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Understanding factors affecting perceived sociability of social software

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ABSTRACT

Sociability is considered to be important to the success of social software. The goal of the current study is to identify factors that affect the users' perception of the sociability of social software and to examine the impact of sociability on the users' attitude and behavior intentions. In a pilot study, 35 web users were interviewed to gain understanding of how they use social software to supplement their social life and to explore the possible factors that influence the users' utilization of social software. In the first study, a questionnaire was developed, and 163 valid responses were collected. From the factor analysis results, seven important factors for social software design emerged, which accounts for 63.3% of the total variance. In the second study, 246 participants were asked to evaluate one of ten popular social applications with respect to the seven factors, their perceived sociability, and their attitudes and intention regarding the use of the applications. Results show that sociability is influenced by *social climate*, *benefits and purposes*, *people*, *interaction richness*, *self-presentation*, and *support for formal interaction*. *System competency* is not a sociability factor, but it significantly influences the user's experience. Sociability and system competency, when combined, can predict 43% of users' attitude towards social software and 51% of their intentions to use social software.

1. Introduction

The Internet is becoming a core part of mainstream social life. In addition to email and instant messaging services (IM), various social technologies, such as blogs and social networking services (SNS), have become more widely used. Since 2002, the expression "social software" has been used when referring to any Internet software which enables groups of people to communicate and to collaborate, from something very familiar such as email, IM, and group forums, to new applications such as blogs, SNS, and web-based collaborative editing tools (Boyd, 2007; Davis, 2003). Social software has been gradually integrated into the everyday social lives of an increasing number of people. The report from PEW Internet & American Life, Adults and Social Network Websites, found that the share of American, adult Internet users who have a profile on an online social network site has more than quadrupled in the past four years – from 8% in 2005 to 35% at the end of 2008. Younger, online adults are much more likely to use social networks, with 75% of adults of age 18–24 using these networks, compared to only 7% of adults that are age 65 and older (Lenhart, 2009). For the largest Internet user population, Chinese netizens, the use of blogging services, online forums and social networks is also growing fast. At the end of 2008, 54.3% of Chinese Internet users had created their own blogs, 75.3% were chatting via IM, and 19.3% were using social networks (China Internet Network Information Center, 2009).

A major challenge to the designers and developers of social software is facilitating social interaction and engagement among the users in a mediated environment. The extent that a computer-supported communication environment supports online social interaction is referred to as the sociability of the environment (Kreijns, Kirschner, & Jochems, 2002; Preece, 2000). Research in computer-mediated communication (CMC) and computer-supported collaborative work (CSCW) found that, in addition to technological issues such as media richness and usability, sociological and psychological concerns have a significant influence on online interaction, and consequently, on the perceived sociability (e.g., Grudin, 1994; Gunawardena, 1995; Haythornthwaite, 2001; Maloney-Krichmar & Preece, 2005; Olson & Olson, 1997; Preece, 1999; Short, Williams, & Christie, 1976). The concept of sociability, its determinants, and consequences have been discussed in past research for medical virtual communities, CSCW applications, and work-oriented groupware (Barab, MaKinster, Moore, & Cunningham, 2001; Grudin, 1994; Kreijns et al., 2002; Maloney-Krichmar & Preece, 2005; Pan, Kuo, & Lee, 2007). For social software that is designed explicitly for supporting mainstream social practices, the importance of sociability is obvious. However, research regarding the sociability study on social software is nearly untouched. Social software, although it shares common properties with online communities and groupware, differs in its explicit goal to support casual social interactions and maintain existing social

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relationships. Additionally, people use social software daily, in a variety of contexts, for a variety of purposes, and with a variety of partners. These characteristics distinguish the sociability design of social software from the design of work-oriented applications like groupware.

This study aims to explore, identify, and validate factors that influence the sociability that is perceived by social software users. A series of qualitative and quantitative studies were performed for this purpose. In the pilot study, we interviewed 35 users to obtain a qualitative understanding of how social software is utilized to support their social life and what influences perceived sociability. Combining interview results with our findings from literature, we then proceeded to a quantitative investigation in the first study. From a survey with 163 valid responses, we identified 7 design factors that are important for effective social software. In the second study, the significant factors were applied to a selection of social software to verify the relationships between the design factors and the perceived sociability. Two hundred and forty-six users were invited to evaluate one of ten selected social software applications. The impact of sociability on the users' attitude and intention to use it was examined to seek empirical support for the demand of sociability design. The difference in sociability perception for different social software was discussed. In conclusion, the implications for designers and for future research were discussed.

2. Literature review

In CMC studies, sociability is often considered to be a feature of the environment that facilitates online social interaction. Perhaps the most well-known view of sociability is from Preece (2000), who refers to sociability as both social policies and technical structures that support the community's shared purpose and social interaction among group members. This understanding of sociability stems from the perspective of the designers and developers rather than from the users. A problem with this conceptualization is that it is difficult to derive a proper measurement of sociability by using it. In fact, it describes determinants of sociability rather than define what sociability actually is. In contrast, Kreijns et al. (2002) defined sociability from the perspective of the user experience. They defined the sociability of a computer-supported collaborative learning (CSCL) environment as the extent that the environment is perceived to be able to facilitate the emergence of a sound social space (Kreijns, Kirschner, Jochems, & Buuren, 2007). This definition, however, is limited to task-oriented group applications. To expand the scope to cover both groupware and social software, this study redefines the sociability as *the extent to which the communication environment mediated by social software is perceived to facilitate social interaction and to enhance social connectivity.*

A growing number of researchers from various disciplines (e.g., sociology, communications, CMC, E-Commerce) have studied the factors that influenced online social interaction as shown in Table 1. Some researchers such as Kollock (1998) adopted a purely social perspective that utilized sociological findings from face-to-face (FtF) cooperation and traditional community building, to guide online community development. Some other researchers adopted a socio-technical perspective, taking the influence of technological systems on social interaction into consideration. We found the latter view more comprehensive since numerous studies found that technical factors (e.g., the infrastructure of information technology, the overall technical quality, the ease of use) had an influence on the user participation and level of online activity (Hsu & Lin, 2008; Jones, 1997; Koh, Kim, Butler, & Bock, 2007). To design a sociable environment, the technology, the individual users, and the interaction between various users should be all considered. Among the literature that discusses factors influencing online social interactions, we found five major aspects that appeared frequently: purpose and benefit, people, social climate, mediated communication, and the technology system.

2.1. Purpose and benefit

Any social software operates to support and enable a social purpose, such as social networking, opinion making or knowledge sharing (Bouman et al., 2008). The purpose should be based upon the understanding of common interests or needs of heterogeneous social software users (Andrews, 2002). A clear statement of purpose is considered to be helpful for stimulating participation (Kim, 2000; Preece, 2000; Preece & Maloney-Krichmar, 2003), and the level of user-need fulfillment and perceived benefits was found to influence users' satisfaction, loyalty, and a virtual community's sustainability (Kim, Lee, & Hiemstra, 2004; Whitaker & Parker, 2000).

Various purposes supported by social software could be categorized according to the type of social support the software is designed to facilitate. According to literature, there are essentially five types of social support: esteem, informational, emotional, social network, and tangible support (Cobb, 1979; Cutrona & Russell, 1990). In online social networks, tangible support is often not direct. Rather, people may request or confirm information about such support (e.g., meeting offline) by using social software. Thus, we combined tangible support with informational support, and classified purposes for using social software into four categories:

- Identity building – esteem support: by using social software, users build a self-image of how they see themselves and how they would like to be seen by others. This is a fundamental condition for any cooperative relationships to emerge and persist (Axelrod & Hamilton, 1981). Self-expression itself is found to be a major motive for hosting a web page online (Papacharissi, 2002). The impoverished communication and potentially asynchronous nature of CMC environments, on the one hand, limit the number of interpersonal cues for self-disclosure; on the other hand, give users more opportunities to present themselves selectively (Gibbs, Ellison, & Heino, 2006; Toma, Hancock, & Ellison, 2008; Walther, 1996). Bouman et al. (2008) suggested that the social software design should provide proper mechanisms that allow the construction of a proper self-concept.
- Emotional interaction – emotional support: through social software, users can exchange care and feelings either with strongly linked associates or with strangers. Despite the lack of non-verbal cues, CMC environments provide some disparate opportunities for emotional interaction compared to traditional media, opportunities such as the accessibility of computer technology, the gathering of like-minded people with similar interests or problems, the anonymity that enables deep and intimate disclosures, and the low barriers to disclose the negative aspects of one's self (Bargh, McKenna, & Fitzsimons, 2002; Finn, 1999; Maloney-Krichmar & Preece, 2005; Tidwell & Walther, 2002). CMC is found effective to facilitate the exchange of emotional-support and empathy among people with health problems, disabilities or people with a low level of actual support (Braithwaite, Waldron, & Finn, 1999; Maloney-Krichmar & Preece, 2005; Rice & Love, 1987; Turner, Grube, & Meyers, 2001). Even for strong relationships that often require no mediation, internet communication technologies are often utilized to help users feel that they are connected with whom they care (Vetere et al., 2005).

Table 1
Review of factors influencing online social interactions from the literature.

Study	Applications	Purpose	Factors/items influencing online interactions
Jones (1997)	Online communities	To identify a set of minimum conditions to be a virtual community	Interactivity, communicators, sustained membership, Virtual space
Kim (2000)	Online communities	To identify basic factors necessary to become an online community	Clear purposes of visitors; flexible and small-scale places; members' roles; leadership of community moderators; online/offline events
Whitaker and Parker (2000)	Virtual agricultural communities	To identify factors which affect individual's decision to join a virtual community	*Technology factors*: infrastructure and service issues, internet-specific and general computing issues *Motivation factors*: users' perception of benefits, user conservatism, and resistance to change *Task factors*: the perceived appropriateness of using technology to support their communication *System factors*: the fit between users' traditional ways of doing things and that of the virtual community
Williams and Cothrel (2000)	Online communities	To propose strategies for successful online community development	Member development, community asset management, community relationship management
Preece (2000), Preece (2001) and Preece and Maloney-Krichmar (2003)	Online communities	To improve the success of online communities	*People*: people interacting with each other, measured with the number of participants; the type of participants; the roles participants plays; their ages, gender, expertise and special needs, etc. *Purpose*: a shared focus of interests, measured with the number of messages, the kinds of messages, interactivity, reciprocity, quality of contributions, and etc. *Policies*: languages and protocols guiding people's interactions, computer systems, measured with trustworthiness, uncivil and flaming behaviors, relationship development, and etc. *Usability of the technical system*: how intuitive and easy the system is for individuals to learn to use and interact with
Millen and Patterson (2002)	Geographic-based community	To identify ways to encourage and support social engagement in online communities	*Design elements*: A common place; use of alerts; *Community members*: Familiarity with communication tools; time available for online social interaction; *Conversation contents*: topic of high human-interest, political and controversial topics
Dellarocas et al. (2003)	Online review systems	To study factors motivating voluntary feedback contributions	Self-interest, expectation of reciprocal behaviors
Koh and Kim (2004)	Virtual knowledge communities	To study the impact of knowledge sharing activities on virtual community success	The level of knowledge sharing activities
Li, Chau, and Lou (2005)	IM	To identify factors influencing users' continuous use of IM	*Attachment motivation*: to keep in constant contact with others *Relationship commitment*: to maintain established relationships *Perceived critical mass*: a certain minimum number of users have adopted the technology to make the system useful *Perceived enjoyment*: an evaluative belief about the communication technology that builds and maintains interpersonal relationships in a social context *Perceived usefulness*: the perception of the fun, enjoyment, and pleasure inherent in using communication technology to keep and develop interpersonal relationships
Maloney-Krichmar and Preece (2005)	Online health community	To understand dynamics of online group interaction so as to provides the information and support people are seeking	Dependable and reliable technology Strong group norms of support and reciprocity Development of a sense of trust Emotional needs being satisfied
Gibbs, Ellison, and Heino (2006)	Online dating	To investigate self-disclosure in online dating	Anticipated future FtF interactions Anticipated long-term associations or commitments
Lin and Lee (2006)	Online communities	To identify determinants for successful use of online communities (measured with satisfaction, behavior intention, and member loyalty)	*System quality*: the desired characteristics of an online community, including system reliability, convenient access, ease of use and system flexibility *Information quality*: quality of online community output, including information accuracy, timeliness, usefulness, completeness and customized information presentation *Service quality*: overall user assessment and service delivery assessment, including interface design presented to members, trust mechanisms provided by the online community, and willingness to help members and provide prompt service
Lento, Welser, Gu, and Smith (2006)	Blogs	To study the impact of social ties on blogging behaviors	The strength of ties, the number of ties to other dedicated bloggers, the ability of drawing in participants with pre-existing strong social ties
Pan, Kuo, and Lee (2007)	Online gaming community	To propose sociability guidelines to help the development of online gaming community	*To improve role play* – promote group cooperation; using communication tools and building norms to avoid communication problems; build good social relationships

Table 1 (*continued*)

Study	Applications	Purpose	Factors/items influencing online interactions
			To increase chances of reciprocity – enhance level of trust; enhance willingness of reciprocity; create contact chances and motivation
Koh, Kim, Butler, and Bock (2007)	Virtual communities	To summary challenges in developing and managing virtual communities	*Social perspective*: – *Communication*: providing enough social presence in mediated communication – *Motivation*: motivating users to participate, such as ongoing provision of content – *Leadership*: developing necessary social climate *Technical perspective*: IT infrastructure and other technical factors
Hsu and Lin (2008)	Blogs	To identify factors motivating people to participate blog activities	Ease of use: the degree to which a person believed that using a blog was free of effort *Perceived enjoyment*: fun and enjoyment in the interaction process *Altruism*: the degree to which a person was willing to increase other people's welfare without expecting returns *Reputation*: the degree to which a person believed that participation could enhance personal reputation through knowledge sharing *Community identification*: perception of belonging to a blogging community
Rau, Gao, and Ding (2008)	Social networking systems	To study the impact of intimacy on users' active posting behaviors	Verbal intimacy and emotional intimacy with other contacts in the system

- Instrumental interaction – Informational support and tangible support: users exchange information that is related to interesting topics, services, resources, and problem solving means with other users via social software. The information quality of an online community is found to influence the users' attitude towards the system and their intention to participate (Lin & Lee, 2006a). Because social software systems are characterized by user-generated content, how to stimulate the users to contribute content of good quality is important. Past research has found factors such as the provision of an evidence of the benefits, the perceived community size, the level of intimacy perceived in the system, and offline interactions, have an influence on the users' posting behavior in online groups (Koh et al., 2007; Rau, Gao, & Ding, 2008; Whitaker & Parker, 2000).
- Relationship management – Social network support: social software provides opportunities for developing and reinforcing one's social networks (Hampton & Wellman, 2003; Koku, Nazer, & Wellman, 2001). Ellison, Steinfield, and Lampe (2007) found that the use of social network services among college students is associated with their ability to keep contact with loosely connected relationships, ability to develop and intensify tightly-knit relationships, and ability to maintain valuable connections as one progress through life changes. It is worthy to note that the users' selection and usage of social software may vary for different relationships of different strength (Haythornthwaite, 2002; Kim, Kim, Park, & Rice, 2007).

2.2. People

An individual's use of a type of communication technology cannot be separated from his communication partner's use (Markus, 1987). People that interact with each other by using a technical system are proposed to be a key component of online community success and a component of sociability (Balasubramanian & Mahajan, 2001; Preece & Maloney-Krichmar, 2003). From the group level, the total amount of users was found to influence the perceived usefulness of a certain communication technology, the users' decision to utilize the technology or not, and their posting and viewing activities (Koh et al., 2007; Li, Chau, & Lou, 2005; Lou, Luo, & Strong, 2000). In addition to the sole number of participants, the similarity of the participants' interests was also found to positively influence the users' satisfaction and loyalty to an online community (Kim et al., 2004), although no significant effect was observed on the users' participation behavior (Beenen et al., 2004).

At the interpersonal level, relationships with others that use the same technology influence the users' perception and usage behavior. Microsoft's study suggested that the ties that represent pre-existing relationships and the ties to dedicated participants might be more predictive for the users' retention in a blog community than the number of ties (Lento, Welser, Gu, & Smith, 2006). Li et al. (2005) found that the motivation for attachment and the relationship commitment of IM users are positively associated with their perceived enjoyment, which further influences the perceived usefulness of a tool. The level of both verbal and emotional intimacy with other users in a SNS was found to be associated with the users' posting frequency in a SNS (Rau et al., 2008). It is interesting to note that completely virtual ties, or "strangers on the internet", may encourage more honest and intimate self-disclosure, especially potentially negative aspects of one's self, since users are less likely to face disapproval from those close to them (Bargh et al., 2002; Rubin, 1975).

2.3. Social climate

Similar to offline occasions, online interaction and the development of relationships are influenced by social-contextual factors. Among these factors that influence online social interaction, the concern for privacy and security has been often discussed. The privacy concern for online practices is found to be just as prevalent as it is for real-world interaction (Cranor, Reagle, & Ackerman, 2000), but there is often a disconnection between users' desire to protect their privacy and their behaviors. For example, Gross and Acquisti (2005) analyzed more than 4000 Carnegie Mellon University students' Facebook profiles and found many students provide personal data generously and unconcernedly, which may expose them to various physical and cyber risks. They suggested that users may be "signaling" themselves because they believe the benefits from public disclosure of certain information in certain situations

surpass its costs (Gross & Acquisti, 2005). Dourish and Anderson (2006) argued privacy and security protection measures should consider the dynamic social contexts users are involved in and the changing information needs and uses.

In addition to the safety perception, a friendly atmosphere is also important to foster open communications via social software. Whereas researchers proposed certain guidelines for developing warm and friendly social climates, the proper implementation to stimulate desired climates relies on a deep understanding of group dynamics and how social influence will take place. For example, a moderation policy is considered to be necessary to deter uncivil behavior, such as flaming (Andrews, 2002; Preece, 2001), but the improper implementation of such policies may influence an atmosphere of open discussion in cyberspace.

The activeness of other people and online activities, or "the evidence that the other is attending" (Short et al., 1976), is another important feature in promoting socially meaningful interactions (Rourke, Anderson, Garrison, & Archer, 1999). Reciprocity is found an important factor influencing users' active participation in online social interaction (Andrews, 2002; Chan, Bhandar, Oh, & Chan, 2004; Maloney-Krichmar & Preece, 2005). Dellarocas et al. (2003) found that the expectation of reciprocation from partners is a main factor in the voluntary participation of eBay users in providing a reputation rating. Recognition from others, either in an intangible form such as identity reinforcement and reputation building or in a visible and tangible form, was also found to influence the users' contribution behavior positively (Butler, Sproull, Kiesler, & Kraut, 2002; Chan et al., 2004). A direct implication is that recognition and reward programs should be developed to motivate the users' active participation (Andrews, 2002; Koh et al., 2007).

2.4. Mediated communication

Some characteristics of CMC may influence users' online social interaction. CMC is characterized by its lack of non-verbal cues, low information bandwidth and richness, and reduced social presence (Daft, Lengel, & Trevino, 1987; Daft & Lengel, 1984; Fowler & Wackerbarth, 1980; Short et al., 1976). Early research that compared CMC to FtF interaction concluded that mediated communication is less friendly, emotional, or personal and more serious, businesslike, and task-oriented. Along this vein, some researchers explored how non-verbal cues could be included in CMC by proper design of avatars, graphics, videos, and gestures (Bente & Krämer, 2002; Bente, Rüggenberg, Krämer, & Eschenburg, 2008; Fish, Kraut, Root, & Rice, 1992; Smith, Farnham, & Drucker, 2000; Yoo & Alavi, 2001). Personalization is also an important feature that influences the quality of the mediated communication, since different users tended to perceive the same verbal cues differently depending on the environment (Andres, 2006). Walther (1992) suggested that people are motivated to adapt to the limited cues of CMC for complex tasks such as forming interpersonal impressions due to their desires to develop relationships in CMC environments. This is consistent with Panteli's (2002) conclusion that email, which is often considered as a lean medium, actually amplified the hierarchical differences within offices, due to the social cues that were contained in the way text messages were constructed.

CMC allows both synchronous and asynchronous communication, and synchronicity itself was found influencing users' behaviors. Whereas synchronous communications are spontaneous and immediate, the asynchronous modes of CMC also allow more time for users to consciously construct communicative messages and the conversation can be more thought out and more organized (Hiltz & Turoff, 1981; Walther, 1996). Users were found manipulating the two communication modes to meet different goals (Cummings, Butler, & Kraut, 2002; Wellman, Haase, Witte, & Hampton, 2001).

2.5. Technological system

A technological system provides a context for online interaction to take place. Li found that the quality of a technological system (in terms of the system reliability, access convenience, ease of use and system flexibility) is a significant predictor of user satisfaction and behavioral intention to participate in online social interaction (Lin & Lee, 2006; Kim, 2000). From a survey of 77 virtual communities in Korea, Koh et al. (2007) found that technological infrastructure had a moderating effect on the users' posting behavior. This is consistent with Whitaker's findings from a case study of a virtual agricultural community (Whitaker & Parker, 2000), in which issues related to information infrastructure such as the cost, accessibility, speed, and information search facilities were identified by community moderators to be barriers of online interaction. For communication technology that is used for social purposes, the enjoyment of usage suggests a type of intrinsic motivation and has been found to be a dominant factor that explains grassroots adoption (Li et al., 2005). The study suggests that social software should be both useful and fun. The aesthetic design of social software may also be of importance, because people are affected by the physical attractiveness of other people and artifacts, and this further affects their everyday social life (Bloch, 1995; Coates, 2003; Dion, Berscheid, & Walster, 1972; Hamermesh & Biddle, 1994). Furthermore, the simplicity and ease of learning of new technologies, such as blogs and wikis, are also important for users (even those having low expertise) to adopt the technology (Avram, 2006; Bross, Sack, & Meinel, 2007; Chatti, Jarke, & Frosch-Wilke, 2007).

Additional research focused on developing sociability features with the belief that certain functions or representations (e.g., a widget showing the presence of other people, a proper metaphor for interface design, or proper visualizations of social activities) should be effective in eliciting sociability in specific contexts (Barab et al., 2001; Farnham, Zaner, & Cheng, 2001; Kreijns et al., 2002). A problem with this research is that the real effect of the influence of the design features on sociability was not empirically examined, partially due to the lack of a proper definition and measurement of sociability.

2.6. Limitations of current sociability research

Sociability was considered to be an important property of software to facilitate social interaction and to enhance social connectivity. The first limitation of current sociability studies is that they mainly focus on group applications or online communities, whereas social software refers to a concept of a wider range. Some recent studies investigated the sociability design regarding specific social software. However, a systematic study of all of the factors that affect the sociability of social software with empirical validation is needed to develop a comprehensive understanding of sociability design for general social software design. Second, current sociability frameworks and sociability guidelines are primarily derived from theoretical analysis (Preece, 2001; Preece & Maloney-Krichmar, 2003) or personal experiences (Erickson, 2003). Empirical validations are required to validate their effectiveness. Finally, the relationship between sociability and the users' experience and behavior intentions is often assumed but is not examined. The current study attempts to address these questions by determining the significant factors that affect the sociability of social software and by testing the relationship between these factors and the users' attitude and behavior intentions.

The current paper studies the sociability of social software in the following order: first, as a whole, and second, for different application genres. This generalized investigation is necessary due to the concern that the goal of all social software is to facilitate people's daily social interaction, and different social software is often combined, integrated, or linked to satisfy the diverse communication

requirements in practice. There is no clear boundary that separates the features of different applications. For example, IM users can send an email by right-clicking on a contact's name in the buddy list and selecting the email option. In many bulletin board systems (BBSs) and SNS, users can also chat simultaneously with your friends. Therefore, it would be more feasible and meaningful to develop a general framework of sociability that is based upon the understanding of the users' need to support their social motives and activities and to evaluate each type of application with the framework.

3. Pilot study: how users utilize social software to support their social life

To determine the sociability factors, a comprehensive understanding of how the users utilize social software to support their social life is needed. In the pilot study, we conducted a series of structured interviews to obtain this knowledge. Through in-depth discussion with real users, this qualitative method also allowed us to collect more potential sociability factors rather than those that were previously addressed in literature.

3.1. Design of the study

Thirty-five participants were interviewed, which included 17 females and 18 males with ages ranging from 17 to 49 ($M = 24.7$). Among the participants were 20 university students, 5 school teachers, 4 employees working in the information technology industry, 3 governmental officials, 1 psychological consultant, and 1 journalist. Occupations other than students were intentionally included in order to obtain knowledge of how employed people utilize these tools to support both their work and personal life. Twenty participants were undergraduate students, of which 12 had bachelor's degrees and 3 had master's degrees. The majority was selected and recruited from researchers' social networks and several were recruited by posting advertisements on Xiaonei.com (a Chinese SNS for college students) and personal blogs. The samples represented Internet users who exhibited a wide variety of Internet usage patterns and experiences, from 2 years of experience and using the Internet for 1 h a week, to 10 years of experience and using the Internet for more than 40 h a week. Most participants had a great deal of experience with the Internet: 78% had used the Internet for more than 5 years, and 83% of the participants accessed the Internet at least once per day. Each participant indicated that they were familiar with at least three types of social software applications among the six types that were listed by the researcher: email, IM, blog, BBS, SNS, and online games.

Each participant was interviewed individually in a quiet place (lab, office, home or cafe), which was chosen to ensure a convenient location for the participant. Permanent audio records of the interview process were obtained for all interview sessions with the permission of the participant. After introducing the goal of the study to the participant and informing him or her that the conversation would be recorded, the interviewer presented the informed consent to the participant. The participant would then complete a demographic questionnaire, and then the interview would begin. Each interview lasted approximately 1–2 h, and the interview was divided into four sessions. In session one, participants were first asked to describe how they participated in social communication in their daily life and what tools they used. Then, they were interviewed about their use of 9 communication channels: FtF (FtF), telephone, SMS, email, IM, blog, BBS, SNS, and online games. Included in the interview were questions about their usage frequency, usage duration, communication tasks, audience and contexts of each channel that they used. They were also asked to describe the advantages and disadvantages of each channel as they perceived them and to rank their perceived sociability of all communication media and the importance of these media in their life. In session two, participants were interviewed about their usage and attitude towards different social software applications. Participants were asked to characterize their communication when using different software to assess the pros and cons of using social software in comparison to other communication channels such as FtF. Additionally, the participants were asked to describe their preference of the tools. In session three, participants were first asked to list the factors that influence their decisions to try a new social software application, to continue using social software applications and to abandon social software applications. They were then asked to evaluate the importance of the items that affect the sociability that they enumerated and 17 items listed by the researchers (social issues: the number of users, the composition of users, the number of contacts from pre-existing social networks, relationship with existing contacts in system users, and content control policy; system issues: asynchronous/synchronous communication, information richness, ease of learning, operation flexibility, simplicity, reliability, speed, aesthetics of user interfaces, customizability, ease of accessing the software/service, entertaining, privacy protection). In session four, participants gave their opinions regarding mobile social tools.

3.2. Results

3.2.1. Amount of use of social software

FtF, phone calls and SMS were considered to be essential communication channels by all of the participants. Overall, FtF, phone calls and SMS were considered to be more important and more sociable than social software. Seventy-one percent of the participants considered FtF to be the most important social channel. In general, FtF and phone calls were considered to be more direct, "real" and rich in non-verbal cues, which serve many types of purposes and functions, but they may cost the user more time and effort. In addition, FtF is considered to be stressful for some difficult types of communication and is "maybe not the best choice". Ninety-four percents of participants considered *online social software* to be an essential channel in their social life. Among online social software, *email* and *IM* were used by all participants, 80% participants were bloggers, 71% were BBS users, 69% were SNS users, and 28.5% were online game players. Regarding the amount of time spent per day, *IM* was reported to be the most heavily used among social software (average time of use is more than 6.4 h per week), followed by *BBS* (about 4.3 h per week) and *email* (about 4.0 h per week). Although the sampling method and size of the sample in this study provide little evidence to the overall figure of social software usage in the general population, we note that the trend resembles the results that were reported in a national survey performed in China which shows that 75.3% of Chinese netizens are IM users, but only 56.8% use *email* (China Internet Network Information Center, 2009).

3.2.2. Usage patterns of different social software

The participants had different purposes of use for different social software. We classified these purposes into four categories (i.e., identity building, emotional interaction, instrumental interaction, and relationship management) based on the social support theory (Cutrona & Russell, 1990). Based on the interview results, we analyzed the advantages and disadvantages of different social software to support these purposes. As shown in Table 2, email is primarily used for formal communication, such as work related or study related issues. Email is often used to communicate with well-known people or workmates but is rarely used with familiar friends, especially with young people. Four students explicitly mentioned that they think "it is weird to send an email to a close friend". Eleven out of the 15 employed people that were interviewed reported that they use email to communicate more frequently with colleagues but less frequently with personal friends. However, 3 participants mentioned that email can also be used for deep

Table 2
Communication contexts, audience and purposes of different media.

Tool	Contexts	Identity building	Instrumental interaction	Emotional interaction	Relationship management
Email	Used more in work life, dealing with formal issues (not instantly needing a reply)	Low support	Strong support for work/study due to its convenience to use, high accessibility of the service, capability to transfer big files, and provision of a permanent log of conversation	Some support for deep communication in intimate relationships; rarely used in daily emotional support exchange due to the lack of contextual information and possible misunderstandings	Some support for maintaining relations with distant people
IM	Used more in personal life	Low support	Strong support for distributed work, convenient and cost saving; good for sending big files which cannot be sent by email	Strong interaction richness due to its synchronized communication and informal communication style, but it also leads to aimless conversation	Strong support for maintaining connections due to the popularity of usage and the buddy list function
Blog	Used more in personal life	Strong support for building virtual and real identities	Strong support due to the ease of publishing and commenting, encourages deep communication, as the writer needs to elaborate feelings or ideas.	Some support for deep communication, but the lack of immediacy and interactivity limits the effect of emotional supports	Some support for maintaining connections due to the buddy list function, but the unequal status of blogger and reader may limit the development of the relationship between users
BBS	Used both for work life and personal life	Some support for building virtual identities	Strong support due to the high informational value and searchability of BBS posts	Some emotional support, depending on if the user is willing to disclose personal issues to unknown people	Low support, anonymity and low social responsibility makes public BBS places lacking of trust and it is difficult to build real and lasting relationships
SNS	Personal life	Strong support for building real identities	Some support for weak connections among acquaintances	Strong emotional support, due to the trustful and relaxing atmosphere	Strong support for relationship maintenance due to the high authenticity of user population and the high level of trust
Online game	Personal life	Strong support for building totally different virtual identity	–	Some support for intimate interactions since game players share common interests, but it is difficult to transfer friendship built in online gaming to real life	–

communication regarding critical issues in an intimate relationship. IM is considered to be a versatile tool that is useful in both work and personal life, and IM is believed to be especially superior in emotional communication, such as exchanging support and gaining friends. Among the 15 employed people, 7 participants used IM in both their personal and work life, whereas the others used IM only in their personal life. In particular, 7 participants reported that they found IM to be a very nice tool to communicate with distant but intimate friends, such as high school classmates or people they meet online. Among the 28 blog users, 13 participants reported that the primary reason for them to maintain a blog was self-presentation. 10 participants also used blogs to share thoughts and feelings with friends. In particular, 3 participants mentioned that visiting a blog of a friend with whom they have not kept a frequent contact would help them to stay close in the relationship. Most of the participants joined a BBS primarily to seek information or for entertainment purposes rather than to socialize. Among the 25 BBS users, only 3 participants reported social activities on a BBS. Two of them were literature enthusiasts, and they regularly communicate with other literature enthusiasts that they met on a BBS. Another participant frequently sought help in a technical forum and also provided assistance to the members of the forum if possible. The results are consistent with previous literature which found that users' selection of communication media is influenced by the purpose and the partner of the communication (Haythornthwaite & Wellman, 1998; Haythornthwaite, 2002; Kim et al., 2007).

3.2.3. Factors influencing the use of Internet social software

The results of the in-depth interviews in the pilot study were transcribed and reviewed, and 44 items were identified as affecting sociability. In summary, *the amount of friends in the system*, *ease of use*, *adequacy of functionalities regarding users' needs*, *system speed*, *media richness* and *system stability* were emphasized by a majority of the users. The items that were considered less critical but still essential were *privacy control*, *content quality moderation*, and *composition of system users (specific population to which the majority of users belong, e.g., students' SNS)*. This result implies that the technical competency of a system is considered fundamental to the success of any social software, whereas the social and content issues may further affect the popularity of different social software.

4. Study one: identification of the factors affecting sociability as perceived by users

From the discussions in previous literature and the results of our interview, several items that affect sociability were listed. However, the importance or priority of these items has not yet been assessed by the users. Whereas certain items were closely related and seemingly driven by one underlying need (e.g., the number of users and the relationship between users), some items were unrelated to each other (e.g., information richness and authenticity of profiles). More understanding of these relationships or the factor structure of these items would be beneficial for the designers to determine the critical aspects of the design. This leads to the two research questions of the first study:

Research question 1: how important do users evaluate each sociability item as it relates to sociability?
Research question 2: what are the common factors underlying sociability items for social software?

4.1. Item generation and purification

Forty-four items that affected sociability were identified from the interview. Plus another 46 items extracted from literature (Daft

et al., 1987; Gunawardena, 1995; Kreijns et al., 2002; Kreijns et al., 2007; Kreijns, Kirschner, Jochems, & Van Buuren, 2004; Lin & Lee, 2006; Preece, 2001; Rourke & Anderson, 2002), 90 unique items were inserted into the initial pool. Upon further examination, a number of items were eliminated because they described characteristics of good sociability rather than factors that contribute to sociability. In the cases where items were closely related, one or two core items were chosen instead of the numerous synonyms that were in the original list. Then, critiques of the items were sought from four undergraduate students who were familiar with the research topic. They were asked to identify incompatibilities between the items, if there were items whose meaning overlapped too much, if ambiguity was present in the item wording, and if there were problems in the item arrangement and overall questionnaire design. Three rounds of discussion among reviewers were held to ensure a consensus on the item purification. Finally, the number of items in the original list was reduced to 34 items. These items were classified into five categories, and each category represents a perspective of social software design: purpose and benefit, people, social climate, mediated-communication, and technology system.

4.2. Data collection and participants

An online survey was constructed to collect the users' opinions about what they considered important for supporting their online social activities that are mediated by social software. The questionnaire consisted of two ntions. The first section included questions about their background, Internet experience, and their experience and attitude regarding social software. In the second section, participants were asked to use a seven-point scale, anchored by the responses "very important" and "not important at all", to evaluate the importance of the 34 items as they related to their use of social software. The questionnaire was distributed online, and the website was pre-tested by five undergraduate students before it was launched for data collection.

The questionnaire was administered to undergraduate students at Tsinghua University and Beihang University by sending emails and by posting messages on the campus BBS. Within two weeks, 195 responses were collected. Out of the 195 responses, 163 responses were valid. A response was deleted if not all of the questions were completed. Of the participants, 36% were females and 64% were males. Their ages had an average value of 20.2 (SD = 1.29). Their majors included industrial engineering, mechanical engineering, software engineering, and economic management. Their average length of Internet experience was 5.4 years (SD = 2.35), and on average, they used the Internet 18.5 h per week (SD = 13.26). They spent an average of 4.9 h (SD = 4.6) in online social activities per week, in which 18% spent up to 1 h, 65% spent 1–10 h, and 17% spent more than 10 h. The large variance in weekly online socializing time indicates a wide variety of social software usage patterns and experiences among the sample.

4.3. Results

4.3.1. Descriptive statistics

As shown in Table 3, the averages of all related content items ranged from 4.04 to 6.30. This suggests that no single item was considered unimportant, although the degree of importance was different. *Security* ($M = 6.3$, SD = 1.04), *privacy* ($M = 6.30$, SD = 1.09), and *speed* ($M = 5.98$, SD = 1.19) had the highest mean values, which indicated that they were considered to be the most important to online sociability. In contrast, *reputation building* ($M = 4.04$, SD = 1.54), *tangible rewards* ($M = 4.07$, SD = 1.49), and *meaning to reality* ($M = 4.29$, SD = 1.59) had the lowest mean values, just above the neutral point, indicating that they were considered to be less important to online sociability.

4.3.2. Factor analysis

Exploratory factor analysis (EFA) was used to identify the latent factor structure. To determine the number of factors to extract, we used a combination of various guidelines. It was recommended to use general guidelines such as the Kaiser criterion of eigenvalues (Kaiser, 1960) and the scree cut-off points (Cattell, 1966) as guides to the dimensionality of the factor space and let the interpretability of the factors indicate the exact number of factors to retain in an exploratory study. By examining the eigenvalues, we found that there were 10 eigenvalues greater than 1.0. Examination of the scree plot shows an elbow point between factor 7 and factor 8. Therefore, we obtained solutions with 7, 8, 9, and 10 factors and compared them to see which structure was more interpretable and which factors appeared consistently. Additionally, for each structure, the following rules were applied to further prune items. First, items that did not load strongly on any factor with a loading over 0.45 or items that had cross-loadings were deleted. Comrey and Lee (1992) indicated that factor loadings larger than 0.45 can be considered to be fair, and factor loadings greater than 0.55 can be considered to be good. Here, we adopted 0.45 as the cut-off value. Second, an item was removed if its inter-item correlations did not exceed 0.30 (Robinson, Shaver, & Wrightsman, 1991).

Finally, an interpretable 7-factor structure with varimax rotation was selected as shown in Table 4. Due to the previously mentioned reasons, 9 items were deleted. The Kaiser–Meyer-Olkin (KMO) measure was 0.8, which indicates a good sampling adequacy (Comrey & Lee, 1992). Factor loadings for all of the items were greater than 0.55 except for the item of *support of group activity*. Seven factors emerged with no cross-loading above 0.45, which indicates that the factors are distinct from each other. Altogether, 63.4% of the variance was explained. Cronbach's α coefficient was computed for each extracted factor to measure its internal consistency. The α coefficients for the first 6 factors ranged from 0.62 to 0.78, which is above the acceptance level for exploratory studies (0.6). The α coefficient for the last factor, *support for formal interaction,* was 0.52, which is below the normal acceptance level. Bradley (1994) suggested that the minimum value of the coefficient indicating sufficient consistency increases with the number of items. For a three-item scale, an α value of 0.5 is sufficient, whereas for a ten-item scale, the value should exceed 0.7. There were only three items that exceeded this value. In summary, the 7-factor structure is acceptably reliable.

Factor 1, which was labeled *system competency*, explains most of variance, or 11.5% of the total. The items in this factor address the necessary system components that are required to deliver interactive, smooth and reliable interaction online: the speed of response, the reliability of the system, the bandwidth of information transfer, and the protection from spam messages and privacy intrusion. It is interesting to note that *privacy* and *disturbance prevention* also loaded strongly on this factors. This indicates that the prevention of privacy intrusion and disturbance is assumed to be a basic feature of social software.

Factor 2, which accounts for 10.8% of the total variance, was labeled *social climate*. It covers items that describe a social atmosphere as being suitable and comfortable for social interaction: the communication should be open and free, users should be free from security concerns, all members should behave with civility, affective communication should be enabled and encouraged, and the psychological distance between members should be small.

Factor 3 was labeled *benefits and reciprocity*, and it accounts for 9.3% of the total variance. This factor describes the benefits that users expect from online social interaction. They expect their input to be rewarded fairly, and their efforts can have an impact on their

Table 3
Descriptive statistics of study one.

Question	Mean	STD
Purpose and benefit		
Informational interaction – the extent to which the information obtained in the system can fulfill the user's needs	5.84	1.17
Originality – the creativity of the content of social activities in the system	5.10	1.30
Affective communication – the ease and effectiveness at which emotions can be expressed to other people and emotional support can be exchanged in the system	5.29	1.20
Support of group activity – the ease at which groups of special interests can be established and maintained	5.14	1.13
Self-image building – the ease at which the user's virtual image can be established and displayed within the system	4.45	1.43
Meaning to reality – the extent to which social activities in this system represent and contribute to events and people in the real world	4.29	1.59
Reputation building – the effectiveness at which a good reputation can be acquired and demonstrated in the system	4.04	1.54
People		
Number of existing social contacts in the system – the number of contacts in the system, which already existed before using the system, such as friends or family members	4.83	1.41
Relationship to existing social contacts in the system – the proximity to contacts, which already existed before using the system, in the system	4.76	1.40
Amount of users – the overall number of system users	4.49	1.51
Social climate		
Privacy – the extent to which the user can control her or his private information in the system	6.12	1.09
Security – the extent to which social activities in the system are safe and will not threaten or endanger personal property	6.30	1.04
Authenticity – the perceived realness of content and exchanged information in the system	4.58	1.58
Prevention from disturbance – the extent to which the user can distinguish between wanted and unwanted information and can block the latter	5.69	1.30
Friendliness – the degree to which members of the system respect and deal politely with each other	5.75	1.06
Open communication – the extent to which users in the system tolerate and respect each other and encourage discussion and different opinions	5.56	1.29
Activeness – the perceived activity of the system including a large number of active members, continuously generated new content and active instigation of social activities	5.52	1.20
Control of content quality – the extent to which the system censors information which is transferred in social activities	4.25	1.65
Reciprocity – the ratio of effort invested in the system and payback	4.54	1.30
Socio-emotional rewards – the extent to which reasonable socio-emotional rewards are received by users for their effort and time invested in the system	4.61	1.54
Tangible rewards – the extent to which tangible rewards are received by users for their effort and time invested in the system	4.07	1.49
Mediated communication		
Information bandwidth – the amount of data that can be maximally transferred within the system at once.	5.50	1.36
Information richness – the variety of media for communication such as text, image, audio or video	5.47	1.32
Immediacy – the degree to which users feel close to each other in the system	5.47	1.27
Simultaneous communication – the extent to which the communication in this system is simultaneous	5.38	1.17
Non-simultaneous communication – the extent to which the communication in this system is non-simultaneous	4.96	1.39
Technological system		
Reliability of the system – the extent to which social online activity can be performed reliably and continuously, without any failure or interruption	5.83	1.44
Speed – the speed, at which information for social activities can be transferred	5.98	1.19
Operation flexibility – the variety of operation modes, such as drag-and-drop, mouse clicks, and shortcuts	5.07	1.44
Online status control – the ability and freedom of the user to freely set her or his online status	5.44	1.22
Searchability – the ability of the system to search for items relevant to social interaction, such as people or events	5.12	1.55
Entertainment – the extent to which users experience interest in social activities in the system	4.88	1.35
Customizability – the ease at which the content and format of exchanged information can be controlled	4.94	1.41
Integrationability – the ability of the system to adapt and integrate contents from other systems	4.74	1.38

real life relationships in addition to their "virtual" relationships. Content quality control also matters, as the lack of such control will harm the benefits that users might gain from the system.

Factor 4 was labeled *people*, and it accounts for 8.7% of the total variance. People's perception of sociability is also influenced by the number of members they can easily reach through the software, the number of people they know who are using the software, and the closeness of the relationship they have with these people.

Factor 5 was labeled *interaction richness* and accounts for 8.1% of the total variance. This factor describes the richness that information can be represented and how easily users can customize the way that they interact with others. Additionally, the users' perception of interaction richness is influenced by whether the users' socializing effort in the system can be recognized and whether socio-emotional rewards can be obtained.

Factor 6, labeled *self-presentation*, accounts for 8.0% of the total variance. This factor addresses how well social software helps the users to convey an impression of themselves to other users, and consequently, how well the users can develop their reputation through verbal or non-verbal communication via the system.

Factor 7 accounts for 7.0% of the total variance. We labeled the last factor *support for formal interactions* because we consider that the items that are included in this factor to address issues related to formal communication. Formal communication is characterized by structured relationships, organized conversations (rather than spontaneous), and a preference to impoverished content and formal language register (Fish, Kraut, & Chalfonte, 1990; Stohl & Redding, 1987). To support formal communication, the *authenticity* of the users' identification and the content of the quality should be protected. Users should find it easy to organize group activities, such as initiating a discussion or arranging a meeting among a group. In addition, *operation flexibility* is also required to support formal communication, in which relationships are structured and communication rules exist, either explicitly or implicitly.

Table 4 provides the importance score of each factor. *System competency* ($M = 5.82$, $SD = 0.93$) and *social climate* ($M = 5.67$, $SD = 0.84$) were rated as the two most important factors and explained most of the variance. The designers of social software should consider these two factors to be indispensible aspects for the success of the software. The importance of *interaction richness*

Table 4
Factor analysis result of study one.

Factor	Item	Loading	Explained variance (%)	Cronbach's alpha (standardized)	Mean
System performance	Speed	0.83	11.5	0.78 (0.78)	5.82
	Reliability	0.69			
	Disturbance prevention	0.68			
	Privacy	0.65			
	Information bandwidth	0.61			
Social climate	Open communication	0.73	10.8	0.77 (0.77)	5.67
	Immediacy	0.73			
	Friendliness	0.69			
	Security	0.64			
	Affective communication	0.55			
Benefits and reciprocity	Meaning to reality	0.68	9.3	0.67 (0.68)	4.29
	Reciprocity	0.66			
	Tangible rewards	0.65			
	Control of content quality	0.62			
People	Number of existing contacts	0.86	8.7	0.74 (0.74)	4.69
	Amount of users	0.74			
	Relations to existing contacts in the system	0.71			
Interaction richness	Customizability	0.67	8.1	0.64 (0.64)	5.01
	Information richness	0.65			
	Socio-emotional rewards	0.56			
Self presentation	Self-image building	0.70	8.0	0.62 (0.63)	4.25
	Reputation building	0.66			
Support for formal interaction	Authenticity	0.73	7.0	0.52 (0.52)	4.93
	Operation flexibility	0.57			
	Support for group activity	0.46			

($M = 5.01$, SD = 1.08) and *support for formal interaction* ($M = 4.93$, SD = 1.0) were moderately high. The former is related to people's need for conveying non-verbal cues in social interaction, and the latter is related to the need for supporting institutionalized relationships. *People* ($M = 4.69$, SD = 1.7) was ranked as slightly important, and its standard deviation is the largest among all factors, indicating that the users' opinions differ greatly on this factor. Finally, *self-presentation* ($M = 4.25$, SD = 1.26) and *purpose and benefits* ($M = 4.29$, SD = 1.16) had the lowest average in importance rating, which was just above the neutral point.

5. Study two: validate sociability factors

5.1. Research framework

A set of latent factors was extracted from sociability items in study one. However, factor analysis is unable to examine to what extent these factors predict the sociability of social software as perceived by the users. The first goal of the second study was to answer this question. Furthermore, the positive impact of sociability on the user experience is often discussed or assumed but is rarely examined. The second goal of the second study is to examine the relationships between sociability, the users' attitude, and the intention to use social software. Fig. 1 shows the framework of research in the second study. We hypothesized that the 7 factors are determinants of perceived sociability of social software, and that the perceived sociability is expected to influence the users' attitude towards the software and their intention to use it. In particular, the impact of each sociability factor on the users' attitude and intention was examined in detail to reveal the most influential design issues.

H1a: system competency has a positive influence on perceived sociability of social software.
H1b: social climate has a positive influence on perceived sociability of social software.
H1c: purposes and benefits has a positive influence on perceived sociability of social software.
H1d: people have a positive influence on perceived sociability of social software.
H1e: interaction richness has a positive influence on perceived sociability of social software.
H1f: self-presentation has a positive influence on perceived sociability of social software.
H1g: support for formal interaction has a positive influence on perceived sociability of social software.
H2a: perceived sociability has a positive influence on users' attitude towards social software.
H2b: perceived sociability has a positive influence on users' intention to use the social software.

5.2. Design of study

A set of social software was evaluated with respect to the 7 factors that were extracted from the first study, the perceived sociability of this software, the users' attitude towards them, and the users' intention to utilize them. Ten applications were selected from five types of social software: email, IM, forum, blog, and SNS. According to the results of the pilot study, online games were not considered to be a major means for social activity. Therefore, online games were not included in this study. For each type of social software, we selected two applications that were popular in China as shown in Table 5. We intentionally selected one Chinese brand and one international brand for each type of software, except for the forum, because the popularity of foreign forums in China is low due to language barriers.

The survey was administered online, and the questionnaire consisted of three sections. In the first section, the background of the research and the online social software applications were introduced. Then, the participants completed a demographic questionnaire. They were asked to select the application that they wanted to evaluate from a list of 10 applications that we provided. This

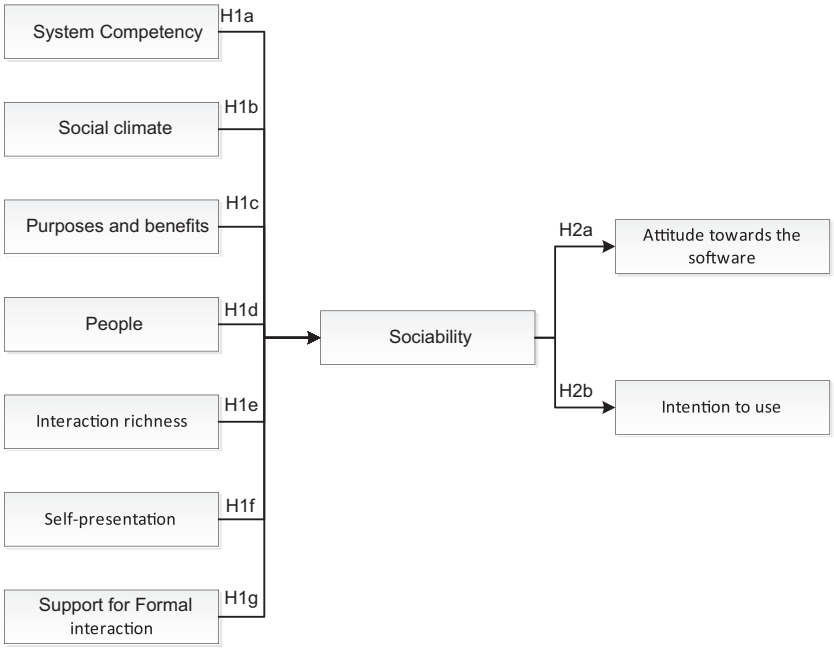

Fig. 1. Hypothesized relationships among design factors, sociability, users' attitude and intention to use.

Table 5
Evaluated applications and number of responses in study two.

Category	Applications	Number of responses
Email	163.com	16
	Gmail	77
IM	QQ	62
	MSN	28
Forum	club.163.com	0
	newsmth.net	4
Blog	Blog. sina.com.cn	5
	Live spaces	14
SNS	Xiaonei.com	39
	MySpace.com	1

self-selection method was used to avoid having participants assigned to evaluate an application that they were not familiar with. In the second section, each application was evaluated against the 7 factors that were extracted in the first study. Each item was reworded into a descriptive statement of the application. A sample statement is: "I feel close to other users in the system" (reworded from the original item of *immediacy*, the degree to which users feel close to each other in the system). Participants used a seven-point Likert scale, anchored by the responses "strongly disagree" to "strongly agree", to evaluate how much they agree with the item statement regarding the application that they were evaluating. In the third section, perceived sociability was evaluated first. The instrument was adapted from Krejins' sociability measure for online learning systems (Kreijns et al., 2007). Three items that were not appropriate for general social software were deleted, and the remaining seven items were reworded to better represent social software (Items: "I can easily communicate with my contacts using this system/software", "I do not feel lonely in this system/software", "Using this system/software enables me to get a good impression of my contacts", "Using this system/software enables me to identify myself with others", "I feel comfortable with this system/software", "This system/software allows enables me to keep relationships with my contacts", and "This system/software enables me to make close relationships with my team members."). Then, the participants' attitude towards the software was measured using three seven-point semantic scales that were anchored by "useful/not useful", "easy to use/difficult to use", and "satisfying/unsatisfying". Cronbach's α value of the measure of the perceived sociability and the attitude towards social software was 0.88 and 0.76, respectively, which indicates an acceptable level of reliability. Finally, their intention to use the software was measured by using another seven-point scale that was anchored from "very willing to use" and "very unwilling to use".

5.3. Participants

Participants were recruited by posting advertisements on campus BBS of Tsinghua University and Beihang University, personal blogs, two Chinese SNSs (i.e., Xiaonei.com and kaixin001.com), and two public BBSs. Within two weeks, 298 responses were collected, which included 246 valid responses. The demographic information of the sample is presented in Table 6. The majority of the respondents were currently students (65%), but there were also 92 non-student respondents. It should be noted that the second largest group consisted of employees that work in the Internet industry (19% of the sample) who were more familiar with the applications than general web users. Many of them worked all day with the help of the Internet. Among all of the participants, 83 were females and 163 were males, and the ages ranged from 16 to 40 (M = 23.0, SD = 3.53). The sample had a good amount of Internet experience and many of them were heavy users of the Internet. The average length of their Internet experience was 6.7 years (SD = 2.03), and they spent an average of 14.4 h (SD = 13.31) in online social activities per week. The sample included both users that spent less than 2 h with social software (14%) and users that spent more than 30 h with social software (5%). These participants' responses reflected a wide range of possible user attitudes and opinions.

5.4. Results

To determine the impact of each factor on the sociability of software, we conducted multiple regression analyses in which the

Table 6
Demographic information of participants of study two.

Variables	Answers	Responses	Percentage (%)
Gender	Female	83	34
	Male	163	66
Occupation	Students	165	67
	Internet industry	47	19
	Business	10	4
	Research and education	7	3
	All others	17	7
Monthly income	0–1000 RMB	156	63
	1001–2000 RMB	23	9
	2001–3000 RMB	22	9
	3001–4000 RMB	16	7
	4001–5000 RMB	3	1
	5001–6000 RMB	11	4
	<6000 RMB	15	6
Frequently used social software	Email	210	87
	IM	231	94
	Forum	153	63
	Blog	154	63
	SNS	121	50
	Game	25	11

average scores of each factor were used as the independent variables and *sociability* was used as the dependent variable. The results are shown in Table 7. The model shows a very good fit ($F = 54.58$, $p < .001$) and a high adjusted R^2 value of 0.61. The coefficients of *social climate*, *benefits and reciprocity*, and *self-presentation* and *support of weak connections* are significant at the $p < .01$ level, and the coefficient of *people* is significant at the $p < .05$ level. However, the coefficients of *system competency* and *interaction richness* are not significant in the model. In summary, H1b, H1c, H1d, H1f, H1g are supported, but H1a and H1e are not supported.

Since different social software applications support different types of social interaction, the relationship between these factors and sociability may differ for various applications. We then conducted multiple regression analyses by using the *sociability* of each type of application as the dependent variable and the seven factors as the independent variables, and the results are shown in Table 8. The type of forum was not considered because there were only 3 responses, which is too low of a number for a meaningful statistical analysis. Given the level of 0.01, the goodness-of-fit of all these models is sufficiently acceptable. The R^2 ranges from .56 and .73, which indicates a high level of explaining the capability of the models. However, for different types of applications, the impact of different factors varies.

- For email applications, *social climate* and *support of weak connections* contribute significantly to *sociability*.
- For IM applications, all of the factors contribute significantly to *sociability*, except for *system competency*.
- For blog applications, only *interaction richness* contributes to *sociability*.
- For SNS, *people* contribute significantly to sociability and *social climate* has a marginal impact on *sociability*.

In all of these models, the *system competency* is not significant. This shows that *system competency* does not significantly influence the sociability. *Interaction richness* contributes significantly to the sociability of IM, and is the only contributing factor for blog sociability, although it is not a significant factor for email and SNS sociability. Therefore, the model of *sociability* was revised, which removed *system competency* from the influencing factors. The remaining 6 factors can explain 61% of *sociability* as it pertains to social software.

The influence of *sociability* on the users' attitude towards the application and their intention to use it was also examined by regression analyses, and the results are shown in Table 7. *Sociability* has a significant and strong impact on both the attitude towards the application ($b = 0.54$, $t = 11.16$, $p < .001$) and the intention to use ($b = 0.73$, $t = 12.61$, $p < .001$). It can predict 34% of the attitude towards the application and 40% of the intention to use. Hypothesis 2 is supported. Furthermore, by including the system competency into the model, the goodness-of-fit is significantly improved. The results show that *sociability* and *system competency*, when combined, can predict 43% of the users' attitude towards social software and 51% of the intention to use. Fig. 2 shows an overview of these verified relationships.

Furthermore, we investigated the impact of the 7 factors on the users' attitude towards the application and their intention to use, as shown in Table 7. Regarding the model of attitude towards the application, the goodness-of-fit model is good ($F = 22.82$, $p < .001$). *System competency* ($b = 0.29$, $t = 4.34$, $p < .001$) and *social climate* ($b = 0.23$, $t = 3.37$, $p < .001$) are significant contributing

Table 7
Regression of sociability, attitude, and intention to use on design factors.

	Dependent variables								
	Sociability			Attitude			Intention to use		
	Parameter	*t*	*p*	Parameter	*t*	*p*	Parameter	*t*	*p*
Independent variables									
System competency	0.00	−0.04	0.97	0.29	4.34	<.001*	0.40	5.21	<.001*
Social climate	0.23	3.94	<.001*	0.23	3.37	<.001*	0.10	1.24	0.22
Purpose and benefits	0.21	3.86	<.001*	0.07	1.06	0.29	0.16	2.24	0.03*
People	0.12	2.67	0.01*	0.03	0.51	0.61	−0.02	−0.42	0.67
Interaction richness	0.08	1.54	0.12	0.07	1.2	0.23	0.18	2.54	0.01*
Self presentation	0.14	3.39	<.001*	-0.03	-0.61	0.54	0.03	0.49	0.62
Support of instrumental interaction	0.20	3.54	<.001*	0.08	1.16	0.25	0.14	1.87	0.06
Adjusted R^2	.61			.39			.38		
Independent variable									
Sociability				0.54	11.16	<.001*	.72	12.61	<.001*
Adjusted R^2				.34			.39		
Independent variables									
Sociability				0.37	7.03	<.001*	0.49	8.05	<.001*
System competency				0.35	6.39	<.001*	0.48	7.76	<.001*
Adjusted R^2				.43			.51		

* Statistically significant at the 5% level.

Table 8
Regression of sociability for different types of social software on design factors.

	Dependent variables											
	Sociability of email applications (N = 93)			Sociability of IM applications (N = 89)			Sociability of blog applications (N = 19)			Sociability of SNSs (N = 40)		
	b	t	p	b	t	p	b	t	p	b	t	p
Independent variables												
System competency	0.02	0.24	0.81	−0.15	−1.6	0.11	0.02	0.07	0.94	0.01	0.07	0.95
Social climate	0.21	2.01	0.05*	0.34	3.48	0.001*	−0.07	−0.25	0.81	0.21	1.63	0.11
Purpose and benefits	0.18	1.93	0.06	0.20	2.32	0.02*	0.40	1.26	0.24	0.26	1.91	0.06
People	0.07	1.1	0.27	0.19	2.35	0.02*	0.00	−0.02	0.99	0.46	3.17	0.003*
Interaction richness	−0.01	−0.06	0.95	0.24	2.38	0.02*	0.56	2.29	0.04*	−0.05	−0.4	0.69
Self presentation	0.04	0.57	0.57	0.30	3.85	<0.001*	0.12	1.02	0.33	−0.06	−0.6	0.55
Support of instrumental interaction	0.36	4.15	<.001*	0.02	0.21	0.83	0.24	0.75	0.47	0.13	0.75	0.46
Adjusted R^2	.56			.68			.73			.61		

* Statistically significant at the 5% level.

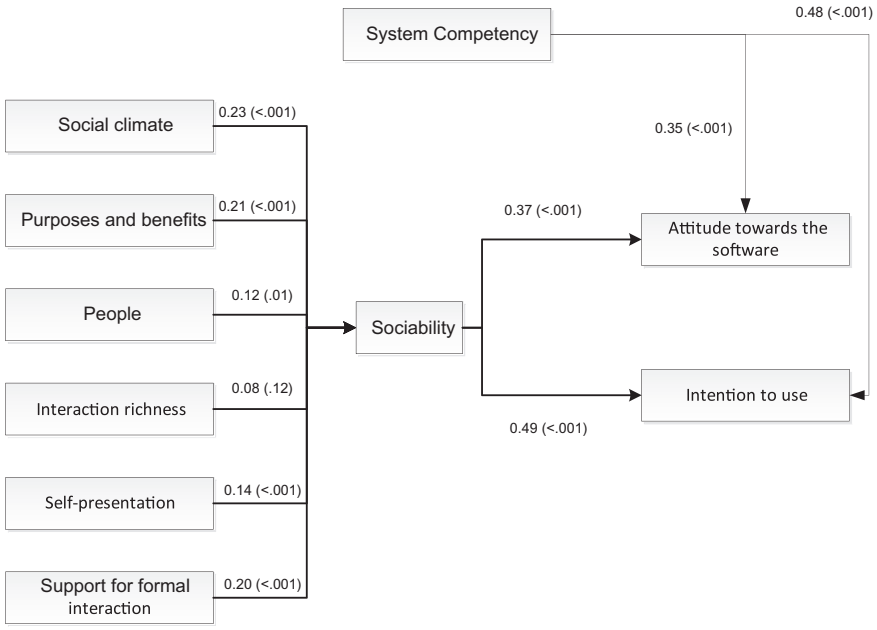

Fig. 2. Verified relationships among design factors, sociability, users' attitude and intention to use.

factors, however, the other factors are not significant in the model. These two factors explain 38% of the attitude towards the application. For the intention to use, *system competency* (b = 0.40, t = 5.21, p < .001), *benefits and reciprocity* (b = 0.16, t = 2.24, p = .03), and *interaction richness* (b = 0.18, t = 2.54, p = .01) have significant contributions. These three factors can explain 35% of the intention of use.

6. Discussion

From a series of qualitative and quantitative studies, this paper developed a framework of sociability that has 6 factors: *social climate*, *purpose and benefits*, *people*, *interaction richness*, *self-presentation*, and *support for formal interaction*. *System competency* was not found to be a sociability factor. However, it is important for the users' attitude toward social software and the intention to use social software. It seems that *system competency* belongs to the usability regime rather than sociability. Our results indicate that the sociability and system competency issues, although closely related in practice, are still distinguishable aspects of social software. Both *sociability* and *system competency* were found to have a significant impact on the user experience with social software. They can predict 43% of the users' attitude towards social software and 51% of the intention to use. Furthermore, the coefficients of *sociability* and *system competency* in the two regression formulas were very close (see Table 7), which indicates that *sociability* is as important as the system competency features, such as the speed, reliability, and information bandwidth. This result advocates the importance of supporting sociability in social software design by integrating sociological, psychological and technological considerations with the overall goal to facilitate online social interaction.

The identification of six sociability factors provides a framework from which the designers can derive sociability design guidelines. This framework shares a certain consistency with Preece's framework (2000) of sociability, in which the factor *people* is related to the component *people*, the factor *social climate* is related to the component *policy*, and the factor *benefits and purposes* is related to the component *purpose*. However, our research provided empirical support for these sociability factors based on an investigation of the users' perception and attitude. Additionally, our research yielded three more sociability factors.

- *Social climate* was considered by the users to be important for social software. Above all, the base requirement that must be met is to provide adequate security. Both operational issues (e.g., encryption strategy, blocking of unauthorized access)

and policy related issues (e.g., efforts to make users aware of security procedures) were found to influence the perceived security (Yenisey, Ozok, & Salvendy, 2005) and should be properly devised. Second, the system should provide a friendly and open communication environment with sufficient immediacy required by effective communications. Policies against unfriendly or flaming behavior should be well established and enforced.

- *Interaction richness* was ranked as being moderately important. Especially for IM and blogs, it is a major sociability factor, and it significantly influences the users' intention to utilize a certain social software application ($t = 2.54$, $p = .01$). In particular, the users' demand for information richness is high ($M = 5.75$, SD = 1.06). Therefore, conveying multiple types of cues should be made possible in IM and blog design to convey abundant non-verbal cues that are required in meaningful communication. In addition to embedding audio or video-based communication, the proper design of an avatar system and emoticons also affect the user experience and the interaction among users (Smith et al., 2000). However, the interpretation of emotional expressions differs across cultures (Koda & Ishida, 2006), and cultural differences should be considered to avoid misinterpretation. Additionally, customizability should be provided to allow users to adapt to their specific communication needs in different contexts.
- *Support for formal interaction* was found to be the most important sociability factor for email. This is consistent with previous studies in which email usage was found to be the most preferred method for formal communications (El-Shinnawy & Markus, 1997; Haythornthwaite & Wellman, 1998). Although formal communication takes place more frequently in professional life and often relies on media and protocols that are established by a work organization, there are instances in which people use personal social software for formal communication. First, it is difficult to draw a clear boundary between the personal usage and work usage of social software, because many people also communicate with their work colleagues when they are not at work and develop personal relationships with work colleagues. Second, there are formal or semi-formal structures in people's personal life, such as special interest clubs, alumni associations, and hometown associations. To stimulate formal communication, social software should provide support for group activities such as sharing knowledge within the group, coordinating a time for location, or voting to make a group decision. The system should take effective preventive measures against email fraud and identity theft to ensure the authenticity of its contents and relationships in the system. Furthermore, the efficiency of information exchange and collaboration work could be improved by flexible operations.
- *People* was found to be a significant sociability factor and the most important sociability factor for SNS. If there are too few people contributing to an online community discussion, it will cease to exist. The number of people needed to make an online community viable and to attract others is known as its critical mass. Our study found that SNS users perceive the importance of *people* and relate it to the sociability of the system. It would be helpful to plan the number and the kinds of people who are expected to use SNS. Viral marketing measures could be adopted and enough incentives should be provided for users to invite their friends and existing connections to join the system. Additionally, measures should be taken to help users identify their own roles in the network, especially socio-emotional roles, to increase the "stickiness" of the system.
- *Benefits and purposes* was found to be important to the sociability design for IM and SNS. Interestingly, both genres are often considered to be addictive or a waste of time. Our results indicated that users do recognize the problem and appreciate the real benefit they can get from the time that they spend on the system. Although fun applications and games may add to the attractiveness of such systems, the designers might find that understanding and supporting the users' true socializing needs and tasks will turn out to be the truly successful approach in the long run.
- *Self-presentation* was found to be a contributing factor to the sociability design for IM. Surprisingly, it was not found to be a sociability factor for SNS or blog applications. This is not consistent with previous studies in which self-presentation was found to be a moderate motive for hosting online homepages (Papacharissi, 2002). A possible reason may be that many Chinese users use IM as the center of their online social life. The content that they post in blogs and SNS are primarily diaries that are used to facilitate emotional exchange rather than to build a personal reputation.

Our results also indicated that the design of different genres of social software should emphasize the different aspects of sociability. The sociability framework that we developed can be used to evaluate the performance of social software applications with respect to the critical factors. This framework facilitates the understanding of discrepancies between different applications. For example, a comparison of two popular email applications showed that Gmail outperforms in nearly all dimensions except in the *people* dimension, as indicated in Fig. 3. Gmail outperformed 163 mail in the following two critical sociability factors of email: support for formal interaction and social climate. This may explain the fact that Gmail has a better perceived sociability ($M = 5.2$), a more positive attitude ($M = 6.2$), and a better intention to use ($M = 6.4$) than 163 mail (sociability: $M = 4.7$; attitude: $M = 5.7$; intention to use: $M = 5.5$).

There are several limitations of our study. First, the surveyed population is characterized by young students and by people working in the IT industry that are highly technology-savvy and experienced in Internet use. People having a low level of computer skills may exhibit different usage patterns and have a different preference. Novice users were found more likely to report a souring effect over the course of Internet use (Neuman, 2000). Additionally, our participants have many friends and family members that are online, which may affect the psychological effect of the Internet (Kraut et al., 1998). This situation should be considered when the results are generalized to other populations. Furthermore, our samples included more male participants than female participants in both studies. Therefore, our findings may be biased because of the dominating number of male participants. Second, the study was conducted among Chinese web users. Because people's social

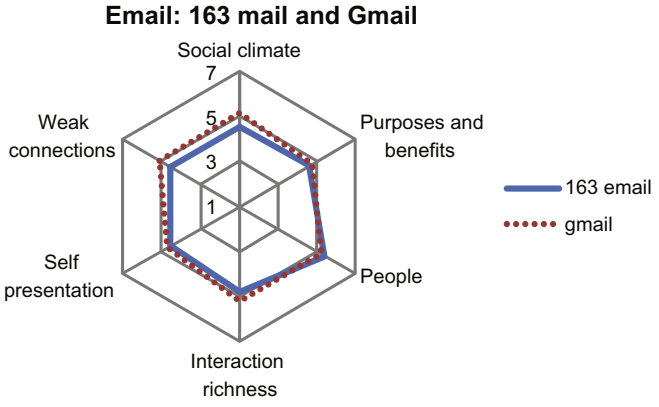

Fig. 3. Sociability comparisons of Gmail and 163 mail.

life is greatly influenced by their cultural background, we do not expect the usage patterns and the users' attitude that was observed in this study to be generalized to other cultures. However, our study provides a foundation for future research that is designed to explore the cultural impacts on social software users' attitude and behavior. Third, participants were asked to select the application they would like to evaluate in the second study. Although this flexible measure could improve the reliability of responses, it also leads to heavily unbalanced data and problems for the statistical analysis. For example, we did not collect enough data for a meaningful analysis of the sociability of online forums.

Despite these limitations, this study provides both theoretical and practical contributions to the design and evaluation of social software. This study empirically investigated the impact of sociability on the users' attitude and their intention to use by providing solid support for the necessity of sociability design. This study also explored and verified six sociability design factors through qualitative and quantitative studies, which resulted in a reference framework for the future development of sociability design guidelines. The tool used in the study can also be used to evaluate the performance of an application along specific sociability dimensions and to draw a sociability profile based on the evaluation.

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