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Evaluating Online forums as a Customer Service Tool for Consumer Products

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ABSTRACT

In this study, we capture communication activities on 14 online forums that are implemented primarily to provide customer service for consumers of mobile phones and MP3 players. We perform a large scale analysis to investigate the social nature and the effectiveness of using online forums as a customer service tool. Unlike previous studies, our research examines a complete archive of the actual communication activities on online forums that are publicly available to general consumers. Our comparative and social network analysis allows us to compare the structural differences among these social networks.

INTRODUCTION

Online social media have gained tremendous popularity among Internet users. Millions of consumers share personal information as well as their knowledge with others, many of whom are strangers, using online communities such as blogs, social network sites, and online bulletin boards. These online communities cover a wide variety of topics and interest groups (see, for example, Byrne (2008) on black social networks such as BlackPlanet.com; Barnett & Hwang (2003) on online forums for breast cancer patients, Schroeder, et al. (2010) on using social software in higher education, and Wasko, et al. (2009) on communications within an online legal professional association network).

Online retailers also implement social media tools to allow customers to learn about new and existing products, obtain technical support, and even express their opinions about the products they have used. In this research, we focus on online forums that are implemented primarily to provide customer service. In spite of the popularity of using online forums as a customer service tool, little research has been done to examine the effectiveness and the social nature of these forums. For example, are these forums useful in providing technical or product advice? Do consumers receive the information they seek? Do forum members actually form a well-connected support group or a community? In order to answer these research questions, our study examines communication activities from a range of online forums, allowing us to conduct extensive analysis and to investigate the social structures that exist and communication activities that occur within the online communities.

We select online forums that were created to support two types of consumer products: mobile phones and MP3 players. These two products are often used on a daily basis and have a large worldwide consumer base. Unlike past studies focusing online communities of experts in specific industries (e.g., financial services: Schoberth, et al. (2006) or professional legal services:

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Wasko & Faraj (2000); Wasko & Faraj (2005) that are not necessarily applicable to general consumers, the forums included in our study support a broad consumer base. In addition, to the best of our knowledge, none of the previous studies on online forums examined online communities that are implemented primarily as a customer service feature. We also select the online forums whose participants come from diverse backgrounds and geographical locations to ensure that our findings can be generalized. We developed a software application that employed advanced data collection techniques to compile a complete archive of information stored on each online forum. Our comparative and social network analysis (SNA) allows us to extend the results from past studies and gain additional insights into the nature and effectiveness of using online forums as a customer service tool.

PAST RESEARCH ON ONLINE COMMUNITIES

Research on online communities spans a broad spectrum of academic fields. Past studies in communications research examined the information exchange that takes place in an online environment (e.g., Sohn & Leckenby, 2007; Liu, 2008). In the field of Marketing, research on word-of-mouth communication encompassed both offline and online environments. Past studies (e.g., Bampo, et al., 2008;Godes & Mayzlin, 2004;Richins, 1983; Putsis et al., 1997; Kozinets, 2002) provided an excellent overview of research in this area. In Organizational Behavior, researchers have examined the nature of virtual organizations and the behavior of their participants (Constant, et al., 1994; Constant, et al., 1996; Desantis & Monge, 1999). Other academic disciplines that have substantial interest in this research topic include Economics (e.g., Ellison & Fudenberg, 1995) and Sociology (e.g., Van den Bulte & Lilien, 2001).

In the past decade, the topic of online communities has also piqued the interest of scholars in Information Systems. Two IS research streams are particularly related to our study. The first research stream examines the information-sharing activities and other behavioral patterns of members of online communities. Jarvenpaa and Staples (2000) conducted a survey of employees at a university to examine their use and perception toward information-sharing tools such as listservs and emails. More recently, Prasarnphanich and Wagner (2009) studied the factors that affect an individual's willingness to share their knowledge in an online environment. In addition, Butler (2001) and Ganley and Lampe (2009) investigated the structures, communication activities, and sustainability of online social communities. Other IS scholars focused on online communities that served a specific group of professionals, such as in government agencies (Liebowitz & Liebowitz, 2008), the financial service (Schoberth, et al., 2006) and legal service (Wasko & Faraj, 2005) industries. A study by Jones, et al (2004) provided a theoretical model of the relationship between online communities and the behavior of their members. They focused primarily on virtual communities where "online, shared, interpersonal interaction spaces, whose membership and existence are fairly open for both observation and user participation" (Jones, et al., 2004), a context similar to the online forums included in this study. Recent studies (e.g., Moon & Sproull, 2008); Trier, 2008) also provided theoretical foundations and techniques for monitoring and increasing member participation in online communities.

However, these past studies focused on one or very few online communities. In addition, many researchers used online surveys of randomly selected members of these online communities (e.g., Jarvenppa & Staples, 2000; Wasko & Faraj, 2005) or used a small sample of data available online (e.g., Wasko, et al., 2009). These approaches allowed past researchers to limit their data

collection efforts to a relatively manageable scale. However, these research methods could lead to a biased view of the online communities and/or could limit the implications of their findings to only certain online environments. For example, studies that were based on survey data may reflect the opinions of only those who have either strongly positive or strongly negative views of their online community and thus felt prompted to respond to the surveys. Moreover, taking a small sample of communication activities on online forums would not allow researchers to thoroughly examine the network structures and social ties within the online communities. In addition, none of these previous studies examined the online communities that are implemented primarily to provide customer services to general consumers.

The second stream of IS research related to our study investigates the impact that online word-of-mouth has on retail sales. IS scholars have extended research findings in Marketing (e.g., Mahajan, et al., 1984) and Economics (e.g., McFadden & Train, 1996; Chavalier & Goolsbee, 2003) and augmented our understanding of the impact of word-of-mouth communication that occurs in virtual environments (see, for example, Xue, et al., 2004; Chen, et al., 2004; Li & Hitt, 2008; Jiang, et al., 2010). However, unlike the online forums included in this current research, these past studies primarily involve online reviews of products – in essence, a one-way communication that does not encourage interaction among participants.

THEORETICAL AND CONCEPTUAL FOUNDATIONS

Even though a large library of existing research has examined various characteristics and applications of online communities, the following three aspects have been the primary focus of most existing studies, especially in the IS discipline: 1) communication activities of online communities, 2) community size, and 3) social network structures. In this research, use theoretical concepts established by past studies as described below.

Communication Activities

Whittaker and Sidner (1996) established a theoretical framework for analyzing communication activities within large social networks. For example, a concept of network interactivity is measured by how many messages are exchanged within the same online conversation. This definition of network interactivity has also been adopted by many other scholars (e.g., Jones & Rafaeli, 1999; Schoberth, et al., 2006).

Because of the large number of participants and messages posted on online social networks, individual members may suffer from information overload (Hiltz & Turoff, 1985). As a result, many messages are posted on these networks, but never receive a reply. In order to measure the level of information overload, Schoberth, et al (2006) defined an online conversation with more than one message as an 'established' conversation in order to help estimate "the probability of an initiating message to be answered." Past studies also examined conversational strategies used by online community members. Among the most common ways to measure conversational strategies is to quantify the average message length either within an online community or by individual members (e.g., Whittaker, et al., 1998). The concepts of network interactivity, established conversations, and conversational strategies are particularly crucial in an effort to evaluate the effectiveness of using online forums as a customer support tool. In the current study, we follow the lead supplied by past studies and examine the communication activities of the fourteen online forums in our data set.

Past studies also attempted to characterize individual members of a social network. For instance, the concept of 'familiarity' is introduced to examine whether or not and how often a person communicates with others and therefore contributes to the communication activities within an online social network (Whittaker, et al., 1998). For example, Rojo and Ragsdale (1997) observed that a very small percentage of online community members accounted for a large proportion of communication activities while the majority of community members never contributed. Building upon these past studies, our research examines the frequency of communications and free-riding behaviors among members of online communities. We also draw upon existing theory to help explain these "mass participation inequalities (Rojo & Ragsdale, 1997)." In establishing an explanation for the social loafing or free-riding behaviors in an online community, Latane (1981) linked the level of individual participation to the size of the social network.

Network Size and Demographics

Past research (e.g., Whittaker, et al., 1998) measured the size and demographics of a social network by reporting the number of participants in the network and the total number of messages posted among the network participants. It was proposed that a social network needs to have a large enough pool of participants (i.e., potential contributors) in order to sustain its long-term existence (Markus, 1987). This concept has been extensively studied and is defined as a 'critical mass' (Hagel & Armstrong, 1997). Intuitively, the larger the social network, the more likely that there are participants with the knowledge, resources, and willingness to help each other. Moreover, as the number of network participants increases, the number of possible interactions among the network members increases exponentially (Butler, 2001).

However, having a large number of participants in a social network could also lead to a significant logistical problem for network members in forming personal relationships and establishing common ground in order to carry on their communications (Butler, 2001; Jones & Rafaeli, 1999). In addition, as mentioned above, an increase in the size of a social network has been linked to adverse behaviors such as social loafing and free riding (Rojo & Ragsdale, 1997). To study the social loafing and free riding behaviors, Whitaker et al. (1998) used the number of topics and individual messages to help characterize a profile of an online community. In order to quantify the behavior of individual members of online communities in our study, we examine the size and profile of online communities in order to compare and differentiate the characteristics of the social network within each community.

Social Network Structure

We also perform a social network analysis (SNA) as presented below. The oft-cited work by Wasserman and Faust (1994) outlined a set of fundamental measurements for evaluating a structure of social networks. One important benchmark of the vibrancy of a social network is the 'density' of communication activities among community members. The density of a social network is usually defined as "the number of social ties that are present among the members in the entire network" as a proportion of the maximum number of social ties possible in the network (Wasserman & Faust, 1994) and is calculated as:

$$\Delta = \frac{2L}{g(g-1)}$$

where the density is denoted as Δ, L is the number of lines present in the network, and g is the total number of members in the network. The network density measurement is traditionally used to compare networks of similar size (i.e., approximately similar number of members) as a smaller network tends to be more dense than a larger one (De Nooy, et al., 2005).

Furthermore, past studies on social networks often visually depicted a social network as a graph and an individual network participant as a node within a graph. This approach enables researchers to examine the degree of "connectedness" (i.e., degree of vertex or nodal degree) among network participants. The degree of "connectedness" for each network member is a measure of communication activities each member (i.e., each node in the graph) has with the other members (Wasserman & Faust, 1994). In our data set, the degree of connectedness of an online forum member is measured by how many other members with whom he or she has conversed. The average degree of vertex summarizes the degree of connectedness among all members in a network and is often used as a comparative measurement among different networks regardless of the number of participants (Wasserman & Faust, 1994). The average nodal degree is calculated as the following.

$$\bar{d} = \frac{\sum_{i=1}^{g} d(n_i)}{g}$$

where $d(n_i)$ is the degree of each node i (i.e., a member), and g is the number of nodes (or members in the forum).

The theoretical foundations described above provide us with a set of measurement tools to examine the structures of online social networks. These conceptual frameworks also allow us to design our data collection process in order to perform comparative analysis of different social networks. In our current study, we focus on a type of social networks created as online bulletin boards (or online forums) in order to provide customer services for general consumers. In the subsequent sections of this research, we describe our data collection and analysis procedures and report our findings.

METHODOLOGY

In order to examine the effectiveness of using online forums to provide customer services for general consumers, we selected the online forums that are created for consumer products, as opposed to studying specialized online forums or social networks. We selected fourteen online forums (see Table 1) that were created to support two types of consumer products: mobile phones and MP3 players. Mobile phones and MP3 players are retail products widely used by general consumers and do not require any extensive or specialized training. The online support forums of these products are designed to assist a non-technical audience for their day-to-day product usage. The fourteen online forums also represent different types of ownerships: manufacturer-sponsored forums, third-party operated forums, and forums operated by telephone service carriers. For example, the Apple iPhone and Blackberry forums are owned and operated respectively by Apple and Research-In-Motion (RIM) who are the product manufacturers, while GSM-Arena and IntoMobile forums are operated by companies with no affiliation to any phone companies. MobilEDIA is also a third-party forum, but it is also an online retailer of various

mobile phone products. In addition, the AT&T Wireless and Vodafone forums are operated by and thus carry the names of the two mobile phone service carriers.

Table 1: Profiles of the fourteen Online Forums.

Forum Name	Primary Usership	Products
Apple iPhone	USA	Mobile
Apple iPod + iTunes	Global	MP3
AT&T Wireless	USA	Mobile
Creative Labs	USA	MP3
GSM-Arena	Europe	Mobile
HTC Forums	USA	Mobile
IntoMobile	USA	Mobile
MobilEDIA	USA	Mobile
Nokia Support	Global	Mobile
Palm	USA	Mobile
Research In Motion (Blackberry)	USA	Mobile
SanDisk Sansa	USA	MP3
Vodafone	UK	Mobile
Zune - Microsoft	USA	MP3

Most online forums allow participants to navigate through various topics by showing a summary page (or an entry page) where the most recent topics are listed with general information such as the topic title, the log-in name of the person who originally started the topic, the date/time of the last post, the date/time of the original post, and the number of answers that have been posted. Figure 1 displays an example of a summary page from an Apple's discussion forum on the basic use of iPhones. Similar to entry pages on other forums, Apple's discussion board shows a short title of each discussion topic (or a thread), the original participant who started the topic, number of replies each topic received, and the date and time the last posting was submitted.

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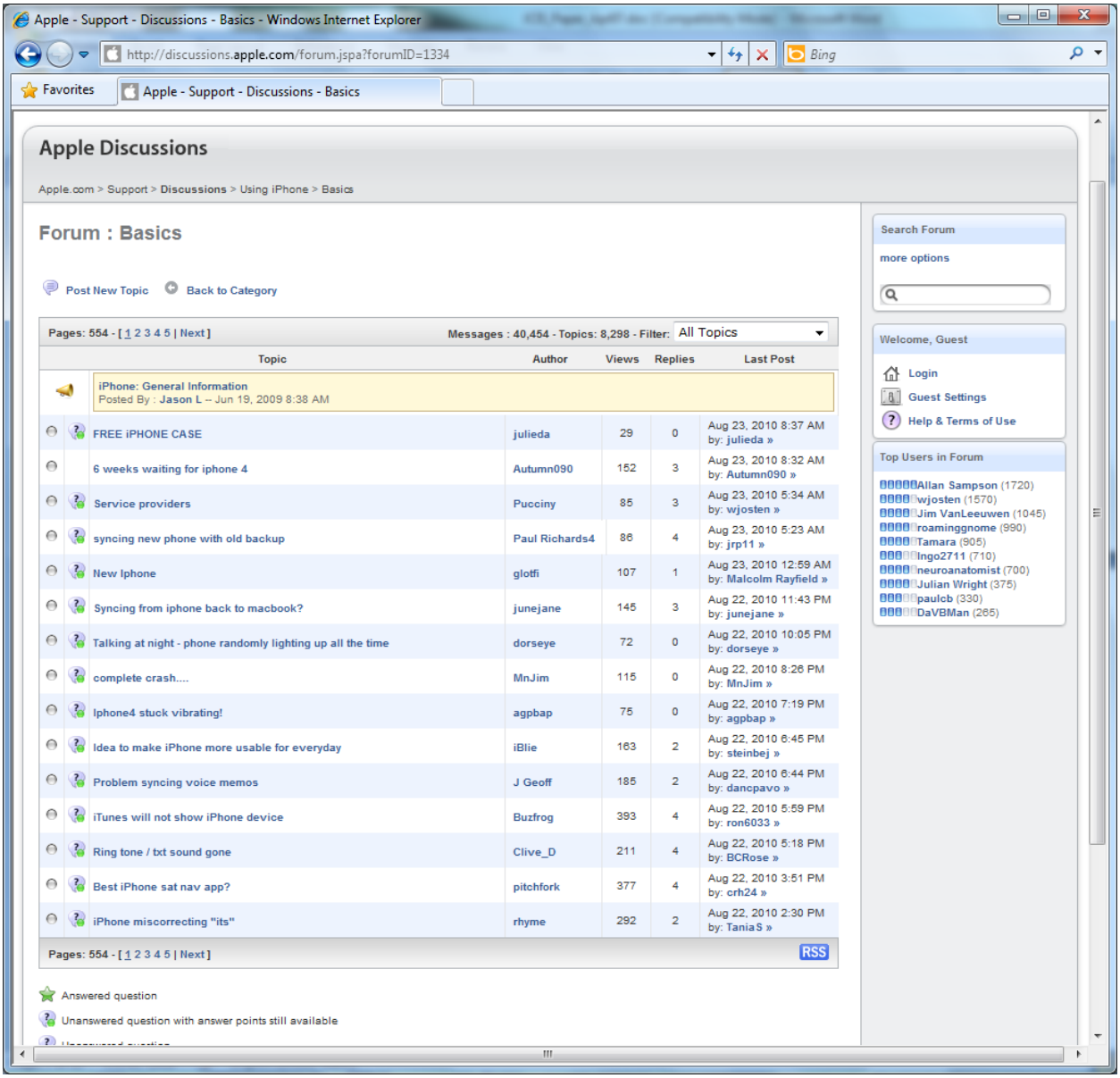
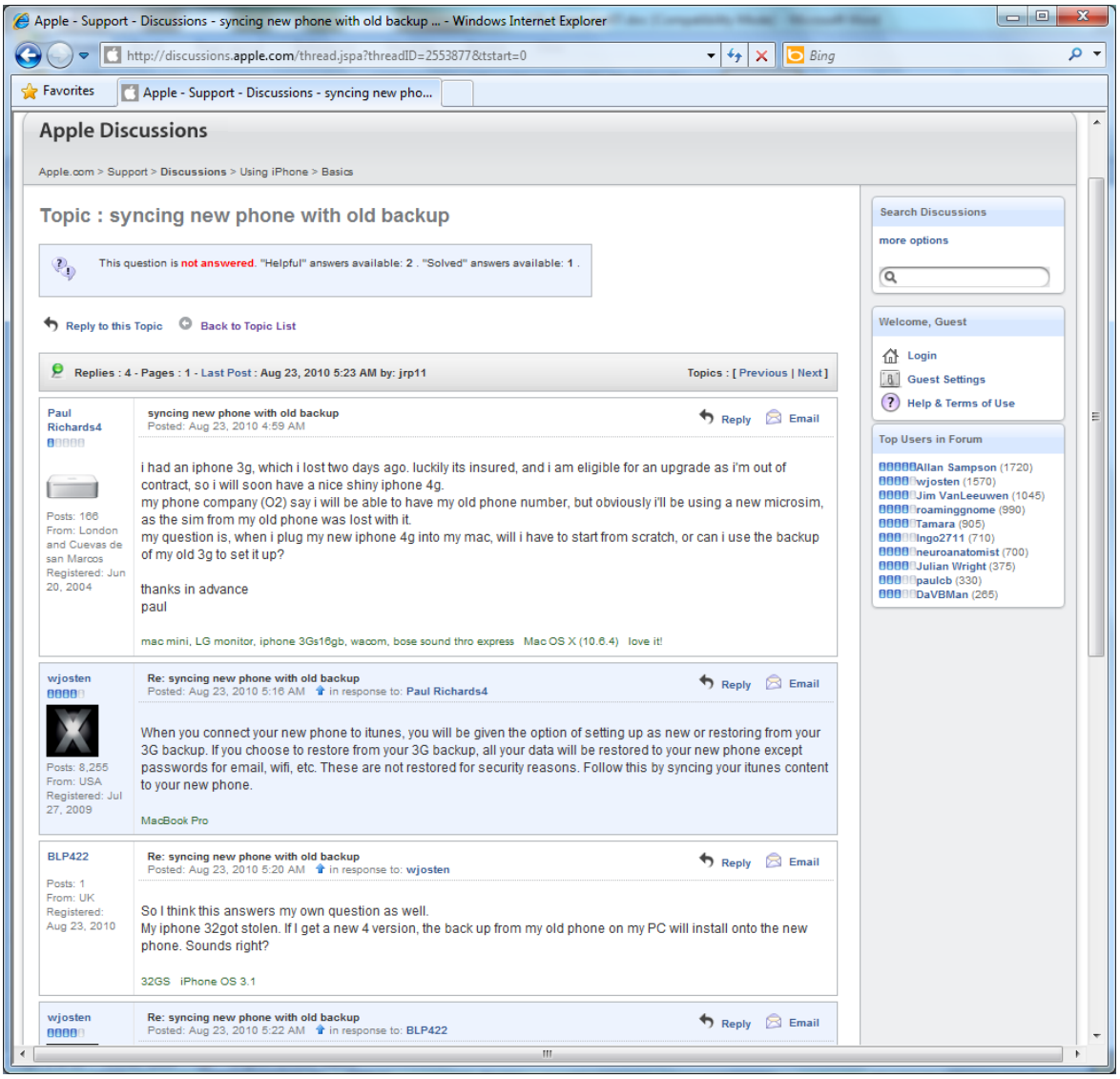
Figure 1: An entry page to an Apple's iPhone discussion forum.



On the summary page, participants can click on an individual discussion topic (i.e., a thread) to see the actual messages that have been posted or to write his or her own message to respond to other participants. Figure 2 shows a screen shot of a discussion page where a participant can read messages posted by others as well as respond to the messages. Most online forums are designed to display similar information. Each message has an identification of the participant who posted the text, his or her profile, and the posting date. In addition, messages within the same topic or thread are grouped and ordered in a chronological sequence.

Figure 2: An example of a discussion page on Apple's iPhone forum.



All fourteen forums included in our study require their members to register before they can post any messages; no anonymous posting is allowed. However, no registration or financial payment is required to read the posted messages. Each registered member must choose a user name that is unique within the forum. Registration on all fourteen forums is free but requires a valid email address. In addition, all fourteen forums have a large number of threads and messages (see Table 2 for the size of each forum). Messages on each forum are usually sorted into categories of topics. For example, on the Apple iPod/iTunes forum, the discussions are divided into categories such as "Using iTunes for Windows," "Using iTunes for Mac," and "Podcasting/Radio in iTunes for Mac."

We also observed that all fourteen forums have implemented at least some mechanisms aimed at encouraging its member participation. For example, on Apple forums, the member who posts a question can award points to another member who provides a solution to the problem. These points can be accumulated to elevate each member's social status within the online community.

These forums also report the number of postings made by each member. In addition, every forum publicizes information about each individual member (e.g., the amount of time since the member joined the forum, geographical location, and personal interest) that presumably helps nurture a sense of community.

In order to examine activities on these online forums, we developed automated data collection software to capture a complete archive of messages posted on each forum. As of January 2013, our software compiled a total of more than 850,000 threads, approximately 3.9 million messages posted by over 840,000 distinct users. A thread is defined as a "tree-like structured visualization of discussions that show the sequence and relation of the messages (Schoberth, et al., 2006)." When available, our software also saved member-specific information such as the date registered and geographical location. This automated procedure was devised to ensure that the process is as minimally invasive as possible to the computer servers hosting the online forums. Using the data set compiled from these forums, we analyze the communication activities on these online forums and present our findings in the next section.

ANALYSIS AND RESULTS

First we examined the size of each online forum. Table 2 provides descriptive statistics from the fourteen online forums included in this study. As shown in Table 2, the fourteen forums range from a very large social network such as Apple's iPod forum with a relatively large number of unique registered participants (over 300 thousand registered users as shown in the 2nd column in Table 2) to a forum dedicated to a smaller consumer base such as HTC phones (about 1,000 registered users). The number of posts indicates the number of messages posted in each forum. Each thread (or discussion topic) contains one or more posts (or messages).

As stated in past studies (e.g., McPherson, 1983; Wittenbaum & Stasser, 1996), large social networks can potentially offer greater benefits to their participants as a result of the "exponential increase" in the number of possible interactions among members. Moreover, a network with a large audience can also offer high social visibility for its contributing members (Butler, 2001). With a large audience, a contributing member can gain a positive public recognition as a reward for helping other members. As reported in (Wasko & Faraj, 2005), participants in a social network are likely to share their knowledge when they perceive that their contribution will enhance their reputation. As can be derived from the statistics in Table 2, the potential number of interactions among members of each online forum is considerably large. Even within the smallest network in our study, the HTC forum, the potential number of interactions among its members is almost 1 million, while the largest network, the Apple iPod + iTunes forum, could have well over 94 million interactions among its members. Intuitively, the potentially large number of interactions and the appeal of social visibility should offer enough incentives for forum participants to exchange information and increase communication activities. Based on statistics in Table 2, larger online forums (i.e., higher numbers of users) tended to have higher numbers of messages posted (4th column), with the exception of Microsoft's Zune and GSM-Arena forums which have relatively smaller numbers of registered users but relatively high numbers of posted messages.

However, having a large number of members does not always mean being a more active social network. When considering the number of posts per user (last column in Table 2), the results indicate that a large number of members in a social network might, instead, cause a logistical

problem for the network members in communicating with one another (Butler, 2001). The number of messages created by members of a large network can overwhelm individual members and impede their ability to pay attention to each other's message and converse with one another. This 'information overload' phenomenon can impede the ability of individual members to form a long-term social relationship (Latane, 1981; Jones & Rafaeli, 1999).

In our analysis, the two online forums with the highest numbers of posts per user, GSM-Arena (32.7 posts per user) and Vodafone (9.5 posts per user), have a relatively small number of registered users (i.e., about 10,000 users each), while IntoMobile, with approximately 50,000 users (i.e., five times larger than GSM-Arena and Vodafone) has the lowest number of posts per user (1.70 posts per user). In addition, the largest forum, Apple iPod, with over 300,000 users, only reports about 3.26 posted messages per user (the third lowest in our sample). These findings confirmed the conflicting hypotheses between the benefits and drawbacks of a network size as well as the ambiguous relationship between the size of a social network and the level of interactions among its members (e.g., Butler, 2001; Schoberth, et al., 2006).

Table 2: Descriptive Statistics of the fourteen Online Forums.

Forum Name	Number of Threads* (in 1,000s)	Number of Users* (in 1,000s)	Number of Posts* (in 1,000s)	Number of Posts per User
Apple iPhone	88	87	445	5.11
Apple iPod + iTunes	306	307	1,001	3.26
AT&T Wireless	65	61	339	5.55
Creative Labs	79	80	354	4.43
GSM-Arena	17	10	327	32.7
HTC Forums	1	1	5	5.00
IntoMobile	48	50	85	1.70
MobilEDIA	12	18	84	4.67
Nokia Support	78	74	337	4.55
Palm	51	61	180	2.95
Research In Motion (Blackberry)	23	20	96	4.80
SanDisk Sansa	15	15	82	5.47
Vodafone	13	10	95	9.50
Zune – Microsoft	57	50	263	5.26

* Numbers are rounded to the nearest thousand and do not include company-employed forum moderators.

We also examined the communication activities that took place within each forum. We use the theoretical frameworks provided in the existing literature to evaluate the communication activities within each online forum. Each of the evaluation measurements is described below, while the specific statistics are presented in Tables 3 and 4.

Average number of postings per member: After excluding administrative postings by company-employed moderators or forum administrators, we compiled the number of times each member of an online forum posted a message either to ask a question or to reply to others.

Average number of messages per conversational thread: This measurement is based on the concept of network interactivity proposed by Whittaker et al. (1998), establishing that network interactivity is measured by how many messages are exchanged within the same online conversation.

Average number of characters per message and average number of words per message: These two measurements are among the most common indicators used to evaluate the 'conversational strategies' of a member of a social network. According to the common ground model (Kollock & Smith, 1996), long messages can be considered as an evidence of a shared interest among discussants, which results in substantive and lengthy discussions.

Percentage of members who posted only one message: This measure allows us to examine the level of free riding behaviors in a social network (Latane, 1981). We assume that a member with only one posting did so to ask a question. Although it is possible that a member could have posted only one message in order to reply to another member (i.e., non-free riding behavior); however we manually inspected a number of randomly selected members with only one posting and found no such case.

Percentage of threads with only one posting (i.e., questions that received no reply): With this measure, we aim to evaluate the effectiveness of using online forums as a customer service tool by focusing on whether or not a question or a posting made by a member actually received any reply. Moreover, this measurement can also indicate the level of information overload among members of a social network (Schoberth, et al., 2006). Similar to the previous statistics, we excluded administrative postings such as announcements by company-employed moderators or forum administrators.

The amount of time between postings: Since most online forums provide the date and time of each posting (see Figure 2 as an example), we also compile and report how often online forum members posted messages (i.e., the amount of time between postings). IntoMobile was the only web site that does not track the date and time when each message was posted. The frequency of posting may serve as an indicator of the level of commitment individual members have with their respective forums as well as the level of interest they have with the products supported by the online forums.

Network density and connectedness: We follow a formal methodology prescribed in past research (Wasserman & Faust, 1994) to measure the social ties and the level of social connectedness within the fourteen online forums. The social ties are measured by the number of actual social ties among the network members as a proportion of the maximum number of social ties possible in the network. This ratio is often referred to as the network density as described in the previous section. To measure the degree of connectedness, a social network is viewed as a graph and an individual member as a node within a graph. The level of connectedness is therefore the degree of vertex among the members of a social network. In our data set, the level of connectedness of an online forum member is an indicator of how many other members with whom he or she has conversed.

Table 3: Network Interactivity and Conversational Strategies.

Forum Name	Avg. number of postings per user	Avg. number of messages per thread (i.e., Thread Depth)	Avg. number of characters per message	Avg. number of words per message
Apple iPhone	5.1	5.1	400	69
Apple iPod + iTunes	3.3	3.3	454	77
AT&T Wireless	5.5	5.2	398	71
Creative Labs	4.4	4.5	461	79
GSM-Arena	33.9	20.3	164	28
HTC Forums	5.4	4.1	364	60
IntoMobile	1.7	1.8	268	48
MobilEDIA	4.7	8.5	397	71
Nokia Support	4.5	4.3	337	58
Palm	3.0	3.5	489	82
Research In Motion	4.8	4.2	431	67
SanDisk Sansa	5.4	5.5	428	75
Vodafone	9.2	7.3	499	91
Zune – Microsoft	5.3	4.6	390	68

Table 3 presents statistics on network interactivity and conversational strategies on the fourteen online forums. Most online forums in our study included a number of features to encourage their members to communicate with one another. These features include a list of the most active users, a list of new or newly updated conversational threads, conferring a special status on actively involved users (e.g., labels such as 'top user', 'guru', etc.). As shown in Table 3, members of a relatively large online forum such as Apple iPod, iPhone, and Nokia do not necessarily post messages more frequently. In fact, members on the Apple iPod forum, which has the highest number of registered users, posted, on average, about 3.3 messages per user, the third lowest among the fourteen forums. In addition, within each conversation thread, the GSM Arena forum has the highest average number of responses (20.3 messages), compared to an average of 1.8 messages per conversation thread for the IntoMobile forum (the lowest in our sample). Interestingly, IntoMobile implements the least number of these features and chooses not to distinguish actively engaged members from members with only one posting (i.e., all members on IntoMobile were referred to as 'contributing member' on the web site). On the other hand, GSM-Arena, the forum with the highest average number of postings per user, allows its registered users to make their experience on the forum more personalized (e.g., sending private messages among each other, allowing members to describe their personal information), in addition to designating social status to its active members and prominently displaying a list of its most active members.

However, members on the GSM-Arena forum tended to post shorter messages (i.e., the lowest number of characters and words per message) than members on other online forums. Members on the Vodafone forum, with the highest number of characters and words per message, were the

most verbose. In addition to displaying a list of members with the highest number of postings and the new and newly updated conversational threads, an important feature implemented by Vodafone to encourage member participation allows members to give each other 'social points' (i.e., a 'kudo'). Presumably, if a member receives a satisfactory answer to his or her posted question, the member can give a social point to the contributing member. Those members who accumulate the highest social points are highlighted prominently in a list of top members on the front page of the forum. These features increase social status and visibility of the top contributing members as well as encouraging the members to put more effort into replying each other's questions.

Obtaining Advice on Online Forums

As we tracked the number of threads with only one initial posting and no reply, we were able to evaluate how effective these online forums are in terms of providing the information sought by their members. Past research (Schoberth, et al., 2006) used this indicator to estimate the probability of a member getting a reply from others. Based on our observation, a large number of customers seeking help on these forums did not receive any responses. On average, over 20% of initial postings on the fourteen forums received no responses. As a result, the overall probability that a forum member would receive an advice he or she seeks is below 80%. However, the probability value varies markedly among the fourteen forums. In particular (see the third column in Table 4), almost 60% of the initial postings on IntoMobile received no responses at all (highest among the fourteen forums), while only 2.6% of initial messages on the VodaFone forum received no replies (lowest among the fourteen forums). Consistent with our previous observations, IntoMobile is the online forum with the least number of features to encourage member participation, while VodaFone has a variety of features designed to increase social status and visibility of contributing members.

On the two forums sponsored by Apple, the iPhone and iPod/iTunes forums, participants receive status points when they successfully help other members. Moreover, Apple forum members with the highest number of status points are listed on the front page of the forum as "top users." Even with the incentives to increase the social visibility and encourage participation, a considerable number of threads (roughly 14% on the iPhone forum and 23% on the iPod/iTunes forum) never received any responses. Moreover, the amount of time between postings among iPod forum members is the longest of the fourteen online forums. The MobilEDIA and Vodafone forums, on the other hand, had the lowest percentages of threads with no response (4.1% and 2.6% respectively). Interestingly, the two forums are not operated by phone manufacturers, with Vodafone being a service carrier and MobilEDIA being a third-party online retailer.

Table 4: Free-riding.

Forum Name	Percent of users with only one posting	Percent of threads with only one posting (including initial question)	Avg. amount of time between postings per user (days)*
Apple iPhone	48.9	13.8	18.0
Apple iPod + iTunes	58.4	23.1	37.8
AT&T Wireless	52.5	14.3	17.0
Creative Labs	48.5	31.7	22.2
GSM-Arena	48.3	27.0	16.7
HTC Forums	47.2	27.5	4.1
IntoMobile	76.2	59.9	N/A**
MobilEDIA	61.1	4.1	18.7
Nokia Support	48.8	25.1	14.8
Palm	58.7	13.2	18.8
Research In Motion	46.7	15.3	4.1
SanDisk Sansa	46.7	11.9	7.4
Vodafone	31.1	2.6	3.8
Zune - Microsoft	50.1	30.5	15.0

* includes only members with more than one posting.

**IntoMobile does not report the date and time of posting on its messages

As shown in Table 4, many participants on these online forums appear to be non-contributing members who made only one posting, presumably to ask a question, but did not participate further in their respective communities. In Figure 3, we compare the fourteen online forums by showing the percentage of forum members and the number of postings. All members in the forums, of course, posted at least one message (i.e., 100% of the participants being reported with at least one posting). The degree of free-riding activities as well as the level of contribution by each member varies markedly across the fourteen forums. For example, IntoMobile has the highest percentage (76.2%) of members who made only one posting (i.e., free riding), while on the VodaFone forum, only 31.1% of its members made just one posting. The actual level of free-riding behavior could be even higher, since a member could make multiple postings to exclusively ask for help, but never reciprocate by answering another member's query.

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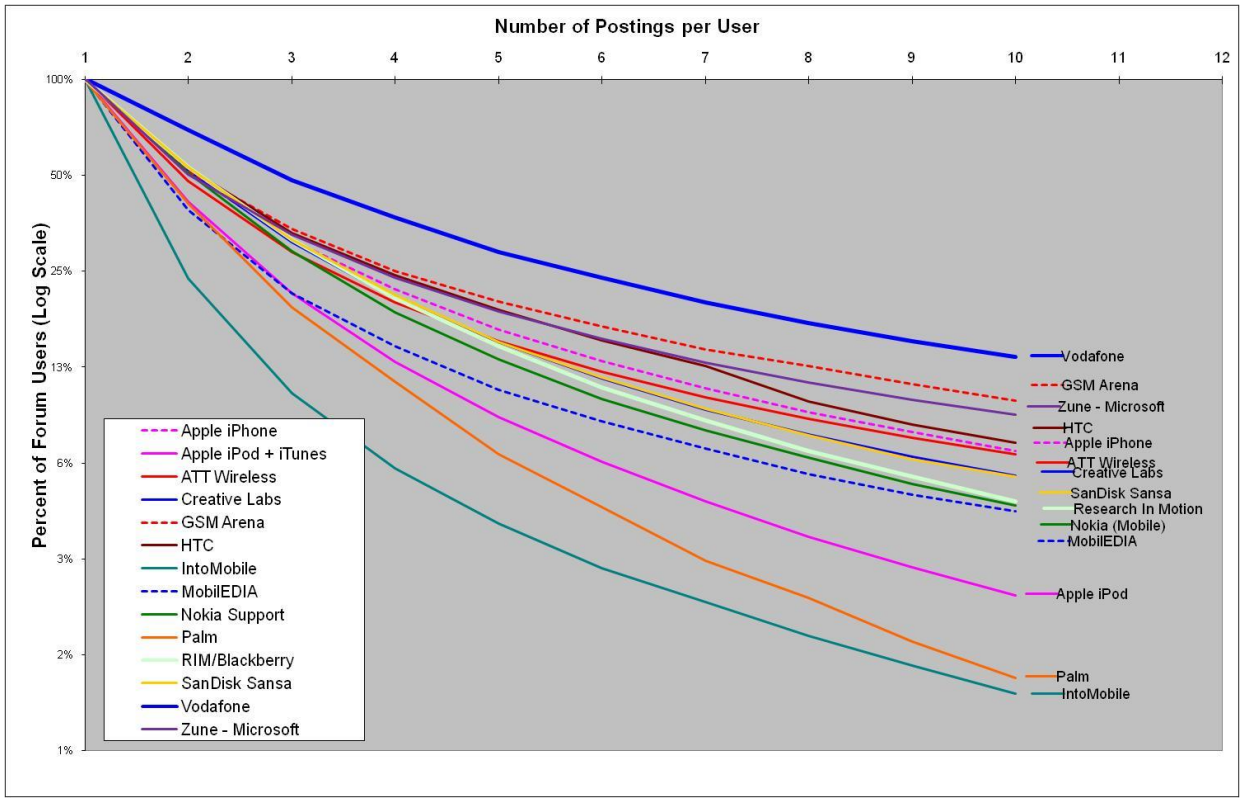
Figure 3: Percentage of forum members and the number of postings.



Online Forums as Social Communities

As shown in Tables 3 and 4, we observed substantial differences among the online forums regarding the frequency of communication exchange and the level of member involvement. We looked at the amount of time between postings by each user to determine the frequency of communication activities (the last column in Table 4). Surprisingly, members on the Apple iPod/iTunes forum post messages relatively infrequently (i.e., over a month between postings) in spite of the popularity of the iPod products and Apple's attempt to promote its online forum as a "community" where members can "exchange ideas and solutions." On the other hand, members on the Vodafone, HTC, and RIM/Blackberry forums tend to post messages more frequently than members in other forums (i.e., about 4 days between postings). Interestingly, members of the Vodafone forum not only communicate frequently, but also tend to write lengthier messages (i.e., on average 91 words per message).

In order to gain additional insight into the nature of the online forums, we also used formal social network analysis (SNA) procedures. As mentioned in previous sections, SNA procedures usually consider a social network as a graph containing multiple nodes. For our data set, each node represents a registered forum member. The online forums included in our study are much larger than the social networks that were usually included in a traditional social science study. As a result, for tractability and in order to derive our results from the complete archive of actual network activities, we consider the online forums in our data set as undirected graphs.

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First we calculated the "density" of communication activities among forum members. For a large social network such as the online forums in our data set, the network density is usually very low as observed in the results in Table 5 (De Nooy, et al., 2005). Even when comparing only networks of similar size, the network density still varies greatly. For example, while AT&T and Palm forums have approximately 61,000 members each, the AT&T forum's network density is three times higher than that of the Palm forum (0.0000380 versus 0.0000128). This indicates that a larger degree of information exchange has occurred on the AT&T online forum than in the Palm forum. Similarly, Microsoft's Zune forum's density is roughly three times higher than that of the IntoMobile forum, each forum having about 50,000 members.

Second, we examined the degree of "connectedness" (i.e., degree of vertex or nodal degree) among the forum members. For our data set, the degree of connectedness of an online forum member is measured by how many other members with whom he or she has conversed. As shown in Table 5, the larger number of participants in a social network does not necessarily imply a greater participation or a higher degree of connectedness within the network. As a result, the number of forum members does not always translate into a greater effectiveness of the forums in providing customers with the information they seek. The two forums with the highest nodal degrees are Vodafone and GSM-Arena, both with a relatively small number of members. Consistent with the statistics presented in Tables 3 and 4, the forum that reported the lowest degree of connectedness, IntoMobile, also reported the highest level of free-riding activities. When comparing the three online forums supporting MP3 player products (i.e., SanDisk, Zune, and iPod), the iPod forum reported the lowest average nodal degree in spite of its much larger number of registered members. Moreover, within the same Apple web site, the iPhone forum, with the number of members roughly 3.5 times smaller than that on the iPod forum, reported almost twice as high the degree of connectedness within the network as the iPod forum.

Table 5: Network Density and Average Nodal Degree.

Forum Name (Number of members)	Network density	Average nodal degree
Apple iPhone (87,000)	0.0000270	4.7068
Apple iPod + iTunes (307,000)	0.0000042	2.5958
AT&T Wireless (61,000)	0.0000380	4.6223
Creative Labs (80,000)	0.0000192	3.0571
GSM-Arena (10,000)	0.0003287	6.1255
HTC Forums (1,000)	0.0016700	2.8891
IntoMobile (50,000)	0.0000126	1.2607
MobilEDIA (18,000)	0.0000966	3.4491
Nokia Support (74,000)	0.0000237	3.4981
Palm (61,000)	0.0000128	1.5535
Research In Motion (20,000)	0.0000791	3.1088
SanDisk Sansa (15,000)	0.0001486	4.4163
Vodafone (10,000)	0.0003329	6.8058
Zune – Microsoft (50,000)	0.0000416	4.0908

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CONCLUSION

In this study we examined online forums created to provide customer service for two consumer products: mobile phones and MP3 players. We included a range of online forums in terms of ownership (i.e., manufacturer-sponsored, retailer-operated, phone carrier-sponsored, and third-party forums), geographical locations, as well as locations of their membership. We compared the differences among these online forums as customer service features and as online social communities. Unlike past research, we derived our results from a complete archive of actual activities on the online forums.

Based on our results, although there exists a substantial degree of free-riding, each forum has an adequate critical mass of loyal., contributing members to sustain ongoing activities. However, in spite of this critical mass and the social incentives created by the forum administrators, a considerable number of forum members did not receive the advice or information they sought. We also observed that the size of the online forum does not necessarily improve the forum's ability to function as a customer service tool. In particular, a larger number of registered forum members does not necessarily increase the chance of receiving a response to a posted question. In addition, smaller forums do not necessarily have a higher degree of "connectedness" among their members.

As with all other scientific research, there are limitations to the interpretations of our results. In this exploratory research, we performed data analysis at an aggregate level and did not include any text mining analysis to gain insight into what forum members actually said in their communication. In addition, future research that further explores the structural differences among these online forums will help identify essential factors that make an online forum more effective as a customer service tool as well as enhance the social ties among forum members. For example, is the level of participation attributable to specific elements of the online forums? Could it be that certain products inspire more passion and camaraderie among forum members? Why does an online forum with a large number of members show relatively little interaction among its members? These research questions can be further explored using more sophisticated analysis such as text and other data mining techniques.

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