JYVÄSKYLÄ STUDIES IN COMPUTING
114

Giuseppe Lugano

# Digital Community Design

## Exploring the Role of Mobile Social Software in the Process of Digital Convergence

JYVÄSKYLÄN YLIOPISTO

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UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄ 2010

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# ABSTRACT

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This study covers the theme of digital community design from the perspective of mobile social software (MoSoSo) and within the broader context of digital convergence. Digital communities and MoSoSo are key products of digital convergence, a multifaceted phenomenon encompassing the technological, economic, cultural and social dimensions. Digital convergence contributes to the evolution of community by the integration of the offline, online and mobile dimensions in a hybrid social space. In the hybrid social space, digital communities are structured, perceived and experienced as mobile social networks through MoSoSo. So far, the potential of MoSoSo and mobile social networking has not been realized because there is a lack of a common conceptual framework on which to ground design solutions. The shortcomings of MoSoSo are addressed in this thesis by applying conceptual analysis and design thinking to develop a conceptualization and a holistic model of MoSoSo design. Support policies to MoSoSo adoption are also discussed. The findings of the study show that MoSoSo can be defined as a class of mobile applications whose scope is to support informal mobile social networking. In this way, MoSoSo design can be enhanced by grounding MoSoSo on its three main building blocks, namely the user profile, mobile social network and social algorithms. The individual level of the user profile concerns the inference and representation of user psychological knowledge; the social level of mobile social networks deals with the sensing and processing of their evolving structure; finally, the interaction level of social algorithms uses the input of the other two levels to dynamically personalize MoSoSo for contextual interaction, while supporting the user's management of incoming and outgoing flows of social information and facilitating social interconnections on the basis of homophily and heterophily. This model conceives MoSoSo as a general purpose social platform, which allow users to attain individual and/or collective purposive action goals through access to social resources embedded in mobile social networks. In this manner, MoSoSo plays an enabling role and has an emancipatory function for digital communities because it provides, through community-generated services (CGS), an increased capability to drive change. By emphasizing grassroots social action, MoSoSo enhances the resilience of individual lives, societies and businesses, which can withstand periods of transformation thanks to a stronger network-based civil society consisting of interconnected self-organizing digital communities. Ultimately, the key role of MoSoSo consists in exploiting digital convergence for the realization of sustainable futures. This goal does not rely only on its conceptualization and design model, but also on how a set of principles of digital community design will be followed and support policies agreed by all relevant stakeholders.

Keywords: digital community, mobile social software (MoSoSo), mobile social network, digital convergence, social computing, conceptual analysis, design thinking

ACM Categories: H.1.2 USER/MACHINE SYSTEMS – H.4.3 COMMUNICATIONS APPLICATIONS - H.5.3 GROUP AND ORGANIZATION INTERFACES - K.4 COMPUTERS AND SOCIETY

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## PREFACE

This thesis is the result of an individual research project on the social aspects of MoSoSo. The research started in June 2005 within the Human Dimensions Research Group of the University of Jyväskylä and was carried out at the Sonera Information Society Unit (SISU) of TeliaSonera Finland until December 2008. Since then, the research has been conducted at the Helsinki Institute of Information Technology (HIIT). The orientation of the first two institutions influenced the approach to the study: Jyväskylä is known to be a "*human technology*" city, welcoming innovative uses of ICT in everyday life, while SISU followed the development of the Finnish Information Society by underlining the need of developing citizens' communication capabilities. The *trait d'union* between the two institutions can be found in the centrality and complexity of the human being as an individual and as a social actor. In the era of digital convergence, developing technology for human use is about identifying the opportunities and challenges of its products, such as MoSoSo.

The study continues a personal path started in 2002 with my Master's thesis in computer science, although its theme is rather different. In my previous work, I compared the Finnish and Italian implementations of their ICT strategies in education in the context of the eEurope action plan of the European Union. The findings of that study, which was partly conducted in Italy and partly in Finland, suggest that ensuring access to ICT is not sufficient to contribute to the success of an education system. For the achievement of learning objectives, human, social and cultural aspects are as important as technological ones. Hence, such knowledge needs to be part of the policy-making and design process of educational technologies.

To answer to the new questions raised by my Master's thesis, I started investigating how to enhance the design of Computer-Supported Collaborative Learning (CSCL) tools at the CoSCo-Edutech research group at HIIT in 2003/04. The discovery of context-aware computing was particularly important in influencing my interests towards personalization of online collaborative environments. The initial interest for understanding the theoretical basis of context-aware applications for CSCL slightly changed focus when I joined TeliaSonera in September 2004. I became interested in mobile social networking services. In that period, the terms *Web 2.0* and *mobile social software* (*MoSoSo*) were about to be coined, and online social networking was rapidly emerging.

Thanks to a lucky coincidence, the objective of my research path – understanding how to enhance the design of mobile social applications in their human and technological aspects – timely coincided with academic and commercial needs. Without this convergence of personal and collective interests, this thesis would not have been published.

Helsinki, May 2010

Giuseppe Lugano

## LIST OF ACRONYMS USED IN THE STUDY

| | |
|---|---|
| 3G | Third-generation mobile networks |
| C&C | Computer&Communications |
| CBG | Community-based groupware |
| CGS | Community-Generated Services |
| CMC | Computer-Mediated Communication |
| CSCL | Computer-Supported Collaborative Learning |
| CSCW | Computer-Supported Cooperative Work |
| F2F | Face-to-face |
| GNP | Gross National Product |
| HAI | Human-Agent Interaction |
| HCI | Human-Computer Interaction |
| HTML | HyperText Markup Language |
| HTTP | HyperText Transfer Protocol |
| ICT | Information and Communication Technology |
| IM | Instant Messaging |
| IP | Internet Protocol |
| MACL | Mobile Access Control List |
| MIT | Massachusetts Institute of Technology |
| MMC | Mobile-mediated communication |
| MMORPG | Massive Multiplayer Online Role Playing Game |
| MMS | Multimedia Messaging Service |
| MoSoSe | Mobile Social Service |
| MoSoSo | Mobile Social Software |
| MUD | Multi-User Dungeon |
| NAB | Network Address-Book |
| P2P | Peer-to-peer |
| PC | Personal computer |
| PDA | Personal Digital Assistant |
| PIM | Personal Information Manager |
| QR code | Quick Response code |
| RFID | Radio-Frequency IDentity tag |
| SIM | Subscribed Identity Module |
| SMS | Short Messaging Service |
| SNA | Social Network Analysis |
| SNS | Social Network Sites |
| TCP/IP | Transmission Control Protocol / Internet Protocol |
| UGC | User-Generated Content |
| WWW | World Wide Web |

# 1 INTRODUCTION

We all are designers of our everyday life. Even if this statement may sound surprising, it just reminds us that man is the artificer of his own future. In every historical period, humans have creatively designed tools for satisfying their everyday needs. Quicker and easier solutions to existing problems typically lead to the appearance of new challenges to tackle, to a continuous reformulation of problems and solutions. In the information age, the role that technologies like mobile social software (MoSoSo), play in our everyday life is not an obvious target to analyze. This is mostly due to the complex patterns and dynamics connected to the creation, development and adoption of any new technology. With the help of conceptual analysis, this study will explore the role of MoSoSo in the multifaceted scenario of digital convergence. By adopting design thinking, the current shortcomings of MoSoSo will be addressed here and a holistic design model introduced. The goal is to allow users to interconnect and self-organize in digital communities to exploit converged digital networks and be, more than ever, the creative and responsible "designers" of their futures.

## 1.1 The problem of "designing" communities

This study covers the theme of digital community design from the perspective of MoSoSo, an emerging paradigm of mobile technology, and within the broader context of digital convergence.

A study about the design of communities may appear counterintuitive, as the term *design* is typically connected to the methods and tools used to improve existing technology or to create and develop new technology. With the information age, social structures and dynamics are increasingly influenced by the use of information and communication technologies (ICT) in everyday situations. Being socio-technical systems, communities can be therefore designed and explored from the viewpoint of their technological enablers, such as MoSoSo.

The objective of this study is not much to evaluate the kinds of communities that can be designed with existing MoSoSo; rather, its aim is to discuss the new forms of community i.e. *digital communities*, which an alternative approach to MoSoSo could enable, and their significance in people's lives and in the functioning of global information societies. Digital communities are currently gaining momentum thanks to widespread and cheap access to Internet, which can flexibly operate as a general purpose social platform. This trend can be illustrated with a recent example, which also demonstrates the meaning of digital communities.

In April 2010, an Icelandic volcano, Eyjafjallajokull, violently erupted, causing an enormous ash cloud that quickly spread around Europe. As ash is dangerous for airplane engines, all departures from a large number of European airports were cancelled for about a week. This exceptional situation had two main consequences: it damaged the economy with a daily loss of about 250 million euros and prevented thousands of passengers from completing their journeys. Because of the sudden disruption and highly uncertain situation not allowing long-term planning, passengers started to self-organize in an ad-hoc manner for accomplishing their goals. As they could not rely anymore on the air transport service infrastructure, they investigated alternatives for completing their journeys. Even if slower than airplanes, car, train, coach and ferry services in those circumstances become precious but scarce resources. As such, access to these means of transport became almost unobtainable and speculations on bus tickets were reported. When a resource becomes suddenly scarce and expensive, people typically fight for gaining exclusive access to it or, if possible, agree to share it with others in need. Instead of competing, many passengers understood that self-organizing in small groups would have increased their chances of being able to complete their travel in a reasonable time and at a decent cost. Mobile devices assumed a key role in creating ad-hoc social groups of passengers in need to reach the same destination: through those devices, online social networking sites (SNS) such as Facebook were used as a means to plan, organize and act. The slogan of Carpool Europe, one of Facebook's groups, clearly explains the nature of the service:

> "Are you stuck in Europe? In wait for the ash to settle, share a ride with other Europeans. The ash cloud from Iceland is stopping flights in Europe. Use this page to hitch a ride or offer a ride with your car. Write where you're at and where you're going. A service from the Swedish carpool movement "Skjutsgruppen" (http://www.facebook.com/carpooleurope)

Similarly to Carpool Europe, which was joined by thousands of travelers, RoadtoShare exploited Facebook to offer a "*free carpooling, car sharing, hitchhiking, autostop service for Facebook users*" (http://apps.facebook.com/roadtoshare). Passengers who self-organize through Facebook to achieve their objective of reaching a common destination are an example of digital communities.

In the last few years, ICT in general and mobiles in particular were often used in a similar manner in different contexts: for instance, in 2001 Filipinos used the Short Message Service (SMS) for political protest to mobilize against

President Estrada, who was forced to resign. Rheingold (2002) coined the term *smartmobs* to describe the new 'smart' forms of ICT-enabled self-organizing social structures. Similarly, *flashmobs* refer to an apparently spontaneous gathering of people who perform an unusual action for a short time in a public place (Mc Fedries, 2003; Marchbank, 2004; Kluitenberg, 2006).

The social function of ICT is central in the idea of *Web 2.0* (O'Reilly, 2005), known also as *social web* (Gruber, 2008), applications running on social software that turn the Internet into as an easy-to-use, pleasant and even addictive platform for social networking. The Web 2.0 upgrades the World Wide Web (WWW), or simply Web, a technological innovation firmly rooted in the vision of a general purpose social platform "*encompassing the decentralized, organic growth of ideas, technology and society*" (Berners-Lee, 1999, p.1) by means of creation of "*a single, global information space*" (p.4).

One of the most recent innovations of the Web 2.0 is Twitter (Mc Fedries, 2007; Java et al., 2007), a social networking tool based on the public sharing of a short message of text – 140 characters, through a user profile. Each message is called *tweet*. Contrarily to SMS, however, tweets are publicly accessible through a search engine; by exploiting the many-to-many communication model, they are sent by all users to all the Twitter community. To filter and navigate content, Twitter users typically subscribe, or follow, the social information feeds of other users. Although the instant and viral nature of Twitter has been promoted for its marketing potential (Comm et al., 2009), its most profound meaning seems to be connected with its ability to satisfy time-critical information needs. During 2008 Twitter has been used to instantly report the effects of the terrorist attacks in Mumbai, India, and to document the experience during the US presidential elections (Hughes & Palen, 2009). In 2009, it was used to overcome the measures of governmental repression that followed citizens' protests for the re-election of the Iranian president Ahmadinejad (Morozon, 2009). Citizens' instant documentation of the evolution of the situation were not only useful for an internal coordination of the protest, but also to provide the external world with an alternative account than that offered by the Iranian media. Many similar stories are frequently reported by the media. They indicate the economic, political and socio-cultural significance of mobile and Internet services. Bringing them together in a converged digital environment, MoSoSo may further emphasize the significance of digital communities in information societies.

A relevant theoretical question concerns in which way digital communities differ from traditional communities. To fully understand this aspect, it is useful to compare the digital communities to the classic traits of community, depicted in an ideal and somehow romantic way by Bauman (2001, p.2):

> "Community is a 'warm' place, a cosy and comfortable place. It is like a roof under which we shelter in heavy rain, like a fireplace at which we warm our hands on a frosty day. Out there, in the street, all sorts of dangers lie in ambush; we have to be alert when we go out, watch whom we are talking to and who talks to us, be on the look-out every minute. In here, in the community, we can relax – we are safe. […] In a community, we all understand each other well. […] We are never strangers to each other. […] In a community we can count on each other's good will. If we stumble and fall, others will help us to stand on our feet again".

In reality, communities have never been an idyllic place, but also presented several 'dark sides': Putnam (2000) argued that the benefits brought to a certain group by *social capital* (i.e. high levels of generalized trust, social norms and networks) can be considered as disadvantageous by others. There is no general rule to produce a "positive" social capital, because its action depends very much on the context. Social capital therefore connects like-minded communities and disconnects communities grounded on different values. In addition, social capital also creates unintended side-effects within a cohesive community, such as exclusion of outsiders, group members' excessive ambitions, limits to individual freedom and norms oriented towards the low end (Portes, 1998).

From a social capital viewpoint, digital communities do not differ much from traditional communities because ICT can be equally useful to attain morally positive or negative objectives. The new features of digital communities are mostly connected to the meaning of social ties and social relationships. Traditionally, community ties were associated to family or kin relationships. From the egocentric angle of *personal communities* (Wellman, 1982 and 1996; Wellman et al., 1988), one's set of interpersonal social ties, also friends are important. In this study, community is not strictly conceived in terms of family or kin, but rather described through the concept of *tie strength*. Granovetter (1973) defined as a "*combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and the reciprocal services which characterize the tie*" (p.1361). In this respect, he proposed a three-tier classification of tie strength including strong ties, weak ties and absent ties. Strong ties are generally connected to family and friends relationships, while weak ties to acquaintances, work colleagues and association members. Within absent ties are included both "*the lack of any relationship and ties without substantial significance*" (p.1361). Hence, this category include people that are strangers to us or with whom we interact but without any feeling of common bond. As illustrated by Bauman's description (2001), communities have typically been associated to strong ties. However, weak ties have become important in communities of practice (Wenger, 1998) and personal communities (Wellman, 1982 and 1996; Wellman et al., 1988). In particular, weak ties have a special role in attaining personal goals, such as find a job (Granovetter, 1974). With digital convergence also *latent ties*, a type of absent ties that refers to "*social ties that exist technically, but that have not been activated*" (Haythornthwaite, 2002), may assume an increasing importance. Latent ties can be activated into weak ties through ICT, for instance by exploiting the principle of *homophily* (Lazarsfeld & Merton, 1954), our natural inclination to establish social bonds with similar or like-minded others. By discovering similarity patterns in user profiles, ICT might provide an opportunity to connect with people we do not know yet, but we should probably know. The discovery of *heterophily* (Rogers & Bhowmik, 1970; Lin, 2001) patterns could also be useful for activating latent ties between different but compatible individuals (e.g. who have, for instance, complementary skills for a learning task).

Referring to the case of passengers self-organizing through Facebook, the common destination of their journeys represents a suitable homophily pattern

to use for activating latent ties. Hence, latent ties are particularly important in digital communities, whose lifecycle can be much shorter than that of traditional communities: in fact, social ties are quickly created around a shared interest or need, and they typically dissolve once the common goal has been achieved. As the case of airport passengers shows, the creation of social ties can easily take place among strangers who recognize a mutual benefit in connecting and acting together. It is worth noting that without mobile devices it would not have been possible to self-organize in such an effective way. However, without access to Facebook, which acted as an indispensable intermediary, mobile devices would not have been able to act as a self-organizing platform.

The way digital communities are structured and experienced therefore depends on the interplay between the underlying technological infrastructure and the social processes developed on the top of it. This theme has the focus of computer-mediated communication (CMC), a research domain inspired by the vision of a computer not just as an information processing tool, but also as a communication device (Licklider & Taylor, 1968). Technological advances and pioneering work in CMC (Hiltz & Turoff, 1978) allowed, already in the late seventies, the transition from personal to social computing (Rauterberg, 2006). Social computing represents a turning point for the history of ICT, because it shifts the attention from socio-technical systems consisting of *single user – single computer* systems to more complex *networked users – networked computers* systems. The use of computers as communication devices connected computing and community as research domains. In the sixties, hackers (Levy, 1984; Jordan & Taylor, 1998; Himanen, 2001), a homogeneous group of technically skilled users, emerged as the pioneers of computer networks. However, until the eighties, the use of computer networks was common only in organizations to support task-efficency and team work. In the nineties, personal computer (PC) and Internet access became common in households in Western societies. Their everyday use widened the scope of CMC beyond organizational contexts and emphasized unstructured informal social interactions based on shared interests.

As the Internet penetration grew, a multitude of sub-cultures and interests made users spontaneously create and develop communities in cyberspace, known also as *virtual communities* (Rheingold, 1993; Jones, 1995 and 1998; Smith & Kollock, 1999; Wellman & Gulia, 1999) or *online communities* (Preece, 2000). However, social computing is not only about community, as it "*describes any type of computing application in which software serves as an intermediary or a focus for a social relation*" (Schuler, 1994b, p.29). Characterizing social computing as a research approach, Wang et al. (2007) observed that "*social computing is a cross-disciplinary research and application field with theoretical underpinnings including both computational and social sciences*" (Figure 1). Although social computing has multiple theoretical underpinnings, it is commonly presented as a paradigm of Human Computer Interaction (HCI). Social computing is a relatively young research domain, which cannot be easily distinguished from other closely related areas emerged in the same period. In the mid-nineties, Kling (1999) and

colleagues developed the field of *social informatics*, originally labeled as "*social analysis of computing*" and "*social impacts of computing*" (Kling, 1999).

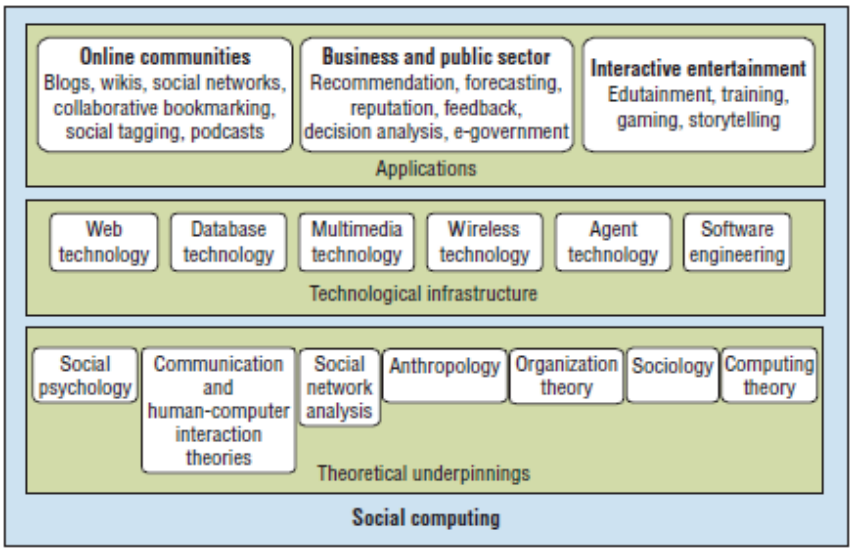


FIGURE 1 Social computing, research and application field (Wang et al., 2007)

In contrast with social computing and social informatics, which share a general interest for the social aspects of ICT use, *community informatics* (Gurstein, 2000) specifically focuses on more specific issues of creation and development of communities through ICT. More recently, *cultural computing* has been introduced as a new computing paradigm aiming at modeling and integrating cultural determinants in ICT. In this manner, social interactions are experienced in a way that embeds the core aspects of users' culture (Tosa et al., 2005; Rauterberg, 2006; Kooijmans & Rauterberg, 2007; Wang, 2009). Less known, but significant are other sub-areas of social computing. These include *mobile social computing* (Dryer et al., 1999; Borcea et al., 2008) and *ubiquitous social computing* (Motahari et al., 2007), which focus on interactions in mobile contexts.

Digital convergence represents a new turning point for social computing and communities: before digital convergence, the boundaries of one's social world were clearly delimited by interactions with real *'offline' communities* or with virtual *'online' communities*. In this context, mobile communication was clearly complementary to face-to-face (F2F) interactions in two main ways: it increased the operating range of offline communities by making them 'mobile' through interactions at distance and it facilitated or acted as substitute of F2F contact in local community interactions.

Mobile communication assumes new meanings thanks to the technological advances of digital convergence. Firstly, the Internet can no longer be associated only to networked PCs in static contexts, such as homes or offices. In fact, the technological advances of digital convergence have made PCs smaller and portable (e.g. laptops), thus suitable to be used in mobile contexts, such as in

trains or planes. Secondly, similarly to computers, also mobile phones have evolved much since the early versions, in which they merely represented wireless versions of landline phones. Indeed, mobile devices became portable multimedia computers or, more simply, mobile computers. The technological distance from the early versions of mobile phones is even reflected by the search for more appropriate terms for the new tool, which is often referred to as *smartphone* (Livingston, 2004; Iftode et al., 2004; Abowd et al., 2005; Raento et al., 2005 and 2009; Ballagas et al., 2006). Thirdly, all devices are increasingly acquiring computational capabilities and becoming interconnected, characteristics that are likely to materialize in the near future in the visions of ubiquitous computing (Weiser, 1991) and the Internet of things (Gershenfeld et al., 2004; ITU, 2005).

The novelties introduced by digital convergence made the social computing landscape more complex to understand by softening the boundaries between the offline, online and mobile dimensions of community interaction. Investigating the social impact of a single digital communication environment represents a unique opportunity for understanding and explaining the new shapes, meanings and ways to interact with communities.

Digital convergence is increasingly affecting our everyday life, but our understanding of its social effects has not progressed as quickly as the development of its technological foundations. It is widely recognized that the importance and convenience of having instant access to one's social networks is the main social benefit of digital convergence. However, this central need is not sufficiently addressed and understood by the research community and is under-utilized by the user community. The limited adoption of MoSoSo can be explained by many concurrent factors, such as the relatively low diffusion and high costs of smartphones, the high costs of mobile data rates, the widening of technological fragmentation of the mobile handsets market, the persistence of complex user interfaces and lack of awareness on the value that MoSoSo would add to people's lives. Indeed, the large majority of users still consider only phone calls and the SMS as the essential applications of mobile communication.

Successfully addressing all the above problems is essential, but it may be not sufficient to realize the potential of MoSoSo. A less known but nonetheless significant problem concerns the lack of a comprehensive conceptual framework for designing MoSoSo. Neither design researchers nor users have a clear understanding of what MoSoSo actually is. The success of online social networking sites and the spreading of mobile Internet access intuitively connects MoSoSo to mobile access to SNS. This answer is partially true, as these applications certainly are MoSoSo but represent only one of its shapes, and not the ones with most potential. With these premises, the main research problem investigated by this study can be explicitly stated: "*what is the role of mobile social software in the complex scenario of digital convergence?*"

The case of the airline passengers who could not rely anymore on a service infrastructure whose availability was earlier given for granted provides an intuition of the role of MoSoSo in the complex scenario of digital convergence. Indeed, MoSoSo enables new forms of social communication integrating Inter-

net content, social networks and contextual needs. Assuming that people will be ensured access to MoSoSo and have the necessary skills and motivation to use it, much of the usefulness of MoSoSo will result from the way it is conceptualized for "designing" digital communities. By investigating the multitude of technical and social issues of MoSoSo, it will be clear that the way digital communities are created, developed and dissolved highly depends on the interplay between human and technological factors.

This study, backed by conceptual analysis (Saariluoma, 1997) and design thinking (Simon, 1969; Saariluoma, 2004 and 2005a; Anderson & Kolko, 2010b), introduces an alternative conceptualization and holistic design model of MoSoSo based on a multifaceted notion of digital convergence and evolutionary view of community. This deductive approach may disappoint those expecting an empirical investigation, which is typically adopted for assigning meaning to new technologies. Instead, the challenges of MoSoSo design are here discussed from the more theoretical perspective of community evolution moving from a strict separation of the offline, online and mobile dimensions of social interaction to the more integrated realm of the *hybrid space* (de Sousa e Silva, 2006; Rheingold et al., 2006; Crabtree & Rodden, 2008; Bilandzic et al, 2009). To underline that hybrid spaces are social spaces, throughout the study the terms hybrid space and *hybrid social space* will be used interchangeably. Mobile devices are the focal point of interaction in the hybrid space: "*hybrid spaces arise when virtual communities (chats, MUDs, and MMORPGs) previously enacted in what was conceptualized as cyberspace, migrate to physical spaces due to the use of mobile technologies interfaces*" (p.261). The conceptual approach adopted in this study is a key complement of empirical research. Anderson and Kolko (2010a) recently argued that a much more theoretical approach to design is required when moving from the tangible to the intangible. Combining social structure and dynamics with computing, digital communities represent a fascinating and challenging domain of investigation that, in order to progress, requires exploratory approaches like the one presented in this study.

The conceptual approach to the study is also reflected in the evaluation of the suggested design model of MoSoSo. Indeed, the discussion does not focus on the usability of MoSoSo, but rather on its potential utility. The notion of *utility* is captured with the idea of *digital resources* that can be defined as symbolic goods with a value. The concept of resource was preferred to that of content because the former is connected to the theories of capital (Bourdieu, 1986; Coleman, 1988; Portes, 1998; Burt, 2000; Lin, 2001), which also offer an insight on how to develop a sociological theory of digital communities (Chapter 10).

The study adopts a resource-based approach to MoSoSo interaction (Chapter 7 & 8): indeed, user profiles and mobile social networks, the two structural building blocks of the design model, are defined in terms of *digital resources*. The idea of digital resource is expressed in this study through a number of synonyms, such as *informational resources*, *symbolic resources* or *digital content*. Although informational and symbolic resources may also be non-digital, in digital communities their meaning is strictly connected to the bits of information

that represents the 'DNA' of their digital nature. Digital resources are either personal or social, depending on the type of ownership and number of people who are granted some degree of control on the resource. Through digital sharing, personal resources can be shared and thus transformed into social resources. In this manner, mobile social networking is about *creating, sharing and using* digital resources in contextual interaction. In MoSoSo interactions, digital resources act as *social signifiers*, "*some sort of indicator, some signal in the physical or social world that can be interpreted meaningfully*" (Norman, 2008 p.18). Digital resources like location, status messages, photos and video-clips are given meanings and influence user's choices, attitudes and behaviors. This conceptual model allows grounding the notion of digital community on the idea of digital sharing. As it has always been, in the era of digital convergence community is still about sharing. To design communities, however, people do not share anymore a physical territory or a solidal social tie, but rather digital resources. As an entry-point for community, digital resources allow both an easy activation of latent ties and a more effective maintainance of long-lasting social ties.

As the story of the Icelandic volcano demonstrates, MoSoSo is particularly useful in case of disruptions and crises because it allows people self-organizing in digital communities and act together to solve a common problem. Instead of representing yet another access point to existing public and commercial services, MoSoSo could act as a general purpose social platform for co-creating community-oriented services, i.e. community-generated services (CGS). In other words, MoSoSo would not simply allow accessing existing social networks, but also creating new ad-hc social ties in real time and on the basis of contextual needs. Participating to a digital community enhances one's possibility to achieve a purposeful action by providing access to a pool of shared resources. From this angle, MoSoSo acts as an emancipatory tool for grassroots and decentralized social change by allowing citizens and communities to influence their future in the direction they wish. From a wider angle, MoSoSo and converged digital networks could therefore provide an effective means for actively participating to the shift towards sustainable information societies. In this context, *resilience* is an important property. Originally used in physics, resilience is now a central keyword of sustainability research. Reivich & Shatté (2002) defined resilience as "*the ability to persevere and adapt when things go awry…to overcome obstacles…to steer through adversities, to bounce from major setbacks and reach out to broaden your world*" (p.1). The realization of sustainable futures cannot rely only on traditional top-down approaches, but it depends also on the way digital communities will be enabled and supported in rendering global societies more resilient to disruptions and crises. In this, MoSoSo may play an essential role.

## 1.2 Research objectives

The study has two primary objectives, namely developing an articulated conceptualization and a holistic design model of MoSoSo. It sets also a secondary

but nevertheless important objective: the discussion of *policy convergence*, a set of support policies required to render MoSoSo as a general purpose platform for social change and to realize the full value of digital convergence.

In regard to conceptualization, MoSoSo is conceived as a technological product of digital convergence. To understand its human and social significance, digital convergence is not regarded simply as a synonym of technological convergence, but as a more complex phenomenon that affects all dimensions of everyday life. For the scope of the study, the interplay between the technological and social dimensions of digital convergence is analyzed. On one hand, MoSoSo represents the technological dimension. On the other, digital communities emerge as social product of MoSoSo interactions. Although communities may be conceptualized in several manners, the network analytic approach (Wellman, 1979, 1982, 1988, 2001a; Wellman et al., 1988; Wellman et al., 2002) seems the most suitable to interpret the individualized nature of contemporary information societies. Digital communities extend the model of personal communities by including new types of relations (i.e. latent ties), forms of interaction (i.e. ad-hoc ties) and scales of communication (i.e. many-to-many). From a MoSoSo viewpoint, digital community interaction is structured, perceived and experienced as mobile social networking activity. Concluding, the social foundations of MoSoSo are connected to central concepts of social theory, such as community and social networks.

To develop a holistic design model, MoSoSo is framed within social computing. As its most recent trend, one key task is to illustrate the relationships between MoSoSo and the existing paradigms of social computing – *groupware* and *social software*. This contribution serves for developing a taxonomy of social computing paradigms that regards all paradigms as complementary to each other. An interdisciplinary approach is useful to unify the academic research of groupware with the more business-oriented approaches to social software. In this way, MoSoSo research can be developed coherently within social computing. At a more technical level, MoSoSo is conceived as a context-aware technology focusing on social context. The goal of the study is to argue that the design model of MoSoSo can be reduced to three main elements, namely the user profile, the mobile social network and social algorithms, which are protocols for contextual social interaction. The key concept of resource is used to ground the definitions of user profile and mobile social network on the prototypical activity of digital sharing. For tackling the key challenges of MoSoSo design (Chapter 5), the analysis will show the central role played by mobile communication data logs, sensor data and mobile usage patterns in contextual social interaction. Through this data, it is possible to derive quantitative measures of human cognitive and social processes, which are used to personalize and to enhance interaction in various ways. For instance, Article III discusses how such user behavioral and social network data can be used to match people by homophily or heterophily, while Article V presents their usefulness for the support of user's decision in digital sharing. Although the formal methods and algorithms have been discussed only at a superficial level, this insight connects MoSoSo and so-

cial computing to several strands of research, such as social network analysis (SNA), user modeling, data mining, probabilistic modeling and machine learning. Concluding, the holistic design model, to be evaluated with empirical studies in future research, demonstrates that MoSoso design requires an interdisciplinary approach in networks to effectively combine technological and social knowledge.

An additional form of convergence, policy convergence, is a theme useful in evaluating the function of the suggested conceptualization and design model of MoSoso in people's lives and in the evolution of large-scale social structures. The role of MoSoSo is connected to the function that digital communities should assume in the transition towards sustainable information societies. A key challenge of the study is to demonstrate that policy convercenge is necessary to realize the true potential of MoSoSo. Through MoSoSo, citizens and communities can find quick, easy and cheap ways to solve their everyday needs by means of access, co-creation and provision of CGS. At a more general level, investing in CGS could provide a way to reduce the high costs of welfare states, to realize innovations and to enable a participatory and inclusive information society. These functions that MoSoSo assume at micro and macro level allow conceiving MoSoSo as an emancipatory platform of self-organization and grassroots social change. All research objectives – conceptualization, design model and policy convergence, are addressed in the articles (Chapter 6). The broader goal of the summary is to build a theoretical framework for an academic dissertation and to summarize its main results. In addition, it also contains a contribution not present in the articles, namely the detailed discussion of the key terms digital convergence and digital community.

## 1.3 Outline of the study

The study consists of twelve chapters, which gradually illustrate the main research problem, address its salient aspects and consider the possible implications. The introduction presents MoSoSo as the main object of investigation, framing it in the context of social computing and connecting it with the sociological concept of *community*. Then, the research question is introduced, anticipating the approach and some of the findings of the study.

Chapter 2 describes the methodological aspects of the study. Conceptual analysis (Saariluoma, 1997) and design thinking (Simon, 1969; Saariluoma, 2004 and 2005a; Anderson & Kolko, 2010b) were applied to address the two main objectives of the study, namely introducing a comprehensive conceptualization of MoSoSo and drawing up a design model for it. The section also presents the motivations for some of the choices made in the study and discusses the significance of the two datasets that were used.

Chapter 3 begins by illustrating the multifaceted process of digital convergence, which represents the background of the study. In this section, it is suggested that the focus should be on the social aspects of digital convergence,

which is a young and significant research area presenting several issues that have not yet been clearly understood and investigated.

Chapters 4 and 5 respectively contain a detailed review of the research on community and of MoSoSo, the two main keywords of the study. In Chapter 4, a historical approach is adopted to illustrate the theoretical advances on community and the models that have been suggested. In particular, the notions of local community, personal community and digital community are presented as key paradigms explaining the shift from agrarian to industrial society and the successive transformation to information society. Chapter 5 contains a detailed review of MoSoSo. First, its origins are discussed, analyzing the relationship between MoSoSo, groupware and social software and underlining the significance and the current immaturity of MoSoSo as research domain. Then, several technical and social aspects of MoSoSo are presented, emphasizing the diverging trends and shortcomings that currently characterize MoSoSo.

Chapter 6 presents an overview of the findings of the articles in relation to the research objectives. The chapter also contains a summary of each article. In Chapter 7 MoSoSo is reconceptualized, by applying conceptual analysis to it. MoSoSo research is framed within social computing and its social roots can be traced to mobile social networks. In Chapter 8, the new conceptualization of MoSoSo is used to derive a holistic design model grounded on three main building blocks: user profile, mobile social network and social algorithms. The suggested model is also discussed in relation to some of the key challenges of MoSoSo, namely privacy, social information overload and social dilemmas. The necessary support policies for a widespread adoption of MoSoSo are discussed in Chapter 9. In this context, the success of MoSoSo is connected to the realization of the goal *sustainable lives in sustainable societies*.

Chapter 10 and 11 describe the implications of the findings from the viewpoint of digital community design and CGS. Chapter 10 presents MoSoSo as an enabler of digital communities and evaluates it from the perspective of digital community design. Its key trade-off is recognized as its capability of exploiting potential while alleviating risks. Then, possible solutions to the key issues identified in the MoSoSo review are discussed as design principles of digital community design. Chapter 11 develops the study's central claim, according to which MoSoSo has an enabling role and an emancipatory function for digital communities through CGS. This claim highlights the importance of developing technological platforms, which enable creation and development of community-oriented services. CGS are useful in illustrating the significance of MoSoSo in individual lives (i.e. achieving one’s life objectives) and in the wider context of societal development and economic growth.

Chapter 12 ends the study by presenting the main contributions of the study, which add to the existing knowledge on MoSoSo. The chapter also discusses the limitations of the study and introduces an agenda for developing the emerging field of MoSoSo research. Among the directions for future research, theoretical and practical directions are presented, with a special mention of the challenge and opportunity to design MoSoSo for social capital (Lin, 2001).

# 2 RESEARCH APPROACH

The previous chapter introduced MoSoSo as the main theme of the study and set as research problem the challenge of understanding its social significance in the complex scenario of digital convergence. This chapter tackles the methodological aspects related to the approach to the research problem. The lack of a suitable conceptual framework is recognized as the main cause behind the current shortcomings of MoSoSo. Two interrelated objectives are illustrated, namely to derive a conceptualization and to develop a design model of MoSoSo. In order to enhance the design of MoSoSo, it is first necessary to articulate a comprehensive conceptualization. For this primary objective, conceptual analysis is presented as a suitable approach, while design thinking is adopted for developing the design model of MoSoSo. The chapter begins by discussing, on a general level, how conceptual analysis and design thinking were applied to pursue these objectives. Next, the choices involved in the conceptualization of MoSoSo at technological, social and business level are discussed. Finally, the two datasets used in the study are described, illustrating how they supported the design thinking process.

## 2.1 Deductive approach to the research problem

This section presents the general structure of the study by introducing the two methods chosen for conceptualizing and developing a design model for MoSoSo, namely conceptual analysis and design thinking.

As illustrated by the review (Chapter 5), MoSoSo is still an immature technology, rapidly evolving and without a clear research domain. Approaches to MoSoSo design are generally grounded on theories and models of HCI. These typically adopt an inductive approach aiming at explaining the properties of phenomena from a set of empirical findings. Broader generalizations and evaluations of the social impact of MoSoSo have not been possible; indeed, the findings of such studies are generally valid only for the specific instance of Mo-

SoSo under scrutiny and for a specific type of audience. Looked at from another angle, the actual limitation of MoSoSo research is not so much due to the over-specificity of its small-scale studies, but rather to the lack of a common conceptual framework that would allow combining the findings of all types of studies and developing a coherent view of MoSoSo as a whole.

The present study aims at filling the current gap of MoSoSo research by adopting a deductive approach grounded on a very general and abstract view of MoSoSo, which is independent of the technology needed for implementing it. Because of this choice, the analysis of existing MoSoSo applications is only the starting point of the investigation, which aims at highlighting the main technical and social issues to address in the general model. For MoSoSo, these issues include, for instance, identity expression, privacy management and social information overload. By adopting a network perspective, all these issues can be addressed together through the concept of *mobile social networks*. By connecting the definition of MoSoSo to mobile social networks, it is possible to build a network-based design model (Chapter 8) of MoSoSo.

Deductive reasoning is far from being perfect, though; because of its high dependency on its basic concepts and definitions, the general model derived with a deductive approach can be seriously challenged if flaws are discovered in its postulates. As Saariluoma (1997) observed, concepts are useful because they "*organize the world for us, but the reality is always more complex than any definitions. Even the most basic concepts of cognitive psychology such as perception and memory appear to be problematic*" (p.58). Although any definition is limited, this should not discourage us from adopting a deductive approach to the analysis of social phenomena. In addition to MoSoSo, this study also problematizes the notions of digital convergence (Chapter 3) and community (Chapter 4) in the development of the general model of MoSoSo (Chapter 8) and explains their possible role in enabling sustainable lives and sustainable societies (Chapter 10).

Another problematic aspect of deductive reasoning concerns its high level of abstraction, which for technological concepts like MoSoSo increases the difficulty of realizing its theoretical benefits in practice. To bridge theory and practice, the study provides a set of supporting policies that various stakeholders need to consider when attempting to realize the potential of MoSoSo.

Therefore, in this study MoSoSo is first conceptualized through a conceptual/analytic approach (Saariluoma, 1997) based on a critical elaboration of secondary research. The outcome of this phase serves as the basis to develop a holistic design model for MoSoSo by applying the principles of design thinking (Simon, 1969; Saariluoma, 2004 and 2005a; Anderson & Kolko, 2010b). Finally, to bridge theory and practice, a number of support policies inspired by a future-oriented realistic view about sustainable lives and sustainable information societies (Viherä, 1999) are discussed.

In conclusion, conceptualizing MoSoSo, designing MoSoSo and realizing a policy convergence represent the three main objectives of the study.

## 2.2 Conceptual analysis

The study adopted conceptual analysis (Saariluoma, 1997) as a tool to develop an articulated conceptualization of MoSoSo based on secondary research (e.g. selection of relevant literature). With its help we can trace the historical origins and to evaluate the current approaches to MoSoSo design (Article I).

When developing a concept, three actions are crucial: defining it, describing its content and explaining its use (Saariluoma, 1997).

Defining MoSoSo already represented a challenge because of the unclear distinction between the various paradigms of social computing like groupware and social software. In addition, it was not easy to decide whether the definition of MoSoSo needed to emerge from the characteristics that MoSoSo has or from the ones that it should have. A syntactic analysis of its keywords reveals that MoSoSo is basically a kind of software used on mobile devices for social purposes. Hence, the task of conceptualizing MoSoSo requires dealing with its technological and social aspects both.

Concerning the social foundations of MoSoSo, the two main alternatives are the concept of *social group*, which is at the core of the groupware paradigm, and the concept of *social network*, which has characterized the studies on social software. A third concept, *community*, is often linked to studies on groupware and especially on social software, which often connects online social networking activity to the creation and development of virtual communities and online communities. Alternatively, the general concept of social space in networked digital environments (Taipale, 2009) could have been employed as a social basis of MoSoSo. Another possibility, which has been adopted in some studies of MoSoSo, was to avoid having to deal with complex and sometimes controversial sociological concepts. This could be done by privileging the dimension of design, for instance by using the information-based perspective of *information grounds* adopted by Counts & Fisher (2008).

My choice has been to ground MoSoSo on the network concept as described in social network analysis (Wasserman & Faust, 1994; Scott, 2000), which allows describing groups and communities in structural terms as different configurations of the social space. This choice corrects one of the main shortcomings in MoSoSo research, which acknowledges the centrality of the network paradigm in MoSoSo without property applying its principles to design. To fill this gap, a network-oriented definition of MoSoSo was developed (Chapter 7) by adapting Shirky's definition of social software (2003).

In regard to content, MoSoSo may be conceptualized as a product or as a service. Although this aspect would have deserved a wider discussion in the articles, the position adopted here regards MoSoSo as a technological platform enabling social-network based services.

As far as its use in contexts is concerned, the conceptual framework of *classes of mobile relationships* (Marti, 2002) has been employed for evaluating the current approaches to MoSoSo and its role in mobile-mediated social interac-

tions. This framework is particularly suitable, because it allows describing three levels of MoSoSo interactions: the subjective level is based on the user-device interaction and focuses on the reflexive relationship of the user with the self. In other words, this form of MoSoSo interaction stimulates awareness of and develops one's self concept. As the self concept involves cultural aspects, this perspective is closely related to cultural computing (Kooijmans & Rauterberg, 2007). The two other objective levels correspond respectively to the dimensions of co-located and distance interactions. As traditional mobile communication services focus mostly on communication at distance, the presence of co-located interactions suggests that MoSoSo extends the scope of mobile communication.

When evaluating existing MoSoSo, the underlying assumption was that MoSoSo can truly enhance social interactions only by taking into account all three classes of relationships. In other words, an integrated approach regarding MoSoSo as a general purpose social platform was considered superior to a solution focused on a particular class of mobile-mediated social relationships. As the success of other popular social platforms, such as phone calls, SMS and the Internet browser suggests, users' social needs are best met through the design of flexible technologies that users can domesticate to their lifestyles. Instead, MoSoSo is typically designed for specific use situations and contexts, which inherently constrain user's choice. In the study, only one out of five types of MoSoSo that had been selected matched the requirement of MoSoSo to be conceived as general purpose social platform satisfying all classes of mobile relationships. Therefore, it was concluded that the scope of MoSoSo design was still limited and could be enhanced.

Another dimension of MoSoSo conceptualization concerns its use from a policy perspective. In particular, Articles II and VI discuss the ideal role of MoSoSo in the development of sustainable information societies.

To improve the potential usefulness to policy-makers, the macro-level analysis of MoSoSo was centered on the European information society and particularly on the current efforts to realize a human-centered and inclusive ubiquitous network society, also described in another study as a broadband information society. In this context, the role and potential of MoSoSo have been naturally connected to the two main goals of the EU Lisbon strategy, namely economic growth and social cohesion. In this respect, it has been observed that MoSoSo, being designed primarily on the basis of commercial imperatives, would not have contributed significantly to information society strategies. Indeed, a critical analysis of MoSoSo literature (Thom-Santelli, 2007) revealed that MoSoSo is currently thought of as an urban entertainment gadget. Depending on the content and context of use, entertainment technology may have positive effects on human behavior (Rauterberg, 2004). Despite its importance, entertainment should not be regarded as the only goal of MoSoSo interaction. The broader scope of MoSoSo is illustrated in Article II with the proposal to design MoSoSo for societal development, which implies designing for social capital rather than for economic capital. As the concept of *social capital* is connected to the idea of community, it was natural to connect together the themes of MoSoSo

design and digital community design. One of the limitations of this analysis concerns its positive bias in describing MoSoSo as an opportunity, without properly presenting its risks and challenges.

Summarizing, by applying conceptual analysis it was possible to define MoSoSo, describe its content and illustrate its potential use. However, the real usefulness of conceptualizing MoSoSo lies in the opportunity for enhancing its design. It is for this reason that design thinking was applied for developing a holistic design model of MoSoSo.

## 2.3 Design thinking

In the second phase of the investigation, the conceptualization of MoSoSo represented a starting point for exploring alternative approaches to MoSoSo design. For this goal, design thinking was considered as the most viable approach because it represented "*a process for practical, creative resolution of problems or issues that look for an improved future result*" (Simon, 1969, p. 55). Design thinking is particularly suitable for exploring the potential of alternative approaches to MoSoSo design because it is inherently oriented at the future. Indeed, the goal of this study is not to evaluate the impact of current approaches to MoSoSo design, but rather the impact that alternative ways of conceiving MoSoSo could have on individual lives and on the functioning of global information societies.

Although its origins date back to the sixties, design thinking has recently gained the interest of researchers and practitioners of design. In 2010, ACM's Interactions journal devoted an issue to design thinking (Anderson & Kolko, 2010b), reviewing also two recent books on the topic (Brown, 2009a; Martin, 2009). The essence of design thinking is represented by the mottos "*today we must all be designers*" (Pink, 2006) and "*design is too important to be left to designers*" (Brown, 2009b). Even the president of the US, Barack Obama, stressed the importance of "*encouraging young people to be makers of things, not just consumers of things*" (Pacione, 2010). The goal of design thinking is to turn an existing situation into a preferred situation by several iterations of a learning process that combines both observation and practice (Pacione, 2010).

The conceptual and empirical elements of design thinking can be described as a process consisting of seven main stages, which are not necessarily performed in a linear manner (Figure 2).


FIGURE 2 Stages of the design thinking process

The study focuses on three of these design stages: the stage of definition, that of research and that of ideation (these stages are marked in green in Figure 2). In fact, the research project that led to this study did not include any implementation or evaluation of a technical prototype of MoSoSo. This was one of the limitations of the study and should be addressed in future research; nonetheless, because of the complexity of the research problem a deliberate choice to concentrate on the theoretical level of design was made. The search was particularly directed to appropriate explanatory frameworks (Saariluoma, 2004) on which to ground the model of MoSoSo design. As Saariluoma (2005a) observed, "*an explanatory framework is a discourse in which one can use a unified system of scientific knowledge to explain and resolve some relevant problem*" (p.5) (Figure 3).

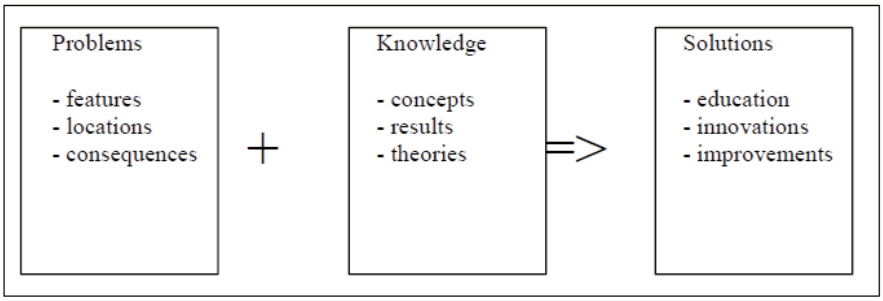


FIGURE 3 Explanatory frameworks in problem-solving (Saariluoma, 2005a)

In this respect, the two knowledge areas of user psychology (Moran, 1981; Saariluoma, 2004) and user sociology (Green et al., 2000; McGuigan, 2005) were combined to produce a solution i.e. a design model for MoSoSo, to develop within the domain of interaction design.

In MoSoSo, user psychological knowledge is associated to the assessment of user needs and action goals in an interaction context. In this study, elements of user psychology are investigated in the context of digital sharing (Article IV), personal privacy management (Article V) and motivational aspects related to the use of digital and non-digital social media (Article VI).

In the networked social space of MoSoSo, it is not sufficient to consider only the individual dimension of the user. Indeed, that dimension has to be employed in synergy with user sociological knowledge, which regards the user as a social actor. In contrast with the industrial view on the user, the sociological perspective on MoSoSo users corresponds to what Green et al. (2000) described as the academic approach to mobile users, who are presented as "*social beings who, because of the numerous worlds in which they circulate, can experience discontinuities around the various and sometimes conflicting identities mobile telecommunications are able to support*" (p.15). This complex view of the user is in sharp contrast with the pragmatic approach of the mobile industry, which attempts "*to leverage business opportunities through fragmenting their offerings to satisfy the perceived*

*needs of users*" (p.15). Based on various observations, Green et al. (2000) concluded that the development of mobile applications and services requires integrating an understanding of users as individuals and as social actors that goes beyond socio-demographics. The present study is an answer to that call. The study argues that the design of MoSoSo, where applications enable mobile social networking activity, cannot be successful if it is not grounded on the network paradigm.

Applying user sociological knowledge to MoSoSo design does not only allow enhancing the overall design solution but also consents to the connection of the mobile device in general and MoSoSo in particular to the broader domain of the sociology of mobile communication systems (McGuigan, 2005). From this viewpoint, the micro, meso and macro effects of MoSoSo can be analyzed – all these levels are included in this study. At micro level, it is argued that MoSoSo may enhance the attainment of both instrumental and expressive action goals by offering perpetual access to the resources shared by the digital community; at meso level, a large-scale adoption of MoSoSo would support the shift towards an integrated model of the digital community (Chapter 4); at macro level, MoSoSo and digital communities are among central elements of the transition towards a sustainable and inclusive information society (Articles II, VI and VII).

To recapitulate, the methodology of the study is based on two main approaches: conceptual analysis of the current state of MoSoSo and design thinking to enhance MoSoSo design on the basis of the integration of user psychological and user sociological knowledge. In the following sections, I firstly describe the vision of the network-based civil society, which guides the discussion on policy convergence - the support policies for MoSoSo adoption in a sustainable society (Chapter 9). Then, I illustrate, in more detail, the methodological issues of the theory-oriented studies, and finally turn to the analysis of qualitative and quantitative methods used in the empirical studies.

## 2.4 Network-based civil society

The utility of the conceptualization and holistic design model of MoSoSo needs to be supported by a realistic vision of the future information society. The vision will act as a bridge from theory to practice because it offers a set of principles to be followed by citizens, communities, policy-makers and businesses.

Specifically, the study aims at integrating the principles of sustainability to design from a human-centric perspective. Several approaches integrating ethics and emotions within interaction design (Norman, 2004) have recently emerged: among them, *value-centred design* (Friedman, 1996; Cockton, 2005) and *life-based design* (Leikas, 2009). The study does not explicitly apply any of these approaches, but it rather follows the vision of the network-based civil society, as suggested by Viherä (1999), which corresponds to an inclusive information society in which citizens are empowered by ICT. The network-based civil society,

through active and responsible citizens self-organizing in communities, complements traditional top-down decision-making with grassroots initiatives (Viherä, 1999). This vision is realistic because it is also emphasized in the ongoing discussion on a more inclusive and participatory European information society (Reding, 2006). The reasons behind the emphasis on active citizenship are not related only to democratic ideals, but also to the need of complementing, with personal support networks and communities, the reduced support provided by declining welfare states. New technologies, such as MoSoSo, are necessary but not sufficient for realizing the desired change. In the articles, it was also discussed what are the important support policies that need to be developed to provide the circumstances for sustainable lives in sustainable societies.

In her doctoral thesis, Viherä (1999) introduced a model centered on the concept of communication capabilities. Each citizen has a certain amount of communication capabilities, which are determined by three main factors: access to a communication technology, competences needed to use properly such technology and motivation in using them for satisfying everyday needs. This model is compatible with the principles of design thinking. Pacione (2010, p.8) quoted the framework "Partnership for 21st century skills":

> "Central to its framework for 21st century learning is the call for innovation skills. […] Learning and innovation skills are what separate students who are prepared for increasingly complex life and work environments in the 21st century and those who are not. They include: creativity and innovation, critical thinking, problem solving, communication and collaboration".

An optimally conceptualized and designed MoSoSo would only provide ubiquitous access to various digital communities, but would not necessarily contribute to the sustenance of additional factors, such as competences and motivation, that are necessary for community involvement. Communication capabilities are developed in social learning environments, such as those offered by digital communities, and digital community interaction is successful when members' communication capabilities are compatible (Figure 4).

When discussing the impact of ICT, technical aspects influencing access to information or people are generally well addressed. Less attention is paid to the skills and competences needed to ICT use. An exception is represented by the detailed analysis conducted by Katz & Rice (2003). Among the three components, however, the motivational aspects of ICT use have been the least adequately covered. Nevertheless, they have an important effect on the way people domesticate ICT and fit them to their needs.

Some of the articles investigate the theme of policy convergence (Chapter 9) needed for successful digital community interaction. In Articles VI and VIII, the analysis of the successful case of Finnish communication camps provides an insight on how digital community development may be pursued by investing in citizens' communication capabilities (Viherä, 1999; Lugano, 2003). In Article VIII, the paradigm presented in relation to communication camps indicates that users's informal everyday learning need to be supported by stimulating social environments, which are necessary for the development of their communication

capabilities. The social process of extending communication capabilities in a community context is a form of community development based on the process of user empowerment (Keskinen, 1999).

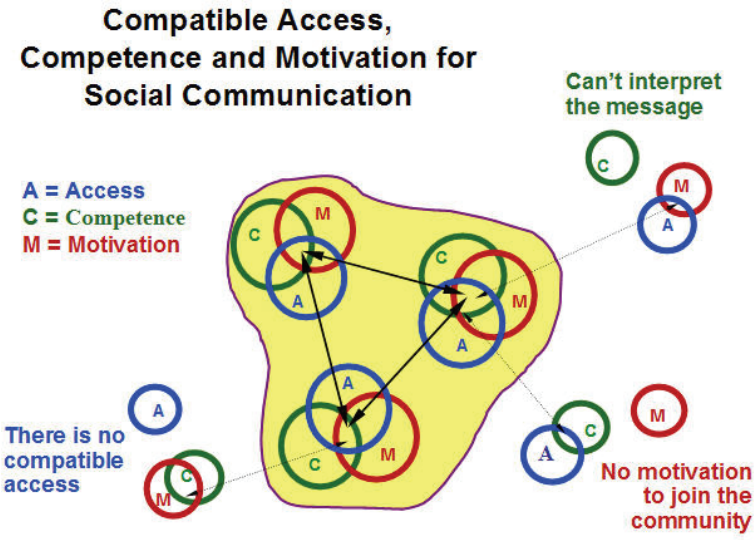


FIGURE 4 Communication problems and communication capability (Viherä, 1999)

Article VI investigates digital natives' and digital immigrants' (Prensky, 2001) motivations in using various types of ICT for social communication. In addition, the differences between these two categories of users are discussed from the viewpoint of realization of a more inclusive information society. Finally, Article II provides a policy-oriented discussion of MoSoSo and expresses the importance of realizing a policy convergence grounded on the centrality of users and communities.

## 2.5 Methodological choices

This section presents the methodological choices related to the technological, social and business aspects of MoSoSo. At technological level, it is explained why MoSoSo represented a better alternative than the other two major social computing paradigms, namely groupware and social software. At social level, the network perspective provides the most suitable framework for laying the foundations of MoSoSo. From a business perspective, the role of MoSoSo as a product or service was considered, arguing that MoSoSo is best characterized as a service platform.

### 2.5.1 Technological focus: groupware, social software or MoSoSo

One of the main challenges of the study concerned the choice of the appropriate technological focus and terminology. The three main paradigms of social computing, groupware, social software and MoSoSo, represented the main alternatives. In this section, I present my motivations for the choice of MoSoSo as the technological focus of the study.

From the perspective of the scientific research tradition, groupware offered the most reliable pick, as it could rely on all existing literature on the mobile use of computer-supported collaborative learning (CSCL) and computer-supported cooperative work (CSCW) systems. In particular, the idea of *communityware* (Ishida, 1997) could have been applied to study community-oriented groupware designed for everyday life. The purpose of communityware is to expand the original scope of groupware studies, which is typically connected to the organizational and educational environments. Although it did not have much success as a computing paradigm, the notion of communityware is relevant because it highlights the five areas of application of community design:

- *Knowing each other*: facilitates the establishment of social ties;
- *Sharing preference and knowledge*: supports the sharing of resources;
- *Generating consensus*: supports a wide range of social interactions (coordination, cooperation, communication) at different scales;
- *Supporting everyday life*: allows information embedded in digital communities to be used as a resource in individual and social action;
- *Assisting social events*: provides context-awareness and personalization.

Groupware and communityware paradigms did not emerge as distinct domains, but rather the latter was naturally included by the former when it expanded its original boundaries. In fact, the focus of groupware studies widened, including not only formal desktop interactions in small social groups, but also informal social exchanges in mobile environments. For instance, Gutwin et al. (2008) introduced the idea of community-based groupware (CBG) as tools enabling informal collaboration. Other authors have been investigating groupware applications in mobile contexts (Kirsch-Pinheiro et al., 2004), in particular for co-located interactions (Fjeld et al., 1999; Morris et al., 2006; Nacenta et al., 2007). Recent research shows that groupware is here to stay: almost thirty years after its debut (Johnson-Lenz, P. & Johnson-Lenz, 1982), De Vreede & Guerrero (2006) introduced a special issue of the International Journal of Human-Computer Studies, stating that "*research in groupware is thriving like never before*" (p.571).

Despite of the recent advances in groupware research, many of the studies apply the new insight to provide new solutions and approaches to traditional issues, such as collaboration and knowledge sharing. In addition, the purpose of interactions is still largely anchored to the social dimension of learning and working activities. Furthermore, the term groupware, while still popular in its

original research contexts, has not been adopted by other disciplines as well. For instance, there are relatively few studies on the use of groupware for political purposes, or for enabling flashmobs, self-organizing and spontaneous aggregations of people. As such activities are both social and enabled, or supported, by ICT, they would naturally fit to a wider definition of groupware. This not being the case, the essence of groupware is still linked with its tradition.

After the turn of the millennium, both the Internet and mobile phones became essential tools for everyday life in most Western societies (Wellman & Haythornthwaite, 2002; Bakardijeva, 2005). A number of creative and spontaneous forms of ICT-mediated social interactions were emerging, but they were not addressed by groupware research.

It was probably for this reason that a new computing paradigm, social software, was introduced. The credit for coining the term is generally given to Clay Shirky, who defined it as "*software that supports group interaction*" (Shirky, 2003). Other people wrote about social software in the same period. For instance, Tom Coates (2002) claimed that social software has to satisfy the objectives that were earlier described by Engelbart (1962|1988), namely the cyborgisation or augmentation of human beings. In contrast to the definition of groupware, both definitions of social software did not originate in the academic domain, but rather in the rapidly evolving conversations online. The early definitions, quite open and vague, were debated and developed collaboratively exploiting the social nature of the Internet, using blog posts and comments. While Shirky's definition (2003) was centered on the idea of group and did not refer to any specific class of technologies, Coates (2005) provided an alternative definition that did not mention groups and that also included references to types of social software. In his view, "*social software can be loosely defined as software that supports, extends, or derives added value from human social behavior – message boards, musical taste-sharing, photo-sharing, instant messaging, mailing-lists, social networking*".

In the same period, the term also started to appear in scientific publications: for instance, Tepper (2003) defined social software as the "*various, loosely connected types of applications that allow individuals to communicate with one another, and to track discussions across the Web as they happen*". Quite interestingly, the author quoted both the contributions of Shirky and Coates, but did not mention at all the relation with the existing groupware paradigm. Other authors (Koskinen, 2006; DiMicco et al., 2008; Anderson, 2005; Dron, 2006) also discussed the potential of social software in CSCW and CSCL without mentioning the term groupware and explaining why the term social software was adopted. Similarly, groupware scholars do not generally refer to social software in their studies. For instance, Jackson et al. (2007) discussed corporate blogging, i.e. the use of social software in organizations, using the term groupware without acknowledging blogs as social software. In this manner, groupware and social software developed in parallel, although they could have benefited from each other, as they present a large overlap between them.

Only a few attempts have been carried out to compare and connect the two paradigms; boyd (2007) provided one of the most significant contributions,

underlining that "social software is "*a term that is thrown around frequently, rarely defined, completely elusive, and yet totally significant*". Then, the author described the position of the social software critics, who considered the term as a simple hype, "*just another term that encompasses groupware, computer-mediated-communication, social computing and sociable media*". At the other extreme, the social software enthusiasts, such as Clay Shirky, Tom Coates and Tim O'Reilly, saw the old concepts as too limited to address the capabilities and scope of new technological innovations. In the debate, boyd (2007) acknowledged the importance of the existing tradition, but also recognized the value of the new paradigm. For the author, social software is more a movement than a category of technologies. In fact, it refers to people who believe and support the idea that "*the web can be more than a broadcast channel*" and that "*collections of user-generated content can have value*". User-generated content (UGC) refers to digital content, which is created by one or more users and then shared online, typically using Web 2.0 (O'Reilly, 2005) applications. Referring to the use of social software in Web 2.0 interactions, boyd (2007) claimed that the real novelty consists of three main elements, namely how social software is designed, how it supports participation and the effect and behaviors it produces in users.

It is not obvious to clearly state the boundaries between social software and groupware. Despite the debate is still open, the study supports the view that social software, compared to groupware, focuses on informal social interactions. However, although Shirky's definition of social software (2003) encompasses all forms of social interaction, social software does not sufficiently emphasize the increasing significance of mobile interactions. For this reason, MoSoSo is the most suitable choice for analyzing the new forms and meanings of mobile-mediated social interactions.

As demonstrated by the MoSoSo review (Chapter 5), MoSoSo is currently an immature paradigm of social computing. As such, the adoption of MoSoSo as technological focus represents at the same time a risk and an opportunity. Investing in MoSoSo research is a risky activity because it is a technological paradigm that has already passed its peak of popularity. Since the popularization of Web 2.0 (O'Reilly, 2005), other terms such as social media have become more popular. The few years of MoSoSo research opened many relevant questions without providing definitive answers. The importance of MoSoSo is also controversial: MoSoSo critics observe that there is no need for such a new paradigm because it does not add anything really new to the existing concepts. At the other extreme, MoSoSo enthusiasts consider MoSoSo as a revolutionary technology able to change our lives. This interpretation makes the common mistake of ignoring the importance of groupware and social software contributions, risking *reinventing the wheel*.

My position resembles boyd's neutral attitude in the groupware-social software debate: MoSoSo is not hype, but has real potential that waits to be uncovered. The work on groupware and social software does not have to be rejected or ignored, but rather integrated with the new paradigm.

From this viewpoint, MoSoSo research represents a great opportunity to bring to maturity a technology that is still poorly understood. There are several reasons to develop MoSoSo research: first of all, a key aspect of digital convergence concerns its mobile focus, with devices becoming increasingly portable, powerful and interconnected. Related to this aspect is MoSoSo's natural fit to informal and spontaneous social interactions. By complementing, augmenting or replacing F2F situations, MoSoSo also allows connecting the traditions of studies on local communities to research on virtual and online communities. In a similar manner, MoSoSo research also presents a converging viewpoint for Internet and mobile communication studies.

MoSoSo research may also be regarded as an intermediate step towards an integrated framework for the study of the design and implications of ubiquitous computing technologies. Being embedded in everyday situations, and used in any situations, the contexts of use are generally mobile and are not necessarily connected with any particular plans, but have to take into account the situated action (Suchman, 1994). In this respect, neither groupware nor social software perspectives are explicitly grounded on to the rapidly changing and dynamic nature of mobile contexts. Indeed, mobile groupware seems more an application of the original paradigm to situations of mobility than a new perspective integrating and extending the traditional framework. As for social software, while its scope has not been limited to static desktop contexts, it has not properly integrated the knowledge on the technical and social aspects of mobile communication systems.

The second trait of MoSoSo research concerns its orientation, which should be firmly anchored in the network paradigm. This follows the need for tools supporting individuals and communities in dealing with the complex interaction aspects of a networked society (Castells, 2000). Although the previous paradigms claim that the social dimension is as important as the technical one, they have an ambiguous attitude towards the social element. In this respect, the original meaning of groupware was definitely based on the traditional idea of social group. Its recent developments towards informal interactions, however, have made the original boundaries less clear, evidencing an attempt to integrate the concepts of group and network. Social software is even less clear on this point: while Shirky's original definition (2003) is also based on the idea of social groups, the support for the social networking function has gradually become more popular. From a design viewpoint, both groupware and social software are quite limited, because the network perspective has not been systematically adopted in the design solutions.

The existing research on MoSoSo is limited in many respects, showing perhaps even more controversial points than groupware and social software do. However, as an immature and emerging research domain, much can be done to influence its future development. To ground MoSoSo research on more solid foundations, it is necessary to clarify its relationship to groupware and social software. Thus, all existing social computing paradigms could be complementary to each other. A second important issue concerns the acknowledgment of

networks in MoSoSo design. The network perspective allows understanding and explaining several aspects of social interactions. For this reason, the integration of its peculiar features in MoSoSo design represents an effective approach to enhance mobile-mediated social interactions. Finally, the scope of MoSoSo, so far mostly limited to entertainment applications, needs to be widened to acknowledge the more diversified needs and socio-cultural backgrounds of its current and future users. The limitations of MoSoSo research represent an opportunity to develop further a computing paradigm with much potential. Thus, this provides a strong motivation and reasons to adopt MoSoSo as the main technological focus of this study.

### 2.5.2 Social focus: adopting a network perspective

Defining the social basis of MoSoSo was an important part of the research project; this issue deals with the problem of discussing which forms of social interaction and social organization may best characterize MoSoSo.

The general idea that MoSoSo corresponds to mobile applications that are designed to enhance social interactions does not say much about the nature of the enhancement. In relation to traditional mobile services, this type of enhancement corresponds to a media enhancement, with rich-media services supplementing voice-based and text-based communication. Alternatively, a scale enhancement would correspond to the extension of the paradigm of interpersonal communication with the dimensions of group and community interactions. This goal should not be associated only to the possibility of accessing Internet sites through the mobile device; as discussed in the review on MoSoSo (Chapter 5), this also means social proximity interactions, support of social awareness, smartmobs and flashmobs.

Although media and scale enhancements are all appropriate ways of explaining the way MoSoSo could improve social interaction, its major contribution would correspond to the extension of human social networking capabilities. The traditional structure of mobile devices, as well as the design of mobile services, does not explicitly support social networking. The structure and features of the address-book, which represents the core component of social networking, have remained almost unchanged since the early versions of mobile phones. The various enhancements of the address-book are still largely under-used (Articles I and IV). Unlike in Web 2.0 applications (O'Reilly, 2005), UGC stored in mobile devices is typically not tagged, commented, rated, organized or connected to address-book entries. Although the social networking ability of the largest majority of users has not so far been supported by mobile devices, a growing number of attempts are being made to find out how to improve the current design of mobile phone-books. One emerging trend is to extend address-book functionalities by means of presence and automatic synchronization, and more generally by integrating Web 2.0 -like features (Oulasvirta et al., 2005; Prati et al., 2007; Jung et al., 2008). To benefit of the new features, users are like-

ly to be asked to follow the requirements of the network address-book (NAB), which needs to access contacts online and not from the memory of the device.

It is not sufficient to move information online to benefit from it in action contexts. As suggested by boyd (2008), exposure and invasion are likely to outweigh the positive value of *social convergence* (i.e. convenient access to multiple social networks in one single information space) if the structural and relational characteristics of networks are not well integrated in the design. So far, the various strands of network theory research, such as graph theory (Harary, 1969), sociometry (Moreno, 1953; Lindzey & Byrne, 1968), social network analysis (Wasserman & Faust, 1994; Scott, 2000) and complex networks (Barabasi, 2002), have not been used as foundations of MoSoSo design. A growing number of studies, however, are adopting this approach (Gips, 2006; Kim et al., 2008) to support more effectively mobile social networking activity. This study suggests that any major social enhancement to MoSoSo would rely in its ability to adapt to constantly changing physical and social contexts to provide users with a unique usable view of their networked world. Although efforts have been devoted in this direction, applications and systems are still not able to learn from networks, to recognize and visualize changes in network structures, and above all, to serve users in function of their social network configuration. Hence, without fully acknowledging the social network perspective in MoSoSo design, its usefulness is likely to remain quite limited.

The network is not the only relevant type of social organization in contemporary information societies. In fact, social groups and communities are still an important part of people's identities and everyday experience. Designing for social networks without explicitly addressing groups and communities could generate controversies. By adopting a network analytic perspective, social groups and communities can be described through two different structural network configurations (Wellman, 1979 and 1988), namely the *clique* and the *cluster*. In this manner, both groups and communities can be found in social networks which refer to the most basic type of social interconnection. Through the mathematical concept of *density*, the notions of group and community can be clearly defined in relation to the configuration of social ties, rather than to the number of ties. Given that any social network can be represented as a graph made of nodes and ties, density is defined as the proportion between the number of ties actually present in a graph and the maximum number of ties possibly present in the same graph.

The idea of social group corresponds to the *clique*, a complete sub-graph identified within a certain graph. The sociological interpretation of the clique depends on the kind of relation under analysis: if one considers the relation *to know someone*, then the clique corresponds to a group where all members know each other, as in the family. Within a graph, it is also common to find a set of nodes that do not constitute a complete sub-graph, but that present a density higher than average. This kind of sub-graph is called *cluster* and corresponds to the idea of community.

One might be led to think that in groups there are fewer members than in a community, but this is not necessarily true, especially when considering parameters like ethnicity, gender or age. The configuration only depends on the type of relation established; in MoSoSo design, it is important to consider in the very beginning which types of relations are to be supported. Besides "*to know someone*", MoSoSo also supports *to be nearby* and several measures of homophily (Lazarsfeld & Merton, 1954), such as "*to have the same interest*", "*to have been to the same event*" or *to be friend of*. It is also useful to use metrics of heterophily (Rogers & Bhowmik, 1970; Lin, 2001) as in the case of "*to search for different gender*". Most often, MoSoSo should be able to support a combination of similarity and diversity metrics, for instance in match-making algorithms and social introduction protocols.

The network analytic approach has its limitations: as social reality cannot be completely defined only by structural component, even the most complex tool for social networking would require human understanding, critical evaluation and judgement to provide the best results. However, tailoring mobile services on the basis of users' evolving social networks can be an effective approach to deal with the complexity of everyday life.

### 2.5.3 Business focus: MoSoSo as product or service

It is not obvious how to distinguish a product from a service, especially in the information age. The etymology of the term 'product' derives from the Latin term *producere*, which referred to any tangible object that was produced to satisfy a particular need or action goal. Like product, also service is designed to achieve the same purposes, but unlike product, service is intangible by nature. In fact, a service has been defined as "*a sequence of activities that constitute a process and that have value for the end user*" (Saffer, 2006). Unfortunately, the distinction between product and service is not simply a matter of tangibility: while the products of industrial societies were tangible, those of information societies may also have an intangible nature. For instance, the commercial plans offered by mobile operators to the mobile users are intangible products.

The impossibility of determining the nature of a product or service on the basis of tangibility alone suggests that it is necessary to include some additional characteristics to their definitions. According to Saffer (2006), most services share the following characteristics: intangible, owned by the service provider, co-created, flexible, time-based, active and fluctuating on the basis of the demand. Among these characteristics, the most interesting one for our goals is the ownership. When customers buy a service, they pay for its use, not for its ownership, but when customers buy a product, they become owners of the product in addition to being entitled to use it.

Although this position might be debatable, this study supports the idea that the concept of service has a wider scope than that of product. In fact, most of the services of everyday use rely on a number of products: from the user viewpoint, using the SMS relies on the availability of two key products, the mo-

bile device (tangible product) and a commercial subscription (intangible product). The functioning of such products generally relies on a number of other products, such as the battery, the charger and the subscribed identity module (SIM) card. By analyzing the number of products involved in the offer of a SMS, it appears that a service is typically more complex than a product because it relies on several components of the process on which the service is designed.

The above makes it easier to consider whether the design approach to MoSoSo presented in this study is connected to the area of product design or to that of service design. The various studies that have been conducted (Chapter 6) suggest that MoSoSo is closer to the idea of service than that of product. Specifically, MoSoSo is conceived as a mobile computing platform, a combination of hardware and software, which acts as a social platform. In other words, the computing function enables higher-level social phenomena such as communication, collaboration, co-creation, participation and collective action. From this viewpoint, MoSoSo is best characterized as a general purpose social platform allowing users and communities to define user profiles, share UGC, discover a common ground to interact, connect, develop and use community-generated services (Chapter 11). Hence, all notions of computing, social and service platform fit to MoSoSo, in accordance with the technical, social or business-oriented emphasis that is underlined.

Even though the articles generally privilege the social perspective, in the Article III the term MoSoSo was changed into MoSoSe, the acronym for *Mobile Social Service*, to illustrate the connection between the social and business significance of MoSoSo.

In the other studies, the traditional term MoSoSo is privileged for two reasons: the use of new terms, such as MoSoSe, was an opportunity to connect the nature of the technological innovation to the area of service design. In addition, maintaining the term 'software' in MoSoSo was regarded as important because services are implemented on the top of an existing technological infrastructure, which acts as the enabler. From this viewpoint, MoSoSo closely follows the tradition of mobile services, such as phone calls and SMS, but offers an important innovation: similarly to Internet social software, MoSoSo enables users to freely implement and co-create mobile services. In this respect, a crucial question concerns control or the level of freedom that users will be given by businesses and governments.

It is not clear yet how the situation will evolve, but there are two opposite trends in play: Internet as a free, open and self-organizing social platform due to its historical development and the traditionally commercial and closed nature of mobile services, still controlled by businesses and governments.

## 2.6 Description of the datasets used in the study

While the objective of 'conceptualizing MoSoSo' has been pursued through a theoretical approach based on review of the available literature, the primary

aim of the study, 'designing MoSoSo', is also supported by qualitative and quantitative analysis of empirical data.

Two main datasets have been used in the course of the research project as a bridge between theory and practice of MoSoSo design. Both datasets were generated by means of structured questionnaires (see Appendices A and B), which had been collected in Heinola (Finland) during the summer of 2005 and in Helsinki (Finland) during the autumn of 2006. Both questionnaires were designed to assess user psychological and user sociological aspects of social communication. While the Heinola dataset aimed at gaining an understanding of the use of the full spectrum of technologies for social communication (both digital and non-digital), the Helsinki dataset focused on mobile communication.

Although the datasets are the result of small-scale studies, they are extremely valuable for the data on characteristics of the respondents. The Heinola dataset is based on the communication camp study (*VI*) and consists of fifty-two responses (56% male, 44% female). The Helsinki dataset, produced in the context of a mobile social networking study, is based on the answers of eighteen young adults (39% male, 61% female). While the age of the majority of participants in the mobile social networking study was between 18 and 25 years, the age of the respondents in the communication camp study included all categories of users: teenagers, young adults, adults and senior citizens. In fact, in that study the youngest respondent was aged 9 and the oldest 65. When aiming at understanding human and social aspects of technology use, it is important to consider the orientations, needs and goals of all age groups. In this respect, the Heinola dataset gives a useful insight to the motivational aspects of two 'generations' of ICT users: the digital natives and the digital immigrants (Prensky, 2001). In both datasets, the respondents were not homogeneous only in relation to gender and age, but also from the viewpoint of their cultural backgrounds. Indeed, participants of different nationalities, all living in Finland, took part in the studies. The distribution of participants' ages and experiences in ICT renders the datasets interesting also from the perspective of cultural computing (Tosa et al., 2005; Rauterberg, 2006; Kooijmans & Rauterberg, 2007; Wang, 2009). The Helsinki dataset presents a rich range of diverse life configurations of young adults in the roles of workers, students or both.

Quite interestingly, the two datasets do not refer to any specific type of MoSoSo. Nevertheless, the analysis of the datasets has important implications for MoSoSo design. Certainly, it would have been useful to gather MoSoSo-specific empirical data, but this task was not obvious because of the limited diffusion of MoSoSo applications. Through an online survey, it would have been possible to gather impressions on existing MoSoSo; however, it would have remained a challenge to discover a group of interconnected individuals (e.g. family, friends) using the same MoSoSo and to analyze their patterns of MoSoSo usage over time.

### 2.6.1 Heinola dataset: the digital community of communication campers

The Heinola dataset was compiled by using a structured questionnaire (Appendix A) during the Communication Camp 2005, which included about eighty participants aged from 9 to 65.

Communication camps are a Finnish social innovation introduced in 1987 to support the grassroots development of the Finnish Information Society by investments in citizens' communication capabilities (Viherä, 1999). Communication camps strive towards this goal by means of group activities that support individual and social learning in a community context emphasizing creativity, self-expression, cooperation, and social communication (Lugano, 2003, Article VIII. Communication campers form an interesting example of a physically-based digital community, and are described in Article VIII as a miniature model of network-based civil society (Viherä, 1999). Camp activities are characterized by the use of several forms of ICT embedded in the daily group activities performed at the camp:

- *radio*: keeping 'Radio Viekas' on the air, broadcasting both locally and online;
- *video*: creating, editing and showing a number of video-clips;
- *newspaper*: creating, editing and distributing Tietotutti, the camp newspaper;
- *info-point*: coordinating all camp activities by digital services, such as SMS broadcasts, and operating 'banking services' based on Lecu, the fictional currency of the camp;
- *restaurant*: planning daily menus, buying food and cooking for the camp community.

Each activity is characterized by a peculiar mixture of information exchange, collaboration, communication, entertainment and self-expression, in which ICT is typically used to accomplish various action goals, such as learning and completing individual and group tasks. In addition to the instrumental use, ICT is used also for satisfying expressive needs that are functional in the development of social ties among communication campers. Indeed, campers often socialize while playing video-games or watching video-clips online.

Thanks to CGS (Chapter 11), communication campers form a self-organizing digital community. Although the majority of participants are in the teenage age-group, a number of young adults, adults and senior citizens take also an active role in the community. The level of experience of camp participants greatly varies, with many young participants – called 'resources' - taking roles of responsibility. All in all, the Communication Camp represented an interesting setting to study different generation of users in action.

The data gathered at the communication camp of Heinola of 2005 was used in Article VI to analyze the motivational aspects connected to social media use. Both digital and non-digital tools were compared by grouping them under four main clusters: non-digital (letters and postcards), mobile (phone calls,

SMS), Web1.0 (email, mailing-lists, forums) and Web 2.0 (instant messaging, blogs, social networking sites).

A dataset based on fifty-two answers to a questionnaire (Appendix A) was collected. Although the dataset contained much information on communication campers, only part of it was used. In fact, Article VI analyzed only campers' demographic information and their answers to an open-ended question on various types of social media (question 9), leaving the rest of the dataset for future studies. The reason for not employing the network data of the Heinola dataset was related to the absence, in the dataset, of actual communication exchanges that occurred during the camp. They are present in the Helsinki dataset, however (Appendix B). Without them, the information provided in the questionnaire is not sufficient for drawing any significant observations on the structure and social dynamics of the social networks present in the communication camp community. After identifying these problems, it was possible to design a better approach to the study of the communication camp community. A new and richer dataset, avoiding this shortcoming, was collected during the communication camp 2009. Multiple methods, such as non-participant observation, interviews and questionnaire, were employed during its collection. Such data should provide stronger evidence to the present study, but it is still an ongoing work and will be published in the near future. Thus, it has not been included in this study.

As for the data used in this study, the Heinola dataset contributes with the analysis of the open-ended Question 9, which focuses on the motivational aspects (e.g. perceived advantage/disadvantage; reason of use/non use; motives for liking/disliking) connected to digital and non-digital personal communication technologies, such as letters, postcards, phone calls, SMS, emails, mailing-lists, forums, blogs, instant messaging (IM) and SNS. For every dataset that relies on an open-ended question, it is a demanding and time consuming task to organize, classify and analyze the answers, which might be even cryptic in some cases. A vector space model (Salton et al., 1975) was employed to analyze the responses by *extracting, ranking* and *visualizing* the most significant keywords as a tag-cloud. The aim of the paper was to compare the motivational aspects of two categories of users, namely digital natives and digital immigrants (Prensky, 2001), in the use of 10 different personal communication technologies. A total of twenty vectors were used for the task. Each vector was filled with the most significant keywords, which were manually extracted by the investigator to obtain maximum reliability. Although this approach does not scale well for larger datasets, it was suitable for the scope of the study. For the visualization as tag-cloud, a freeware online application, TagCrowd, was used.

### 2.6.2 Helsinki dataset: the mobile social network of young adults

Unlike the Heinola dataset, which provided a total perspective on the digital community of communication campers, the Helsinki dataset presented a partial, individually centered and mobile perspective on a digital community consisting

of a group of friends living in the same city. Instead of emphasizing group dynamics, the approach of Helsinki dataset aimed at uncovering structural and relational patterns of mobile social networking activity. Even though the Helsinki dataset has been presented only in one of the studies (Article III), it is used in this dissertation to support and evaluate the theoretical concepts described in other studies as well (such as Articles IV and V).

The Helsinki dataset, compiled of the responses to a structured questionnaire (Appendix B), contains both user psychological and user sociological knowledge. User psychological variables correspond to the users' general attitude towards mobile communication (Questions 1-4) and to the attitude towards F2F intimate sharing and mobile sharing of digital content (Questions 9-11). User sociological knowledge is linked to the sociability aspects involved in the management of one's personal community (Questions 5-8).

While all above groups of questions were based on user perceptions of such issues, an additional group of questions was included to assess the actual user experiences in mobile social networking. Specifically, users were required to transcribe the communication logs of their mobile phone directly onto the tables of the questionnaire (Questions 12-15). Such information included, among others, call durations, amount of Internet data exchanged, and detailed metadata related to incoming, outgoing and missed phone calls, incoming and outgoing SMS, and Multimedia Messaging Service (MMS). Although it was in principle possible, participants were not asked to transcribe the content of the SMS and MMS. In addition to being time-consuming, this task could have also been regarded as an intrusion in the personal privacy of participants. As such information can be useful in capturing the instrumental and/or expressive function of text and multimedia messages, an alternative approach was used: instead of copying the content of the message, users were asked to characterize the communication by associating it to one or more 'topic' tags. To facilitate the user task and the grouping of similar tags, a number of pre-determined 'topic' tags were suggested (e.g. emotion, work, entertainment, gossip, chat, agreement, question, answer, location expression, opinion expression, recommendation, meta comment). In addition to the 'topic' tag, participants were also asked to associate the name of the communication recipient to a 'social group' tag and to a 'location' tag. The former type of tag was used to compare the perceived and actual frequency of communication with social groups, while 'location' tags were used to determine the spatial distribution of the personal community and the importance of the mobile phone as supplement (at local level) or replacement (at distance) of F2F communication.

# 3 DIGITAL CONVERGENCE

While the previous chapters focused on the general research problem and on the approach adopted in its investigation, here the objective is to describe digital convergence as the background of the study. The chapter has two main goals: firstly, to demonstrate that digital convergence is not yet another term for technological convergence, but rather a much more complex phenomenon encompassing the technological, economic, cultural and social dimensions. After characterizing digital convergence on a general level, each of its dimensions is discussed. The second objective of the chapter is to underline the social focus of the conceptual analysis of MoSoSo, which lies at the intersection between the technological and social dimensions of digital convergence. This angle allows connecting MoSoSo to digital communities, anticipating the content of the next chapter.

## 3.1 The multiple facets of digital convergence

Digital convergence is often regarded as a synonym to technological convergence. Inspired by Jenkins's conceptual framework (2001), in this section I present a more complex view of digital convergence and show that scholarly research has not yet paid enough attention to its cultural and social dimensions.

The term digital convergence is often associated with the coming together of telecommunication systems, computer networks and media industry (Yoffie, 1997; Covell, 1999; Mueller, 1999). This perspective suggests that digital convergence should be regarded as a form of technological convergence. Indeed, the term convergence has a technological connotation because its etymology comes from the world of science and mathematics: Gordon (2003) explained that the term was used for the first time in the seventeenth century by an English scientist, and later adopted by Darwin (1859|1998) in describing the evolution of the species.

The emerging human-technological perspective does not regard technological convergence and digital convergence as synonyms because that would underestimate its human and social aspects, essential elements for understanding technology in use. Saariluoma (2005b, p.1) explained well this emerging perspective: "*instead of seeing technology as a construction following the laws of nature, the challenge of human technology is to explore and understand how humanist and social research can contribute to the conceptualization and implementation of technology*". Human-technological approaches to digital convergence are becoming more common and, according to them, this phenomenon should be regarded as a complex and multifaceted process that has its enabling factor in technological convergence (Jenkins, 2006; Fortunati, 2007).

Jenkins (2001) illustrated the human-technology approach by describing convergence as a process made up of several sub-processes and encompassing technology, culture, society, and the economy:

- *technological convergence*: the digitalization of all media content, corresponding to Negroponte's view of transformation of *atoms to bits* (1996);
- *economic convergence*: the horizontal integration of the media entertainment industry;
- *global convergence*: the cultural hybridity resulting from the global circulation of digital media content;
- *cultural convergence*: the explosion of new forms of creativity at the intersections of various media technologies, industries and consumer groups; a new participatory folk culture is enabled by tools which allow average people to archive, annotate, appropriate and recirculate content;
- *social or organic convergence*: consumers' multitasking strategies for navigating the new information environment. It is a cognitive process, because it occurs within the user's cranium.

This study adopts a slightly modified version of Jenkins' (2001) original conceptual framework, including four main variations.

First of all, Jenkins (2001) has in media convergence the synthesis of all converging processes. His choice was influenced by the media orientation of the whole research work. In this study, the term digital convergence seems more appropriate because all forms of convergence have their prototypical process and enabling factor in digitalization, i.e. the transition from atoms to bits.

Secondly, technological convergence is conceived more broadly than in Jenkins' work (2001): instead of referring merely to the digitalization of all media content, here it refers to the integration of telecommunication networks, computer networks, and the media into a single digital network kept together by the Internet protocol (IP) (Covell, 1999).

Thirdly, contrary to Jenkins (2001) assertions, I regard global convergence and cultural convergence as a single process, which is mostly cultural. It is tightly linked with the ideas of globalization and post-modernity, of which

convergence and its opposite, divergence, are important characterizing features (Fortunati, 2007).

And finally, social convergence is not conceived only as a cognitive process taking place in the user's cranium, but also as a social process happening in physical or virtual spaces characterized by interpersonal and/or community interactions. Referring to community interactions mediated by ICT, social convergence as a cognitive process resembles the notion of imagined community (Anderson, 1983), while as a social process it describes the actual exchanges with one's personal community (Wellman, 1982 and 1996; Wellman et al., 1988). As thoughts influence action and vice versa, the cognitive and the social components of social convergence are interconnected and can mutually influence each other through the interface of digital devices.

The above observations lead to the conceptualization of digital convergence as a set of interdependent processes (Figure 5). Technological convergence acts both as enabler of other forms of convergence and as contributor to digital convergence, which in turn benefits from the unique contributions of all other forms of convergence. Although not illustrated in Figure 5, all components of digital convergence influence the emergence of new forms of technological convergence, contributing to a bidirectional development process.

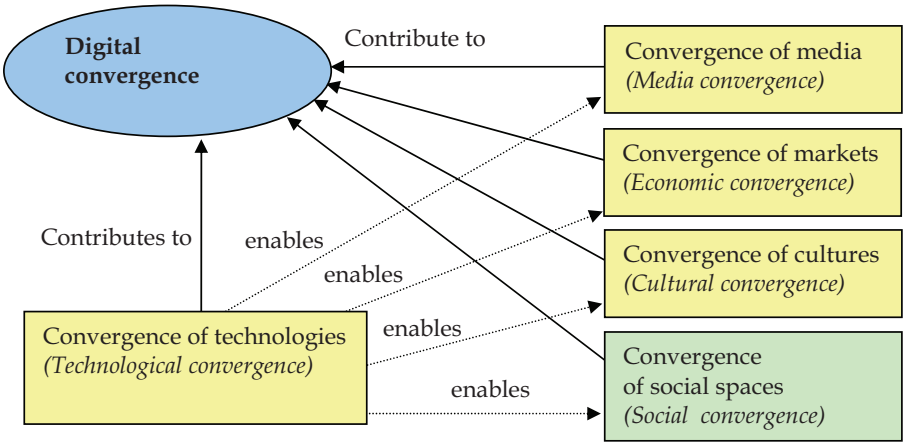


FIGURE 5 The multiple facets of digital convergence

Compared to the other types of convergence, scholarly interest for the cultural dimension of convergence and especially for social convergence (green box in Figure 5) is a recent trend. Thus, there are still many unanswered questions, waiting for their solutions, in the field.

There has been more research on media convergence, economic convergence and technological convergence than on cultural and social convergence simply because these two latter dimensions are much younger than the others. Indeed, socio-cultural effects cannot be visible when a technological innovation is being developed or is used only by early adopters. The effects emerge once

those innovations have become everyday tools. In other words, socio-cultural effects follow the domestication process of ICT (Silverstone & Hirsch, E. 1992; Silverstone & Haddon, 1996; Lie & Sørensen, 1996). In this view, a technological innovation is a social and cultural, as well as political and economic process.

Placing all forms of convergence on a timeline (Figure 6), research on digital convergence can be ordered and analyzed from a historical perspective. The most recent strands of research on cultural convergence and social convergence are still in their infancy, while the other strands have a slightly longer history. For instance, the debate on media convergence started at the end of the seventies; at that time, the vision that traditional mass media and new media could converge spread first among engineers (Farber and Baran, 1977) and then among media theorists (De Sola Pool, 1983).

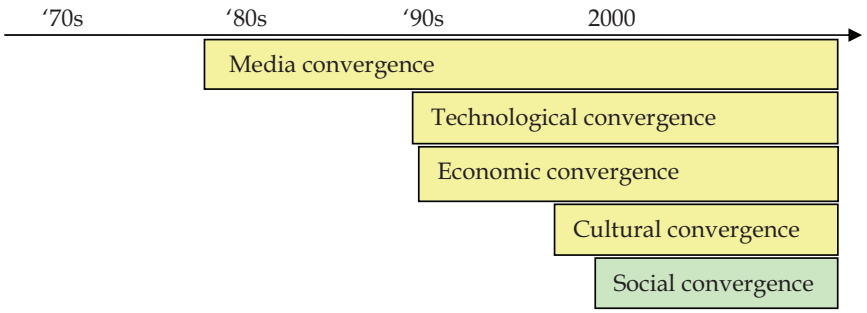


FIGURE 6 Timeline of research approaches to digital convergence

Since the nineties, technological convergence has been promoted by the ICT industry, which saw a commercial opportunity in its implementation. Therefore, the study of the evolution of the media market, or economic convergence, closely follows the more technically-oriented studies of technological convergence (Baldwin et al., 1996). Around the turn of the millennium, the establishment of the Internet and mobile communication as everyday communication paradigms, and their progressive convergence, gradually triggered several social and cultural effects, of which we are now just witnessing their early signs. The following sections discuss, in more detail, the developments that took place in each of these research domains.

## 3.2 Media convergence

The convergence of personal communication technologies and mass media is enabled by the Internet standards, which allows supporting all main communication models. While Internet access was earlier limited to desktop computers, it is now becoming common also on mobile devices. This innovation is expanding the traditional focus of mobile communication systems beyond

interpersonal interactions and enabling new forms of interaction centered on the creation and sharing of social media.

Historically, the discussion on media convergence can be traced back to De Sola Pool (1983), who envisioned "a process called the convergence of modes is blurring the lines between media, even between point-to-point communications, such as the post, telephone, and telegraph, and mass communications, such as press, radio, and television" (p.23). His list of personal communication technologies neither included the PC nor computer networks, which already existed in the beginning of the eighties but were not yet common in households. Back then, the Arpanet, the ancestor of the Internet, was only used in a few contexts, such as the academic environment. In addition, the limited network bandwidth and computer's computational power at that time did not support multimedia applications.

Although not mentioned in De Sola Pool's (1983) vision, PCs and the Internet were the missing links to realize what he described as "*one integrated digital network serving all purposes*" (p.38). Through social software, i.e. online applications used for social communication, the Internet can operate as a mass medium (Morris and Ogan, 1996; Shirky, 2008) and as a personal medium. All forms of social software have in the IP protocol the glue supporting all three major communication models, namely unicast, broadcast and multicast (Figure 7), which respectively enable personal communication (1-to-1), group and community interactions, mass communication (1-to-all) and group communication (1-to-many and many-to-many).

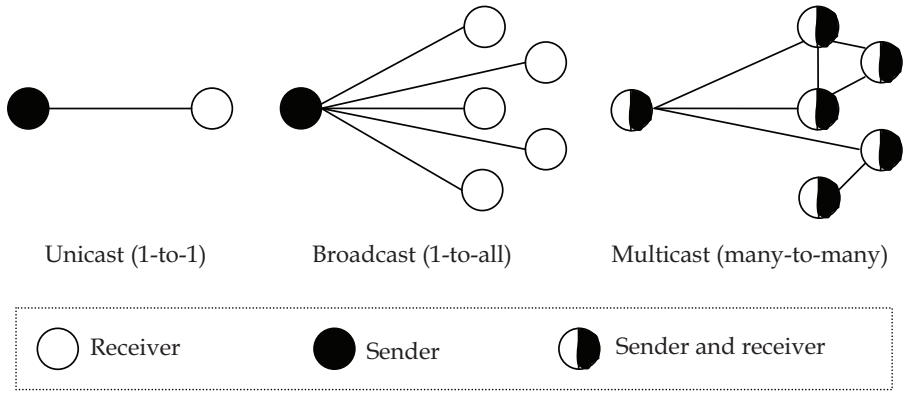


FIGURE 7 The three main communication models

In contrast to the previous communication technologies, which were based on a single communication model, the flexibility of the IP protocol allowed Internet applications to support one or more of them, both synchronously and asynchronously. For instance, the email is typically used for interpersonal communication (Walther et al., 1994), but it can also support group and community interactions (Rheingold, 1993; Preece, 2000).

The flexibility of the Internet architecture entails also a higher degree of complexity and uncertainty. The technical features of social software do not explain how it will be used in practice. Sometimes it is not even possible to determine in advance the audience that will access a message: as Shirky (2008) explained, the meaning and function of a blog changes according to the number of its readers; it can be extremely personal and trigger an intense amount of exchanges among a few regulars, or function more similarly to mass media where the number of readers can be counted in hundreds or even thousands. Similarly, interactions in online SNS, such as Facebook or LinkedIn, can scale from a few dozen up to thousands of personal connections.

The model introduced in Figure 7 shows just the basic configurations that Internet social software assumes in social interactions. Because of their numerous features and options, an almost unlimited number of variations are possible. Nevertheless, a large number of users adopt the standard configuration. For example, most digital photos or video-clips are freely accessible in media sharing sites like Flickr and YouTube. However, access to such content can also be restricted. Similarly, Internet forums may be completely public, semi-public or private.

In conclusion, one of the main characteristics of media convergence is the integration of different types of media content and scales of communication that were earlier separated. Until the emergence of mobile devices, such as smartphones, that integrate computer capabilities and Internet access, mobile services were conceived as based on the unicast model and offered a synchronous and an asynchronous alternative, namely the phone call and the SMS. The new technological capabilities of mobile devices, combined with the creativity of users, are reshaping the traditional meaning and boundaries of mobile communication systems. A major area of interest, which is still widely unexplored, is the role of mobile devices in creating and developing communities.

Before turning to the cultural and social aspects of digital convergence, which are mostly connected to the grass-roots adoption of ICT in everyday life, it is worth examining the technological and economic dimensions of digital convergence connected to the commercial goals set by the ICT industry.

## 3.3 Technological and economic convergence

This section illustrates the technological and economic dimensions of digital convergence, two synergic processes driven by the ICT industry to benefit the commercial interests of the newly converged markets. A number of aspects connected to digitalization, such as personalization and mobility, are described. Although a technologically deterministic view was dominant until the nineties, the important role of users, for whom the converging technologies provide empowering tools, has been recently acknowledged as well.

Farber and Baran (1977) are often described as the fathers of technological convergence because of their seminal paper in which they envisioned the pro-

gressive convergence of computing and telecommunication systems. Such vision was adopted by some pioneer companies of digital convergence, such as Japan's NEC Corporation, which in 1977 promoted C&C (Computers and Communications) as its corporate slogan (Yoffie, 1997).

In the nineties, the vision of technological convergence became gradually possible thanks to the digitalization process (Negroponte, 1996) and the increasing interconnectivity of computer systems enabling information highways (Gates et al., 1995). It was commonly accepted that these two drivers had transformed the world, opening new opportunities for innovation and economic growth and promoting progress, democracy and prosperity. Time journalists Elmer-Dewitt and Jackson (1993) described digitalization as the main factor driving the implementation of the "electronic superhighway": indeed, the digitalization process would have facilitated access to textual and audiovisual content, allowing service providers to offer a variety of services supporting work, learning, entertainment and socialization. The authors also pointed out that digital convergence was an industry-driven technological process:

> "welcome to the information highway. […] Already the major cable operators and telephone companies are competing – and collaborating – to bring this communicopia to your neighborhood […] now the only questions are whether the public wants it and how much it is willing to pay" (Elmer-Dewitt and Jackson, 1993).

The idea of communicopia, which regarded digital convergence as a new cornucopia representing a powerful source of revenues, shows that in this period the main motivations for realizing digital convergence were commercial.

The business interests connected to technological advances provided scholars with material to describe economic convergence as a natural complement of technological convergence; in this context, the main effort was directed in describing how the converging market would have evolved. The idea of evolution of the media market from vertically separated systems to a horizontally integrated cluster, including content, packaging, transmission, software and terminals (Figure 8), was commonly accepted (Baldwin et al., 1996; Yoffie, 1997; Mueller, 1999; Lind, 2004), even though there were those who questioned the fact that technological convergence implies convergence of markets (Gambardella & Torrisi, 1998).

Silverstone (1995) observed that a technologically deterministic view was dominant in the nineties: in fact, companies were convinced that the new capabilities of digital technology could be easily adopted and could influence the development of information societies in the way they imagined, generating large streams of revenues.

Even when his approach follows the technologically determinist tradition, Negroponte (1996), the founder and director of the Media laboratory at the Massachusetts Institute of Technology (MIT), is one of the few figures that took a wider perspective on digital convergence by not illustrating only the benefits, but also the challenges of the digital era. His main message was that, although digital convergence was developed by businesses, its meaning and ultimately its impact on everyday life would be in users' hands once the support of na-

tional governments and international bodies had started coming in. One of the most significant predictions of the media-guru concerned the role of digital technologies in the individualization of society, a trend described later by various sociologists (Bauman, 2001b; Beck and Beck-Gernsheim, 2002). Indeed, Negroponte (1996) correctly predicted that digital technologies would be designed to respond to individual needs, therefore allowing a lot of personalization in appearance, features and content of these technologies.

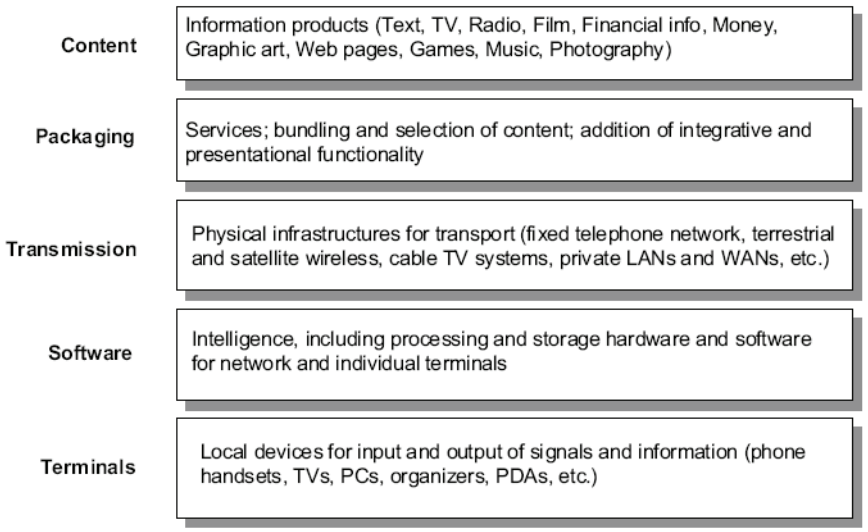


FIGURE 8 View of the converged media environment (Mueller, 1999)

In addition to personalization, Negroponte (1996) described another consequence of digitalization, namely the decreasing dependence on space and time dimensions in human activities and disappearance of the related restrictions: "*the access, mobility, and the ability to affect change are what will make the future so different from the present*" (p.231). Hence, digital technologies in mobile applications in particular support individual needs, goals and expectations by providing empowering tools. When Negroponte (1996) published his best-seller, *Being Digital*, mobile phones were just about to start their road to success. Already in the nineties, the ICT industry believed in the potential of mobile phones, especially where they would integrate computer capabilities. Yoffie (1997) illustrated, from a technical perspective, the trend that would have made the two personal technologies converge:

> "the telephone and the computer, for example, both utilize digital technologies, but historically they have served completely different markets with entirely different functions. The process of digital convergence implies that a computer begins to incorporate the functionality of a communicating device, and the telephone takes the functionality of a computer" (p.2).

This observation implicitly suggests that the technological convergence of computers and telephones represents a commercial opportunity, which however involved also the challenge to adjust to a converging market. One way of tackling such challenge consists in understanding the meaning of technological convergence from the viewpoint of everyday use of converging devices.

Indeed, the implementation of the third-generation (3G) of mobile networks corresponded to the launch of smartphones, a new type of mobile device integrating computer capabilities. The physical transformation of mobile phones into computers took place gradually by incorporating initially the characteristics of cameras and later larger screens, more sophisticated mobile operating systems, sensors and new types of interfaces, such as touch interfaces. In their latest versions, mobile devices can be used not only to perform the same tasks that were earlier a privilege of PCs, but also many new actions taking advantage of contextual information. Considering also the growing popularity of laptops, it has been argued that digital convergence has a mobile focus. This is especially true with the design of many digital services, which increasingly rely on the availability of a mobile device as the main touchpoint with customers.

Mobile devices are today used to buy tickets for public transport, or to pay goods at the supermarket. While shopping, users can also use their mobile devices to retrieve additional information, through quick-response (QR) codes, on the products they wish to buy. Thanks to radio-frequency identification tags (RFIDs), customers will soon also be able to automatically access online databases and obtain information tailored to their profile (Zhu et al., 2005).

Although these kinds of services are not widespread yet, the ICT industry is massively investing in the development of their supporting technology and business models. As in the nineties, commercial interests are still the main force driving these trends. Considering the lessons taught by Web 2.0 (O'Reilly, 2005), it is likely that technological convergence will benefit most those who can better understand and predict the human, social and cultural factors connected to the use of converging digital technologies in everyday life.

## 3.4 Cultural convergence

As discussed in the previous section, it is essential to understand the cultural aspects connected to the era of digital convergence in order to develop a profitable business and to explain the major trends shaping information societies. In this section, I illustrate some key aspects of what Jenkins (2006) defined as a convergence culture. These include the implications of the new role that ICT users have and the risks attributed to new forms of digital divides.

The main novelty of cultural convergence is represented by the roles that ICT users can have either as single individuals or as collective groups. In fact, they are no longer considered only as consumers but also as creative individuals. From this viewpoint, media consumption becomes a social process linked to

the interactive nature of Web 2.0 applications (O'Reilly, 2005). There is no concise definition of Web 2.0; it is not simply a set of new technologies, but a wider set of closely interrelated socio-technical aspects, which range from people's interconnections via digital content through social software to a variety of social features such as comments, tags ratings and real time chats. The potential of the collective activity around digital content has been regarded as a form of collective intelligence (Lévy, 1997) that has a central role in the emerging value chain of Web 2.0 (Surowiecki, 2004; Howe, 2006; Tapscott and Williams, 2006).

Users can become the best partners for organizations by taking the role of co-creators, co-developers and creative innovators (Rheingold, 2003; Jenkins, 2006; Shirky, 2008). However, in this role they can also undermine the traditional organizational structure by introducing numerous new challenges. A notable case concerns the legal and commercial implications of peer-to-peer (p2p) computing and digital sharing, or the political impact of smartmobs (Rheingold, 2003). The dual face of users as partners and menaces of organizational or institutional stability is a natural product of empowered ICT users and communities. It is not obvious for public and private organizations how to exploit the positive potential and limit the negative effects of our more participatory society. In companies, it is necessary to adopt new models of work and innovation: the importance of control, security, centralization and obscurity needs to be balanced with users' demand for freedom and less control in a decentralized and transparent media environment. Among the innovative models that are emerging, particularly significant is the organizational shift from "walled gardens" to "open gardens", which is based on interoperable and open standards (Ajokar and Fish, 2006; Halpin, 2008) emphasizing transparency and participation.

The emancipatory potential of digital convergence might also imply a potential for new forms of digital divide (Norris, 2001; Warschauer, 2004), which can also be discussed in terms of divergence. The relationships between convergent and divergent processes need to be carefully considered: describing various conceptual perspectives on convergence and divergence, Fortunati (2007) described convergence as *"a strategy to rationalize the physical and technological space or, to put it more adequately, to overcome the distribution of technologies in space, and to rationalize the time and convenience of their use*" (p.110). Similarly to Negroponte (1996), Fortunati (2007) underlines the implications that technological convergence has on the time and space dimensions; in addition, she also observed that

> "while being a spatial advantage, […] the rationalization of space might entail a loss of effectiveness in functionality, definition of languages, modalities and services and an increase, at the same time, of the functional complexity of technology, which is scarcely tolerated by users. […]. Convergence may imply also a model of control that deserves to be discussed" (p.110).

Such observations suggest that the increasing complexity of tools, like the mobile phone, might represent a serious obstacle for the realization of their potential utility. From a macro perspective of large-scale social structures, conver-

gence in technologies and their increasing complexity might even lead to diverging societies, fragmented in a multiplicity of disconnected homogenous sub-cultures. In other words, digital convergence might contribute to the widening of the digital divide and to the creation of a balkanized information society rather than an inclusive one. These new forms of divide are not only about differences in access to mobile/Internet and technological competences, but involve a wider range of socio-cultural aspects (Katz & Rice, 2003). As illustrated in the Article VI, the realization of an inclusive information society needs to address not only the specific needs and values of different user generations like digital natives and digital immigrants (Prensky, 2001), but also their effective interaction through intergenerational bridges.

This perspective on convergence – divergence – can help evaluating an important aspect of technological convergence, such as the integration of the functionalities of several everyday objects in the mobile device. The increasing number of features of mobile devices suggested a parallel between mobile devices and Swiss army knives (Livingston, 2004; Satyanarayanan, 2005; Lugano, 2007). Swiss army knives are useful only in emergency situations, while specialized tools are more suitable for use in ordinary contexts. Therefore, the mere convergence of the functionalities of numerous everyday tools (Figure 9) does not necessarily imply an added value to the user. The real challenge, Lugano (2007) pointed out, is not to replicate the features of an object on the mobile device, but rather to enhance such features with the peculiar characteristics of mobile devices, namely portability, connectivity, personalization and contextualization (see 9.3).


FIGURE 9 The mobile device as digital Swiss army knife

One way to acknowledge the increasingly central role of users and communities, and to cope with the risks of new digital divides, concerns the analysis of the social context, in which the phenomenon of social convergence plays a key role.

## 3.5 Social convergence

Cultural convergence deals with the effects of technological convergence on global information societies, its macro effects. Among them, I have illustrated the new role that ICT users and communities have, as well as the challenges that this structural change entails. In this section, I focus on *social convergence*, i.e. the consequences of technological convergence on the actions and interactions of single individuals in social networks, its micro and meso effects. Research on social convergence phenomena is recent; its central term, social convergence, generally refers to social coordination and virtual co-presence.

Social coordination, in turn, refers to the physical or virtual convergence, or rendezvous, of two or more people. When social convergence is discussed in a physical context, it is often related to a special form of social coordination in which mobile communication plays an important role, i.e. micro-coordination (Ling and Yttri, 2002; Farnham and Keyani, 2006). Micro-coordination typically encompasses both the spatial and temporal dimension of an encounter in a real location, including four main processes: agreeing on date, time and modalities of the meeting; informing that one is late, a phenomenon also known as *softening of time*; instant renegotiation of previous agreements; and calling to locate the other person at a meeting place.

Drawing from earlier work on physical co-presence in disaster sites, Hughes et al. (2008) discuss virtual co-presence as a form of social convergence that takes place in virtual environments. Specifically, the authors claim that, as in physical contexts, web-sites support socially convergent behavior. In particular, people may interact with other virtually co-located users in accordance with the characteristics of the roles they take (Goffman, 1959).

While micro-coordination and physical or virtual co-presence involve an actual social process, the second important type of social convergence is inherently a cognitive phenomenon dealing with the effects caused by the convergence of the multiplicity of social spaces into a single digital space. Causing an overlapping between the physical and virtual space of mobile communication, traditional mobile services already produced a tension between public and private sphere (Rice & Katz, 2003a). The inclusion of the online dimension adds new meanings to this problem; analyzing the use of Facebook, one of the most popular online social SNS, boyd (2008) synthesized the effects of social convergence as exposure and invasion and described those effects as "*a result of new technological developments*" (p.18) that is characterized by "*the collapse of disparate social contexts into one*" (p.18). Exposure and invasion are the two cognitive challenges generated by the desire for an increasing convenience of access to social information, which supports more efficient and immediate interactions. Expo-

sure in this connection deals with personal privacy concerns such as personal lives becoming too transparent or hyperpublic; invasion here refers to the problem of social information overload caused by the impossibility, due to the human limited cognitive capacity, to process adequately the amount of social network information made available.

The main challenges of social convergence, exposure and invasion, can be framed in the more general context of the user's control of information flow. From the user's perspective, the problem of personal privacy management concerns the strategies to apply in the conversion of outgoing flows of personal information to social information, while social information overload concerns the selection of cognitive filters to apply to the incoming flows of social information. Both challenges have to be addressed at both technological and human level: exposure and invasion have to be approached as design and education challenges. In other words, the user would not be able to find the optimal trade-off between pros and cons of social convergence without being offered effective design solutions and without being able to develop competences through a learning process. In this view, privacy is regarded as a dynamic practice closely associated to digital sharing. Adapting Fortunati's position (2007) in the issue of social convergence in MoSoSo and developing an appropriate solution to exposure and invasion requires understanding, conceptualizing and new models of control over social network information in mobile contexts.

## 3.6 Focus on the social aspects of digital convergence

The multiple facets of digital convergence that have been illustrated demonstrate that digital convergence is not only about technological convergence, but a much more complex phenomenon. While the technological aspects and economic implications of digital convergence have been discussed for some decades, its cultural and social meanings still remain a young research area, which is nevertheless very relevant for everyday social interactions.

The study aims at contributing to an unexplored research domain, which lies at the intersection between the technological and social elements of digital convergence. Specifically, MoSoSo and digital communities are respectively presented as technological and social products of digital convergence.

Digital communities (Chapter 4) represent the contemporary shape of community, a concept that has a prominent place in the sociological discussion. The term *digital* is added to community because multiple types of ICT are embedded, to a different extent, in all forms of community interaction. In contemporary information societies, communities interact in a hybrid space (de Sousa e Silva, 2006; Rheingold et al., 2006; Crabtree & Rodden, 2008; Bilandzic et al, 2009) that contribute by adding an always-on, ubiquitous and integrated digital layer on top of traditional models of community. Thanks to such digital layer, contemporary communities become *digital*. From a community perspective, the idea of hybrid social space corresponds to the increasing integration and over-

lapping of the offline, online and mobile spaces of community interaction traditionally associated with F2F, Internet and mobile communication. Through converged digital networks, models of local community, mobile community and virtual/online community converge (Figure 10) to form the model of an integrated digital community (Sillence & Baber, 2004). As digital community is characterized by the advantages and problems of social convergence, the problem of digital community design needs to address technological solutions from a human and social perspective.

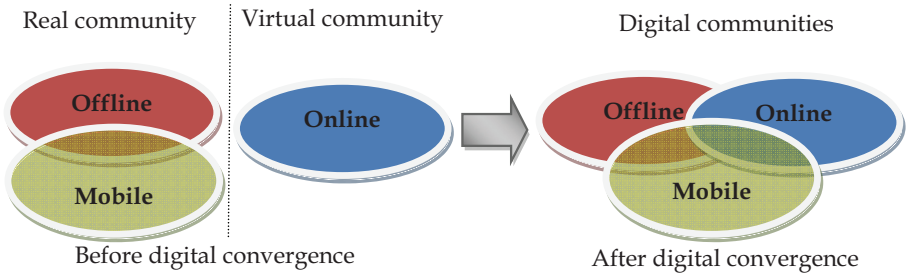


FIGURE 10 Effect of digital convergence on community

The study presents a mobile perspective to the theme of digital community design, focusing on how to conceptualize and design MoSoSo, an emerging paradigm of social computing, in order to realize the potential and manage the risks of social convergence. Although MoSoSo can be used to support interpersonal communication, its most natural location is in the domain of digital community interactions. MoSoSo adds the many-to-many communication paradigm to mobile communication, which has its traditional focus on interpersonal communications. The technological focus of MoSoSo is also motivated by the current transition towards the paradigm of ubiquitous computing for which MoSoSo is an important step. In addition, it is important to shed light on the effects that the multiple facets of convergence have on the formation and development of mobile social systems. This topic has not been systematically discussed in scientific research, with one notable exception (Nyíri, 2008).

Being products of digital convergence, digital communities and MoSoSo are strictly related phenomena. The aim of the study is to find out how the conceptualization and design of MoSoSo might affect the meaning and function of digital communities in the era of digital convergence. Answering to this principal question requires a detailed analysis of both community and MoSoSo, the two concepts that are illustrated in the next chapters.

# 4 EVOLUTION OF COMMUNITY MODELS

One of the most interesting, but also complex, perspectives in the analysis of the social aspects of digital convergence concerns the analysis of the impact of this phenomenon, which was illustrated in the previous chapter, on the meaning of community. Taking an evolutionary perspective, community is regarded as a concept influenced by the characteristics of historical periods. In addition, it is argued that this evolution alternates between periods of convergence and divergence. With the industrial revolution, urban communities quickly emerged as an alternative to rural communities as the dominant form of human association. Classic sociology analyzed the two models of community in opposition. This diverging view about community, based on the different types of local solidarity, was later unified by the network analytic perspective, which shifted the interest to the evolving patterns of social structure. A new diverging trend appeared with the information revolution, leading to the emergence of virtual/online communities, offline communities and mobile communities. By reviewing a large amount of community studies, it is argued that digital convergence is producing a new shift in the meaning of communities by letting the offline, online and mobile dimensions blend into each other. Added to the hybrid social space, digital communities therefore extend the original meaning of community by including new types of relations (i.e. latent ties) and forms of interaction (i.e. ad-hoc ties) grounded on the prototypical activity of digital sharing.

## 4.1 Community, a history of convergence and divergence

This section presents the challenges involved in the conceptualization of community, a highly controversial but nevertheless important concept for scholarly research. Taking an evolutionary perspective, the evolution of the concept of community is associated to three main periods referred to as tradition, modernity and postmodernity. The characteristics and relations among these periods

are then illustrated on a general level. Finally, the current trend of digital communities is anticipated. A key aspect of digital community design concerns the awareness about the diversity of communities that can be "designed" and the peculiar function they assume in a particular historical period.

Community is a concept that occupies an important place in the *sociological discourse* (Tönnies, 1887|1967, Nisbet, 1953; Arensberg & Kimball, 1965; Hillery, 1955 and 1982; König, 1968; Bell and Newby, 1971; Turner, 1969; Cohen, 1985; Wellman, 1979 and 1988; Castells, 2000; Bauman, 2001a; Delanty, 2003) and has received significant contributions from other disciplines as well, such as *social psychology* (Sarason, 1974; Mc Millan & Chavis, 1986), *political science* (Anderson, 1983; Putnam, 1993 & 2000), *organizational learning* (Wenger, 1998), *CMC* (Rheingold, 1993; Harasim, 1993; Turkle, 1995; Baym, 1995; Jones, 1995 and 1998; Parks & Floyd, 1996; Etzioni & Etzioni, 1997 & 1999; Blanchard & Horan, 1998; Komito, 1998; Smith & Kollock, 1999; Wellman & Gulia, 1999; Wellman et al., 2002; Katz & Rice, 2004; Kavanaugh et al., 2005; Kavanaugh, 2007) and *interaction design* (Schuler, 1994a and 1996; Preece, 2000; Kim, 2000; Cohill & Kavanaugh, 2001; Carroll & Rosson, 2003 and 2008; Carroll & Ganoe, 2008).

Despite of the vast amount of research on the central question of what a community is, there is neither consensus on its definition nor on its meaning and function. This might be understandable, considering the variety of conceptual perspectives that have developed on the notion of community; however, even in its native discipline, sociology, the term has not found a common ground. As Kavanaugh (2007) observed, "*even a brief scan of the literature reveals that one of the few areas of agreement between sociologists of community is that an agreement on an adequate definition is impossible to reach*" (p. 102). Reviewing a large body of literature on the topic, Hillery (1955) identified 94 different definitions and found that more than half of them (69) agreed on four main characteristics: a group of people, common ties, social interaction and a shared place. Quite interestingly, the least common denominator of the 94 definitions was the presence of people. Almost thirty years later, Hillery (1982) synthesized his attempts in developing a theory of community as a "research odyssey". Conceptualizing and defining community is therefore a task that presents enormous challenges. For the scope of this study, however, it is not necessary to start a sociological debate on the topic, but rather motivate the choice of a functionally designed approach to community.

The etymology of a word is always a useful starting point in the search for a meaning: as pointed out by Williams (1983), the meaning of the term community directly derives from the Latin words "*communis*" and "*communitatem*" that indicated *putting something in common* or *having something shared by all or many*. Therefore, the etymology of the term already suggests that community is rooted in the idea of sharing something among people. Through a plethora of definitions, conceptualizations and classifications, community scholars have debated what people should actually share to *make a community*. The traditional perspective on community views local solidarity as the most important indicator of a community (Tönnies, 1887|1967). Such element generates what is perceived by

community members as the core of the sense of community (Mc Millan & Chavis, 1986). More recent views emphasize other aspects as well: organizational learning has suggested that community can refer also to the shared sociocultural practices that emerge in a group of people that work together to realize a common goal or objective (Wenger, 1998); community can also be described in terms of social structure that is defined by the sharing of symbolic or material exchanges that take place in the space of social networks (Wellman, 1979 and 1988); sharing that forms the basis of the view of an imagined community (Anderson, 1983) has a subjective nature based on the recognition of oneself as a member of a wider group. According to Delanty (2003), whatever the shared element that is chosen as the foundation of a community, the basic motive for sharing it with others has to be found in the "*search for belonging in the insecure conditions of modernity*" (p.1). This position is also supported by the position of Bauman (2000a), who regards community as a means to seek safety in an insecure world.

Every historical period presents its menaces and threats, which generate fears and uncertainty that can be best faced with the support of the community. The most recent of such fears seems to be connected to the strong forces of globalization and to the feeling of uncertainty caused by living in a *risk society* (Beck, 1992) in which the traditional institutional boundaries are fading and becoming more *liquid* (Bauman, 2000). Community members cannot easily find individual security by cooperating to defend the boundaries of the community from external threats because it is not clear where such boundaries are, as they are in constant evolution. Once, such boundaries were found in the shared physical territory of the tribe, village or neighborhood; today, the search of well-defined boundaries would be unsuccessful because of the wider scope of community involvement resulting from higher physical mobility and availability of ICT for global communication. In this context, community is no longer a "*total world, supplying anything one may need to lead a meaningful and rewarding life*" (Bauman, 2001a, p. 172). Instead of talking of total commitment to a single community, it is more appropriate to refer to many partial communities to which the individual partially is committed. As for all other aspects of life, the choice of such communities is highly personal and constitutes a central element of the concept of networked individualism (Wellman, 2002), the key feature of individualized information societies (Bauman, 2001b; Beck & Beck-Gernsheim, 2002).

The effects of globalization and ICT to the large-scale social structures reflect also on the community on a smaller scale. We connect globalization and ICT to information societies, but also in the past the major societal transformations affected the meaning of community in a similar manner. The structural changes that occur in every historical period are what the Greek philosopher Heraclitus termed *panta rai*, which can be translated as *everything flows* (Bakalis, 2005). From this viewpoint, community, as part of the human world, is deemed to evolve and to be influenced by the forces of historical periods. Having introduced the classic theory of flows, which has its most recent development in

Castells' space of flows in network societies (Castells, 2000), Heraclitus probably provides the most suitable philosophical basis to discuss community from an evolutionary viewpoint. This position allows a flexible view on community, differing from the classic theories and static conceptualization of community with its ideal and unchanging set of characteristics.

Choosing the historical approach to describe the development of the concept of community is useful because it allows underlining community trends and transformations across historical periods while having its own challenges: for instance, it is not simple, and it might be also controversial to choose which historical periods should represent landmarks for the humanity. A crucial fact for the history of a certain country might be considered as less important for another country. It can be argued that every nation and society has its own patterns and pace of development: while many countries entered the information age a few decades ago (Castells, 2000), several others are still agrarian societies. To avoid dangerous generalizations, my discussion on the evolution of the theoretical concept of community focuses on the developments that occurred in the Western society.

Given this premise, and following the approach suggested by Delanty (2003), the history of a community can be represented by three main periods, which can be labeled with the concepts of tradition, modernity and post-modernity (Figure 11). These three major periods, which contain several trends within them, are based on two main landmarks, namely the industrial revolution and the information revolution.

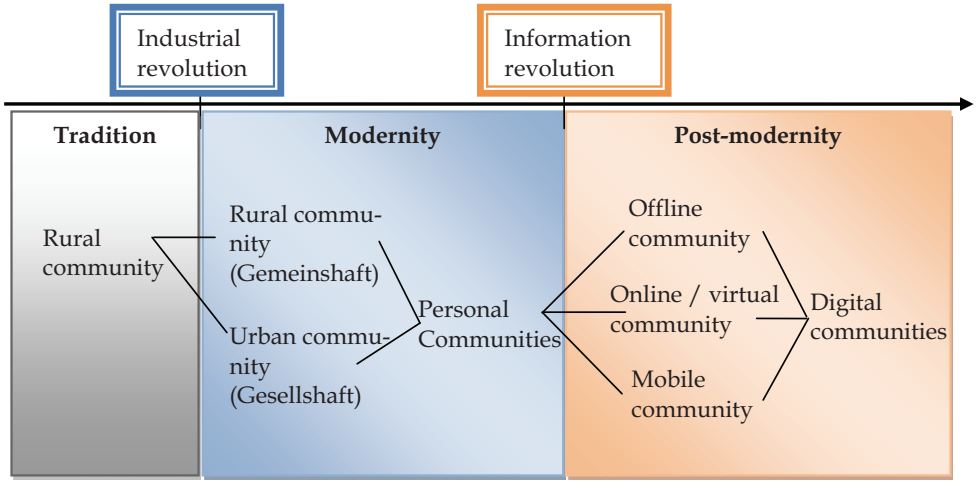


FIGURE 11 Historical evolution of community models

During these periods, the development of community can be described as a series of diverging and converging trends, which are linked to reflect the emergence or decline of key conceptualizations of community. For instance, the distinction between Gemeinschaft and Gesellschaft (Tönnies, 1887|1967) is cur-

rently important mostly for its historical contribution and impact, although it looks rather old-fashioned. With the decline of old perspectives, new proposals for the study of community have been put forward. These include the network analytic approach (Wellman, 1979, 1982, 1988, 2001a; Wellman et al., 1988; Wellman et al., 2002) and the symbolic approach (Turner, 1969; Cohen, 1985). However, the structural approach of the personal community is more suitable for the purpose of the study: on one hand, it allows integrating, in interaction design, the knowledge on structure and properties of technological networks and, on the other hand, concepts and methods of social network theory.

The period of the traditional community, known also as the period of the rural community, remained unchanged until the industrial revolution. From a sociological viewpoint, the early discourse on community spans the period in between the French and American revolutions and the industrialization at the end of the nineteenth century.

The industrial revolution caused a transition from agrarian society to industrial urban society (Ashton, 1962). In the discourse on community, such shift corresponds to the dichotomy between the existing form of human association, Gemeinshaft, and the emerging form of social organization, Gesellshaft, and represents the shift between tradition and modernity (Tönnies, 1887|1967). In an attempt to explain the new forms of social cohesion that appeared in the urban industrialized world, early sociologists asserted that the traditional function and meaning of community had been progressively eroded. As Wellman (1979) explained, this position represents the central statement of the "lost community" argument, which would have appeared several times, in different forms, until now (Putnam, 1993 and 2000).

Two main trends can be recognized in the period of modernity. Its opening phase was characterized by the divergence between agrarian and urban communities, which are regarded as two distinct, alternative and conflicting forms of human association (Tönnies, 1887|1967). In its ending phase, which occurred around the end of the seventies and beginning of the eighties, urban communities became the dominant form of human association because of migration to cities. According to Putnam (2000), while the population living in rural areas in the US decreased from 44% in 1950 to 20% in 1996, the population in metropolitan areas, both in suburbs and city centers, increased from 56% to 80%. Therefore, although agrarian communities did not disappear, urban communities established themselves as the main form of local community. By emphasizing more the individual than the collective experience of the networked social world of the city (Simmel, 1908), urban local communities can be best described with the concept of personal community.

In the nineties, the new social affordances of the ICT opened novel frontiers to community interaction, going beyond the local dimension of the city. Instead of a physical migration to a new territory, ICT allowed people to virtually migrate to the cyberspace to experience life in virtual communities (Rheingold, 1993; Harasim, 1993; Turkle, 1995; Jones, 1995 and 1998; Smith & Kollock, 1999). Much of the early work on virtual communities consists of their

analyses in relation to 'real' communities (Etzioni & Etzioni, 1997 and 1999), with contrasting positions: Rheingold (1993) popularized the idea of the virtual community as a small-scale and intimate realm representing an opportunity to experience again the idealized feeling of the agrarian community. In this view, the virtual community symbolized a sort of Neo-Gemeinshaft, which was naturally regarded in opposition to everyday experience of the offline community. For Komito (1998), the virtual community described by Rheingold (1993) was only one of the possible forms of community in the cyberspace. Specifically, it was a form of moral community, which Bauman (2000a) described as ethic community. According to Komito (1998), the many other forms of virtual community should not be regarded as 'fake' communities of some kind or another, but rather as facets of a multifaceted concept that could have also normative, proximate or fluid foundations in addition to the moral basis. For some others (Schuler, 1994a and 1996), virtual communities had to be regarded as a natural complement to local community interactions, enhanced by means of CMC. Analogously, Blanchard & Horan (1998) portrayed virtual communities as a powerful means to foster social capital in physically-based communities.

In addition to the diverging positions on the meaning of virtual community, related terms started to appear: the most common alternative wording is online community (Preece, 2000; Kim, 2000), which emphasizes the connection to the online world of the Internet rather than the virtuality of its space. In relation to virtual and online community, local communities have been retroactively labeled also as "real" communities and "offline" communities.

The diverging trends in post-modern society are not limited only to the emergence of virtual / online communities enabled by CMC, but also to the contribution of mobile communication. Indeed, while virtual communities had been initially regarded as a means to create new social ties based on shared interests, mobile phones provided the possibility to strengthen existing ties by enabling perpetual contact with family and friends (Katz and Aakhus, 2002). Instead of being in competition with F2F, phone calls and SMS became its ideal complement. They facilitated forms of social coordination or replacement, by allowing contact at distance (Katz and Aakhus, 2002; Ling, 2004). In some particular cases, mobile services such as the SMS have even played a role in the formation of ad-hoc mobile communities on the basis of a shared objective, such as political protest. These forms of mass-mobilizations, which had their first important appearance in the Philippines in the citizens' protest against President Estrada, have been defined as *smartmobs* (Rheingold, 2002). Even if the mobile device represents a very effective tool for satisfying the needs of a mobile community, mobile communication introduces also new challenges to F2F, such as more frequent "absent presence" (Gergen, 2002), or being physically in a place but simultaneously absent.

The initial trend of post-modernity shows a fragmentation of the urban personal community into multiple and partially overlapping instances of the offline, online and mobile community. Later, the realization of digital convergence promotes a new trend, which is slowly emerging, characterized by the

convergence of the multiple facets of community towards an integrated model of digital community (Sillence & Baber, 2004). As Delanty (2003) observed, ICT have given community new possibilities for its manifestation. Being complex to understand, digital communities need new approaches for their analyses and descriptions. They are far from being understood because the technology on which they are based is still in the adoption phase and has not produced any major social consequences. However, the early signals of digital communities have to be taken into consideration in both their positive and negative implications. Considering how deeply the design of a technology influences the way a community is established and the way it develops, survives and disappears, it is essential to carefully look at the conceptual grounds of community before introducing a design solution.

In the remaining sections of the review, the three main phases of community are analyzed in more detail with the goal of identifying differences, common traits, their significance for individual lives and societal development. Such knowledge represents the basis for the understanding of and designing for digital communities.

## 4.2 From tradition to modernity: Gemeinschaft and Gesellschaft

This section presents the classic views on community, which can be traced back to the major contribution of Tönnies (1887|1967). In one of the most recent and interesting variations, Bauman (2000a) reinterprets the Gemeinschaft – Gesellschaft dichotomy as the co-existence of ethical and aesthetic communities. All these perspectives cannot be easily applied as basis for digital community design, but they are useful for understanding the characteristics and function that communities traditionally had in people's lives. The section ends by anticipating the network analytic approach, which overcomes the classic dichotomic perspectives through the notion of personal community, which synthesizes the more egocentric spirit of modernity.

It is generally accepted that meaning and function of communities have started to change with the industrial revolution. Komito's work (1998) underlined that agrarian communities were not necessarily bound to the same single place for all their life-cycle: in fact many of the early agrarian communities were nomadic and had to constantly move to territories that provided abundant natural resources. Even though they did not possess advanced forms of mobile communication technology, such communities were highly mobile. This differed from the present forms of mobile community, by assigning physical mobility to the collective group rather than to a single individual. All relevant ties followed people anywhere they moved; thus, nomadic communities are traditional in the sense that they are connected to the idea of densely connected social groups sharing a common geographical territory.

The first important scientific contribution to set the reference for all subsequent studies of community is the pioneering study of Tönnies (1887|1967),

who, towards the end of the XIX century, introduced what Nisbet (1953) referred to as community-society dichotomy.

As an urban sociologist, Tönnies (1887|1967) was interested in explaining the implications that the major transformations of society of his time had on the human forms of association. Inheriting romantic ideas, he felt that the transition towards modernity, represented by industrialization and migration to cities, meant a gradual erosion of the tradition. In this context of analysis, he recognized two major forms of human association, one representing the tradition, Gemeinschaft, and another describing the new social order, Gesellschaft. While the former paradigm referred to the tight social relationships existing among family members and friends in rural villages, Gesellschaft described the view, typical of urban life, of social relationships that were used as instruments or means to reach a goal. In Gemeinshaft, law is informal and power a matter of consensus. By contrast, Gesellshaft requires a more complex form of social organization regulated by laws and contracts. Finally, Gemeinschaft is naturally associated to a common sense of place, which is rooted on mutual solidarity among the members who share a geographical territory. Gesellschaft associations, on the other hand, do not naturally form and develop in urban environments. For this reason, Tönnies (1887|1967) concluded that there exist no communities in the urban society, which does not consist of communities in their traditional meaning, but only of social networks used by individuals to promote their self-interests. Similar positions were expressed earlier by Rousseau (1762|1962), who claimed that unselfishness and the interest for common good existing in a community cannot suit the egocentrism of modern societies, and by Simmel (1908), who referred to urban environments as interacting circles of social networks. Rather than representing two different and complementary forms of community, the dichotomist classification of community into Gemeinschaft and Gesellschaft shifted the attention to the problem of survival of community in modernity.

Subsequent studies on community questioned the fact that local solidarity exist only in small-scale agrarian environments: König (1968) asserted that primary ties and solidarity can also emerge in Gesellschaft and that cities should not be regarded as places of social disorganization. Urban solidarity, however, was described as different from agrarian solidarity: for Durkheim (1893|1997) the modernizing of society did not cause the disappearance of forms of solidarity, but rather it contributed to the emergence of a new form, typical of urban environments, which he termed organic solidarity. In other words, solidarity existed both in agrarian and urban environments, but in different shapes (Table 1). These two basic forms of solidarity derive from the characteristics of Gemeinschaft and Gesellschaft (Tönnies, 1887|1967). Durkheim's position (1893|1997), which indicates that forms of communal solidarity can exist in modern urban environments, is the foundation of the "saved argument" on the community question (Wellman, 1979; Wellman, 1988). Schmalenbach (1977) observed that the focus on the individual consists in opportunity to choose with whom to create and develop social ties: while in Gemeinschaft ties are mostly

involuntary because they are linked to the family and territory in which one is born, in Gesellschaft relationship development requires a more active and conscious effort.

TABLE 1 Solidarity characteristics in Gemeinschaft and Gesellschaft

| **Mechanical solidarity (Gemeinschaft)** | **Organic solidarity (Gesellschaft)** |
|---|---|
| Small isolated homogeneous population | Larger population spread out over a larger geographical area |
| Division of labor based on cooperation | Complex division of labor |
| Ties based on custom, obligations and emotion | Ties related to relationships connected to the division of labor |
| Moral system based on shared values and beliefs | Normative System based on laws and sanctions |
| Little individual freedom | Much individual freedom |

Despite some criticism, Tönnies's work (1887|1967) has been the most influential conceptualization of community for several decades. For instance, it has been used to develop the anthropological approach to community studies: in the work of Arensberg and Kimball (1965), the idea of community is connected to the idea that the general patterns of culture and society find a manifestation in the community. In their view, community is not socially constructed by its members, but rather a pre-existing entity that exists above its members.

More recently, Bauman (2000a) presented an interesting development of the original community-society dichotomy: instead of opposing the meso and macro structure of society, he described community in relation to the micro level of the individual and more specifically from the perspective of choice between individual freedom and collective security. Using nostalgic tones, Bauman (2000a) asserted that community is a means for an individual to seek security in an insecure world. As in the case of agrarian communities, its primary function was to protect its members from external threats. Community should therefore be seen as an implicit common agreement rooted in ethics and based on the idea that sharing the same territory implies sharing a common destiny. However, the rise of new forms of community, which he calls aesthetic, privilege the dimension of individual freedom over that of collective security. This choice implies less interdependence and obligations to others and the right to self-determination. By introducing the notions of ethical and aesthetic community (Table 2), Bauman (2000a) illustrates the choice between communities supporting individual freedom and communities supporting collective security.

In spite of the challenges that the literature on community presents, the traditional view on community can be synthesized with the notion of local community (Bell & Newby, 1971). Although Gemeinschaft and Gesellschaft may differ on many characteristics, they have in common the sharing of a physical territory. Assuming that community cannot be analyzed in other context than that of a local territory, sociologists have been looking at how social patterns develop locally. Certainly, this assumption was valid before the industrial revolution: people's social lives were clearly limited to a well defined single

territory. However, alternative approaches were required to study urban communities, whose members exhibit higher mobility and participate in multiple social networks distributed over a large territory.

TABLE 2 Characteristics of aesthetic and ethical communities

| | **Aesthetic community** | **Ethical community** |
|---|---|---|
| *Nature* | Subjective | Objective |
| *Primary Purpose* | Satisfy individual needs | Satisfy common needs |
| *Association* | Short/Medium-term | Long-term |
| *Membership* | Easy to obtain / quit membership | Difficult to obtain / quit membership |
| *Obligations* | Not necessarily | Yes |
| *Common ground* | Similarity of interests / preferences | Fraternity |

The need to overcome the spatial limitations in the traditional studies on community found an interesting answer in the network analytic perspective introduced by Wellman (1979) as an effective instrument to describe the emerging forms of community. Indeed, by adopting a network perspective, it is possible to overcome the limitations of community studies, replacing the spatial focus on community with evolving patterns of social structure. As Wellman (1979) explained, "*the fundamentally structural community question has often been transmuted into a search for local solidarity, rather than a search for functioning primary ties, wherever located and however solidary*" (p.1202). By focusing on social structures, it has been possible to overcome the dichotomist perspective of tradition versus modernity and to adopt an evolutionary perspective grounded on the idea that community is socially constructed by people who experience it through social interactions.

## 4.3 The post-modern shift towards personal communities

As described in the previous section, the great influence of the pioneering work initiated by Tönnies (1887|1967) produced a dualism between the community models of Gemeinschaft and Gesellschaft, which reveals a tension between the Gemeinschaft's logic of the collective group and Gesellschaft's privilege for personal choice. The former aspect continues to be strong in agrarian communities, while urban communities emphasize individual freedom. The essence of the transition from tradition to modernity can be found in the weaker constraints of the external environment on personal choice. By emphasizing interaction in egocentric networks, personal communities interpret well the spirit of modernity and allow analyzing the social impact of communication technologies, like telephones, mobile phones and the Internet.

The concept of personal community was initially introduced by Henry (1958) to "*help toward the understanding of feelings of malaise that may accompany*

*the processes of Westernization and urbanization*" (p.831). In his view, personal community corresponds to "*a group of people on whom everyone can rely for support and approval*" (Henry, 1958, p.827). By stating that personal communities could be described through some basic parameters related to social structure, such as reliance, number, constancy and involvement, Henry (1958) anticipated the network analytic approach to community (Wellman, 1979). Such concepts, however, were just intuited and not developed scientifically because the field of SNA was not mature yet (Wasserman and Faust, 1994; Scott, 2000).

Wellman (1979) benefited from a more developed field of SNA, which was applied to the analysis of community in a revolutionary manner: "as Wellman (1988) explained, "*the social essence of community is neither locality nor solidarity, but in the ways in which networks of informal relations fit persons and households into social structures*" (p.131). Through the network analytic approach, the community question can be analyzed by "*looking directly at linkages rather than at solidarities*" (Wellman, 1979, p.1203) that, according to the author, "*can do much to free the study of community from normative and spatial predilections*" (p.1203). This approach allows describing, in a different manner, the long period of transition that started with the establishment of urban communities during the industrial revolution and continued with the emergence of several new forms of community during the information revolution.

The central claim of the network approach to the community question is that community has experienced since the industrial revolution, "*a shift away from communities based on small-group-like villages and neighborhoods and towards flexible partial communities based on networked households and individuals*" (Wellman et al., 2003). Reporting evidence from previous studies in urban sociology, Wellman et al. (1988) listed a number of concurrent factors that had an important role in this shift:

- the emergence of capitalist modes of behavior, which do not favor commitment to the well-being of the community as a whole;
- the bureaucratization of work, which influenced the separation of business ties (i.e. with workmates) from kinfolk and neighbor ties;
- the large scale of the city and its richness, which allowed participation in many different interest groups;
- the decreasing importance of the traditional practices of mutual favours and collective tasks, which were affected by the *McDonaldization* of life. Through products and services, organizations replaced traditional forms of social support that were earlier carried out within the community;
- the increasing dispersion and distribution of social ties resulting from the increased mobility enabled by cheap, efficient and widespread means of transportation and communication.

All together, these major transformations of society contributed to changing the social unit of community from the collective group to the single networked individual. The concept of personal community has been developed mostly by Wellman and his colleagues (Wellman, 1982 and 1996; Wellman et al., 1988;

Wellman & Gulia, 1999; Wellman et al., 2002; Wellman et al., 2003), but the importance of networks for explaining new forms of social aggregations in post-modern global societies has been emphasized also by other sociologists (Castells, 2000; Van Dijk, 2006).

With the help of the network analytic approach, it is possible to observe the impact of large-scale factors, such as the adoption of ICT, through the small-scale interactions in communities. In addition, the observation of such trends also offers material to revise and extend traditional models of community in light of their new structure, meaning and function. For instance, Fischer (1982) tried to explain whether the residential telephone undermined local community or fostered the detachment of people from place. By analyzing empirical data, he discovered that the telephone did not diminish the importance of the local dimension; on the contrary, its social effects seemed more complex. Indeed, the telephone "*enhanced participation of all kinds, local and extralocal, thus expediting the expansion of all social activity*" (p.265). In addition, Fischer (1982) recognized in the emerging trend of privatism an important feature of personal communities: "*the telephone appears to be implicated more in another trend, that of increasing privatism […], the participation in valuation of private social worlds as opposed to the larger, public community*" (p.265). Many of the social activities that were earlier associated to public space of interaction could be managed within the private space through the landline telephone.

The analysis of the social effects which were due to the introduction of an important technological innovation, the telephone, anticipated the themes that have represented the core of the debate on the role of mobile phones in people's social lives (Haddon, 2000; Katz & Aakhus, 2002; Green, 2002; Fortunati, 2002; Rheingold, 2002; Rice & Katz, 2003a; Ling, 2004 and 2008; Ito et al., 2005; Mc Guigan, 2005). Specifically, mobile communication introduced new and more flexible ways of maintaining social ties, contributing to the fragmentation of community into several interconnected and networked social spaces.

The use of computer networks as social networks (Wellman, 2001a) has generally been connected to CMC, which is grounded on the idea that the PC is not only an information-processing tool but also a communication device (Licklider & Taylor (1968).

Unlike landline and mobile telephony, CMC was not originally regarded as a support for F2F interactions and "offline" communication. In the early nineties, virtual communities (Rheingold, 1993) emerged as electronic agoras, where the pioneers of the online world gathered and interacted. Although the Internet was becoming increasingly popular, it was not yet an everyday tool. In 1995 there were 16 million Internet users (Di Maggio et al., 2001), which corresponded to 0.4% of the world population. This group was quite homogeneous, as Internet access is strongly influenced by demographic characteristics, such as gender or ethnicity, by needs gratified by the communication technology, and by resource availability (Rice & Katz, 2003b).

Hackers represent the prototypical type of virtual community. Hackers are typically described as a homogeneous group of users with a strong interest for

technology, a higher-than-average technical knowledge of computer systems, and access to computer networks. It was quite natural for them to establish online social forums to exchange knowledge, to cooperate or compete (Levy, 1984; Jordan & Taylor, 1998). Being motivated by a strong ethical component (Himanen, 2001), the hacker community developed in the cyberspace a form of mechanical solidarity that was earlier observed only in agrarian environments. It was for this reason that the original description of the virtual community provided by Rheingold (1993) established an ideal view of Gemeinschaft for the online world. The early accounts of life in a virtual community gave the idea that the ideal world of Gemeinschaft could be recovered, not in a physical real territory, but rather in the alternative dimension generated by computer networks in the cyberspace.

As did the appearance of *community and society* (Tönnies, 1887|1967) in the industrial period, the publication of *the virtual community* (Rheingold, 1993) ignited a strong debate in the scientific community, with arguments supporting the utopian or dystopian visions of community in the cyberspace. Smith & Kollock (1999) argued that the online world generates new social spaces in which "*the economies of interaction, communication and coordination are different than when people meet face-to-face*" (p.3), but also pointed out that "*the kinds of interactions and institutions that are emerging in the cyberspace are more complicated than can be captured in one-sided utopian or dystopian terms*" (p.4).

The complexity of the effects of the Internet on individuals and communities is well expressed by the contradictory findings of the HomeNet longitudinal study (Kraut et al., 1998 and 2002). In the first study, Kraut et al. (1998) observed Internet beginner users, finding that the use of the Internet led to a small decline in the psychological and social well-being of participants. When the study was repeated a few years later, the negative effects had dissipated (Kraut et al., 2002). In addition, they also found that extroverts and people with much social support had better outcomes from the use of the Internet than introverts or people with little support.

Some perspectives on virtual communities can be placed somewhere in between the utopian and dystopian extremes: for instance, Baym (1995) described virtual communities as a space that can facilitate the exchanges of 'real' fan groups, which are rooted in shared interests and practices. She also pointed out that the opportunity for interaction is not a sufficient condition for the emergence of a virtual community. Indeed, by applying an ethnographic approach to analyze the exchanges that took place in a newsgroup, Baym (1995) found out that virtual communities rely on a much more complex infrastructure consisting of five elements: external contexts, spatio-temporal determinants of access to cyberspace, design of the technological platform, purpose of the discussion and participant characteristics (i.e. personality, demographics).

Parks & Floyd (1996) attenuated the worries for the negative effects of Internet use by claiming that personal relationships develop online, but they often continue also offline because the "*cyberspace is simply another place to meet*".

Based on this observation, they conclude that there seem not to be a "*sharp boundary between relationships in cyberspace and those in real life*".

Although it has been associated to the idea of online world, the notion of virtual community has often been connected with that of online community (Preece, 2000; Kim, 2000), while all other forms of community not connected to CMC have been labeled as offline communities. According to Wellman et al. (2002), the online and offline dimensions complement each other and emphasize the networked nature of contemporary communities: "*rather than increasing or destroying community, the Internet can best be seen transforming community such that it becomes integrated into rhythms of life, with online integrated with offline activities*" (p.151). For Wellman et al. (2002), the offline dimension is mostly connected to F2F proximity interactions and MMC at distance. In this respect, the traditional role of mobile devices was to support offline interactions to maintain contact at distance (Katz & Aakhus, 2002) or to strengthen local social ties, for instance facilitating social coordination (Ling, 2004).

The most recent technological advances allowed mobile devices to introduce features of virtual communities in the mobile context. The study of mobile devices used beyond interpersonal exchanges falls in the domain of mobile communities (Koch et al., 2002; Rheingold, 2003; Schubert & Hampe, 2005; Axup et al., 2006; El Morr & Kawash, 2007). The growing interest for this strand of research, which is centered on the social affordances of mobile technologies, can be explained with the various approaches and their related labeling practices. The term *mobile community* has at least two close synonyms, namely *mobile virtual community* (Rheingold, 2003) and *mobile social network* (Ziv & Mulloth, 2006; Humphreys, 2007).

The iMode in Japan (Barnes & Huff, 2003), the first successful implementation of a mobile social networking system, enhanced mobile-mediated social interactions in the sense that it made communication channels typical of the Internet context, such as the email, available. Unlike Internet social software, the iMode was used to strengthen existing social ties rather than to create new ties. Ishii (2004) observed that "*among the wide array of personal communication media, the mobile Internet is the medium used to communicate with the closest friends or relatives whom the respondents most often see face-to-face*".

While the majority of studies on virtual and online communities followed the sociological tradition of community studies, much of the research around mobile communities emphasize more the technological and economic viewpoints. Once the Internet and mobile devices had become everyday tools (Wellman & Haythornthwaite, 2002; Bakardijeva, 2005), and especially after the explosive success of online SNS (boyd & Ellison, 2007), also mobile communities gained commercial significance. Mobile communities are valuable because they merge the business potential of the online and offline contexts (Schubert & Hampe, 2005): in fact, they are a form of hybrid community in the sense that they rely on multiple access channels, the Web and the mobile, and integrate real and virtual "buddies".

Although most research dealing with mobile communities is focused on viable business models, Rheingold (2002 and 2003) contributed to the sociological discourse by presenting, with enthusiastic and worrying tones, the new social frontiers of mobile communication: indeed, the technological capabilities of mobile devices would allow new forms of virtual communities that possess very short life-cycles characterized by intense interactions, for example the smartmobs can potentially support effective forms of decentralized collective action. Such technologies, however, are inherently double-edged swords in the hands of users because they possess the potential to act both as cooperation amplifiers and as always-on panopticons.

Synthesizing the relatively small amount of research that has been conducted on mobile communities and mobile virtual communities, El Morr & Kawash (2007) identified three main orientations with various topics of overlapping interest (Figure 12).

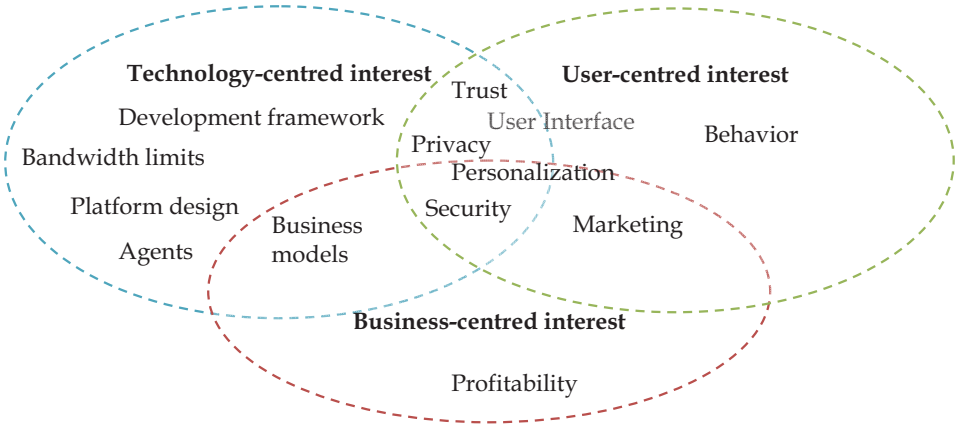


FIGURE 12 Mobile community approaches (El Morr&Kawash, 2007)

This study is ideally centered in the intersection between the human and technological dimensions of Figure 12, which concerns the way theoretical knowledge on human and social behavior contributes to the development of models of trust, privacy, security and personalization. These concerns are addressed in the design of MoSoSo. Although business aspects do not represent the focus of the analysis, the study provides also a number of business implications.

To summarize, the appearance of the Internet and mobile communication promoted a new form of divergence that affected personal communities, now fragmented into three main overlapping forms: the virtual/online community, the offline community and the mobile (virtual) community. Although the relationship among such forms is complex, scientific research has paid much attention to the way the virtual/online community relates to the more traditional model of offline community. In particular, going online has been described as a

possibility to return to the *lost community* (Rheingold, 1993) or as a way to liberate the community from its boundaries, thus enriching existing forms of local community (Schuler, 1994a and 1996). The new trend of mobile (virtual) communities has been considered in relation to both the offline and online dimensions and regarded as some kind of *trait d'union* among them. In this way, the mobile device emphasizes the ongoing individualization process of society (Bauman, 2001b; Beck, U. & Beck-Gernsheim, 2002) by making the individual a 'portal' to his/her social world (Wellman, 2001b).

## 4.4 Hybrid social space and the integrated digital community

This section deals with the contemporary shape of community, which is structured on the top of a hybrid social space integrating the offline, online and mobile dimensions. This emerging view, which is adopted in the study, extends the network analytic perspective of personal communities (Wellman, 1982 and 1996; Wellman et al., 1988) by assigning new meanings to the nature of the social tie, to the form and duration of a social relationship, and to the scale of community interaction. While personal communities were introduced to overcome the limits of the search for local solidarity, digital communities update previous community models by acknowledging users' integrated approach to social communication.

The new meanings assumed by contemporary communities are reflected in the multiple labels associated to communities in scholarly research, such as *hybrid* (Schubert & Hampe, 2005), *cross-media* (Trappeniers et al., 2008) and *content-based* (Turpeinen & Kuikkaniemi, 2007). Although there is not much agreement on labels and approaches, the new community form seems to be grounded on the convergence between the offline, online and mobile dimensions, which blend into each other (Figure 13).

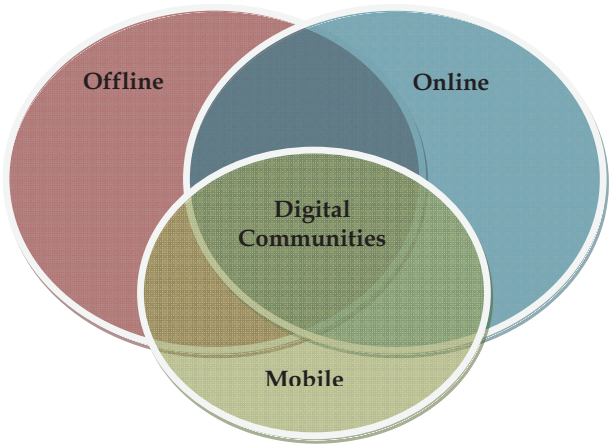


FIGURE 13 Progressive convergence of community models

The multiple characterizations of contemporary communities are not just hypes or fads. Other key sociological terms, such as social space, are also affected by digital convergence. In Simmel (1908), social space corresponded to a shared geographical space, which at the same time enables and constrains social action. The notion of social space has traditionally been regarded as more general and loose than that of community; however, the two concepts are clearly connected. Indeed, both social space and community studies focus their analysis on social interactions in a shared geographical space. Castells (2000) introduced the concept of networked social space to describe the centrality of networks. In community studies, the same concept was expressed by Wellman (1979 and 1988) with the network analytic approach to personal communities. Similarly, digital convergence offers a new insight to the theory of social space, which has been characterized as hybrid space (de Sousa e Silva, 2006; Rheingold et al., 2006; Crabtree & Rodden, 2008; Bilandzic et al, 2009).

Convergence and integration are the keywords that best characterize the hybrid space. According to de Sousa (2006), mobile technologies are at the focal point of this transition and act as enablers in three main ways: firstly, mobiles blur the boundaries between physical and digital space; secondly, mobile access to online social networks affects more closely the dimension of offline communication (i.e. F2F interactions); and thirdly, the mobile Internet reconfigures the structure, perception and experience of physical space by augmenting it with digital information. This position resembles the findings of Taipale (2009), who described the transformative function that mobile Internet technology has on the concept of social space.

To put it shortly, the hybrid space is connected, mobile and social. Crabtree & Rodden (2008) describe hybrid spaces as a media space comprising virtual and physical spaces. This shift implies a tighter connection between bits and atoms, which presents the requirement to designers to integrate tangible and intangible resources in a personalized context-aware user interface. In the editorial of Open 11 journal, all of it devoted to the concept of hybrid space, Seijdel (2006) offers a clear account of what hybrid means:

> Hybrid is a mix of "concrete and virtual qualities, of static and mobile domains, of public and private spheres, of global and local interests" that is "currently experiencing a powerful impetus thanks to wireless and mobile technologies like GSM, GPS, Wi-Fi, and RFID, which are making not only the physical and the virtual but also the private and the public run into each other more and more" (p.4).

Kluitenberg (2006) describes the hybrid space as a multiform concept connecting local space and digital social networks. He goes further arguing that hybrid spaces "*must be deliberately designed to create free spaces within which the subject can withdraw himself, temporarily, from spatial determination*" (p.14). To this purpose, he also illustrates a number of principles, such as privacy, connection/disconnection and empowerment, to apply to design.

The concept of hybrid social space, synonym of hybid space that stresses its social dimension, is useful for understanding digital communities because they emerge on top of it. Digital communities are socio-technical systems,

which rely on the ubiquitous and always-on social connectivity offered by converged digital networks. The model of the integrated digital communities corresponds to the intersection between the domains of the online, mobile and offline communities (Figure 13), which are progressively blending into each other. The concept of digital community, although not widely used in this way, has been introduced in the literature to refer to a group of users whose interactions are not confined to a single technological realm (Sillence and Baber, 2004) but instead use multiple technologies, or *technology bundles* (Ling, 2004).

The study of community, as well as the design of technology for community, needs to acknowledge the current trends connected to the combined usage of offline, online and mobile communications. When multiple technologies are used concurrently, it is needed to collect and aggregate data from multiple sources to understand community structure and dynamics. This challenge is at the same time an opportunity, as the Internet and mobile devices offer an enhanced capability to collect, analyze and interpret large amounts of data on complex social systems (Barabasi, 2002; Heer & boyd, 2005; Eagle, 2005; Onnela et al., 2007; Eagle et al., 2009; Raento et al., 2009; Gilbert & Karahalios, 2009) that significantly contribute to a better understanding of human and social behavior.

From a community perspective, such advances allow acquiring a comprehensive understanding of contemporary communities. In particular, as Internet and mobile technologies are typically used as personal communication devices, they make it easier to explain how converged digital networks affect the structure, perception and experience of personal communities (Wellman, 1982 and 1996; Wellman et al., 1988). Through the notion of digital community, the model of personal community is extended to emphasize the new meanings that digital convergence assigns to three key aspects of personal communities.

First of all, the nature of the interpersonal social ties in digital communities has a looser meaning than in personal communities. In addition to weak or strong (Granovetter, 1973) ties, digital communities add also latent ties (Haythornthwaite, 2002), which might be turned into weak or strong ties through the support of social computing applications, such as MoSoSo.

Secondly, the duration of social ties in digital communities is not necessarily long-lasting as it is in personal communities. Indeed, digital community ties can be ephemeral, particularly those established in an ad-hoc manner. Ad-hoc social ties are becoming increasingly significant in contemporary information societies because they arise from the demand of instantly satisfying needs, or being able to quickly affect change. Entertainment, politics and the economy are areas in which ad-hoc social connections are becoming relevant. In fact, smartmobs (Rheingold, 2002) are a form of ad-hoc community enabled by mobile technologies for the purpose of collective action. At the basis of smartmobs there is not a network of established social relationships, but rather a common value, ideology or objective. Therefore, in digital communities the notion of social tie is not synonymous with social relationship in the traditional sense; instead, it is closer to a logical association, either of the homophilus or heterophilus type (Rogers & Bhowmik, 1970, Lin, 2001), which connects two or more per-

sons. When the digital community is regarded from a mobile perspective, it corresponds to the notion of mobile social network (Articles III, IV).

Thirdly, the scale of digital community interaction may be much bigger than in the past: in rural communities, interactions were associated to villages, which in urban communities were replaced by cities. Although the local dimension is still important in personal communities, the scope of digital community interaction is oriented even more towards a global audience.

By acknowledging latent ties, ad-hoc social interactions and large-scale audiences, the differences between social space and community have become less marked than in the past, making one wonder which peculiar characteristics still allow distinguishing the former from the latter. Being a strictly sociological question, it is out of the scope of this study, but shall be considered when developing a sociological theory of digital communities (Chapter 12).

Technological convergence is a reality, but the shift towards digital communities has not been completed yet. Considering the penetration of smartphones (Quick, 2009), the current period somehow resembles the early stage of virtual communities, when going online was not yet a mainstream habit. Even when some trends, such as smartmobs, flashmobs or other types of swarming behavior, are now slowly emerging, they are still relatively uncommon. To complete the shift towards digital communities requires that the mobile Internet is an integral part of everybody's daily life.

For the moment, it is possible to illustrate some of the traits that seem relevant to digital communities and concern the various intersections of the digital community dimensions.

According to Rheingold (2003), offline and online interactions had initially different purposes, which were respectively related to the maintenance of local acquaintances and the creation of new social ties based on affinity. The author added also that in the long run the process of the digital convergence and the ubiquitous access to communities will make the two dimensions blend into each other, unifying and enriching the concept of community. For Agre (2001), such enrichment corresponds to the always-on condition, described as a world of freedom containing "*anonymous global forces that ceaselessly rearrange all relationships to their liking*" (p.13). The always-on condition is related to a series of new socio-cultural phenomena, such as 'digital lifestyles', i.e. to digital experiences that complement our real, physical world (Hofmann and Thomas, 2008). From a social perspective, the always-on condition might be analyzed as a phenomenon of social convergence (see 3.5).

The second related trend concerns the overlap between online and mobile dimensions. While computers are getting smaller and becoming portable, mobile devices are acquiring computational capabilities and becoming portable multimedia computers. Mobile computers are typically defined as smartphones (Livingston, 2004; Iftode et al., 2004; Abowd et al., 2005; Raento et al., 2005 and 2009; Ballagas et al., 2006). As both personal communication devices can now access computer and mobile networks, the online world becomes an extension of the mobile world and vice versa. This clearly implies that digital communi-

ties are both online and mobile. Even if technological networks and devices have thus functionally converged, it is not possible to adopt a converging view on technology design because each device has its own characteristics and typical contexts of use.

The third trend concerns the relationship between offline and mobile dimensions, which were already complementary to each other before digital convergence (Haddon, 2000; Katz & Aakhus, 2002; Green, 2002; Fortunati, 2002; Rheingold, 2002; Rice & Katz, 2003a; Ling, 2004 and 2008; Ito et al., 2005; Mc Guigan, 2005). The new capabilities of mobile devices in general and sensors in particular, however, allow redefining a new sense of place through location-based services and social proximity interactions (Eagle & Pentland, 2005; Persson et al., 2005).

Taken together, these trends suggest that digital convergence is likely to add a new meaning and function to personal communities. In this respect, the study suggests adopting the idea of integrated digital community to approach the community question in contemporary information societies and to tackle the problem of digital community design. Such approach assumes that the online, offline and mobile dimensions of community do not compete. They should not be regarded as distinct entities; rather, they just represent the complementary dimensions of everyday life.

The integration of the online, offline and mobile dimensions opens a novel opportunity to overcome the traditional dichotomist approach to community and to consider conceptualizations of community grounded on the idea that community is about sharing. In particular, digital sharing in MoSoSo represents the foundation of digital community interaction. From the user's viewpoint, digital sharing refers to the action that, on one hand, discloses personal resources as social resources to other community members, and, on the other, grants access to their social resources (Chapter 8).

The history of community does not end with the phase of digital communities, which represent a moment of unification following the diverging phase that started in the early nineties. Several new trends, either diverging or converging, will follow in the future. For instance, the semantic evolution of the Internet and the establishment of the paradigm of ubiquitous computing (Weiser, 1991) are likely to introduce new issues, which may be related to the social significance of agents, robots and the like (Chapter 12). Without a better understanding of the social aspects of digital convergence, such as digital communities, the next frontiers of technical computing may present more negative than positive implications to social computing. The aim of the study is, however, not to develop a sociological theory of digital community, but rather to apply the theoretical framework of digital communities to enhance the design of its key technological enabler, MoSoSo, to serve human and social needs.

# 5 MOBILE SOCIAL SOFTWARE

The analysis of the intersection between the social and technological dimensions of digital convergence reveals that digital communities and MoSoSo represent its two most characteristic products. As two sides of the same coin, digital communities and MoSoSo influence and complement each other. Hence, the design of digital communities is strongly affected by how we design MoSoSo. MoSoSo is a very young and still immature domain, which has, however, strong links to the more solid research traditions of groupware, social software and context-aware computing, just to name a few. Its peak of success seems already have passed, as new closely related trends like mobile social media or mobile Web 2.0 have gained more popularity. Convinced that MoSoSo has still much potential to express, an overview of its peculiar technological and social traits is presented in this chapter. The overview ends with a summary of the key challenges to be addressed in MoSoSo design.

## 5.1 MoSoSo, emerging area with several contributions

Digital convergence contributes by extending the existing paradigms of social computing with MoSoSo, a class of mobile applications that exploits converged digital networks to enhance social interactions. In the literature, MoSoSo is often described with two synonyms, mobile social applications (Iachello et al, 2005) or social-mobile applications (Smith, 2005). As it is a product of digital convergence, studies on MoSoSo are extremely recent. The first occurrences of the term can be traced back to 2004 (Melinger, 2004a and 2004b), although related applications had been developed earlier in research on context-aware computing (Holmquist et al., 1999) and also presented as location-based community services (Burak & Sharon, 2004). All such strands of research might be analyzed under the general concept of MoSoSo, a paradigm that emerged in response to the need to understand the meaning, to predict the social impact

and possibly exploit the commercial value of the new technological capabilities of mobile communication.

Satisfying the human need for social communication, the success of MoSoSo might significantly contribute to the takeoff of mobile Internet services by giving a sense to the whole process of digital convergence. These were the premises that could explain the growing popularity of MoSoSo around 2005 (Churchill & Halverson, 2005; Eagle & Pentland, 2005; Smith, 2005; Yung et al., 2005) and its public recognition in 2006, when Counts et al. (2006) organized a workshop on MoSoSo at the annual CHI conference. Three years later, the CHI workshop still represents the highest peak of popularity of the term. MoSoSo has not developed as expected, and it is difficult to predict if MoSoSo will create its own research domain or merge with the existing ones.

The limited recognition of MoSoSo should not be regarded as a failure for the whole category of social applications. The multiplication of similar trends reveals quite the opposite. The most significant of these are mobile social computing (Persson et al., 2005; Borcea et al., 2008), mobile2.0 (Holmquist, 2007), mobile web 2.0 (Ajokar & Fish, 2006), mobile social media (Toivonen, 2007; Multisilta, 2008, Ziv, 2008), mobile media (Davis & Sarvas, 2004; Davis et al., 2005; Ahern et al., 2006; Hjorth, 2008; Matsuda, 2009), context-aware mobile computing (Ahern et al. 2006; Tang, 2007; Beach et al., 2008; Gay, 2009) and mobile social networking studies (Ziv & Mulloth, 2006; Pietiläinen et al., 2009; Counts & Fisher, 2008).

Most of these trends connect a number of existing fields of research and practice, such as social computing (Schuler, 1994b), Web 2.0 (O'Reilly, 2005), social media (Lietsala & Sirkkunen, 2008), new media (Haythornthwaite, 2002; Jenkins, 2006; Van Dijk, 2006), context-aware computing (Schilit et al., 1994; Dey, 2001; Raento et al., 2005), and online social networking studies (Gross & Acquisti, 2005; boyd & Ellison, 2007).

The fragmentation of the area derives from the multiple existing strands of research within to the same domain and, in some cases, from the difficulty to establish whether mobile Internet applications are a subset or extension of Internet applications or vice versa. Depending on the perspective, mobile social computing might be analyzed within social computing or vice versa. In a similar manner it is possible to characterize the relation between social media and mobile social media and between online and mobile social networks.

Despite of the confusion, the abundance of approaches centered on the social aspects of digital convergence demonstrates that there is much interest and expectations around them. Understanding and designing for mobility is particularly important for preparing to ubiquitous computing scenarios (Weiser, 1991). For this reason, wearable computing (Mann, 1997; Rhodes et al., 1999; Pentland, 2000), ubiquitous computing (Weiser, 1991) and pervasive computing (Satyanarayanan, 2001) are important research domains for MoSoSo. For instance, wearable computing applications might be considered as the ancestors of MoSoSo. For this reason, a selection of wearable applications was analyzed in

the review of MoSoSo applications presented in Article I. As Heyer (2008) observed,

> "wearables are natural platforms for mobile social computing" (p.12), but "prototyping a mobile social system with wearables presents difficulties […] Modern mobile phones however are highly sophisticated and widely deployed – meeting the definition of wearable in many regards – and as such the more favourable contemporary choice of platform by both commercial and academic designers" (p.13).

A related field of application of MoSoSo concerns the studies on emerging forms of social organization that are enabled by mobile technologies. In contrast to wearable, ubiquitous or pervasive approaches to mobile computing, these studies are typically more interested in the social implications of mobile technology than in the technology itself; among the various topics of interest, an important place is occupied by the descriptions of MoSoSo as an enabler of large-scale mass mobilizations, which are often connected to forms of collective action (Rheingold, 2002; Hirsch & Henry, 2005).

The attempt to contextualize MoSoSo in a single research domain is problematic. As illustrated, MoSoSo is a multidisciplinary area with multiple contributions. To make coherent progress on MoSoSo research, however, there is a need to develop a common understanding of the central issues of MoSoSo, to which the various perspectives can be applied. For instance, MoSoSo might be described as a technological paradigm of social computing and discussed in relation to groupware (Johnson-Lenz & Johnson-Lenz, 1982; Dyson, 1990; Bannon and Schmidt, 1989; Ellis et al., 1991; Grudin, 1993 & 1994; Mandviwalla & Olfman, 1994; Koschmann, 1996) and social software (Shirky, 2003; Tepper, 2003; boyd, 2007). This task presents problems, because there is not even a clear understanding of the differences of the two latter paradigms. In fact, social software appeared as a reaction to the decreasing popularity of groupware and differentiated itself by focusing on the multiple facets of informal online social networking rather than on work or learning activities in well-defined groups.

Groupware applications were originally designed to support social interactions in the context of CSCW and CSCL. MoSoSo could be labelled as a form of mobile groupware. According to Smith (2005), however, MoSoSo is significantly different from groupware applications because it is not primarily designed to "*increase efficiency and productivity of professionals on the go*", but rather to meet a wide range of social needs. It is particularly tailored to the profile of younger users with very dynamic and active social lives. If this observation legitimates MoSoSo, it is also true that the groupware concept has been rapidly evolving and expanding its original boundaries, which were linked to formal desktop interactions in small social groups, towards a broader meaning that also includes informal social exchanges in mobile environments. This trend is demonstrated by the implementation of the Hummingbird (Holmquist et al., 1999), a tool supporting mobile group collaboration and awareness, which can be considered the ancestor of current MoSoSo.

The other close relative of MoSoSo is social software, online applications that in the original definition of Shirky (2003) were not limited to static interac-

tion contexts, but also included mobile contexts. This definition would have rendered the term MoSoSo unnecessary. Melinger (2004a), however, argued that MoSoSo was needed because it

> it "represents more than merely a grafting of social software onto a mobile platform. […] Mobile social software allows people to make connections while they are not tethered to a specific place. And mobile social software becomes more useful when the location of the user is taken into account in the functionality of the software".

From this viewpoint, social software might be regarded as a sub-group of MoSoSo. Or more simply, social software and MoSoSo could be just thought of as distinct paradigms with some overlapping between them. It is possible to identify several scientific areas contributing to MoSoSo (Table 3). Most of the perspectives are in between several areas of research, even if they typically have a technological, social or economic focus.

The variety of domains that are related to MoSoSo is demonstrated by the increasing academic and commercial interest, which however has not been sufficient to establish MoSoSo research as a multidisciplinary research domain. At commercial level, none of the types of MoSoSo has yet been adopted by a critical mass of customers. Academic research has not produced any theory related to MoSoSo and the significance of the related studies is limited to specific applications, activities and contexts. Indeed, such MoSoSo are mostly of exploratory nature and use prototypes developed for research purposes. It can be concluded that MoSoSo, as every emerging research domain, is still quite immature and looking for its own identity.

TABLE 3 Scientific areas contributing to MoSoSo research

| **Scientific area** | **Perspectives** |
|---|---|
| Technology-oriented (natural sciences) | Social computing & mobile social computing, context-aware computing, wearable computing, pervasive computing, ubiquitous computing, complex networks, groupware, social software |
| Social orientation (human & social sciences) | Social media & mobile social media, communication theories of new media, SNA, emerging forms of social organization, online and mobile social networking, social impact of ICT in everyday life |
| Economic orientation | Web 2.0 & Mobile2.0, digital service development, open/community innovation studies |

It is therefore likely that still some years are needed for MoSoSo to establish its own research area, either autonomous or connected to the existing strands of research.

## 5.2 Defining MoSoSo: the role of context

There exist several definitions of MoSoSo; although they are differently worded and have areas of disagreement, most of them agree that the concept of context

is central to MoSoSo. Context seems to be the primary keyword for MoSoSo, especially social context, because the 'software' component that is added to traditional mobile services aims at enhancing social interaction in a very personalized manner. In this view, personalization is realized by employing models of context that fit to the dynamic nature of mobile situations. Indeed, Jung et al. (2006) defined MoSoSo as "*an approach centering on the use of personal devices in connection with the ongoing social context*".

Before discussing its social aspects, it is important to provide an idea of the general and challenging notion of context. When context-aware computing was introduced, Schilit & Theimer (1994) defined context as the "*location of use, the collection of nearby people and objects, as well as changes to those objects over time*" (p.23). The understading of context and context-awareness was developed by Dey (2001), who conceived context as "*any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves*". According to Tamminen et al. (2004), all definitions of context are too general to support the design process in a meaningful manner. In their view, context should be rather understood in a specific use situation, which includes many variables, such as cognitive (e.g. motives, plans…), social (e.g. other people) and computational (e.g. devices, resources). Integrating most of the variables contained in the various definitions of context, MoSoSo might be regarded as a form of mobile context-aware application centered on the social variables of mobile contexts, or more precisely, on the use of contextual resources in social interactions (Gay, 2009).

Two main trends can be identified in the way existing MoSoSo integrates the concept of context in its design: in the first trend, context is primarily conceived as location and secondly as nearby people and objects that can be part of the interaction; in the second trend, context is associated with people, who might decide to disclose their contextual cues, such as location, status and the like. When contextual interaction is associated with a specific location, which might correspond to the range of Bluetooth or WiFi connections, MoSoSo is generally associated to the general idea of *location-based services* (Melinger, 2004a and 2004b; Eagle & Pentland, 2005; Smith, 2005) or more specifically to *social proximity applications* (Persson et al., 2005). If, on the other hand, contextual interaction privileges the dimension of the personal community, MoSoSo is typically described as a form of *social awareness application* (Oulasvirta et al., 2005). The two dimensions of social context in MoSoSo, the 'context as physical place' and 'social context as networked space', closely resemble the local and network analytic approaches to community (Chapter 4). The first meaning is applied by social proximity applications, which privilege the dimension of local community interaction. The second model of social context is used in mobile social awareness applications, which are typically designed to support interactions with one's personal community (see 5.4.3). The connection between social context and the ideas of social space and community indicate that the choice of a model of community is particularly important for the design process of MoSoSo.

The two main classes of MoSoSo, namely social proximity applications (i.e. a form of location-based mobile service) and mobile social awareness applications, may present many hybrid variations. For instance, in location-based MoSoSo the range of interaction space can vary from few meters supported by Bluetooth scanning in social proximity applications (Persson et al., 2005) to the whole city as in Dodgeball (Humphreys, 2007), one of the first well-known examples of MoSoSo. In both cases, the focus on location is based on the idea that MoSoSo might facilitate the creation of social ties through serendipitous encounters or contribute to the strengthening of existing local ties through support to social coordination, friend-finding and rendezvous. While both social coordination and friend-finding typically involve communication at distance and a progressive convergence to a commonly agreed physical meeting place, serendipitous activities such as dating or business networking are based on co-located interaction. As Eagle & Pentland (2005) explained, social proximity interactions are a particular form of location-based social networking that opens a new range of social opportunities thanks to sensor-based mobile social networking. When introducing BlueAware and reviewing other tools, such as Jabberwocky (Paulos & Goodman, 2004), the authors envisioned useful applications supporting serendipity, dating, friend-finding and collaboration in companies. From a community perspective, location-based MoSoSo would therefore represent an opportunity for the community to get back to its local dimension.

Location-based MoSoSo's emphasis on the place where one is located might be regarded as an additional advantage or disadvantage to mobile communication. On the one hand, it might contribute by demonstrating that the local context of interaction is still the most important community space; on the other hand, it imposes a clear spatial boundary on MoSoSo-based interactions, despite the fact that personal communities are based on multiple and distributed social networks (Wellman et al., 2002). If location is regarded as a property of one's contacts rather than as the primary variable of the social context, MoSoSo can be connected to the space of mobile social networks. The space of mobile social networks is not necessarily connected to a physical place: indeed, Churchill & Halverson (2005) do not restrict the scope of MoSoSo only to location-based services, but extend it to any form of social networking. A similar position is expressed by Jung et al. (2006), who regard location-based services, based either on social proximity interactions or communication over a wider local range, only as a sub-set of MoSoSo.

When MoSoSo is conceptualized as a means that emphasizes the dimension of the personal community (Wellman, 1982 and 1996; Wellman et al., 1988), it can be defined as a set of "*techniques for articulating social practices that create, maintain and manage networks of relationships amongst people and encourage the circulation of culture in untethered, networked-based usage contexts*" (Bleecker, 2006). The definition agrees that MoSoSo is important both in creating and maintaining social ties but also underlines the need to apply a network perspective to MoSoSo. Linking MoSoSo to a narrow or large geographical territory would mean to limit the natural freedom of establishing networks in an untethered

manner. The author also emphasizes the role of MoSoSo in the circulation of culture, a term that in this context might seem quite vague. For his purpose, culture refers to the effects of free circulation of information flows in the personal community, which contribute to the idea of a converging culture (Jenkins, 2006). Although each paradigm of MoSoSo has its peculiarities, all forms of MoSoSo are basically rooted in the idea of digital sharing, which also implies social interconnectivity. As the least common denominator of digital communities (see 4.4), digital sharing is a key element for developing a holistic approach to MoSoSo design. That kind of approach would integrate both the location-centered and the network-centered views of MoSoSo into a general purpose model.

## 5.3 Technical basis of MoSoSo

To understand the social aspects of MoSoSo, it is necessary to provide an overview of its technological basis as well. Depending on the choices, users might perceive and use MoSoSo in different ways. Adopting the terminology used by Melinger (2004b), gaining an understanding of the technical basis of MoSoSo allows explaining its first-level effects, which are closely related to the specific features of the application. For instance, SMS provides an asynchronous alternative to synchronous phone calls. The first-level effects entail second-level effects, which are complex and not easily predictable. The use of SMS for organizing large-scale mobilizations for political protest corresponds to a second-level effect of SMS. Although the technical basis of MoSoSo may be used in unexpected and creative ways, it is important to discuss how some technological choices might affect social relationships, forms of social organization and the experience of cities.

### 5.3.1 Stand-alone application or general purpose social platform

The first important issue concerns the way MoSoSo is conceptualized in the literature. In the various accounts, MoSoSo has been referred to as an approach (Jung et al., 2006) as a set of techniques (Bleecker, 2006), as services (Liu et al., 2009), as systems (Thom-Santelli, 2007; Humphreys, 2007; Counts & Fisher, 2008; Heyer et al., 2008), as software (Eagle & Pentland, 2005), as middleware (Borcea et al., 2008; Pietiläinen et al., 2009), as applications (Smith, 2005; Pellegrino, 2006; Tang, 2007; Kolko et al., 2007b; De Jong et al., 2008; Tsai et al., 2009; Belloni et al., 2009) or as a product (Crowley, 2005), among others.

These terms have often been used not exclusively: for instance, according to Churchill & Halverson (2005), MoSoSo refers to both applications and services. Axup et al. (2006) discuss MoSoSo both in terms of system and services. For Counts et al. (2006), MoSoSo includes also standards for software, hardware and protocols. It is worth underlining that the term product has been used to

characterize the commercial nature of a specific MoSoSo (Crowley, 2005). While the term middleware is specific, the terms software and applications are much more general but still limited to the technical aspect. On the other hand, the term systems might also include the interplay of human and technological elements. The other important term, services, is often used to refer to the whole process in which MoSoSo is included. The two remaining labels, 'approach' and 'set of techniques', are less bound to technology and more linked to the way designers approach it.

In addition to analyzing the way MoSoSo is characterized, it is important to discuss also some terms that might fit well to the nature of MoSoSo and that, quite surprisingly, have not been used much so far. Even if the term middleware is closely associated to it, MoSoSo is not typically described as a general purpose social platform. Instead, MoSoSo is more commonly described as a stand-alone application. This analysis on terms that characterize MoSoSo indicates that MoSoSo is typically associated to a limited range of social activities, contexts and features. This observation is confirmed also by De Jong et al. (2008), who regarded the lack of integrated MoSoSo solutions as a limitation. Indeed, focusing the design of MoSoSo on a single main purpose implies also limiting the scope and adding constraints to the practical utility of MoSoSo. However, Jung et al. (2006) also observed that

> "In theory, the ambitious of designing a 'general social tool' would be feasible only if the common user needs and the nature of social interaction were well understood in the domain area. But when the technology does not have established social practices, it may be a challenge to acquire such understanding in order to inform the design decisions for mobile social software concepts" (p.70).

Although the choice of designing MoSoSo as a stand-alone application is imposed by the limited understanding of the complex processes that are connected to contextualized social interactions, the cost of not addressing such complexity would be not to realize the real potential of MoSoSo.

### 5.3.2 SMS-based, client-based or cross-media solution

Three main generations of MoSoSo can be identified when considering its historical development as a technology: the SMS-based, the client-based and the cross-media one. This classification allows including early examples of MoSoSo that would be excluded if only the most recent versions running on smartphones were considered.

The SMS-based generation includes smartmobs practices (Rheingold, 2002), early friend-finders, match-making and location-based applications such as Dodgeball (Crowley, 2005; Ziv and Mulloth, 2006; Humphreys, 2007), Txtmob (Hirsch & Henry, 2005) or Swarm (Farnham and Keyani, 2006). The most common features of this kind of MoSoSo are SMS alerting and notifications. Because of the nature of the SMS, the first-generation MoSoSo only supports asynchronous interactions. One of the reasons to introduce MoSoSo as a

SMS-based service was to be able to reach a critical mass of users by adopting a well-known and popular technology (Crowley, 2005). Designing a SMS-based MoSoSo typically shifts most of the work to the server side; as in the case of Dodgeball, designers developed a query language that was able to interpret the various commands. For instance, '@TheClub' had to be parsed by the server as a description of the current location to search in the database of local places.

The client-based generation of MoSoSo includes all types of applications designed for social purposes. These can be installed in a mobile device, typically a smartphone. The most common types of client applications used for social communication include mobile email, mobile IM, mobile SNS and mobile browsers. In some cases, such software comes bundled with the device, while in others it needs to be installed through a manual procedure, which requires the download of a specific client application. The lack of agreement among vendors for a set of basic set of MoSoSo to be installed on the device is a serious obstacle to the users' adoption and diffusion of MoSoSo. A notable exception is the mobile browser, the only client application that is bundled with all models of smartphone and that can function as a general purpose social platform by offering a standardized way of accessing digital communities through the mobile device. Mobile access to online social networks through mobile browsers is currently the most common form of MoSoSo.

Although not widespread, the most interesting examples of client-based MoSoSo include a variety of mobile applications that have been designed for use in mobile contexts. For instance, Reno (Smith, 2005), a location-aware MoSoSo, aims at facilitating rendezvous among two or more people. Unlike SMS-based MoSoSo, which required a server to perform the location calculation, Reno uses the GSM infrastructure. According to Smith (2005), the participants of user studies regarded Reno easier to use than SMS and less intrusive than a phone call for coordinating a group meeting.

While Reno focused on the strengthening of existing social ties, other types of client-based MoSoSo, such as BlueAware, BlueDar and Serendipity (Eagle & Pentland, 2005) have been developed for the creation of new social ties by facilitating serendipitous encounters. The authors regarded MoSoSo as an introduction system that can exploit user and network information in various manners, for instance by introducing people on the basis of similarity of their user profiles or mutual acquaintances. If this approach opens new frontiers to MoSoSo, it also renders the work of designers more complex because it imposes the requirement of collecting contextual data. By focusing on the social context, the key types of contextual data are represented by user behavioral, social network data and environmental information.

Another important example of client-based MoSoSo is DigiDress (Persson et al., 2005), a research prototype which was developed as Scent (Jung et al., 2006) and later launched as a commercial product under the name of Nokia Sensor (Persson & Jung, 2005). Like Reno and Serendipity, also Scent focused on social proximity interactions, but differs from those two applications by the choice of not including any privacy measure in the design: in fact, the user pro-

file created in the application is regarded as a sort of 'digital self' that is presented to the co-located others. Like a real body, also the digital self is visible to others and takes part to the ritual of social interactions.

Although very different in nature and purpose, Reno, Serendipity and Scent aimed at enhancing social interactions among nearby individuals. Socialight (Melinger, 2004a and 2004b) was not limited to this dimension of interaction; rather, it connected all the various dimensions to the wider area of community creation and development, which benefits of both acquaintance-based friend-finding and interest-based introduction protocols. By connecting MoSoSo to theories of community and social capital, Melinger (2004a) uncovered an important property of MoSoSo: its utility, both locally and globally, in strengthening strong ties and in creating and developing weak ties.

Unlike the SMS-based generation, client-based MoSoSo can support both synchronous and asynchronous communication. In addition, it can exploit the capabilities of digital convergence better because it is not limited to textual interactions but can also support all forms of multimedia. Being more powerful, the client-based generation is inherently more complex to design, in particular when it comes to the mechanisms regulating information flow, display of digital self through the user profile and protocols for social connectivity.

The third type of MoSoSo, cross-media MoSoSo, has a hybrid nature: for instance, the basic features of Slam (Counts, 2007; Counts and Fisher, 2008) can be used on traditional mobile phones, while its full range of features can be used only on smartphones. Therefore, Slam can be regarded both as SMS-based and as client-based MoSoSo. Cross-media MoSoSo does not include only MoSoSo developed for different types of mobile technologies, but especially MoSoSo that is designed to be used in combination with other media, running across different technological platforms. For instance, Rhub is a cross-channel type of MoSoSo based on a syntax that can be used in SMS, IM and email (Heyer et al., 2008). Within this group, Twitter (Mc Fedries, 2007; Java et al., 2007) probably is the most popular application, as it allows members to describe, in 140 characters, what they are doing by using email, instant messaging systems, SMS or the Twitter site. In many cases, client-based MoSoSo allows accessing social applications email, IM and SNS in mobile contexts. In a way, this group of applications can be regarded as a form of cross-media MoSoSo.

The three main categories of MoSoSo that have been introduced here can be compared on the basis of their relationship with the Web (Figure 14). Specifically, SMS-based MoSoSo is more mobile-centric, while client-based MoSoSo is typically more online-centric. Cross-media MoSoSo places itself half-way between the mobile and online world because it actually integrates them into the more general dimension of digitally converged networks.

From an historical viewpoint, the mobile-centric SMS-based approach to MoSoSo is also the oldest, while the online-centric approaches that developed later carried with them promises that have not been fully fulfilled. Indeed, client-based MoSoSo is not widespread yet and it is likely to never take off because of the difficulty in reaching a critical mass of users.

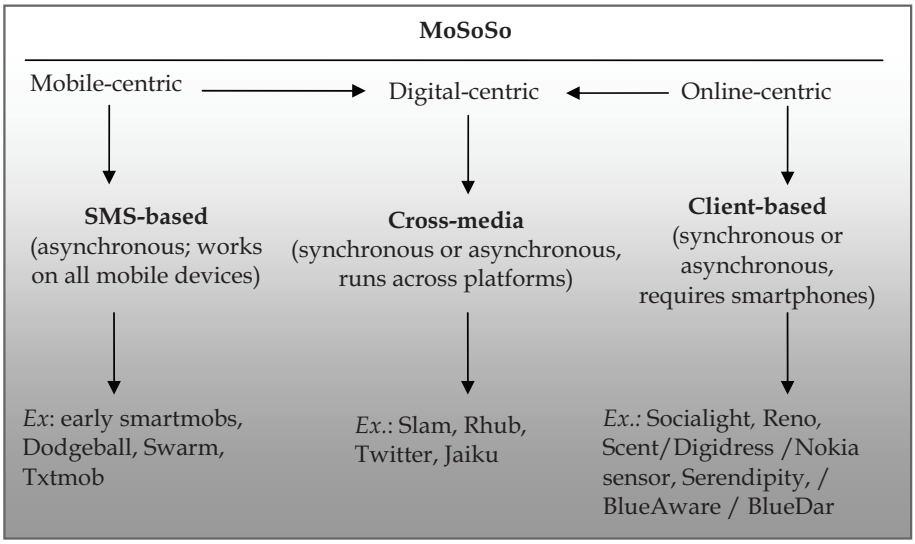


FIGURE 14 Classification of MoSoSo by technical basis

The most recent trend, the cross-media approach to MoSoSo, is also promising and likely to reach the critical mass by not forcing users to adopt a specific technological solution, but rather by offering a wide range of choices for all needs and contexts of use.

### 5.3.3 Architecture: client-server or peer-to-peer

The choice between a centralized or distributed architecture on which to ground a MoSoSo solution is another important technical issue that the designers have to face. The range of possibilities includes, on one extreme, the traditional client-server approach, which offers the opportunity to implement a centralized solution, and, on the other extreme, the p2p approach that follows the opposite approach of decentralization. Both types of architectures have been used by MoSoSo designers, with the client-server approach being the oldest and most popular (Melinger, 2004a and 2004b; Smith, 2005; Eagle & Pentland, 2005). The most recent trends in MoSoSo, however have experimented with p2p approaches, which seem promising (Magaldi et al., 2008; Pietiläinen et al., 2009; Tsai et al., 2009).

SMS-based MoSoSo, which relies on an SMS server, is inherently connected to the client-server model. Similarly, cross-media MoSoSo is also bound to the client-server model, as it typically needs to access information from shared repositories. On the other hand, client-based MoSoSo does not present this limitation. The p2p approach has been widely used in social proximity applications based on the establishment of temporary ad-hoc social connections. For instance, the user profiles that are publicly accessible through Nokia Sensor

(Jung et al., 2006; Persson et al., 2005; Persson & Jung, 2005) are accessed directly through the devices and do not rely on the Web. P2P models are extremely versatile and efficient. Although they provide an opportunity to explore, they also present several challenges, which are connected to their decentralized nature. In particular, the adoption of p2p models of technologies and services would require organizations to revise their current business models and carefully consider the legal aspects connected to free and uncontrolled circulation of digital information flows.

### 5.3.4 MoSoSo in relation to existing Internet applications

When considering MoSoSo in relation to existing Internet applications, two main positions can be recognized: whereas the former position supports the idea that MoSoSo contributes to the mobile Internet by extending existing online applications to the mobile environment, the latter position sees MoSoSo enabling new types of socio-technical networks that are not necessarily connected to the Internet. Broadly speaking, SMS-based MoSoSo belongs to the latter group and cross-media MoSoSo to the former group. As for client-based MoSoSo, the class of applications that exploit sensor-based connectivity, i.e. social proximity applications, might be regarded as distinct webs of sociability, while the others that remain present a higher overlapping with the existing online social networks.

As multiple trends intersect, there exists some evidence that supports both of these positions: for instance, a large portion of UGC that is at the core of Web 2.0 (O'Reilly, 2005) has been created with mobile devices. Part of it has also been directly uploaded to the Web through mobile devices, but most of it is first downloaded to the desktop or laptop computer and then published online. However, most digital content stored in mobile devices is not published online, but rather kept on mobile devices and showed to friends in F2F situations, or sent to friends through mobile services such as the MMS.

With the diffusion of smartphones and cheaper mobile data plans, an increasing number of users have started to access their favorite web-sites through mobile devices. SNS are among the most popular sites. At first sight, this trend seems to indicate that MoSoSo is extending the online social networking activity to mobile contexts. Mobile social networking, however, should not be regarded simply as mobile access to online social networking. For Axup (2006),

> "MoSoSo services are more than web-sites with mobile access added; they are new methods to coordinate mobile activities, new ways to connect with people when it is useful, and new ways for group interaction and creativity to take place" (p.66).

It has also been found that MoSoSo is particularly valuable in developing countries, where there are significant barriers to Internet access (Kolko et al., 2007b). In these areas, MoSoSo would provide an effective alternative to public Internet access points for exchanging information with one's social network. In addition,

the author also observed that SMS-based MoSoSo constitutes the most suitable form of MoSoSo in these areas because of the underdeveloped 3G infrastructure and costly smartphones.

### 5.3.5 MoSoSo in relation to existing mobile services

Representing a synthesis of the online and mobile world, MoSoSo can be described in relation to traditional mobile services. In this context, the most typical question concerns the new activities that MoSoSo enables.

Unlike phone calls and SMS, which are based on a single medium, respectively voice and text, MoSoSo supports different types of media. From this viewpoint, it is more similar to MMS, which however presents a rigid conceptual model that closely resembles the idea of digital postcard. In contrast to MMS, MoSoSo is much more flexible and allows several variations of design that adapt to different needs, contexts and communication models.

A common trait of the phone call and SMS is that both are designed for interpersonal communication. Although MoSoSo offers the 1-to-1 communication model, it typically includes the group communication models as well, both in the 1-to-many and in the many-to-many version. From this viewpoint, MoSoSo has the potential to overcome the scalability problems of mobile communication systems, recognized as one of their major limitations for social coordination (Ling, 2004).

A number of other aspects, which are more social than technical in nature, differentiate MoSoSo in relation to traditional mobile services: for instance, MoSoSo allows a much richer presentation of the digital self through the integration of user profiles, one of the typical features of social software applications. Indeed, in the basic version of mobile phones the concept of digital self was limited to an address-book entry, which typically consisted of the 'telephone number, textual label' pair. The concept of user profile is not well developed in a mobile social networking system based on phone calls and SMS. The features offered by the address-book are very limited and not well connected to the services: indeed, the photo, ring-tone and notes that can be associated to a contact entry are more related to the need for personalization than to the provision of advanced social-network based services.

Another important difference between MoSoSo and traditional mobile services concerns the function that MoSoSo has in MMC. While the role of phone calls and SMS is connected to the maintenance and strengthening of one's existing social ties, MoSoSo also offers the possibility to establish new social ties through a wide range of methods. Together, phone calls, SMS and MoSoSo play a crucial role both at a local and at a global level. The usefulness of traditional mobile services, however, does not depend on the characteristics of the context, which in MoSoSo are fundamental. For instance, social proximity applications are almost useless in places where the density of people is low (Thom-Santelli, 2007). Although its usefulness for developing countries has been underlined (Kolko, 2007a), MoSoSo is generally designed to be appre-

ciated as an urban technology. Furthermore, while phone calls and SMS have been quickly adopted by users of all ages, genders and social positions, MoSoSo is designed to be particularly appealing to teenagers and young adults, the social groups with the most active and demanding social life.

A final important aspect, which is discussed elsewhere (see 5.3.1), concerns the conceptualization of traditional mobile services and MoSoSo: while the former are conceived as general purpose social platforms, the latter is typically designed as a stand-alone social application.

In conclusion, it can be argued that MoSoSo introduces novel aspects in mobile communication systems. These aspects derive from its multifaceted nature, more similar to online social software than to traditional mobile services. The function of MoSoSo should be therefore regarded as complementary to phone calls and SMS, not as being in competition with them.

## 5.4 Social aspects of MoSoSo

The technical basis of MoSoSo, its software, is functional for achieving its social purpose. For this reason, a complete overview of MoSoSo has to include a description of the social aspects of MoSoSo. First of all, the typical activities and contexts in which MoSoSo is used are presented; secondly, the effects that MoSoSo produce on several issues relevant to community interaction, namely identity expression, mobile social networking, digital sharing, social dilemmas, personal privacy management and social information overload, are analyzed. The shortcomings that current MoSoSo present in relation to these issues are a part of an input to the design phase.

### 5.4.1 Spatial context of MoSoSo: an exclusive urban gadget

Research has demonstrated that MoSoSo has great potential in rural areas (Kolko et al., 2007a), but nevertheless it remains inherently an urban technology. Furthermore, MoSoSo is typically associated to specific urban areas, such as streets, shops, restaurants, cinemas, bars and clubs. To put it shortly, MoSoSo privileges consumption- and entertainment-based urban experiences (Thom-Santelli, 2007). Indeed, Dodgeball (Crowley, 2005) was not made available everywhere, but only in twenty-two American cities, the locations of which had been mapped into the database. In addition, Bluetooth-based social proximity applications make sense only in densely populated places, in other words, cities.

After all, if MoSoSo is about turning potential opportunities into real opportunities, the city certainly offers many more opportunities than the countryside. It is implicitly assumed that MoSoSo enriches urban experiences by offering individuals more chances to socialize while spending their time in public transport, restaurants, bars and streets. The always-on connectivity to place and people might increase the phenomenon of compression of time (Green, 2002),

related to the idea of timeless time, the "*desequencing of social action, either by compression of time or by the random ordering of the moments in the sequence*" (Castells, 2000).

The effects of time compression and timeless time have been analyzed by scholars who described the intense use of mobile phones during transitions between place or activity or while waiting. Fortunati (2001) pointed out the negative consequence of not being able to enjoy 'lost time' that could be filled with reflection, observation and reduction of the uniformity of one's existence. For Rheingold (2002), "*any waiting time becomes a potential communication time and the general notion of time is "softened" to accommodate all kinds of activities, sometimes in a simultaneous manner*". The negative consequences are philosophically summed by Castells et al. (2007), who asserted that "*by saturating dead time with communication, people compress and, ultimately, deny time*". Being constantly immersed into a space of perpetual connectivity leads to the desire for disconnection (Jauréguiberry, 1998) and produces a negotiation about the times of one's availability to communicate. Accessibility becomes then more related to time than space, with public and private times personally regulated by switching on and off the mobile phone (Green, 2002). Observing time patterns, Haddon (2000) described the paradox of people having more free time available to them, but feeling that their lives are becoming busier: the more new technologies allow us to accomplish in an instant, the more we seem to run out of time (Meyrowitz, 2004). Investigating the effects of time in everyday life, Eriksen (2001) even speaks of 'tyranny of the moment'.

These effects are likely to become more common when the notion of perpetual contact (Katz & Aakhus, 2002) is extended with access to converged digital networks, producing an increase in interruptions generated by incoming alerts, notifications, updates and messages. In this respect, Turkle (2008) raised the question of whether we are leaving enough time to take our time:

> "Those who are attached to Blackberry technology speak about the fascination of watching their lives "scroll by", of watching their lives as through watching a movie. One develops a new view of the self when one considers the many thousands of people to whom one may be connected. Yet just as teenagers may suffer from a media environment that invites them to greater dependency, adults, too, may suffer from being overly tethered, too connected".

It seems quite paradoxical that the view of the tethered self (Turkle, 2008) might be associated with the diffusion of MoSoSo technology defined in terms of *"untethered, networked-based usage contexts*" (Bleecker, 2006).

In a recent exploratory study of MoSoSo in the subway setting, Belloni et al. (2009) discovered a typical case of the tethered self, which was presented as the presence-awareness dilemma. One of the participants witnessed the negative implications of presence-sharing: "*once I realized one of my colleagues was in the train, I didn't really know what to do…I don't know him so much and I didn't really want to talk about work*". This critical aspect, common to all ubiquitous technologies, should not lead to the idea that MoSoSo would bring more problems than benefits. On the contrary, it should encourage designers to develop ade-

quate technical solutions that take into account relevant social issues such as the human desire for disconnection.

These issues are addressed in the MoSoSo design model by suggesting the inclusion of both 'amplifiers' and 'attenuators' of social information, dealing respectively with the amplification and attenuation of social opportunities.

### 5.4.2 Identity representation and expression

MoSoSo is currently associated to consumption- and entertainment-based urban experiences (Thom-Santelli, 2007). This conceptualization has notable implications for the profile of its typical users, who tend to be young, technology-oriented and socially active. Some of the features of MoSoSo, such as friend-finding and match-making are aligned more with the lifestyles of teenagers and young adults who have very high social needs and very dynamic and quickly evolving lives. MoSoSo is tailored to the profile of teenagers and young adults because they represent the key consumer segment for businesses, especially where new technological innovations are concerned.

When designers thus conceptualize a specific category of ideal users, they impose constraints to the adoption of MoSoSo by envisioning a limited set of user profiles matching the contexts and activities considered in business scenarios. Discussing the case of Dodgeball, Thom-Santelli (2007) concluded that such model of MoSoSo does not exploit the richness of the city and the multiplicity of its resources, but rather encourages homogeneous experiences. To overcome this view, the author suggested moving beyond the typical user and facilitating not only homophilus interactions, but also heterophilus interactions. From the design viewpoint, these issues concern the choice of a general user model and the design of protocols for social connectivity (Chapter 8). The former can be associated to the user profile, the way the individual is represented in the digital social space of MoSoSo, while the latter can be associated to the concept of mobile social networking.

The key issue of identity representation and expression is addressed in this section, while the support of various forms of social interconnection in the mobile context is discussed in the next section (see 5.4.3).

In traditional mobile services, individual identity is coupled to the telephone number, which allows the unique association of a phone call or SMS to a specific person. By integrating the knowledge of the real identity of the caller or sender of a SMS, traditional mobile services have generally been considered as trustworthy. This contrasts with online social software most of which is based on the notion of virtual identity, which does not necessarily match the participant's real identity. In addition to the chosen textual identification - the nickname - the virtual identity can be enriched by graphical avatars and fantasy descriptions of the self. Compared to traditional mobile services, virtual identities in social software are considered less trustworthy. Trust in virtual communities was not usually associated to the real identity, but rather to users' behavior in

the system. This aspect decoupled identity from trust, allowing users to use their creativity to create and develop virtual identities.

In many ways, digital convergence has put an end to the cyberspace (Pang, 2007) replacing it with the notion of hybrid space (de Sousa e Silva, 2006; Rheingold et al., 2006; Crabtree & Rodden, 2008; Bilandzic et al, 2009). Being highly connected to the dimension of offline interaction, identity representation in the hybrid space shall include a virtual identity, but nevertheless allow connecting it to a real identity. It seems that in MoSoSo the forms of identity representation and expression are closer to the virtual identities of cyberspace than to the real identities of traditional mobile services.

In DigiDress (Persson et al., 2005; Persson & Jung, 2005), a type of MoSoSo that particularly emphasized the centrality of identity expression, the virtual identity included four tabs (Figure 15), each of which was freely modifiable by the user, who could also choose whether to use textual or graphical entries.

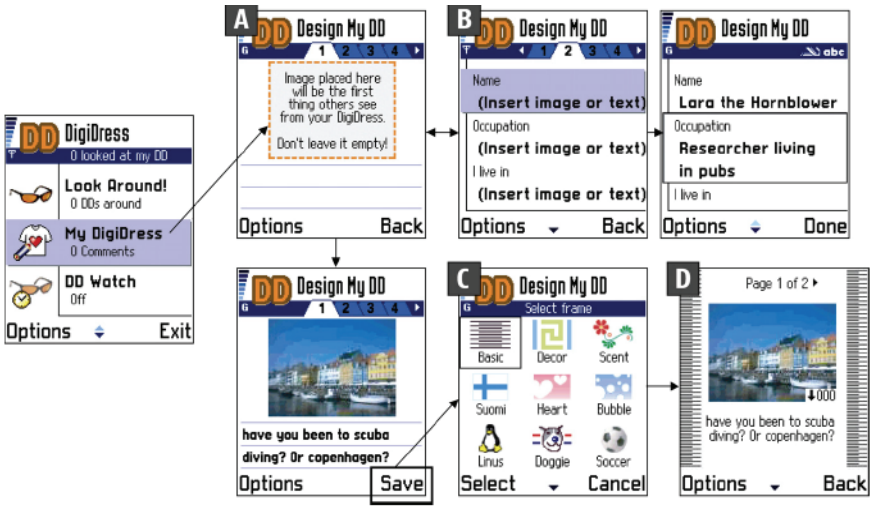


FIGURE 15 Identity expression in DigiDress (Persson et al., 2005)

Among the pre-defined fields for identity expression included by the designers were: the main profile image and textual presentation of the self; a number of fields with a main identification (e.g. name), work-related information (e.g. occupation), location-information (e.g. residence) and personal preferences (e.g. 'I cannot live without…', 'Favorite food/drink', 'Favorite phone model', 'Favorite TV program'); and additional features for personalizing the identity space (e.g. graphical template to personalize the margins).

As described by Persson et al. (2005), the rich media identity expressions created by the participants of the DigiDress field trial were serious and playful, revealing and non-revealing. In particular, participants choose the style of the identity expression according to the way they intended to use MoSoSo. Specifically, a sober style of virtual identity was typically associated to an interest for business networking, while more creative and playful profiles were created by

those who were more interested in pure socializing and entertainment. In Nokia Sensor, the commercial version that followed the DigiDress prototype, identity expression features were enhanced on the basis of the field trials (Persson & Jung, 2005), including also the set of personal media (e.g. photos, videos, audioclips) related to the personal identity.

Although very similar to the user profile created in online SNS or forums, the virtual identities of DigiDress are created for and used in mobile contexts. WhozThat (Beach et al., 2008) took another approach, known as 'social aggregation': instead of creating the virtual identity through the mobile, WhozThat uses a 'social ID' to retrieve the user's virtual identities from online SNS (e.g. LinkedIn, Facebook…) and then shares them with another user who has requested access (Figure 16).

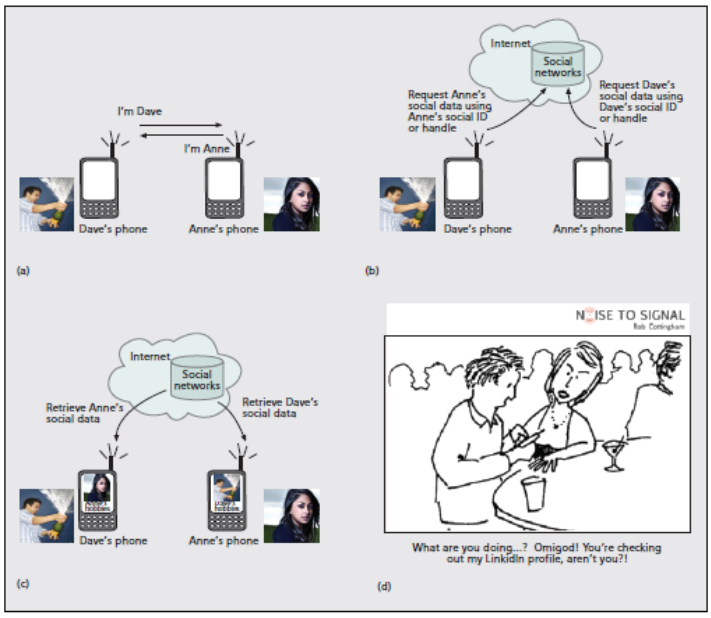


FIGURE 16 WhozThat approach to virtual identity (Beach et al., 2008)

Social aggregators, such as FriendFeed, collect feeds from multiple sources, such as blogs, SNS and other Web 2.0 sites, and display their aggregation as output on the desired device. Bhatt et al. (2008) stated that social aggregation increases information awareness; when MoSoSo is conceived as an aggregator of social information, it consequently becomes a tool supporting social awareness. The increasing popularity of social aggregators reflects the need for technological convergence not only in the hardware domain of networks, but also on the software dimension of social networking sites. This form of aggregation, however, presents the problem of how to construct a virtual identity on the basis of multiple instances that might differ on several aspects.

DigiDress and WhozThat present different approaches, but both follow the web-based model of virtual identity. Counts & Fisher (2008) noted that "*be-*

*cause mobile social networking services appear to facilitate face-to-face interactions, greater transparency to true user identity than in web-based social networking systems may be needed, even among networks of mostly known members*" (p.6). This observation was motivated by the findings of the user study on the Slam prototype. The authors reported that the disconnection between online and offline identity had the following cause: "*Slam users who knew each other well offline, had difficulty recognizing one another online due to alias confusion and lack of visual cues*" (p.8).

It can be concluded that the need for identity expression and representation is an essential feature of MoSoSo, which is typically associated to the concept of user profile. Quite surprisingly, the concept of identity has not been discussed extensively in MoSoSo literature, even if it is a key aspect of the mobile social context (Dey et al., 2001). The two main positions that have been identified concern the need for presenting a real identity, like in traditional mobile services, or having a virtual identity that is not necessarily connected to the real one. In this latter approach, two trends have been recognized, namely the creation and presentation of a single virtual identity on the mobile, like in DigiDress/Nokia Sensor, and the aggregation and sharing of multiple identities expressed by the user in SNS, like in WhozThat.

### 5.4.3 Mobile social networking

The concept of MoSoSo can be linked to the use of mobile applications in social groups (Rantanen et al., 2004; Jacucci & Salovaara, 2005; Salovaara et al., 2006) and communities (Melinger, 2004a; Axup et al., 2006; Cao et al., 2007; Counts, 2007), but its most general meaning is associated to mobile social networking (Churchill & Halverson, 2005; Counts & Fisher, 2008; Pietiläinen et al., 2009).

As Churchill & Halverson (2005) explained, "social networking is built on the idea that there is a determinable structure to how people know each other, whether directly or indirectly". When the structural perspective is adopted, social group and community can be explained as two particular configurations of networks, being connected respectively with the fully connected graph and with the cluster or clique (Scott, 2000). These terms are all based on the basic concept of density of a graph, the number of ties that are present over the maximum possible number of ties. Density and a set of technical terms represent the expression of social networking that has been developed in the field of SNA by analyzing F2F social interactions.

As for the concept of community (Chapter 4), the diffusion of CMC has led to the need to differentiate between the offline and online dimension of social networking. In particular, online social networking systems, which have in SNS their main paradigm, have their peculiar feature in making the structural connections visible and usable through social software for communication and information needs. In fact Friendster, one of the early SNS, was described as an online social networking site that "*allows people to explicitly articulate their social network, present themselves through a profile (interests and demographics) post public testimonials about one another, and browse a network of people*" (boyd, 2004). To put

it in other words, an online social networking system consists of a user profile that delivers a presentation of the (virtual) self, a navigable view of the network of interconnected user profiles, which can be also commented, rated and tagged, and a number of additional features that support social networking, such as search, filter, personalized views and the like.

The recent extension of computing capabilities to mobile devices introduced a third dimension to the social networking phenomenon, the mobile social networking. Mobile social networking is a synthesis between the offline and the online dimensions, and there are two main views about it. The first connects mobile social networking to the multiple ways of networking with one's personal community by means of different and multiple communication channels that are offered by the mobile device, such as phone calls, SMS, MMS and MoSoSo. This perspective, which is developed in this study (articles III and IV), is anchored to the SNA tradition, which aims at understanding the overall structure and evolution of one's personal community. In the second view, which is by far the most common, mobile social networking is regarded as an extension of online social networking systems to mobile contexts, and therefore more naturally associated to mobile SNS (Pietiläinen et al., 2009; Monnè, 2009).

The notion of mobile social networking is best analyzed looking at the role that MoSoSo plays in the maintenance and extension of the ties of one's personal community. In this respect, MoSoSo provides two peculiar functions, namely *social proximity* interactions aiming at the creation of new social ties and *social awareness* enhancement to strengthen the existing social ties.

With social proximity applications, mobile communication extends its focus also to co-located social interactions, which are typically more oriented towards the creation of new ties with strangers than with established acquaintances. The origins of this class of applications, which represents only a subset of MoSoSo (Jung et al., 2006), are linked to the work that has been conducted on *wearable communities* (Kortuem and Segall, 2003), also known as *communities of co-location* (Lawrence et al., 2005). In this context, the role of computer-augmented systems was to support F2F encounters by realizing Engelbart's (1962|1988) old dream of augmenting human memory, intellect, creativity, communication and physical senses through computing power.

Although all approaches in this category are based on the common idea that MoSoSo should be designed to support co-located social interactions, they differ in the range of situations in which MoSoSo could be used, from informal applications such as dating, gaming and media sharing at large scale events to more formal activities such as workflow optimization and knowledge management in organizational contexts.

Dating has been the most typical type of application for informal mobile social networking: at the end of the nineties, Lovegety was commercially launched in Japan as a mobile application that scanned the environment for potential crushes and alerted the user in case of success. In addition to dating, the design of Serendipity (Eagle & Pentland, 2005) was also meant to support more formal types of interactions. Another type of social proximity application, Di-

giDress/Nokia Sensor (Persson et al., 2005), has been used both as a tool for business networking and for pure socialization and entertainment. While the radius of social proximity applications is typically limited to a few meters of Bluetooth sensor scanning, Dodgeball (Crowley, 2005; Ziv & Mulloth, 2006; Humphreys, 2007) extended the radius of a social proximity application to the whole city. Although Dodgeball has been often used as a friend-finder to maintain contact with established ties, it could also be used as an introduction system to facilitate interaction among people with mutual acquaintances. While all the mentioned applications are examples of people-centered MoSoSo, another strand of MoSoSo is place-centered: for instance, the Jabberwocky was implemented to establish ties in public urban spaces that are connected with the people's daily routine. In this context, the Jaberwocky aimed at creating a sense of place by facilitating interaction with familiar strangers, "*the individuals we regularly observe but do not interact with*" (Paulos & Goodman, 2004).

The whole class of social proximity relies on the assumption that there are many social opportunities connected to several public urban spaces that are not exploited yet. In this respect, the objective of MoSoSo is to support the user in realizing such opportunities. However, the limited popularity of social proximity applications might indicate that realizing the potential value of these social situations is much more complex than matching the characteristics of the user profiles of people who happen to be nearby. In fact, the real challenge of MoSoSo is to model the various aspects of the interaction context and make inferences on the basis of such data.

While social proximity applications use location as the primary contextual parameter to mediate social interactions, social awareness applications integrate a wider number of contextual cues, which are disclosed among interconnected contacts to maintain a state of social awareness. In this respect, this type of MoSoSo focuses more on the strengthening of existing social ties than on the creation of new social bonds.

The concept of social awareness has been previously used in CSCW and has been regarded as a critical element for successful collaboration because "*the understanding of the activities of others provides a context for your own activity*" (Dourish and Bellotti, 1992). Social awareness is a special type of awareness defined by Goleman (2006) as a form of social intelligence represented by what we sense about others. The author observed that simply sensing how another feels does not guarantee fruitful interactions; according to him, social awareness has to be supported by a second form of social intelligence known as social facility.

In the context of MoSoSo, social awareness is about sharing information about one's context. Presence is a limited form of context, including the availability and status message that has become popular with IM systems (Grinter & Palen, 2002). In MoSoSo, presence may also include location information. Integrating the notion of context (see 5.2), MoSoSo transforms the mobile device into a social awareness device. Examples of mobile social awareness applications are Hummingbird (Holmquist et al., 1999), InfoRadar (Rantanen et al., 2004), ContextContacts (Oulasvirta et al., 2005) and PePe (Lehikoinen and Kaik-

konen, 2006). The main challenge of social awareness applications lies in the way the design supports the progressive disclosure of contextual cues. In mobile situations, the quickly changing nature of context adds additional challenges to the implementation of mobile social awareness applications.

In conclusion, MoSoSo offers two main classes of applications to support mobile social networking, namely social proximity applications and social awareness applications. The purpose of these classes is different: whereas the former type privileges the extension of one's personal community, the latter focuses on the strengthening of the existing social ties. In both cases, the key challenge for design seems to be connected to the key feature of digital sharing and personal privacy management, topics that are discussed in more detail in the next section.

### 5.4.4 Personal privacy management

Personal privacy is one of the critical issues of MoSoSo, which is associated to digital sharing. In MoSoSo, digital sharing is often described as the process of disclosure of personal contextual cues with others. Adopting similar terms, this study presents digital sharing as the sharing of personal resources as social resources with other members of the digital community. Being the least common denominator of digital communities, it is of uttermost importance to analyze the problem of personal privacy management.

Social computing applications would not be social without digital sharing. Communication is a form of sharing: phone calls imply sharing a bidirectional channel to talk and SMS have a similar role, even though they operate asynchronously. In online SNS, digital sharing is typically associated with the sharing of personal media, such as photos, video-clips, status messages and the like. Through digital sharing, personal media become social media and enable a variety of social practices, such as comments, ratings, tags or conversations. Variables of the social context, such as location, status message and information on nearby persons, are often used in both social awareness applications (Oulasvirta et al., 2005) and social proximity applications (Persson et al., 2005; Eagle & Pentland, 2005). Although the sharing of these variables is not technically different from the previous forms of sharing, it has raised significant privacy concerns.

Unwanted intrusion in one's personal life is one of the perceived dangers associated to the use of MoSoSo. As Melinger (2004a) wrote in one of the first papers on MoSoSo, these applications "*bring with them the ability to closely monitor community members and invite unwanted communications, characteristics that often prompt anxieties about intrusions into privacy*".

Adopting a technical viewpoint, Beach et al. (2008) raise the question of developing effective architectures to prevent cyber-stalking. Jung et al. (2006) observed that "*personal data on mobile phones, such as phonebook content, has rarely been re-purposed beyond personal use. Using that data in social interactions may raise concerns of privacy*". As people do not want invasive technologies to compromise their privacy, it is important to design mechanisms that are able to alle-

viate privacy concerns. It must be noted that the same problem also affects online SNS, such as Facebook (Acquisti & Gross, 2006; boyd, 2008).

The main problem faced by both users and designers is that such applications are practically useless if nobody discloses any information to others. At the other extreme, users could also decide to give up their privacy to access the same kind of information between them. As Johansson (2008) observed, this mechanism should work in a reciprocal manner so that both parties would be needed for the creation of an agreement. Hence, the real challenge for users is to find a trade-off between revealing and not revealing, and for designers to effectively support the possible disclosure strategies (Counts et al., 2006; Tang, 2007).

The issue of personal privacy management is a serious one because it has been reported, in different ways, in almost all studies on MoSoSo. It is typically focused on the privacy management in the community context rather than on potential privacy abuses conducted by governments and corporations. A notable exception is provided by Kolko et al. (2007a), who regarded MoSoSo as a way to overcome the poor privacy provided by public Internet access points. In this case, the problem of personal privacy management seems not to be serious in the community thanks to the trust that exists among its members.

In Jabberwocky (Paulos & Goodman, 2004), the authors found "*a tension in users between a desire for social data and concerns about privacy in public places*". In the Serendipity user studies, Eagle & Pentland (2005) reported that 5 percent of the selected participants decided not to take part in the study because of privacy concerns. In the same study, other participants emphasized the desirability of being able to easily turn MoSoSo on and off, in order to be in control of the situation at any time.

The designers of Serendipity (Eagle & Pentland, 2005) followed the principle of never jeopardizing users' privacy expectations: for instance, they inserted an acknowledgement protocol for the reception of SMS and limited serendipitous introductions to friends-of-friends trust network. Similarly, Smith (2005) reported that privacy was one of the main principles to follow in the design of Reno, and users had to be always in control of the disclosure of location information.

In the study of DigiDress / Nokia Sensor (Jung et al., 2006; Persson & Jung, 2005), the design approach was significantly different from that of other types of MoSoSo because no privacy mechanisms were integrated in the design of the application, which emphasized identity expression. As expected, privacy concerns emerged but "*many interviewers reported to have strategically exploited the supplementary features to alleviate their concerns*" (Persson & Jung, 2005, p.12). For instance, the designers included a block-list feature to allow users to exclude any further communication with a specified user. The block list acts like a firewall against intrusions to one's private sphere.

Despite these ad-hoc solutions to personal privacy management, MoSoSo still lacks general and adequate mechanisms addressing the critical issue of privacy. It has been noted that the same problem affects also the more general context of the social web, especially SNS (boyd, 2008; Gürses & Berendt, In press).

Understanding disclosure of contextual cues in the mobile context seems to be the central issue in MoSoSo design. Referring to status messages that are common in SNS and many forms of MoSoSo, Oulasvirta (2008) argued that users should learn to use prescriptive rather than descriptive cues. The former type is quite neutral and does not allow making many inferences, while the latter allows intrusive interpretations. Observing that not all contextual cues have the same value in inferences, the author also pointed out that designers should learn to distinguish between primary and secondary cues. As regards users, they should be able to select a minimum amount of cues to disclose, to minimize privacy violations and to avoid other two problems related to the disclosure of multiple cues, namely disinterest and overload.

Tang (2007) provided a contribution in this direction, suggesting three main mechanisms: provision of privacy-aware collection of contextual information; inclusion of features controlling privacy in relation to context sharing; integration of feedback information to users who are made aware of the effects and consequences of their privacy settings.

The approach to privacy management introduced in Article V follows the work of Tang (2007) and in particular his suggestion of rule-based privacy controls for sharing context. The novelty added in Article V consists in linking personal privacy management controls to social network information, such as tie strength (Granovetter, 1973; Marsden & Campbell, 1984; Gilbert & Karahalios, 2009). As observed by Beach et al. (2008), automated and semi-automated approaches to the support of the user's decision in sharing contextual information offer intriguing research possibilities and perspectives that have to be investigated further.

### 5.4.5 Social information overload

The issues of personal privacy management and social information overload are tightly connected. In fact, they are both consequences of digital sharing. However, while personal privacy management derived from the effect of outgoing flows of personal resources as social resources, social information overload deals with the management of incoming flows of social resources. The two problems therefore represent the two sides of a coin – user's control of information flow – that need to be addressed both trough technological solutions and human strategies.

Social information overload is a special case of the more general problem of information overload, which does not exclusively focus on information coming from social connections. Rafaeli et al. (2005) explained the cognitive nature of the problem:

> "perceiving others and one's relation to them requires some processing capacity. People have only finite resources for processing […] A sense of too much social information has measurable impacts on both individual behavior and social cohesion in the long term" (p.65).

The abundance and frequency of social inputs coming from a multiplicity of social connections compete for the attention and time of the user, who has to actuate a number of strategies, such as increased filtering and selective availability. For instance, receiving many emails every day requires the user to assign priorities; only the most urgent emails are read and/or answered, while scarce attention is paid to all other messages.

Discussing about volunteer activity coordinated by mailing-lists, Kane & Klasnja (2009) explained that "some informants mentioned feeling overwhelmed by newsletters or invitations to volunteering activities" (p.4571). The same happens to popular blogs, which receive hundreds or thousands of comments per post: in these cases, the blog assumes more the function of traditional mass media than the more intimate dimension of informal conversations that most social media convey (Shirky, 2008). Furthermore, being connected to many buddies in instant messaging implies turning one's availability to 'busy' or 'invisible'.

The easiness of digital convergence technologies like RSS feeds, which aggregate content from multiple sources, has its positive and negative side: it allows a lot of content to be gathered, but the user might then experience the feeling of being overwhelmed by such amounts and diversity of content. Paulos & Goodman (2004) described the phenomenon of 'civil inattention' in the context of the city as a strategy to avoid the sense of urban overload. While in small villages one can afford greeting and even engaging in a brief conversation with everybody met on the street, in cities this is simply unmanageable. In villages such short interactions are necessary for maintaining relationships with relatively few people, but in cities this practice would be less rewarding because of the impossibility to maintain relationships with thousands of people. Although some persons have better social skills than others, there seem to be a cognitive threshold that is connected with the ability to effectively manage social connections. According to Dunbar (1998), this threshold is around 150.

Although the problem of social information overload is as important as that of personal privacy management, it has not been systematically addressed in the literature on MoSoSo, even if information filters have been included in most implementations of MoSoSo. This trend might be explained by the increasing risk of social information overload with the growing number of network contacts. As the majority of MoSoSo have suffered from the opposite problem, i.e. pervasiveness, social information overload has not been regarded, unlike privacy, as a primary concern (Persson & Jung, 2005). While this observation is correct for some forms of MoSoSo, such as social proximity applications, the same does not apply to other forms of MoSoSo, such as mobile social aggregators and social awareness applications. In an empirical study on a MoSoSo prototype called Rhub, Heyer et al. (2008) reported the experience of participant who said "*[my] phone holds 150 messages – it's always getting full after Rhub*" and "*when I hear my phone beep, I know it's Rhub*".

Design solutions shall aim at minimizing social information overload. Listing the design requirement for 'social pairing systems' in the context of a backpackers community, Axup et al. (2006) emphasized an important principle:

> "do not overload hubs. Some people will naturally have more useful information than others due to travel routes and duration of travel. Hubs will not be able to support all feasible ties to them unless automation is used" (p.366).

In the context of volunteering activities, Kane & Klasnja (2009) expressed the need for MoSoSo to provide notifications to prospective participants, but only when they are relevant. In this respect, a people-centered approach to information filtering offers a viable alternative to traditional collaborative filtering techniques (Shardanand & Maes, 1995; Hanani et al., 2001). In particular, social-network based approaches (Lam, 2004) need to be integrated with traditional perspectives to prioritize, select and display the relevant streams of social content that match with the complex variables of the interaction context.

In trying to deal with the social overload problems that arose with Rhub, Heyer et al. (2008) associated the content of the message to tags or sets of words that could represent an input of the filtering system. However, such feature was not much used by the participants of the user study. The minimization of social information overload seems to require a synergic partnership between technological and human strategies: on the basis of a study on the reading of emails in organizations through Blackberry mobile devices, Allen & Shoard (2005) suggested that, in addition to a filtering system, users should better distribute the workload of the day and also not aim at providing perfect and complete answers to the messages. In other words, the authors suggested that giving approximate answers is better than not giving any.

The issue of social information overload remains open, as does that of personal privacy management. Although they require to be tackled with different approaches, they are inherently connected by being both grounded on the circulation of information flows in mobile social networks. In this respect, one shortcoming in the literature on social information overload concerns the role of the social network structure in the design of information filters, a topic that is addressed in the approach to MoSoSo design through the concept of social algorithms (Chapter 8).

### 5.4.6 Trust and reputation

One of the major challenges for MoSoSo is the integration of the concept of trust and the implementation of a recommendation system (Axup et al., 2006). This mechanism, necessary for the success of any e-commerce system (Resnick et al., 2000), is currently missing in MoSoSo. The prospect of acquiring a good reputation in a community through being trusted and estimated is a significant incentive for good behavior.

Unless standard and interoperable trust and reputation protocols are integrated in the design of MoSoSo, it will not be possible to change its current connotation of 'entertainment gadget' (Thom-Santelli, 2007). Its transition towards a tool for societal change has to deal with the 'Fakester dilemma' (boyd, 2004): are virtual identifies trustworthy and desirable in a social network? On the one hand, they contribute in making the community interesting and entertaining, but, on the other hand, they also reflect the fundamental weakness of trust on SNS. Therefore, the issues of trust and reputation have to be necessarily associated to the discussion on identity representation (see 5.4.2). The sharing of contextual cues, resources typically perceived as extremely personal, requires a trust basis among communication partners. Trust cannot be easily established and developed relying only on virtual identities, especially when interaction and activities take place in a real space rather than only in the cyberspace.

How to integrate trust and reputation in MoSoSo? In the Oxford Dictionary of Modern English, reputation is defined as "*what is generally said or believed about a person's or thing's character or standing*". Much of what other people say about a person is based on their previous experiences with him/her. Therefore, in MoSoSo it is necessary to pay attention to the social comments and ratings about a person. Users' trust and reputation ratings could be used as a parameter to filter information, or to support the automatic disclosure of contextual cues. This could alleviate the problems of social convergence, exposure and invasion (boyd, 2008), which are related to personal privacy management (Melinger, 2004a and 2004b) and social information overload (Gundelsweiler, 2006).

Reputation and trust ratings might be connected to the quality of social information delivered in mobile social networks, for instance through social ratings associated to digital content, as it already happens in most Web 2.0 applications (O'Reilly, 2005). In social proximity applications, the notion of trust is often associated to the amount of common acquaintances (Eagle & Pentland, 2005). Alternatively, trust can also be linked to the concept of reciprocity; as trusted contacts tend to return favors, a reciprocal relationship can also be assumed as trustworthy. Models of generalized trust can also be integrated together with or instead of models of interpersonal trust. This choice allows assigning trust values to collective groups instead of single individuals. Although interpersonal trust values may differ, in some circumstances it could be useful to link trust values to a group of contacts labeled as family, friends, work colleagues or acquaintances. Default values of trustworthiness, derived from surveys on generalized trust (Kolko et al., 2007a), can even be associated to whole populations or cultural groups.

Trust models shall be included in MoSoSo on the basis of qualitative and quantitative measures of social network experience. As Kolko et al. (2007a) have stated, "*it is necessary to think about a system that leverages experience with social networks and that also takes into account a collective awareness of which information to trust and which viewed more skeptically*". Popularity, or prestige, may also prove useful as indicators of one's reputation: for instance, in Nokia Sensor (Persson &

Jung, 2005), the user's 'popularity' was computed on the basis of the amount of views of his/her profile.

To conclude, metrics of trust and reputation may benefit of an integrated approach that combines some quantitative and qualitative aspects.

### 5.4.7 Scalability issues in mobile social systems

Scalability is an important property of complex technical systems. The concept has many definitions, which are typically related to measures of system performance (Hill, 1990; Hwang, 1992). A system scales well if its performance does not decrease when additional resources are added to a single node (vertical scalability) or when more nodes join the system (horizontal scalability).

As computer networks are inherently social networks (Wellman, 2001), scalability can be analyzed not only from the technical viewpoint of computer architectures, but also from the perspective of social interaction. In this context, horizontal scalability refers to the number of users – the size of their personal community - while vertical scalability is about the properties of social ties and the flow of informational resources. From the perspective of social interaction, scalability issues in mobile communications have not been discussed much. Most scholars have highlighted the large-scale social, economic and political implications of small-scale interactions, taking for granted the interpersonal nature of mobile communication. According to Counts (2007),

> "group-based interactions have long been used in web and desktop environments", but "these social benefits have not been translated to mobile devices, possibly because such devices historically were designed for voice communications, which does not scale well beyond the dyad" (p.75).

Another position has been reported by some scholars, who have described how traditional mobile services have been employed in large-scale social contexts. Mentioning the role that the chains of text messages exchanged by Filipinos played in the resignation of president Estrada in 2001, Katz and Aakhus (2002) observed that "*the mobile phone, a quintessential instrument for two-way interpersonal communication, can also work as a tool to spur and coordinate the action of masses for political change*" (p.3). Rheingold (2002) coined the term smartmob to refer to the mobile-mediated large-scale mobilizations of people with a common goal, such as a political protest.

According to Ling (2004), smartmobs have not extended the traditional scope of mobile communications as their nature is not interactive and modifications to the original plans are not permitted. The author goes further, considering the number of people that can be interactively coordinated as one of the current limitations of the mobile device. Beyond the threshold of 8-10 persons, the scale of mobile communication enters the domain of mobile virtual communities, the natural extension of virtual communities that exist online and present the following characteristics (Rheingold, 2003):

- *many-to-many, desktop and mobile, always on*: instant access to people and digital resources;
- *interactive coordination of small or large groups*: even if the group is typically limited to 4-8 persons, mobile virtual communities can scale beyond that limit;
- *shared purpose*: gaming, social interaction, artistic media, business, and politics.

Rheingold's mobile virtual community (2003) is an instance of digital communities that emerge with new tools for social communication, such as MoSoSo. In this respect, the main question concerns MoSoSo's contribution to enhance the scalability of mobile communication systems beyond interpersonal and small social group interactions by including also many-to-many communication within the personal community. Little is known on how MoSoSo design features should adjust in relation to the size of the personal community (horizontal scalability) and/or to the increasing flows of digital resources (vertical scalability). By modeling scale variations in terms of information flows, new and more effective support mechanisms for personal privacy management and social information overload can be designed.

So far, MoSoSo has been developed and tested in relation to a well known size of the social group. Much of MoSoSo is tailored to support interpersonal and small group interactions. For instance, Rhub (Heyer et al., 2008) explicitly addressed the needs to communicate, coordinate and share in the context of a small social group. In a field study of DigiDress, Jung et al. (2006) found out that the applications encouraged small group interactions, even if it was mostly used at the level of interpersonal communication. It seems particularly difficult to design MoSoSo for supporting real-time interactive coordination of several individuals. Counts & Fisher (2008) claimed that Slam could support both synchronous and asynchronous discussions between numerous users. The findings of their study, however, do not allow verifying the validity of this statement, as they are based on a small number of users.

A number of other MoSoSo has been designed to suit the needs of larger social groups. For instance, mGroup (Jacucci & Salovaara, 2005; Salovaara et al., 2006) aimed at enhancing the experience of the participants of large-scale events, such as sport events, music festivals and celebrations by means of mobile sharing. Similarly, Liu et al. (2009) discussed the design of mobile social services for large-scale exhibitions. Introducing Mobslinger, Clemson et al. (2006) explained the potential of large-scale ubiquitous urban social games. Unlike mGroup and Mobslinger, TxtMob is oriented at supporting political protest rather than light entertainment. In fact, the TxtMob service was developed to enable swarming behavior through SMS in large demonstrations.

In some cases, the target focus has not been really clear. For instance, a number of friend-finders and mobile matching applications (Burak and Sharon, 2004; Smith, 2005) have been described as community services, even when they do not seem to support many-to-many communication. Much of the confusion in this case might be due to the difficulty of conceptualizing community (Chapter 4). Indeed, one-to-one and one-to-many communication modes support only

the personal community model. Discussing the use of MoSoSo in the mobile community of backpackers, Axup (2006) found that backpackers' communities typically include 10-12 people, a reasonable number that allows constructing a communal experience.

The clear orientation of the existing MoSoSo to a particular scale of social interaction might be explained by their specific focus to a certain type of activity. However, a deeper understanding of the scalability issues connected to MoSoSo is essential for a general purpose model of MoSoSo that has to fit to a variety of situations and contexts.

### 5.4.8 The structural unit of MoSoSo: single individual or group

Since its early days, mobile communication has been inherently portable, personal and pedestrian (Ito et al., 2005). Mobile devices are personal because they are both owned and used by single individuals. It has been argued that mobile devices render humans as 'cyborgs' because they represent an extension of the human body (Fortunati, 2001). Through mobiles, humans display a sort of digital self with intimate and detailed personal information, which is visible in both real and virtual contexts. If the characterization of mobile devices as personal communication tools provides an interesting view on the self, the other two characteristics, portable and pedestrian, are connected to the contexts in which mobile devices are used. Being wireless and portable, such contexts are not limited to homes and offices, but include any possible public space.

The common practice of discussing about private matters in public spaces has led scholars to characterize mobile communication as a personal technology that enables private talk and public performance (Katz and Aakhus, 2002). This label, however, refers more to the implications of the calling function than to those associated to text messaging, which is a much more unobtrusive form of communication.

Part of the original characterization of mobile communication might be challenged by MoSoSo. In fact, it is likely that mobile devices will remain portable and pedestrian, but they might either emphasize more the collective dimension than the personal sphere or enforce an egocentric view of the social world. These two opposite directions of the evolution of mobile devices do not regard the actual ownership of mobile devices but rather the way mobile devices are used as social devices.

When MoSoSo is designed to emphasize the dimension of the collective group, it corresponds to the notions of technology of cooperation (Rheingold, 2002) and platform of participation (Tapscott & Williams, 2006). Instead of supporting only interpersonal and small group conversations, MoSoSo can act as a cooperation amplifier (Rheingold, 2002) by enabling the dimension of community interaction on the basis of the many-to-many communication model. In this way, MoSoSo would support the emergence of forms of collective intelligence (Lévy, 1997) by exploiting the wisdom of the crowds (Surowiecki, 2004).

By privileging the community perspective, individuals are able to achieve together what they cannot achieve alone. Although the technological platform is important, the key requirement in this case concerns the adherence to a common objective and set of values, which are internalized. When considered in the context of learning, MoSoSo can effectively support a community of practice (Wenger, 1998; De Jong et al, 2008).

For Coppola et al. (2008), MoSoSo should be conceptualized and designed as architecture of participation: specifically, it could link a community to a context in which people can interact with each other directly or indirectly through social features, such as tags, comments, ratings and multimedia. The authors argue that a sort of crowdsourcing model (Howe, 2006) could be implemented through MoSoSo and applied to enhance the experience of museum visits.

According to Counts & Fischer (2008), the core structural unit of MoSoSo might be represented by the group concept rather than by the individual. This observation led the authors to implement Slam, which supports both communication and information needs of groups, while implementing the 'information ground'. The concept of information ground, which focuses on people's information behavior in informal social settings, is close to the idea of digital community in the sense that both emphasize the information-centeredness of community interaction.

While the communitarian orientation of MoSoSo emphasizes cooperative behavior, its egocentric orientation conceives MoSoSo as a tool for gaining competitive advantages. In this respect, MoSoSo facilitates the opportunistic realization of self-interests by providing instant and ubiquitous access to the resources embedded in one's personal community. In addition, MoSoSo might also facilitate the realization of the value of such resources in a specific action context. In this view, MoSoSo is functional to the attainment of personal goals, plans and expectations, which are in most cases about socializing and entertainment. From a design viewpoint, egocentric approaches to MoSoSo design are grounded on the concept of personal user profile and private communication with networked contacts, whereas communitarian oriented approaches are based on the idea of a collective profile and public interactions in the hybrid social space.

Although it is challenging to classify MoSoSo in one of the two groups, the large majority of MoSoSo applications seem to follow the egocentric model, which however does not exclude them being used in a collective manner.

## 5.5 Key issues of MoSoSo design: challenges and opportunities

The broad review of the contributions to MoSoSo, which involved a variety of technical and social aspects, clearly demonstrates that the design of MoSoSo involves many challenges that have not been systematically addressed. The shortcomings in design may be partly explained by a lack of theoretical understanding of MoSoSo, as well as by the unavailability of a comprehensive con-

ceptual framework to address all issues. The multiplicity of positions and the areas of disagreement are summarized in the following table (Table 4).

TABLE 4 Summary of technical and social issues in MoSoSo design

| Issue | Positions |
|---|---|
| *Design approach* | Specific (stand-alone application)<br>Integrated (general purpose platform) |
| *Base Technology* | Continuity (SMS-based)<br>Evolution (client-based)<br>Integration (cross-media) |
| *Architecture* | Centralized (client-server)<br>Decentralized/distributed (p2p) |
| *Spatial focus* | Exclusive (urban environments)<br>Inclusive (ubiquitous) |
| *Individual Identity* | Continuity with traditional mobile services (real identity)<br>Continuity with online social software (virtual identity) |
| *Mobile social networking* | Creating new ties (social proximity)<br>Maintaining existing ties (social awareness) |
| *Personal privacy management* | Human filters (manual disclosure of contextual information)<br>Human-technological filters (technological support of disclosure of contextual information) |
| *Social information overload* | Human filters (manual information filtering)<br>Human-technological filters (technological support of information filtering) |
| *Trust and reputation* | Qualitative measure (previous experiences) for recomm. system<br>Quantitative measure (prestige/popularity) for recomm. system |
| *Scalability issues* | Support of small-scale social interactions<br>Support of large-scale social interactions |
| *Social unit of design* | Single individual (egocentric view)<br>Collective group (communitarian view) |

As is the case with the review, the table also is largely incomplete because the field is in rapid evolution and touches many of the most complex issues discussed in both social and computing literature. The purpose of the table is to illustrate the emerging area of MoSoSo and the existing knowledge accumulated in scientific studies. The various alternatives to the aspects of MoSoSo design serve as basis for developing a conceptualization and holistic approach to MoSoSo design (Chapters 7 and 8). These issues are evaluated in the broader context of designing MoSoSo for digital communities. The problem is tackled from the perspective of the utility that structural and relational information of social networks may have in developing human-technological solutions (Saariluoma, 2005b) for the critical aspects of MoSoSo design.

In contrast to the design for the online community (Preece, 2000; Kim, 2000), designing MoSoSo for digital communities requires emphasizing the dimension of utility in addition to usability and sociability. Utility is not to be regarded simply in economic terms and from a material perspective. In fact, utility may be connected at micro level to the role that MoSoSo plays in people's lives and at macro level to the way its global adoption affects the development

of information societies. In MoSoSo, utility may be also regarded as the enhancement of the capacity to attain instrumental or expressive action goals by means of access and use of social network resources. Useful insights on the wider meaning of utility can come from critical perspectives on MoSoSo, which unfortunately are not abundant. However, there is a notable exception in the work of Thom-Santelli (2007). In her study, utility is discussed mostly from the perspective of user's access and use of social network resources.

Scott and Counts (2008) described MoSoSo utility in terms of *information capital*, the individual's capacity to access information. In their approach, information capital is connected to a number of network indicators, such as the size of *information grounds*, which roughly correspond to the notion of digital community, and a variety of embedded resources. Instead of using the term information capital in this study, the utilitarian aspect of MoSoSo use in digital communities is captured with the notion of *digital resources*, which is used to define user profile and mobile social networks, the structural building blocks of the holistic design model. This choice allows connecting MoSoSo design to the sociological concept of *social capital* (Bourdieu, 1986; Coleman, 1988; Putnam, 1993 and 2000; Portes, 1998; Burt, 2000; Lin, 2001) and in particular with the perspective of 'individual social capital', also known as the network theory of social capital (Lin, 2001). The integration of the network theory of social capital in MoSoSo design represents one of the major theoretical extensions of the study (Chapter 12).

# 6 FINDINGS

The numerous shortcomings and the diverging approaches to MoSoSo design raised the question of how to realize the unexploited potential of this emerging paradigm of social computing. The suggested approach to this problem consists in developing an articulated conceptualization of MoSoSo and then deriving from it a holistic design model. To bridge theory and practice, policy convergence, a set of support policies required to realize the potential of MoSoSo, is also introduced here. Each of these contributions is discussed in detail in the next three chapters. The following sections provide an introduction to these themes by presenting a general overview and a brief summary of the enclosed articles.

## 6.1 Overview of the scientific contributions

The thesis contains eight studies, seven of which have been presented in international conferences (Articles I, II, IV, V, VI, VII and VIII) and one published in an online journal (Article III). Some of the articles (I and IV) were not peer-reviewed, but they have been included for their significance in the context of the whole thesis: notably, in Article I the status of MoSoSo is evaluated, a first definition of MoSoSo introduced and some design ideas anticipated. In Article IV, an early version of the design model of MoSoSo is presented. Among the six peer-reviewed papers, two were accepted as short papers (Articles V and VIII) and four as full papers (Articles II, III, VI and VII). Three articles (IV, V and VIII) were co-authored.

It is worth noting that the structure and length of this dissertation resemble more a monograph than a collection of articles with a short summary. To achieve a more conventional style, the articles could have been simply referenced instead of being included here. However, a decision was made to incorporate them in this study to clearly show the intellectual development that oc-

curred while exploring MoSoSo from a variety of perspectives. In addition, this approach also demonstrates the active involvement of several research communities, which provided expertise and feedback in the search for the right approach and answers to the research problem.

The varied audience and numerous participants therefore witness the interdisciplinary approach adopted in this study. Article III was published in FirstMonday, one of the first online journals to be solely devoted to the Internet and created to meet the needs of a diverse international public, mostly but not necessarily from the academy. Most of studies were illustrated to a public of experts in technology and humanities, with two exceptions presented to a more homogenous audience. Indeed, Article V was reported to the 'User Modeling community' and Article VIII to 'educational technology' experts. Two studies (Articles II and VI) were introduced to conferences organized within the framework of the development of the European Information Society. Although these papers contain insight on conceptualization and on design of MoSoSo, they are more policy-oriented than the others and tackle also the important issue of macro-level implications of MoSoSo. In particular, Article II was presented during the eChallenges 2007 conference, an annual event supported by the European Commission, which attracts hundreds of delegates from leading commercial, governmental and research organizations. Article VI, presented to the audience of the EU/COST298 action, was awarded with the certificate of the best paper in the 'early stage researcher' category.

The studies are divided into three main themes, *conceptualizing MoSoSo*, *designing MoSoSo* and *policy convergence*, and address the main objectives of the study (Figure 17).

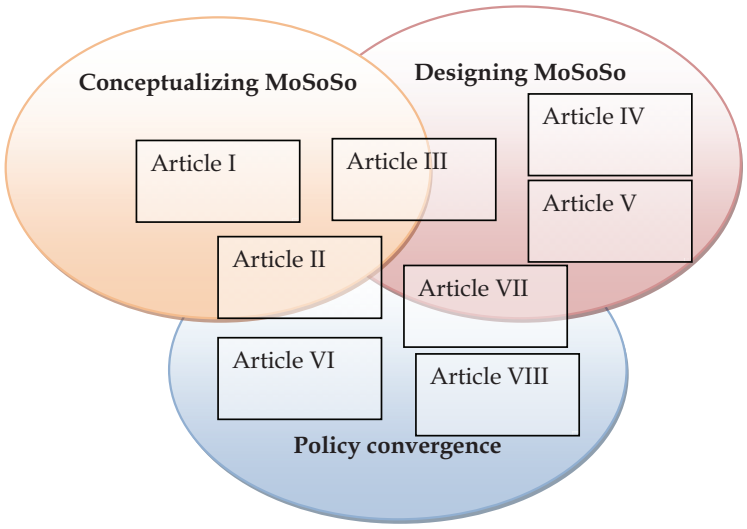


FIGURE 17 Functional role of the studies in the dissertation

In particular, two of the studies (Articles VI and VIII) do not explicitly address MoSoSo, but present implications useful to its adoption. Two are scientific contributions (Article I and II), clearly addressing the conceptual aspects of MoSoSo, Article II being also policy-oriented. Three others studies (Articles IV, V and VII) are more focused on the design issues, Article VII also addressing also policy issues. Article III, which contributes to the theoretical and practical understanding of mobile social networking, acts as the cornerstone of the whole dissertation because it represents the *trait d'union* between conceptualizing and designing objectives. In the following sections, a brief summary of each of these articles is illustrated, while a more detailed discussion of the three themes of the study is left for the next chapters.

## 6.2 Summaries of the articles

Article I Lugano G. 2006. Understanding Mobile Relationships. In J. Multisilta & H. Haaparanta (Eds.): Proceedings of the Workshop on Human-Centred Technology (HCT 2006), Pori (Finland), 152-161.

The article presents MoSoSo as an emerging area of social computing. It traces the historical origins of MoSoSo by connecting it to existing research areas, namely groupware and social software. It also illustrates its state-of-the-art by evaluating a selection of five academic and commercial MoSoSo through the conceptual framework of classes of mobile relationships proposed by Marti (2002). Finally, the insight is used to develop a more articulated conceptualization of MoSoSo and to illustrate its main design challenges.

Already in this early study, MoSoSo is firmly associated to the process of digital convergence, as it is described as a product of the "*progressive technological convergence of computer networks and mobile networks*" (p.161). The social significance of MoSoSo is linked to the network-analytic perspective of community, according to which "*work, community and domestic life have largely moved from hierarchically arranged, densely knit, bounded groups to social networks*" (p. 152, quoting Wellman, 2001). By adapting Shirky's earlier definition of social software (2003), MoSoSo is defined as a "*kind of software that supports the interaction among networked mobile users*" (p.155). This definition emphasizes the crucial importance of understanding the idea of 'social link', the concept that allows MoSoSo to influence both structure and action.

All together, the findings of the article indicate that MoSoSo is still an immature paradigm which needs to be developed for its real potential.

Article II Lugano, G. 2007. Mobile Social Software: Definition, Scope and Applications. In P. Cunningham & M. Cunningham (Eds.): Expanding the knowledge economy – issues, applications, case studies. Amsterdam: IOS Press (Vol.2), 1434-1441.

This study develops the insight of Article I in relation to the definition of MoSoSo and then discusses its scope and possible applications in the context of the shift towards a sustainable European Information Society. The study adopts a visionary account of society rather than an empirical approach, and argues that the shift towards sustainability requires cooperation and active participation of skilled citizens.

In regard to the definition, MoSoSo is presented as "*a class of mobile applications whose scope is to support social interaction among interconnected individuals*" (p.1435) and "*an emerging paradigm which exploits the media convergence process and the increasing power of mobile devices to offer a variety of services*" (p.1435). The informal nature of MoSoSo is also discussed in relation to groupware and social software. Concerning its scope, it is argued that MoSoSo is currently limited to pure entertainment applications. Although entertainment remains an important aspect of technology-mediated social interactions, the scope of MoSoSo needs to be extended. In this respect, the study argues that MoSoSo should be designed for social capital. This perspective would allow considering not only the user consumption of digital content, but also the social utility of content created and shared in digital communities, as well as the implications of the possibility to self-organize in ad-hoc communities. In this manner, MoSoSo could be used in a wide range of applications supporting both social and economic development.

The article also mentions, without elaborating further, the opportunity to develop a resource-based view of MoSoSo supporting both informal social exchanges and transactions through virtual currency.

Article III Lugano G. 2008. Mobile social networking in theory and practice. FirstMonday 13(11).

This study analyzes the theoretical basis of mobile social networking with the objective of providing the missing conceptual framework for theorizing and designing tools for mobile social networking, such as MoSoSo. This objective is addressed by investigating how knowledge of the structure and dynamics of networks can be used as input to develop a suitable conceptualization and design model of MoSoSo. In this context, humanistic and mathematic approaches to networks are regarded as complementary to each other; although they developed in parallel as distinct domains, they can now adopt technology design as their natural point of convergence.

The first section of the study is dedicated to the theory of mobile social networking, which is connected to the tradition of SNA. A number of classical and recent studies on networks are reviewed. It is asserted that mobile social networking deals with the utilization of network knowledge to produce interaction opportunities and that so far this knowledge has not been sufficiently exploited in MoSoSo design. In the second part of the study, the theoretical foundations of mobile social networking are explored empirically with the goal of discussing how a design solution might be enhanced.

Combining a theoretical and empirical approach, the study concludes that a more systematic application of the network paradigm would lead to a better conceptualization and design of mobile social networking applications.

Article IV Lugano G., Kyppö J. & Saariluoma P. 2006 Designing people's interconnections in mobile social networks. In V.P. Guerrero-Bote (Ed.): Proceedings of the 1st International Conference on Multidisciplinary Information Sciences & Technologies (INSCIT 2006). Merida (Spain). Open Institute of Knowledge. 500-504.

This study discusses the methodological aspects of MoSoSo design and introduces a three-level design model of MoSoSo based on a design thinking approach. The human dimension and the service orientation of MoSoSo is also emphasized by introducing the notion of *mobile social services* (*MoSoSe*), which has not been developed in the subsequent studies.

One of the main findings of the study concerns the idea that the full potential of MoSoSo can be exploited by designing it as a general-purpose social platform. More precisely, MoSoSo was conceived as a platform for creation and provision of mobile social networking services. This concept has been developed in the thesis through the notion of CGS.

The other contribution of the study is represented a holistic model of MoSoSo design, which integrates a mathematical (i.e. graph theory, complex networks) and a psychological approach (i.e. sociometry) to networks. Both frameworks are synthesized by the wider perspective of social network analysis (Faust & Wasserman, 1994; Scott, 2000), or network theory, suggested as foundation of MoSoSo design. The application of mathematical techniques and social interpretations of social network information flows represent the core concepts of the design model. This consists of three levels, in which user psychological knowledge (step 1) and social network knowledge (step 2) represent input for interaction design (step 3). In the interaction level the 'invisible' knowledge (implicit and explicit) gathered in the other two levels becomes visible to the user as a personalized interface of MoSoSo tailored to user's contextual needs and to the characteristics of the mobile social network.

The many innovative ideas of the paper would have been stronger if supported by empirical data. The awareness of this limitation provided the motivation to conduct a theoretical and empirical investigation of mobile social networking (Article III), in which most of the ideas were evaluated.

Article V Lugano G. & Saariluoma, P. 2007 To Share or not to share: supporting the user decision in Mobile Social Software applications. In C.Conati, K.McCoy & G.Paliouras (Eds): Proceedings of the International conference on User Modelling (UM 2007), Corfu (Greece). Lecture Notes in Artificial Intelligence 4511. Springer, 440-445.

This study addresses the key issue of digital sharing in MoSoSo from the perspective of personal privacy management. Building on the previous work conducted by Preibusch (2006) and by Seigneur & Jensen (2004), the objective of the study is to introduce a conceptual model, a map of concepts and relationships,

and to approach privacy as a decision problem based on the evaluation of the dynamic trade-off between privacy and trust.

The design approach assumes that MoSoSo is centered on a user profile consisting of a public and private section. The private section, or *user profile settings*, includes user psychological knowledge, such as user's attitudes towards digital sharing, and user sociological knowledge, such as the history of social behavior in the system and mobile usage patterns. User psychological and user sociological knowledge are used to compute privacy and trust values.

Trust refers to interpersonal trust, which is connected to the social interconnection value, as assessed on the basis of social network knowledge. Privacy is based on the perceived privacy damage related to a certain type of resource. The study suggests addressing explicitly this aspect of user psychology by directly *asking the user* to rate perceived privacy damage through a survey. The answers to the survey, properly coded, represent the default rule to digital sharing. If no other rules are added, the approach to personal privacy management corresponds to the *one-fits-all* notion. The notion of *Mobile Control Access List* (MACL) is introduced as a data structure including all the rules to manage access to digital resources. The design of the survey is left for future research.

The contribution of the study lies in a method to compute trust gain (in relation to a user / group / sharing context) and privacy damage (in relation to a specific resource to share). One of the main conceptual issues on the background of this study concerns the general problem of manual or automatic approach to social information processing. The solution that is presented takes an intermediate position, combining both manual and automatic procedures. By supporting both of them, the user can choose on which approach to rely and be in control of the situation, deciding how to maximize opportunity and to minimize risks. The suggested approach to mobile privacy management is suitable also for ubiquitous scenarios in which agents would be required, more and more, to take decisions or act on behalf of the user.

Article VI Lugano G. 2009. Towards an inclusive Information Society: an empirical study on digital natives and digital immigrants in Finland. In B.Sapio, L.Haddon, E.Mante-Meijer, L.Fortunati, T.Turk & E.Loos (Eds.): Proceedings of the COST 298 Conference 'The good, the bad and the challenging - the user and the future of information and communication technologies'. Copenhagen (Denmark). Koper: ABS Center, 757-766.

The study investigates the motivational aspects in the use of social media of two generations of ICT users, namely digital natives and digital immigrants (Prensky, 2001). The goal of the study was twofold: firstly, to evaluate through empirical data how the different needs, goals and lifestyles of the two user groups are reflected in social media use; and secondly, to discuss the implications from the perspective of policies aiming at realizing an inclusive Information Society. Similarly to the Article II, this study maintains that citizens are the most important resource for the transition towards sustainable information society.

Unlike in other studies, an empirical approach is chosen and fifty-two answers to an open-ended question on the social perception and experience of

digital and (i.e. calls, SMS, email, IM, forum, SNS) non-digital (i.e. postcards, letters) media was analyzed. The digital community of the Communication Camp (Viherä, 1999; Lugano, 2003) was the context for data collection. At a conceptual level, the study adopts the notion of communication capability to evaluate the answers in relation to technical (access), human and social (competences, motivation) components that affect ICT use, under-use and non-use.

The analysis of the dataset shows that digital natives and digital immigrants perceive and experience both traditional and new forms of social media in a different manner. The most marked differences emerged in relation to the perception, experience and value of time. Specifically, *slow time* (Eriksen, 2001) seems to be far more important for digital immigrants than for digital natives. In a less marked manner, digital natives pointed out the expressive value of the new forms of social media, while digital immigrants privileged instrumental use of new media and expressive significance of traditional media. In regard to their attitude towards ICT, whereas digital natives can be described as techno-enthusiasts, tending to emphasize the positive sides of the technology they use; digital immigrants seem to be techno-skeptic, as their judgments are sometimes negatively biased towards technical innovations. However, considering both positive and negative implications of a technology, in most cases such attitude simply reveals a more developed critical eye.

For moving towards an inclusive information society, the study argues that an inclusive approach to these two user groups should be followed. In particular, policies should aim at the creation of inter-generational bridges, which would allow a mutual enrichment through community interaction, rather than considering these groups as distinct. Realizing such bridges does not only provide access or educational opportunities to acquire technical skills; these bridges are essential in supporting community creation and development at a local and at a global level. In this respect, the Communication Camp experience is a positive example that can be adapted to various contexts to realize the vision of a network-based civil society (see 2.4 and 11.3).

Article VII Lugano G. 2008. Reconciling social and economic development: the role of virtual currency in mobile social applications. In K.Nyiri (Ed.): Proceedings of the conference 'Mobile Communication and the ethics of social networking'. Communications in the 21st century – the Mobile Information Society. Budapest (Hungary), 175-182.

This study analyzes, by adopting a visionary approach and future research methods, the challenge of designing ICT to reconcile societal and economic development. The study suggests investing in the empowerment of self-organizing networked communities. The idea of empowerment is associated to the possibility to self-organize, produce and share resources in a community setting. Policy and design aspects of MoSoSo are discussed in that context, and the potential of p2p and virtual currency are illustrated.

The concept of p2p is introduced as a technical mechanism with the potential of stimulating cooperation at the community level and reconciling factors for economic and social development at the societal level. In particular, the pa-

per focuses on p2p approaches that employ the notion of virtual currency (Buttayán and Hubaux, 2003; Zhong et al., 2003; Irwin et al. 2005), defined as a unit for exchange and transactions in a digital community. By reflecting on the use of ficitional currency in Finnish communication camps (Viherä, 1999; Lugano, 2003), a scenario in which MoSoSo could be employed to enhance existing recycling practices of cans/bottles in supermarkets is presented. It is argued that p2p approaches based on virtual-currency and successfully employed for the sharing of computational resources (processor, storage, network bandwidth) could also work well for the sharing of any type of symbolic and material resource in a digital community. Furthermore, they also provide a means to apply innovative business models on human and social knowledge (see 9.4 on the benefits of the human-centric model).

To strengthen this position at a conceptual level, the approach is linked to the social capital theory (Bourdieu, 1986; Coleman, 1988; Portes, 1998; Putnam, 2000), and in particular to the network theory of social capital (Burt, 2000; Lin, 2001), in which social capital is defined as "*resources embedded in the social structure that can be accessed and/or mobilized by social actors for purposive actions*" (Lin, 2001). In this perspective, the outcomes of social capital, which might be of social or economic nature, depend on the motivations of the interconnected social actors in sharing and mobilizing their personal resources as social resources. In such situations, it is common that social actors rationally choose to privilege self-interest instead of collective interest. In doing so, they typically behave competitively rather than cooperatively. Virtual currency does not enable only innovative business models, but also acts as a mechanism stimulating cooperative behaviour, thus regulating social dilemmas (Axelrod, 1984; Ostrom, 1990).

Article VIII Lugano, G., Viherä, M.L. & Viukari, L. 2006. Towards a network-based civil society. The Communications Camp paradigm. In Kinshuk, R.Koper, P.Kommers, P.Kirschner, D.G.Sampson & W.Didderen (Eds.): Proceedings of the 6th IEEE International Conference on Advanced Learning Technologies. Kerkrade (The Netherlands), 1012-1013.

This short paper presents Finnish Communication Camps (Viherä, 1999; Lugano, 2003) as a miniature model of the ideal network-based civil society. The conceptual basis and practical implementation of the Communication Camp are illustrated: moving from theories of constructive learning (Glaser & Bassok, 1989; Lonka, 1997), Communication Camps support the development of campers' communication capabilities (Viherä, 1999) by offering a stimulating environment for informal learning and socialization.

Camp participants, divided in groups, are responsible for the functioning of the entire camp by running its main activities (i.e. information desk, restaurant, newspaper, radio, videos). It is worth noting that all activities integrate F2F and mediated social interactions by exploiting mobile phones and Internet connectivity. In other words, the Communication Camp represents a self-organizing digital community whose members co-create, develop and enjoy its basic free services (see CGS in Chapter 11).

# 7 RECONCEPTUALIZING MOSOSO

Regarding conceptualization, MoSoSo is currently seen as a young and immature paradigm of social computing. A network approach is employed to clarify the complementary functions that MoSoSo, groupware and social software have as social computing paradigms and to conceive MoSoSo as a general purpose social platform. In this regard, MoSoSo is defined as a class of mobile applications whose scope is to support informal mobile social networking. The findings of Article III, which connects the theory to the practice of mobile social networking, demonstrate how a systematic application of the network paradigm enhances our understanding of MoSoSo and approaches to its design.

## 7.1 A classification of social computing paradigms

The first step in conceptualizing MoSoSo was to gain insight on its current status. Among other things, this task included tracing the historical origins of MoSoSo and connecting it to other paradigms of social computing.

By tracing the historical origins of MoSoSo (Article I), it was found that it is a very recent phenomenon. MoSoSo emerged around 2005 to exploit the new capabilities of mobile devices offered by digital convergence for the enhancement of social interactions in mobile contexts. As Article I was conducted later, in 2006, there was neither much availability of scientific knowledge on MoSoSo nor any applications known to the large public. Because of these aspects, the evaluation of MoSoSo was mostly conducted at a theoretical level and was exploratory in nature.

In spite of these challenges, it was found that groupware and social software were always mentioned in discussions on MoSoSo, but the boundaries between such paradigms of social computing had not been clearly described. This shortcoming suggests, on one hand, that groupware and social software should be regarded as the natural predecessors of MoSoSo and, on the other, it presents a research challenge of clearly defining the boundaries between them.

In articles I and II, this challenge is addressed, linking the controversy around the classification of social computing paradigms to three main issues: the support of formal or informal social interactions, the orientation to static or mobile interaction contexts and the theoretical focus on social groups or social networks. In this respect, MoSoSo naturally fits to the dimension of informal social network interaction in mobile contexts.

This characterization led to the first definition of MoSoSo based on an adaptation of Shirky's definition of social software (2003) as "*software that supports group interaction*". Replacing the focus on social groups with social networks, MoSoSo is defined as "*software that supports the interaction among networked mobile users*" (Article I, p.155). The first network-oriented definition of MoSoSo is elaborated further in Article II, in which MoSoSo is regarded as "*a class of mobile applications whose scope is to support social interaction among interconnected individuals*" (Article II, p.1435). This definition does not stress the informal nature of MoSoSo interactions, and thus a third, more complete definition of MoSoSo can be presented: MoSoSo is a class of mobile applications whose scope is to support informal social interaction among interconnected individuals. This definition might seem slightly cumbersome, but it is useful to emphasize the key importance that the notion of *social link* has for MoSoSo. Given this premise, MoSoSo can be more concisely defined as a class of mobile applications whose scope is to support informal mobile social networking.

As far as the distinction between informal and formal is concerned, social software would refer to a class of desktop computer applications - used in static interaction contexts such as homes or offices - whose scope is to support informal online social networking, while groupware would concern a class of applications whose scope is to support formal social interactions, both in static and mobile contexts. Because of the blurring boundaries between informal and formal, it is worth noting that work and learning activities, on which groupware still focuses, are here conceived as formal social interactions, even if the significance of informal exchanges in such contexts has been increasingly emphasized through the enhancement of groupware with social media features.

In addition, by adopting the network perspective, there is no distinction between social group and social network because the former concept simply represents a specific configuration of the latter (i.e. the clique). In this way, both online and mobile applications designed for group communication or social networking would fall into the groupware category. By adopting this classification, groupware, social software and MoSoSo would not overlap but instead be complementary to each other (Table 5).

TABLE 5 Relating MoSoSo to the other social computing paradigms

| | **Formal** | **Informal** |
|---|---|---|
| **Mobile** | Groupware | MoSoSo |
| **Desktop** | Groupware | Social software |

## 7.2 Evaluation of the current status of MoSoSo

The social significance of MoSoSo is explored in Article II, which analyses five different types of MoSoSo: a wearable computing apparatus (i.e. Sociometer), a larger project on context-aware mobile social computing (i.e. Reality mining), a social proximity application (i.e. Nokia Sensor), a mobile social awareness application (i.e. ContextContacts) and a cross-media social awareness application (i.e. LiveAddressbook). SMS-based MoSoSo (Chapter 5) was not taken into account because MoSoSo was linked only to smartphones. The mobile versions of existing Internet social software applications were not selected, privileging MoSoSo natively designed for the mobile context.

The comparison of the chosen types of MoSoSo demonstrated that MoSoSo is typically designed as a stand-alone mobile application rather than as a general purpose social platform. Among the selected MoSoSo, ContextContacts was the only one supporting all forms of digital community interaction, which were analysed using Marti's (2002) concept of classes of mobile-mediated social relationships. The choice of a stand-alone application provides the advantage of associating MoSoSo to a well defined activity. If not done so, it might not be simple for the user to understand the purpose of MoSoSo. However, restricting the scope implies also limiting its usefulness to a few typical contexts/activities and categories of users. This insight was strengthened by the analysis of Thom-Santelli (2007), who regarded MoSoSo as a tool with a limited utility.

The study also offered a second interesting finding, which confirmed the weak conceptual basis of MoSoSo. The mobile phone-book, central gateway to mobile social networking services, has not improved much since the early versions of mobile devices. Social awareness applications (i.e. ContextContacts, LiveAddressbook) aimed at filling this gap by enhancing the original address-book with contextual cues. In social proximity applications, the mobile address-book is not explicitly mentioned. However, they underline the significance of user profiles, i.e. rich-media description of the self. All together, the various types of MoSoSo indicate that mobile phone-books need to include both a richer description of the user and more advanced features to share contextual cues.

Although all the selected types of MoSoSo agreed on the importance of these two elements, they showed different approaches to their implementation.

In regard to user representation, social proximity applications generally privilege the virtual identity approach, while mobile social awareness tools typically display the real identity. The former approach follows the spirit of virtual communities, while the latter the tradition of mobile services. Even if the support of virtual identities offers a way to stimulate users' creativity and self-expression, it does not offer a solid basis for the development of interpersonal trust. When used in leisure-oriented contexts or within a trusted circle, the impossibility to display real identities might not represent a serious problem. In contexts requiring a trust basis, however, the use of virtual identities might simply be regarded as untrustworthy and would lower the motivation of the participants to interact.

When considering digital sharing, both personal privacy management and control of incoming social information flows are essential. In social proximity applications, such as Nokia Sensor, user profiles are publicly displayed because there they are regarded as digital extensions of clothing, which are visible to nearby persons. In mobile social awareness applications, such as ContextContacts, privacy is instead modeled as a dynamic privacy that needs to be supported by a design mechanisms based on the principle of selective disclosure.

A third interesting aspect concerns the underlying communication model of MoSoSo. In most cases, MoSoSo aimed at enhancing interpersonal interaction rather than at implementing the many-to-many communication model used by online SNS. NokiaSensor was an exception, as it included a guest-book in the user profile to allow others to read and post comments.

The results of the evaluation of the various types of MoSoSo are due to several approaches MoSoSo were experimented with. Several interesting ideas were identified, demonstrating the potential of MoSoSo but also a lack a common ground or view of the technology. The divergence of views on MoSoSo can be explained with the different purposes of each application. However, MoSoSo was generally conceived as a stand-alone mobile social application. As this approach does not present the key requirement of a common basis for design, it lowers the complexity of MoSoSo, but it also constrains its potential. All in all, it may be concluded that MoSoSo was found to be a young and still immature paradigm of social computing, typically designed as a gadget which could express much more potential if conceived as a general purpose social platform.

## 7.3 Associating MoSoSo to mobile social networks

The fragmentation of approaches towards a technology represents a serious obstacle for the formation of a well-defined identity for this technology and for supporting its widespread adoption. The history of the mobile telephony shows that the SMS has not had in the United States the same success it had in other countries because of the multiple SMS standards in use (Ling, 2004; Castells et al., 2007). Even the Internet might not be as popular without the Web, a technological infrastructure in which "*anything can be linked to anything*" (Berners-Lee, 1999, p.4). Similarly to the Web, MoSoSo should functionally be able to connect anybody with anybody, in an ad-hoc or long-lasting manner, through digital content. Hence, mobile devices should be regarded as a single open and standard social platform to create or strengthen social ties, and to communicate with a single person or with small or large groups. Like the phone call and the SMS, MoSoSo is, therefore, to be conceived as a general purpose social platform. From a technical viewpoint, this solution could be implemented as a social layer consisting of several interconnected modules (Article II) that can work on top of different mobile computing architectures. At a theoretical level, this task requires developing a general definition of MoSoSo to be used as the foundation of a holistic approach to MoSoSo design.

The conceptual foundations of MoSoSo can be derived by the insight offered by previous research projects on wearable computing (i.e. the Sociometer) and mobile social systems (i.e. Reality Mining), which demonstrated how the recent advances in the science of networks (Barabasi, 2002) provide an effective conceptual tool to understand MoSoSo and enhance its design. Hence, MoSoSo can be conceptually grounded on mobile social networks. In this way, the theory of mobile social networking connects to and enriches the tradition of SNA (Wasserman & Faust, 1994; Scott, 2000).

Being aimed for mobile social networking, MoSoSo deals with the utilization of network knowledge to facilitate informal social interaction opportunities. Classical and recent studies on networks show that the structure and evolution of mobile social networks can be observed "*through the lenses of mobile devices" (*Article III*)*. In fact, mobile devices can gather behavioral and contextual data on which to apply tools and methods of SNA to obtain a structural representation of the mobile social network, to infer aspects of mobile-mediated social relationships and even to predict patterns of human behavior (Eagle, 2005). All this knowledge is not only significant for human and social research, but has profound design implications that until now have not been sufficiently exploited. As the analysis of Sociometer and RealityMining suggests (Article I), the knowledge of theoretical models of the structure and dynamics of complex networks may find a practical application in MoSoSo through its capacity to measure and infer such properties, making them usable in contextual interaction. Hence, a network-based approach to design might contribute to the consecration of MoSoSo as a mature paradigm of social computing and also support a wider user adoption.

To apply a network perspective, user psychological and user sociological knowledge could be employed instead of methods centered on technology or business models: "*to be able to develop useful applications which would allow exploiting the knowledge and power of social connections, before working on the technology, we have to deal with human relationships and their dynamics*" (Article I, p.156). This principle materializes in the discovery of the *social link* in MoSoSo:

> "In this perspective, mobile social software would be a kind of software that supports interaction among networked mobile users. The definition considers the crucial property of mobile users, mobility, and the fact that there is an invisible 'social link' which keeps them interconnected […] Hence, it is of crucial importance to understand the meaning of 'social link' and associate it with 'interaction-styles', which should include a certain control over the resources and information; not only with whom we want to interact, collaborate or share, but also which information will be shared". (Article I, p.155).

The notion of mobile social network was not yet adopted in Article I, but the characteristics of the social link already provide an idea of how to approach MoSoSo from a network perspective. This early insight was elaborated in successive studies (Articles II, III, IV), which developed the theoretical foundations of MoSoSo. The key concept of mobile social network was defined as "*user's patterns of interconnection with others emerging through mobile communication*" (Article III). This definition indicates that mobile social networks are egocentric and

have their structural unit in the individual social actor, which is represented in MoSoSo as a user profile, similarly to online SNS. Although not going very deeply into it, the study also mentions the possibility of designing mobile virtual communities, in which the structural unit is represented by the collective group rather than by the individual. In a second more elaborated definition, mobile social network is described as a "*socio-technical concept corresponding to patterns of interconnections among users emerging directly or indirectly through mobile communication*" (Article III).

Both definitions of mobile social network are similar because they are based on the key idea of *social interconnection* – the social link of Article I. In practice, it is digital content that connects, or keeps interconnected, users in mobile social networks. The social link cannot exist if such content, which is typically described in the user profile as phone number, demographics, personal preferences, media or contextual data, is not shared.

In Article V, all the variables of the user profile are described as digital resources. In addition to the actual content, each resource would also include some metadata, expressing its utilitarian dimension, or value, its privacy settings and its owner (user, group of users, everybody).

By definition, resources are goods with value. In MoSoSo, resources are symbolic goods and their value is not necessarily monetary. As suggested in articles II and VII, the value of a resource may be expressed in terms of virtual currency, the unit for exchange or transactions. The value of a resource would reflect its utility for the user in a specific context. For this reason, resource value is inherently dynamic and may be influenced by several variables, which may be context-dependent or relational. Asking help (i.e. share his/her resources) from a friend is generally easier than from a stranger; however, the outcome of the interaction strongly depends from the type of support that is asked. The development of ontologies of resources, metrics and methods for the assignment of value, are beyond the scope of this dissertation and are left for future research (Chapter 12).

As digital sharing is the key feature of MoSoSo interaction, it is natural that special care needs to be given to privacy management. In Article V, each resource contains a measure of its perceived privacy damage, which may be different for strong, weak and latent ties. In addition, privacy-related metadata may contain references to contact, group or context rules.

Resource ownership is a related issue connected to private, semi-private or public access: when associated to a single owner, a resource would therefore be part of the user profile); when part of the pool of shared resources, the *commons* of a single community or all communities, such resource is part of the community profile. The wallet, as a container of currency connected to resources, is strictly associated to the concepts of resource and ownership. Furthermore, the wallet is connected to the user profile, following the model of a mobile device re-engineered in a way that all its components are logically and functionally interconnected. This is discussed in more detail in Article II.

Through the notion of *digital resource*, the nature of mobile-mediated relationships is inherently content-based and relies on the characteristics of digital sharing. From this viewpoint, social proximity applications are mobile social networking applications that use location as the primary criterion for social interconnections. When these applications are used for match-making purposes, location-based sharing needs to be supported by compatibility methods, which apply, for example, the homophily (Lazarsfeld & Merton, 1954) and heterophily principles (Rogers & Bhowmik, 1970; Lin, 2001) to one or more user profile variables, such as gender, age, location, common friends and preferences. In this way, serendipitous encounters may be facilitated through MoSoSo.

The dating scenario also suggests an important aspect of mobile social networking: MoSoSo should not only support the maintenance of weak and strong ties, but also acknowledge latent ties (Haythornthwaite, 2002) in the creation of new social ties. In this respect, MoSoSo makes users aware of a latent tie by making visible the invisible social patterns connecting users by metrics of similarity (i.e. homophily) or complementarity (i.e. heterophily). Behavioral and contextual data stored in mobile devices is important for making users aware of a latent tie through MoSoSo: for instance, "*homophilus relations could be investigated considering users' similarity in mobile usage patterns*" (Article III). Making latent ties usable is an important function of MoSoSo: this process typically follows direct interaction, in which communication partners express their surprise for how much they have in common (a friend, an event that they attended, values, interests). Whereas such invisible patterns typically emerge unexpectedly and in an unplanned manner in F2F communication, in online SNS they are often made visible by the system, which compares the information present in the user profiles. For instance, Facebook produces recommendations to connect with other users on the basis of the amount of mutual acquaintances. In a similar manner, serendipity in MoSoSo could be supported by a systematic analysis of user behavioral and contextual data.

In conclusion, articles I, II and III maintain that MoSoSo can be conceived as a general purpose social platform by adopting a network perspective. This would make MoSoSo a mobile social networking tool supporting creation and development of any type of social tie through the sharing of digital resources.

## 7.4 Mobile social networking: from theory to practice

The theoretical foundations of mobile social networking are explored empirically with the goal of discussing how to enhance a design solution for MoSoSo on the basis of network knowledge (Article III).

Through a questionnaire, user psychological (general orientation towards mobile use, practice of digital sharing) and a user sociological (structural and relational aspects of respondents' mobile social networks) data were collected. In the questionnaire, these two elements corresponded to two main sections, the former designed to obtain information on demographic and psychographic as-

pects of the respondent, and the latter focused on mobile behavioral variables related to one/two weeks of communication activity. A total of eighteen young adults, all friends or acquaintances of the author of the study, responded to the questionnaire.

The analysis of the dataset reveals several findings, providing evidence to both conceptual and practical aspects of mobile social networking:

1. Phone calls and SMS were perceived as the only essential mobile services;
2. Mobile social network management tools are still too limited;
3. Sharing practices can be enhanced by integrating the nature of one's social relationship;
4. Networks of interpersonal ties do not diminish the role of social groups in mobile social networking;
5. Social matching algorithms should not focus only on the space dimension, but also, by considering users' homophily in periods of the day or the week, on the time dimension;
6. Although mobile communication facilitates globally dispersed networks, the largest bulk of mobile social networks is still local;
7. Mobile social networks are used to accomplish both instrumental and expressive action goals;
8. Users' mobile social networks tend to have hundreds of contacts, but only 20% of social ties are commonly used;
9. There is a mismatch between the users' perception and actual use of active social ties;
10. In a mobile social network, a very small set of people have the largest networks and hence play a special role in the digital community.

Despite the availability of a mature infrastructure of converged digital networks, it was confirmed that only phone calls and SMS were perceived as essential services of mobile communication: in fact, the largest majority of communication exchanges consisted of phone calls (67%) and SMS (33%). Other types of services were not popular at all: only one of 948 communication exchanges was a MMS. Although 61% of the users owned a Smartphone, only 17% reported to have occasionally browsed a web-site or read email with it. As the MMS belongs to the wider category of mobile Internet applications, the finding suggests that the phenomenon of under-use of MoSoSo has old roots.

In regard to mobile social network management, it was found that the respondents do not exploit the advanced features of mobile phone-books, the primary access point to one's mobile social network management. In most cases, such tools are used only for the creation of a new contact by using the simplest entry <*textual label, phone number*> and for the search of a contact to call or text. This finding indicates that not enough attention has been paid to enhance the adoption of mobile social network management tools. This finding confirms the insight of Article I on the need for urgent improvements to such tools, such as simpler and more usable user interfaces for mobile phone-books.

It was also investigated to which extent the nature of the social relationship affects the user decision in mobile sharing. Respondents were asked to state how often they would share various types of digital content (e.g. location, presence, phone-book entries, calendar/notes, ring-tones, game-applications, and personal media) with friends (Figure 18) and acquaintances (Figure 19).

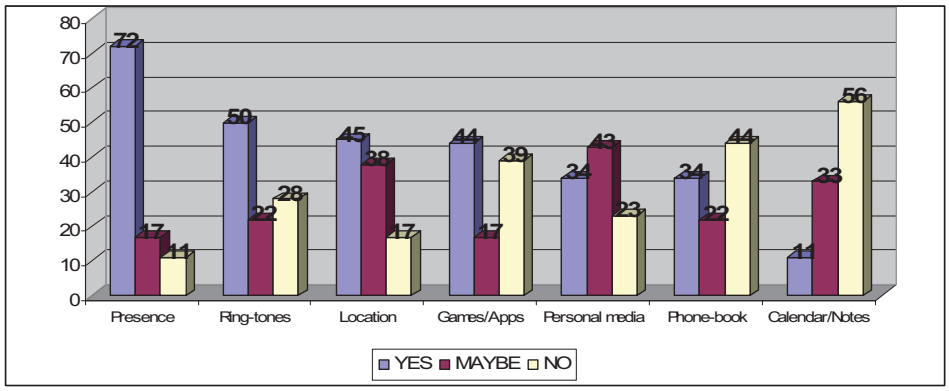


FIGURE 18 Attitude towards mobile sharing with friends

As expected, the respondents reported that they would share digital content more readily with friends than with acquaintances. Furthermore, some types of resources were found to be perceived as more sensitive than others. According to some readers of the study, the figures are not very readable. To enhance their readability, the same data is presented here in a slightly different manner. The two figures answer to the question *which of the following resources are you willing to share with your friends/acquaintances through your mobile device?* The answers *always* and *often* of the original table were aggregated and displayed as label *YES*. The answers *seldom* and *never* as label *NO,* and, finally, the percentage related to the answer *sometimes* was labeled as 'MAYBE'.

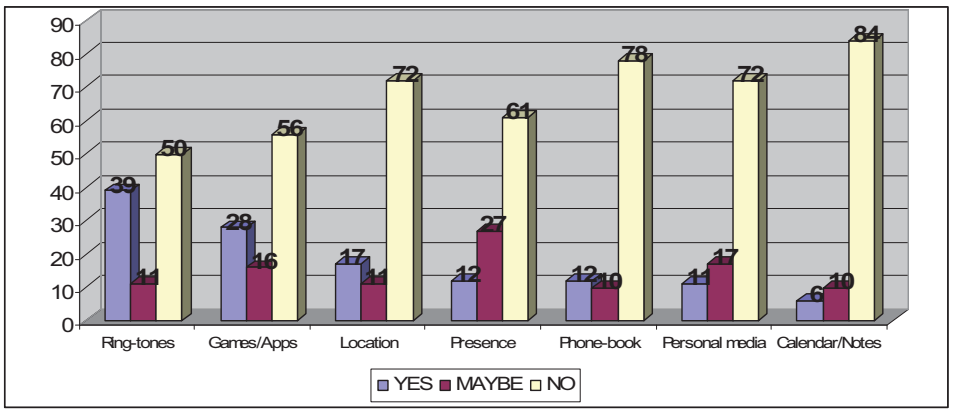


FIGURE 19 Attitude towards mobile sharing with acquaintances

Calendar events and personal notes were regarded as the most sensitive type of personal resource, as only 11% of study participants would share them with friends and 6% with acquaintances. By contrast, digital content that is downloaded to the mobile device, such as ring-tones, games or applications, are not regarded as very harmful for personal privacy. However, many study participants did not see it useful to share applications with others.

The data of the figures indicates that the assessment of tie strength, at least in terms of latent, weak and strong ties, is beneficial for the implementation of mechanisms supporting the user's decision in mobile sharing (Article V). Acknowledging the relational dimension, one should consider three different thresholds of privacy sensitivity, which are respectively connected to digital sharing with friends (i.e. strong ties), acquaintances (i.e. weak ties) and strangers (i.e. latent ties). In addition, the findings also show that relational information on the properties of the social tie is not sufficient to implement mechanisms of privacy management, which need to be also supported by models of perceived risk associated to the various types of digital content.

While the metrics of tie strength need to be embedded and assessed at the social level of MoSoSo design, perceived risk values associated to the disclosure of contextual cues represent a form of user psychological knowledge to be measured at the individual level. Both concepts may be described manually by the user through explicit feedback or automatically inferred by social algorithms on the basis of behavioral data. The manual and automatic approaches can also be combined: Article V suggests the use of a mobile user survey to initialize the variables of the user profile, such as user's attitude towards mobile sharing – which would produce the default privacy settings – and to add contact and context rules in an automatic manner.

Another important finding of the study concerns the role of social groups, which were found to have an important function in mobile social networking. For each communication entry – phone call or SMS –, respondents were asked to specify to which social group the communication was directed. A list of predetermined groups was provided, including social groups of cognitive (friends, acquaintances), biological (family) or institutionalized (work colleagues) nature. When analyzing the frequency of communication exchanges by social group, it emerged that multiple interaction patterns existed, reflecting the different roles that groups have in satisfying the user's instrumental and expressive needs. Instead of manually specifying and updating groups, group management features and communication services might benefit of procedures that automatically detect social groups in the mobile social network on the basis of behavioral data. By using group management features in combination with privacy management mechanisms, rules for accessing digital resources could be generated and associated to social groups in a dynamic manner.

The time dimension of mobile communication was also analyzed. On the basis of communication data, users' habits in calling and sending SMS were grouped in time clusters. Although such important aspect has not been discussed enough in the other studies, the findings indicate that user time statistics

might be useful for enhancing mobile service personalization (class A of mobile relationships, see Article I). For instance, such information can be used for personalized billing recommendations and optimization of phone contracts, or to enhance social awareness by automatically suggesting to other users the most suitable times for calling or texting. Furthermore, combination of time and location variables could have interesting applications for homophily-based algorithms matching *familiar strangers* (Paulos & Goodman, 2004), people whose paths routinely cross.

Social matching algorithms tend to focus on space rather than time, and it is useful to analyze datasets to determine the spatial distribution of mobile social networks. In other words, those algorithms aim at assessing how important local ties are in mobile social networks. This question was investigated by Wellman (1996), who found that local ties still play a central role in personal communities. The author warned, however, that such findings are strongly influenced by the way social networks are defined and measured. Wellman's insight (1996) is confirmed by Article III, which shows that most communication (64%) took place at a local level - between contacts living in the same city. The fact that mobile social networks consists of many local contacts indicates that location-based services and social proximity applications are an important category of MoSoSo. However, much of the communication (30%) also occurred at global level, between contacts living in different countries. This finding was certainly influenced by the international background of half of the study participants and confirmed the high physical mobility of young generations of citizens and their need for maintaining in perpetual contact (Katz & Aakhus, 2002) at distance. From a design viewpoint, location information can be used to enhance the address-book, for instance allowing filtering of contacts by location. This enhancement would support the goal of enabling more efficient searches and reducing cognitive load, especially for large networks.

The spatial distribution of mobile social networks also reveals another interesting aspect: the dataset includes communication spread in sixteen different countries, fifteen of which are European. The strong similarities in the backgrounds of most interconnected people and their regular communications confirm the homophily hypothesis. Despite the global scope of mobile communication, the respondents, all of whom were European citizens living in Helsinki, tended to create and maintain networks with other Europeans. Despite such similarity, the influence of different cultural backgrounds can be observed: for instance, Italians communicated regularly and frequently with their distant family, while Finns called or sent SMS less frequently, despite the cheaper communication costs. From a sociological viewpoint, the spatial distribution and the communication patterns of a mobile social network can tell much about the nature of the digital community. By mining user behavioral patterns in mobile social network communication, it might be possible to personalize community-mediated interaction by acknowledging the shared cultural determinants (Rauterberg, 2006).

The nature of users' action goals was investigated by asking respondents to describe the instrumental or expressive nature of each communication of the dataset. Such information was not obtained by analyzing the communication content, but rather by asking respondents to specify the closest match among a number of pre-defined textual labels. The analysis shows that the mobile device is used both to satisfy instrumental (56%) and expressive (44%) communication needs. Among the instrumental communications, the most common category was *questions*, which shows how important it is for mobile users to rely on other members of the mobile community as trusted sources of information. The answers provide insight also for design: for instance, MoSoSo could support manual or automatic addition of metadata to digital content. By employing the approach suggested in Article VI, tagclouds could be generated. Tagclouds can provide an alternative way of accessing people and information in mobile social networks by letting the user proceed by logical associations. In this way, these associations can be used to the support contextual action goals, which can always be briefly characterized by a number of relevant keywords. In addition, tagclouds would also function as an additional tool to deal more efficiently with the complexity of information flows.

The probability of accomplishing a contextual action goal through network connections is also influenced by the extension of one's mobile social networks. By comparing the size of the address-books and the number of different contacts present in the communication logs, it was possible to assess the amount of *active* ties. An *active tie* corresponds to a social tie connecting people who regularly communicate. Although address-books typically contained between 100 and 200 contacts, on average respondents communicated only with 21 of them. Although Pareto's expression "*vital few, trivial many*" was coined already in the beginning of the Twentieth century to refer to the unequal distribution of wealth in his country, it also suits well for the characterization of the relevance of contacts in address-books. In fact, most ties described by mobile phone-books are not active, reflecting the existence of latent ties, which were once strong or weak ties. The presence of many inactive ties is explained by the fact that mobile phone-books are not frequently updated by users. In addition, they do not automatically adapt themselves to the evolution of social dynamics in the mobile social network. The current mismatch between the cognitive and technical representation of mobile social network might be reduced by including evolving models of mobile social networks in MoSoSo. In this way, inactive ties might be automatically archived, updating at the same time access permissions to shared resources. This enhancement would greatly ease user's efforts in mobile social network management.

The dataset also reveals a difference between cognitive ties and actual ties. The former was assessed on the basis of a qualitative measure (i.e. respondents' answer concerning frequency of communication), while the latter was assessed through a quantitative indicator (i.e. mobile communication logs). Actual communication with social groups, as described by mobile communication logs, was found to be lower than perceived communication reported by respondents.

A more systematic comparison among cognitive and real social ties should be undertaken, as this finding suggests that researchers, in addition to designers, must carefully reflect on whether to adopt qualitative or quantitative approaches to mobile social network models.

Furthermore, the representation of respondents' mobile social network shows that the smallest group of respondents (17%) had the largest mobile social networks. Considering the scale-free nature (Barabasi, 2002; Onnela et al., 2007) of mobile social networks, hubs may be found in this group. Another structural aspect concerns the low overlap of mutual acquaintances: as the respondents were selected according to their friendship with the author of the study, this finding confirms that multiple social groups that are interconnected by a few key individuals, the hubs. Being so important for the spread of information and for the resilience of the network, MoSoSo needs to provide methods for detecting users who are acting as social hubs. This special role might be regarded as a form of prestige acquired through a particularly active participation in the digital community. To encourage participation, hubs might receive special treatment, for instance through incentives (e.g. virtual currency) as recognition of their high social status.

In conclusion, the findings provide several design ideas for moving from the theory to the practice of mobile social networking, demonstrating that MoSoSo design would greatly benefit from a systematic application of the network paradigm.

# 8 NETWORK APPROACH TO MOSOSO DESIGN

This chapter illustrates a more complete and revised version of the network-based design model than described in the articles. This model, which renders MoSoSo a general purpose social platform for contextual interaction, consists of three levels. The individual level deals with the representation of the user as a collection of personal and social resources (i.e. user profile). Resources are digital representations of tangible or intangible goods that assume value in an action context. Digital sharing allows sharing personal resources as social resources, thus interconnecting users. It follows that the social level of the mobile social network is all about interconnected user profiles. Social ties are therefore described in terms of access and sharing of social resources. The interaction level, which deals with the use of such resources in context, describes how MoSoSo will facilitate contextual interactions through social algorithms, procedures that take as input the combination of user behavioral, social network and context data to return a personalized MoSoSo interface. This model also allows developing solutions for personal privacy management, social information overload and social dilemmas.

## 8.1 From conceptualization to design

The conceptualization of MoSoSo as a general purpose social platform grounded on the concept of *mobile social networks* represented the first step towards the development of a conceptual framework for designing better tools for mobile social networking. As illustrated in the previous chapter, the recent breakthroughs in the science of networks (Barabasi, 2002) suggested that mobile devices are suitable tools for gaining a deep understanding of the structure and dynamics of networks. Although this knowledge can be used as input to personalize MoSoSo, it has not been used much for this purpose yet. Until now, humanistic and mathematic approaches to networks have developed in parallel;

by regarding these domains as complementary, they find a natural convergence in interaction design.

The early insight of a holistic design model for MoSoSo is presented in the second part of Article I. By exploiting the notion of *social interconnection*, the abstraction of a *social network layer* satisfying all classes of mobile-mediated social relationships (Article I) is proposed. In this way, MoSoSo would support both the maintenance and extension of one's social network, at distance and in a co-located setting. In Article IV, the preliminary version of the design model is presented. That study applied a design thinking methodology (Simon, 1969; Saariluoma, 2004 and 2005a; Anderson & Kolko, 2010b) based on the integration of graph theory (Harary, 1969; Bollobas, 1998) and the emerging research of complex networks in sociometry (Moreno, 1953; Lindzey, 1968), a network-oriented approach to obtain user psychological knowledge (Saariluoma, 2004). Both frameworks are synthesized by the wider perspective of social network analysis (Faust & Wasserman, 1994; Scott, 2000), or network theory.

The basic design model consists of three levels of design, where user psychological knowledge (individual level) and social network knowledge (social level) are used as input for interaction design (interaction level). In the interaction level, the 'invisible' knowledge gathered in the other two levels becomes visible to the user through a personalized interface of MoSoSo tailored to the user's contextual needs and to the characteristics of the mobile social network. The basic concepts of the design model presented in Article IV and then discussed also in Articles III and VII have been updated, but they did not change significantly. Some terms, such as *personal social space*, have been left out, while others, such as *social algorithms*, have appeared. These changes indicate the continuous refinements and efforts applied to enhance the early version of the design model. Unlike other approaches to MoSoSo design, the conceptual model presented here has a holistic nature aiming at covering all general aspects of digital community interaction. In other words, it conceives MoSoSo as a general purpose social platform rather than as a stand-alone application. The design model can be defined as a *network* approach because structural and relational properties of mobile social networks are used as input to support and facilitate the user's social action (Figure 20).

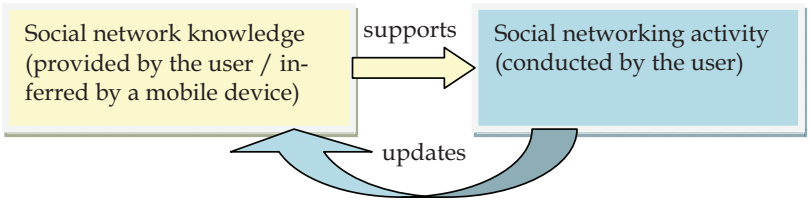


FIGURE 20 Network-approach to MoSoSo design

It is also a human-technology approach (Saariluoma, 2005b) in the sense that the social network knowledge is inferred by a mobile device on the basis of real-time collection and processing of behavioral data and contextual information.

By providing a constantly open window to one's social world, mobiles allow users to make sense of the range of possibilities and opportunities embedded in the action context.

When used as a friend-finder MoSoSo allows checking for nearby friends or acquaintances. Such knowledge may influence the behavior of the user, who could decide for instance to change his/her path in order to meet or avoid a particular person. Each individual choice in mobile social networking has an effect on the evolving configuration of one's personal community. A sudden decrease of interactions with a contact that was regularly present in mobile communication data logs might be interpreted as a weakening tie. More generally, any manual or automatic modification to user profile variables (e.g. location, profile picture, status message, current work, relationship status, new photos/video-clips, blog entry) produces a number of subjective inferences, which maintain social awareness and provide context for social communication.

In MoSoSo, as in online SNS, such inferences are increasingly due to indirect communication rather than direct interactions. This practice, allowed by the properties of smartphones (Livingston, 2004; Iftode et al., 2004; Abowd et al., 2005; Raento et al., 2005 and 2009; Ballagas et al., 2006), emphasizes the reflexive nature of mobile communication systems, referred to as class A of mobile-mediated social relationships in Article I.

Instead of being exclusively used for communication, MoSoSo may be exploited by using it as a constant source of information about what is happening in others' people lives. We may not know or remember the birthday of a friend or acquaintance, but if that information has been disclosed to MoSoSo, it can provide a reminder and/or trigger the sending of a brief message of good wishes. Similarly, a change in the relationship status or employment situation may lead to the offer of one's practical or emotional support, as well as to the potential exploitation of such change for the attainment of self-interests.

The realization of potential opportunities is constrained by the difficulty to pay close attention to all network updates because of the scarcity of time and cognitive resources. In addition, it is not always clear whether the risks of personal privacy would outweigh the benefit that one could gain from the disclosure of one's personal resources. Albrechtslund (2008) argued that online social networks represent a form of participatory surveillance; this trend may become even more common in mobile social networks, with MoSoSo acting as an *always-on panopticon* (Rheingold, 2002).

Despite the challenges, it is generally acknowledged that the main advantage of mobile social networking is in providing more convenient access to social information. By means of many-to-many communication, MoSoSo lowers the access threshold to such information. Due the recent developments of Internet social software, in particular SNS, computers can provide good graphical representations of user's social networks (Heer & boyd, 2005) that can enhance human social networking capacity. Users can manage larger networks, perform quicker searches, filter information through multiple criteria, share resources

more efficiently and overcome time-space limitations in communication and collaboration processes.

Easier access, however, does not necessarily imply an enhancement in contextual usage. The benefits of more convenient access may remain only potential or be outweighed by its costs if human and technological solutions of MoSoSo do not include mechanisms to support contextual usage.

In regard to technological mechanisms, the design model introduces social algorithms as a tool supporting contextual social interactions. Social algorithms address this need by seeking to synchronize and interconnect human mental models of social networks with the automatic models represented in the personalized interface of MoSoSo. Recent research on complex networks (see Article III for a review) found that the structure and dynamics of social structure can be described as a result of processing large streams of social network data. Mobile devices provide a unique opportunity for updating user and mobile social network models in real time because they are always with the user. In this way, it is possible to create a positive feedback loop, with the output of social action influencing social structure, which in turn supports future actions. As in every process of this kind, there is the problem of the initialization phase. In MoSoSo, the initialization of the data structures is carried out by the user shortly after purchasing a mobile device. As in online SNS, the user needs to create a user profile and to provide the structural information by adding or importing contacts to the mobile phone-book. The user profile may combine implicit data (e.g. user's individual usage patterns and contextual logs) and explicit data (e.g. survey of sharing attitudes, as suggested in Article V).

Social algorithms alone are not sufficient if not enough attention is paid to the human aspects. The ideas of *information literacy* (Shapiro & Hughes, 1996), *human capital* (Becker, 1964|1993) and *communication capabilities* (Viherä, 1999) stress that competences and motivational aspects are central for realizing the potential value of access. These aspects are related to policy convergence (Chapter 9), the support policies for empowering users and communities through a synergic integration of access, competences of motivation.

The general approach combining social structure and social action suggests that designing MoSoSo is about understanding and modeling patterns of social connectivity, and linking them to interaction opportunities. This key challenge may be tackled by integrating the three building blocks, namely user profile, mobile social network and social algorithms (Figure 21). The user profile and mobile social network, together, correspond to social network knowledge (i.e. the dimension of social structure), while the interaction level directly supports social networking activity (i.e. the level of social action).

Each of these three key concepts relies on an explanatory framework: the individual level is based on user psychological knowledge (Saariluoma, 2004 & 2005a) that provides input on user needs, motives, values, preferences and action goals. The social level is grounded on user sociological knowledge (Green et al., 2000; McGuigan, 2005), and more specifically on the application of net-

work theory concepts and methods (Wasserman & Faust, 1994; Scott, 2000; Barabasi, 2002) to mobile social networking activity.

The interaction level deals with the way MoSoSo facilitates contextual interaction. Through social algorithms, knowledge of user profile (i.e. cognitive variables, current location) and mobile social network (i.e. types of social context, such as people nearby) are linked to context data (i.e. additional environmental information such as characteristics of the physical context). If social algorithms are lacking, mobile social networking features need to be managed manually. Although this approach provides the highest reliability, it could easily become unmanageable because its complexity grows with network size. Social algorithms represent a necessary compromise between efficiency and reliability and offer a trade-off between human agency and level of automation in the user's control of social information flow.

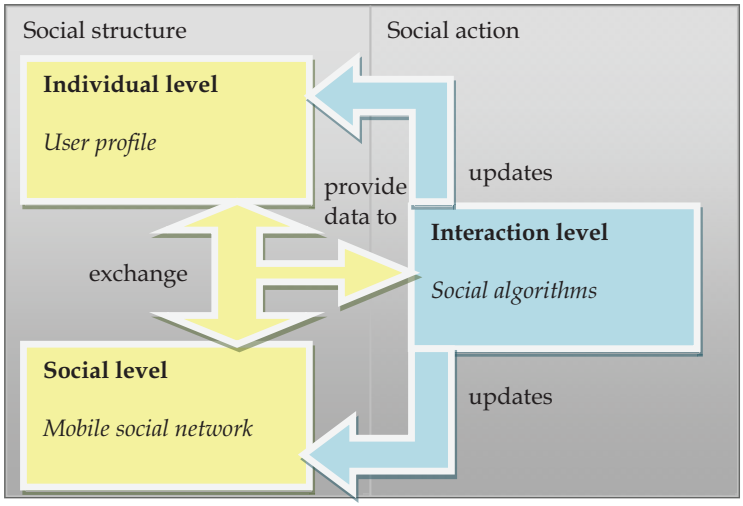


FIGURE 21 Building blocks of MoSoSo design model

User profile, mobile social network and social algorithms could be implemented as separate modules in the design solution. Nevertheless, they are interconnected concepts: for instance, context variables are used to update the user profile and also to assess those network resources or people that are accessible in that context. The ultimate goal of interconnecting all modules is to create an evolving model of digital community in which social structure, as opportunity and/or constraint, influences social action through MoSoSo and in which the effects of social action mediated by MoSoSo play a role in the dynamic shaping of social structure. In other words, the mediation of digital community interaction through MoSoSo has to necessarily combine the dimensions of structure and action by acknowledging their interplay.

The rest of the chapter first describes in more detail each of the building blocks of the design model and then discusses them from the viewpoint of some of the key challenges of MoSoSo design.

## 8.2 Building blocks of the design model

### 8.2.1 Individual level: user profile

Users represent the smallest structural units of digital communities. Being unique and indivisible, users may be regarded as the atoms of the digital community, the nature of which is not simply the sum of the characteristics of its members, but rather presents a much more complex and mysterious alchemy in continuous transformation. In MoSoSo, the relevant traits of the user are firstly conceptualized (i.e. user model) and then implemented (i.e. user profile). The emerging properties of the digital community, as well as the opportunities/constraints presented to users in MoSoSo interaction, are determined by the characteristics of user profiles.

User profiles, central elements of all paradigms of social computing, are typically linked to the representation of the user's information and communication needs in terms of interests and preferences (Amato and Straccia, 1999). Using different approaches, research has addressed the question of how to build and update a user profile that accurately represents the user's current interests. Such input has been generally used to personalize the user interface. By considering the design of SNS, Donath & boyd (2004) alleged that user profiles function as public displays of identity and are expressed through the interests, preferences and values emerging in social media content (e.g. tags, ratings, photos).

In this study, a resource-based approach to the user profile was adopted. A *resource* may be defined as a good that has value in one of more specific contexts. Through the concept of resource, user profiles embed the utilitarian dimension of the action-value in context. In fact, a resource may also be characterized as a type of data that supports the attainment of action goals of instrumental (i.e. find a job) or expressive (i.e. provide social solidarity) nature. The ethereal nature of digital communities affects the type of resources, defined as *digital resources* or *informational resources,* embedded in its structure. Although digital resources may be more naturally associated to information than communication, they can satisfy both communicative and informative needs.

Hence, resources embedded in digital communities are symbolic resources, which may have a correspondence to material resources. For instance, the 'user location' resource corresponds to a physical place that can be univocally described through geographical coordinates. Other resources, such as 'user name', are intangible but formally listed in a register office. The shape of resource is not homogeneous: in fact, some resources, like presence, are aggregations of other resources (e.g. status and location). In addition, resources may rely on one or more types of media; for instance, an SMS is a text-based resource and an MMS is a multimedia resource. Both SMS and MMS, however, may be included into the wider category of personal media, which includes, among others, also digital photos, video-clips and audio recordings. Through digital sharing, personal media becomes social in the sense that other users can access personal

resources as social resources and perform on them a variety of social operations like commenting, tagging or rating.

Considered from the perspective of control, *personal resources* and *social resources* represent the two main forms of digital resources. Personal resources are owned by a single user, who has full control over them. The owner is often also the creator of the resource, either knowingly or unknowingly: for instance, personal media is generally created intentionally when taking photos or shooting video-clips, while communication logs are resources produced unintentionally as by-product of the communicative act. Social resources are personal resources shared, temporarily or permanently, with other members of the digital community. Sharing personal resources as social resources is generally a decision taken by the user, and may be supported by social algorithms (Article V). Once shared, social resources may still be owned by a single user or become a commons owned by a collective group. In some cases, the user may retain the ownership on a shared resource without fully controlling it anymore because sharing of it with others implies a diminished capacity of control on that resource. For instance, sharing a digital photo means that users, in addition to being able to see the photo, can also copy, modify and redistribute it. Discussed from a commercial angle, these issues are about digital rights management (DRM).

The same user who shares some of his/her personal resources as social resources typically benefits by having an access to a roughly similar amount of social resources. Depending on the forms of control, the user may even appropriate some of the social resources of the digital community as personal resources. When social resources are limited, mechanisms coping with social dilemmas like *tragedy of the commons* (Hardin, 1968) are desirable. Through digital sharing, personal resources and social resources connect the level of the individual user to the wider context of digital community interaction. Using the conceptual framework of resources, a user profile may be regarded as a collection of personal and social resources (Figure 22).

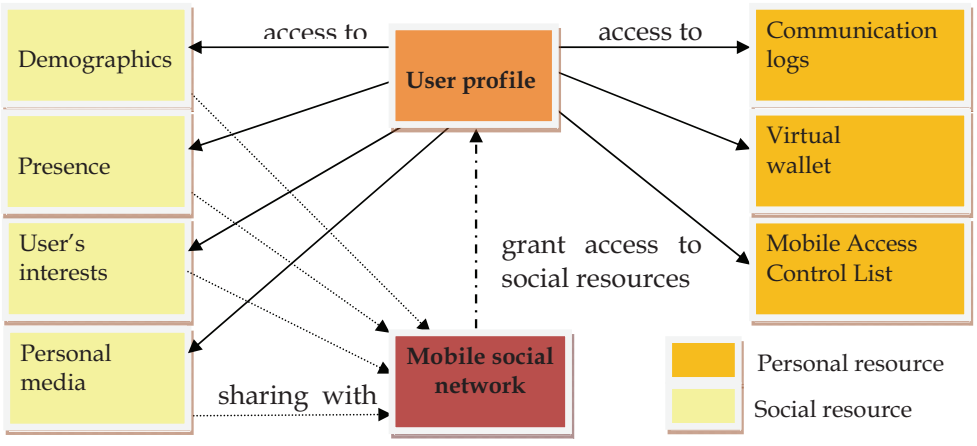


FIGURE 22 User profile as collection of personal and social resources

While most of personal resources can be disclosed to others who are participating in social interconnection and sharing, some of these resources are maintained private because they are considered too sensitive to be shared. Such personal resources are named *private*; the MACL, a data structure supporting mobile sharing described in Article V, is an example of a private personal resource. The virtual wallet presented in Article VII is another element of the user profile and only partly private. In fact, virtual wallet metadata may be disclosed (e.g. the type and amount of currency that the user has accumulated, and how it has been accumulated), while the personal criteria that are used to assign value to material or symbolic resources owned by the user may remain private.

Concluding, the user profile characterizes the individual level of MoSoSo design. Users' profiles are not simply descriptions of users' interests, but include any type of information that may be associated to the user. The resources described in Figure 22 offer only one of the possible approaches that can be adopted to specify which resources should be included in the user profile. Designers may decide to adopt a user profile that better fits to the nature of a specific digital community; particular attention must be paid to differentiate between personal resources that should be kept as private and those that could be shared as social resources. Finally, another key issue is the definition of the basic operations (i.e. access, use, search…) that can be applied to personal and social resources.

### 8.2.2 Social level: mobile social network

In MoSoSo, a group of interconnected user profiles corresponds to a mobile social network (Figure 23).

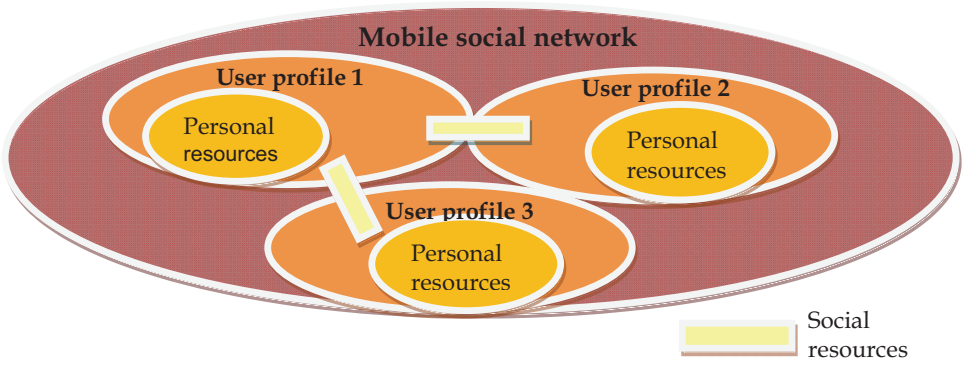


FIGURE 23 Mobile social network as interconnected user profiles

This definition of mobile social network follows the more general definition of social network. As stated by Wasserman and Faust (1994, p.20), "*a social network consists of a finite set or sets of actors and the relation or relations defined on them*".

According to the authors, "*the presence of relational information is a critical and defining feature of a social network*". As several types of relations connecting individuals can be identified, the degree of multidimensionality of a social network is defined by the number of social interconnection protocols. Such protocols also determine the multidimensionality of the social tie. Supporting multiple protocols for social interconnection therefore means supporting multiple types of relations. When this is the case, changing the chosen relation affects the whole configuration of the mobile social network. Although the number of relations to be used to interconnect people is practically endless, in practice they are limited by the implementation of the user profile and more specifically by the choice of one or more personal resources to share as social resources. In fact, the sharing action allows specifying which relation is chosen to establish a bidirectional channel for information exchange and communication.

Early mobile phones supported the simplest mobile social network because user profiles only consisted of a unique personal resource, the pair <*phone book entry id, phone number*> that acted as user identifier. More precisely, the mobile phone number was the only type of personal resource that could be shared as social resource. Two main social interconnection protocols existed to exchange phone numbers: the first and by far the most used was the sharing of phone number by direct interaction (i.e. while speaking in a F2F setting or on landline phones) and the second by indirect interaction (i.e. sending a business card by SMS or sending the phone number by email). Having a mobile phone number offers the opportunity to communicate in real time (i.e. through voice calls) or asynchronously (i.e. through SMS). Early mobile phone features supported the memorization of phone numbers with the help of the phone-book, a digital version of the existing paper phone-books. Therefore, the prototypical mobile social network was represented by a list of contacts present in the mobile phone-book, the size of which was limited by the capacity of the memory of the mobile device. Such mobile social networks were uni-dimensional, as the social ties (i.e. relations) were based on the concept of *mutual acquaintance*.

The multi-dimensional concept of *social tie*, which embeds multiple protocols for social interconnection, enhances MoSoSo's mobile social networking activity. For instance, one of the main classes of MoSoSo, namely social proximity applications, can exploit the nature of sensors, such as Bluetooth, to introduce one's location as the main protocol of social interconnection. In this way, mobiles can be used also for interaction with co-located or proximate strangers. Obviously, *location sharing* would not be sufficient if not supported by other protocols, such as *shared interests,* inferred by a publicly displayed user profile (Persson et al., 2005; Jung et al., 2006; Persson & Jung, 2005).

The purpose of Article III is precisely to show the potential of the network-based conceptualization of mobile social networks. In particular, it demonstrates how several protocols of social interconnection could be implemented on the basis of a simple mobile communication dataset. It was found, for example, that the size of mobile social networks ranged from a few dozens to hundreds of contacts. Although users had quite many ties, interactions took place only

with a small portion of their contacts, which represent the core group of the mobile social network. Despite the differences in frequency of communication, phonebook-based mobile social networks are a good approximation of the actual network of the user's social relationships: it would seem surprising not to find a close contact included in the mobile phone-book. Although the core of mobile address-book contacts tends to remain permanently stored, new contacts are constantly added, and many others are deleted. The pace of such changes reflects the dynamicity of the user's social life. The large-scale Reality Mining project (Eagle, 2005; Eagle & Pentland 2006) provided evidence for this model, showing how rich behavioral data can be easily collected, stored and analyzed on smartphones to enrich MoSoSo personalization and interaction.

The two structural building blocks of mobile social networking, user profile and mobile social network, are highly interdependent. The power relations among them determine the orientation of the MoSoSo application (see 10.4.8). As user profiles in mobile devices get more complex and similar to the ones used in SNS, also mobile social networking functions become more advanced. The more personal resources are shared as social resources, the higher are the opportunities, but also the risks, in realizing the goals of mobile social networking activity. For example, if MoSoSo is designed to support dating, the user can enhance the possibilities to find a match by specifying his/her *relationship status* (i.e. personal resource). By including additional information in the user profile (e.g. photo, city of residence, drinking habits, income, kids), the possibility to discover a closer match, either manually or through automatic recommendation systems (i.e. a form of social algorithm), is higher. The information on the user's relationship status is typically not only shared with trusted contacts, such as friends and acquaintances, but also with strangers. This form of disclosure, on one hand, increases the probability of success, but, on the other, affects also the possibilities that somebody could use the same information for malicious purposes.

The trade-off between opportunity and risk in sharing resources of the user profile with one's mobile social network is relatively easy to understand for a specific activity such as dating, but it becomes much more complex to address when regarded from the general perspective of all possible types of digital community interaction. Chapter 10 discusses the main challenge of digital community design: i.e. to develop human and technological solutions to *exploit potential and manage risks* (Counts et al., 2006).

Despite the complexity of this problem, all critical issues of mobile social networking could be connected to two main functions, namely extending and maintaining one's mobile social network by supporting the establishment of new ties and strengthening existing ones. In MoSoSo, the former function is typically supported by social proximity applications and the latter by social awareness applications. When MoSoSo is conceptualized as a stand-alone application to be used in specific contexts and for a limited range of activities, one or the other approach might be adopted. To satisfy the general needs of digital

community interaction, it is necessary to combine the two approaches into a complete model of mobile social network management.

In this study, a number of concepts have been suggested (Articles I, III and IV) to proceed towards a holistic model of mobile social network management. A starting point could be the sharing of personal resources as social resources, or a social operation on a resource (e.g. search, classify, group, modify, tag, rate, comment), which produces a transformation in the configuration of the mobile social network. More precisely, any operation producing a hierarchical arrangement of the nodes for a mobile social network with a non-hierarchical tree-like shape can be regarded as a ranking operation (Figure 24).

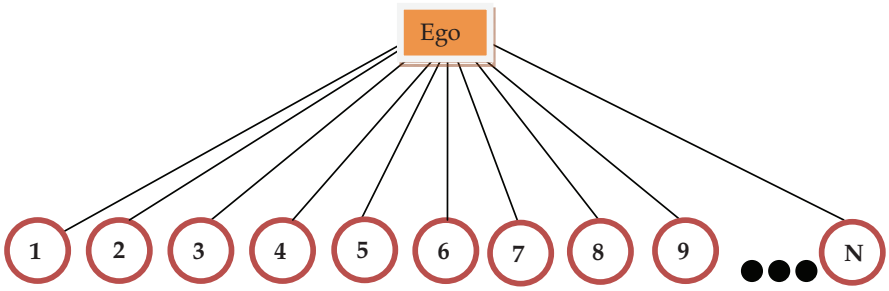


FIGURE 24 Basic arrangement of contacts in a mobile social network

In traditional mobile services, a node is part of Ego's mobile social network when it is included in the mobile phone-book. In this case, being part of the mobile social network implies the possibility to exchange calls or SMS. In addition to the functions of calling or texting, Ego could apply a basic level of personalization (e.g. personalized ring-tone) to each contact, and also create groups. Social groups, however, are not associated to any significant feature in group communication. These operations do not significantly transform the structure of the mobile social network: in the mobile device, all network relations are on the same level. In other words, the representation of the ties in the mobile device does not match with the mental model of the user.

To enhance mobile social networking, a required shift concerns the attempt to embed in the technical system an adaptive model, which is as close as possible to the mental model of the user. Were this goal achieved, MoSoSo features would be naturally tailored to the user's mobile social network. To proceed towards this goal, the mechanisms and processes that are connected with the operations on social resources are to be considered carefully.

The first observation is that MoSoSo is conceptually much closer to an SNS than to traditional mobile services; for instance, whereas traditional mobile services do not allow interactions with friends-of-friends, MoSoSo, similarly to SNS, also supports this form of social networking. Furthermore, in MoSoSo, adding an entry to the address-book does not simply mean that the user can call or send a text message to that contact; similarly to SNS, interconnecting also

means gaining access to the resources embedded in the social structure of the contact and disclosing one's resources.

The heterogeneity of resources and the operations that can be performed on them, demand a more specialized model of managing social ties. It is not sufficient anymore to grant all forms of control (i.e. by adding somebody) or none (i.e. by not accepting a request). The required advanced forms of social network management need to be grounded on the chosen model of tie, which in turn should affect the forms of access and control on network resources. For instance, supporting the establishment of ad-hoc and temporary ties, which are typical of sensor-based communication, would imply limited or temporary access to resources, a way to exploit potential and to minimize risks.

By conceiving ties as multi-dimensional, it is possible to re-arrange the configuration of the mobile social network on the basis of the criteria that are relevant in a specific interaction context. These kinds of operations should be enabled by a query-system that would allow, for instance, selecting contacts according to one or more variables. For example, a user who wishes to invite a group of friends for dinner could apply a social query that runs multiple ranking operations on social resources, thus producing a hierarchical arrangement of contacts (Figure 25).

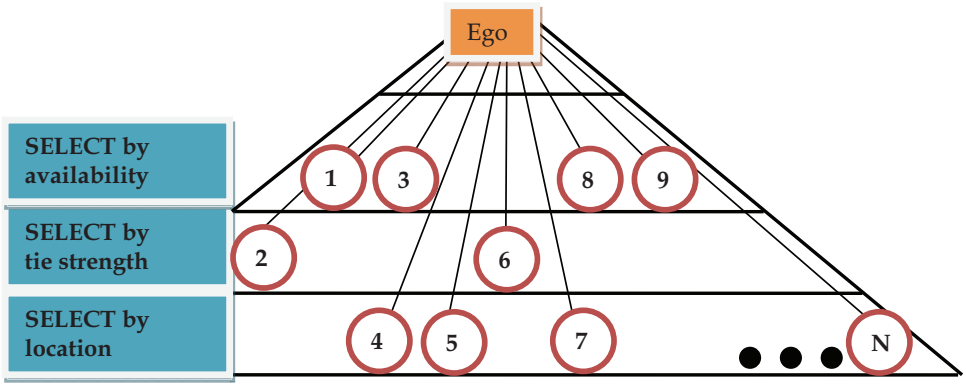


FIGURE 25 Hierarchical arrangements of contacts produced by social query

The user might be interested in selecting, from his mobile social network, those who are currently in the same city (i.e. select by location), close friends (i.e. select by tie strength) and available that evening (i.e. select by availability). Those accepting the invitation could be automatically granted some control on the resources related to the *dinner event*, such as event information and photos taken during the dinner. Considering the history of interactions, multiple hierarchies could develop in the same mobile social network and become associated to multiple reputation systems and levels of control on the embedded resources. Hence, mobile social networks do not inherently present a hierarchical form of social organization. In specific interaction contexts (e.g. the organization of an event), applying queries performs a ranking operation that produces a hierarchical arrangement of contacts.

Although power issues have not been addressed in the enclosed articles, they represent an important aspect of mobile social networking systems that needs to be elaborated in future research (see 12.4). For the scope of this dissertation, it is sufficient to emphasize that mobile social networks needs to embed an understanding of the nature of the social tie and use this knowledge to implement relational forms of control on social resources.

### 8.2.3 Interaction level: social algorithms

User profile and mobile social network represent the structural concepts of the MoSoSo design model. To link structure with action, it is necessary to introduce social algorithms, procedures that take as input the combination of user behavioral, social network and contextual data and return as output a personalized interface of MoSoSo through which the user can interact with the mobile social network. As illustrated in Article III, social algorithms are "*procedures that collect and analyze large amounts of low–level data and return higher level knowledge to the user*". Much of the success of this process consists in the quality of social inferences produced by social algorithms. Hence, social algorithms are specialized algorithms dealing with social information - a special category of information that is rich in social meaning.

Through social algorithms, the interaction level provides opportunities for contextual interaction. Social algorithms are complementary to the user profile and the mobile social network as they take care of the personalization and contextualization of MoSoSo interface. Without the presence of social algorithms, these tasks would have to be performed manually. By including a degree of automation, social algorithms provide an essential cognitive support to the user for dealing with the complexity of social information.

The function of social algorithms is to support users' choices in regard to various social processes, such as social interconnection, digital sharing and social information management. By including several functions for enhancing contextual interaction, social algorithms may be conceptually conceived as a container of classes of socially-oriented algorithms (Figure 26).

An important class of social algorithms deals with the properties of the social ties, such as tie strength and reciprocity. Traditional methods to infer tie strength on the basis of network data (Granovetter, 1973; Marsden & Campbell, 1984) have been recently applied to online social networks (Gilbert & Karahalios, 2009) and could be successfully used in mobile social networks as well (Onnela et al., 2007; Eagle et al., 2009). Measures of tie strength can support the user's decision in mobile sharing (Article V) and in processing streams of social information. For instance, higher priority could be given to social information coming from *closest* contacts. The social interconnection value returned by the *frequency algorithm* (Article III) offers insight on how mobile communication data logs may be used for assessing tie strength in mobile social networks.

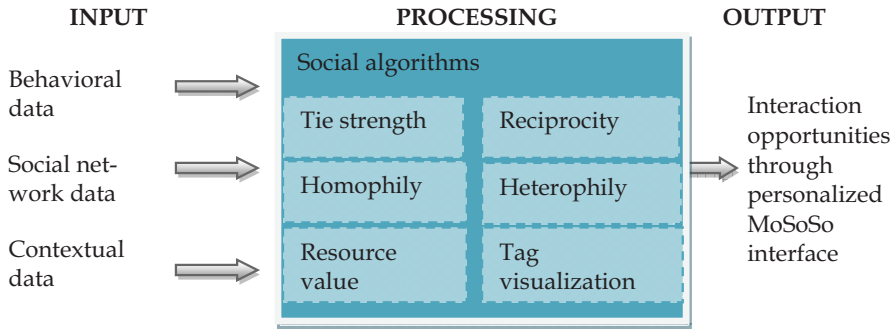


FIGURE 26 Social algorithms as procedures enhancing contextual interaction

A related type of social algorithm concerns social introduction protocols, which facilitates the activation of latent ties (Haythornthwaite, 2002). Latent ties are particularly important in Nokia Sensor (Jung et al., 2006; Persson et al., 2005; Persson & Jung, 2005), in which this opportunity was explored by means of public sharing of creative user profiles, described as digital extensions of human bodies. In the RealityMining project, it was investigated to which extent social serendipity can be planned through MoSoSo (Eagle & Pentland, 2005).

By inferring common interests, mutual acquaintances and other shared traits through the analysis of behavioral and contextual data, MoSoSo could take advantage of the homophily principle (Lazarsfeld & Merton, 1954; Rogers & Bhowmik, 1970; Lin, 2001) to activate latent ties. Users' similarity in mobile usage patterns could be evaluated, as shown by the *homophily algorithm* (Article III). Similarly, heterophily (Rogers & Bhowmik, 1970, Lin, 2001) would also be useful in many contexts where matching by diversity is required. Heterophily could be applied to provide opportunities for mutual enrichment in a community, as in the case of digital natives and digital immigrants in Finnish communication camps (Article VI).

Traditional mobile services do not provide support for activating latent ties, whereas Internet social software does – especially in online SNS. Although MoSoSo interaction with strangers seems to be an appealing application area, there are still several challenges limiting its widespread use. In particular, privacy mechanisms and trust models need to be integrated in the design solution: as Eagle & Pentland (2005) observed,

> "BlueAware, BlueDar and Serendipity introduce a significant number of privacy concerns if deployed outside a carefully controlled experiment with human subjects' approval. These privacy issues must be reviewed in detail before releasing this service to the general public" (p.32).

The network approach to MoSoSo design allows addressing the challenging aspect of proximate interaction with strangers within a general schema for digital community interaction grounded on *social interconnections*. Indeed, MoSoSo can be useful not only in activating latent ties, but also in the maintenance of strong ties and in turning weak ties into strong ties, both in co-located manner

and at distance. Especially in interaction with strangers, social algorithms may take care of computing trust and risk values used for supporting the user's decision about mobile sharing (Article V).

Resource-centered social algorithms assume a key role in the use and control of personal and social resources, because they simplify the access to them. Among other things, this class of social algorithms assigns values to resources in terms of virtual currency (Article VI) and contains methods for tag-visualization of resources (Article VII). A crucial aspect of social algorithms concerns the selection of appropriate resources of the mobile social network on the basis of the user's goals in the action context. The same configuration of the mobile social network may trigger different personalized views of MoSoSo when considered in relation with a competitive or cooperative model (Figure 27).

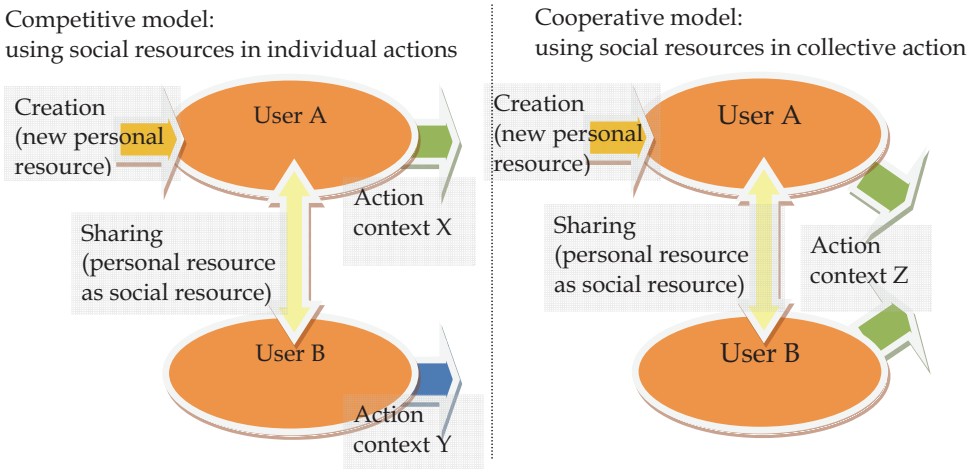


FIGURE 27 Competition and cooperation in mobile social networks

In a typical example, user A takes a photo (i.e. create a new personal resource) and decides to instantly share it as a social resource with a friend (i.e. user B).

In a *competitive scenario*, the social resource (i.e. the photo) is used to attain different purposes. Here, competition refers to two action processes that use the same resource and are not necessarily interdependent. For instance, user A may give a high rating to the photo, and a social algorithm could suggest using this photo as new mobile wallpaper. User B may tag a few friends recognized in the picture, and there is a social algorithm offering options to share the photo with them.

In a *collaborative scenario*, the social resource is used to attain a common objective or different objectives with interdependent tasks. For instance, user A plans to organize an event and would like to involve trusted persons who are available. The results of a social query show that only one person is available, namely user B. Following the suggestion of MoSoSo, user A shares the event

information (i.e. social resource) with user B, who expresses his/her availability for the organization of the event. By accepting the invitation, user B gains control of all the resources related to the event. User A enquires user B about his/her availability for a meeting in a café to discuss the roles in the event; as the meeting time approaches, the current location of user A and user B is disclosed to facilitate physical convergence at the place of meeting. While the sharing of event information has no ending timestamp, the mutual disclosure of users' location is automatically set with a timestamp of 10 minutes. Even if it is not common in current MoSoSo, fixing an expiration timestamp would represent an effective mechanism to support the sharing of personal resources as social resources. The same model could be extended to a more complex case with an arbitrary number of interconnected users.

The previous examples represent different ways in which MoSoSo may assist users in purposive actions. In the competitive model, social resources are exploited for the attainment of individual and/or collective actions goals. Hence, social algorithms aim at facilitating the user's exploitation of mobile social networking opportunities. They can do this by applying a variety of metrics, such as matching by similarity or by diversity, which correspond to the concepts of homophily and heterophily (Rogers & Bhowmik, 1970; Lin, 2001).

In Article IV, homophily-based algorithms are explored and two similarity metrics connected respectively to the frequency of communication and to the similarity in user's profile variables, are introduced. Both social algorithms rely on behavioral and communication data stored in the mobile device. These types of data are extremely sensitive and therefore their disclosure presents privacy concerns; instead of sending such data to an external server, it is suggested to run the algorithms locally on the mobile device. Although not explicitly mentioned, this observation supports a p2p approach to MoSoSo. In particular, the data to be processed by social algorithms should be stored in a compatibility matrix, a data structure containing the social interconnections values of the user and each contact of among his/her personal community. As the interconnection metrics are multiple, corresponding to the multidimensional definition of the social tie, also the compatibility matrix presents the same multiplicity. The social algorithms corresponding to the chosen similarity metric are therefore used as the main criteria to mine the network data for finding and representing connectivity patterns in the mobile social network.

The *frequency algorithm* takes as input a sub-set of mobile communication logs related to the interpersonal interactions of user A and user B related to a specified period of time; from this sub-set, only the interactions from user A to user B are selected when A's viewpoint is considered more relevant (egocentric perspective – "*how much attention I received from B?*"). When both directions of relation are relevant, also the communication units that user B reserves to user A are included and allow measuring reciprocity**.** In both cases, the interconnection value that is generated corresponds to the number of communication units that are exchanged of the total amount of communication of that period (percentage of communication). The frequency algorithm, as the term says, privi-

leges the quantitative measure of the relation. However, it can be combined also with qualitative metrics so that more complex forms of social relation, such as friendship, can be measured. An interesting aspect of this procedure is that it can be applied to multiple communication channels at the same time, for instance to phone calls and SMS. As digital convergence implies also a convergence of information flows from several communication channels, such approach could be extended to social exchanges mediated by IM, SNS and other forms of MMC. Thus, the ideas that were already present in Granovetter's work on tie strength (1973) have been expanded beyond the sociological domain and applied to interaction design (Gilbert & Karahalios, 2009).

The *homophily algorithm* uses as input one or more mobile usage patterns, such as time of communication, user location, communication recipient, user preferences, and other types of sensor data. A homophily value for the user A is assessed for the chosen variable. The algorithm searches for the closest match to A in the personal community by applying clustering algorithms that return all the users belonging to the same cluster with A. As in the frequency algorithm, also in this case there are thresholds that refer to the number of steps that have to be performed by the clustering algorithm before returning the matches.

The two social algorithms introduced in Article III indicate that multiple interaction models could be integrated in MoSoSo. Indeed, the frequency algorithm is more suitable for assessing the relational properties of existing social ties, such as tie strength. The homophily algorithm also enables interaction with strangers and the activation of latent ties.

Summarizing, social algorithms deal with contextual social interaction by supporting the human social networking ability. Although social algorithms are necessary to cope with the huge amounts of behavioral and contextual data to process in real time, their implementation presents deep challenges connected with the trade-off between human agency and technological automation. In the following sections, some ways of dealing with these challenges are discussed.

## 8.3 Towards a solution to MoSoSo key design challenges

### 8.3.1 Modeling privacy as a decision problem

As described in the review (Chapter 5) and in the discussion of the design model, personal privacy management is a key challenge of MoSoSo design. This issue is tackled in Article V, which connects privacy to digital sharing. There personal privacy management is regarded as a dynamic practice demanding the user to continuously choose whether or not to share personal resources as social resources. A conceptual model is then introduced to approach personal privacy management as a decision problem based on the evaluation of the dynamic trade-off between privacy and trust.

The basic idea of the conceptual model is to increase the degree of automation of privacy mechanisms in MoSoSo and to maintain the user in control of

the situation through a rule-based system. By using only the default rule, which is created by the user, MoSoSo would apply a *one-fits-all* approach – a single rule applying to all contacts, resources and contexts. By manually or automatically adding contact, group or context rules, MoSoSo would implement the more dynamic approach of *selective disclosure*. Rules are based on the evaluation of a condition: if the privacy damage associated to a resource to be shared – its perceived risk – is lower than the value of interpersonal trust connected to a contact, group or context to which the resource is about to be disclosed, the user is suggested to share a digital resource. Similarly to the rules used in Internet firewalls and email spam filters, the same condition may be evaluated each time or saved in MoSoSo as a permanent rule.

To compute privacy and trust values, user psychological and user sociological knowledge are used.

Trust refers to interpersonal trust, which is connected to the social interconnection value, as assessed on the basis of social network knowledge (Article III and IV). This value might be associated to tie strength measures (Granovetter, 1973; Marsden & Campbell, 1984; Gilbert & Karahalios, 2009). In interaction with strangers, interpersonal trust might correspond to the degree of similarity among users assessed through homophily-based social algorithms (see 8.2.3).

Privacy is based on the perceived privacy damage related to a certain type of resource. The study suggests addressing explicitly this aspect by directly *asking the user* to rate perceived privacy damage through a survey. The answers to the survey, properly coded, represent the default rule to digital sharing. The design of the survey was left as a task for future research.

The approach is based on previous work conducted by Preibusch (2006), who introduced the notion of *privacy sensitivity*, and by Seigneur & Jensen (2004), who described privacy as a decision problem in which the user needs to decide whether to trade privacy for trust. The main contribution of Article V lies in a method to compute trust gain (in relation to a user/group /sharing context) and privacy damage (in relation to a specific resource to share).

The approach assumes that the design of MoSoSo includes a resource-based user profile consisting of a public and private section. The public section contains the personal resources that may be shared as social resources, whereas the private section corresponds to the *user profile settings*, which cannot be shared and include variables such as the user's attitudes towards digital sharing, user behavioral data and mobile usage patterns statistics.

Privacy is regarded as a dynamic process, as a practice connected to the exchange or trading of personal resources as social resources. If the user prefers to adopt a *selective disclosure* approach instead of the *one-fits-all* policy, this choice supports the idea that there is no general rule for sharing which is valid for all users and all contexts. Instead, this approach requires that the decision is evaluated on a case by case basis. Considering the efforts required by a continuous evaluation, automatic support to the user's decision-making is desirable. Gürses & Berendt (In press) argue that the digital sharing is not necessarily a 'privacy nightmare' if supported by mechanisms combining *relational informa-*

*tion* and *transitive access control*. These aspects are considered in the suggested solution, in which specialized algorithms and data structures could support the user's decision process by:

1 determining minimal privacy damage M for the disclosure of a personal resource
2 computing trust gain T for user(s) who will be granted access to the personal resource
3 suggesting the choice of YES to share the personal resource as social resource if T > M

While the social algorithms presented in Article III are dedicated to the issue of social connectivity, another class of social algorithms could deal with privacy issues, evaluating the condition above.

The first parameter, privacy damage M, is assessed combining explicit and implicit approaches: when the mobile device is switched on for the first time, the creation of the default rule is based on a user survey, which also sets some variables of the private section of the user profile. The data structure implementing such rule would consist of an array of pairs <*personal resource, privacy harm*> to be generated for each contact, group or interaction context. The set of all arrays constitute the MACL, a matrix of associations between the types of personal resources and privacy threats. Additional rules can be added on the basis of new contacts or contexts defined manually by the user or automatically inferred by the device. In this latter case, updates might be based on probabilistic models, which are not discussed in detail in the article. However, it is suggested that such models would make use of mobile social network data.

The second important variable, trust gain T, numerically encodes aspects of the social relationship that can be manually specified or inferred through an analysis of mobile behavioral data. The existence of social tie can be determined by checking whether the contact requesting access to a resource is present or not in the mobile phone-book. If present, properties of the social tie can be determined by using social algorithms as described in Article III. As Gilbert & Karahalios (2009) showed, prediction models of tie strength can benefit from the large amount of relational information. In MoSoSo, such task could be performed by using frequency of communication, call duration, sharing history, reciprocity of communication as ratio between incoming/outgoing calls/messages, reciprocity in sharing, homophily as a degree of overlapping interests or behavioral patterns, events attended together or number of shared acquaintances.

The suggested approach to mobile privacy management is suitable also for ubiquitous scenarios in which agents are increasingly demanded to take decisions or act on behalf of the user. To evaluate the actual benefits and problems of the suggested approach, it would have been beneficial to test the effectiveness of the MACL structure by implementing a prototype and evaluating it in a user study. As it is, much of the theoretical discussion still remains without an empirical ground. However, these lines of thought are plausible because similar

problems, such as email spam and Internet firewalls configuration, have required semi-automated methods which use user psychological and user sociological data.

### 8.3.2 Alleviating social information overload: tags and filters

MoSoSo does not currently provide many tools to alleviate the problem of social information overload, a problem that corresponds to the inability to adequately process incoming flows of social information. Cognitive strategies represent only a partial solution to the problem, which needs to be addressed also in a technological manner. Unlike with privacy, no article is dedicated to finding a solution to this problem, but ideas contributing to ease social information overload are discussed (Articles I, III, V and VI).

Article I and V identify, in the manual or automatic approach to information processing, one of the main conceptual aspects of the problem of social information overload. For instance, it is pointed out in Article I (p. 159) that "*the process of managing and organizing information is taking more and more of our time*" and suggested that "*the visualization of the personal social network, based on criteria chosen by the user according to the context, could be useful to support a more efficient time and contact management, especially if linked to user's usage patterns and statistics*".

Although focused on privacy management, the approach illustrated in Article V has also implications on the more general problem of user's control of information flow. The need for supporting the continuous decisions demanded of the user in digital sharing is recognized and an intermediate position between manual and automatic procedures is suggested. By allowing a manual, semi-automatic or fully automated approach, the user would have the opportunity to choose whether to privilege reliability – the most privileged in the manual approach – or efficiency – best in the automatic procedure. This choice leaves it to the user to decide how to maximize opportunity and minimize risks. Article V points out that automatic approaches to information processing are likely to have an increasingly important role because of the growing amount of social information flows on the one hand, and limited available time and cognitive capacity on the other.

The possibility to collect and analyze user behavioral and social network data might also provide new opportunities for dealing with the problem of social information overload by means of personalized social information filters. For instance, Article III suggests the possibility to enhance the mobile phonebook by filtering out non active ties or by showing contacts by location, tie strength, social group or shared resources. In addition, MoSoSo will also include alternative methods for accessing and navigating social information. For instance, tag-clouds could represent an effective mechanism to browse people and resources through logical associations. In Article VI, a method for generating tag-clouds on the basis of textual input is presented. Specifically, the metadata attached to digital resources could be analyzed to extract the most mea-

ningful keywords, to be then ranked according to their frequency and visualized as a tag-cloud (Figure 28). Tag-clouds could be interactive, satisfying action goals by connecting tags to people and resources that are the most useful in a specific context.


FIGURE 28 Example of tag-cloud used in Article VI

The method to generate tag-clouds could be applied not only on metadata, but also to the actual content of communications, which says much about the user's interests, action goals and preferences. This form of user psychological knowledge may be used for several purposes: for instance, Google's algorithms for the Gmail service (http://mail.google.com) automatically analyze the content of users' emails to associate contextual advertisements to them. Similarly, in MoSoSo social algorithms may analyze content to automatically update user profile and mobile social network, as well as to alleviate the problem of social information overload by filtering out irrelevant content.

Mechanisms providing solutions to the problem of user's control of social information flow are therefore an important element of MoSoSo design. Tags acknowledge the trade-off between reliability and efficiency defined by the availability of manual and automatic approaches to information processing. In addition, they represent an additional enhancement for navigating resources through logic associations by acting in synergy with other tools, such as search and filtering methods.

### 8.3.3 Social dilemmas: stimulating cooperative behavior

Mobile devices are personal devices that are mostly used to attain individual action goals by means of interpersonal communication. When conceived as tools for digital community interaction, mechanisms balancing self and collective interests are desirable to avoid the tragedy of the commons (Hardin, 1968). Social dilemmas have been extensively described from a theoretical viewpoint (Axelrod, 1984; Ostrom, 1990) and analyzed in virtual communities (Kollock, 1999), which typically present mechanisms to stimulate cooperative behavior. Although cooperation is an important social process, in MoSoSo design it has not been adequately addressed.

In Article VII, the combined adoption of a p2p model and the use of virtual currency, defined as the unit for exchanges and transactions in a digital community, are suggested as mechanisms to stimulate cooperative behavior. Conceptually, this approach is based on three main input sources, namely literature on p2p computing (Buttayán & Hubaux, 2003; Zhong et al., 2003; Irwin et al. 2005), the network theory of social capital (Lin, 2001) and the successful use

of fictional currency in Finnish communication camps (see 2.4 and also Viherä, 1999; Lugano, 2003).

Some approaches to p2p computing assert that virtual currency is useful for balancing self and collective interest in the sharing of computational resources (processor, storage, network bandwidth). For instance, the p2p application Bittorrent demands the user to share part of his/her bandwidth in order to download a file through the p2p network. Through the concept of *social capital* provided, the same idea could be successfully extended beyond the p2p computing community and computational resources. Social capital may be defined as "*resources embedded in the social structure that can be accessed and/or mobilized by social actors for purposive actions*" (Lin, 2001). As MoSoSo provides the opportunity to create, share and use personal resources as social resources, virtual currency supporting social capital measures could represent a form of reputation system (Resnick et al., 2000; Axup et al., 2006) balancing self and collective interests. The use of a fictional currency, the Lecu, in the digital community of communication campers is an indicator of the viability of such model; in that community, Lecus provided incentives to camp participants to contribute to the *commons* by carrying out some of the least pleasant but vital tasks of the self organizing community, such as cleaning.

In Article III, mobile virtual communities (Rheingold, 2003) are also presented as a communitarian alternative to mobile social networks, which are inherently egocentric. In mobile virtual communities, a collective *community profile* instead of an individual user profile might be used, or, in the automatic sharing, personal resources could be used as social resources. In addition, the dimension of public interactions would be preferred to private communication. As illustrated in Article V, the integration of trust models, especially those based on real user identities, represents an important requirement for MoSoSo design, not only for personal privacy management, but also for facilitating the practice of returning mutual favors and enforcing reciprocity norms.

By adopting the insight of Kooijmans & Rauterberg (2007), mobile virtual communities could emerge by weakening the Western individual self-concept through the support of reflexive interactions in MoSoSo (i.e. class A of mobile relationships in Article I).

In conclusion, the challenge of MoSoSo design is to naturally support the balance between competitive and cooperative behavior in the digital community through several mechanisms, such as virtual currency, collective user profiles, automatic sharing of personal resources, trust models and reputation systems.

# 9 POLICY CONVERGENCE

The success of MoSoSo does not depend only on the way it is conceptualized and designed, but also on support policies, a number of conditions influenced through decision-making by several stakeholders, such as public institutions, private organizations – mobile device manufacturers, telecom operators and service providers in particular – and civil society. These measures are presented here as a new form of convergence, policy convergence, which might greatly influence the adoption of MoSoSo, and the way it is used in everyday life.

## 9.1 Sustainable lives in sustainable societies

Strategic political and economic choices play key roles in the realization of the value of any technology, both in individual lives and in the functioning of information societies. The starting point of these strategies consists in the answer to the central question: "what is the purpose this particular technology serves?". The answers of the involved actors differ, revealing their roles and values: monetary profit represents the primary purpose of companies, while public institutions recognize in technologies a means for increasing the efficiency and reducing the costs of its apparatus, as well as a tool for improving citizens' quality of life.

Despite the different nature of the sometimes conflicting objectives and methods used to achieve them, actors engaged in long negotiations in the public and private sector co-create policies supporting technology use. In democratic societies, this traditional top-down approach to decision-making and policy development takes also into account citizens' requests and feedback, which is provided through various channels (e.g. media, mass mobilizations). It is extremely difficult to realize a balanced synergy between top-down and grassroots approaches to social change. Especially in times of crises, governments are often forced to take decisions which go against citizens' interests. This typically leads to protests, revolts and social unrest.

As described in Chapter 2, this study discusses the theme of policy convergence in relation to the optimistic vision of a future sustainable model of information society. In this vision, MoSoSo empowers a network-based civil society consisting of interconnected digital communities, which work in harmony with the public and private sector for achieving the common goal of sustainable lives in sustainable societies.

Despite their centrality, support policies have received little attention in MoSoSo literature, which has been mostly focused on the technical aspects and the social impact of MoSoSo at an individual and community level. The Internet and traditional mobile communication services have had an enormous effect on large scale social structures, affecting national and global politics, economy, culture and societies. If MoSoSo is not to be conceived as a mere set of gadgets, the question arises about its contribution towards wider objectives. Likewise, one may also consider the new challenges a widespread use of MoSoSo might introduce. By analyzing these aspects, choices in the way MoSoSo is conceptualized and designed might be modified, and ad-hoc support policies might be put in place.

Several studies (Articles II, VI and VII) directly or indirectly connect the design of MoSoSo, and its role in the process of digital convergence, to the need for a policy convergence among all stakeholders. Although there are marked differences in the interests, goals and methods of the various bodies, there seem to be a general agreement on the need to realize a more sustainable model of information society. In light of the global environmental, financial and economic crisis, the shift towards sustainability seems to be an urgent priority. ICT functioned as the engine and backbone of contemporary information societies; likewise, it can become a key enabler of sustainable information societies. It is therefore natural to explore the significance that MoSoSo may have in the transition towards sustainability and to consider the way it could support participation and mobilization of users and digital communities.

A key aspect of policy convergence concerns a discussion of a solution for the problem of user conceptualization (Lugano et al., 2009). The solution deals with the way citizens might affect the evolution of societies through the use of everyday ICT. Public and private organizations have a different view of users, typically described as citizens by the former group and as customers or consumers by the latter. When EU Commissioner Reding (2006) expressed the requirement of "*getting users on board*", she called for an agreement on user conceptualization, an agreement which should follow a more general convergence on the role of citizens in information societies. Article II deals with this requirement from the perspective of MoSoSo by presenting a visionary account of a society in which MoSoSo strengthens social capital.

Inspired by Viherä's (1999) vision of how active, skilled and motivated citizens could contribute to the realization of a sustainable information society, it was found that by acknowledging multiple user roles, MoSoSo could act as a tool with emancipatory potential. This issue is described in detail in Chapter 11; here, it is sufficient to state that to achieve this purpose the scope of MoSoSo

should not therefore be limited only to pure entertainment and socialization, but should also acknowledge "*the role of the user, not only seen as a consumer, but also as an active citizen, producing and sharing knowledge*" (Article II, p.1434). Through MoSoSo, users "*can self-organize, create and share knowledge, contributing to the development of the society*" (Article II, p.1435). In this way, citizens would not be valuable only for their commercial potential, but also for their role as key resources in the shift towards sustainability societies.

In Article VII, the user's role (consumption or construction oriented), the social dynamics of the digital community (competition or collaboration) and the level of mediation of MoSoSo (control of the user or confidence on the automatic procedures) are discussed in reference to the design model of MoSoSo presented in Article IV. In Figure 29, the tension between active and passive models of citizenship is described in the individual model.

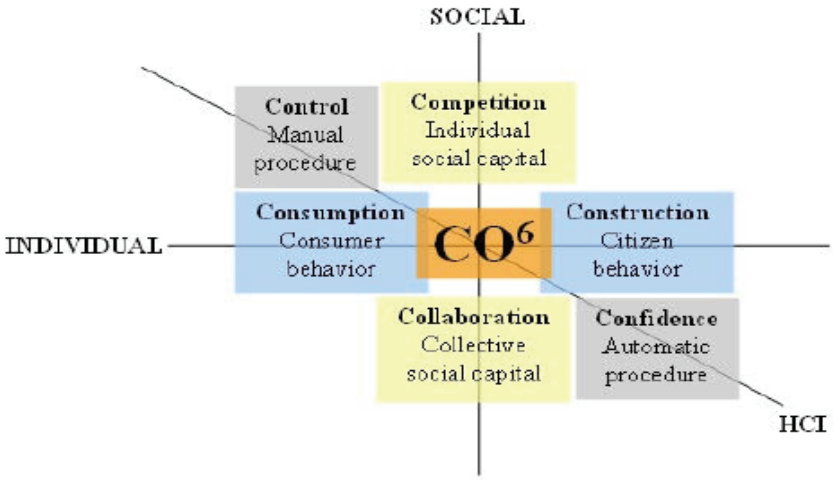


FIGURE 29 Resource-based view of the MoSoSo design model

At the social level, the trade-off between self-interest (i.e. making individual use of social capital) and collective goals (i.e. social capital as commons) is underlined. The interaction level presents another trade-off, concerning the choice between manual control of decisions on the creation, sharing and use of resources and confidence on automatic MoSoSo procedures.

Although the design model reaches a too abstract level in suggesting ways in which MoSoSo should be designed, it provides material to reflect on the centrality of support policies, which influence choices in delicate trade-offs existing between the dimensions of MoSoSo design.

The delicate trade-offs existing at individual, social and interaction level suggest that a key function of MoSoSo is to support "*everyday social interactions that exploit the networked shape of social structure, acknowledge the individualization process of society and the liberalization of individual sociability*" (Article VII, p.175).

From a structural viewpoint, digital communities link the micro and macro levels of the information society by enabling individual users to benefit from the opportunities and to affect change at the macro level. In this way, MoSoSo design is about understanding its potential and challenges from multiple viewpoints, from the individual level of usability and user experience to the dimension of community experience and its large-scale implications.

Defining the scope of MoSoSo is therefore not only a matter for technical engineers, designers and marketing experts, but will also involve public and private organizations. Their goal is to agree on a synergic integration of technology, policies and business model to achieve common objectives. For instance, if user profiles in MoSoSo were not linked to the real user identities, users might not easily take the role of "*citizens engaged in forms of democratic governance*" (Article I, p.159) because of the lack of a trust basis. The opportunity for ubiquitous participation provided by MoSoSo can be described from the viewpoint of the Internet potential for democracy and innovation (Von Hippel, 2005; Tapscott & Williams, 2006). By extending the Web 2.0, MoSoSo might strengthen the existing trend which sees users as an opportunity to influence the evolution of the social, cultural, political and economical basis of information societies.

Digital technologies equally support the attainment of positive and negative goals; hence, the direction of change might not necessarily be the most desirable one. However, considering how users behave offline and online, it may be assumed that a large majority of citizens would generally demonstrate positive behavior if supported by adequate technology, high education and appropriate policies. For instance, the way Wikipedia is designed as a technology of cooperation (Rheingold, 2002) alleviates the problem of vandalism (Shirky, 2008). Similarly, the positive potential of MoSoSo is likely to be much greater than its negative implications because digital communities would render deviant behavior a marginal and isolated phenomenon.

The problem of designing technologies supporting sustainable lives and societies can be discussed from the viewpoint of the resource-centered conceptualization of the ICT user. Recognizing the value of the user implies acknowledging the value of the resources created, shared and used in digital communities. From this viewpoint, the function of MoSoSo is to support instrumental and expressive value creation through informal social interactions. In some studies (Articles II and VII), social capital theory is suggested as a suitable conceptual framework to capture the utilitarian dimension of MoSoSo. From this viewpoint, integrating social capital in MoSoSo design would allow considering how MoSoSo could support social capital processes connected to the utility that social networks may have for individuals, communities and society at large. The development of the theoretical basis of MoSoSo through social capital is left as a task for future research (Chapter 12).

## 9.2 Reconciling social and economic development

Several definitions of sustainability and sustainable development exist. In this study, both concepts are strictly connected to the idea of balancing dimensions of a problem that are currently unbalanced.

In Article VII, MoSoSo is discussed in the context of sustainability and a scenario of sustainable use is presented. Specifically, the article describes how MoSoSo could enhance the current bottle/can recycling systems of supermarkets by integrating a virtual currency system. This scenario helps us to appreciate the flexibility of conceptualizing users as collections of personal and social resources: upon returning a material resource (bottle/can), its economic value could be described both in terms of real and virtual currency.

Instead of receiving a paper receipt, a user would get an amount of real and virtual credits directly in the mobile wallet of his/her mobile device. This operation could be easily implemented through a 2D barcode reader software and a mobile phone camera.

The user's act of recycling bottles would correspond to the trading of a personal resource as a social resource with the company managing the recycling. In addition to or as an alternative to a short-term monetary reward, users may share the amount of virtual currency with their digital community or publicly. In this way, metadata on the user's activity in a real context would produce an effect that is directly notified to the digital community.

In this case, the motivation to share such information with others would be based on ethical grounds, i.e. on the desire to stand out in a social group as a performer of a morally positive activity, such as recycling.

The ranking of the user's environmentally friendly activity by showing his/her social standing could be part of the reputation system of MoSoSo. If publicly displayed, such information could also be used by institutions or organizations to award prizes that recognize the contributions of active citizens.

The example presented here is only one of the many possible variations of the same theme; for instance, the awarding of the recycling activity might be linked to households or neighborhoods rather than to single individuals, thus stimulating interaction and cooperation for the achievement of a common objective. In this manner, MoSoSo would play the role of an enabler of activities connected to active citizenship, letting digital communities counterbalance "*the negative forces of globalization and supplementing declining welfare states with an emerging welfare society*" (Article VII, p.177).

Virtual currency would not be significant only for enabling new forms of environmentally friendly activities but also in implementing sustainable business models, extending the notion of *virtual economies* (Castronova, 2005) from virtual to real contexts. This shift is possible thanks to the possibility to interact in a hybrid space (de Sousa e Silva, 2006; Rheingold et al., 2006; Crabtree & Rodden, 2008; Bilandzic et al, 2009), which allows adapting to the real world models conceived for online virtual worlds. The coexistence and mutual

enrichment of the virtual and real dimensions would also imply associating virtual currency to both virtual and real goods, such as the bottles and cans of the scenario above.

Digital community interaction presents also a profitable side and provides, through *virtual currency*, an alternative to crowdsourcing models (Howe, 2006) to involve users in the 'value chain': although digital resources are typically exchanged among community members, they may be also traded among digital communities and with organizations in exchange of real or virtual currency. This system can be supported by mobile payments, also known as M-payments, an emerging trend involving bank and credit card institutes in addition to telecom operators and service providers.

In Article II, several ideas for a virtual currency system are presented. First of all, the *virtual credit* is introduced as a unit for a virtual currency system. A virtual credit is defined as "*a digital resource with a recognized value by the market*" (Article II, p.1440). Three types of virtual credits are suggested: public credits accumulated and recognized by public institutions and organizations (international, national or local); private credits provided by private companies; and finally community credits granted by groups and communities of users for valuable contributions. Inappropriate behavior would also be sanctioned in the digital communities by the loss of virtual credits, which can affect negatively the user's reputation. An important component of the virtual currency system is its convertibility in virtual or real environments, for instance for purchasing a cinema ticket. The publicly available 'rankings' of users are an important aspect of the system and would represent an incentive for collective action (Axelrod, 1984). As the credits represent capitalization of social resources, they could also represent a way to measure capital in communities and societies. These measures of capital, not being limited to the economic dimension, could become a complement to traditional measures such as Gross National Product (GNP).

Through the integration of virtual currency in MoSoSo, personal and community interest can be balanced (micro level) and societal and economic goals rendered equally important (macro level). To avoid the fixation to the economic dimension of currency only, it is necessary to adopt a multidimensional conceptualization of capital (Bourdieu, 1986). Hence, the theory of social capital (Bourdieu, 1986; Coleman, 1988; Putnam, 1993 and 2000; Portes, 1998; Burt, 2000; Lin, 2001) would represent the conceptual foundation of this approach aiming at producing economic growth as a side effect of the strategies focused on societal development.

## 9.3 Investing in citizens' communication capabilities

Citizens and communities, precious resources for sustainability, need to be properly supported for realizing positive grassroots social change.

As argued by Viherä (1999), policies too focused on access are likely to fail because they do not address the two other central aspects of ICT use, namely

skills and motivation. She coined the term *communication capability* to refer to the overlapping area between access, skills and motivation in ICT use (Chapter 2). Citizens' communication capabilities are not well developed despite a mature technological infrastructure offering cheap and quick access to networks.

To realize the potential of digital convergence, and consequently MoSoSo, policy convergence needs to invest in the development of citizens' communication capabilities. These can easily develop through informal interactions in a social context. Therefore, one of the priorities of policy convergence is to allow citizens to create and develop digital communities and participate in them.

Because communication capabilities can be decomposed into access, skills and motivation, support policies need to address each of these dimensions.

Although access is already a well developed area, Article II describes one way to offer easier access to digital communities by means of less complex design of mobile devices and widespread adoption of common standards.

The complexity of mobile devices can be reduced by not regarding them anymore as digital Swiss army knives (Livingston, 2004; Satyanarayanan, 2005; Lugano, 2007). Like traditional Swiss army knives, mobile devices replicate the features of everyday objects. This practice limits the perceived utility of mobile devices, whose value clearly emerges only in emergency situations when specialized tools are not available.

Mobile devices could overcome this current shortcoming if they were technically re-engineered in a modular manner. In their basic shape, they should contain only the essential modules for social communication and information access. However, they also need to be easily upgraded through addition of modules that best suit to one's needs.

Mobile devices could be re-engineered in a modular manner by focusing of their four peculiar features, namely portability, personalization, contextualization and connectivity. MoSoSo could be conceived as a module for digital community interaction offering four basic functions:

- ubiquitous interaction with digital communities (*portability*);
- personalized access to digital communities through a user interface, which takes into account user psychological and user sociological characteristics (*personalization*);
- contextual interaction with digital communities through an interface, which takes into account the characteristics of the interaction context (*contextualization*);
- use of any technical network as a social network (*connectivity*).

These features could guide the technical implementation of all mobile device components (phone-book, calendar, camera and the like) as interconnected modules that can connect and communicate with other devices through interoperable standards. All modules need to be logically designed around the three main building blocks of the design model, namely user profile, mobile social network and social algorithms (Chapter 8).

The other two elements of communication capabilities, competences and motivation, are discussed in Article VI, which focuses mostly on competences in intercultural communication and motivational aspects in ICT use. The article does not explicitly address MoSoSo, but a wider set of technologies, both digital and non-digital (i.e. postcards/letters) used for social communication. Cultural aspects are framed within the general discussion on generations of ICT users and in particular within the discourse on digital natives and digital immigrants (Prensky, 2001).

The goal of the study was twofold: firstly, to evaluate through empirical data how the different needs, goals and lifestyles of the two user groups are reflected in ICT use; and secondly, to discuss the implications from the perspective of policies aiming at realizing an inclusive Information Society. Instead of focusing on MoSoSo, the motivational aspects connected to the use of different social applications, both digital and non-digital, are compared by grouping them under four main clusters: non-digital (letters and postcards), mobile (phone calls, SMS), Web1.0 (email, mailing-lists, forums) and Web 2.0 (instant messaging, blogs, social networking sites). A dataset of fifty-two answers to a questionnaire, which contained an open-ended question for each type of social application, was collected.

The analysis of the dataset showed that digital natives and digital immigrants perceive and experience both traditional and new forms of social media in a different manner. In this respect, it was found that perception and experience of time seems to be a particularly important category, with digital natives showing a *need for speed* and digital immigrants appreciating *slow time* (Eriksen, 2001) more. In a less marked manner, digital natives emphasized more the expressive value of the new forms of ICT with a wide variety of adjectives, while digital immigrants described the instrumental value of ICT and the expressive significance of traditional media like letters and postcards. Whereas digital natives can be described as techno-enthusiasts, tending to emphasize the positive sides of the technology they use, digital immigrants seem to be techno-skeptic, their judgments being sometimes negatively biased towards technical innovations. However, in most cases such attitudes simply reveal a more developed critical eye when considering both the positive and negative implications of a technology.

Although digital natives and digital immigrants are profoundly different in many respects, an inclusive approach to these two user groups should focus on how to create inter-generational bridges that allow a mutual enrichment through digital community interaction rather than considering them as distinct groups. Building such bridges would not only provide access to technical skills and educational opportunities for acquiring such skills, but would support community creation and development at a local and at a global level.

Such goal requires action and policies at various levels. Firstly, more studies on computing cultures and interdisciplinary approaches to research on digital natives and digital immigrants are necessary. Secondly, the dimension of everyday learning, which is mostly informal, unplanned and highly social, has

to be supported more extensively. In this respect, the Communication Camp experience was regarded as a positive example that can be adapted to various contexts to realize the vision of a network-based civil society. A third policy requirement concerns the idea that a sustainable information society cannot be realized if technologies are not designed to have emancipatory potential for citizens and communities (Chapter 11). In this context, empowerment was conceived as the opportunity to acquire and develop communication capabilities in an individual or social manner. This process implies enabling citizens to create, share and use symbolic and material resources through ICT, as well as to support the spontaneous process of self-organization. In relation to the emancipatory function of current ICT, the Internet already provides advanced support for the development of communication capabilities. Mobile applications, however, were found to be limited in this respect, in particular for their lack of proper support to digital community interaction.

In conclusion, communication capabilities represents an effective conceptual framework to guide policy convergence by offering a way to regard access, competences and motivation as equally important dimensions of ICT use.

## 9.4 The benefits of adopting a human-centric model

The model of communication capabilities (Viherä, 1999) represents a clear example of thinking in a human-centric manner. Indeed, it combines a technological element (i.e. access to ICT) with two human aspects (i.e. competences and motivation in ICT use). Despite the popularity of terms such as *user-centred* or *user-friendly,* human-centric approaches are not yet common.

It is possible to illustrate this point by considering the problem of MoSoSo under-use (Kämäräinen & Saariluoma, 2007). Although a deeper analysis of the factors that influence the adoption of MoSoSo is out of the scope of this study, it is worth noting that an optimal conceptualization and design model of MoSoSo would not alone solve the problem. In fact, these should be supported by policy convergence through the acknowledgement of the centrality of users and communities. In practice, support policies should be based on the domestication process (Silverstone & Hirsch, 1992; Silverstone & Haddon, 1996; Lie & Sørensen, 1996) of MoSoSo. Instead, policies are typically focusing on access, which represents a necessary but not sufficient condition.

In relation to the mobile Internet, a closely related trend to MoSoSo, a recent report from Nielsen research (Quick, 2009) showed that smartphone penetration is growing in Western countries, with an average rate of 17% and a peak of 28% in Italy. The report underlined that access to the mobile Internet is still far from being all embracing. Indeed, it is still confined to a quite homogenous profile of mobile users, which are "*predominantly male […], 65% more likely than the average mobile subscriber to go between the ages of 25 and 34, and nearly two times as likely to make more than $100.000 a year*" (Quick, 2009). Such figures are influenced by the relatively high costs of smartphones and mobile Internet data rates.

Hence, the adoption of the mobile Internet is increasing more slowly than expected, even where a mature technological infrastructure is available. Article III found that, although more than half of respondents owned a smartphone, only phone calls and SMS were perceived as essential services.

Statistical survey data and recent market research provide useful indicators on the access dimension and also typically contain recommendations and guidelines concerning technological and economic dimensions, such as speed, standards and pricing. Academic research might contribute to understanding, explaining and developing better strategies for enhancing MoSoSo adoption. Unfortunately, these kinds of academic sources are not widely consulted because they are considered too complex and abstract for commercial scenarios.

Companies also conduct internal research and participate in national and international research projects, which often provide useful insights. In many cases, however, such results do not significantly affect the final shape of the product or service. The unbalanced relationships between political and economic factors, on one hand, and human and social needs, on the other, are some of the explanations. Until the former outweighs the latter, it would not be possible to effectively support a human-centric perspective.

A key aspect of policy convergence concerns the replacement of the techno-economic model – in which technology acts as the synergic partner of political and economic strategies – with a human-centric model grounded on human and social needs (Figure 30).

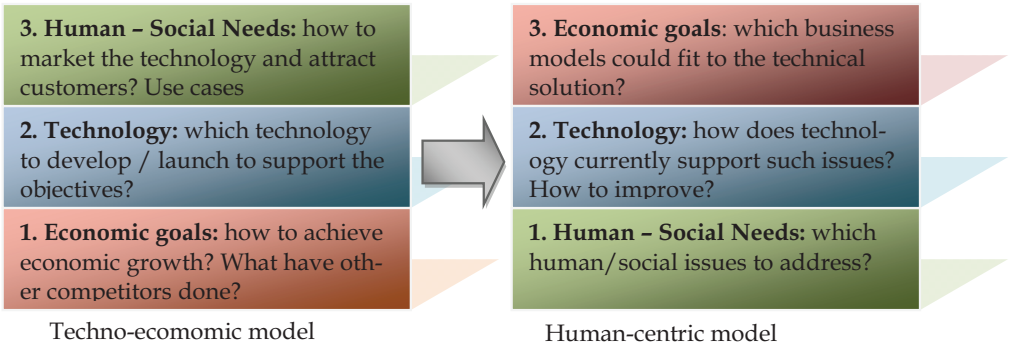


FIGURE 30 Shift from techno-centric to human-centric model

In both models, the development of the technological solution is the intermediate step in the process of product or service development. In the techno-economic model, technological innovation primarily supports the achievement of organizational goals, which are mostly economic and political. Once such requirements are satisfied, marketing will support the commercial launch of a product or service through typical usage scenarios for the various user segments. Even when techniques of participatory design are adopted, they might affect the design of the technological solution while not influencing political and economic goals. Thus the view of the product or service reflects the ideo-

logical views of the decision-making bodies of the organization; hence, the success and failure of services and products of a company depend on the quality of visions and principles of its dominant class. From this viewpoint, under-use (Kämäräinen & Saariluoma, 2007) is about a mismatch between business and real usage scenarios.

The human-centric model attempts to minimize this mismatch by assigning the primary importance to human and social needs. Considering the recent challenges of globalization and the multiple crises experienced, user empowerment (Keskinen, 1999) might be considered as the main objective of the human-centric model. By empowering users in the role of citizens, it would be possible to stabilize the current "*imbalance between the expectations and the performance of ICT*" (Keskinen, 1999, p.13).

While not excluding the presence of ideologies in the decision-making process, approaching design from a human-centric rather than from a techno-economic perspective at least shifts its priorities from the logic of economic growth to the real needs for societal development. Such approach does not deny the profit-oriented nature of private organizations, but simply points out that business models can often be considered as the final step of an innovation process. The main advantage of the human-centric innovation model lies in its power to democratize the decision-making: by letting users take an active part in the innovation process, their motivations for improving their condition by alleviating the problem of under-use (Kämäräinen & Saariluoma, 2007) may get a boost. The design model of MoSoSo follows the human-centric model principles: rather than directly supporting organizational innovation, it supports community innovation (Gurstein, 2004; West & Lakhani, 2008; Van Oost et al., 2009).

# 10 DIGITAL COMMUNITY DESIGN

The new insight on MoSoSo obtained by means of conceptualization, design model and policy convergence is adopted now to develop the broader theme of digital community design. The notion of digital community, anticipated in Chapter 4, is articulated in more detail here by arguing that MoSoSo acts as an enabler of digital communities. From a sociological viewpoint, it contributes to widen the scope of community and, in a more technical sense, to seamlessly integrate the multiple perspectives on offline, online and mobile communities. By adopting the human-centric approach described in Chapter 9, it is argued that digital community design is all about realizing balanced trade-offs between risks and gains that MoSoSo involves. To this purpose, a set of eight principles of digital community design is introduced and discussed in relation to the challenges of MoSoSo design presented in the final section of Chapter 5.

## 10.1 MoSoSo as enabler of digital communities

The starting point for an evaluation of MoSoSo in relation to the concept of community consists in demonstrating that the implementation and adoption of the suggested model of MoSoSo would fill the current lack of a technological enabler for the theoretical model of the integrated digital community. In fact, neither traditional mobile services nor current Internet social software, represent suitable paradigms to support the shift towards digital communities.

Traditional mobile services (i.e. phone calls, SMS/MMS) were originally conceived for interpersonal communication and not for community interaction. As Ling (2004) observed, phone calls and SMS are flexible and powerful tools for the coordination of activities of small groups. SMS has also been employed in many innovative manners, enabling its use even in large-scale mobilizations beyond the domain of the small social group (Rheingold, 2002). Indeed, SMS is an example of a simple and flexible general purpose social platform that, however, is limited to short textual messages. For this reason, SMS has been

adopted as the technological choice for the early forms of MoSoSo (Smith, 2005; Hirsch & Henry, 2005; Crowley, 2005; Ziv and Mulloth, 2006; Humphreys, 2007; Farnham and Keyani, 2006). The enhanced capabilities of digital convergence, however, allow enhancing MoSoSo beyond SMS to support also interactive and rich-media community-oriented applications. In other words, SMS is a good starting point for MoSoSo but does not adequately support the basic primitive operations of digital community interaction, namely create, share and use multiple forms of digital content in a contextual and personalized manner.

Compared to mobile devices, the Internet provides a much richer variety of tools for social communication. In particular, the most recent wave of social software, such as IM, blogs and SNS does not suffer from scalability issues, as it is suitable for interpersonal, group and community interactions. In addition, they provide interactive and rich-media applications that are used to satisfy a variety of instrumental and expressive needs. Despite of these advanced characteristics, they lack the support of contextual interaction that can be included only by extending such applications to mobile contexts.

It may be observed that there is not actually much need for introducing a novel approach to MoSoSo because mobile browsers and many types of specialized mobile clients (i.e. mobile email readers, mobile IM application, VoIP tools) already embed the idea of MoSoSo. Indeed, they provide the user a rich and wide range of choice for social communication.

This observation is plausible and acceptable, as this group of tools has been included in the online-centric category of MoSoSo (Chapter 5). In many cases, however, such applications are mere replications of the original applications designed for more static desktop use of the Internet. The port from the desktop to the mobile version just consists in the simplified design of the user interface that reflects the higher cognitive constraints of the mobile context. This approach reinforces the idea of mobile devices as digital Swiss Army knives that contain a zillion of functionalities, most of which are rarely used.

The design model introduced in this study supports a more radical approach to MoSoSo and would literally require re-engineering the mobile device from both a conceptual and a technical point of view. Indeed, as explained in the articles, MoSoSo is not currently based on a unique and consistent representation of the user (i.e. the user profile) and his/her own digital community (i.e. the mobile social network). In addition, the ecology of incompatible and conceptually divergent applications that currently represent the most advanced form of MoSoSo does not provide a coherent set of operations on incoming and outgoing information flow. Indeed, each application has its own set of options that regulate the disclosure of personal resources (i.e. privacy management), information filters for displaying incoming social resources (i.e. social information filters) and methods to achieve personalization/contextualization of the user interface.

In short, current approaches to MoSoSo do not support an integrated model of digital community, but rather a fragmentation of social networks.

A new category of MoSoSo known as mobile social aggregators (Bhatt et al., 2008) is currently emerging and speaks for the convenience of a more integrated approach to mobile social networking. This type of MoSoSo represents advancement but does not yet exploit the full potential of the concept because the connection of accessible resources and action context is still too weak. It is likely that in the near future mobile social aggregators would not simply provide access to multiple sources of social information in a single place, but would also offer a set of features to apply transformations and inferences matching to contextual variables.

Referring to the present situation, both mobile services and Internet social software are not fully supporting the emergence of digital communities, which is the main social effect of digital convergence. Indeed, we are merely witnessing the early signs of the transition illustrated in Figures 10 and 13. So far, the offline, mobile and online dimensions converge only in a technological sense, meaning that it is possible to both use traditional mobile services and access Internet content through the mobile device and in any real space. However, this does not automatically mean that one's multiple social networks are also converging on a structural, perceptual and experiential level. For instance, the online dimension is not yet well socially integrated with the offline and mobile; when one wants to meet a friend, it is more common to make the social arrangements to converge, in the meeting place, by using phone calls or SMS than through email or IM. While on the move, it is still far more common to send SMS or call somebody than to send email or chat. The preference for traditional mobile applications may be influenced by their better affordances in the mobile context.

It may be concluded that traditional mobile services act as a bridge between virtual/online communities and offline communities: on one hand, phone calls and SMS are used to strengthen ties with one's offline community, both locally and at distance; on the other, they allow integrating ties created within online communities with offline contacts (Parks & Floyd, 1996).

It is common for people to exchange phone numbers in IM or in online SNS and then call or send a SMS to coordinate a F2F meeting. The effect of these practices is that most of contemporary online communities are no longer purely virtual, as in their early days (Rheingold, 1993), but they are becoming more integrated with the offline dimension. In this respect, MoSoSo is expected to amplify the existing trend of perpetual contact (Katz & Aakhus, 2002) by supporting a digital lifestyle in which constantly connected social lives (Hardey, 2009) play a key role not only in the development of personal identity, but also in the attainment of personal life objectives.

Through MoSoSo, it is possible to check, in any context, the evolving patterns of one's social network, having the possibility to filter relevant attributes and perform social operations on them. Checking the network updates is likely to influence one's current behavior: for instance, reading of birthday reminders in Facebook often triggers users to send a short message of wishes. Similarly, a real time sharing of one's presence (i.e. status message, location, availability) could trigger the wish to meet, or avoid, somebody, as well as influence the

choice of the more appropriate communication medium. It is important to realize that the most basic form of digital community interaction, the sharing of portion's of one's user profile with others (i.e. turning personal resources into social resources) is an antecedent of a direct interaction. As the case of social proximity applications illustrates (e.g. Nokia Sensor), sharing the user profile is a necessary step to perform to be able to establish new ties with somebody.

Digital sharing can, therefore, be regarded as the socio-technical basis of digital communities. Digital sharing is an operation that was originally introduced in Internet contexts. By connecting sharing with action, MoSoSo extends the range of possibilities for social communication. Specifically, the most significant effects lie in the possibility to inform or observe mobile social network members in real time by sharing personal resources or accessing social resources. These two basic operations, both related to the process of digital sharing, influence the way social resources are mobilized in purposive actions. On the one hand, the use of personal resources can support the attainment of individual action goals that do not necessarily involve social communication. For instance, sharing information about an event that one is planning to attend might trigger the desire to participate to the same event. Although such knowledge is likely to increase the chances of a F2F meeting during the event, it does not necessarily require that the contacts communicate before the event. On the other hand, digital sharing might represent the basis for developing more advanced forms of social organization that are functional to the attainment of collective action goals, as in the case of peer production (e.g. Linux) and collective action (e.g. smartmobs for political protest). Hence, the creation and sharing of symbolic resources in the digital community may have both a reflexive and a social effect.

From a sociological viewpoint, it has been observed (Chapter 4) that sharing has always been the basis of community. In the era of digital convergence, sharing in a community involves the sharing of digital content, which may be information, communication or any other type of symbolic resource. Being the least common denominator of communities in information societies, digital sharing reminds us that all contemporary communities are, to a different extent, mediated by digital technologies. In brief, all communities in information societies are digital communities. As personal communities (Wellman, 1982 and 1996; Wellman et al., 1988), digital communities have a networked structure; unlike them, digital communities present a higher degree of technology mediation and emphasize indirect communication as well. Without a strong argumentation, this view of community might not be regarded as acceptable by a sociologist. Indeed, the sociology of community offers many definitions of community, which nonetheless seem to have in common a static and exclusive view of the concept in which a set of static characteristics dogmatically determine *what makes a community*. This study instead supports a more dynamic view of community modeled as a multi-layered concept grounded on the sharing of digital resources. The need for an update on the view of community is also emphasized by the appearance of terms like *smartmobs* (Rheingold, 2002), *communities*

*of action* (Zacklad, 2003) or *instant communities of practice* (Castells et al., 2007), which would not fit to traditional community models.

Concluding, the suggested conceptualization and design model allow connecting the online dimension of digital resources with the offline interaction in real contexts. In doing so, they let the offline, online and mobile dimensions converge also from a social viewpoint, and implement the idea of social convergence. Therefore, by filling the *last mile* of social connectivity, MoSoSo acts as an enabler of the model of digital community.

## 10.2 MoSoSo as a transformative technology for community

Analyzing the effects that mobile phones and the Internet have on the sociological concept of social space, Taipale (2009) argued that such digital technologies have a *transformative* capacity that operates at structural, perceptual and experiential levels.

As the concept of community relies more generally on social space, Taipale's work can be used as a basis to evaluate MoSoSo as an enabler of digital communities. It might be useful to remind here that community is a form of social space that has been traditionally linked to forms of place-based social organization, which present a higher degree of internal social cohesion due to kinship and family ties. The adoption of the network analytic perspective on community (Wellman, 1979 and 1988) has made it possible to shift the focus from local solidarity to the networked space of the personal community (Wellman, 1982 and 1996; Wellman et al., 1988) in which the individual acts as a portal, replacing the traditional centrality of physical place. This approach has allowed expanding the original scope of community, for instance by acknowledging also the importance of weak ties (Granovetter, 1973). From the perspective of social space, such expansion has also made the concept of community closer to that of social space. At an experiential level, the boundary between the two concepts is even harder to describe, as they both correspond to the dimension of social networking.

In this study, the model of personal community was extended with that of digital community, which does not include only the established social ties, weak and strong ones, but also the invisible latent ties Haythornthwaite (2002) created through MoSoSo's discovery of patterns of interconnection. In a way, such conceptualization of digital communities has lowered the threshold of the basic form of community (i.e. digital communities based on digital sharing) in a way that its meaning has gradually become closer to that of social space.

Much of the analysis of Taipale (2009) is based on the effects of mobile phones and the Internet as closely related digital technologies for social communication. Although his study does not focus on MoSoSo, in the conclusions the author suggests that the social effects of converged mobile Internet applications might open a new research domain that needs to apply human and social

knowledge to policy-making and technology design. In particular, Taipale (2009) observed that

> "mobile communication and Internet-based social association practices diverge from each other" (p.78), but also that "the mobile phones have become more personalized and networked appliances with the enriched digital content and improved data transmission properties. This means that the mobile phones offer more possibilities to create all kinds of social spaces" (p.79).

Among the emerging forms of mobile-mediated networked social spaces, Taipale (2009) included *mobile encounter networks*, an ephemeral form of networked social space that is created via sensor-based interconnections (i.e. Bluetooth) and that allows communication and digital sharing.

The findings of this study provide additional knowledge on the ways in which MoSoSo transforms social space exploiting the peculiar features of digital convergence. In particular, the transformation concerns the emergence of digital communities thanks to the progressive convergence of three heterogeneous social spaces, namely the social space of F2F interaction (i.e. the dimension of the *offline* community), that of Internet-based communication (i.e. the dimension of the *virtual/online* community) and finally that of mobile communication (i.e. the dimension of the *mobile* community).

Using the conceptual framework introduced in this study, Taipale's mobile encounter networks (2009) correspond to mobile social networks enabled by social proximity applications. The design model of MoSoSo explains that people's interconnections can be established on the basis of the homophily (i.e. *connecting by shared location, age and interest*) and heterophily (i.e. connecting by different gender) principles (Rogers & Bhowmik, 1970; Lin, 2001).

The question on how new forms of mobile technology can influence the transformation of social space can be analyzed also by considering the effects produced by the three building blocks of the design model (i.e. user profile, mobile social networks and social algorithms). In other words, these elements provide a foundation for understanding all forms of MMC.

At the structural level, the transformative capacity of MoSoSo is expressed in this study by the concept of mobile social network and by the application of network theory to enhance MoSoSo design. As Taipale (2009) observed, "*transformations in the shape of social space begin from the material level of space*" (p.75) but also "*engender changes in the experiential level*" (p.75). Social algorithms represent a bridge between social structure and social action. Through them, the structural level of digital communities materializes as personalized MoSoSo interface. Furthermore, it has been emphasized how important is the gathering of user behavioral and contextual data to update the structural and relational properties of the digital community.

The enabling function of MoSoSo for the integrated model of digital community is explained through the acknowledgement of its transformative capacity in the phases of conceptualization and design. Their effect concerns the rendering of a permanent and ubiquitous digital layer that supports the creation or maintenance of people's interconnections; such layer reflects the structure of

digital communities and is updated in real time taking into account the social dynamics of digital communities, which are inferred through the analysis of behavioral and contextual data. These characteristics would not be possible on any other form of digital technology and are therefore tightly associated to the peculiar features of mobile devices, the only current platform for ubiquitous interaction. Hence, MoSoSo turns mobiles into social platforms for digital community interaction through which users can create, share and use symbolic and material resources for attaining individual and/or collective action goals.

## 10.3 Designing digital communities: opportunities and risks

As a general purpose social platform for digital community interaction, it is essential to discuss also what kinds of interaction MoSoSo enables.

Although the theme of digital community design is discussed here from the perspective of MoSoSo, it is worth noting that digital community design is not only about MoSoSo and mobile devices. Indeed, it includes all forms of mobile and ubiquitous social interaction, both formal and informal, which can be enabled by networked digital technologies.

Evaluating opportunities and risks of digital community interaction represents the key challenge of digital community design. It is useful to discuss this theoretical principle through two recent applications.

Swiss pharmaceutical group Novartis has been "*testing a technology that inserts a tiny microchip into each pill swallowed and sends a reminder to patients by text message if they fail to follow their doctors' prescriptions*" (Andrew, 2009). This new application of mobile communication may be regarded as a form of mobile-centric MoSoSo exclusively focused on the class A of mobile-mediated social relationships (Marti, 2002). Instead of interacting with another human being, the SMS reminder operates like an intelligent agent acting on behalf of the patient's doctor and triggering an action in the patient.

As previously discussed (Article I, Chapter 7), reflexivity occupies an important role in MoSoSo interaction. If Novartis would decide to include also the social element in their medical application of MoSoSo, they could easily implement a social algorithm matching patients on the basis of their similarity in health condition, demographics, location and attitude towards drugs. In this way, in addition to the drug reminder, they could also be motivated to meet other similar patients. A similar online service already exists (www.patientslikeme.com), and it claims that patients' conditions benefit from sharing their experiences with other patients who are in the same situation.

Instead of creating an account and a user profile in the web-site of the online service, through MoSoSo patients might simply add a *health* module to their user profile and decide to share health-related personal resources, such as symptoms, treatment and experiences as social resources with others in situations similar to their own. In this manner, a digital community of patients would naturally emerge and develop in a self-organized manner.

The current version of the medical SMS reminder application presents both advantages and risks: on one hand, it allows patients have hand in their daily drug management; on the other, it may function as a tool for monitoring patients who do not comply with their doctors' prescriptions. Continuous reminders might be regarded as a silent, cheap and effective method to make sure that patients will follow the rules, but instead of forcing patients to receive these notifications and become obsessed with them, SMS reminders might simply be an option that patients could voluntarily activate. Equally, finding other patients with similar concerns should be an option made available for those who desire sharing their experiences with others. In fact, some people might prefer not to spread sensitive information on their medical condition resembling the way gossips and viruses spread.

SenseNetworks' (www.sensenetworks.com) tools MacroSense and CitySense represent another recent example of MoSoSo-like applications for digital communities. The company SenseNetworks was founded, among others, by Alex Pentland, the professor and the driving force behind Sociometer (Choudhury & Pentland, 2003) and RealityMining (Eagle & Pentland, 2005) research projects on complex social systems at MIT. The motto of SenseNetworks, "*indexing the real world using location data for predictive analysis*, sounds both ambitious and alarming. Its meaning can be better understood by analyzing MacroSense and CitySense.

By anonymously analyzing large amounts of mobile location data in real time, MacroSense enables "*companies to understand customers and anticipate needs in order to deliver accurate recommendation, personalization and discovery – better than ever before – without retaining customers' original data*". In other words, companies are offered a highly sophisticated marketing tool identifying and clustering users according to homophily metrics, such as group roles and behavioral patterns. Instead of being directly benefited by users, this data, which is inherently social, is processed by businesses for better tailoring their products and services to meet customers' needs.

While MacroSense is a type of MoSoSo connecting digital communities to businesses, CitySense, with the slogan "*where is everybody?*", directly addresses users and enables them to navigate the city in a completely new, graphical and digitally augmented manner. CitySense enhances the current use of maps on mobile devices by replacing the principle of searching with *sensing*. In other words, instead of waiting users to search for resources (e.g. restaurants, concerts) in a relevant location, mobile devices constantly monitor and visualize city's activity in real time through a 'heat map' showing top hotspots and status messages from relevant locations.

By analyzing and visualizing large amount of streams of location data in real time, CitySense allows the user to exploit the wisdom of the crows (Surowiecky, 2004). In the next version, CitySense will not only display users' destinations but also contain homophily-based filters that allow locating similar kinds of users. This enhancement is likely to be achieved by processing not only location data, but also many other behavioral variables.

As illustrated by the design model of MoSoSo, in principle any variable, i.e. a personal resource, of the user profile may be shared with others as a social resource. Considering the problems of privacy and ownership of digital data, the solution of CitySense consists in the anonymous collection and processing of users' location data and in regarding users as owners of all data they create.

Through MoSoSo like CitySense, cities become physical spaces for digital community interaction, transforming *community networks* (Schuler, 1994a and 1996; Cohill & Kavanaugh, 2001; Carroll & Rosson, 2003 & 2008) into *digital cities*. According to Ishida (2000), digital cities are cities which "*integrate urban information (both achievable and in real-time) and create public spaces for people living in the cities*" (p.7). Until the advent of MoSoSo, digital cities were visited through online portals providing mostly institutional and commercial information. The emergence of the Web 2.0 (O'Reilly, 2005) and its extension to mobile contexts allow participation in the life of digital cities, where one can make sense of what is happening through the everyday experiences of other people and by interconnecting and interacting with them.

As highlighted in the findings (Chapter 7), the local dimension is still important in mobile social networks, although they are not limited by spatial boundaries. Through MoSoSo, digital cities might become more interactive, as serendipitous interaction could be made more common and trusted by using homophily-based protocols of social interconnection. As Thom-Santelli (2007) clearly explained, urban experiences should not be limited only to interactions with like-minded others. If the importance and richness of diversity (as also underlined in Article VI) are not acknowledged through heterophily-based protocols, the objective of inclusive cities and societies might remain only a dream and one of the facets of a balkanized reality in which digital communities are highly cohesive internally and poorly connected to each other.

Novartis' medical SMS reminders and SenseNetworks' products MacroSense and CitySense provide only a small window, through MoSoSo, to the new frontiers of digital community interaction, which have been theoretically discussed throughout the thesis. While the medical SMS reminders may be regarded as a specific application, CitySense is a general purpose social platform supporting an endless number of individual and social actions. These two examples offer an opportunity to reflect on the risks connected to MoSoSo design in particular and digital community design in general. The principles of SenseNetworks as a company are a good starting point for reflecting on these issues:

1. People should own their own data;
2. People have a right to privacy;
3. People should receive a meaningful benefit in exchange for sharing data;
4. Aggregate anonymous location data should be used for common good.

While principles 1 and 2 are clear, even where they concern ownership, collaboratively created resources should be connected to a collective group rather than to a single individual.

The other two principles are more complex to interpret. As discussed in Article V, mobile sharing may be regarded as a problem about how to weigh expected benefits and potential damage related to the disclosure of a personal resource as a social resource. As in any complex decision problem, there is much uncertainty in digital sharing, and it can be considered as a risk, which one chooses to take to enhance the probabilities of attaining an action goal. In any case, it should be for the user and not for a company or an institution to decide what to receive in exchange for sharing data.

The concept of *benefit* is also controversial, especially if the benefit for an individual happens to correspond to damage for a community. This leads to the vague concept of *common good* included in principle 4. As illustrated in Chapter 9, the notion of *common good* represents a central keyword of policy convergence.

An additional observation can be made of the anonymization process, which is the key requirement of SenseNetworks' products. While conducting an anonymous real-time analysis of user behavioral patterns, such data may also be de-anonymized and used for other purposes. For instance, Narayan & Shmatikov (2009) developed a re-identification algorithm, which can be used on anonymized online social network data. They concluded that "*anonymity is not sufficient for privacy when dealing with social networks*" (p. 181).

The difficulty of evaluating opportunities and risks offered by the new forms of MoSoSo suggests going back to the theoretical discussion on community and specifically on the implications of adopting digital sharing as the least common denominator of digital communities. This choice allowed expanding the traditional boundaries of community (Figure 31), lowering the threshold for entering and participating in a communitarian experience, both at a perceptual and at an experiential level.

Through MoSoSo, a group of co-located strangers can instantly connect and interact, becoming involved in the same digital community. The fading social and spatial-temporal barriers inherently represent an opportunity and a risk.

It is generally agreed that digital technologies, in particular MoSoSo, offer convenient and quick access to information, people and resources. This advantage is well synthesized in the *anytime anywhere access* rallying cry, spread by the ICT industry and challenged by academic research (Perry et al., 2001). Access being easier, quicker cycles of open innovation through mass collaboration (Howe, 2006; Tapscott & Williams, 2006) as well as large-scale mobilizations (Rheingold, 2002) become possible. Furthermore, the democratic potential of participatory technologies (Von Hippel, 2005) has also been described as a contributing factor.

Each of these positive aspects seems to have its costs, which occur at a cognitive (i.e. social information overload), social (i.e. personal privacy management) and societal level. By acting as a digital community, users can replace public or private services with their newly found power to organize without an organization (Shirky, 2008). Because self-organized digital community services can be delivered quickly, at very low costs and effectively by exploiting personal social networks, they may even compete with institutional and commercial

services. Putting more powerful technological tools like MoSoSo in the hands of users does not yet imply influencing positively their actions, as the choice to attain immoral or illegal action goals still remains in human hands.

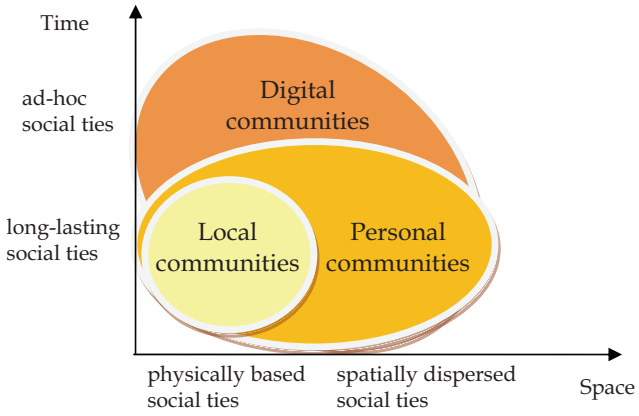


FIGURE 31 Digital community extends existing community models

Therefore, MoSoSo represents an increasingly complex and powerful but, at the same time, double-edged technological weapon, which also requires the development of appropriate human and technological strategies to exploit potential and managing risks. The findings of the study address this challenge in two ways: first, by suggesting appropriate support policies (Chapter 9), such as investment in communication capabilities (Viherä, 1999), to empower the user's critical capacity of assessing gains and risks. The second contribution is related to a set of socio-technical principles of digital community design, which are illustrated in the following section.

## 10.4 Principles of digital community design

The key challenges of MoSoSo design (Chapter 5) and the need for realizing the potential of MoSoSo by considering also its risks can be tackled by discussing a set of eight principles of digital community design (Table 6).

TABLE 6 Principles of digital community design

| | |
|---|---|
| **Principle 1** | Design general purpose social platforms |
| **Principle 2** | Support crossmedia communication |
| **Principle 3** | Encourage self-organization and decentralization |
| **Principle 4** | Design for inclusion rather than for exclusion |
| **Principle 5** | Enforce trust by privileging real to virtual identity |
| **Principle 6** | Provide both amplifiers and attenuators of social information |
| **Principle 7** | Design socially scalable technologies |
| **Principle 8** | Adopt a communitarian and/or an egocentric approach |

These principles, which emerged while conducting the studies and writing this dissertation, do not aim at being universal as the *Ten Commandments;* rather, they are illustrated here mostly to guide and inspire discussion on digital community design.

### 10.4.1 Design general purpose social platforms

The first important question, which has also been discussed elsewhere (Chapter 7), concerns whether to implement MoSoSo as a stand-alone application or as a general purpose social platform for digital community interaction. In the review, it was noted that the former approach is currently the most popular because it is less challenging. However, one can also consider that restricting the focus of MoSoSo to a well defined context, function and user group also implies limiting its potential utility and the number of potential adopters.

To enable an integrated model of the digital community, MoSoSo should be conceived as a general purpose social platform. In the context of computer systems, a platform refers to a hardware and/or software architecture that serves as a foundation or base. Different types of computing are used at different levels: operating systems are a low-level software platform because they are directly interfaced with the hardware. Higher-level software platforms include, among others, Java, without which many Internet applications would not function. Digital convergence introduced a number of mobile operating systems, such as Symbian, Palm OS, Windows mobile and Android. From a technical perspective, a platform is a hardware and/or software architecture that allows other software to run on top of it.

In relation to Internet social software, MoSoSo should be designed keeping in mind the model of the Web (Berners-Lee, 1999). The flexibility of Internet protocols allowed new and more sophisticated social platforms to be implemented within the ecology of online social media. For instance, blogs and SNS, such as Facebook, are general purpose social platforms.

As the Internet goes mobile, also the context of social platforms becomes mobile. Until now, the mobile browser has been the most popular type of general purpose social platform available for mobile devices. Browsers, however, were originally designed for desktop computing rather than mobile computing. Much of MoSoSo do not rely on mobile browsers, but on client applications originally conceived for utilization in mobile contexts. The most severe limitations of mobile browsers consist in not supporting context-awareness (Schilit et al., 1994; Dey, 2001; Raento et al., 2005; Ahern et al. 2006; Tang, 2007; Beach et al., 2008; Gay, 2009). Mobile browsers neither use contextual data to personalize the interaction mode nor exploit user behavioral knowledge that can be inferred through the analysis of information stored in the mobile device (e.g. photos, communication logs, address-book entries). As argued in Article II, the mobile device needs to be re-engineered in a completely new manner to exploit context-awareness; specifically, all features should be interconnected to enhance

the user experience, as in ContextPhone, a successful academic prototype (Raento et al., 2005) implemented on top of Symbian architecture (Figure 32).

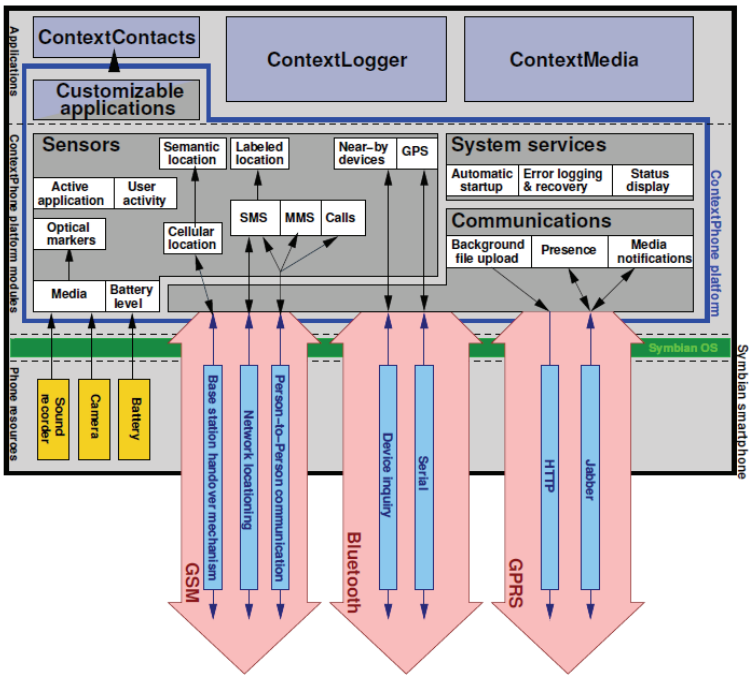


FIGURE 32 ContextPhone computing platform (Raento et al., 2005)

In Figure 32, ContextContacts (Oulasvirta et al., 2005) represents a mobile social awareness application that benefits from all the underlying modules of the ContextPhone platform. As illustrated in Article I, ContextContacts (Oulasvirta et al., 2005) represents the only type of MoSoSo that supports the three classes of mobile-mediated social relationships (Marti, 2002). For this reason, it could be used as an example of more general versions of MoSoSo which are not limited to social awareness but would also support social proximity interaction and other forms of digital community interaction.

In conclusion, an important aspect of digital community design concerns the design of general purpose social platforms, such as those for phone calls, SMS and the Internet browser. Conceiving MoSoSo as a general purpose social platform cannot be simply achieved by enriching existing mobile services with more advanced technical features, as in the case of the MMS. In addition, adapting the model of the Internet browser to the needs of mobile context does not seem the most efficient way to support all forms of digital community interaction. Instead of trying to fit the traditional browser model to the needs of mobile computing, it would be more beneficial to create platforms natively conceived for mobile contexts. For instance, synergic use of maps, sensors and GPS might provide digitally augmented views of cities and graphical methods to access, navigate, organize and transform resources embedded in the structure of hybr-

id spaces (de Sousa e Silva, 2006; Rheingold et al., 2006; Crabtree & Rodden, 2008; Bilandzic et al, 2009).

### 10.4.2 Support crossmedia communication

MoSoSo currently exist in three main forms: mobile-centric (SMS-based), online-centric (client-based) and digital-centric (cross-media). Whereas mobile-centric approaches rely on the existing infrastructure to maximize the number of potential adopters, online-centric approaches aim at exploiting the full potential of digital convergence assuming that in the near future the largest majority of mobile devices will have computational capabilities.

The third approach is by far the most interesting because it attempts to achieve both objectives by allowing digital content to be accessed and/or used across multiple media. This approach synthesizes the essence of digital communities by making the *digital layer* accessible independently of the device or technology used. Such layer is the result of the convergence of multiple technologies, which should render access independent of the digital technology used. Cross-media solutions also contribute to the emergence of the model of the integrated digital community; in fact, they do not only allow access to information across technologies, but especially emphasize social convergence, the convergence of the social networks that were earlier associated only to a single communication technology (Figure 33).

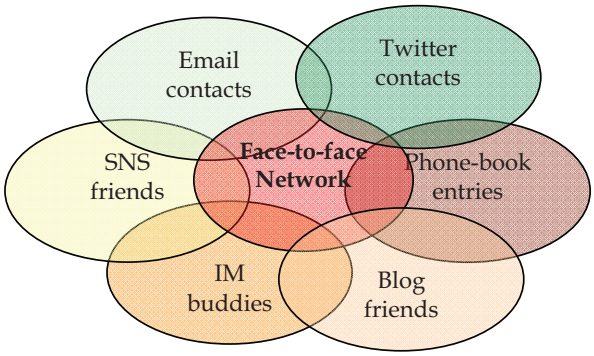


FIGURE 33 Crossmedia communications assists social convergence

In this way, IM buddy-lists, phone-book entries, email contacts, SNS friends and the like would all converge and gradually be part of the general and common interaction space of digital communities.

### 10.4.3 Encourage self-organization and decentralization

Until now, the design of mobile services has been characterized by a very clear distinction between service provider and service consumer: the former role has been typically covered by public and private organizations and the latter by end users. From a technical viewpoint, such distinction is generally supported by a centralized model based on the client-server architecture. This contrast with the Internet, which was designed as a decentralized network; for this reason, it naturally supports p2p applications, many of which (e.g. Napster, BitTorrent) have been realized by end users who have created disruptive innovations.

Digital convergence and the infrastructure for ubiquitous computing allow applying both centralized and decentralized approaches to MoSoSo design. Although client-server approaches are currently the most common, p2p approaches such as community cloud computing (Marinos & Briscoe, 2009; Du, 2009) are emerging and seem promising.

Cloud computing (Baun et al., 2009) is a new form of Internet computing centred on the sharing of resources. It allows realizing highly-scalable and device-independent services at relatively low costs. These benefits are counterbalanced by serious privacy issues. Moreover, efficiency is privileged at the expense of resilience and environmental considerations. Some of these shortcomings may be eased by community cloud computing, a trend within cloud computing that emphasizes the need of engaging communities in the *clouds*. Marinos & Briscoe (2009) observed that community cloud computing utilizes "*networked personal computers for liberation from the centralized vendor model*" (p.472).

Despite the concerns connected to any computing paradigm, as cloud computing, decentralization is an important means for achieving sustainable information societies. As discussed also in Chapter 9, compared to the past, citizens will rely less on welfare state and more on the support provided by a welfare society: from the individual viewpoint, an important portion of support may come from one's digital community. Being precious resources, citizens and communities can do much for reconciling societal and economic development. From a technical perspective, p2p represents the most suitable approach to MoSoSo design because it would allow analyzing personal data on the mobile device, thus minimizing the user's privacy concerns (Article V). In addition, this approach allows the user to take multiple roles (e.g. consumer, producer) in digital community interaction. Furthermore, techniques suggested in p2p computing (Article VII) might be applied to mobile social computing for stimulating cooperative behavior. And finally, p2p would be better than client-server approaches in supporting the wide scope of MoSoSo, which enables users to create, share and use resources in self-organizing social structures. By allowing users to navigate through the opportunities presented by digital communities, MoSoSo would represent a sort of emancipatory technology. On the other hand, it should be investigated whether obtaining more independence from institutions and organizations would also imply a new form of dependence of digital community structures.

Therefore, several challenges remain. While institutions speak about empowering citizens and communities, businesses are more interested in involving them in their value chain to generate revenue streams. For different reasons, both institutions and businesses need to maintain some control on citizens' activities; the role of institutions cannot be replaced by other ad-hoc authorities, otherwise *user-generated States* (Frissen et al., 2008) may emerge. Business need to maintain at least some control on the information flow and users' activities to be able to exploit their commercial potential. For different reasons, p2p approaches are regarded as powerful but also as dangerous.

In conclusion, all stakeholders need to consider the degree to which to support self-organizing digital communities.

### 10.4.4 Design for inclusion rather than for exclusion

MoSoSo is currently conceived as an urban technology supporting consumption- and entertainment-based social practices, which correspond more to the needs and lifestyles of the young generations of ICT users. (Thom-Santelli, 2007). While phone calls and SMS are useful to senior citizens as well, the characteristics of MoSoSo do not fit to their typical needs. From their viewpoint, MoSoSo is currently more exclusive than inclusive. In general, the implementation of exclusive technologies does not support policies oriented at the realization of an inclusive information society.

The analysis of the attitudes and experiences of social media used by two different generations of ICT users, digital natives and digital immigrants (Article VI) reveals that inclusive technologies supporting inclusive policies can be realized by changing the conceptual model on which such technologies are grounded. Specifically, ubiquitous technology is currently linked to a single dimension, access, which does not provide enough understanding of the human and social needs. By adopting the tri-dimensional conceptual framework of communication capability (Viherä, 1999) - which includes also user's motivation and competences in addition to access (Figure 4), it is possible to conceive inclusive technologies, which are inherently tools for participation.

A second notion of inclusion was also illustrated in the study. By considering the conceptual framework of Article I, being inclusive mean supporting all three classes of mobile relationships (Marti, 2002), which correspond to the dimensions of co-located, distant and reflexive interaction.

To design for inclusion, the notion of *network* is more suitable than the idea of *place* because the former does not contain spatial constraints and allows integrating the three dimensions of offline, online and mobile space into the more general concept of mobile social network. Besides supporting interaction with the local *here* and the distant *there*, mobile social networking tools have to deal with the *nowhere*, the immaterial space of human subjectivity. In this reflexive space, inclusive strategies correspond to the acknowledgement of the importance of time for human disconnection and the need for attenuators of social network signals.

### 10.4.5 Enforce trust by preferring real to virtual identity

Acknowledging the need for identity representation and expression is an essential aspect of MoSoSo design, which is connected to the user profile. For boyd & Heer (2006), user profiles are digital bodies. Therefore, status messages and content linked to the user profiles play an important role in the process of impression management (Goffman, 1959). In reference to the resource-based model of user profile (Chapter 8), user identity is one of the key resources because it is connected to the sharing of any other type of resource as well.

Unlike in traditional mobile services, in which real identity is associated with one's telephone number, MoSoSo generally adopt a looser approach by allowing users to create virtual identities that are not necessarily connected to their real identities. As discussed in Chapter 5, this approach is an inheritance of online social software design supporting virtual communities, which have been regarded as distinct entities from real communities.

As digital convergence integrates the online, mobile and offline dimensions, MoSoSo is not only used to update a community of distributed Internet buddies, but also to facilitate F2F meetings. When used to create a new social tie, the issue of trust is crucial; in relation to interpersonal interactions, virtual identities are less trustworthy than real identities. However, within a group, which ensures generalized trust (i.e. alcoholics anonymous, hacker community), the creation of virtual identities is viewed as positive because it can contribute in making interaction livelier or simply allowing individuals to speak more openly without the worries of being recognized.

To be coherent to the previous principle, any inclusive approach to MoSoSo design needs to allow creating both real and virtual identities. However, real identities should be privileged over virtual identities. This principle could be implemented in user profiles by defining real identity as a mandatory module to be verified – as it happens already in Internet banking systems, and an optional module describing one or more virtual identities.

Depending on the trust level required by the situation, the user might make visible one or the other type of identity. In the approach to privacy management (Article V), virtual identity was suggested for the sharing of content perceived as capable of causing only low privacy harm and real identity for more sensitive items. Acknowledgement of multiple identities would also imply that the user's reputation would consist of several reputation values connected to different interaction contexts. For instance, one of the reputation values might be associated to the recycling habit (Article VII) and another to the quality of social information shared with the mobile social network. Depending on the trust level of the interaction context, it may be sufficient to disclose the general reputation value or only one of its elements.

In conclusion, MoSoSo might not be adopted in contexts and situations where a certain level of trust is necessary if it exclusively supported only virtual identities. For this reason, although virtual identities should be encouraged, the

definition of a real identity should represent the primary criterion for identity representation and expression in MoSoSo.

### 10.4.6 Provide amplifiers and attenuators of social information

Much of the usefulness of MoSoSo is related to the way it can facilitate the management of social network information streams. In the review of MoSoSo (Chapter 5), the user's control of information flow was separately discussed as personal privacy management and social information overload. These two issues were respectively associated to outgoing and incoming information flows. Both of them can be tackled through social algorithms, procedures that form the core of the interaction level of MoSoSo (Chapter 8) by providing technological support to the user's social action. An important aspect of social algorithms concerns the level of mediation they should provide, which is likely to be somewhere in between the two extremes of technology-driven interaction and human-driven interaction (Figure 34).

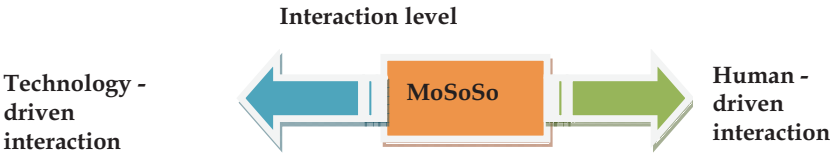


FIGURE 34 Trade-off between human agency and automation

Technology-driven interaction is based on the user's high confidence on the reliability of the technological support. In the human-driven approach the user should have full control because automated or semi-automated procedures would just add interferences to the interaction, making it more complex rather than simpler. Although MoSoSo should be designed to allow both solutions, it should guide the user towards an optimal trade-off between the two opposites of technology-driven and human-driven interaction.

Implementing a balanced solution between the need for automation and the human desire to be in control is one of the major challenges of ICT in general (Sheridan & Parasuraman, 2006) and MoSoSo in particular. On one hand, there is a general agreement that ICT can support users in overcoming their limited cognitive capacity and biological limits. On the other, there is an increasing awareness of the challenges of automation, especially in the highly dynamic mobile contexts (Vihavainen et al., 2009). Rauterberg (1995) discussed the theme of human information processing in HCI in terms of *incongruity*, "*the difference between the complexity of the context and the complexity of the active and learning system*" (p.222). To acknowledge incongruity in contextual social interactions means measuring both the complexity of the context and the complexity of the perceived context from the user's point of view. This knowledge can then be used for achieving a good balance between technology- and human- driven in-

teraction. As Rauterberg (1995) pointed out, "*to satisfy the human need for variety (and optimal information) the work system must be flexible and individualisable. Of course, this demand leads to difficulties in complex system design*" (p.226).

The model of Figure 35 can be applied to illustrate how social algorithms could play an important role in making MoSoSo interaction more effective. For instance, part of the user profile information could be updated on the basis of acquisition of contextual information, such as user's current location (stage 1). In addition to acquiring information, MoSoSo could also perform higher-level operations on behavioral data by inferring and displaying (stage 2) structural elements of the personal community (e.g. the mobile social network). Furthermore, as suggested in Article V, semi-automated support for the user's decision in sharing digital content (stage 3) could be implemented on the basis of behavioral and contextual data. Finally, in some cases MoSoSo could take decisions on behalf of the user (stage 4) through agents. Scenarios of agent-to-agent and agent-to-human interaction, however, are not discussed to any length in the present study and are left for future investigation (Chapter 12).

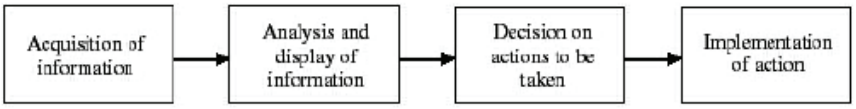


FIGURE 35 Stages of the automation process (Sheridan&Parasuraman, 2006)

As a design principle, MoSoSo should behave in some cases as an *amplifier* and in others as an *attenuator* of social information (Figure 36). These two terms, typically used in electronics, refer to tools that are used to transform the signals of a technical system by increasing or decreasing them. Similarly to the concept of scalability, they have been generally employed in the context of technical systems. Their meaning is relevant for social systems as well.

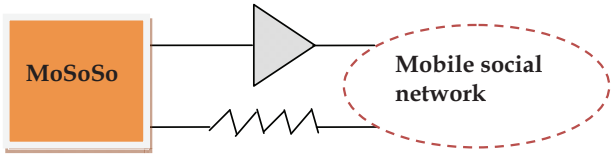


FIGURE 36 Amplification and attenuation of mobile social network

Until now, far more attention has been paid to the role of ICT as an amplifier of social network information. For instance, adding friends in SNS has typically been easier than removing them. Similarly, tools for removing information from the Internet have not experienced the same pace of development as those supporting online publishing. Indeed, the Internet constantly grows through continuous transformations. The amount of information is growing because more

digital content is added than removed. The increasing complexity might lead to a decreasing ability of users to efficiently deal with it; at a certain point, information might just interfere with rather than augment knowledge, negatively affecting its usefulness.

It is time to systematically address attenuation of social network signals in digital community design. In context-aware computing, this task has been discussed as the challenge of selecting the most relevant resource for the current context. As a type of context-aware platform, MoSoSo provides a new perspective to this problem, emphasizing the structure and dynamics of the mobile social network as primary variables of context (Schilit et al., 1994; Dey, 2001; Raento et al., 2005; Ahern et al. 2006; Tang, 2007; Beach et al., 2008; Gay, 2009).

### 10.4.7 Design socially scalable technologies

Scalability, introduced in the context of technical systems, is important for social systems as well. Scalability issues have not been systematically addressed in the present study and are one of the areas to be developed in future research (Chapter 12). On the basis of the literature and the findings of this study, it is possible to make some comments.

Small-scale social interactions at an interpersonal level are likely to remain the most common ways to use mobile devices; in this context, MoSoSo might help in the establishment of new social ties and in the maintenance of existing ties. In addition to horizontal scalability (i.e. the number of users in the social system), MoSoSo could also support vertical scalability (i.e. user's capacity to process increasing amounts of social information) through social algorithms.

The most disruptive effect of MoSoSo, however, might take place at the level of large-scale interactions corresponding to the opportunity to go beyond the small social group (Ling, 2004), which has so far represented the traditional scope of mobile communication. The phenomena of *flashmobs* (Mc Fedries, 2003; Marchbank, 2004; Kluitenberg, 2006) and *smartmobs* (Rheingold, 2002) demonstrate that people feel the need of large-scale mobilizations for a variety of reasons, including political protest and pure entertainment. Being enabled by SMS, traditional mobile devices were already powerful in supporting such emerging forms of ad-hoc social organization. Through MoSoSo, digital convergence can greatly extend people's swarming capabilities by allowing a more refined type of social coordination, for example instant sharing and decentralized decision-making.

As already illustrated in Chapter 9 and elsewhere, due to the weakening state support for welfare, there is an increasing need for taking more responsibility of the course of one's personal life, suggesting that ad-hoc forms of social organization are likely to become more popular in filling the gap left by the institutions. Users might seek security in their digital communities by utilizing the resources that satisfy their instrumental and expressive needs. From a political viewpoint, enhancing citizens' ability to self-organize and carry out collective actions may be regarded as a resource for sustainability or a threat to politi-

cal stability. This study emphasized the former type of scenario (Article VII for MoSoSo and recycling activity, Article II for active citizenship and Article VI for inclusive society), although a number of challenges, more political than technical, have been highlighted.

Above all, it has been observed that after technological convergence, there is need also for a policy convergence of all stakeholders. The aim should be to reach a common view on how the potential of technological convergence could be used for realizing common goals. Although the current national and international policies are increasingly oriented towards this ambitious goal, in practice too many views of interests are diverging, and much work has to be done, at all levels and in a very short time, to make better sense of these issues.

### 10.4.8 Adopt a communitarian and/or an egocentric approach

The two key structural elements of MoSoSo are the individual user and the digital community, which are described in the design model by the user profile and the mobile social network. The power relationship between these two building blocks determines the orientation of MoSoSo, which is said to be egocentric when the individual dimension is dominant and communitarian when the collective dimension is stronger. Ideally, both should be supported by the design solution. In practice, the choice depends from the type of digital community analyzed.

In many cases, both traits are present in social software and MoSoSo: for instance, Facebook has an egocentric orientation because its basic building block is the individual user profile, but it includes also a communitarian dimension through its group feature. On the other hand, although they rely on a user profile as well, Internet forums present a communitarian orientation because they give precedence to a common view in forum discussions. In addition, they also typically offer more personal tools for exchanging private messages with other forum members. While egocentric solutions privilege the dimension of private communication, communitarian approaches generally tend to focus on interaction in public spaces. The difference between egocentric and communitarian-oriented social applications is even more evident when we consider the scenario of leaving the community. In many cases, users keep their accounts unwittingly, because it is generally more difficult deleting than creating them. Still, when they succeed in deactivating or deleting their personal accounts in the system, their online social networks ceases to exist; in contrast, removing one's account from an Internet forum does not bring the whole community down, as the conversations and users are linked to threads rather than to people.

Choosing an egocentric or communitarian approach has many design implications; in MoSoSo, the main question to be carefully addressed by designers concerns *who counts more in the mobile social system, the individual or the collective identity, i.e. needs, values, goals and practices?*

Certainly, the function and context in which MoSoSo is framed have much influence on the chosen approach. For instance, if MoSoSo is meant to support

an open source project, the perspective of the community is more suitable than that of a single contributor. Similarly, the same approach is suitable for MoSoSo interactions among sport team members, NGOs associates or groups of informal learners. In fact, the interactions taking place in these groups are more structured in the sense that individuals are assigned well-defined roles and goals to facilitate the progress of the activity. Activities like organizing a birthday party or exchanging photos with friends, however, are less structured; for them, a mobile social network approach is more adequate.

Although research is currently aiming at integrating aspects of individual behavior in social networks, it is also worth considering to include the cultural determinants of wider social groups, as suggested by Kolko et al. (2007a), or the traits of different generations of ICT users (see the differences between digital natives and digital immigrants in Article VI). In doing so, social computing gradually embeds also aspects of cultural computing (Tosa et al., 2005; Rauterberg, 2006; Kooijmans & Rauterberg, 2007; Wang, 2009).

In respect to egocentric and communitarian orientation, two different configurations of MoSoSo were discussed, namely mobile social networks (Article III) and mobile virtual communities (Rheingold, 2003). Mobile social networks present an egocentric orientation because they refer to the individual patterns of social interconnection that emerge, implicitly or explicitly, through MMC. On the other hand, mobile virtual communities are more communitarian because they inherit the characteristics of early virtual communities (Rheingold, 1993).

The design model for MoSoSo introduced in this study adopts the egocentric perspective of mobile social networks because the scientific basis of the design model is represented by the psychological and sociological views of the individual user. However, the same model can be easily adapted to the communitarian view of mobile virtual communities by choosing alternative frameworks that allow establishing a power relationship in favor of the collective rather than in favor of the individual.

# 11 COMMUNITY-GENERATED SERVICES (CGS)

In all historical periods, communities have provided a sense of belonging to their members and protected them from external threats. Even if MoSoSo contributes in widening the traditional idea of community by including ad-hoc social interactions and activation of latent ties, it does not significantly change the function of communities in people's lives and in global societies. Specifically, the primary role of MoSoSo in the process of digital convergence consists in allowing citizens to freely self-organize in digital communities by offering a powerful means to easily and quickly create, share and mobilize symbolic and material resources for the attainment of individual and/or collection action goals. In doing so, MoSoSo assumes also an emancipatory function for digital communities because it represents a flexible social platform for the co-creation and provision of CGS. The discussion on policy convergence is here developed by presenting the expected impact of CGS on personal, societal and economic growth. From the viewpoint of a single individual, it allows tolerating better the decreasing reliability and increasing costs of public and private services by easier and cheaper access to shared community resources. At the level of large-scale social structures, MoSoSo represents an effective tool for empowering a network-based civil society to participate more widely in processes of innovation and societal transformation.

## 11.1 The emancipatory potential of MoSoSo: CGS

Arguing that MoSoSo has an enabling role in the transition towards digital communities is not relevant only from the theoretical viewpoint of community, but especially for introducing a wider discussion on the significance of digital communities in people's lives and in contemporary information societies. This discussion, related to policy convergence (Chapter 9), considers the meaning and function of MoSoSo both at the micro level of the individual and at the macro level of society.

As illustrated in the review (Chapter 5), the effect of MoSoSo in people's lives and in the evolution of information societies is unknown because it is not yet a technology that has reached critical mass. However, an analysis of its expected implications can be conducted by evaluating the new insight on MoSoSo provided by this study. For this kind of analysis, investigations on the role of MoSoSo in the functioning of large-scale social structures are more useful than small-scale studies. Although the former types of contribution are not common, critical (Thom-Santelli, 2007) and visionary (Rheingold, 2002) contributions shed light on the need, reasons and function of MoSoSo, providing deep implications for policy-makers and designers.

In particular, the work of Rheingold (2002) indicates that the greatest potential of MoSoSo may lie in its capacity to act as a technology of cooperation, enabling users to produce knowledge and resources that are of general usefulness to the digital community (i.e. the commons) and to self-organize in real time to act together for a common goal. Thom-Santelli (2007) describes the current implementation of MoSoSo as an exclusive and urban technology with limited utility to the masses. The majority of studies on MoSoSo reflects the current conceptualization of MoSoSo as a *gadget* with a utility that is comparable to that of digital Swiss knives (i.e. really useful only in emergency situations). This suggests that Rheingold's vision (2002) may materialize only through a reconceptualization of MoSoSo. The study contributed in this direction, offering an inclusive conceptualization of MoSoSo as a general purpose social platform and a holistic design model that allows users to self-organize in digital communities and to create and share digital resources.

Promoting self-organization and mobilization of people and resources to satisfy a variety of everyday needs, MoSoSo does not act only as a technology of cooperation, but also as technology with an emancipatory potential that may materialize at all levels of social structure. Emancipation, in this context, refers to the full acknowledgement of the multiple roles that ICT users may take in everyday life. The design model presented in this study supports this principle. Its three building blocks (i.e. user profile, mobile social network, social algorithms) are the basis for community-centered development of higher-level processes that exploit the instrumental and/or expressive utility of digital resources in contextual action goals.

These higher-level processes enabled by MoSoSo, described in Article IV as mobile social services (MoSoSe), represent a form of community innovation (Gurstein, 2004; West & Lakhani, 2008; Van Oost et al., 2009). Specifically, MoSoSo supports the creation, development and exploitation at an individual and/or collective level of CGS that are based on the primitive operations of creation, sharing and usage of digital resources. The emancipatory potential of MoSoSo lies in the way these operations support the grassroots innovation process of CGS development.

The emergence of an ecology of CGS types signifies that a single networked individual or self-organizing communities may have higher autonomy, or simply wider choice, from that of commercial and public services. From this

viewpoint, CGS may represent both an opportunity and a thread to public and private sectors, depending on whether they will label users and digital communities as *partners* or *menaces*.

As already illustrated in Chapter 9, this study supports the position that users should be regarded as the most precious resource for social change. In particular, they could promote what Perez (2002) described as process of *societal re-engineering*. Such processes, which are not only typical of the information age, are centered on the appearance of new technological innovations, which lead first to a period of explosive growth and then to a crisis, which is followed by a third phase of more harmonious and sustainable growth. Slot & Frissen (2008) argue that this model of socio-technical change fits well for an analysis of the impact of the Internet and in particular the Web 2.0 on people's everyday life and larger social structures. The authors mentioned user empowerment when explaining that the services of Web 2.0 allow users to take new roles in the creation and development of services that earlier were reserved only to business parties. In relation to the next wave of public services, some authors even hypothesize future scenarios of user-generated states (Frissen et al., 2008; Leadbeater & Cottam, 2008) in which self-organizing communities support or replace institutional functions.

Extending the Web 2.0 to mobile contexts, MoSoSo amplifies the current trends and represents a way for users to move more easily from the online to the offline dimension. In this regards, SMS-based smartmobs (Rheingold, 2002) represent only the peak of an iceberg that is now about to emerge.

It is clear that MoSoSo would act as an amplifier of both positive and negative intentions, as any other technology. The obvious risks, however, should not become a reason to limit the potential of MoSoSo by maintaining its state as a *gadget*. In fact, as for the Internet and mobile phones, its positive outcomes are likely to be greater than the negative ones. The future of MoSoSo as a gadget or as a tool with emancipatory potential does not depend only on users' creativity, but especially by the choices that public institutions and private organizations will take in the deployment of the technology, in the approval of appropriate policies and laws and especially in the diffusion of values grounded on a culture of trust rather than on a culture of suspicion.

In the following sections, CGS is firstly discussed in relation to the micro dimension of personal development (i.e. achieving one's life objectives), and then considered at the macro level of public institutions and private organizations, which are respectively more focused on the societal change and economic growth.

By connecting the micro and macro levels of social structure, MoSoSo and digital communities can play a key role in the major plan of renewal towards more balanced individual lives and sustainable societies. In this respect, MoSoSo's role is to facilitate the accomplishment of instrumental and expressive action goals set by single individuals or collectives in their multiple roles of citizens, consumers or creative innovators.

## 11.2 Personal development: the strength of network ties

At individual level, CGS are tightly connected to the way MoSoSo allows users to exploit the instrumental and expressive value of digital resources embedded in mobile social networks in everyday activities.

As reported by a digital native in the Article VI, the mobile phone is appreciated because it helps to *"change things quickly"* – in fact, several digital immigrants in the same study connected mobile phones to efficiency. Although it is not explicitly mentioned, all generations of users agree that an important value of the mobile device lies in the way it helps getting things done through the support of one's social network contacts. Through voice calls and SMS, people ask for information and rapidly receive answers; in a similar manner, they seek and easily find help, give birthday wishes, coordinate meetings, organize events or spread gossip. Although its scale is typically limited to interpersonal or small group interactions (Ling, 2004), mobiles act as a general purpose social platform for communication with family, friends and business colleagues. In other words, mobiles are used to access resources through weak or strong ties, depending on the need in the specific action context.

The Internet, and in particular online SNS, has a complementary role to traditional mobile services. Its scope is not limited to the small social group because it supports many-to-many communication. In addition, it provides a rich-media environment in which photos and video-clips are the most common type of digital resources created, shared and used. Furthermore, the sharing of a common interest or practice often forms the basis for turning invisible ties into weak ties. From a technical viewpoint, the Internet browser and the Web standards (e.g. TCP/IP, HTML, HTTP) represent the general purpose social platform for virtual/online communities. As illustrated in the Article VI, the Internet is appreciated for its richness of content rather than for its efficiency.

By combining the efficiency of traditional mobile services with the richness of the Internet, MoSoSo opens new interesting frontiers for the attainment of personal goals in the everyday life.

The implementation of the holistic design model (Chapter 8) is expected to provide an instant opportunity to access, share and use a variety of digital resources through invisible, weak and strong ties. Similarly to Internet social software, invisible ties can be turned into weak ties by exploiting the various protocols for social connectivity (i.e. matching by similarity/diversity) that are supported by MoSoSo. Spectators at a football game might create an ad-hoc interconnection to enrich the collective experience of the event, for instance, by sharing photos or video-clips, commenting the event in real-time through a chat system, creating ad-hoc polls, or even broadcasting personalized views of the event through live video feeds. As soon as the event ends, such ad-hoc ties disappear, unless some of the members of the ad-hoc digital community became connected by exchanging their contact details. As the example shows, most of

the ad-hoc ties are available only temporarily, but some of them may persist and develop into long-lasting relationships.

Similar opportunities for digital community interaction are not limited only to leisure-oriented contexts, but they embrace all kinds of collective activities rooted on shared values or needs (e.g. the desire for political action). For instance, the supermarket scenario of Article VII indicates that the same primitive operations adopted for enriching the experience of a football game would also be suitable for enriching recycling practices. In relation to traditional mobile social networks and online social networks, the main novelty of MoSoSo is its higher speed of change granted by instant rich-media access and on-the-site contextual usage. In brief, MoSoSo diminishes the time span between intention and action. From the viewpoint of innovation, this means that ideas can quickly turn into innovations. Similarly, large-scale mobilizations can materialize, be orchestrated, coordinated and dissolved almost in real time.

As every technology, also MoSoSo has its costs. Rheingold (2002) warned against the serious privacy concerns that the new forms of mobile technology introduce, acting as amplifiers of cooperation as well as always-on panopticons. Describing social convergence, boyd (2008) illustrated the problems of invasion and exposure, which are respectively connected to incoming and outgoing flows of social information. In addition to privacy, this perspective also includes the cognitive costs that involve fragmented attention spans, interruptions and information processing costs. These issues were discussed throughout the study. Here, we discuss them from the individual viewpoint of maximizing the utility of network ties and minimizing their risks.

MoSoSo may help taking better decisions, as long as it is able to "know" the user and the characteristics of his/her networks, and able to communicate that knowledge back to the user through a personalized context-aware interface. For instance, personal privacy management (Article V) was presented as a decision problem in which privacy practices can be supported by MoSoSo through the integration of risk and trust models.

The same approach is also used in Article III, which introduces social algorithms implementing homophily-based social introduction protocols. Specifically, homophily patterns are obtained on the basis of mining communication and usage logs of mobile devices. These metrics represent two of the dimensions of the multi-dimensional social ties conceptualized in the design model. According to that description, frequency of communication may be used to assess tie strength in the traditional sociological sense (Granovetter, 1973; Marsden & Campbell, 1984), while similarity in mobile usage patterns may be useful to provide interaction opportunities to strangers.

The nature of the social tie plays an important role in the process of granting access and use of a network resource. In fact, as illustrated in Article III, users show different attitudes in the sharing of digital resources with friends or acquaintances. The characteristics of the context, the user's role and the properties of the social ties should therefore be taken into account to assess the value that a network resource has as a utility in attaining a contextual action goal.

While among strong ties of the digital community the exchange of resources might operate on a trust-basis (i.e. have no costs other than trust), among weak ties and especially with strangers access and use of network resources might be modeled as a transaction based on virtual currency. This approach would also enable business models for transaction within and between digital communities, and between digital communities and organizations.

These ideas embedded in design model demonstrate that the utility of MoSoSo is likely to be influenced by the way designers are able to understand and model the network structure and social dynamics of digital communities. This key aspect of design has been used to a very limited extent in online SNS but not at all in traditional mobile services. Its importance is expected to be much greater in MoSoSo because of the high constraints of mobile contexts and the rapidly changing roles of the user in such contexts. A very promising direction for the exploitation of network knowledge in design has been created by the integration of the mathematical studies on the structure and dynamics of complex networks (Eagle et al., 2009; Onnela et al., 2007) and by the increasing awareness of the importance of turning the behavioral and contextual data stored by mobile devices into usable knowledge (Raento et al., 2009).

## 11.3 Societal change: empowering network-based civil society

As an emancipatory tool, MoSoSo is not only used to promote one's self-interest, but also to produce societal change at the level of large-scale social structures (i.e. organization, city, region, country). Specifically, MoSoSo empowers citizens by providing the opportunity to implement a more advanced form of democratic governance based on the principles of free self-organization and active participation in the development of a sustainable information society.

Traditionally, emancipation has been linked with freedom from hunger and degradation and the guarantee of entitlements to physical and social security (Ray, 1993). In the context of the shift towards sustainability, emancipation through digital technologies is not limited to the acknowledgements of traditional rights and duties such as voting and paying taxes, but it also includes all aspects related to the empowerment of active citizenship in a knowledge society. In this sense, MoSoSo offer users a greater degree of autonomy and action from the controlling institutions and organizations. This vision presents severe challenges for its implementation:

> "Transforming the decision making paradigm implies structural systems change. User participation needs to be transformed from reacting to top-down policies to methods of bottom-up, i.e. to proactive deliberation by participating in setting priorities and agendas, in joining the preparatory phase and in the creation of policies. The empowerment of the ICT users and employing of user-pull are the necessary preconditions for evolving the decision making processes from zerosum games to winwin strategies." (Keskinen (1999, p.228).

Despite the challenges, it is useful to reflect on the emancipatory function that mobile devices have had since their early appearance.

By analyzing the power relationship between teens and their parents, Ling & Yttri (2006) found that mobile phones enable teens to move from the sphere of interest of the family to the one of the peer-group. Such process has the potential to undermine family rituals and break forms of traditional solidarity of hierarchical social structures. From a Weberian perspective, power can be interpreted as the chance provided by mobiles to one man or more to "*realize their own will in a communal action even against the resistance of others who are participating in the action*" (Gerth & Mills, 1948 | 2001, p.180).

By enhancing existing forms of mobile communication, MoSoSo has the potential to contribute to a radical change of the structural foundations in information societies by supporting the process of societal re-engineering (Perez, 2002). This study has demonstrated that this potential can be realized by interconnecting citizens in digital communities and by letting them self-organize by creating, sharing and using symbolic and material resources to attain individual and/or collective action goals.

Digital community processes are mostly internal; however, the networked shape of information societies propagates their impact on the other social structures as well. Regarded from a macro perspective, grassroots informal social interactions interconnecting digital communities form a network-based civil society (Viherä, 1999) that acts as the glue between citizens, public and private sector (Figure 37).

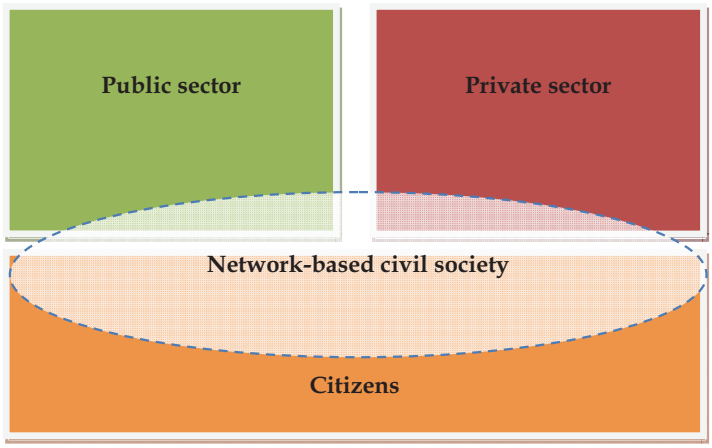


FIGURE 37 Network-based civil society connects social structures

In the traditional sense, civil society typically consists of registered formal organizations. The idea of network-based civil society, however, extends its boundaries also to informal types of social organization that may be based on ad-hoc or long-lasting collaboration for the achievement of goals centered on shared interests, purposes or values.

As it has been argued in the discussion on policy convergence, supporting the emergence of a network-based civil society does not mean only providing an adequate technological platform that enables citizens to interconnect in digital communities, but it also means developing policies and practices that support participation and inclusion. Among them, investing in citizens' communication capabilities (Viherä, 1999) is particularly important.

The concept of *digital divides* (Rice & Katz, 2003b; Warschauer, 2004) can be described as an incompatibility as regards the dimensions of its communication capability. In this respect, incompatibility might emerge in one or more of its main elements, namely access (i.e. technical dimension), competences and motivation (i.e. human dimensions). As illustrated in Article VI, the emergence of an inclusive network-based civil society requires developing policies and technology that aim at minimizing all forms of incompatibility. If this problem is considered from the perspective of cultural computing (Tosa et al., 2005; Rauterberg, 2006; Kooijmans & Rauterberg, 2007; Wang, 2009), understanding the motivational aspects of different generations of ICT users, such as digital natives and digital immigrants, is crucial in establishing bridges among different computing cultures that can enrich each other through mutual cooperation and exchange. In the Article VI, along with the theoretical discussion, the informal learning experience of Finnish communication camps (Viherä, 1999; Lugano, 2003, Article VIII) is presented as a suitable means for developing cultural bridges and interconnecting digital communities.

The acknowledgement of citizens' and communities' central role in the shaping of the sustainable future of the Information Society can be framed in the context of the philosophy of technology (Ihde, 1993; Pitt, 1999; Feenberg, 2000), an area within critical theory (Tyson, 2006) whose goal is "*to understand, evaluate and criticize the ways in which technologies reflect as well as change human life individually, socially and politically*" (Tripathi, 2008). Taking a constructivist approach, Feenberg (1991, 2000), who has done pioneering work in this field, claims that technology can be democratically constructed as part of a program of radical social transformation to reach the goal of 'democratic rationalization'. This objective implies that "*actors intervene in the technological design process to shape it toward their own ends*" corresponding to "*the defence of the conditions of a meaningful life and a liveable environment*" (Tripathi, 2008).

This perspective opposes all types of determinism, both in its technological (Ellul, 1964) and social form (Green, 2002) and supports a more constructivist viewpoint (Berger & Luckmann, 1966). For Tripathi (2008), "*technology is thus neither neutral nor autonomous, but ambivalent: it is always open to alternative developments with different social consequences*". Moving from a social constructivist approach, Communication capability (Viherä, 1999) and the informal learning experience of Finnish communication camps (Viherä, 1999; Lugano, 2003) fit well to the goal of democratic rationalization. Framing the building blocks of policy convergence within the philosophy of technology helps explaining why digital technologies in general and MoSoSo in particular can be regarded as enablers of a form of emancipation.

In conclusion, MoSoSo empowers the user by providing them with a tool which enhances the control over one's life by granting instant access to the resources of digital communities. From this viewpoint, MoSoSo is expected to widen the emancipatory role of the mobile phone in moving from a complex power structure to another (Ling & Yttri, 2006). Hence, MoSoSo might weaken the links to traditional institutions and organizations while deepening the involvement and connection with the digital community, a more flat type of social structure that has its own demands related to the maintenance and extension of credentials for the access and mobilization of social resources.

## 11.4 Economic growth: the end of the end user

The role of CGS in the large-scale context of the global service economy can be analyzed by considering the evolution of the relationship between users and businesses. In this respect, the emancipatory function of MoSoSo is expected to amplify the current trend of *user empowerment* and to contribute to the end of the end user.

The concept of *end user* is connected to the traditional view of users as passive entities that are placed at the end of the value chain as mere consumers of a product or service. In this context, the meaning of end user is market-oriented and does not represent the viewpoint of information systems (Doll & Torkzadeh, 1988), in which end user refers to one or more individuals who operate a piece of software or device, such as MoSoSo. Therefore, from a technical viewpoint MoSoSo users are still end users, but in organizational sense their role is evolving towards the more compressive role of prosumer.

The concept of *prosumer* was suggested in the seventies by McLuhan & Nevitt (1972), pioneers of media convergence who argued that in the successive decades consumers would have evolved also as producers.

In the eighties, Toffler (1980) defined prosumers as users who take part to the process of product and service development, contributing to the increasing demand for personalized products and services. In this conceptualization, prosumers are not necessarily empowered users because their power is limited to the personalization phase and not to decision-making or profit sharing. In other words, organizations remain in control of the whole innovation process.

More recently, these ideas have been elaborated in various manners: for instance, Howe (2006) introduced *crowdsourcing*, an alternative model of outsourcing in which communities of ICT users, the crowds, contribute to product or service development by presenting innovative ideas or solutions to existing problems (Brabham, 2008). The assumption behind crowdsourcing models is that a group of autonomous individuals is likely to take better decisions than single individuals or experts (Lévi, 1997; Surowiecki, 2004) in three main areas: thinking and information processing (i.e. cognition), decentralized coordination and cooperation. Crowdsourcing does not empower users because the initial and final phases of the process are in the hands of companies, who decide the

relevant problems, apply copyrights to the solutions suggested by the crowd and reap the profits.

The crowdsourcing process is an adaptation of the open source development model (Tuomi, 2002) to the needs of the companies where a single individual or a collective group has a problem, which is then broadcasted through personal social networks. Through network interactions, a digital community consisting of individuals who are interested in solving the problem emerges and develops solutions through the social tools for communication, coordination and cooperation. Once a solution is developed, members of the digital community may improve it in time and enjoy collectively its rewards, which are not necessarily economic.

In the early nineties, much before the idea of crowdsourcing, this process was successfully applied by Linus Torvalds for the creation of a free operating system that would become an alternative to commercial operating systems. As Tuomi (2002) observed, when analyzing the case of Linux, the Internet functioned as a platform for community innovation, where a common interest (i.e. creating a free operating system) developed into an ecology of community-centered practices. Hence, the idea of *community of practice* (Wenger, 1998) applies to the digital communities that interconnect and cooperate with a specific common objective.

The explosive growth of the Web 2.0 (O'Reilly, 2005) has ben regarded as a phenomenon of mass collaboration via digital networks with an enormous innovative potential (Howe, 2006; Tapscott & Williams, 2006). Users creatively exploit the Internet for a variety of reasons, such as the creation of new services, the support of the political campaigns of presidential candidates or for revealing scandals and giving them more publicity. All these and other practices demonstrated that groups of interconnected ICT users can today affect local and national politics, have an impact on the media and transform innovation processes in a very rapid manner thanks to the characteristics of the technological medium and to the lack of formal hierarchical structures.

From a business perspective, the exploitation of mass collaboration can produce a considerable competitive advantage. Connecting the prototypical collaborative innovation model of Wikipedia with its economic implications, Tapscott & Williams (2006) describe, with the concept of *wikinomics,* the potential large-scale impact of such model. One of the key ideas of wikinomics is that the success of the innovation process tightly depends on the characteristics of the technology and on the way it is domesticated by the community. This technology is described in terms of *platform for participation*, an alternative wording that resembles Rheingold's concept of *technologies of cooperation* (2002); in both cases, the basis is represented by digital communities.

As an enabler of digital communities, MoSoSo also represents an important enabler of community innovation, provided that its conceptualization and design overcame its current *gadget* function and integrated all the functions needed to support multiple user roles. By supporting informal mobile social networking, the holistic design model (Chapter 8) establishes MoSoSo as a flex-

ible platform for community innovation. Through MoSoSo, ideas can freely circulate in mobile social networks and develop as innovations. Similarly, personal resources shared as social resources acquire value in action contexts.

As Shirky (2008) explained, social software and MoSoSo can contribute to dramatic changes in the power relationships of society, allowing users to *organize without organizations*. Old organizational planning is replaced by new production models based on technology-mediated cooperative processes, which are often established in an ad-hoc manner. Compared to traditional organizational processes, the innovation model of digital communities presents several advantages: first of all, digital communities take shape at a much faster speed and at lower costs; second, they naturally support the emergence of open innovations through the structured, voluntary and ad-hoc aggregation of personal interests and skills.

In the long term, these characteristics might contribute to reshape the power relationship of digital communities with public institutions and private organizations (see also the discussion on societal change in 11.3). Instead of applying new methods, such as crowdsourcing, to achieve the old goal of economic growth, business organizations should develop strategies for developing a synergic and long-lasting partnership with public institutions and network-based civil society for realizing sustainable businesses and participatory forms of democratic governance. In these processes, users and digital communities would not act only as co-creators and co-developers of technological innovations, but also participate more actively in the decision-making and the realization of technological and social innovations.

# 12 CONCLUSIONS

The study investigated the role that MoSoSo, a young and still immature social computing paradigm, has in the multifaceted scenario of digital convergence. MoSoSo and digital communities were regarded as the two key trends lying at the intersection between the technological and social dimensions of digital convergence. It was found that MoSoSo acts as an enabler of digital communities, and digital communities provide a useful perspective to understand MoSoSo, especially in connecting its design to human and social needs. By applying conceptual analysis and design thinking, an articulated conceptualization and holistic design model of MoSoSo were developed and discussed. This contribution provides a motivation to regard MoSoSo as a general purpose social platform for social change rather than as an urban entertainment gadget. As much of this potential is connected to the use of mobile social networks in contextual interaction, integrating the science of networks with interaction design is one of the key challenges of MoSoSo research. Several questions related to MoSoSo research were raised, but could not be answered here. To describe the limitation of this study, an agenda for MoSoSo research is presented. Among the future extensions, the viability of designing MoSoSo for social capital is discussed.

## 12.1 Main contributions of the study

Digital convergence is a recent complex phenomenon affecting individual lives and the functioning of information societies. Throughout the study, it has become clear digital convergence is much more than technological convergence, of which it represents only a powerful enabler.

The study investigated the role that MoSoSo has in the process of digital convergence. Considering the several dimensions of digital convergence, this problem could have been studied within a media, a technological, an economic or a cultural perspective. It was instead approached from the viewpoint of so-

cial convergence because it is interesting and timely relevant. Because of its novelty, the social effects of digital convergence are not yet fully visible even if its technological infrastructure is mature. From a research viewpoint, studying the social aspects of digital convergence is like exploring an unknown territory that may be full of treasures and traps. In this respect, choosing MoSoSo as the main object of study proved to be very challenging because the technology was neither widespread nor well understood and researched. This difficulty, however, also represented an ambitious opportunity: indeed, instead of aiming at a small incremental contribution to an established discipline, the study had the potential to provide an original and innovative insight to develop MoSoSo research and to connect it within the wider context of social computing. In brief, the research challenge presented high risks, but also high gains.

As illustrated in the review, previous research did not adopt a holistic approach to MoSoSo design; rather, it typically evaluated the social impact of MoSoSo prototypes in small scale user studies, inferring from the empirical findings some basic principles and ideas for design. Instead of applying inductive logic, this study developed the theoretical basis of MoSoSo through a deductive approach that combined conceptual analysis (Saariluoma, 1997) and design thinking (Simon, 1969; Saariluoma, 2004 and 2005a; Anderson & Kolko, 2010b). The two methodologies were used to pursue the two primary objectives of the study, namely to elaborate a new conceptualization and a holistic design model of MoSoSo.

The goal of the study was not to contribute with new knowledge to the design of MoSoSo as a technology, but rather to demonstrate the potential of MoSoSo in designing digital communities. Exploring the link between MoSoSo and digital communities, respectively a technological and a sociological construction, increased the complexity of the research because it demanded to examine critically and to combine creatively various areas of knowledge.

The main contributions of the study are three; the first, of sociological nature, maintains that MoSoSo acts as enabler of digital communities by offering the opportunity to maintain or expend one's mobile social network by means of creation, sharing and use of digital resources. The second contribution, represented by the holistic design model of MoSoSo, has direct implications on the development of MoSoSo as a technology. It is argued that user profile, mobile social network and social algorithms represent the three essential building blocks of MoSoSo. To clarify its scope in relation to other social computing paradigms, it is also underlined that MoSoSo is associated to the dimension of everyday informal social interaction in mobile contexts. The third contribution of the study is policy-oriented. It is maintained that all involved stakeholders need to acknowledge users and communities as precious resources for achieving the objective of sustainable lives in sustainable societies. The full value of MoSoSo in digital convergence, represented by its exploitation as an emancipatory tool for social change through CGS, needs to be supported by yet another form of convergence referred to in this study as policy convergence.

Concerning the sociological contribution of the investigation, it has been observed that each historical period contributes with its peculiar features to the evolution of community (Chapter 4). Digital convergence, as one of the key characteristics of the information age, has a transformative effect on the structure, perception and experience of social space in general (Taipale, 2009) and community in particular. This transformation has been described in several ways: boyd (2008) presented social convergence as "*the collapse of disparate social contexts into one*" p.18). This single multiplex social context in which technological and social networks converge, was defined by Sillence & Baber (2004) as the integrated digital community. The term *digital community* was also adopted in this study and provided with a richer characterization. By making access to a social network independent from the technological network in use, the emergence of digital communities put an end to the cyberspace (Pang, 2007). In fact, the offline, online and mobile dimensions of interactions blend into each other forming a single integrated social space. The notion of digital communities was also connected to the model of hybrid space (de Sousa e Silva, 2006; Rheingold et al., 2007; Crabtree & Rodden, 2008; Bilandzic et al, 2009), which contributes with an always-on, ubiquitous and integrated digital layer of social information. As "*class of mobile applications whose scope is to support social interaction among interconnected individuals"* (Article II), MoSoSo lies at the core of this shift towards a hybrid space in which the offline, online and mobile dimensions of interaction gradually overlap.

Although signs of the emergence of digital communities have been documented for years using similar wordings, this study underlines that MoSoSo, especially its latest smartphone-enabled versions, acts as enabler of digital communities. This key function of MoSoSo for communities can be better understood using an analogy from the history of mobile telephony. In the nineties, the mobile phone was regarded as a wireless version of the landline phone and as an enhanced of cordless phones. This technological innovation freed social communication from the "tyranny" of space. By allowing to reach us independently of where we are, mobile devices opened the era of mobile communication. Similarly, MoSoSo is the "wireless" version of the Internet in the sense that it removes the constraints of accessing virtual/online communities and online social networks from a static context (e.g. at home, at work). Through converged digital networks, we can now connect social networks to places and contextual needs. This is the essence of digital community interaction.

The mobile focus of digital community interactions also contributes in providing new meanings to community. It has been argued (Chapter 8) that digital communities extend the meaning of community by means of ad-hoc social ties, which are typically the result of an activation of latent ties by exploiting homophily or heterophily principles (Lazarsfeld & Merton, 1954; Rogers & Bhowmik, 1970; Lin, 2001). The importance of ad-hoc ties in digital community interaction reflects the urgency of satisfying contextual needs, which are often ephemeral. When grounded on ad-hoc social ties, digital communities turn into instant communities. This feature of contemporary communities also reflects

the spirit of the information age, in which everything, not only information, needs to be immediately available for consumption. Paradoxically, digital communities are expected to be most useful when each of us will be forced to consume less (e.g. energy, food, water). In other words, digital communities are expected to be particularly important for the shift towards sustainable lives and sustainable societies characterized by more sober and balanced lifestyles. It is perhaps utopist imagining an altruistic society in which MoSoSo helps people activating latent ties for the satisfaction of basic emotional and material needs. It is more realistic that, in times of crises, people will rely more on the trusted support of strong ties than on that of weak and latent ties. Nevertheless, all types of ties might be useful for mass mobilizations aiming at producing grassroots social change or simply for attaining an individual or collective action goal based on shared interests.

In synthesis, the conceptual analysis of MoSoSo revealed that digital communities are increasingly influencing social lives at micro level and producing grassroots social change at macro level. This trend, already visible in the 'static' Internet, is accelerated by MoSoSo, which allows attaining purposive actions through access to social resources embedded in mobile social networks.

The study did not investigate only the sociological meaning of MoSoSo in the evolution of community. Indeed, the conceptualization of MoSoSo through a community perspective served to derive a design model grounded on human and social knowledge rather than on technological and economic concepts. Although the importance of several strands of research like context-aware mobile computing (Schilit et al., 1994; Dey, 2001; Raento et al., 2005; Ahern et al. 2006; Tang, 2007; Beach et al., 2008; Gay, 2009) and mobile social media (Toivonen, 2007; Multisilta, 2008; Ziv, 2008) was acknowledged, MoSoSo research was more extensively connected to social computing.

One of the main challenges of the study consisted in clarifying the differences and peculiar features of existing social computing paradigms. For this task, MoSoSo was linked to informal mobile social networking, while social software was connected to informal social networking from static interaction contexts. Finally, groupware was regarded as the leading paradigm for formal social interactions (e.g. CSCL, CSCW) in both static and mobile contexts.

The review of MoSoSo (Chapter 5) illustrated the several shortcomings of MoSoSo research. Among them, it was argued that MoSoSo is an emerging but still an immature paradigm of social computing because of the lack of a comprehensive conceptual framework to address the central design issues of MoSoSo. An exception is the critical review of MoSoSo by Thom-Santelli (2007), who analyzed MoSoSo at a conceptual level. Her conclusion was that the design of MoSoSo can and needs to be improved because the potential of MoSoSo cannot be exploited by conceiving and designing such technology as a limited urban entertainment gadget. Depending on the content and contexts of use, entertainment technology has in many cases positive effects on human behavior (Rauterberg, 2004). However, regarding MoSoSo only as an entertainment technology would not allow exploiting its potential in other domains of the every-

day life. In the sudy, the limited conceptual understanding of MoSoSo was described as one of the major reasons for its limited success, both at commercial and at academic level.

The network perspective, already useful for describing digital communities, was adopted for developing a holistic approach to MoSoSo design. It was observed that the two network traditions, namely the mathematical and social approaches to networks, that so far have developed in parallel find a natural converging point in the field of interaction design. The network theory represented a suitable paradigm to integrate theories on technological and social networks for several reasons; firstly, the network approach allows analyzing the social effects of MoSoSo from the perspective of the personal community (Wellman, 1982 and 1996; Wellman et al., 1988); secondly, the social aspects of digital convergence deal with the use of technological networks as social networks (Wellman, 2001); thirdly, research conducted in social network analysis (Wasserman & Faust, 1994; Scott, 2000) and more recently in complex networks (Barabasi, 2002) successfully applied mathematical understanding to model and explained human behavior and social dynamics. Such knowledge is increasingly used not only for advances in the social sciences, but also for the design enhancement of social computing applications. The value of contextual interaction relies on the evolving models of user and mobile social network, which need to be continuously updated by observing and interpreting behavioral patterns and evolving social structures.

Therefore, the application of network theory constitutes the key to develop MoSoSo research in a multidisciplinary manner. It aims, on one hand, to explain the evolution of social structures through the lenses of mobile-mediated social interactions, and, on the other, to enhance mobile-mediated social interactions through the knowledge of evolving social structures.

The network approach allowed grounding MoSoSo on the concept of *mobile social network*, defined as a "*socio-technical concept corresponding to the patterns of interconnection among users emerging directly or indirectly through mobile communication*" (Article III). This approach tackles mobile social networking as a problem of modeling and designing people's interconnections in mobile social networks (Article IV). This problem was decomposed into three sub-areas, which led to the definition of the three building blocks of the design model.

The first problem area concerned the need for inferring user psychological knowledge (Saariluoma, 2004) required to support the variety of individual needs, preferences, experiences and goal orientation. These elements were embedded in the idea of *user profile*, described as a collection of personal and social resources that may be explicitly provided by the user or automatically inferred by MoSoSo.

The second problem area referred to user sociological knowledge (Green et al., 2000; Mc Guigan, 2005), related to the description of structural and relational aspects of digital communities. Considered from the viewpoint of MoSoSo, these issues were discussed by adopting the notion of *mobile social network*, which was developed as a set of interconnected user profiles.

The third problem area concerned the dimensions of digital community interaction, which in MoSoSo corresponds to the idea of mobile social networking. This level deals with the personalization and contextualization of the MoSoSo interface in a way that it can optimally support the user's exploitation of social resources in action contexts. The delicate trade-off between human agency and automation was tackled by introducing social algorithms, a class of procedures and mechanisms that are functionally designed to support the user's cognitive and social tasks. Within this group, the protocols of social connectivity, based on the complementary concepts of homophily and heterophily (Lazarsfeld & Merton, 1954; Rogers & Bhowmik, 1970; Lin, 2001), were found to be particularly important.

The sociological and technological dimensions of the study, which correspond to the interdependent challenges of conceptualizing and designing MoSoSo, were supported by a policy-oriented discussion on the need of policy convergence. The guiding principle of policy convergence states that citizens and self-organizing communities represent a priceless resource for realizing a fairer and more balanced information society with a human face. Therefore, they should not be regarded just in the role of consumers, but rather supported in their role of responsible citizens and creative innovators. By acknowledging the multiple roles of the user, MoSoSo naturally supports community innovation and participatory forms of democratic governance, speeding up grass-root processes and lowering transaction costs. To use this human potential in the shift towards sustainable societies, it is necessary to develop and offer sustainable ICT solutions. The flexible design of the Internet already supports this vision, but mobile devices have not been so far implemented as emancipatory technologies for social change.

The conceptualization of MoSoSo as a general purpose social platform for self-organizing digital communities allows connecting the new generation of mobile technologies to the original nature of the Internet, which is free, decentralized and extremely resilient. Specifically, it is suggested that MoSoSo may have an emancipatory role for digital communities when conceived as a technology supporting self-organization, creation and circulation of knowledge and resources in digital communities. In this context, emancipation through MoSoSo is conceived as an increased capability to act for positive change without the traditional institutional support, but benefiting from the resources embedded in one's social network.

Especially in times of crises, communities prove to be very important thanks to the material and emotional support they provide to their members. In this way, they represent a natural means for letting human organizations persist and positively develop in spite of powerful negative forces, such as diminished support of welfare states or increasing cost of commercial services due to other complex factors (e.g. resource depletion, climate change, globalization dynamics). Although digital communities present new characteristics compared to traditional communities, this key function remains unaltered. As previously discussed, MoSoSo may promote a stronger network-based civil society able to

cooperate with public and private institutions and to assist individual citizens or small social groups in the management of their everyday life. Acting as an amplifier of both positive and negative intentions, MoSoSo, and more generally emancipatory technologies, represent both an opportunity and a thread to traditional decision-making bodies. However, these risks can be minimized by investing now on citizens' lifelong development of communication capabilities (Viherä, 1999) and on the creation of environments based on cultures of trust and freedom rather than on cultures of suspicion and control. The network-based civil society is a network of self-organizing digital communities that can achieve high efficiency by operating at an informal or semi-informal level.

As Shirky (2008) observed, low cost and high speed are the main advantages provided by "organizing without an organization". However, these benefits do not come without costs, which are mostly of a cognitive and social nature. In fact, to exploit the utilitarian dimension of MoSoSo and digital communities, it is necessary to continuously invest in informal social relations, often without knowing the effects of such actions. One should strive to enjoy the positive aspects of serendipity (Eagle & Pentland, 2005), which may represent opportunities for personal or professional development, without ignoring its dark sides. As Counts et al. (2006) suggest, the key principle of MoSoSo design is to realize its potential and to manage its risks. According to boyd (2008), exposure and invasion are two of the most central issues of social convergence that need to be tackled in the design solution. The principles of digital community design, to which the suggested model of MoSoSo design complies with, offer an initial contribution to maximize gains and minimize risks of MoSoSo interaction.

The exploration of the role of MoSoSo in the process of digital convergence has therefore shown that its meaning is connected to digital communities and mobile social networks and that its value for people's lives and global information societies greatly depends on how stakeholders will implement policy convergence.

## 12.2 Limitations of the study

The study has gone some way towards enhancing our current understanding of MoSoSo, which can now overcome its current status of immature paradigm of social computing. However, this does not mean that the suggested conceptualization, design model and support policies represent complete and definitive answer to the problem. Indeed, the study presents several limitations, some of which suggest also directions for future research.

The first limitation consists in the impossibility to develop, test and evaluate a prototype of MoSoSo based on the suggested design model. In other words, only the first three stages of the design thinking process (Figure 3) were applied in this study. The absence of an evaluation of the findings grounded on solid empirical data renders the whole study weaker because the results derived by means of deductive reasoning may sound simply speculative. Howev-

er, developing a conceptual framework and evaluating it empirically would have been unfeasible as an individual research project because requiring more resources, competences and time. When the study was in the planning phase in 2005, it was conceived as a collaborative research project involving public-private partnerships. In that period the Web 2.0 (O'Reilly, 2005) was quickly emerging and the term MoSoSo had been just coined. As natural extension of Internet social networking applications to the mobile context, there were both many open research questions and many expectations around MoSoSo. In particular, it was expected that theoretical knowledge would have contributed to the development of commercial products and services. Although a number of companies such as TeliaSonera and Nokia showed interest for financing the research project, the rapidly changing dynamics of the organizational context of the ICT industry, and a number of misunderstandings and unfortunate coincidences, did not allow conducting the study as a group project. Because the lack of a conceptual framework was recognized as a serious obstacle for the academic and commercial development of MoSoSo, the study was directed to a conceptual contribution, leaving a lot of empirical work as a future extension.

A second important limitation consisted in the choice of approaching the research problem in an interdisciplinary manner in spite of the lack of a research team covering the required areas of expertise. This shortcoming was minimized by devoting a considerable effort to be sufficiently proficient with the research domains involved in the study, which included sociology, social psychology, communication sciences and computer science. The acquisition of new knowledge in these areas considered primary for the investigation, did not allow frequent refreshments of technological competences, which were nonetheless relevant for MoSoSo. A number of courses were taken to develop the necessary competences. In addition, academic experts and practitioners were regularly consulted. However, the quality of the arguments would have benefited by regular meetings with a research team studying the problem from different angles.

A third crucial aspect concerns the fact that the dissertation is centered on the term *digital community*, which was not employed in any of the studies. Indeed, all scientific contributions focused on the concept of mobile social network, mentioning only in Article I the importance of the network perspective to understanding contemporary communities. The contemporary presence of the concepts of *community* and *network* in this study may generate some confusion in the reader. However, during the research it gradually became clear that a model of community had to be integrated into MoSoSo because the combination of technological and social networks represented the key for the description of the evolution of contemporary communities. The discovery of the network analytic perspective (Wellman, 1979, 1982, 1988, 2001a; Wellman et al., 1988; Wellman et al., 2002) provided the link between social networks and community. Instead of introducing a new term, digital community, Wellman's idea of personal community could have been adopted as well. However, the effects of digital convergence on social space (i.e. hybrid social space) and

community (e.g. integrated digital community, mobile content communities) suggested that to explore the role MoSoSo in digital convergence it would have been necessary to first understand the meaning of community in contemporary society. This task, which could have been discussed in the articles, it has instead been developed while writing the dissertation.

A fourth remark concerns the employment of the abstract term *resource* in the development of the design model. As MoSoSo is typically presented as a social awareness application or as a location-based service, other general keywords such as *contextual cue* or more specific references to the *content* of the cue (i.e. user location, status message) could have been adopted. Through these terms, it would have easier to connect this study to existing literature on social context and context-awareness and social media. However, the choice of developing an alternative view of MoSoSo based on the concepts of personal and social resources was motivated by the strong link of such keywords to social theory (Lin, 2001). In this way, the conceptual framework presented in this study offers the opportunity to develop a sociological theory of digital communities, for instance through the integration of the MoSoSo conceptualization with social capital literature (Bourdieu, 1986; Coleman, 1988; Portes, 1998; Putnam, 2000; Burt, 2000; Lin, 2001).

A fifth limitation concerns the egocentric orientation of the suggested design model for MoSoSo. As it has been underlined in the study (Chapter 5 and 8, Study III), MoSoSo can be designed choosing the collective group as its structural unit. This choice seems more suitable for discussing digital community design because communities are typically connected to common needs, attitudes and backgrounds. This aspect, which corresponds to the communitarian dimension of mobile virtual communities (Rheingold, 2003) has not been developed much in the study and remains one important area to explore in future research. Specifically, it should be investigated which changes to the design model of MoSoSo are necessary to acknowledge mobile virtual communities as well. In this study, the egocentric perspective was utilized because digital communities were regarded as an extension of personal communities (Wellman, 1982 and 1996; Wellman et al., 1988), which provide an egocentric view of the social world. However, in Chapter 7 it was suggested that the three building blocks of MoSoSo would be suitable for both egocentric and communitarian MoSoSo. Although there is no need of additional concepts, the communitarian design model of MoSoSo would replace individual user profiles with collective user profiles whose attributes are automatically shared among all members of the collective group. In other words, joining a collective group would automatically turn part of members' personal resources into social resources shared as a commons. Social algorithms, instead of paying attention to individual interaction patterns, would need to take into account the dynamics of the collective group and assess the partial interaction goals of its members in relation to the major collective goal.

In addition to these major limitations, a number of additional choices could have improved the quality of each single article.

In Article I, an alternative choice of MoSoSo to evaluate could have been taken. Although both social proximity and social awareness applications were selected, the class of SMS-based MoSoSo was not included in the study. The choice was motivated by the fact that this class of applications was regarded as a MoSoSo's ancestor, mainly connected to rich-media applications supported by smartphones. In Article II, the analysis of the potential macro implications of MoSoSo adoption would have been stronger with the help of some future research methods, such as future workshops, or taking a qualitative approach, for instance interviewing leading experts of social media. Also, the relations of MoSoSo with social software and groupware could also have been analyzed more precisely in that article: in fact, although the analysis is detailed and articulated, the boundaries between social software and groupware are not very clear. The improvement of such understanding would have led to a better definition of MoSoSo. In Article V, the conceptual model of privacy management would have been more complete with a basic evaluation of the solution, for instance through a laboratory test with a few selected test users.

All in all, the study could have been improved in many ways both in its general structure and in the more specific contributions. Time matters and the many challenges connected to the development of an individual research project over several years required taking some decisions, such as to publish a still somewhat incomplete but yet significant contribution for the domain of MoSoSo research, which has not progressed much since the beginning of the research project. As a positive side, the awareness of the limitations of the study suggests many useful directions for its enhancement in future investigations.

## 12.3 An agenda for MoSoSo research

The study adds substantially to our current understanding of the theoretical basis of MoSoSo through a novel conceptualization, a comprehensive design model and a list of support policies regarding digital community interactions.

Although the study is limited in several ways, its weaknesses do not only correspond to aspects of the whole research project that could have been improved, but also to areas that have been only superficially explored and analyzed despite their importance. This research has thrown up many questions in need of further investigation. An agenda for MoSoSo research would contribute to extend and integrate the knowledge acquired through this study. In particular, the study would have benefited both from theoretical and practical extensions, which respectively contribute towards the development of the complementary conceptual and practical knowledge.

At a practical level, further research in this field should address the four stages of the design thinking process (Figure 3) that were not explored in this study. In particular, a domain of investigation could be chosen and analyzed from the perspective of digital communities. At this point, a prototype of MoSoSo will be implemented by applying the design model and developed in a

participatory manner by involving the users in the research project. In this way, the designers can continuously learn and improve the technical prototype, providing insight also to the refinition of the theoretical basis of MoSoSo. In addition, once a satisfactory implementation of MoSoSo is obtained, its commercial exploitation might also be considered, together with the legal aspects involved. An interesting and relevant area to which apply the theoretical insight of MoSoSo is the emerging market of *green* products and services, which follows the citizens' need and desire to contribute to the safeguarding of the natural environment. This issue was addressed in Article VII.

At a conceptual level, the theoretical foundations of MoSoSo can be refined and extended in several ways. Firstly, the foundations of the design model for MoSoSo could be strengthened by integrating in the conceptualization of MoSoSo the theory of social capital (Bourdieu, 1986; Coleman, 1988; Putnam, 1993 and 2000; Portes, 1998; Burt, 2000; Lin, 2001). This extension, which would describe the utilitarian dimension of community, is discussed in 12.4.

Secondly, a more thorough investigation is needed to understand mobile virtual communities (Rheingold, 2003) and to incorporate such knowledge in the general conceptual framework of digital communities. Intuitively, mobile virtual communities and mobile social networks represent the communitarian and the egocentric sides of mobile-mediated access to digital communities. The two forms of digital community are grounded on the power relationship that exists among the two social units of MoSoSo, namely the individual user and the collective group (see 5.4.8 and 10.4.8). In relation to the discussion on community, the concepts of aesthetic and ethical community (Bauman, 2001a) might be employed as a basis for mobile social networks and mobile virtual communities. As MoSoSo dynamically reconfigures the personalized aspect of social structure according to user's action goals, it can be deduced that mobile social networks typically correspond to aesthetic communities in which self-interest prevails. Mobile virtual communities, on the other hand, are ethical communities because they are not grounded only on the sharing of digital content. Instead, they rely on shared values or goals, which are necessary for the collective group to collaboratively achieve a common objective. The integration of both egocentric and communitarian dimensions in MoSoSo has an important implication, which concerns the acknowledgement of different models of access, sharing and use of social resources. Specifically, while in the egocentric model the decision about which personal resources to share as social resources lies with the individual user, in the communitarian model adhering to the collective might require the user to automatically share personal resources as social resources, or *commons*. The types of control on digital resources differ according to the forms of commitment that the different models of aesthetic and ethical communities present.

Thirdly, as the concept of *digital resources* (personal and social) is central to the design model of MoSoSo, the development of an ontology of digital resources is an important and perhaps necessary improvement of the model. In this respect, it is not sufficient to describe only the relationships among them in

technical terms (e.g. textual, audio, still image, multimedia resource), but especially their social significance in terms of usefulness and risks in MoSoSo-mediated interactions. Such significance might represent the value of the resource in a specific action context, which may be explicitly and dynamically characterized in terms of virtual currency.

Fourthly, it is suggested that the significance of MoSoSo in the context of mobile communication systems is further analyzed through the lenses of scalability in mobile social system (see 5.4.7 and 10.4.7), which needs to be explored both in its horizontal and vertical dimensions. It is likely that the focus of mobile communication systems may remain anchored to interpersonal and small group communication, which would therefore represent the dimension of ordinary social interaction. However, the most profound meaning of mobile communication systems is likely to be associated to the enhanced capacity of instant and ad-hoc large-scale mobilizations. Not being so common, such mobilizations would represent the dimension of extra-ordinary social interaction, which may be particularly useful in cases of emergencies, political protests, distributed problem-solving or urban social gaming.

Fifthly, to better understand MoSoSo adoption, a more systematic investigation of its user psychological aspects is needed. The study has described the different motivational aspects that may be associated with the two computing cultures of digital natives and digital immigrants (Prensky, 2001). The creation of inter-generational bridges is an important requirement of sustainable and inclusive information societies. This may be addressed by adopting human-technological approaches (Saariluoma, 2005b) to minimize incompatibility in communication capabilities (Viherä, 1999).

Last but not least, it is strongly recommended to constantly update the introduced model on the basis of the new technological trends that are likely to lead to the emergence of new paradigms of social computing. This study has functionally analyzed the technological aspects of digital convergence from the perspective of their social consequences. In this way, digital technologies were associated to the trend of social convergence, "*the collapse of disparate social contexts into one*" (boyd, 2008, p.18) and to the model of the integrated digital community (Sillence & Baber, 2004).

As we are starting to understand these concepts, the new frontiers of social interaction are already materializing. Specifically, the integration of ubiquitous computing (Weiser, 1991) with human-agent interaction (HAI) (Lewis, 1998) may lead to the emergence of ubiquitous social software (UbiSoSo) as the next paradigm of social computing. Similarly to MoSoSo, UbiSoSo refers to a class of applications supporting interactions in mobile contexts. However, UbiSoSo would additionally acknowledge the dimension of agent-mediated communication (i.e. agent-to-agent and agent-to-human interactions). By integrating social algorithms, the model of MoSoSo design introduced in this study can be easily extended and evolve as model of UbiSoSo design. In fact, the function of social algorithms was described in relation to the degree of automation that MoSoSo may provide in the use of digital resources in a specific action context.

UbiSoSo emerges when the decision-making is systematically automatic and delegated to agents based on advanced and intelligent forms of social algorithms.

Building on the existing definition of MoSoSo, UbiSoSo may be preliminarily defined as a class of mobile applications the scope of which is to support social interaction among interconnected individuals and objects. A critical and almost philosophical issue embedded in this definition concerns whether agent-to-agent and agent-to-human interactions could be included within the realm of social interactions. Considering that several studies already have defined human-robot interactions as social interactions (Gockley et al., 2004), it is likely that in the future it may become increasingly common to directly interact with a person or with an agent acting on his/her behalf, or delegating such tasks to a personal agent. For these reasons, the new dimensions that UbiSoSo would add to social computing may also imply a further evolution in the sociological understanding of community and an extension to network theories. It is not possible to predict when UbiSoSo will emerge, but it may be argued that its appearance may be associated to the next wave of Internet technologies, which might be labeled *Web 3.0*. There is already an ongoing discussion of the concept of the Web 3.0 (Silva et al., 2008; Hendler, 2009; Cena et al., 2009); its essence seems to be captured by a new form of technological convergence, which would bring together the *social web* and the *semantic web* (Berners-Lee et al., 2001) to form the *social semantic web* (Gruber, 2008; Breslin et al., 2009).

## 12.4 The opportunity of designing MoSoSo for social capital

These findings suggest several courses of action for future research. Among them, the most relevant is the refinement and development of the theoretical basis of MoSoSo. The design model of MoSoSo is grounded on the concepts of personal and social resources, which are generally important in social theory and particularly central in the network theory of social capital (Lin, 2001).

Social capital has emerged in the last decades as a central property of communities (Bourdieu, 1986; Coleman, 1988; Putnam, 1993 and 2000; Portes, 1998; Burt, 2000; Lin, 2001). Similarly to community, social capital is a controversial concept, with several definitions and conceptualizations. Originally developed within sociology, the term has been adopted in political science as a useful tool for policy-making. In particular, Putnam (1993 and 2000) connected social capital to civic sense and democracy, defining it as "*features of social organisation, such as trust, norms and networks that can improve the efficiency of society thus facilitating coordinated actions*" (p.167). Analyzing social capital indicators in American society, Putnam (2000) concluded that social capital had been decreasing since the end of World War II, implying a crisis and decline of the importance of communities in contemporary American society. Studies on virtual, online and mobile communities (Chapter 4) suggest that communities have not lost their significance. The decline observed by Putnam (2000) depends from his

definition of community. Indeed, he associated social capital to local communities (Tönnies, 1887|1967), ignoring all successive and emerging forms of community. If the model of community had acknowledged the dimension of virtual communities, the results would have been probably different. Specifically, he could have discovered that only part of social capital is formed and developed locally through offline interactions and that increasing amounts are generated online. A number of studies have demonstrated that ICT contributes to social capital (Blanchard & Horan, 1998; Kavanaugh & Patterson, 2001; Quan-Haase & Wellman, 2004; Katz & Rice, 2003 & 2004; Ling, 2008)

Social capital is therefore becoming increasingly relevant in digital communities because ICT play an important role in the support and mediation of people's social world. The observation that "*society got more technical, while software got more social*" (Davis, 2003, p.6) is a strong indicator of the interplay between social computing paradigms, such as MoSoSo, digital communities and social capital. The early elaborations of social capital (Bourdieu, 1986; Coleman, 1988) are too complex to be effectively integrated to the conceptual framework of MoSoSo introduced in this study. Putnam's approach (2000) is not adequate either because it is grounded on a traditional view of local community. Although networks are central in all conceptualizations of social capital, their function is clearly expressed only in the network theory of social capital (Lin, 2001). In this view, social capital is defined as "*resources embedded in a social structure that are accessed and/or mobilized in purposive actions*" (p.41). Adopting a network approach, Lin (2001) presents a model of social capital that can be easily applied to personal communities and, therefore, also to digital communities.

The findings of the study explicitly refer to social capital several times (Articles II, III, VI and VII) in various contexts. However, the complexity of the topic has not allowed integrating the network theory of social capital (Lin, 2001) with the conceptual framework of digital communities and MoSoSo. Further research regarding the role of MoSoSo for social capital would help in strengthening the link between human and social knowledge and technology design. The principle of *designing for social capital* (Article II) could form a sustainable alternative to the implicit principle of designing for economic capital currently followed by businesses. The strategies of public institutions are already oriented towards citizens' development of human and social capital; integrating social capital in technology design would offer businesses an opportunity to shift from economic to social capital models. As all forms of capital are interdependent and can be converted from one to another (Bourdieu, 1986), social capital would represent a converging element for public and private organizations. Therefore, economic capital might be accumulated also as a side-effect of strategies focusing on social capital. The profit-oriented nature of private organizations would not need to change, but simply to evolve to more sustainable models. In this sense, CGS and the idea of transactions based on virtual currency between digital communities, and between digital communities and organizations (Article VII), might be a possible direction for materialization of the utilitarian dimension of social capital managed through MoSoSo.

## 12.5 Final remarks

In the opening chapter, the main research question of the study was presented. Taking a social perspective, MoSoSo was first associated to digital communities. Then, its function was discussed in relation to the significance of digital communities in people's lives and functioning of societies and businesses. It was argued that the key role of MoSoSo consists in exploiting digital convergence for the realization of sustainable futures. Specifically, MoSoSo allows complementing traditional top-down approaches to decision-making and societal transformation with quick and inexpensive grassroots social action. Although this is only one possible interpretation for MoSoSo and related technologies, it is the right moment to invest in this view. Especially now that we are searching for sustainable solutions to transform the ongoing global crises into an opportunity for renewal, we should truly empower citizens and communities through an emancipatory technology like MoSoSo. In the short-term, the empowerment of a network-based civil society may challenge traditional political and economic thinking. Despite the possible adverse side-effects, governments and businesses are required to reshape their structure, role and functioning to persist. Precisely, they should apply long-term *resilience thinking*, an approach that

> "offers a different way of understanding the world around us and of managing our natural resources. It explains why greater efficiency by itself cannot resolve our resource issues, and it offers a constructive alternative that creates options rather than limits them" (Walker & Salt, 2006 p. XIII).

Although Walker & Salt (2006) connected resilience thinking to natural resources, we could generalize his insight by regarding resilience thinking within social computing as a form of design thinking (Simon, 1969; Saariluoma, 2004 and 2005a; Anderson & Kolko, 2010b) oriented towards the goal of sustainability. The holistic model of MoSoSo design introduced in this study is coherent with resilience thinking. Indeed, its structural building blocks, user profile and mobile social network, are grounded on the concept of digital resources. The mobilization of symbolic and material resources through MoSoSo could be employed, for instance, to minimize the impact of a collective problem like depletion of natural resources in our lives. It is a big challenge to design MoSoSo as a platform for social change. Much bigger, however, is the challenge of behavioral change required by all of us to enjoy sustainable lives in sustainable societies.

# YHTEENVETO (FINNISH SUMMARY)

Olemme kaikki oman elämämme suunnittelijoita. Toteamus voi kuulostaa yllättävältä, mutta se muistuttaa meitä siitä, että ihminen on oman tulevaisuutensa tekijä. Jokaisen aikakauden historiassa ihmiset ovat luovasti suunnitelleet tekniikkaa täyttämään omat tarpeensa. Aikaamme, joka tunnetaan myös informaation aikakautena, kuvataan usein tietokoneiden ja mobiililaitteiden käytöllä. Tietotekniikka on nopeasti tullut välttämättömäksi osaksi arkeamme. Viestintävälineet auttavat meitä muun muassa lieventämään etäisyyttä perheestä ja ystävistä; ne mahdollistavat työmme ja vapaa-aikamme joustavan hallinnan sekä henkilökohtaisten aikataulujemme ja tapaamistemme uudelleen järjestämisen; ne tarjoavat myös nopean ja edullisen pääsyn tietoon riippumatta ajasta ja paikasta. Epäilemättä tietokoneet ja mobiililaitteet tekevät elämästämme helpompaa. Kuitenkin ratkaisut ja parannukset olemassa oleviin ongelmiin ovat tuoneet meille uusia haasteita, jotka johtavat jatkuvaan ongelmien ja ratkaisujen uudelleen muotoiluun. Tieto- ja viestintätekniikan (ICT) sosiaaliset vaikutukset eivät ole ainoastaan myönteisiä: julkisen ja yksityisen tilan väliset rajat ovat häipymässä ja asettavat uusia haasteita yksityisyydelle. Jatkuva online-tila tuo mukanaan liiallisen informaation riskin ja vastaavasti irrottautumisen halun; identiteetti kehittyy lisääntyvässä määrin virtuaaliyhteisöjen ja sosiaalisten online-verkostojen kautta. Näitä kehityssuuntia on melko vaikea havaita, ymmärtää ja selittää vain yhden teknososiaalisen alueen avulla. Kun tarkastellaan niitä suhteessa moninkertaisiin konvergoituneisiin digitaaliverkkoihin, on niiden arviointi on vieläkin haastavampaa.

Digitaalinen konvergenssi on yleensä rinnastettu tekniseen konvergenssiin, koska verkot ja erityisesti laitteet ovat konvergenssin näkyvin osa. Viime vuosina tietokoneet ja mobiililaitteet ovat yhä enemmän lähentyneet toisiaan mahdollistaen pääsyn mediasisältöön, ihmisiin ja palveluihin kaikkialla. Kannettavat tietokoneet ovat pienempiä ja lähempänä kämmentietokoneita. Samalla matkapuhelimista on tullut kannettavia tietokoneita. Kuitenkaan digitaalista konvergenssia ei tule pitää synonyyminä tekniikan konvergenssille, sillä monitahoinen konvergenssin käsite kattaa teknologiset, taloudelliset, kulttuuriset ja sosiaaliset ulottuvuudet. Itse asiassa varhaiset sosiaaliset ja kulttuuriset vaikutukset syntyvät, kun konvergoituneen digitaalisen ympäristön tekninen infrastruktuuri saavuttaa kypsyytensä. Näin ollen tutkimuksen tarkoitus oli selvittää vuorovaikutusta digitaalisen konvergenssin teknologisten ja sosiaalisten ulottuvuuksien välillä mobiilin sosiaalisen ohjelmiston näkökulmasta (MoSoSo).

MoSoSo on digitaalisen konvergenssin teknologinen tuote yhdistettynä mobiililaitteiden käyttöön epävirallisissa sosiaalisten verkostojen vuorovaikutustilanteissa. Vaikka puhelut ja tekstiviestit ovat edelleen mobiililaitteiden tärkeimmät sosiaaliset toiminnot, yhä useammat ihmiset käyttävät matkapuhelintaan sähköpostin sekä pikaviestien lähettämiseen tai sosiaalisen median palveluihin pääsyyn netissä. Nämä ovat suosituimmat MoSoSo:n muodot, jotka sisältävät myös vähemmän tunnettuja, mutta erittäin tärkeitä välineitä, joilla voi-

daan löytää ja olla vuorovaikutuksessa sellaisten paikallisten ihmisten kanssa, joilla on samanlaiset tai yhteneväiset kiinnostuksen kohteet (esim. sosiaalisen läheisyyden sovellukset), tai laittaa liikkeelle suuria ihmisryhmiä (esim. smartmobs / flashmobs ). MoSoSo on myös median luomista ja jakamista yhdessä tapahtumakokemuksien lisäämiseksi tai osallistumiseksi innovaatioprosesseihin (esim. mobiili sosiaalinen media). Näitä termejä ja muita, kuten Mobile 2.0, käytetään nykyään kuvaamaan erilaisia mobiili-välitteisiä sosiaalisia vuorovaikutuksia, jotka kaikki kuuluvat tässä tutkimuksessa yleisen MoSoSo-käsitteen alle. Kehittyneestä teknologisesta infrastruktuurista huolimatta, MoSoSo:n mahdollisuuksia ei ole tähän mennessä laajalti huomattu. MoSoSo:n teoreettiset perustat eivät ole selviä, sillä sekä akateemiset, että kaupalliset näkökulmat esittävät erilaisia suuntauksia. Tutkimukset MoSoSo:sta ovat yleensä alustavia, eivätkä ne ole vielä tuottaneet yleistettäviä tuloksia. MoSoSo kärsii myös alhaisesta käyttöönotosta, johon on vaikuttanut muun muassa MoSoSo:n vähäinen hahmottaminen urbaanina ja eksklusiivisena viihdelaitteena. MoSoSo:lla ei ole omaa identiteettiä, koska käyttäjiltä puuttuu perusteltu yhteinen näkemys sen tekniikasta ja laajuudesta.

Nykyiset puutteet täsä tutkimuksessa antoivatkin voimakkaan motivaation tutkia syvemmin MoSoSo:a, jotta ymmärrettäisiin sen rooli digitaalisen konvergenssin prosessissa. Aihetta lähestyttiin yhdistämällä kaksi tutkimusmenetelmää, käsiteanalyysi (Saariluoma, 1997) ja suunnitteluajattelu (Saariluoma, 2004 ja 2005), jotka mahdollistivat selkeän hahmottamisen ja kokonaisvaltaisen suunnittelumallin MoSoSo:lle. Teoriaa ja käytäntöä yhdistämään käytettiin viestintävalmiuksien mallia (Viherä, 1999)., Viestintävalmiuksien mallia käytettiin myös kuvaamaan sitä emansipoivaa roolia, joka MoSoSo:lla voisi olla siirtymisessä kestäviä tietoyhteiskuntia kohti edellyttäen että on olemassa oikealla tavalla tukevaa politiikkaa.

Kirjallisuuskatsauksen yhteydessä todettiin, että sopivan käsitteellisen kehyksen puute on yksi suurimmista esteistä MoSoSo:n mahdollisuuksien toteutumiselle. Johtuen ongelman teoreettisesta luonteesta, sen ratkaisemiseksi valittiin deduktiivinen lähestymistapa, joka perustuu käsiteanalyysiin.

Sosiologisesta näkökulmasta MoSoSo on mielenkiintoinen kohde tutkia, koska se tarjoaa mahdollisuuden seurata ja ymmärtää uusia tapoja, joilla ihmiset ymmärtävät ja kokevat sosiaalista tilaa. Kuten Taipale (2009) väittää, mobiili- ja internet-sovellusten synergisellä käytöllä on muokkaava vaikutus sosiaaliseen tilaan. Useat tutkijat ovat ottaneet käyttöön termin *hybridi sosiaalinen tila*. Se on sosiaalisen tilan uusi kehittyvä muoto, joka yhdistää fyysisen ja digitaalisen tilan ja integroi mobiiliverkot sekä sosiaaliset on-line-verkot kasvotusten tapahtuvien vuorovaikutusten kanssa. Yhteiskunnallisen viestinnän muuttuneena tilana hybridi sosiaalinen tila johtaa myös yhteisön uuteen näkökulmaan, jota tässä tutkimuksessa kutsutaan *digitaaliyhteisöksi*. Lähentyminen ja yhdentyminen ovat digitaaliyhteisön keskeisiä piirteitä, joilla on uusia ominaisuuksia perinteisempiin yhteisöihin verrattuna. Klassinen Gemeinshaftmalli (Tönnies, 1887 | 1967) ei sovellu kuvaamaan digitaaliyhteisöjä, sillä ne eivät välttämättä perustu paikallisiin yhteiskunnallisiin solidaarisuussiteisiin, jotka syntyvät per-

he- tai sukulaissuhteista. Digitaaliyhteisöt rakentuvat yhteisöjen verkosto-analyyttiselle näkökulmalle (Wellman, 1979, 1982, 1988, 2001a; Wellman et al., 1988; Wellman et al., 2002), joka keskittyy muuttuviin yhteiskuntarakenteen malleihin. Digitaaliyhteisöt laajentavat henkilöiden yhteisöjä, digitaalisen jakamisen prototyyppisen toiminnan kautta, lisäämällä uusia suhteita (esim. piilevät siteet), vuorovaikutuksen muotoja (esim. ad-hoc siteet) ja viestintäasteikkoja (esim. monen suhde moneen). Analysoimalla miten digitaalinen konvergenssi muuttaa yhteisöä, on mahdollista ottaa huomioon verkoston näkökulma ja hahmottaa MoSoSo:a mobiilisovellusten luokkana, jonka tarkoitus on tukea epävirallista mobiilia sosiaalista verkostoitumista. Tukemalla mitä tahansa sosiaalista suhdetta, MoSoSo:n yleinen tarkoitus on olla sosiaalinen foorumi kontekstuaaliselle vuorovaikutukselle. Verkostolähestymistapa auttaa liittämään tutkimuksen MoSoSo:sta verkko- eli graafiteoriaan, sosiometriaan ja monimutkaisiin verkostoihin, ja selkeyttämään MoSoSo:n suhdetta groupware-ohjelmistoihin ja sosiaalisiin ohjelmistoihin, eli näihin muihin kahteen keskeiseen sosiaalisen tietojenkäsittelyn paradigmaan.

Soveltamalla suunnitteluajattelua (Saariluoma, 2004 ja 2005a), MoSoSo:n hahmottaminen oli lähtökohtana kehittää kokonaisvaltainen kolmitasoinen suunnittelumalli. Yksilötasolla käsitellään käyttäjän kuvausta henkilökohtaisten ja sosiaalisten resurssien kokoelmana (eli käyttäjäprofiilina). Resurssit ovat aineellisten tai aineettomien hyödykkeiden digitaalisia kuvauksia, joilla on arvo toiminnan yhteydessä. Digitaalisen jakamisen avulla voidaan jakaa henkilökohtaisia resursseja sosiaalisina resursseina, ja näin yhdistää käyttäjiä toisiinsa. Tästä seuraa, että mobiilin sosiaalisen verkon sosiaalisessa tasossa on kyse toisiinsa yhdistyneistä käyttäjäprofiileista. Sosiaaliset suhteet kuvataan siis sosiaalisiin resursseihin pääsyllä ja jakamisella. Vuorovaikutustasolla, joka koskee näiden resurssien käyttöä tietyssä kontekstissa, kuvataan miten MoSoSo voi helpottaa kontekstuaalisia vuorovaikutuksia sosiaalialgoritmien kautta, eli menettelyjä, joissa otetaan syötteenä käyttäjän käyttäytymistietojen, sosiaalisen verkon tietojen ja asiayhteystietojen yhdistelmiä, jotka muodostavat henkilökohtaisen MoSoSo -rajapinnan.

Tämän jälkeen MoSoSo:n hahmottaminen ja suunnittelumalli liitettiin digitaalisen yhteisön suunnittelun laajempaan merkitykseen, jonka tulee käsittää inhimilliset ja sosiaaliset tarpeet ennen teknisiä sekä liiketoiminnallisia näkökohtia. Näin saatiin ehdotettu suunnittelumalli MoSoSo:n vuorovaikutuksen riskien ja hyötyjen näkökulmasta. Kustannusten minimoimiseksi ja hyötyjen maksimoimiseksi otettiin käyttöön digitaalisen yhteisön suunnittelun kahdeksan periaatetta: ensiksi MoSoSo olisi suunniteltava yleiskäyttöisenä, sosiaalisesti skaalattavana, viestintävälinerajojen ylittävänä ja täydellisenä sosiaalisena tietoalustana. Sen olisi myös edistettävä itseorganisointia sekä desentralisointia, ja tarjota sosiaalisen tiedottamisen suurentajia ja pienentäjiä. Lisäksi MoSoSo:n pitäisi aikaansaada luottamusta vaatimalla käyttäjiltä heidän todellista henkilöllisyyttään, mutta sen pitäisi myös sallia useiden virtuaalisten identiteettien luomista ja käyttämistä. Lopuksi MoSoSo:n pitäisi tukea sosiaalisen maailman yksilöllistä tai yhteisöllistä näkökulmaa digitaaliyhteisön tarpeiden mukaan.

Digitaaliyhteisön suunnittelun periaatteita käytettiin MoSoSo:n roolin arvioimiseksi siirryttäessä kestäviin tietoyhteiskuntiin. Vaikka MoSoSo auttaa yhteisön perinteisen käsityksen laajentamisessa useilla uusilla ominaisuuksilla, se ei merkittävästi muuta perinteistä yhteisön roolia ihmisten elämässä ja globaaleissa yhteiskunnissa. MoSoSo:n ensisijaiseen rooliin digitaalisen konvergoitumisen prosessissa kuuluu nimenomaan se, että kansalaiset saavat vapaasti organisoida itse digitaaliyhteisöjä. Tämä tarjoaa tehokkaita keinoja, joiden avulla voidaan helposti ja nopeasti luoda, jakaa ja hankkia symbolisia ja aineellisia resursseja, joilla on mahdollista saavuttaa yksilöllisiä ja/tai yhteisiä tavoitteita toiminnassa. Lisäksi MoSoSo antaa digitaaliyhteisöille emansipoivan roolin, koska se on joustava sosiaalinen foorumi yhteisöstä syntyvien palvelujen yhdessä luomiselle ja tarjoamiselle (CGS). Nopeiden, helppojen ja halpojen yhteisiin yhteisön resursseihin pääsyjen ansiosta tämä on kestävä systeemi, joka vahvistaa niiden kansalaisten joustavuutta, jotka joutuvat selviytymään julkisten ja yksityisten palvelujen luotettavuuden vähenemisestä ja nousevista kustannuksista. Suurten sosiaalisten rakenteiden tasolla MoSoSo:sta voi tulla tehokas väline valtuuttaa sellainen verkostopohjainen kansalaisyhteiskunta, joka osallistuu aktiivisemmin innovaatioprosesseihin ja yhteiskunnan muutoksiin. Tutkimus väittää myös, että kaikkien sidosryhmien hyväksymä toimintatapojen/mallien kehittäminen on keskeinen edellytys tämän arvon toteuttamiseksi. Toimintatapojen/mallien kehittämisessä tulee pitää kansalaiset ja yhteisöt kestävän kehityksen keskeisinä resursseina ja toteuttaminen edellyttää panostamista kansalaisten viestintävalmiuksien kehittämiseen (Viherä, 1999).

Tutkimuksessa laajennetaan MoSoSo:n nykyistä käsitystä tarjoamalla kattava käsitteellinen viitekehys: tutkijat voivat käyttää viitekehystä kehittääkseen tutkimusta MoSoSo:sta ja julkiset sekä yksityiset organisaatiot toteuttaakseen kestäviä ratkaisuja CGS:n perusteella. Tämä esitys korostaa, ettei MoSoSo:a voida enää pitää pelkästään viihteen välittäjänä, vaan pikemminkin teknisenä alustana yhteiskunnalliselle muutokselle. Suurin osa tästä potentiaalista liittyy mobiilien sosiaalisten verkostojen käyttöön kontekstuaalisessa vuorovaikutuksessa, siksi verkostojen, tieteen ja vuorovaikutteisuuden suunnittelun yhdistäminen on yksi MoSoSo-tutkimuksen merkittävimmistä haasteista. Tulokset osoittavat uusia suuntia tulevalle tutkimukselle: nämä ovat esitetty MoSoSo:n tutkimuksen esityslistalla. Muun muassa haaste suunnitella MoSoSo sosiaalista pääomaa varten vaikuttaa lupaavimmalta teoreettiselta laajentumiselta, sillä se mahdollistaisi MoSoSo:n vuorovaikutuksen kontekstuaalisen arvon sijoittamista sosiaalisen pääoman teoriaan (Bourdieu, 1986; Coleman, 1988; Putnam, 1993 ja 2000; Lin, 2001). Tämä laajentuminen tarjoaisi myös materiaalia digitaaliyhteisön sosiologisen teorian kehittämiselle. Suunnittelun näkökulmasta ehdotetun suunnittelumallin empiirinen arviointi erityisessä kontekstissa olisi luonnollisin jatko tälle tutkimukselle.

Kun käyttäjät voivat helposti olla yhteydessä toisiinsa ja itse järjestää digitaaliyhteisöjä hyödyntääkseen konvergoituneita digitaaliverkostoja yksilöllisten ja/tai yhteisten tavoitteiden saavuttamiseksi, heistä tulee entistä luovempia ja vastuullisia oman tulevaisuutensa "suunnittelijoina".

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# APPENDIX A : COMMUNICATION CAMP QUESTIONNAIRE

Participant name _____

Gender Male Female
Age _____
Nationality _____
Occupation _____
Email _____
Telephone number _____

Please write a list (name, surname) of people you know and are participating to the Communication Camp in Heinola. If you are participating for the first time or you don't know anybody, you can also leave the table empty.

| Best Friends | Friends | Acquaintances | Acquaintances |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

How often do you meet with the following groups during the year?

| | Very Seldom | Once a Month | Once a Week | More Times a Week | Everyday |
|---|---|---|---|---|---|
| **Family** | | | | | |
| **Partner** | | | | | |
| **Friends** | | | | | |
| **Acquaintances** | | | | | |
| **Work Colleagues** | | | | | |
| **Strangers** | | | | | |

How good is the quality of communication using the following means? Please rate from 1 (not good at all) to 5 (very good) according to your preferences.

| | Face to face | Letter/ Postcard | Email | Phone call | SMS/MMS | IM / Chat |
|---|---|---|---|---|---|---|
| **Family** | | | | | | |
| **Partner** | | | | | | |
| **Friends** | | | | | | |
| **Acquaintances** | | | | | | |
| **Work Colleague** | | | | | | |
| **Strangers** | | | | | | |

How often do you use the following ways of communicating with your contacts?

| | Never | Seldom | Sometimes | Often | Everyday |
|---|---|---|---|---|---|
| **Face to face meeting** | | | | | |
| **Post (letter, postcards…)** | | | | | |
| **Email** | | | | | |
| **Landline phone** | | | | | |
| **Mobile Phone** | | | | | |
| **Instant Messaging (MSN, ICQ, Skype)** | | | | | |
| **Online Communities (Friendster, Orkut…)** | | | | | |

How many of the following do you receive, in average, every day?

| | 0 | 1-3 | 3-5 | 5-10 | > 10 |
|---|---|---|---|---|---|
| **Letters/Postcards** | | | | | |
| **Phone calls** | | | | | |
| **Text Messages** | | | | | |
| **Multimedia Messages** | | | | | |
| **Emails** | | | | | |

How many contacts do you have in the following categories?

| | 1-10 | 10-30 | 30-50 | 50-100 | > 100 |
|---|---|---|---|---|---|
| **Paper addressbook (with postal addresses)** | | | | | |
| **Mobile phone (addressbook)** | | | | | |
| **Email contact list** | | | | | |
| **Instant Messaging buddy-list** | | | | | |
| **Online Communities (Friendster, Orkut…)** | | | | | |

Where do your contacts live?

| | Very few | A Few | Some | Quite Many | Many |
|---|---|---|---|---|---|
| **Same city** | | | | | |
| **Same country, different city** | | | | | |
| **Different country, inside EU** | | | | | |
| **Different country, outside EU** | | | | | |

How often do you communicate with the following groups?

| | Never | Seldom | Sometimes | Often | Everyday |
|---|---|---|---|---|---|
| **Family** | | | | | |
| **Partner** | | | | | |
| **Friends** | | | | | |
| **Acquaintances** | | | | | |
| **Work Colleagues** | | | | | |
| **Strangers** | | | | | |

Please give your sincere opinion, in a few lines, on the following ways of personal communication

Example of opinions: Advantages/Disadvantages ; Why do you use /don't use ; Why you like/ dislike

| | |
|---|---|
| Letters | |
| Postcards | |
| Phone calls | |
| Text Messages | |
| Emails | |
| Mailing-lists | |
| Forums | |
| Blogs | |
| Instant Messaging | |
| Online Communities (Orkut, Friendster…) | |

## APPENDIX B: MOBILE SOCIAL NETWORKING QUESTIONNAIRE

Participant name _____

| | | | | |
|---|---|---|---|---|
| Age | | < 18 | 18-25 | |
| 26-30 | 30+ | | | |
| Gender | | Male | Female | |
| Nationality | | Finnish | Other (specify) | |
| Working status | | Student | Worker | Both |
| Do you live | | Alone | With family | |
| With partner | | With friends | | |

Email _____

Telephone number _____

Which model of mobile phone do you have?

Which models of mobile phones have you had before?

For how many years have you already used a mobile phone?

| | | | |
|---|---|---|---|
| < 1 | 1-3 | 3-5 | > 5 |

How many phone numbers do you have? (take into account phone numbers you use when you go abroad):

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | >3 |

How many contacts you have in your address book?

| | | | | |
|---|---|---|---|---|
| <10 | 10-50 | 50-100 | 100-200 | 200+ |

How many groups of people are present in your address book?

- Family
- Work colleagues
- Friends
- Boyfriend / Girlfriend
- Acquaintances
- Friends of friends
- University friends
- 'Old times' friends
- Friends living in another city (same country)
- Friends living in another country
- Services (Taxi, Police, Saldo…)
- Other groups

Which one of the following additional fields do you edit when adding a new contact?

| | Always | Often | Sometimes | Seldom | Never |
|---|---|---|---|---|---|
| **Email** | | | | | |
| **Postal Address** | | | | | |
| **Additional phone numbers** | | | | | |
| **Personal Web-site** | | | | | |
| **Image of the new contact** | | | | | |
| **Birthday** | | | | | |
| **Notes** | | | | | |

How often do you call the following groups?

| | Every day | Weekly | Monthly | Seldom | Never |
|---|---|---|---|---|---|
| **Family** | | | | | |
| **Work colleagues** | | | | | |
| **Best friends** | | | | | |
| **Boyfriend / Girlfriend** | | | | | |
| **Acquaintances** | | | | | |
| **Friends of friends** | | | | | |
| **University friends** | | | | | |
| **'Old times' friends** | | | | | |
| **Friends living in other city** | | | | | |
| **Friends living in other country** | | | | | |
| **Services (Taxi, Saldo…)** | | | | | |
| **Other** | | | | | |

Which of the following items would you share with your friends?

| | Always | Often | Sometimes | Seldom | Never |
|---|---|---|---|---|---|
| **Your current location** | | | | | |
| **Your current status/mood** | | | | | |
| **Your contacts** | | | | | |
| **Your calendar events/notes** | | | | | |
| **Ring tones** | | | | | |
| **Mobile games / application** | | | | | |
| **Photos** | | | | | |

**Status:** Available, Busy, Offline (like in Messenger systems)
**Mood:** Happy, Sad, Tired

Which of the following items would you share with acquaintances?

| | Always | Often | Sometimes | Seldom | Never |
|---|---|---|---|---|---|
| **Your current location** | | | | | |
| **Your current status/mood** | | | | | |
| **Your contacts** | | | | | |
| **Your calendar events/notes** | | | | | |
| **Ring tones** | | | | | |
| **Mobile games / application** | | | | | |
| **Photos** | | | | | |

Do you ever show to somebody the messages that you receive? To whom?

| | Always | Often | Sometimes | Seldom | Never |
|---|---|---|---|---|---|
| **To your best friend** | | | | | |
| **To your family** | | | | | |
| **To work colleagues** | | | | | |
| **To other people** | | | | | |

Call duration

| | Time (specify time of last reset) |
|---|---|
| **Last call** | |
| **Total received calls** | |
| **Total dialled calls** | |
| **Total GPRS data sent** | |
| **Total GPRS data received** | |

Please fill the following table with phone calls information stored in your mobile phone (distribution if phone call logs are not stored or deleted)

| TO/FROM | IN / OUT / MISSED | DATE | TIME | GROUP | TOPIC | LOCATION |
|---|---|---|---|---|---|---|
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**GROUP:** Friends, Family, Boyfriend/Girlfriend, Work, Acquaintance, Friend of Friend, Service, Other (when Unknown number)

**TOPIC:** emotion, work, entertainment, gossip, chat, agreement, question, answer, location expression, opinion expression, recommendation, meta comment

**LOCATION**: approximated location of the contact (name of the city if in the same country, otherwise name of the country)

Please fill the following table with text messages information stored in your mobile phone (distribution if messages are not stored or deleted very often

| TO/FROM | IN / OUT / MISSED | DATE | TIME | GROUP | TOPIC | LOCATION |
|---|---|---|---|---|---|---|
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Please fill the following table with MMS messages information stored in your mobile phone (distribution if messages are not stored or deleted very often)

| TO/FROM | IN / OUT / MISSED | DATE | TIME | GROUP | TOPIC | MEDIA ATTACHED |
|---|---|---|---|---|---|---|
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**GROUP:** Friends, Family, Boyfriend/Girlfriend, Work, Acquaintance, Friend of Friend, Service, Other (when Unknown number)

**TOPIC:** emotion, work, entertainment, gossip, chat, agreement, question, answer, location expression, opinion expression, recommendation, meta comment

**LOCATION:** approximated location of the contact (name of the city if in the same country, otherwise name of the country)

**Thank you for your answers!**