appropriation. Encouragement of pro-social rather than anti-social behavior is an important requirement for social software systems [41]. In the case of social networking sites, appropriation support involves functionality that encourages the development of social relationships, and discourages acts that break down social relationships. Appropriation support in these sites can include the following:

- reputation management – providing reporting mechanisms for undesired behavior
- restrictive features – defining what type of information is searchable
- privacy controls – allowing customized settings for each member

The next section of the model, the usage layer, represents how members use the site. This usage layer has two parts. The first part is appropriation, or compliance with the standards for behavior set by the site. The second part is

more general. It is labeled habitual routines. It represents how members use the site, and how frequently they return.

The lowest section of the model, the evaluation layer, contains system effectiveness measures. These measures are fit and performance. Fit, in this model, is defined as the ability of the functionality of social networking sites to support the task model for social interaction. Performance is defined as perceived efficiency, effectiveness, and satisfaction with use of the site.

The final component of the model is the feedback loop. It is displayed as a dotted line, originating from performance, leading to habitual routines, then back to system design processes. It is not displayed as a solid line so as not to imply a significant correlation. This feedback loop is expected to affect the evolution of the site. However, the nature of that evolution is not anticipated to be predictable or consistent.

4. Empirical evidence in support of the model

Three studies conducted to date provide evidence in support of portions of the Social Software Performance Model. The first was a qualitative study based on semi-structured interviews with 19 graduate and undergraduate students, which has been described in some detail previously [22]. The subjects were recruited and interviewed by undergraduate students as part of a class assignment. The subjects report use of a variety of social networking sites, such as MySpace, Facebook, Xanga, and Hi5. They explain their use of social networking sites to maintain existing relationships and develop new ones. This study helped define the ways in which people use these sites for social interaction.

The second study was an online survey targeted at Facebook and MySpace members, conducted August-September 2006, and is described in [33]. MySpace and Facebook users were chosen for this study, not only because these are among the two largest social networking sites, but also because there are some differences in their functionality, the impacts of which may be studied.

To recruit subjects, one author created profiles on Facebook and MySpace, and posted survey

Pre-Conference Draft

invitations to public groups and forums. Subjects received one free download from iTunes. The 226 subjects include 132 Facebook members (57 male, 72 female, and 3 no response) and 94 MySpace members (48 males and 46 females).

The survey collected data, using open ended questions, which support the validity of the performance construct as a goal of members of social networking sites. When asked “What do you like the most about using social networking software?”, many subjects responded in terms of the increase in their effectiveness and efficiency in developing and maintaining relationships.

Subjects described the functionality of social networking sites as effective and convenient: *“It is so much more convenient to have all the information I want to share with friends in a centralized, organized information system. Compared to everyone having their own webpage, email/forum for talking, etc.” ... “Its like having an online address book that automatically updates itself.”*

Subjects said the use of social networking sites helped them to save time, and be more efficient: *“Saves me time” ... “I can communicate with my friends quickly” ... “I like the convenience of keeping track of your friends without having to call them all the time” ... “Less effort than other forms of communication.”*

These remarks indicate that members of social networking sites do appreciate and consider effectiveness and efficiency when evaluating their use of these sites.

The third study, also an online survey, was conducted March-April 2007. The 67 subjects were 44 male and 23 female undergraduate students, recruited by offering extra credit for their class grade. The majority are active members of a social networking site (58 out of 67), with the most listing Facebook (32) or MySpace (22) as their primary site.

The third study tested scales of fit with respect to two of the tasks members carry out on social networking sites. The results are presented in a table included in the Appendix. The first is a four question scale for fit between the site and self presentation, i.e. profile design. This construct (labeled ProfileDesignFit in the Appendix) includes questions such as “I carefully design my profile so that others can get the right impression

as to who I am.” This scale has a Cronbach’s alpha of .773.

The second scale measures the fit between the site and the use of social networking sites to meet people (labeled MeetPeopleFit in the Appendix). It includes questions such as “I can sustain online relationships using a social networking site such as MySpace or Facebook.” The Cronbach’s alpha for this four question scale is .763.

There are strong correlations for both fit scales and perceived effectiveness, a measure of performance. (see Table 1 in the Appendix). These correlations provide support for the section of the model that predicts that fit has a positive effect on performance.

5. Discussion and Conclusion

Evidence collected from three studies supports parts of the model. There is evidence in support of using performance as an objective with regard to use of social networking sites.

Two scales with respect to fit have been tested and show good reliability and correlation to performance. These scales capture fit with regard to self presentation (i.e. profile design) and fit with respect to meeting new people. There was a strongly significant correlation with r values of .460 or higher between the fit scales and, effectiveness, a component of performance.

The results presented here are preliminary and incomplete. A larger study is being planned that will collect more complete data from users of MySpace and Facebook to allow for a broader testing of components in the model, and their inter-relationships. In the future, this could be extended to studying a wider variety of social software applications and sites.

The Social Software Performance Model builds on the Fit Appropriation Model by adapting it to social networking sites, and adding a feedback loop. We believe that an understanding of both task technology fit and appropriation are needed to accurately describe and predict usage of social networking sites. We also add a feedback loop that reflects both the current development techniques that emphasize frequent changes based on user feedback, and our observations regarding the rapid evolution of these sites.

Pre-Conference Draft

As more and more social interaction moves online, designers are faced with challenges with regard to building systems that encourage positive social interaction. Systems that do this successfully do well; systems that do not usually fail. When tested more completely, we hope this model can provide a clearer explanation of the ways that social interaction can be successfully implemented in social software.

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Appendix

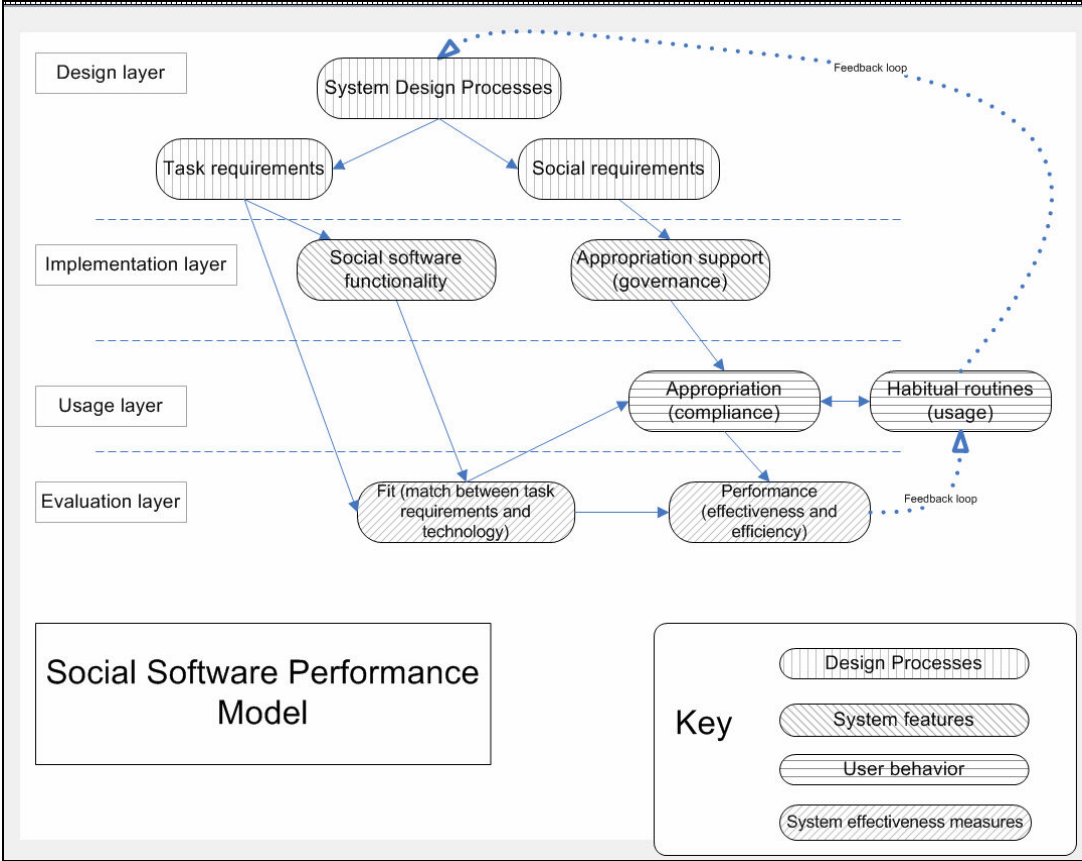


Figure 2: The Social Software Performance Model

	I find using a social networking site is the best way to keep in touch with my closest friends.	ProfileDesignFit	MeetPeopleFit
I find using a social networking site is the best way to keep in touch with my closest friends.	1	.462(**)	.504(**)
ProfileDesignFit	.462(**)	1	.561(**)
MeetPeopleFit	.504(**)	.561(**)	1

Table 1: Effectiveness correlation table

** Correlation (Pearson’s R) is significant at the 0.01 level (2-tailed).