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## Summary

PICOS aims at advancing the state-of-the-art in technologies that provide privacy-enhanced identity and trust management features for both online and mobile community-supporting services. To do so a detailed understanding of different targeted communities, their characteristics and requirements is needed. Within this deliverable we analyse and summarize relevant existing work. We provide an overview of existing classification approaches, and present a tailored approach we developed based on existing work and empirical analysis to meet our specific goals. The results of this work will help to focus the work in the following steps of the project, especially the requirements definition.

The PICOS project receives research funding from the Community's Seventh Framework Programme.

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## The PICOS Deliverable Series

These documents are all available from the project website located at http://picos-project.eu.

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# The PICOS Deliverable Series

## Vision and Objectives of PICOS

With the emergence of services for professional and private online collaboration via the Internet, many European citizens spend work and leisure time in online communities. Users consciously eave private information; they may also leave personalized traces they are unaware of.  The objective of the project is to advance the state of the art in technologies that provide privacy-enhanced identity and trust management features within complex community-supporting services that are built on Next Generation Networks and delivered by multiple communication service providers. The approach taken by the project is to research, develop, build trial and evaluate an open, privacy-respecting, trust-enabling platform that supports the provision of community services by mobile communication service providers.

The following PICOS materials are available from the project website http://www.picos-project.eu.

### Planned PICOS documentation

- Slide presentations, press releases, and further public documents that outline the project objectives, approach, and expected results;
- PICOS global work plan providing an excerpt of the contract with the European Commission.

### PICOS results

- *PICOS Foundation* for the technical work in PICOS is built by the categorization of communities, a common taxonomy, requirements, and a contextual framework for the PICOS platform research and development;
- *PICOS Platform Architecture and Design* provides the basis of the PICOS identity management platform;
- *PICOS Platform Prototype* demonstrates the provision of state-of-the-art privacy and trust technology to leisure and business communities;
- *Community Application Prototype* is built and used to validate the concepts of the platform architecture and design and their acceptability by covering scenarios of private and professional communities;
- *PICOS Trials* validate the acceptability of the PICOS concepts and approach chosen from the end-user point of view;
- *PICOS Evaluations* assess the prototypes from a technical, legal and social-economic perspective and result in conclusions and policy recommendations;
- *PICOS-related scientific publications* produced within the scope of the project.

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# Foreword

This deliverable is a joint effort of the PICOS consortium. Anyhow, different partners had the main responsibility for writing and editing different sections.

The state-of-the-art analysis regarding categorisation of communities was lead by Center for Usability Research & Engineering (CURE), with the majority of work done by Christina Köffel.

The initial categorisation approach was developed in a joint workshop in Frankfurt lead by CURE with participants from Johann Wolfgang Goethe-Universität Frankfurt (GUF), Hewlett-Packard Laboratories Bristol (HPL) and Masaryk University (BRNO). Results of the workshop were written down by CURE and GUF. This description directly went into the section of this deliverable that describes the different dimensions for categorizing communities.

The requirements section was led by GUF, with the major inputs coming from Stefan Weiss.

All materials related to the questionnaire were led by CURE including the description of the methodology, the analysis section and the summary of results. Main contributors were Johann Schrammel and Christina Köffel.

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# List of acronyms

| | |
|---|---|
| *ACM* | *Association for Computing Machinery* |
| *APEC* | *Asia-Pacific Economic Cooperation* |
| *API* | *Application Programming Interface* |
| *BBS* | *Bulletin Board System* |
| *CHI* | *Computer-Human Interaction/Conference for Human-Computer Interaction* |
| *COSMOS* | *Community Online Services and Mobile Solutions* |
| *CSCW* | *Computer Supported Cooperative Work* |
| *ENISA* | *European Network and Information Security Agency* |
| *FIT* | *Fraunhofer Institute for Applied Information* |
| *FP6* | *Sixth Framework Programme* |
| *GPRS* | *General Packet Radio Service* |
| *GUI* | *Graphical User Interface* |
| *HCI* | *Human Computer Interaction* |
| *IDM* | *Identity Management* |
| *IEEE* | *Institute of Electrical and Electronics Engineers* |
| *IP* | *Internet Protocol* |
| *IRC* | *Internet Relay Channel* |
| *MMORPG* | *Massively Multiplayer Online Role-Playing Game* |
| *MOO* | *MUD object oriented* |
| *MOSOSO* | *Mobile Social Software* |
| *MUD* | *Multi-User Dungeon, Domain, Dimension* |
| *MUSH* | *Multi-User Shared Hack, Habitat, Holodeck, Hallucination* |
| *P2P* | *Peer-to-Peer* |
| *P3P* | *Platform for Privacy Preferences Project* |
| *PC* | *Personal Computer* |

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# 1 Introduction

Online communities have been growing massively recently and – at least by some parties – are expected to become the next “big thing” in the internet. Hence, research and business have taken up to study the possibilities and risks of these communities. One characteristic of the area is that it is not - or very diversely - defined what constitutes an online communities. For example internet forums, blogs, dating sites, chat rooms are considered to be online communities by some parties, whereas others only take dedicated social networking sites such as Friendster into account. The common ground is that there is no common ground when it comes to defining online communities. Since PICOS focuses on online and mobile communities, a structured approach that identifies conceptualises and describes different types of communities is needed.

In this document we first describe the objectives of the categorisation work and the goals we want to achieve. Next we present and discuss the approach and methods we have chosen. We then provide a summary on the state of the art on community categorisation and clustering approaches. Then the results of an online questionnaire that covered the information disclosure behaviour of users on different communities are described. Next the detailed categorisation is described, and also trust is further analysed with regard to different contexts. High-level implications for the future work in PICOS - especially the requirements definition - are discussed in Section 4.

## 1.1 Objectives and scope

The objective of this deliverable is to identify and group the key users of communities in general and to categorize the main communities that will be part of the PICOS work according to criteria that are relevant for the management of trust and privacy. Furthermore implications and consequences related to trust, identity and privacy are identified. These provide an important input to the deliverable D2.4, which analyses and defines the PICOS requirements in detail.

This document will be used during the whole duration of PICOS and will provide the basis for further work e.g., in the requirements definition (which will be based on the defined community groups) and will be an important input for the architecture of the PICOS platform.

## 1.2 Approach and methodology

This section describes the general approach we have chosen and the methodology that was used in the different stages of the categorisation process. A main decision was to use a combination of expert-based and empirically-based clustering approaches.

First, a detailed recherché on approaches to cluster or categorize communities was done. Searched sources included the IEEE and ACM digital libraries, academic resources as well as the web in general. The results of this analysis are summarized in section 5 of this document.

Based on this state-of-the-art, in an expert-based workshop an initial categorisation of communities was defined. Very fast it became clear that the best approach to the categorisation of communities in our case is to first identify and define individual dimensions, next to find useful sub-dimensions that further differentiate the characteristics of a dimension. Naturally we also discussed the possibility of

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an approach based on typical clusters of communities, but such an approach seemed to be not as fruitful for the work in the following work packages, as a definition based on single dimensions allows for more detailed comparison and adjustment. Anyhow, one also could cluster communities, and then describe the clusters by defining characteristic combinations of attributes on the different dimensions.

Parallel to this theoretically guided classification of communities a questionnaire was developed to collect information on the users' behaviour with regard to issues of privacy, trust and identity management. The questionnaire focused on the users' willingness to share different types of information such as e.g., real name, date of birth, interests, etc. This information was collected for different communities, and naturally also demographics were surveyed. Next, the data was analyzed with regard to significant differences either between communities or between different groups of users. This empirical information then was used to refine and adapt the theoretical classification.

Finally, the developed categorisation model was further improved by a cycle of expert feedback. The categorisation model was described and explained, and then individual feedback from experts in different fields was collected. Critical comments and suggestions for improvements were collected and integrated into the community classification.

# 2 State-of-the-art and related work

This section provides an overview of the state-of-the art and related work regarding the categorisation of key users of communities, social networks and mobile services. Some of the terms introduced in this section are further and more precisely defined in the PICOS taxonomy deliverable [Kosta and Dumortier 2008].

Within this chapter the phenomenon of social and online communities as well as mobile communities will be introduced. During the last years especially social communities have attracted the attention of research institutions and commercial companies. This has resulted in a constantly growing number of online and social community applications. Further also scientific publications and studies have been published that mainly cover the users’ motivation to use online communities and their willingness to provide private information. This development has not been notified in the area of mobile communities so far (as can be seen from the number of papers published), but is expected to be a future area of interest. Therefore it is the goal of PICOS to also investigate this rather novice area and include it in the categorisation of communities to form a basis for possible future community categorisation approaches.

After an overview of literature published on social and mobile communities, popular exponents for both communities are shown in this chapter. Concerning the categorisation of communities, already established possibilities derived from previous works are presented and in the summary we reason why they are not applicable to the PICOS project. Since one of PICOS’ objectives is privacy, trust and identity management in online, social and mobile communities, available literature on this topic is also presented.

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## 2.1 Social communities

In August 2007 Forrester Research has conducted a review of the five major social networking sites (MySpace, Facebook, Tagged, Friendster and hi5) [Temkin 2007]. The main goal was to investigate how well these sites support young adults in the creation of new profiles. The results show that all sites failed, especially concerning a lack of privacy information, inefficient task flows and poor text legibility. The improvement on the usability of these processes is urged.

Another research conducted by Forrester Research in June 2007 focused on the consumer's use of social networks [Li 2007]. Altogether 5,197 users have been asked about their use of online social networks. The results indicate the most youths and some adults (merely young adults) are using social networking sites. Out of the active users, 47 % are teenagers and 59% are young adults. Generally youths use social networking sites more often than adults with an average of 60 % teenagers and 68 % young adults using it on a daily basis. In the adult user group, male users are slightly dominant and more than 27 % dispose of a higher education. In the younger user group, female users (57 %) are dominating. Moreover the social network MySpace is dominating both user groups. For the reason on why they are using online social networks, most adults indicated that they want to stay in touch with friends and family. Furthermore the users' activity level has influence on the youth's opinion about social networking and on the interest in marketers.

A snapshot of Facebook users has been gathered by Joinson in two studies conducted with 378 users of two different universities [Joinson2008]. The major usage of Facebook was as a surveillance tool to virtually watch people. The users were eager to see what old contacts and friends were up to, how they behave and how they look (how they have changed). Therefore Facebook was used as a self-presentation tool, building social capital and maintaining contact with distant friends. The usage patterns differed according to the users' intentions. People wanting to meet new contacts were more permissive in their privacy settings, users' not interested in meeting unknown persons were more restrictive. Joinson also indicates the problem of privacy concerns and the main usage purpose of Facebook. Default privacy settings are assumed to be too restrictive for users' willing to meet new friends.

According to Andrews [Andrews2002] users of a certain age and lifestyle are reluctant to online interaction. One of the main reasons is that when interacting online, people only trust people they know. Therefore Andrews suggests a framework for engaging sceptical people in social communities. The recommendations contained in this article encompass the start of the community, encouragement of early online interaction and movement to a self-sustaining interactive environment.

Lampe et al. have investigated the users' motives for using Facebook: either to find new friends or to learn more about people they initially met offline [Lampe et al. 2006]. Altogether 2 surveys involving 2525 first-year students at Michigan State University have been conducted. The first survey took place before the students joined the university. When asked if they have heard about Facebook, 95 % of students answered yes. 84 % of the students were in fact members of Facebook and 68 % of them have created their account within the last three month before the survey. The second poll was carried out one semester later. Then about 95 % of the students asked were Facebook members. The investigation also enquired who the users' believed to be the most frequent visitors of their profile. 93 % of the students thought that their high school friends would look at their profile. Generally Lampe et al. discovered that users' generally expect their profiles to be viewed by others. Generally the viewers are expected to be peers, excluding faculty members. In most of the cases an offline connection exists

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between friends. Therefore the necessity to facilitate the link to offline connections should be eased. Concerning the overall use of Facebook, the results have shown that it is primarily used for social searching, i.e., establishing and maintaining previous relationships.

boyd has concentrated her studies in the field of social networking and conducted an ethnographic fieldwork on the online social networking platform Friendster [boyd 2004]. She has applied social theory to her investigations in order to get an understanding of how users employ context to present themselves, to examine the impacts of the network structure on connecting and spreading people and to detect the issues involved in articulating one's social network as compared to a behaviour-driven network. The Friendster network only permits to contact people within four degrees. Most users fear the presence of their boss, their mother or their students in case of teachers. Different information is presented by the users, depending on the audience. Generally also Friendster is mostly surfed for already known people and to reconnect with people from the past. Nevertheless also searches out of curiosity are conducted. In the professional area, head-hunters increasingly use social networking systems to track the live of potential employees'. The biggest problems of Friendster are fakesters, fake persons such as cultural characters, community characters or passing characters. Fakesters display the fundamental leak of trust on Friendster and are a discussion point between the systems' developers and the main customers.

In another publication boyd treats the issue of trust and intimacy in connection with Friendster [boyd 2003]. Friendster is an identity-driven intimate community by definition and requires several trust issues to be solved. First of all trust in the preservation of the private identity from part of the user towards the architect of the technology has to be established. Secondly, it is important that the users' can trust in the system architecture to fulfil all expectations concerning context or privacy. Thirdly, the users should trust each other and have confidence in the social norms the system is based on. In order to investigate the users' trust towards Friendster, 200 interviews and 6 focus groups have been conducted. These findings have been published in different sources [Gross et al. 2005; Acquisti and Gross 2006].

## 2.2 Mobile communities

As it can be seen from the previous section, there exists much knowledge about social communities, but only a few publications on mobile communities are currently available. Therefore the latter are a main topic of PICOS. To distinguish from other communities, mobile communities are defined in the PICOS taxonomy deliverable as “a group of people generally united by shared interests or goals who interact either only by means of location-independent communication information and communication technologies or (also) via community platforms providing relevant mobile interfaces to their services“[Kosta and Dumortier 2008].

Fremuth and Tasch state that the definition of mobile communities is similar to virtual communities, but mobile communities are using mobile devices [Fremuth and Tasch 2002]. In contrast to virtual communities, mobile communities are expected to be more concentrated on people and communication than on topics. Generally Fremuth and Tasch try to investigate success factors of mobile communities based on research on existing virtual communities and mobile phone providers. So far communication services were only used for contacting known persons and communicating within peer-groups. Therefore the authors expected mobile communities to be mostly used to stay in contact with friends and potentially form personal communities using different services. Additionally

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the COSMOS project is introduced, which is a planned prototype for a lifestyle-based mobile community. Its main objective is the mobile support of communities. The goal is the development of generic services and technologies for operating mobile communities. Currently there are two prototypes established and evaluated in the domain Lifestyle and Healthcare[1].

At the same time as Fremuth and Tasch published their definition, Ann Ekholm released a paper about the main issues of mobile communities [Ekholm 2002]. This work was released prior to the beginning and big success of social communities, such as MySpace. Therefore it mostly treats mobile communities as opportunities to chat with other peers. Ekholm provides an overview of the fundamental elements of mobile communities (virtual space, virtual representation of identity and conversation) as well as a short summary of mobile communities available at that time. In fact, SMS-chat, TV-chat and instant messaging were popular community applications at this time and the first and latter one are still important today. Furthermore Ekholm touches problems such as software portability, the user's cognitive load when typing, conversations and ergonomic issues when typing on a numeric keypad.

Another step concerning online communities was the offering of location-based services. Burak and Sharon [Burak and Sharon 2004] investigated the acceptance of these services in their work. For their 21 month experiment they conducted a survey of FriendZone, a mobile community that offers instant messaging & locater, location-based chat and anonymous instant messaging and also provides privacy functionalities. The design principles for the development of FriendZone were multi-platform functionality (PDA, PC, and mobile phone), consistent look-and-feel, accuracy of location-based services and inherent privacy functionalities. Using the instant messenger & locator, users have the possibility to locate and contact friends on their community buddy list. Nevertheless the anonymous instant messenger was far more popular, especially since it opened the possibility to meet people in real life and still be anonymous. Formerly unknown people could therefore get in contact with each other. Furthermore a mobile chat, offering local chat zones was implemented. The FriendZone system was tested using log files of more than 47,000 users and by conducting interviews. The results show that mobile communities demand different design concepts with simpler user interfaces that take advantage of the mobility-factor.

To combine mobile affordances with the possibility of desktop computers Braun and Gräther created a mobile community for mobile devices with small displays which is called Community2Go [Braun and Gräther 2007]. In addition another feature of Community2Go is its compatibility with the FIT community toolbar and the possibility to access communities of interest. Braun and Gräther have considered the functionality necessary for mobile devices, technical preconditions and the limited display when designing Community2Go. Hence its most important features are to be up to date about the online community, to be able to see the bookmark collection, to be able to add bookmarks and to be aware of the online status of community members. The resulting application has been tested in a week-long usability evaluation and the results show that the users appreciated the Community2Go system and would even prefer a combination with the FIT community toolbar. The authors have demonstrated the use of mobile communities on small devices as well as the support of Communities of Interest using mobile devices.

In this context Demestichas et al. engage in future ambient communities and describe their possibilities in their publication [Demestichas et al. 2007]. According to them ambient communities

[1] http://www.cosmos-community.org/index_eng.html

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utilize location, speed, user-created multimedia content or sensor-related data to create appealing virtual communities for mobile terminals, such as mobile phones. A good overview of available communities in the categories rendezvous coordination applications (e.g., Dodgeball, Paytxt), moblogs (e.g., Yospace) and geo-referenced photo sharing (Socialight) is given. The authors claim ambient communities to be an extension to the current state-of-the-art. The novelties provided by ambient communities are automatic data collection and uploading, real-time data processing, anonymity and privacy functionalities and different services under a common umbrella. Further an introduction to the service architecture and possible applications is given. Services provided by the planned community will be information about traffic conditions, clubbing/restaurant information, file sharing, environmental applications and the real-time collection of multi-media content. Until the publication of the paper a testbed has been implemented and further research has been planned.

After an overview of the common understanding of mobile communities (i.e., a community that is accessible by mobile devices or an aggregation of individuals in a setting that supports mobile technology) Aschoff and Novak provide their own definition of mobile communities: “A mobile community consists of a group of people who share a common interest and continuously interact with each other while benefiting from immediate access to the (current) locations of the group members and of the members’ situated knowledge and experiences related to these locations”[Aschoff and Novak 2008]. According to this understanding of mobile communities, they have developed a short message service (SMS) based location-related mobile forum. Since previous studies merely investigated high-tech setups, Aschoff and Novak wanted to research whether there are advantages of using low-tech setups, such as SMS services. Furthermore the transferability of desktop based communication platforms to mobile devices and the requirements of real-time mobile applications have been investigated. The results of a field study conducted revealed that the low technology approach was successful. Therefore they suggest that further approaches towards mobile communities should focus more on reasonable usage scenarios than on the technological possibilities of the mobile devices employed. Additionally Aschoff and Novak state that future needs will be location-based services, message filtering and alternative input and output devices.

## 2.3 Examples of popular online and mobile communities

The following list gives an insight into the wide spectrum of online and mobile communities naming the mostly renowned communities.

Online communities:

- MySpace (http://www.myspace.com)
- Facebook (http://www.Facebook.com)
- Orkut (http://www.orkut.com)
- Friendster (http://www.friendster.com)
- Flickr (http://www.flickr.com)
- Del.icio.us (http://del.icio.us)
- LinkedIn (http://www.linkedin.com)
- YouTube (http://youtube.com)

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- Wikipedia (http://www.wikipedia.org)
- Digg (http://digg.com)

- Mobile communities:
- Dodgeball (http://www.dodgeball.com)
- Socialight (http://socialight.com)
- Yospace (http://www.yospace.com/index.html)
- Qiro (http://www.quiro.net)
- Qeep (http://www.qeep.com/int)

## 2.4 Classification of communities

The following sections provide possible categorisation aspects of online and mobile communities based on currently available literature. The field of classifications varies a lot due to contrary approaches chosen by the authors. However, many similarities can be found, and differences frequently derive from the specific purposes and application domain the authors had in mind when creating the classifications. The next sections provide an overview of the existing approaches structured according to the main purpose of categorisation criteria.

We also want to mention that we are not aware of any literature that focuses on categorisation possibilities of mobile communities, probably due to the novelty of the area. Nevertheless, according to Fremuth's and Tasch's definition of mobile communities [Fremuth and Tasch 2002], the approaches introduced in the following are to a certain extend also applicable to mobile communities.

### 2.4.1 General categorisation approaches

The history of online communities has been described by Preece et al. [Preece et al. 2003]. They define online communities as a group of people who interact in a virtual environment and that are guided by policies within these environments. These policies can be defined as sociability. Besides a description of the emergence of communities starting with e-mail services, they underline that communities are increasing in importance, with 84 % of all internet users having contact with online communities. This phenomenon is called "glocalization". According to them the biggest difference between online and offline communities is the lack of non-verbal cues and social presence, especially in textual online communities. As a possible classification method of online communities they name the following factors: physical/virtual presence, purpose, software environment, size, duration of their existence, stage in their life-cycle, culture of their members and governance structures. A more detailed description of these factors and their impact is not given. Nevertheless, the need of research in this area is pointed out.

[Porter 2004] describes five attributes that could characterise virtual communities: purpose (content of interaction), place (virtual versus hybrid), platform (synchronous vs. asynchronous), population interaction structure (pattern of interaction) and profit model.

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### 2.4.2 Categorisation related to usage context and purposes

The influence of social networks onto the social capital built has been investigated by Ellison et al. [Ellison et al. 2006]. To investigate their goal Ellison et al. have conducted a survey on the use of Facebook by 286 Michigan State University undergraduates. They collected demographic information, general information about Facebook usage, psychological measures as well as social capital measures. The findings indicate that there is a positive connection between certain kinds of Facebook usage and the creation of social capital. Concerning the use of Facebook 96 % of the participants included the name of their high school in their profile and the overwhelming majority of students were using Facebook to keep in touch with friends. The possibility for misuse is also mentioned. Concerning the categorisation of communities the following three possible categories are suggested: sites related to work-related context, sites treating the issues of romantic relationship initiation and sites in connection with shared interests such as music or politics.

[Stanoevska-Slabeva and Schmid 2001] developed a comprehensive classification related to the content of virtual communities. They defined four groups of communities: discussion, task/goal oriented, virtual world and hybrid solutions. The main purpose of discussion communities is the exchange of information related to a specified topic. Task- and goal-oriented communities are formed to achieve a common goal by cooperation. Virtual worlds are online communities that are formed around virtual worlds and games. Hybrid communities contain elements of more than one of the mentioned categories.

[Hagel and Armstrong 1997] classify communities with regard to their focus on consumers or business-to-business. For consumer-focused communities they further differentiate between geographic communities (formed around a physical location the participants share interest in), demographic communities (e.g., seniors, teens, singles, etc) and topical communities (formed around a shared topic; hobbies are a typical example).

[Lechner and Hummel 2002] use five types of virtual communities: games, interest, business-to-business, business-to-costumer and costumer-to-costumer.

### 2.4.3 Categorisation based on use of content

As a part of their investigation, Olsson et al. have investigated the content use of four different communities [Olsson et al. 2008]: one real-live community and three virtual mixed communities (IRC channel, athletes and scouts and fishers). In order to investigate their main objective, Olsson et al. have conducted personal and group interviews, contextual inquiries and distributed usage diaries. The results have shown that the users' did perceive collective content rather as a sign of communality than as ownership. The extent to which content is collective was heavily influenced by the semantic content of the content item, the community's contribution and the level of sharing. Because of their findings, Olsson et al. have introduced a categorisation of content according to private and public and collective and personal content.

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### 2.4.4 Categorisation based on communication infrastructure

Jean-Francois Renaud has released an online article including a categorisation of online communities in February 2008 [Renaud 2008]. He suggests a classification into mass social networks, social news, social bookmarking, social media and content sharing, blogs and microblogs and hybrid communities. The following paragraphs form an excerpt of his work:

### 2.4.5 Categorisation based on User Roles

According to [Renaud2008] 52 % of all members of online communities are inactive and are split up into the creators (13 %), the critics (19 %), the collectors (15 %), the sociables (19 %) and the onlookers (33 %).

Thom-Santelli et al. have conducted 33 user interviews using an enterprise online taggings system to determine the five major social roles [Thom-Santelli et al. 2008]. The system tested disposed of an enhanced contact directory, a blogging tool, a social bookmarking website and a podcast repository. The researchers investigated five major social roles:

- Community-seeker (finds members of existing communities)
- Community-builder (creates community where it is missing)
- Evangelist (uses different systems and connects the members of a group)
- Publisher (production and dissemination of content)
- Small Team Leader (low frequency tagging; communication to other members)

From those findings Thom-Santelli et al. drew design implications for social tagging.

Preece differentiated community members in passive lurkers and active posters [Preece 2004].

### 2.4.6 Further Categorisation Approaches

On Wikipedia virtual communities are categorized into benchmark virtual communities and additional virtual community listings. Benchmark communities can further be distinguished into Usenet, BBS, Academic, Blog, Webcomic, Virtual world/city, Instant Messaging, IRC, MMORPG, MOO, Mososo, MUD/MUSH, P2P, Wiki, WWW and Consumers. Additional virtual communities can also be distinguished into discussion boards, social networking, art communities, MUD/MUSH/MOO, ethnicity-based communities and other types.

In their work, Beinhauer et al. categorize virtual communities according to the kind of user behaviour, the content and the orientation of communities [Beinhauer et al. 1999]. The categorisation according to the kind of user behaviour bases on the ideas of Cliff Figallo. He relates the user to the relationship between users or the relationship from users to the content. The content based categorisation has its origin in Hagel/Amstrongs' consumer and business oriented communities. Beinhauer et al. describe the orientation of a community to be mostly defined by the provider and his motivation and not by the users.

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A good overview of different categorisation possibilities of online communities is provided by Fremuth and Tasch [Fremuth and Tasch 2002]. They describe Hagel and Armstrongs' classification into geographic, demographic and interest based communities as well as Kim's suggestion to add an activity based community. Furthermore Durlacher's communities of purpose, practice, circumstance and interest are described and an overview of the suggestion of Brunhold et al. is given. Further categories are suggested: user groups, providers, purpose and motivations.

The characteristics of networking sites are described by Donath and boyd as mutual, public, unnuanced and decontextualised [Donath and boyd 2004]. Furthermore they stated that it is possible to analyze the reliability of social networks using signalling theory. Hence pseudonyms have little costs. A public display of connection is an implicit verification of identity and can be viewed as a signal of the reliability of one's identity claim. On the other hand, public displays of connections give someone else the possibility to establish that they are you. Thus the publicly displayed information of online social networks eases identity theft.

### 2.4.7 Summary

As described in the previous sections, different researchers are using different kinds of categorisation models and approaches for online communities. Besides approaches for a general categorisation of online communities, approaches that categorise communities related to usage context and purpose, categorisations based on the use of content or the user roles and further categorisation approaches have been introduced.

However, we found none of these approaches directly applicable for PICOS, as none of them covered all areas relevant for the PICOS objectives. Therefore the PICOS project suggests a different approach to categorise online communities, as introduced in chapter 3.

## 2.5 Privacy and trust needs in online and mobile communities

The previous sections introduced literature that focuses on online communities. As stated before less research on mobile communities is available. Since they are a main area of interest of PICOS, the focus of the project is directed towards this new area and the arising trust, privacy and identity management issues. Nevertheless these problems also and especially apply to traditional online communities. In the following sections we present current literature on trust, privacy and identity management needs in online and mobile communities.

### 2.5.1 Information disclosure behaviour and privacy needs in online and mobile communities

Gross et al. have conducted a study of the privacy settings on Facebook of more than 4,000 students at Carnegie Mellon University [Gross et al. 2005]. The majority of the recruited students were undergraduate students. Altogether 90 % of the users had a picture in their profile, 87 % revealed their birth date and 39 % even listed their phone number. Furthermore 50 % of the students using an online community listed their current residence and 62 % of those in a relationship revealed their partners' name (or even linked to their partner). Concerning the validity of the information the researchers detected that 89 % of all names appeared to be realistic and 61 % of the used profile images were

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suitable for direct identification. It is generally established that users re-use their images on different social networking sites and are therefore re-identifiable through their pictures. A low percentage of users (1.2 %) made use of costume privacy settings and only 3 users changed their visibility. This information allows deducting that in general users are unconcerned, oblivious or pragmatic about their personal privacy. The information revealed would allow the identification of the social security number of people living in the United States. Besides the publicly disclosed information, Facebook itself states in its terms of use that the IP address is recorded and data might be shared with third partners. Another experiment has shown that 30 % of the Facebook users would add a completely stranger to their friends list. In fact a random person sent out invitations to 250.000 people and 75.000 actually accepted. This leads to the conclusion that friends on social networks are defined differently than friends made offline.

A study similar to the one of Gross et al. has been conducted by Lampe et al. [Lampe et al. 2007]. A total of 30,773 Facebook profiles of students at Michigan State University have been investigated for their content and privacy settings. The main goal of this study was to determine whether or not there is a connection between the profile structure and the number of friends. Out of all profiles searched, 19 % were restricted and could not be used for the research. Of the remaining profiles, 93 % of the users listed their gender, 83 % listed their hometown, 45 % indicated their detailed residence and 89 % listed their major field of study. Furthermore 80 % of the students showed their favourite movies, 78 % listed their relationship status, 83 % indicated their birthday and even 92 % of students displayed their e-mail-address. On average the profiles were filled to 59 % and generally it could be detected that undergraduate members had more friends than others. Generally it could be detected that different profile elements have a different impact on the number of friends a user has. Furthermore social pressure might also be an important factor for joining Facebook at the beginning, which leads to the conclusion that social networks help to support pre-existing relationships.

The facilitation to share ones identity in social networking communities is treated by Stutzman [Stutzman 2006]. According to them social networks allow for a holistic and more subjective disclosure of identity information. In order to investigate this problem, Stutzman has conducted a pilot survey involving 38 college students (mostly undergraduates). Out of the students enquired 90 % participate in online social networks. In fact 87 % of users publicly indicate their name on Facebook, 72 % list their high school, 67 % indicate their relationship statues, 65 % disclose address information and 38 % of the students indicated their sexual orientation on their Facebook profile. Basically the students enquired in this survey are mostly okay with their friends accessing their profile. Nevertheless they are interested in the protection of their identity.

In first ENISA position paper the major security issues of online social networks are described and recommendations for improvement are given [Hogben2007]. The paper focuses on the positive commercial and social effects of those networks and puts an emphasis on their safety. According to Hogben there are 15 major threads in social networks. Amongst those are secondary data collection, face recognition, difficulty of complete account deletion, infiltration of networks, cyber-stalking, cyber-bullying and corporate espionage. 19 Recommendations from the Virtual Group are presented. Important points are awareness-raising and educational campaigns, increasing the transparency of the data handling practices, promotion of stronger authentication and access-control mechanisms, encouragement of using reputation techniques and the promotion of research in anonymisation techniques.

A framework for analyzing privacy requirements and privacy-related data was introduced by Preibusch et al. [Preibusch et al. 2007]. According to them the topic of privacy in online social

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networking sites is severely under researched. Social networks have increased in importance, also on a commercial level. Providers of social networking services are allowed to collect the users' personal data and use it for marketing purposes. Online marketing is pointed out to be one of the privacy concerns in social networks. Therefore Preibusch et al. introduce different levels of data, depending on the person the data is disclosed to: group data, community data and public data. In order to early analyze conflicts, multilateral requirements analysis methods are presented. Furthermore an extension for the Privacy Policy language P3P is suggested and possibilities to seamlessly integrate these policies into human to human interactions are given.

The results of the above mentioned studies point out that people are very willing to share data and provide information about themselves, that they are not very aware of possible arising problems of social networking sites and are not very careful or cautious in their behaviour. For example a rather large number of users even add completely unknown persons to their profile. This unwariness opens doors for data misuse and problems such as infiltration, cyberstalking or cyber-bullying. Another privacy problem is that providers are allowed to collect users' personal data for marketing purposes. This, in addition, leads to constrain the personal rights of the user.

### 2.5.2 Maintenance, research and restoration of trust

In their work about trust and the avoidance of escalation Vasalou and Riegelsberger point out that there is a need for research in this field [Vasalou and Riegelsberger 2008]. According to them it is not only important to build trust, but also to maintain and recover trust after breakdowns. Currently most researchers focus on reputation systems instead of possibilities to regain trust after minor and unintentional breakdowns that might occur when humans are interacting with systems or each other. Basing on a user study conducted on etsy and ebay, Vasalou and Riegelsberger provide design implications to repair trust breakdowns. For example they suggest building mechanics to prevent users from drawing undue judgements or to prevent escalations of negative emotions. Furthermore mechanisms that allow the offender to apologize are needed.

A special interest group at the conference on Human factors in computing systems 2007 focused on advancing the trust debate [Riegelsberger and Vasalou 2007]. The information contained in the abstract of the SIG was obtained from previous CHI and CSCW workshops in 2006. Riegelsberger and Vasalou suggest the following dimensions of future trust research:

**Objects of trust and related risks**: We have gone from human-computer interaction to human-human interaction, therefore the focus has to be directed towards privacy, phishing, SPAM and reputation systems. Trust should be also established in non-working environments such as online gaming or dating.

**Methods and background of trust research**: There is a lack of unity concerning the concepts and methods. Often the employed methods are bound to specific research traditions.

**Models and framework of trust**: There is a lack of awareness that theoretical frameworks in fact exist.

**Goals and ethics of trust research**: Trust is combined with ethical dilemmas, for example when phishing attacks are based on guidelines for trustworthy design.

A workshop at the conference on Human factors in computing systems 2006 focused on the problems of trust, collaborations and compliance in social systems [Riegelsberger et al. 2006]. Research has

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shown that societies with a higher level of social capital and trust are more productive and maintain more stable relationships. Existing trust mechanisms at this time were policies, reputation systems and rich channels. Novel approaches such as self-awareness mechanisms based on shame and embarrassment in combination with the use of real identities, reparative mechanisms using feedback of past behaviour and forgiveness and social recommender mechanisms are suggested as the centre of future research.

Jensen et al. have investigated what kind of reputation information in online social networks such as chats, games or newsgroups is important to the systems' users [Jensen et al. 2002]. As state-of-the-art rating systems have been introduced: ranking systems, rating systems, collaborative filtering systems, implicit peer-based systems and explicit peer-based systems. In a survey 462 participants were asked to imagine who they would like to meet in an online network (chat). Results have shown that the similarity of interests and ratings by friends are the most important criteria for online social contacts. Therefore it can be stated that social information is somehow important to users.

This findings show that trust is a not ignorable factor in online communities to adhere the satisfaction of the user in the system. Since the trend also directs towards mobile devices, similar issues can be detected in the field of mobile communities.

### Trust in mobile communities

Mobile devices that are autonomous and interconnected through (unreliable) wireless links are the main topic of a paper published by Keoh and Lupu [Keoh and Lupu]. These so-called ad hoc networks come to existence in different situations such as business meetings or gaming sessions. Several security issues are connected to this situation: communications security, authentication, community membership and access control to the resources. In order to safely use ad hoc networks, trust has to be established between the members of such a community. The participants themselves have to enforce the trust through rules such as doctrines. Another safety restriction is that only eligible users should be allowed to join the network. Keo and Lupu introduce current trust establishing methods and give a perspective for future possibilities.

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# 3 PICOS community dimensions

The PICOS community dimensions are a result of a state-of-the-art analysis as presented in chapter 2, an expert-based workshop, the PICOS community questionnaire (c.f. Appendix), expert feedback and the objectives of the PICOS project.

In the previous chapter we summarized existing classifications of online and mobile communities. Even though every of these classifications provide very valuable input for PICOS, we came to the conclusion that we have to develop our own classification approach – naturally based on existing ones – to achieve our goals. Two main treasons drove this decision:

- Even though many different aspects are covered by the different classification approaches, there is no existing approach available that covers and integrates all of these aspects.
- For the PICOS purposes the existing classifications did not reflect the different influencing factors on trust and privacy requirements sufficiently (probably because these approaches were not developed with regard to trust and privacy aspects).

Table 1 on the next page shows the influences of the different authors on our work and how we integrated the different perspectives in our classification.

### Orthogonal set of dimensions

The general approach was to identify an orthogonal set of dimensions which can describe and characterize any PICOS-relevant community by a combination of levels of these dimensions. Two main reasons guided our decision to choose a dimension based approach rather than a classification of different community types:

- The dimension-based approach provides more flexibility in dealing with new and emerging communities (or a change of existing communities), as they can be characterised with the existing dimensions. The model itself does not need to be changed to be able to include new circumstances.
- To base the classification of communities on dimensions also fosters the systematic analysis of generic requirements related to these dimensions.
- An overview of the different dimensions is provided in Figure 1 and will be explained in detail in the following sections.

### Importance of dimensions

Naturally the different dimensions are of varying importance for privacy, trust and IdM issues. Without detailed empirical studies it is difficult to exactly quantify the importance of the different dimensions with regard to their influence on privacy, trust and IdM issues. We therefore provide a rough estimation and classification of the importance of the dimensions on 3 levels (major, medium and minor importance) based on related work and experts' assessment. The importance of each

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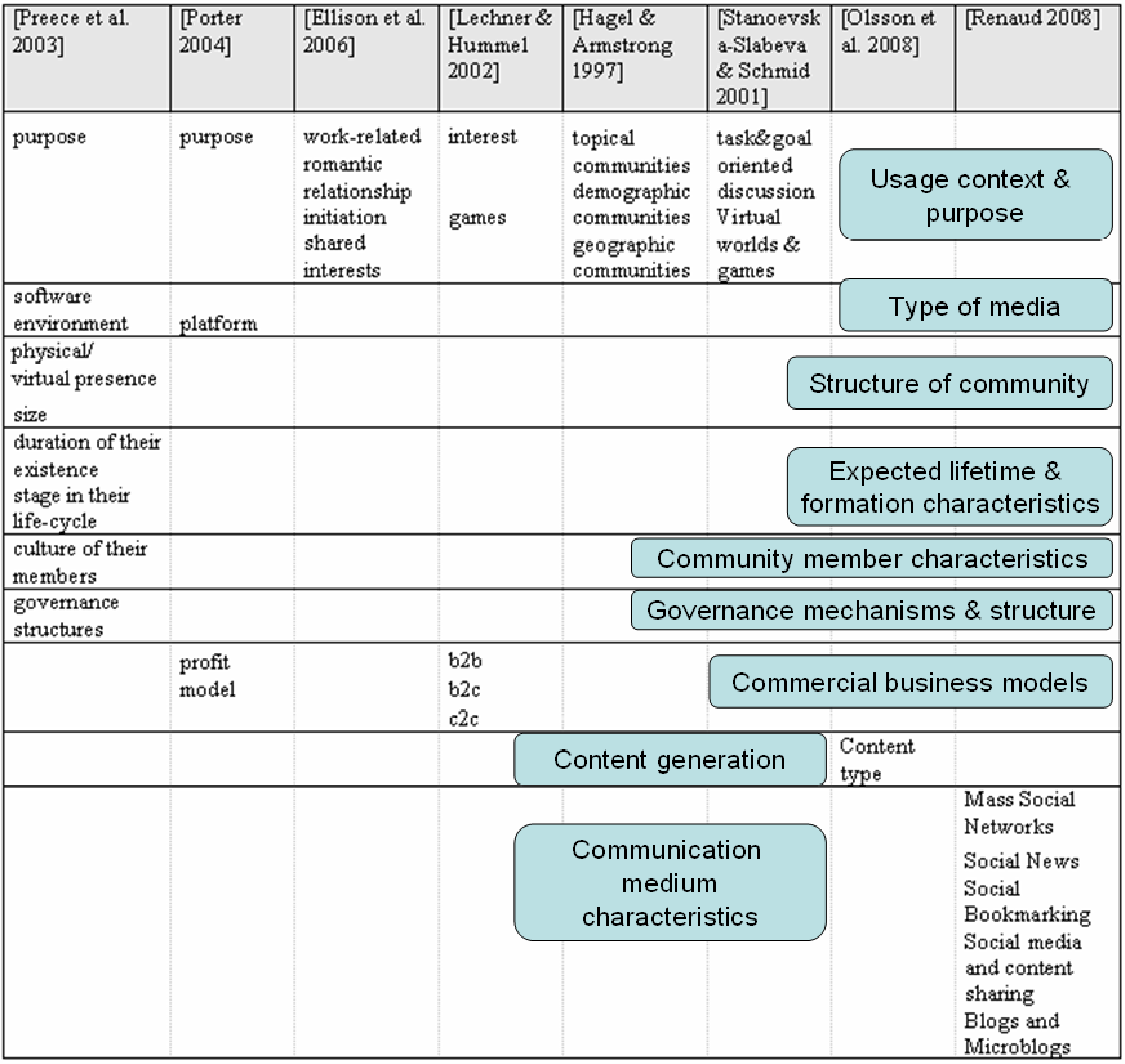
dimension is provided in the description of the dimensions in the following chapters as well as in Table 2 in Chapter 3.4.

Table 1 provides an overview and summarisation of the before induced influencing approaches on the PICOS categorisation model.



| [Preece et al. 2003] | [Porter 2004] | [Ellison et al. 2006] | [Lechner & Hummel 2002] | [Hagel & Armstrong 1997] | [Stanoevska-Slabeva & Schmid 2001] | [Olsson et al. 2008] | [Renaud 2008] |
|---|---|---|---|---|---|---|---|
| purpose | purpose | work-related<br>romantic relationship initiation<br>shared interests | interest<br>games | topical communities<br>demographic communities<br>geographic communities | task&goal oriented<br>discussion<br>Virtual worlds & games | Usage context & purpose | |
| software environment | platform | | | | | Type of media | |
| physical/ virtual presence<br>size | | | | | Structure of community | | |
| duration of their existence<br>stage in their life-cycle | | | | | Expected lifetime & formation characteristics | | |
| culture of their members | | | | Community member characteristics | | | |
| governance structures | | | | Governance mechanisms & structure | | | |
| | profit model | | b2b<br>b2c<br>c2c | | Commercial business models | | |
| | | | Content generation | | | Content type | |
| | | | Communication medium characteristics | | | | Mass Social Networks<br>Social News<br>Social Bookmarking<br>Social media and content sharing<br>Blogs and Microblogs |

**Table 1 Overview and summarisation of influencing approaches on the PICOS categorisation model.**

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## 3.1 High-level dimensions

The next sections describe and characterize the high-level dimensions of communities relevant for the PICOS project. Characteristics of communities were identified that significantly influence issues related to trust, privacy and IDM.

The image below provides an overview of the identified community dimensions:

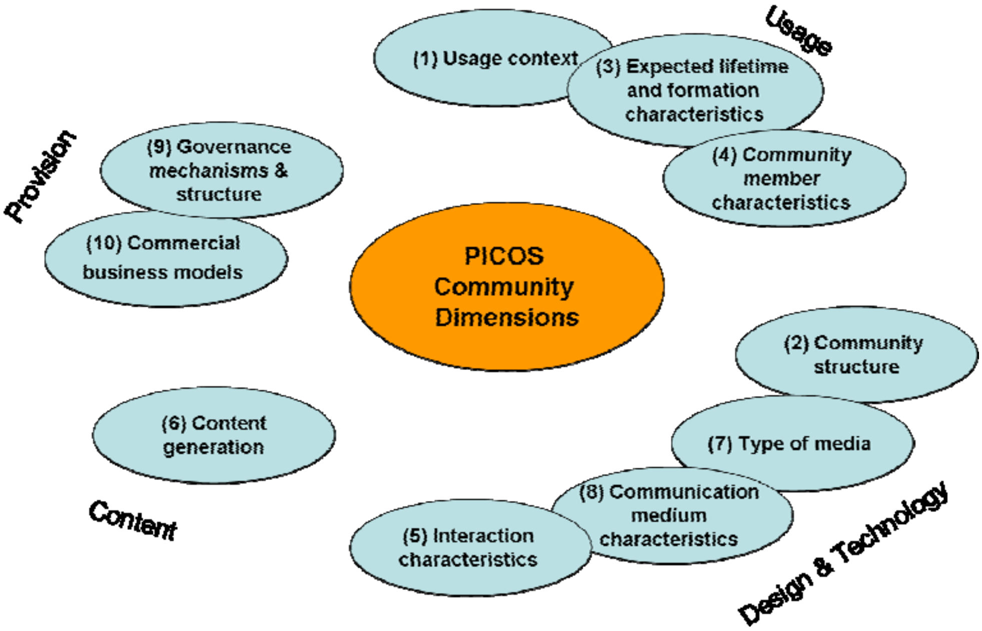
(1) Usage context
Usage
(3) Expected lifetime and formation characteristics
(4) Community member characteristics
Provision
(9) Governance mechanisms & structure
(10) Commercial business models
PICOS Community Dimensions
(2) Community structure
(6) Content generation
(7) Type of media
Content
(8) Communication medium characteristics
(5) Interaction characteristics
Design & Technology

**Figure 1 PICOS communities dimensions**

### 1. Usage context and purposes (major importance)

The usage context is the most important dimension with regard to its consequences, significance and implications for trust, privacy and IDM issues. It defines work-related and leisure-related purposes and interests of a community and their members' voluntary engagement, romantic relationship initiation, location-/mobility-relation and multiple purposes. In this dimension the main tasks of the users, the information exchange and data disclosure that is needed to be able to use and interact with the system and the other users in a meaningful way are considered. The importance of this dimension is also indicated by its usage in almost every categorisation model we analysed (see previous page).

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**2. Structure of community (medium importance)**

A second major dimension is the structure of community, which defines the community in terms of its size, churn rate, relationship types, etc. The structure of a community naturally has an important influence on the resulting dynamics of the communication, on the possibilities and restriction of interaction and on the involved potential risks and threats for the privacy, security and identity management concerns of its users.

**3. Expected lifetime and formation characteristics (medium importance)**

In the existing community classification approaches the expected lifetime and formation characteristics of a community are rarely used for the classification, only [Preece et al. 2004] also include community characteristics related to the duration of existence of the community. Within PICOS this dimension is of special relevance for the resulting trust, privacy and IDM needs and requirements.

**4. Community member characteristics (medium importance)**

Communities are different with regard to their user base i.e., the average user of community services might have very different knowledge, economic background, privacy needs etc. The characteristics of community members naturally influence the characteristics of the whole community. Within PICOS the community member characteristics are important in a twofold way. First, the need for privacy and trust is influenced by the members' characteristics. Second, the developed PICOS tools need to fit to the community members' abilities and habits.

**5. Interaction characteristics (medium importance)**

This dimension summarizes relevant characteristics of the interaction. Both, the quantity (how often participants use the community service or interact with other community members) and quality (the emotional intensity of the exchange and the expressivity of the medium) of interactions are considered.

**6. Content generation (medium importance)**

In several community classification approaches content is a central category for defining communities. However, no explicit distinctions are made regarding who is creating this contents and who owns which rights on the content. That is a central aspect for privacy and trust issues.

**7. Type of media (medium importance)**

Type of media differentiates between online and mobile communities. Past research has shown that user behaviour and needs are significantly different in online and mobile settings, and we expect also different needs with regard to privacy and trust issues. Also for the development of tools and the provision of services this distinction is highly relevant, as very different technologies are used in the two contexts.

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### 8. Communication medium characteristics (minor importance)

The communication medium characteristic varies between main types of communication patterns that have emerged in the web: networking, news and media and content sharing.

This differentiation is especially important for the objectives of PICOS as the different characteristics of networking, news or media and content sharing sites shape the users' disposition to share data and their expectation regarding the usage of this data by others. Also the questionnaire results support the influence and relevance of this dimension.

### 9. Governance mechanisms & structure (minor importance)

This dimension describes the rules and regulations which exist (i.e., structure) for the interaction between the members of a community and how their compliance is enforced and how misuse is sanctioned (i.e., sanctioning mechanisms).

Clearly the governance mechanisms of a community are important for privacy and trust issues (e.g., rules against unauthorized data disclosure, establishment of trust in the provider, etc.) and therefore within PICOS we need to especially consider this dimension.

### 10. Commercial business models (minor importance)

Commercial aspects of communities describe all aspects, which are related to the financing of a community. Such activities serve to build the financial basis for the operation of a community and can be subdivided into internal, external and hybrid financing. The commercial aspects characterize how revenues are generated and thereby how the services, which e.g., allow to communicate and interact within the community, are financed.

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## 3.2 Validation of community dimensions

In addition to defining the community dimensions based on prior research and theoretical deduction we also planned to validate the relevance of the community dimensions empirically. An empirical evaluation was chosen to improve the validity of the categorisation and to develop a useful categorisation that is in accordance with reality. Therefore we designed a questionnaire that investigates the user's privacy preferences, requirements and usage of privacy settings in different usage contexts. The findings of the questionnaire (1) validate the found high-level dimensions and (2) provide major input for the categorisation of the communities. The complete questionnaire and a detailed evaluation of the results can be found in the Annex.

In order to reach a wide audience throughout the World Wide Web, the PICOS community questionnaire was distributed in the countries of the PICOS project members and on different community platforms throughout the web.

Due to lack of time and resources, the questionnaire has only been designed in English and in German. To gain a sufficient response rate, in German speaking countries, the questionnaire was available in German. in English speaking countries an English version was provided.

## 3.3 Main conclusions from questionnaire results

In this section we want to summarize the main results from the online questionnaire with relevance to the classification of communities. These are as follows:

- There are significant differences in the behaviour and needs of users with regard to the type of community. An important differentiation is between sites intended for networking (social or professional) and sites where networking and the provision of data serves a secondary purpose.
- Usage context is important even within the same type of community. For example, there are important differences in the information disclosure behaviour of networking communities whether they are in a professional or social context.
- According to our results gender and age only have minor influence on the information disclosure behaviour in the different community types.
- In general people with higher education and higher income are more cautious to share information.
- The number of friends and the time spend on a community correlate with the disposition to disclose information.

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## 3.4 Detailed community dimensions

The dimensions are structured and grouped within the categorisation according to their relevance and importance (shown in brackets after each dimension); an overview is provided in Table 2 below. In the next sections then each of the dimensions is described in detail, examples are provided and consequences, significance and implications for privacy, trust and IDM issues are listed are derived in order to underline their scope and relevance in and for PICOS.

**1. Usage context and purposes (major)**
Work-related purposes and interests
Leisure-related purposes and interests
Voluntary engagement
Romantic relationship initiation
Location-/mobility-related
Multiple purposes

**2. Structure of Community (medium)**
Size
Virtual vs. face-to-face communication
Types of relationship
Organizational structure
Churn rate

**3. Expected Lifetime & Formation Characteristics (medium)**
Long-term
Short-term
Ad-hoc communities

**4. Community Member Characteristics (medium)**
Technological experiences and background knowledge
Understanding of underlying commercial aspects
Individual identification with group
Cultural background of members
Availability of resources
Privacy sensitivity
Homogeneity of community members

**5. Interaction characteristics (medium)**
Frequency
Intensity
Expressivity of medium

**6. Content generation (medium)**
Provider-generated
User-generated content
3rd party generated

**7. Type of media / channel diversity (medium)**
Mobile
Online

**8. Communication medium characteristics (minor)**
Networking
News and information
Media and content sharing

**9. Governance mechanisms (minor)**
Internal governance
External governance

**10. Commercial business models (minor)**
Internal Financing
External Financing

**Table 2 Overview of community dimensions**

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### 3.4.1 Usage context and purposes

The first dimension of our classification approach describes the general purposes and context of usage of the community. This category should provide the general background for understanding and characterizing the motives of users or user groups for both joining and using the service, the goals they typically want to achieve on or with the site, the usage, communication and interaction patterns that emerge, etc.

The majority of communities consist of users with relatively homogenous purposes on that specific site or service (they may be very different with regard to criteria not related to the specific service), as these services typically evolved around specific topics, needs and interests. Services and communities with homogenous purposes can be roughly described by their relation to different major aspects of life. However, communities with rather diverse purposes of its users also exist.

The importance of this dimension is also supported by the results of the validation questionnaire, which showed major differences in the information disclosure behaviour of users of communities in different contexts. For example, networking communities rely on providing valid information to serve its purposes, whereas in a gaming context the possibility to re-identify a user behind his pseudonym is sufficient. This is clearly reflected in the questionnaire results. Whereas 68.5% of professional community users disclose their real name to unknown persons, only 4.7% do so in the gaming community.

#### Work-related purposes and interests

The purpose of these communities is related to work or business contexts. Examples for such communities are e.g., sites to manage and share ones business contacts such as LinkedIn or XING or sites and services which provide a platform for a special group of professionals.

A detailed example of an online community used in a professional context is provided by [Thom-Santelli et al. 2008]. They describe a system that comprises an enhanced contact directory, a blogging tool, a social bookmarking website and a podcast repository.

**Examples:** XING, LinkedIn

**Consequences, significance and implications for privacy, trust and IDM:**

- Personal data might be especially sensitive as it is related to the professional environment of individuals influencing e.g., their career development or professional appearance.
- Not only the direct user is involved; frequently, also enterprise policies and regulations regarding the publication of company related information have to be considered.
- Questions and conflicts on who should be able to control the content – the individual or the company – might arise.
- Fake identities or pseudonyms cannot be used to the same extend as in other sites because the publication of a real identity is essential to fulfil the purpose of most sites (e.g., networking, business development, career advancement).

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- If professional community members also get access to personal data of individual community members that might not be directly related to the professional purpose, conflicts may arise from revealing information about an individual that was not meant to be communicated to a particular target group.

### Leisure-related purposes and interests

Within this dimension, communities that evolve around shared hobbies and leisure time activities can be summarized. Typically participants use these sites to share information regarding the common topic, to chat, to organize events and to share activities, etc. We want to emphasize that we only consider sites in our research that allow and support the interaction and communication between users and therefore services that only offer information are not represented in our classification.

**Examples:** MySpace, Friendster

**Consequences, significance and implications for privacy, trust and IDM:**

- Users might be less careful in providing personal information than on sites with a professional context.
- User can be expected to have a more experimental approach to services, try them out for fun, etc. It is to be researched if the initial barrier to join such a community is lower.

### Voluntary engagement

Voluntary engagement characterizes activities that are task-driven (e.g., within a work-related context contrary to the focus on relaxation and leisure activities) but that are done without payment, i.e., voluntary due to a belief in the goals and purposes of the community. Typically also organisations are formed (e.g., clubs), but they are to be differentiated from work or leisure related forms of organisations by distinctive characteristics. .

**Examples:** open source development platforms, Wikipedia, indymedia

**Consequences, significance and implications for privacy, trust and IDM:**

- Both, work and leisure related patterns needs to be supported by trust and IDM related measures.
- In case the voluntary engagement is in the context of political activities or similar sensitive areas privacy and trust issues become especially important. This is particularly true for the relationship to official public bodies.
- While providing an identification mechanism to assure the actual authorship of content, these communities need to provide some form of pseudonymisation in order to enable an individual to participate who wants to separate various roles from one another (e.g., professional role as employee of a software company separated from private role as political activist in the community).

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### Romantic relationship initiation

The common interest and goal of participants of communities in this dimension is the initiation of romantic relationships. A distinctive feature of these communities is that the users typically do not know each other beforehand, and that the initiation of relationships that move into the real world is explicitly desired.

**Examples:** dating.com,

**Consequences, significance and implications for privacy, trust and IDM:**

- Discretion about relationships and communication as well as the confidentiality of provided personal information is of special importance.
- There is a special need to provide functionalities to minimize the risk of discrimination, stalking, predatorship or related activities.
- The private nature of these communities might create an environment where individuals start to share very sensitive personal information such as pictures, sexual orientation, or personal likes and dislikes due to a false sense of privacy without realizing the degree of publication or searchability of this information.
- There is a special tension between publishing one's own identity and the want for staying anonymous.

### Location-/mobility-related

Location or mobility related communities are characterized by the central importance of the location aspect for the formation and/or purpose of the service. Typical examples for such communities are ad-hoc groups that are formed based on the location of their members i.e., persons in close proximity to each other.

**Examples:** Next2Friends, Qiro

**Consequences, significance and implications for privacy, trust and IDM:**

- Location information can be especially sensitive compared to other information.
- Typical applications require the "always-on" function to determine the location of the user, thus, actively turning off the mobile device or the location finding function might influence the privacy requirements.
- If the exact location of a user is known, he or she possibly can be tracked down and information not intended to be shared can be captured (e.g., a picture of the user is taken, etc.).

### Multiple purposes

The question here is whether the community members have rather similar or rather distinct purposes. For example, on a dating site the purpose in general will be rather similar whereas a site like MySpace is used fur much more divergent purposes by different users and user groups.

**Examples:** bloggs, web space,

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**Consequences, significance and implications for privacy, trust and IDM:**

- Difficulty to identify general guidelines and practices that serve the privacy requirements of all user groups and usage purposes alike.
- Complexity of anticipating the core privacy issues.
- Enhancing the privacy functionalities for one user group might imply restricted functionality for another user group.
- Difficulties to communicate privacy-enhancing measures correctly and in an easy to understand manner.

### 3.4.2 Structure of Community

The structure of a community naturally has an important influence on the resulting dynamics of the communication, on the possibilities and restriction of interaction and on the involved potential risks and threats for the privacy, security and identity management concerns of its users. The next sections identify major attributes that describe communities with regard to different structural aspects.

An empirical indicator for the relevance of this dimension is the correlation between the information disclosure behaviour and the number of “friends“ a user has within a community that was found in our questionnaire. In fact, the results in section 7.20 indicate that the more friends a user has, the more information he is willing to disclose.

#### Size

A relevant distinction criterion for our purposes is the size of the community. It is highly important for privacy issues and the related management infrastructure whether a community has e.g., 20, 200 or 20.000 members. For the estimation of size inactive accounts are not used, because the size of the community is defined by the number of active users i.e., members that did log in or were actively using the service recently.

**Examples:** Big: MySpace, Facebook, World of Warcraft

**Consequences, significance and implications for privacy, trust and IDM:**

- Very diverse privacy, trust, and IDM requirements might exist for very large or rather small communities.
- Due to a community’s size, the managing of trust by direct interaction and observation of other users might be more difficult – formal means for trust management are much more important than in small communities.
- Large communities might have a higher potential risk in attracting the attention of participants that are interested in misusing the information.
- Specific dynamics such as network effects can evolve in large communities much better than in smaller communities (e.g., collecting “friends”).

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- The possibilities for an individual to influence the future direction of the community is much smaller in a large community and therefore, the personal control one might have over the personal information in such a community might move further away from the user.

### Virtual vs. face-to-face communication

Communities can be distinguished with regard to their prevailing means of communication between members. The main difference with regard to the PICOS objectives here is whether communication between members is taking place only via electronic mediation (virtually) or if face-to-face interactions are also part of the typical communication patterns.

Virtual communities are communities where the members typically only interact virtually. Face-to-face interactions might occur, but they are not a typical part of the interaction, occur only scarce and the majority of interaction partners never meets face-to-face.

Mixed communication communities are communities where the members typically interact both physically and virtually. For most services there is no explicit need to communicate face-to-face, but research has shown that social networks typically are used by existing communities to communicate with each other, organize and schedule events and meetings and to stay in touch.

Face-to-face communities are communities where the members typically only interact physically. Electronic and virtual means are only used in a minor role. Due to the objectives of PICOS these communities are only relevant for PICOS in an indirect role i.e., experiences, expectations, patterns, etc. learned in direct communication influence the behaviour for virtual and mixed communication. Also an existing face-to-face community can form the starting point for virtual communities, and therefore should be well understood.

**Examples:**

- Virtual Communities: Gaming platforms, boards and discussion platforms for solving certain problems occurring by products, software and other topics.
- Mixed: Facebook, StudiVZ, Angling Community

**Consequences, significance and implications for privacy, trust and IDM:**

- In virtual communities trust has to be established based only on the electronically mediated communication channels.
- In exclusively virtual communities multiple identities are easily possible, as they are not linked to an identifiable person.
- Mixed: Need for proper mechanisms to link online and offline data.
- Mixed: Online communication is linked to offline communications.
- Mixed: Patterns of communication and trust are closer to offline patterns.

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### Types of relationship

Besides size of the community and modality of interaction (virtual or face-to-face) also the technically supported or promoted structure of relationships and communication is important. Distinctions are to be made between communities and services that are mainly oriented towards one-to-one communication, communities where the prevailing structure is one-to-many or many-to-many.

**Examples:**

- one-to-many: forums
- one-to-one: private chats, two-person games

**Consequences, significance and implications for privacy, trust and IDM:**

- In one-to-one settings it must be communicated and ensured, that the information is only visible to the authorized partners.
- When different types of relationships exist the user needs to understand the different roles and privacy implications correctly.

### Organizational structure

The organizational structure describes a community in terms of its differentiation of roles with according rights. This should not be confused with different social roles user can take. Organizational roles include different sets of rights and possibilities to interact with the system and each other.

**Examples:** Administrators in forums, Wikipedia (known authors versus anonymous users)

**Consequences, significance and implications for privacy, trust and IDM:**

- In case of different roles these need to be communicated.
- Trust must also be established into the higher-ranking users i.e., user with more rights to change content.
- The possibility of power struggles needs to be considered.
- Questions of transition or promotion from on role to another role have to be considered.

### Churn rate

Churn rate characterizes the stability of a community in terms of the member base. A distinction has to be made between stable communities, that exist for a long time and the users basically are dealing with other users they have already interacted with before and communities with a high fluctuation, where members typically do not interacted with each other repeatedly.

**Examples:**

- High churn rate: single pages (initiation of romantic relationship pages) typically have a rather high churn rate either because they are successful or people get bored of it and move on. Also story-based gaming sites typically have high churn rates, as they are played only once through the whole story, and then people move on to other games.

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**Consequences, significance and implications for privacy, trust and IDM:**

- In case of a high churn rate means for establishing trust with strangers become more important.
- With a high churn rate also the drift of the whole community with regard to privacy related attitudes, positions and practices can change faster than in stable communities and also the future tendencies are harder to predict.

### 3.4.3 Expected Lifetime and Formation Characteristics of Community

Life time is a relevant factor, as differences in the expected lifetime can introduce quite different behaviour patterns. Within this context we also want to mention that the lifetime of the community must not be the same as the lifetime (or availability) of the community platform and communication. There are several examples of communities that do not exist anymore, but all their communication still is available on the web.

The results of the PICOS community questionnaire indicate that users tend to provide more information the more time they spend using a community. As the time spend on a site also accumulates with the time a user is a member of the community we can expect to discover relations between the lifetime of a community and the disclosure of personal information. However, we cannot directly prove this thesis by the available empirical results.

#### Long-term

Most communities are long-term oriented i.e., no explicit end of the community is known, and the users expect the community to be around for quite some time.

**Examples:** open-source-development communities,

**Consequences, significance and implications for privacy, trust and IDM:**

- Trust and privacy issues need to be established for long term, and also it must be assured that data and policies not only currently but also in the long run are safe.
- Issues of changing and deleting past information become more relevant.
- As there is no explicit end for the community, questions in relation to cancelling membership and similar are of more importance than for short term communities.

#### Short-term

Short term communities are communities, which expected lifetime is very short. We define short in this context as an expected duration of the community of less than a year. Short-term communities are typically related to an event/a series of events. For example several short term communities evolved around the European football championship. Anyhow, even though these communities are short term, it is highly probable that users will encounter each other again in communities of related interests (in the football example e.g., the world championship).

**Examples:** em2008.sixgroups.com, www.fussball-foren.net

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**Consequences, significance and implications for privacy, trust and IDM:**

- Users only have limited time to establish trust.
- There are no typical old hands around.
- It might not be clear what happens with the data after the founding event has passed.

### Ad-hoc communities

Ad-hoc communities are characterized by an opportunistic, short-term and purpose-driven context of origin. Typical examples for ad-hoc communities would be e.g., the visitors of a rock concert, that communicate via their mobiles. Ad-hoc communities typically disintegrate after the opportunistic reason falls away.

**Examples:** wireless ad-hoc networks

**Consequences, significance and implications for privacy, trust and IDM:**

- The user does not have control over who the other partners of the community are, as they are based on proximity.
- It might not be clear what happens with the data after the founding event has passed.

## 3.4.4 Community Member Characteristics

Communities are different with regard to their user base i.e., the average user of community services might have very different knowledge, economic background, privacy needs etc. This dimension tries to classify and describe the most important characteristics of the users with regard to the PICOS objectives.

In the questionnaire we collected different demographic and behaviour variables and analysed the results with regard to significant differences. Our results indicate for example that age and education seem to be important influence variables for the information disclosure behaviour, whereas gender and computer knowledge (to our surprise) do not seem to have an important influence. The influence of age and education is considered in the section “privacy sensitivity”. However, we decided to keep the sub-dimension technological experiences, as we think it has important implications for the user interface possibilities of the PICOS platform.

The results also indicate differences according to country, but due to in some cases very small number of participants these results should be interpreted very carefully.

### Technological experiences and background knowledge

A first important characteristic of the communities’ user is the average users’ general level of experience with technology and computers, as this has significant influence on the knowledge about security risks and threats and on what privacy enhancing means can be applied successfully.

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**Examples:**

- Average user is very experienced: Open source development communities,
- Average user is medium experienced: Facebook, StudiVZ

**Consequences, significance and implications for privacy, trust and IDM:**

- Different levels of knowledge regarding threats can be expected.
- Experienced users are better in estimating and identifying possible threads.

### Understanding of underlying commercial aspects

Here the average user's experience and knowledge level regarding economical and business processes, payment organization etc. is characterized. This dimension is closely related to the previous one, but more targeted towards the understanding of underlying processes and not the technological solution. Anyhow, in practice the two dimensions are highly interrelated and have to be considered together. For example, for paying online with PayPal, the user needs to understand both, the business process and model of PayPal, and he needs to be able to use the involved technology.

**Examples:**

**Consequences, significance and implications for privacy, trust and IDM:**

- In case inexperienced users are to be expected special attention towards communicating the possibilities and risks should be taken.
- Provision of trust enhancing means also needs to consider economic knowledge and not only technological experiences.

### Individual identification with group

Aspects of (high or low) identification with the community and the group cohesion are relevant for this dimension. , i.e., in some communities identification with the group and related aspects are very important, whereas in other communities this aspect is not important at all.

**Examples:**

- High identification: (virtual) fan clubs and pages
- Low identification: Help forum

**Consequences, significance and implications for privacy, trust and IDM:**

- In case of high identification with the group breaching of trust or privacy might be experienced more serious than in groups with low identification.
- In case the individual identification with the group is low informal mechanisms and rules that establish trust and secure privacy cannot be expected to unfold the same as in groups with high identification.

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### Cultural background of members

Communities can also be characterized by the dominating cultural background of the members. This is important, as social interaction patterns and patterns of trust establishment can vary significantly between cultural groups.

**Examples:**

- Brazil, Iran: Orkut
- Germany, Austria: StudiVZ

**Consequences, significance and implications for privacy, trust and IDM:**

- Establishing trust should be adapted to the specific cultural background of the community participants.
- Violation of cultural norms probably leads to decreased trust.
- International sites need to find an optimized trade-off between a local and international approach.

### Availability of resources

An important characteristic of the community members is the availability of resources of any type, whereas the most relevant type of resources are economic and technological. To be able to participate and use online communities basic resources need to be available. For example, nominally can participate in an online community structured around sharing videos with a low-bandwidth connection, but practically this doesn't make sense.

**Examples:**

- Extensive resources available: technical development communities

**Consequences, significance and implications for privacy, trust and IDM:**

- Means to enhance privacy need to work with the (potentially limited) user's equipment.
- User with different equipment needs to be supported.

### Privacy sensitivity

Here the expected privacy sensitivity of the average member is characterized. Privacy sensitivity is expected to be highly interrelated with the purpose of the community and the type of information that is shared.

**Examples:**

- High sensitivity: self-help groups, such as those concerned with health issues like http://www.onko-kids.de/

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**Consequences, significance and implications for privacy, trust and IDM:**

- Very sensitive community needs additional privacy-enhancing means.
- Non-privacy-sensitive members of privacy sensitive communities should not be forced to use burdening PETs to be able to interact and participate.

### Homogeneity of community members

For the PICOS objectives it is also relevant, whether community members are rather homogenous or heterogeneous with regard to the roles they are taking within the community. The questions here are if there are different roles with different rights within the community or not and if these roles are supported by the system (or of mere social type).

**Examples:**

- Homogenous Community roles: most online communities have a rather homogenous structure, e.g., MySpace, Flickr, etc.
- Non-homogenous Community roles: Small asymmetries in user roles are typical for communities and services that follow a basic=free, advanced=fee based business model.

**Consequences, significance and implications for privacy, trust and IDM:**

- Asymmetries in the relationship (users with more rights than others) ask for specific trust, privacy and IDM solutions, because the user with the less advanced role does not have the possibility to actually experience, what users with advanced roles can do.

## 3.4.5 Interaction characteristics

This dimension describes the typical interaction patterns of an average community member. The questionnaire results support the importance of this dimension, especially for professional and social networks. In these networking oriented communities there seems to be a clear relationship between the time spend within the community and the way people deal with their private information. In short, the more time people spend in a community, the more information they are willing to share. Interestingly, there is no such trend in the other community types.

### Frequency

Frequency describes how often the participants use the community service or interacts with other community members. For some communities typically there will be interaction activities every day, whereas for other communities less frequent patterns of interactions are to be expected. Frequency may also vary depending on the topic the community is concerned with. Day-trading communities for example have dramatically increased interaction peaks when stock exchanges have business volumes.

**Examples:**

- High frequency: Trading communities offered by banks, saving clubs and broker associations

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**Consequences, significance and implications for privacy, trust and IDM:**

- High interaction frequency requires systems to be able to support frequent interactions (even if they are not directly consecutive) without the need for repeated security routines.
- Low frequency interactions need to communicate the trust and privacy seriousness every time the user interacts again.

### Intensity

Intensity tries to describe the emotional involvement and importance of the online community to the user. This dimension is closely related to the previous one (frequency) and also to the identification with the group. However, it is a distinct dimension as frequency typically correlates with intensity, but this does not need to be so in every case. For example, during an online auction a user might check the current situation of bids frequently, but this doesn't mean he has to be intensely emotionally involved.

**Examples:**

- High intensity: Services targeted at the initiation of romantic relationships

**Consequences, significance and implications for privacy, trust and IDM:**

- The higher the emotional engagement of the users the more serious a breach of privacy or trust hurts.

### Expressivity of medium

This dimension describes the available bandwidth and expressivity of the medium used for interaction and communication. Video for example is more expressive than audio, which again is more expressive than text only. Expressivity of the medium describes its capacity to convey the information beyond the mere textual content of a message that in face-to-face communication is expressed through gestures, mimic, intonation, etc.

**Examples:**

- Expressive medium: Community with included video chat functionality
- Low-expressive medium: text-only communication

**Consequences, significance and implications for privacy, trust and IDM:**

- Expressive media can transport subtle signs that are used by humans to evaluate the trust of interaction partners.
- An expressive medium also implies that expressive data can be the subject of trust and/or privacy issues.
- Expressive media records frequently are identifiable without further linking to the source (e.g., by the specific pitch of tone, etc), therefore regarding privacy protecting means are needed.

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### 3.4.6 Content generation

Within this dimension the focus lies on who is the main generator of the contents. Naturally, in services a mix of contents provided by different sources can be found. Anyhow, to have a clear view on who is producing the different contents helps to understand the resulting privacy, trust and IDM issues. For the PICOS community questionnaire especially communities with user-generated content have been investigated.

#### Provider-generated

The content is mainly generated by the service provider / host of the community. Typically the content here is an add-on for the users and it is used to increase customer loyalty. The main reason for joining the community is interacting with others, and the content the provider generates is a nice additional service.

**Examples:**

- http://www.euro2008.uefa.com/
- http://europe.nokia.com/

**Consequences, significance and implications for privacy, trust and IDM:**

- Issues of differentiation between the contents provided by the service provider and the content provided by end-users might arise e.g., should the user apply the same quality and trust standards?
- Differentiation between editorial content and advertisements becomes important.

#### User-generated content

The content is mainly generated by the users themselves, and the other community members can access it.

**Examples:** MySpace, YouTube,

**Consequences, significance and implications for privacy, trust and IDM:**

- Questions regarding the ownership of content become important, e.g., was the content really produced by the user?
- Possible provision of means for the user to protect his/her rights to his/her content both in the short- and the long-term.

#### 3rd party generated

The content is mainly generated by a 3rd party. Typically for the end user / community member this situation is not different from the provider-generated configuration.

**Examples:** Brokerage and day-trading portals in which the content is provided by stock exchanges, press agencies and listed companies.

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**Consequences, significance and implications for privacy, trust and IDM:**

- Identification of the generator of the content might be difficult, but is an important prerequisite to establish trust in the accuracy, quality, and integrity of the content.

### 3.4.7 Type of media / channel diversity

Type of media differentiates between online and mobile communities. Out of more than 850 respondents to our questionnaire only 8 respondents participated in mobile communities. This is a strong indicator that mobile communities are still in their very beginnings. Anyhow, we think a differentiation between online and mobile communities is needed. First, with the decreasing of mobile data transfer costs and the increased possibilities of mobile devices we expect a significant increase in the importance of mobile communities in the near future. Second, mobile communities introduce news and/or qualitatively different risks with regard to privacy and trust issues. Within PICOS we also target to research these new threats and provide mechanisms to overcome them from the beginning.

#### Mobile

Interactions and access to contents is mainly done from mobile devices such as mobile phones or PDAs. Connection to the service is established typically either by WiFi or GPRS.

**Examples:**

- Mobile dating communities and buddy-finding communities
- www.myqiro.de

**Consequences, significance and implications for privacy, trust and IDM:**

- Location can potentially be tracked, and regarding mechanisms to avoid misuse should be implemented.
- Mobile devices typically only use very small screens. Therefore privacy enhancing means and security functions need to be designed very concise to not waste the limited screen space.
- Privacy mechanisms play an important role in such communities for ensuring that that presence and availability can be managed in a concise and easy –to-use manner.

#### Online

Interactions and access to contents is mainly done through the web typically by use of a web browser. However, also specialized programs can be used to interact online. This is especially common for the gaming sector.

**Examples:** almost all considered communities offer online access. Only a few mobile services do not provide a web version of their contents.

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**Consequences, significance and implications for privacy, trust and IDM:**

- The ease of use and the widespread use of online media channels through very different types of devices present major risks for ensuring the information privacy to its users.
- Identity management systems start to merge and while a simplification of IDM systems might be desired, the potential risk of reducing the security level in the process is an important issue.
- Building trust for online communities for community providers might mean that a consistent application with clear terms and agreements and a consistent privacy and data protection policy might be important. It is to be researched how important the brand and image of the online community might be and if a trusted system of rules and a code of conduct is relevant.
- Vulnerabilities in used technologies and media channels might increase when a community is using multiple channels simultaneously. The more channels are used, the more of the existing vulnerabilities need to be addressed.
- IDM systems are still extremely different from one media channel to another (e.g., online vs. mobile) and, thus, privacy-enhancing mechanisms need to be addressed for each channel.

### 3.4.8 Communication medium characteristics/communication structure

This dimension describes the prevailing communication structure and communication medium usage characteristics of the online community. Three main areas were identified; naturally in reality hybrid structures are very common, but usually within one system or service one can also identify system parts that are dealing with mainly one of the identified areas.

This differentiation is important for the objectives of PICOS as these different characteristics share the users' disposition to share data and their expectation regarding the usage of this data by others. Also the questionnaire results support the influence and relevance of this dimension. For example the implications of trust on the communication medium characteristics can be seen in the results of the questionnaire. It clearly states that there is a correlation between the communication medium and the trust in a community. For example, users of networking communities tend to trust these communities more than users of gaming communities.

#### Networking

The shared information is used for networking purposes mainly. With networking we refer to the establishment, consolidation and maintenance of private and professional relationships.

**Examples:** LinkedIn, XING

**Consequences, significance and implications for privacy, trust and IDM:**

- To be useful for the user he has to provide his real name. In this context the use of pseudonyms is not expedient.
- Networking can develop social dynamics that lead to relatively careless privacy and trust behaviour.

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### News and information

The shared information is of the type news mainly. The main goal of the users is to keep updated and receive and share information of relevance.

**Examples:** yigg, newstube, Digg

**Consequences, significance and implications for privacy, trust and IDM:**

- Participating in news and information sharing potentially provides extensive information regarding the interests and preferences of a person. This information could be used for unwanted targeted advertising, unauthorized profiling, etc.

### Media and content sharing

The main focus of the service and community is the sharing of media files. The type of media that is shared could be pictures, videos, audio files, texts, etc.

**Examples:** Flickr, YouTube,

**Consequences, significance and implications for privacy, trust and IDM:**

- Copyright and privacy issues for individuals appearing in a video or on a photograph might be an issue.
- The ease of third-party use of the media without the authorization of the original content provider or individual shown on the picture or video presents a major risk.
- Clear rules and mechanisms for ensuring the content provenance and the proper usage of the media only for the identified purpose/s is an important requirement.

## 3.4.9 Governance mechanisms & structure

This dimension describes the rules and regulations which exist (structure) for the interaction and the exchange of information between the members of a community and how the compliance of such rules is enforced and misuse is sanctioned (mechanisms). The dimension is subdivided into internal and external governance, depending on the responsibility for regulation.

The results of the questionnaire underline the relevance of this dimension. Users are restrictive, regarding the distribution of their personal data. E.g. a majority of 52.2% of social network users provide their e-mail address only to their friends. However the willingness to share such personal information with others also depends on the type of information. E.g. in contrast to this the willingness to share instant messaging contact information is higher. Only 42% of the users declared that they would only share this information with friends.

Such complex attitudes regarding the willingness to exchange information and to interact with others in a community needs to be ensured and supported by adequate governance mechanisms,

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### Internal governance

Internal governance is focused on those structures and mechanisms which are carried out by the community members themselves. Such form of governance is very common not only in communities but in the context of all websites, which allow users to create and share their own content. For example, other users can be ranked or otherwise evaluated to some degree (e.g., ignored/banned), content can be commented, rated and even re-edited or flagged as inappropriate if necessary.

**Examples:** Online-gaming communities in which members have the possibility to "punish" misbehaviour of allied members. Discovering that an ally is spying for another alliance may be one of the most prominent examples.

**Consequences, significance and implications for privacy, trust and IDM:**

- Without a strict code of conduct and documented rules and regulations, the internal governance by community members might conflict with the privacy requirements of individual members (e.g., someone is flagged as someone behaving badly while the individual's identity was misused and the real person had no idea of the activities that lead to the banning).
- An IDM system needs to define roles and activities that specific community members have and can engage in, otherwise the risk for misuse might be very high.

### External governance

External governance is focused on those structures and mechanisms which are carried out by the community provider. In fact, already the provision of tools for self-regulation of the users can be regarded as a mean of external governance, even though in most cases a user is not bound to use them. Further means could be the provision of a simple guideline on how to behave in the community as well as more complex mechanisms, like the centralized review of e.g., uploaded images or other user created content.

**Examples:** : E-Learning platforms in which virtual tutors are managing discussions and ensure that interactions between learners (students) are concentrated on the objectives of the course and that misbehaviour, such as lurking, is minimized.

**Consequences, significance and implications for privacy, trust and IDM:**

- While an external governance by the community provider might be able to provide a more consistent level of privacy, such a system might also be too general to encompass all needs and requirements of individual community members.

## 3.4.10 Commercial business models

Commercial aspects of communities describe all aspects, which are related to the financing of a community. Such activities serve to build the financial basis for the operation of a community and can be subdivided into internal, external and hybrid financing. They characterize how revenues are generated and thereby how the services, which e.g., allow to communicate and interact within the community, are financed.

The relevance of this dimension is implicit, as there usually needs to be any form of financing of a community. In addition the results of the questionnaire demonstrate the general demand for communities and especially social networks. E.g. 67% of the participants declare that they use social networks. This high attendance leads to further commercial potentials associated with communities, as they may be addressed (e.g., with advertising).

### Internal Financing

Internal financing comprises all financing activities, which have their origin within the community itself. In such a case, a community is financed by its members, who are paying for the provision of the community platform and infrastructure. Internal Financing comprises the following sub-categories.

Membership-based internal financing envisions a fee for the participation in the community. This may be a one-time fee, which has to be paid at the date of the subscription to the community or a time based fee, which has to be paid repeatedly within a particular interval (e.g., every month). In the latter case, the fee allows to remain in the community. Also a combination of both forms would be possible.

Within the context of service-based financing, a community member does not pay for her or his membership in the community (as in membership based financing), but for the provision of particular services which are provided via the community infrastructure. Such services are part of the community and may extend the basic usage features. Thereby different levels of services can be distinguished (e.g., basic versus premium services). For instance, a simple mail system to communicate with other members could be among the basic features of a community, whereas the archiving of mails would be an additional feature the user would have to pay for.

However, it should be considered, that the term ‘service’ is in this context not limited to technical features. A service could also be the provision of specific content by the community provider (e.g., related to a particular topic).

**Examples:**

- Internal financing is, for instance, one of the major income sources for Open Source projects which have not reached the broad public. Despite that example, this financing model is used for most closed communities where the members prefer staying private and external financings are regarded to be intrusive for the community.

**Consequences, significance and implications for privacy, trust and IDM:**

- An internal financing model typically also means that community users are more aware of the specific rules and regulations governing the handling of their personal information, however, sometimes the paying for a service or membership might also have the effect that the user is expecting an appropriate level of privacy because he/she trusts the community from the outset.
- Community members paying for a specific membership and/or service also represent a more attractive targeting group for advertisers or for unauthorized individuals or groups who want to access the user’s identity information.
- By delegating decisions on which data shall be disclosed to whom and which preventive measures shall be applied, the customer has to decide in how far he trusts the service provider to manage the data and preferences properly.

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### External Financing

In this form, financing relies on 3rd parties instead of the community members. 3rd parties may be primarily companies, which are interested in the marketing of their products and services. Hence, the financing is based on marketing activities. Such activities can consist of advertisements (e.g., Banners, Sponsored links), Participation in affiliate programs (e.g., Amazon Associates), or cross selling (advertising of complementary products or services).

An additional form of external financing is sponsorship, which means that either the whole community or several parts of it (e.g., specific services) are financed by one or a few sponsors. Also donations (by private individuals, companies or institutions) are a sub-part of this category.

**Examples:**

- Sponsoring: Many companies from the food-sector such as Nestlé and Maggi try to increase the customer value by offering clubs and community portals following this financing model.

**Consequences, significance and implications for privacy, trust and IDM:**

- Additional parties that are interested in the provision of a community might represent a heightened risk for using the personal information provided by community members for purposes other than the ones originally identified.
- Strict guidelines for the collection, use, and transfer of personal information in the community need to be set up especially mentioning third parties that might receive data about the users.
- Increased risks occur when external financing partners change (e.g., an investor changes or the community provider sells the community to a third party) unless the rules and regulations governing the business model and the processing of personal information is openly and actively managed and provided to all users.

## 3.5 Application of the approach with example communities

Table 3 on the next page shows the application of our dimension-based classification approach with two well known online communities: Xing and Facebook. The classification shows that these two communities are rather similar in many dimensions (e.g., Dimensions 2, 3, 6 to 10), but also that important differences exist in dimension 1 (Usage context and purposes) and 4 (Community member characteristics).

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| | Xing | Facebook |
|---|---|---|
| **1. Usage context and purposes** | | |
| Work-related purposes and interests | Yes | No |
| Leisure-related purposes and interests | No | Yes |
| Voluntary engagement | No | No |
| Romantic relationship initiation | No | No |
| Location-/mobility-related | No | No |
| Multiple purposes | No | No |
| **2. Structure of Community** | | |
| Size | Big | Big |
| Virtual vs. face-to-face communication | Virtual | Virtual |
| Types of relationship | One-to-one | One-to-one |
| Organizational structure | Basic/premium members | No differentiation |
| Churn rate | Low | Low |
| **3. Expected Lifetime and Formation Characteristics** | | |
| Long-term | Yes | Yes |
| Short-term | No | No |
| Ad-hoc communities | No | No |
| **4. Community Member Characteristics** | | |
| Technological experiences and background knowledge | Experienced | Medium |
| Understanding of underlying commercial aspects | Good | Medium |
| Individual identification with group | Low | Medium |
| Cultural background of members | Divers | Divers |
| Availability of resources | High | Medium |
| Privacy sensitivity | Medium | Medium |
| Homogeneity of community members | Low | Low |
| **5. Interaction characteristics** | | |
| Frequency | High | High |
| Intensity | Low | Medium |
| Expressivity of medium | Low | Low |
| **6. Content generation** | | |
| Provider-generated | No | No |
| User-generated content | Yes | Yes |
| 3rd party generated | No | No |
| **7. Type of media / channel diversity** | | |
| Mobile | No | No |
| Online | Yes | Yes |
| **8. Communication medium characteristics** | | |
| Networking | Yes | Yes |
| News and information | No | No |
| Media and content sharing | No | No |
| **9. Governance mechanisms & structure** | | |
| Internal governance | No | No |
| External governance | Yes | Yes |
| **10. Commercial business models** | | |
| Internal Financing | No | No |
| External Financing | Yes | Yes |

**Table 3 Application of the approach with example communities**

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# 4 Summary of Privacy, Trust and Identity Management Implications

This section specifies the high level requirements for the identified categories of communities as they relate to privacy, trust, and identity management in the context of their use and interaction mode.

## 4.1 Differentiation of Trust

As trust generally characterizes a relationship between two or more entities, there are different trustable entities in a community context. The entities, which are related in this context, include the community platform, the platform provider, service providers and the community members. Thus, from a community member's perspective, trust may characterize (to some degree) the relationships to all these entities. Trust as a dimension for the categorisation of communities describes, how important which of the following aspects of trust is for a specific community.

### 4.1.1 Trust in technology

"Trust in technologies" describes trust of entities in the underlying technology, which provides the (technical) basis for the community. Trust in technology describes, how far the platform is reliable, save and resistant against attempts of wiretapping, and if it provides e.g., mechanisms for the security of user specific data. Entities in this case are the community members. Some aspects of this trust facet could be measured and assessed in an objective manner by checking the availability of trusted computing components and other technological provisions.

### 4.1.2 Trust in community provider

The trust a community user has in the provider of the community platform has an important implication on the success of the community growth. One issue that influences trust in the community provider is the way the provider handles the user's personal data and if he uses the data only for the specified purposes. Trustworthiness in this respect can be build up by the provider, for example, by providing open and transparent privacy policies and by responding to incidents or privacy breaches in a professional way. If the user is assured that his personal data gets handled appropriately by the provider, he will be more likely to trust the community provider with his personal information.

### 4.1.3 Trust in other community members

The trust one user has or does not have in other members of the community can also influence the success of the community growth. Sometimes reputation mechanisms such as showing the membership tenure, activity level, or social graph of community members can enhance the trust community members have into each other. On the other hand, communities that offer, for example, the anonymous posting of news and blog comments by its members might see a reduction of trust , particularly when these comments are abused to include persona opinions and negative or discriminatory judgements about other community members.

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### 4.1.4 Trust in service providers

Trust issues may also occur if the service provider/s is/are different from the actual community provider, e.g., third parties that provide payment systems for paying the community membership fees or the telecommunication provider responsible for a video stream platform. Trust in service providers also involves the treatment of personal information which is provided by community users in the context of the relevant service usage.

## *4.2 Risk Analysis*

In this section, specific risks are identified, analyzed, and discussed that are likely to have an impact on privacy, trust, and identity management aspects of the respective communities. These risks might be added as separate topics to the requirements catalogue as the project coordinators see an appropriate fit.

### 4.2.1 Potential risks and related consequences of misuse

Any civil engineer will determine the specific risks a newly designed bridge spanning across a river will face before engineering the required static of the bridge. Software engineering typically follows different procedures. Software is often designed according to functional requirements and creative ideas. User acceptance tests, therefore, mainly include the test of basic functions. Does the software perform? Does it do what it was supposed to do? Risk scenarios are hardly ever tested. An exception would be the engineering of security solutions as they also follow a risk-based design process.

In the case of designing PICOS communities, possible risks to the use of these communities or to specific functions within the community need to be known. The following list provides some idea on the range of risks to the information privacy for community users.

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| Social Context | Example for Possible Privacy Risks |
|---|---|
| Business Networking | Blackmail, Breach of Confidentiality, Data Reuse/Secondary Use, Discrimination, Aggregation |
| Personal Friendships | Intrusion, Breach of Confidentiality, Data Reuse/Secondary Use, Aggregation, Identity theft, Abuse by Cyberbullies[2] or Predators, Badmouthing, Pedophilia |
| Publication and Broadcasting | Unwanted Exposure, Distortion, Data reuse/Secondary Use, Abuse by Cyberbullies or Predators, Video-bullying, Objectionable material, Pedophilia, Child pornography |
| Special Interests or Communities | Discrimination, Data reuse/Secondary Use, Aggregation, Intrusion, Exposure, Breach of Confidentiality |
| Virtual Identities | Exposure, Appropriation, Identity theft, Breach of Confidentiality, Insults, Cyberbullying |

**Table 4 Examples for privacy risks when using online communities**

Knowing the specific risks, the community provider can determine very precisely what his systems need to do in order to reduce or eliminate these risks from invading the users' privacy and possibly causing damage.

### 4.2.2 Risk of user unawareness

Recent privacy studies for online communities reveal the fact that most users are unaware of specific risks of privacy-invasive activities and have no idea to what degree their online profiles and the PII connected to it is visible and exposed to others [Acquisti and Gross 2006]. A fact that also explains results from user surveys where users always say they are clearly concerned about their own privacy but then make decisions to reveal PII data about themselves that are contradictory to their concerns for privacy [Flinn and Lumsden 2005]. [Acquisti and Grossklags 2004] have elaborated on this dichotomy between privacy attitude and behaviour and concluded that individuals are neither able to calculate the probabilities and amounts of risks nor are they able to perceive the long-term risks and losses while acting in privacy-sensitive situations.

As a consequence, PICOS needs to research the awareness of community users towards potential privacy risks in more detail and make suggestions for solving this issue – an aspect that is most effective when researching actual user behaviour in the PICOS communities itself rather than on a theoretical level upfront.

[2] Cyberbullying involves the use of information and communication technologies to support deliberate, repeated and hostile behaviour by an individual or group, that is intended to harm others (as defined by Bill Belsey, founder of the website www.cyberbullying.org).

### 4.2.3 Existing technical vulnerabilities

The fast growth of online communities and the use of mobile applications to connect people and to provide an ever increasing range of services disregard the fact that most technologies used are vulnerable to security and privacy-invasive activities. Software patch update archives relating to security flaws in the technology alone should be an indication that the quality of these applications may not be appropriate to justify new and advanced features that increasingly process personal data in an unprotected fashion. More control structures would need to be integrated to reduce the risks for security and privacy-invasive activities.

However, the increasing complexity of web application technology and the recent introduction of mashable applications in the so-called Web 2.0 environment are not helpful in providing the needed control structure. In fact, the Web evolves without minding the necessity for control over personally identifiable data. This is especially apparent in online social networks. Personal data provided by the user to one application may spread to a number of other applications without further control over its usage simply by mashing applications. This will also be an issue for PICOS communities where personal data is mashed and aggregated to provide additional services. Privacy-enhancing technologies can support the protection of personal data in such set-ups but as Ian Goldberg stated in his PET report, most privacy-enhancing technologies to date have been concerned only with the privacy of identity [Goldberg 2002]. The diverse privacy requirements discussed in the previous section should make clear that the privacy of the user's identity alone cannot suffice and PICOS needs to address the appropriate requirements for a privacy-enhanced use of vulnerable technologies.

### 4.2.4 Data Portability

An additional risk to the information privacy of community members is the growing practice to 'mash-up' various community or social network applications, their features, and particularly their users' personal data. The cumbersome activity of signing up for a number of new community services and the repeated work to enter profile information and to add friends and relationships to these sites has led to a fatigue problem. Calls for more integration of applications and for a network of communities stem in part from the inconvenience users have when entering the same information again and again. The other side of the coin is the economic advantage community providers see by integrating their services.

Google's Open Social API alliance with companies such as LinkedIn, Plaxo, Friendster, and hi5 to write standards for an integration of these applications and for a portability of social network data for example can be seen as a way to gain ground in the race for market share. The potential combined market share of the Open Social API alliance partners was summed by Hitwise Intelligence [Tancer 2007] to be five times as high as Facebook's market share at the time of the alliance announcement.

The implications these developments have on the users' information privacy become clear when trying to address the vast list of privacy, trust, and identity management requirements listed in the previous section.]

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## 4.3 High level implications on PICOS requirements

In order to address the relevant implications in a very structured and pragmatic way, the following figure attempts to show the main building blocks for the high level implications. The basis for most of the implications to be addressed within PICOS – be it for privacy, trust, or identity management issues – are laid out in laws and regulations. Yet, for a more detailed catalogue of implications, it is important to know where the implications originate from. Thus, besides the legal and regulatory side, PICOS will also address the appropriate privacy, trust, and identity management functionalities of its solutions from a personal, technical, as well as business point of view.

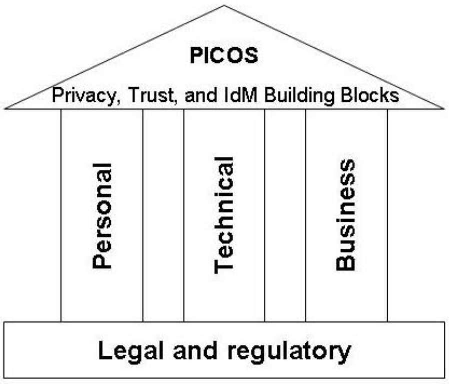

**Figure 2 Building blocks for defining the functionalities for Privacy, Trust, and Identity Management**

The following descriptions intend to clarify those four building blocks. After setting the high level requirements from a legal and regulatory point of view, minimum requirements to be collected from individual users (personal), technology assessments (technical), and community providers (business) are addressed.

### 4.3.1 Legal and regulatory requirements

Regardless of the identified community and the interacting parties, there is a set of privacy requirements that is defined primarily by the legal and regulatory framework in the relevant jurisdiction. In the context of PICOS, those legal and regulatory requirements for protecting the information privacy of PICOS community users are derived directly from the EU Directive 95/46/EC of the European Parliament and of the Council of October 24, 1995 on the protection of individuals with regard to the processing of personal data and the free flow of such data (called 'EU Directive' in the following text).

The EU Directive protects the fundamental rights of European Union citizens to privacy with respect to the processing of personal data. The primary focus of the EU Directive is on the acceptable use and protection of personal data. Like all other European Union privacy legislation, this Directive also requires that personal data be collected, stored, changed or disseminated only with a citizen's express consent and with full disclosure as to the use of the data. The Directive also prohibits the transfer of

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personal data from European organizations to non-European Union nations and organizations that do not adequately protect the safety and privacy of personal data.

The EU Directive is based to a large extent on a set of privacy principles that are internationally recognized. The following privacy principles represent a combination of those privacy principles that were defined by international organizations such as the OECD, APEC or from the International Conference of Data Protection & Data Privacy Commissioners, e.g., in their ‘Montreux Declaration’. We extend these principles by some high level privacy requirements related to each privacy principle that should form the basis for the legal and regulatory privacy requirements for PICOS.

| **Privacy Principle** | **Privacy Requirement** |
|---|---|
| Consent and Choice | Obtain the knowledge and consent of each individual for the collection, use or disclosure of his or her PII |
| Purpose Specification | Identify all the purposes for which PII will be collected, used, and disclosed |
| Collection Limitation | Collect only PII from individuals that is necessary to fulfil the identified purposes |
| Use, Retention, and Disclosure Limitation | Use, retain, or disclose PII only for purposes consistent with those for which it was collected |
| Data Minimization | Retention of PII only if necessary to fulfil the identified purposes; disposal of PII that is not necessary anymore |
| Accuracy and Quality | Ensure that PII is as accurate, complete, and up-to-date as is necessary for the purposes for which it is to be used |
| Openness, Transparency, and Notice | Openly display specific information about the application provider’s policies and practices relating to PII management |
| Accountability | Publish the individuals who are accountable for facilitating compliance with applicable privacy requirements |
| Security Safeguards | Ensure the integration of appropriate safeguards to protect PII collected, used, stored, or disclosed |
| Compliance | Provide users with means to challenge the compliance with the requirements listed above (and all others identified) |

**Table 5 Deriving Privacy Requirements from recognized Privacy Principles**

Besides the legal and regulatory requirements set out in the EU Directive for the safeguarding of the individual user’s privacy and the protection of his/her personally identifiable information (PII), there are also legal requirements such as contractual obligations that the community provider usually has with third parties and that need to be implemented. We will address those in more detail under the section ‘business requirements’.

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### 4.3.2 Personal user requirements

Information privacy always directly relates to the individual person involved and in particular the personally identifiable information (PII) processed from this individual. Thus, regardless of the type of community used and the purpose for which it is used, the privacy requirements the community needs to address is at first related to the personal requirements of the user.

The most obvious dimension that comes to mind when dealing with information privacy in the context of using online, mobile or offline communities is to provide functionalities that allow the user to set privacy preferences such as access or viewing rights for a particular content and for particular users in the application. Another example for a privacy preference might be that the individual wants to stay anonymous when providing certain information about him or herself, wants to restrict who can have access to specific PII, or may want to restrict what the PII can be used for.

Privacy preferences, however, depend on a number of factors that create a certain level of concern for the individual providing his/her PII while using a particular technology in a specified context. The personal disposition of an individual towards privacy and his/her preferences can depend on the person’s understanding of the technology used, the social and cultural background, the sensitivity of the data provided, past experience and as well as socio-psychological needs .

All of that, including the purpose the application is used for and the context it is used in may influence the individual’s privacy preferences. For example, if the individual uploads a very personal photograph of him- or herself to a community application in the context of dating relationships, he or she may not want that photograph to be viewed by a group of professionals in the context of career development and job recruiting.

Furthermore, the level of trust an individual has towards people he/she interacts with in a community or towards the technology platform the community runs on may also influence the individual privacy preferences.

Personal requirements towards the identity management systems provided by the community application are very limited and mainly address the expectation what type of personal data the system requires for enabling the correct and true identification of the authorized individual. The identity management system should be designed in such a way that only the minimum set of PII is needed. A lot of identity management systems do not adhere to the privacy principle of data minimization. In general, though, requirements for identity management systems are mainly addressed as technical requirements and depend mainly on the system platforms used.

When seriously considering the personal requirements towards privacy, trust, and identity management aspects in a community application, the system design needs to consider a very distinctive set of requirements addressing all potential users or user groups with their individual needs in the potential context. Knowing the application’s users and their personal requirements towards privacy, trust, and identity management aspects would be the key success factor for the application.

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The personal requirements at a minimum should address the user’s expectations towards:

- privacy preferences in each community category,
- the degree of anonymity expected,
- the personal sensitivity of information provided,
- categories (trust groups) of viewing and access rights the user expects to set,
- personal information necessary for identification purposes, and
- awareness of the potential risks of privacy-intrusive activities.

### 4.3.3 Technical requirements

Besides the fact that privacy requirements do not form a central concern for designers and are treated as a secondary aspect when developing the kind of online communities such as social network applications existing today, there is a fundamental difference in translating privacy requirements to the design of a ‘private community’ versus designing ‘privacy into an online community’.

Today’s technical privacy features in online communities for example follow the approach of offering features to make the access to content ‘private’. However, this practice may even create a false sense of privacy leading to a lower concern for it. The blocking and view settings pretend that the user himself has control over his privacy when in fact he only puts some access or view restrictions on specified content. What happens with his personal data at large and how it is used in different contexts and for example by third parties is not at all addressed with these functional features.

Additionally, the type of interface or GUI the user expects when providing personal information should also be considered. Studies so far have only addressed requirements such as the opt-in or opt-out type of choices or the privacy preference settings mentioned earlier. In most cases today, the checkbox for agreeing with a privacy policy somewhere when signing up for the service is considered to be enough for complying with the minimum legal requirements. However, additional interface features such as warnings provided when privacy breaches may occur or an overview of the PII provided and how it is used today should be considered as well.

In turn, the choices for the right type of identity management system, an overall technical infrastructure, and for a database management system that can cope with the complex requirements of managing PII and not applications will most likely determine the overall privacy level that a provider can realistically provide to his clients.

The technical requirements at a minimum should address:

- data security safeguards especially for PII,
- data management procedures,
- interfaces that include notices and warnings on potential risks, and
- the protection (labelling) of sensitive data from unintended use.

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### 4.3.4 Business requirements

In addition to the personal requirements set by the individual community users and the technical requirements defined by the technology used, the community provider itself may have a separate set of requirements towards the provided privacy, trust, and identity management functionalities of the community. The provider may have, for example, contractual obligations with third parties or there might be privacy and data protection benchmarks such as professional or industry standards that need to be fulfilled. Additionally, there might be work council requirements for example when implementing a new application that allows personnel to connect with each other in an online community. Generally, the provider needs to assure adherence to a set of binding corporate rules and company policies that state the procedures on how to process PII.

Some of these requirements are determined by the provider’s business model or the context of the community. For example, the business model of a provider of a social network community sees the personal data provided by its users as the core asset. Without such data, the business model would not work and, for example, anonymous data would contradict the social networking character of the application. Therefore, the business model itself provides certain requirements to the privacy, trust, and also identity management set ups of the application.

On the other hand, the provider may have particular needs for protecting itself from privacy breaches or privacy-invasive activities towards its users that could harm its brand and image. As a consequence, the provider needs to define detailed rules and regulations that the community application needs to adhere to. Those internal rules and regulations may also be extended to third parties that have access to the PII of the application users and need to consider issues such as consent options, data classification schemes, notification procedures, data transfer rights, data protection measures, and retention procedures.

Professional or industry standards pertaining to the provider may also influence the requirements for the privacy, trust, and identity management solutions. Examples for that could be industry standards on how to process health information about patients in communities that exchange health histories and experiences with certain therapies.

The business requirements at a minimum should address:

- specified privacy policies and procedures,
- the disclosure of PII to third parties,
- measures for creating trust among users towards the other community members, the community provider and towards the technology implemented,
- alternative privacy-enhancing techniques in case the needed PII procedures contradict with the general privacy principles (set forth above),
- segregation of duties and roles model for appropriate identity management system configurations, and
- procedures for providing users with breach notification and redress capabilities.

The descriptions above attempt to point out where and from whom the requirements for the privacy, trust, and identity management solutions are derived from. The following matrix shows the potential influence of these requirements graphically.

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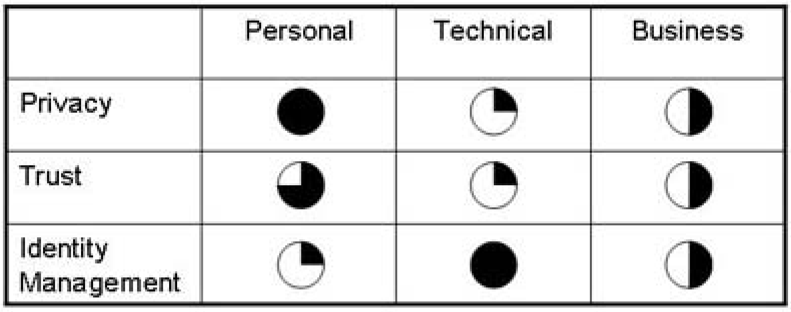
Privacy-enhancing solutions are mainly driven by personal requirements derived from the individual users and participating parties of communities. Measures for creating trust are also influenced to a great degree by personal requirements of individual users but the business (the community provider) has an own interest in assuring a certain trust level of its users. On the contrary, identity management solutions are largely driven by technical requirements and by the business model of the community provider.



| | Personal | Technical | Business |
|---|---|---|---|
| Privacy | ● | ◔ | ◑ |
| Trust | ◕ | ◔ | ◑ |
| Identity Management | ◔ | ● | ◑ |

**Figure 3 Potential influence of requirements on Privacy, Trust, and Identity Management set up**

# 5 Closing Remarks

PICOS aims at the development of tools and technologies for privacy-enhanced identity and trust management in the context of online and mobile communities. Given this broad application field ways to systematically study and structure the application domain are needed. In this document we tried to identify the main influencing factors for a community's privacy and trust needs and developed a categorisation approach based on these dimensions of communities. We also identified first implications for privacy, trust and IDM issues.

As with all classifications there are different possibilities to organize the factors, our classification is based on prior categorisation approaches tailored to the objectives of PICOS. In our classification we were guided by prior approaches of other researchers and the main aim was the usefulness of the structure for the future work.

The next step within PICOS will be the detailed analysis of requirements from a community-specific as well as technical, business and legal point of view closely related to the identified community dimensions. As mentioned, we already started to collect implications for privacy, trust and IDM, but these net to be further detailed and differentiated to form the basis of the PICOS platform.

Even though we validated the classification approach by use of an extensive questionnaire (minor) changes in the structure of the classification approach might be needed in the future, for example when a detailed analysis of the requirements suggests a different organisation of the categorisation.

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The PICOS project receives research funding from the Community's Seventh Framework Programme.

# Appendix A User behaviour in online communities - results from a questionnaire study

## *A.1 The questionnaire*

Thank you for participating in this survey.

This questionnaire is part of the PICOS project, a European project focusing on privacy and online communities (http://www.picos-project.eu). The PICOS consortium consists of eleven partners from seven different countries of the EU. It contains a balanced mixture of specialists from the fields of science, research and industry. Within 3 years, PICOS will investigate and develop a state-of-the-art platform for providing trust, privacy and identity management in mobile communities.

Answering the questions will take about 15 minutes and is anonymous. The information provided by you will be treated confidentially and will be used only for the PICOS project.

You have the possibility to participate in a raffle for Amazon vouchers (total value over 700 Euros), therefore you can voluntarily enter your e-mail-address at the end of the questionnaire.

**When you work with computers you need help …**
o Often
o Sometimes
o Rarely
o Never

**How much time do you spend actively using the internet in a week?**
o Less than 1 hour
o 5 to 15 hours
o 16 to 30 hours
o 31 to 50 hours
o More than 50 hours

**What do you do when you are online? (select one or more answers)**
o Sending e-mails
o Chatting
o Gaming
o Making calls/using Skype (internet telephony)
o Watching videos
o Searching for information
o Browsing
o Reading (e.g., blogs, ebooks)
o Shopping (e.g., ebay)
o Downloading stuff
o Other: ________

**Are you familiar with the term „online community“?**

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o Yes o No

**If yes, please describe what the term „online community“ means for you. (max. 400 characters)**

**Please read the following short definition of online communities.**
An online community - according to our understanding - is a group of people that primarily interact via a computer network. Online communities have also become a supplemental form of communication between people who know each other primarily in real life.

An online community is a social network with a common interest, idea, task or goal that interacts in a virtual society across time, geographical and organisational boundaries and is able to develop personal relationships. Different online communities have different levels of interaction and participation among their members. This ranges from adding comments or tags to a blog or message board post to competing against other people in online video games. (source: Wikipedia)

Examples of online communities are: LinkedIn, XING, Facebook, MySpace, StudiVZ, Flickr, LastFM, YouTube, Blogger, Twitter, Digg, World of Warcraft, SecondLife, Steam, Qiro, qeep

**Are you a member of a professional network such as LinkedIn or XING?**
o Yes o No

**Are you a member of a social network such as Facebook, MySpace or StudiVZ?**
o Yes o No

**Are you a registered member of a content sharing network such as Flickr, LastFM or YouTube?**
o Yes o No

**Are you a member of a social news network such as Blogger, Twitter or Digg?**
o Yes o No

**Are you a member of an online gaming community such as World of Warcraft, SecondLife or Steam?**
o Yes o No

**Are you a member of a mobile community such as Qiro or qeep?**
o Yes o No

**Are you actively participating in other online communities?**
o Yes o No

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**If you are a member of professional networks such as LinkedIn or XING, which information are you disclosing to which kind of users?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don't disclose this information | Does not apply |
|---|---|---|---|---|
| Real name | | | | |
| Invented name/nickname | | | | |
| Picture of yourself | | | | |
| Job position | | | | |
| Real date of birth | | | | |
| Current Employer | | | | |
| Education | | | | |
| Field of work | | | | |
| Website | | | | |
| Friends/contacts | | | | |
| Company contacts (e-mail, phone) | | | | |
| Private e-mail-address | | | | |
| Private phone number | | | | |
| Private address | | | | |
| Interests | | | | |
| Instant messaging contact (e.g., Skype) | | | | |

**How many friends/contacts do you have on average on professional networks such as LinkedIn or XING?**

**How much time do you spend on average using professional networks such as LinkedIn or XING in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

**How much do you trust the providers of professional networks such as LinkedIn or XING to treat your data confidentially?**
o I fully trust these networks.
o I don't fully trust them but I'm confident.
o I only trust them to a certain extent.
o I don't trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider on professional networks such as LinkedIn or XING?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

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**If you are a member of social networks such as Facebook, MySpace or StudiVZ, which information are you disclosing to which kind of users?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don't disclose this information | Does not apply |
|---|---|---|---|---|
| Real name | | | | |
| Invented name/nickname | | | | |
| Real picture | | | | |
| Fun picture | | | | |
| University/school | | | | |
| Previous school/university | | | | |
| Course of studies | | | | |
| Gender | | | | |
| Real date of birth | | | | |
| Invented date of birth | | | | |
| E- mail-address | | | | |
| On campus residence | | | | |
| Address | | | | |
| Phone number | | | | |
| Instant messaging contact (e.g., Skype) | | | | |
| Relationship status | | | | |
| Name of partner | | | | |
| Working place | | | | |
| Interests | | | | |
| Groups | | | | |
| Website | | | | |
| Favourite music | | | | |
| Favourite books | | | | |
| Favourite movies | | | | |
| Favourite quotes | | | | |
| Picture albums | | | | |
| Friends/contacts | | | | |
| Applications/programs | | | | |
| Videos (selfmade) | | | | |
| Music (selfmade) | | | | |
| Current location | | | | |
| Current status | | | | |

**How many friends/contacts do you have on average on social networks such as Facebook, MySpace or StudiVZ?**

**How much time do you spend on average using social networks such as Facebook, MySpace or StudiVZ in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

The PICOS project receives research funding from the Community's Seventh Framework Programme.

**How much do you trust the providers of social networks such as Facebook, MySpace or StudiVZ to treat your data confidentially?**
o I fully trust these networks.
o I don’t fully trust them but I’m confident.
o I only trust them to a certain extent.
o I don’t trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider on social networks such as Facebook, MySpace or StudiVZ?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

**If you are a member of content sharing networks such as Flickr, LastFM or YouTube, which information are you disclosing to which kind of users?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don’t disclose this information | Does not apply |
|---|---|---|---|---|
| Real name | | | | |
| Invented name/nickname | | | | |
| Real picture | | | | |
| Fun picture | | | | |
| Gender | | | | |
| Real date of birth | | | | |
| Invented date of birth | | | | |
| E- mail-address | | | | |
| Address | | | | |
| Phone number | | | | |
| Instant messaging contact (e.g., Skype) | | | | |
| Interests | | | | |
| Groups | | | | |
| Website | | | | |
| Favourite music | | | | |
| Photo album | | | | |
| Friends/contacts | | | | |
| Videos (self-made) | | | | |
| Country | | | | |
| Comments | | | | |

**How many friends/contacts do you have on average on content sharing networks such as Flickr, LastFM or YouTube?**

The PICOS project receives research funding from the Community’s Seventh Framework Programme.

**How much time do you spend on average using content sharing networks such as Flickr, LastFM or YouTube in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

**How much do you trust the providers of content sharing networks such as Flickr, LastFM or YouTube to treat your data confidentially?**
o I fully trust these networks.
o I don't fully trust them but I'm confident.
o I only trust them to a certain extent.
o I don't trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider on content sharing networks such as Flickr, LastFM or YouTube?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

**If you are a member of social news networks such as Blogger, Twitter or Digg, which information are you disclosing to which kind of users?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don't disclose this information | Does not apply |
|---|---|---|---|---|
| Real name | | | | |
| Invented name/nickname | | | | |
| Real picture | | | | |
| Fun picture | | | | |
| Gender | | | | |
| Real date of birth | | | | |
| Invented date of birth | | | | |
| E- mail-address | | | | |
| Address | | | | |
| Phone number | | | | |
| Instant messaging contact | | | | |
| Relationship status | | | | |
| Workplace | | | | |
| Interests | | | | |
| Groups | | | | |
| Website | | | | |
| Political interests | | | | |
| Favourite music | | | | |
| Favourite books | | | | |
| Favourite movies | | | | |
| Photo album | | | | |
| Friends/contacts | | | | |
| Country | | | | |

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**How many friends/contacts do you have on average on social news networks such as Blogger, Twitter or Digg?**

**How much time do you spend on average using social news networks such as Blogger, Twitter or Digg in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

**How much do you trust the providers of social news networks such as Blogger, Twitter or Digg to treat your data confidentially?**
o I fully trust these networks.
o I don’t fully trust them but I’m confident.
o I only trust them to a certain extent.
o I don’t trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider on social news networks such as Blogger, Twitter or Digg?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

**If you are a member of an online gaming community such as World of Warcraft, SecondLife or Steam, which information are you disclosing to which kind of users?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don’t disclose this information | Does not apply |
|---|---|---|---|---|
| Nickname | | | | |
| Real name | | | | |
| Real picture | | | | |
| Fun picture | | | | |
| Gender | | | | |
| Real date of birth | | | | |
| Invented date of birth | | | | |
| Game play statistics | | | | |
| Groups | | | | |
| Friends/contacts | | | | |
| Character achievements | | | | |
| Character skills | | | | |
| Interests | | | | |
| Instant messaging contact (e.g., Skype) | | | | |
| Website | | | | |
| Country | | | | |

**How many friends/contacts do you have on average on online gaming communities such as World of Warcraft, SecondLife or Steam?**

The PICOS project receives research funding from the Community’s Seventh Framework Programme.

**How much time do you spend on average using online gaming communities such as World of Warcraft, SecondLife or Steam in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

**How much do you trust the providers of online gaming communities such as World of Warcraft, SecondLife or Steam to treat your data confidentially?**
o I fully trust these networks.
o I don't fully trust them but I'm confident.
o I only trust them to a certain extent.
o I don't trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider of online gaming communities such as World of Warcraft, SecondLife or Steam?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

**If you are a member of a mobile community such as Qiro or qeep, which information are you disclosing to which kind of users?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don't disclose this information | Does not apply |
|---|---|---|---|---|
| Real name | | | | |
| Nickname | | | | |
| Real picture | | | | |
| Fun picture | | | | |
| Gender | | | | |
| Real date of birth | | | | |
| Invented date of birth | | | | |
| E-mail-address | | | | |
| Phone number | | | | |
| Groups | | | | |
| Friends/contacts | | | | |
| Interests | | | | |
| Instant messaging contact (e.g., Skype) | | | | |
| Country | | | | |
| Photo album | | | | |
| Current location | | | | |

**How many friends/contacts do you have on average on mobile communities such as Qiro or qeep?**

The PICOS project receives research funding from the Community's Seventh Framework Programme.

**How much time do you spend on average using mobile communities such as Qiro or qeep in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

**How much do you trust the providers of mobile communities such as Qiro or qeep to treat your data confidentially?**
o I fully trust these networks.
o I don't fully trust them but I'm confident.
o I only trust them to a certain extent.
o I don't trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider on mobile communities such as Qiro or qeep?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

**If you are a member of other online communities, which communities are you participating in? (max. 400 characters)**

**Which information are you disclosing to which kind of users on other online communities you are actively participating in?**

| | Unknown persons/entire network (friends included) | Known persons/friends | I don't disclose this information | Does not apply |
|---|---|---|---|---|
| Nickname | | | | |
| Real name | | | | |
| Real picture | | | | |
| Fun picture | | | | |
| Gender | | | | |
| Real date of birth | | | | |
| Invented date of birth | | | | |
| Groups | | | | |
| E-mail-address | | | | |
| Home address | | | | |
| Friends/contacts | | | | |
| Interests | | | | |
| Instant messaging contact (e.g., Skype) | | | | |
| Website | | | | |
| Country | | | | |
| Other: | | | | |

**How many friends/contacts do you have on average on other online communities you are actively participating in?**

The PICOS project receives research funding from the Community's Seventh Framework Programme.

**How much time do you spend on average using other online communities in a week?**
o Less than 1 hour
o 1 to 5 hours
o 5 to 10 hours
o More than 10 hours

**How much do you trust the providers of other online communities you are participating in to treat your data confidentially?**
o I fully trust these networks.
o I don't fully trust them but I'm confident.
o I only trust them to a certain extent.
o I don't trust such networks at all.

**Did you choose to limit the access to your profile data to certain people by using the privacy setting function of your provider on other online communities you are participating in?**
o Yes o No

**If yes, are you satisfied with the way these privacy settings work?**
o Yes o No

**Are you using the same passwords for logging into more than one online community?**
o Yes o No

**Are you using the same nicknames on more than one online community?**
o Yes o No

**Are you using the same pictures on more than one online community?**
o Yes o No

**Imagine you register for a social networking platform and have to enter your date of birth as mandatory field - what do you do?**
o I abort the action and do not register - the social network was not that important to me.
o I enter some invented information.
o I fill in my real date of birth as it is obligate and I want to join.
o I fill in my real date of birth because I have no problem disclosing this information.

**Imagine you register for a social networking platform and have to enter your name as mandatory field – what do you do?**
o I abort the action and do not register - the social network was not that important to me.
o I enter some invented information.
o I fill in my real name as it is obligate and I want to join.
o I fill in my real name because I have no problem disclosing this information.
**Imagine you register for a social networking platform and have to enter your weight as a mandatory field - what do you do?**
o I abort the action and do not register - the social network was not that important to me.
o I enter some invented information.
o I fill in my real weight as it is obligate and I want to join.
o I fill in my real weight because I have no problem disclosing this information.

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**Did you ever have problems with the safety of your online data on any network/site?**
o yes o no

**If yes, please state the network (name of the network) you had the problems with and the kind of problems you had.**

**Do you believe that it is possible to steal your online data?**
o yes o no

**In your opinion, how high is the probability that you will be having privacy issues (e.g., misuse of your data, fraud)?**
o Highly probable.
o Probable.
o Not very probable.
o Improbable.

**Are you …?**
o Male o Female

**How old are you? (please type in your age in numbers)**

**What is your highest (complete) level of education?**
o Compulsory education
o Professional school/apprenticeship
o Grammar school/school leaving examination
o University/college degree

**Where do you live?**
o Austria
o Australia
o Belgium
o Czech Republic
o Denmark
o France
o Germany
o Great Britain
o Italy
o Netherlands
o Norway
o Poland
o Sweden
o Switzerland
o Spain
o USA
o Other:

**Please enter your date of birth (voluntarily, dd/mm/yyyy).**

**What is your current profession?**
o Employed
o Freelancer, self-employed, working independently
o Business owner
o Pupil, student
o Other

**How high is your monthly income (after taxes)?**
o Less than 1,500 EUR / 2,330 USD / 1,170 GBP / 11,150 DKK
o 1,500 to 3,000 EUR / 2,330 USD to 4,700 USD / 1170 GBP to 2,390 GBP / 11,150 DKK to 22,300 DKK
o More than 3,000 EUR / 4,700 USD / 2,390 GBP / 22,300 DKK
o Not specified

Filling in this survey you have the possibility to win one out of the following prices:

- 50 Amazon gift vouchers, value 10 EUR
- 5 Amazon gift vouchers, value 30 EUR
- 1 Amazon gift voucher, value 50 EUR

To participate in the raffle, please enter your valid e-mail-address. Your information will be treated confidentially and will not be used for any other purpose than the raffle.

**E-mail-address**:

When clicking on next, the questionnaire will be submitted.

Thank you for participating in this survey!

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## A.2 Questionnaire distribution

The PICOS community questionnaire was created using sawtooth software and was uploaded to CURE's website. Different logins for different areas of distribution were then distributed using different means of communication. The participants therefore obtained a link directly to the first page of the questionnaire, which contained some information about the PICOS project and the purpose of the questionnaire. As an incentive users were given the possibility to participate in a raffle for prices.

The following paragraphs provide a short overview of the distribution channels employed for spreading the questionnaire:

**PICOS Partners**
The consortium partners of the PICOS project were asked to distribute the PICOS questionnaire within their companies. Furthermore also external contacts were asked to fill in the questionnaire.

**Test User Database**
For potential usability tests CURE disposes of a test user database, where people interested in participating in usability tests can sign up. Using this channel the questionnaire could be distributed to about 400 people.

**Befriended Universities**
Several befriended universities (other than partner universities) were contacted and asked for permission for the questionnaire to be distributed within their institutions. Therefore a larger audience of students could be reached. The following universities have offered their cooperation:

- FH Hagenberg (Austria)
- Wirtschaftsuniversität Wien (Austria)
- Kunstuniversität Linz (Austria)
- Aalborg University Copenhagen (Denmark)
- University of South Australia (Australia)

**Crossing**
The online platform Crossing/OpenBC is a social software platform for professionals. Currently the owners of Crossing claim that it is used by people from over 190 countries[3], with the majority of users being Germans. So far the platform is available in the following languages: English, German, Spanish, Portuguese, Italian, French, Dutch, Chinese, Finnish, Swedish, Japanese, Russian, Polish, Turkish and Hungarian.
Groups within Crossing are small clusters of people sharing interests, e.g., university alumni or soccer fans. The questionnaire was posted in forums of different groups project members had access to. Since not all groups have high activity, only a moderate response rate could be achieved.

[3] www.wikipedia.org

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**StudiVZ**

StudiVZ, SchülerVZ and MeinVZ are the names of very popular German social networking platforms that are interconnected. Initially the network was targeted towards college and university students (StudiVZ) in Europe. Recently it has expanded towards other areas in order to attract pupils (SchülerVZ) and non-students (MeinVZ).

The abbreviation VZ stands for Verzeichnis, which means directory in German. Generally StudiVZ is comparable to other social networks currently available. Nevertheless the owners of StudiVZ claim it to be one of the biggest social networks in Europe, with reportedly about four million members as of August 2007 mostly in German-speaking countries Germany, Switzerland and Austria. [4]

The questionnaire has been posted in different forums and personal contacts have been contacted. Again, because of the low activity within those forums the response rate is only moderate.

**Facebook**

Facebook is a social networking website that is privately owned and has been launched in 2004[5]. In the beginning only enrolled students were allowed to join the network. The name also derives from university background: American students are sometimes given Facebooks - a book with pictures of other students/staff members – to facilitate social contacts. But similar to StudiVZ the rules have been changed and now Facebook is a free-access website. Its main goal is to connect people in networks with different backgrounds (e.g., work, hobbies). Every user can add friends to his/her network and write them messages. Moreover they can update their profile or status in order to present themselves and what they are doing.

The questionnaire has been distributed in English and German to different contacts of consortium members as well as different groups.

**LinkedIn**

LinkedIn is a business-oriented social networking site (similar to OpenBC). It was launched in 2003 and mainly used for professional networking. As of December 2007, its site traffic was 3.2 million visitors per month, growing at an annual growth rate of about 485%. As of May 2008, it had more than 22 million registered users, spanning 150 industries. [6]

The PICOS community questionnaire was distributed to different LinkedIn contacts of project members.

**Diverse Forums**

Different online forums treating different topics ranging from animals to online gaming (e.g., World of Warcraft) were also employed to distribute the questionnaire.

## Period of Distribution

The PICOS community questionnaire was available between Thursday, 29th May 2008 and Wednesday, 11th June 2008. Within this period 856 questionnaires were filled in.

[4] www.wikipedia.org

[5] www.wikipedia.org

[6] www.wikipedia.org

The PICOS project receives research funding from the Community's Seventh Framework Programme.

### Incentives

Incentives are believed to raise the total response rate for about 15 – 20 % [7]. Therefore the participants were offered the possibility to win a price in a raffle. Since the questionnaire was sent to multiple countries, the distribution and availability of the product in all of the participating countries had to be assured.

Therefore amazon.com gift vouchers were chosen as the main incentive. Altogether 50 gift vouchers with a value of 10 Euros, 5 vouchers with a value of 30 Euros and one voucher with a value for 50 Euros were raffled.

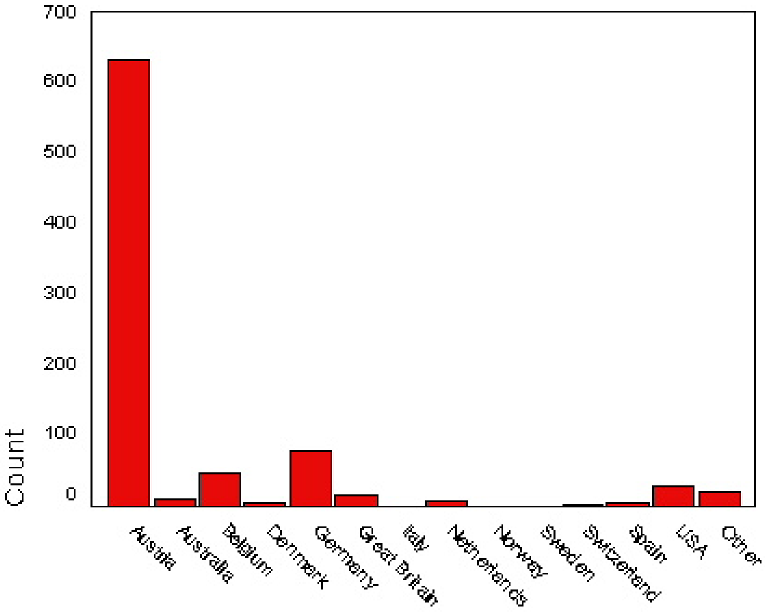
# A.3 Participants

## A.3.1 Demographics

### Nationality

In total we received 856 fully completed questionnaires. The questionnaire's respondents came from the following countries:

| | Frequency | Percent |
|---|---|---|
| Austria | 632 | 73.8 |
| Australia | 10 | 1.2 |
| Belgium | 48 | 5.6 |
| Denmark | 6 | 0.7 |
| Germany | 79 | 9.2 |
| Great Britain | 15 | 1.8 |
| Italy | 1 | 0.1 |
| Netherlands | 7 | 0.8 |
| Norway | 1 | 0.1 |
| Sweden | 1 | 0.1 |
| Switzerland | 2 | 0.2 |
| Spain | 5 | 0.6 |
| USA | 28 | 3.3 |
| Other | 21 | 2.5 |



[7] http://www.peoplepulse.com.au/Survey-Response-Rates.htm

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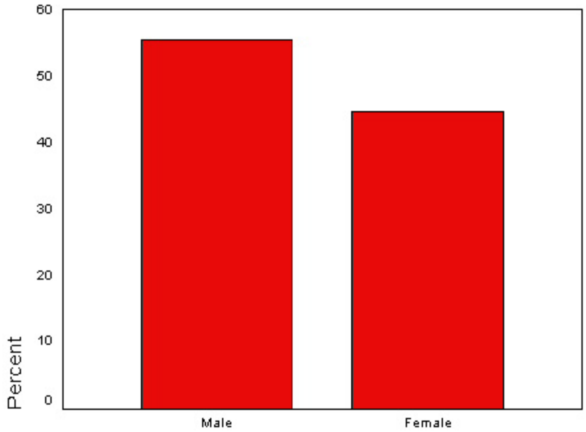
- As you can see the number of respondents is very high. We also see that the majority of the respondents came from Austria followed by Germany and Belgium. That implies that we have a bias towards German speaking users. This bias should be considered during the analysis of the results and when applying the results for user groups and systems outside the German-speaking area.

**Sex**

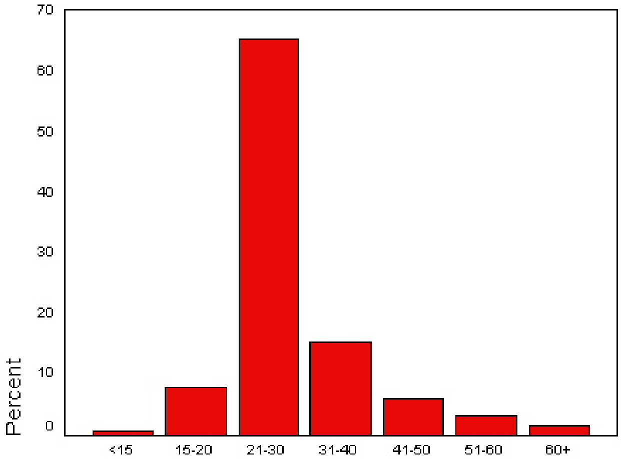
| | Frequency | Percent |
|---|---|---|
| Male | 474 | 55.4 |
| Female | 382 | 44.6 |

The distribution of participants with regard to their sex was almost equal with a slight majority of male users.



**Age**

| | Frequency | Percent |
|---|---|---|
| <15 | 6 | 0.7 |
| 15-20 | 68 | 7.9 |
| 21-30 | 558 | 65.2 |
| 31-40 | 130 | 15.2 |
| 41-50 | 52 | 6.1 |
| 51-60 | 28 | 3.3 |
| 60+ | 14 | 1.6 |



A predominant majority of users was in the age group of 21 to 30 years. This probably is caused by three effects. First, this age group also is most active in online communities. The popularity of Facebook and similar networks in universities is a good indicator for this. Second, students were directly recruited for the questionnaire through contacts to different universities. Third, young people in education typically are easier to be motivated by a small amount of money than older people with a job.

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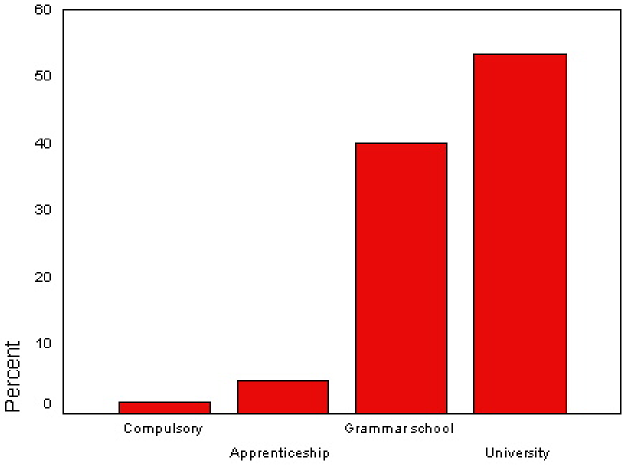
### Highest degree of Education

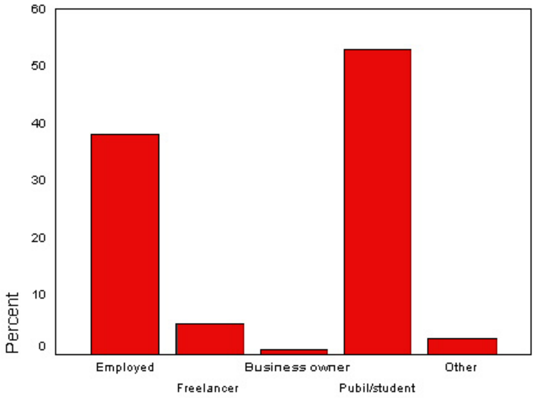
| | Frequency | Percent |
|---|---|---|
| Compulsory education | 15 | 1.8 |
| Professional school/apprenticeship | 42 | 4.9 |
| Grammar school/school leaving examination | 344 | 40.2 |
| University/college degree | 455 | 53.2 |



More than 50 % of the questionnaire participants have a university or college degree. This again can be explained by the three effects stated in the previous paragraph. Also the elevated number of participants that have completed grammar school can be credited to the recruitment of university students.

### Profession

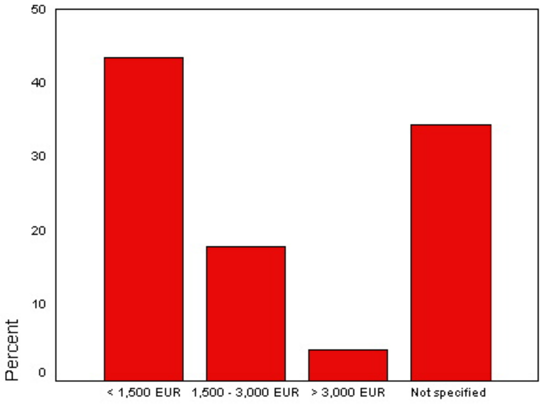
| | Frequency | Percent |
|---|---|---|
| Employed | 328 | 38.3 |
| Freelancer | 45 | 5.3 |
| Business owner | 7 | 0.8 |
| Student or Pupil | 452 | 52.8 |
| Other | 24 | 2.8 |



In compliance with the results stated above, the dominating profession of the questionnaire's participants was student or pupil (52.8 %, 452 persons). Nevertheless 38.3 % of the respondents indicated that they are employed.

### Income

| | Frequency | Percent |
|---|---|---|
| Less than 1,500 EUR | 371 | 43.3 |
| 1,500 to 3,000 EUR | 154 | 18.0 |
| More than 3,000 EUR | 36 | 4.2 |
| Not specified | 295 | 34.5 |



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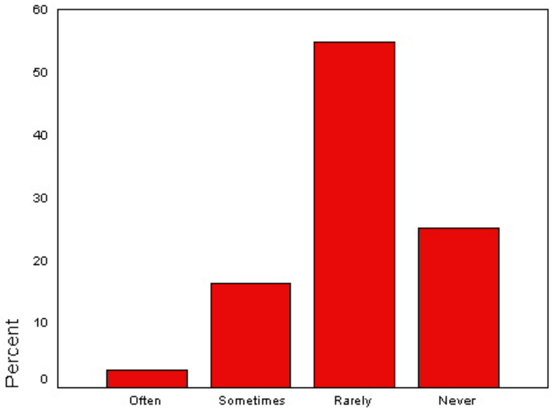
34.5 % did not specify their income, for the rest the majority earns less than 1500 € per month. Given the high level of education this rather low income is quite surprising. A possible explanation is that we have a high percentage of students in the respondents.

## A.3.2 PC knowledge and online activities

### PC Knowledge

When you work with computers you need help …

| | Frequency | Percent |
|---|---|---|
| Often | 24 | 2.8 |
| Sometimes | 143 | 16.7 |
| Rarely | 470 | 54.9 |
| Never | 219 | 25.6 |

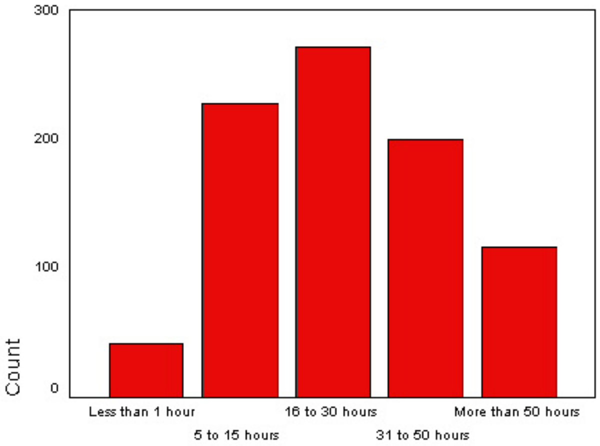


Out of the 865 respondents 470 (54.9 %) indicated that they only need help rarely when working with computers and 219 (25.6%) stated that they never need help. Altogether the majority of users consider themselves to be rather advanced computer users. This high level of computer literacy could be derived from the fact that most of the users were highly educated and therefore also used computers on a regular basis. Nevertheless the respondents were asked to evaluate their own knowledge, which may result in a positive bias.

### Time spend online

How much time do you spend actively using the internet in a week?

| | Frequency | Percent |
|---|---|---|
| Less than 1 hour | 41 | 4.8 |
| 5 to 15 hours | 227 | 26.5 |
| 16 to 30 hours | 272 | 31.8 |
| 31 to 50 hours | 200 | 23.4 |
| More than 50 hours | 116 | 13.6 |



Concerning the time spent online, the majority

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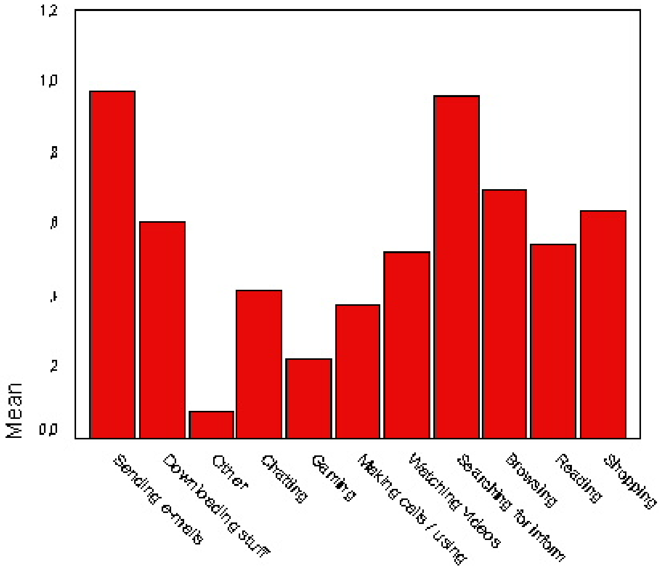
of participants (31.8 %) actively use the internet between 16 and 30 hours a week. Generally it can be said that over 80 % of users spend between 5 and 50 hours a week online. Only 4.8 % use the internet less than one hour, but 13.6 % are even online more than 50 hours a week.

**Activities when online**

What do you do when you are online?

| | Frequency | Percent |
|---|---|---|
| Sending e-mails | 830 | 97 |
| Downloading stuff | 514 | 60 |
| Other | 64 | 7 |
| Chatting | 360 | 42 |
| Gaming | 197 | 23 |
| Making calls | 317 | 37 |
| Watching videos | 445 | 52 |
| Search information | 822 | 96 |
| Browsing | 599 | 70 |
| Reading | 462 | 54 |
| Shopping | 548 | 64 |



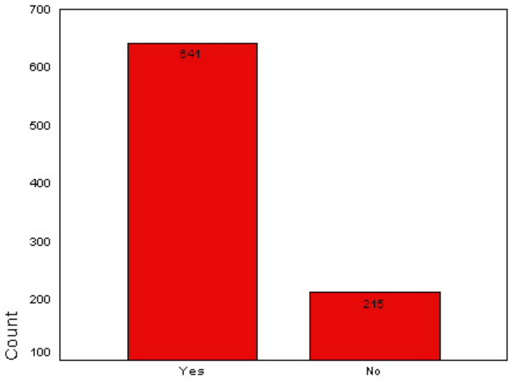
Almost all users indicated that they are sending e-mails (97 %) and searching for information (96 %) when online. Online shopping (64 %) and downloading (60 %) are other common online activities. Summarizing it can be said that most of the users have a goal for their online activity, but also like to browse the web (70 %). Communication, information retrieval, downloading and browsing can be seen as the major activities when online. Only 7 % of participants indicated that they were following other activities than the ones offered by the categories. Examples for those activities are working, learning, streaming music, website maintenance, blogging, e-banking but also social networking was mentioned several times.

## A.4 Online Communities

**Familiarity with term**

Are you familiar with the term "online community"?

| | Frequency | Percent |
|---|---|---|
| Yes | 641 | 74.9 |
| No | 215 | 25.1 |



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Out of the 856 respondents 74.9 % indicated that they are familiar with the term “online community”, which means that they have at least heard of it. Such a large number indicates that online communities are an integral part of our modern online society and more and more people are getting in contact with different types of online communities. The participants’ understanding of online communities varies from a common place where people meet, connect and belong to unwanted web .0 pages.

**Participation in communities**

| | Frequency | Percent |
|---|---|---|
| Professional Network | 356 | 41.59 |
| Social Network | 578 | 67.52 |
| Content Sharing Network | 320 | 37.38 |
| Social News | 136 | 15.89 |
| Online Gaming Community | 127 | 14.84 |
| Mobile Community | 8 | 0.93 |
| Other online Community | 309 | 36.10 |

Our research indicates that the most popular type of networks is "social network" (67.52 %). This underlines the increasing presence of social networks in media, literature and research. But also professional networks that allow people to establish work-related contacts are increasing in popularity. Content sharing networks such as Flickr, where people offer self-generated content to others also represent a larger part of the user’s online activities (37.38 %). Furthermore the users are participating in various other online communities such as topic related websites, different internet forums, dating sites, IRC channels, Wikipedia, couch surfing sites, websites from party photographers and diverse chats.

## A.5 Professional networks

**Information disclosure**

| | Unknown Persons | Friends | Do not disclose | Does not apply | |
|---|---|---|---|---|---|
| Real name | 68.5 | 28.1 | 2.8 | 0.6 | Percent |
| | 244 | 100 | 10 | 2 | Frequency |
| Invented name or nickname | 53.7 | 5.6 | 5.9 | 34.8 | Percent |
| | 191 | 20 | 21 | 124 | Frequency |
| Picture of yourself | 62.9 | 22.5 | 10.7 | 3.9 | Percent |
| | 224 | 80 | 38 | 14 | Frequency |
| Job position | 63.8 | 29.8 | 4.2 | 2.2 | Percent |
| | 227 | 106 | 15 | 8 | Frequency |
| Date of birth | 25.3 | 53.7 | 17.4 | 3.7 | Percent |
| | 90 | 191 | 62 | 13 | Frequency |
| Current Employer | 55.1 | 34.3 | 7.3 | 3.4 | Percent |

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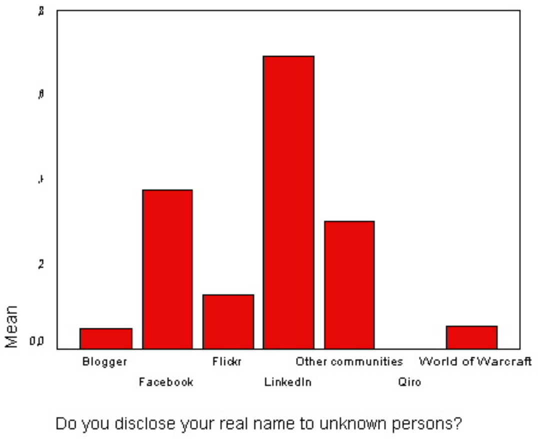
| | | | | | |
|---|---|---|---|---|---|
| | 196 | 122 | 26 | 12 | Frequency |
| Education | 60.1 | 34 | 5.1 | 0.8 | Percent |
| | 214 | 121 | 18 | 3 | Frequency |
| Field of work | 72.5 | 23.6 | 2 | 2 | Percent |
| | 258 | 84 | 7 | 7 | Frequency |
| Website | 42.7 | 26.4 | 11.2 | 19.7 | Percent |
| | 152 | 94 | 40 | 70 | Frequency |
| Your contacts and friends | 28.1 | 58.1 | 10.4 | 3.4 | Percent |
| | 100 | 207 | 37 | 12 | Frequency |
| Company contact information | 28.1 | 46.1 | 18 | 7.9 | Percent |
| | 100 | 164 | 64 | 28 | Frequency |
| Private e-mail-address | 8.7 | 53.9 | 31.2 | 6.2 | Percent |
| | 31 | 192 | 111 | 22 | Frequency |
| Private phone number | 3.1 | 43 | 45.5 | 8.4 | Percent |
| | 11 | 153 | 162 | 30 | Frequency |
| Private address | 2.2 | 39.9 | 48.9 | 9 | Percent |
| | 8 | 142 | 174 | 32 | Frequency |
| Interests | 41 | 39.9 | 13.5 | 5.6 | Percent |
| | 146 | 142 | 48 | 20 | Frequency |
| Instant messaging contact | 15.7 | 47.5 | 22.2 | 14.6 | Percent |
| | 56 | 169 | 79 | 52 | Frequency |



In professional networks participants appear to disclose more information than on other online communities. An example can be seen in the figure on the right side, comparing the disclosure of one's real name over different networks. It clearly indicates that people on professional networks tend to state their true name more frequently.

Of all members of professional networks questioned 96.6 % indicated to give away their real name. Only 28.1 % of those limit their disclosure to known persons. Concerning the disclosure of one's invented name or nick name, the tendency clearly indicates that users tend to give this information to unknown people more often (53.7 %) than to know persons (5.6 %).

Over 85 % of users of professional networks upload a picture of themselves, only 10.7 % stated not to disclose this information. From the aforementioned 85 % only 22.5 % limit the access to their picture to known persons.

Work-related information is disclosed quite frequently on professional networks. The reason for this might be the nature of professional networks, i.e., the establishment of professional connections for different purposes, e.g., collaboration on projects or finding a job. Job position, current employer, field of work and company contact information is disclosed in 93.6 %, 89.4 %, 96.1 % and 74.2 % of cases

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respectively. Except for the company contact information which is more frequently limited to known persons only (46.1 %), the aforementioned information is more often provided to unknown people.

Private contact information such as the private e-mail-address, phone number or postal address is, if given away, only disclosed to known persons. Slightly more participants decide to disclose this information to friends than not disclosing it at all. For example, 53.9 % display their private e-mail-address to friends and 31.2 % do not disclose this information to anybody. Out of 356 users of professional networks, only 8 disclosed their private address to the entire network.

Also contacts and friends are kept more privately. While 28.1 % of users of professional networks decide to share information about their contacts or friends with unknown persons, 58.1 % limit this information to their friends/contacts only.

## A.6 Social networks

| | Unknown Persons | Friends | Do not disclose | Does not apply | |
|---|---|---|---|---|---|
| Real name | 55 | 33.2 | 10.2 | 1.6 | Percent |
| | 318 | 192 | 59 | 9 | Frequency |
| Invented name or nickname | 65.1 | 8.7 | 2.8 | 23.5 | Percent |
| | 376 | 50 | 16 | 136 | Frequency |
| Real picture | 65.7 | 25.4 | 6.7 | 2.1 | Percent |
| | 380 | 147 | 39 | 12 | Frequency |
| Fun picture | 31 | 17.1 | 9.2 | 42.7 | Percent |
| | 179 | 99 | 53 | 247 | Frequency |
| University or school | 61.4 | 29.2 | 7.6 | 1.7 | Percent |
| | 355 | 169 | 44 | 10 | Frequency |
| Previous school or university | 44.8 | 32.7 | 16.3 | 6.2 | Percent |
| | 259 | 189 | 94 | 36 | Frequency |
| Course of studies | 57.4 | 29.1 | 10.4 | 3.1 | Percent |
| | 332 | 168 | 60 | 18 | Frequency |
| Gender | 79.1 | 17.5 | 2.1 | 1.4 | Percent |
| | 457 | 101 | 12 | 8 | Frequency |
| Working place | 17.6 | 29.8 | 32.9 | 19.7 | Percent |
| | 102 | 172 | 190 | 114 | Frequency |
| Interests | 47.4 | 35.6 | 11.4 | 5.5 | Percent |
| | 274 | 206 | 66 | 32 | Frequency |
| Groups | 50.5 | 37.4 | 7.3 | 4.8 | Percent |
| | 292 | 216 | 42 | 28 | Frequency |
| Website | 27.2 | 23.2 | 17.1 | 32.5 | Percent |
| | 157 | 134 | 99 | 188 | Frequency |
| Favourite music | 43.9 | 23.4 | 19.6 | 13.1 | Percent |
| | 254 | 135 | 113 | 76 | Frequency |
| Favourite books | 41.5 | 23.7 | 19.7 | 15.1 | Percent |
| | 240 | 137 | 114 | 87 | Frequency |
| Favourite movies | 42.7 | 24.2 | 19.7 | 13.3 | Percent |

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| | | | | | |
|---|---|---|---|---|---|
| | 247 | 140 | 114 | 77 | Frequency |
| Favourite quotes | 39.6 | 23.4 | 18.3 | 18.7 | Percent |
| | 229 | 135 | 106 | 108 | Frequency |
| Picture albums | 25.8 | 46.2 | 15.7 | 12.3 | Percent |
| | 149 | 267 | 91 | 71 | Frequency |
| Real date of birth | 42.6 | 39.6 | 14.7 | 3.1 | Percent |
| | 246 | 229 | 85 | 18 | Frequency |
| Invented date of birth | 11.6 | 3.8 | 8.5 | 76.1 | Percent |
| | 67 | 22 | 49 | 440 | Frequency |
| E- mail-address | 12.5 | 52.2 | 26.1 | 9.2 | Percent |
| | 72 | 302 | 151 | 53 | Frequency |
| On campus residence | 7.4 | 23.9 | 35.8 | 32.9 | Percent |
| | 43 | 138 | 207 | 190 | Frequency |
| Address | 2.8 | 26.8 | 53.1 | 17.3 | Percent |
| | 16 | 155 | 307 | 100 | Frequency |
| Phone number | 2.1 | 27 | 54.2 | 16.8 | Percent |
| | 12 | 156 | 313 | 97 | Frequency |
| Instant messaging contact e.g., Skype | 17.6 | 42.4 | 25.3 | 14.7 | Percent |
| | 102 | 245 | 146 | 85 | Frequency |
| Relationship status | 33.7 | 31.1 | 26.5 | 8.7 | Percent |
| | 195 | 180 | 153 | 50 | Frequency |
| Name of partner | 2.2 | 17.6 | 51.7 | 28.4 | Percent |
| | 13 | 102 | 299 | 164 | Frequency |
| Friends and contacts | 39.8 | 48.4 | 9 | 2.8 | Percent |
| | 230 | 280 | 52 | 16 | Frequency |
| Applications or programs | 10.2 | 20.1 | 22.3 | 47.4 | Percent |
| | 59 | 116 | 129 | 274 | Frequency |
| Self-made videos | 10 | 11.1 | 22.8 | 56.1 | Percent |
| | 58 | 64 | 132 | 324 | Frequency |
| Self-made Music | 8 | 8 | 21.8 | 62.3 | Percent |
| | 46 | 46 | 126 | 360 | Frequency |
| Current location | 11.8 | 24.7 | 30.4 | 33 | Percent |
| | 68 | 143 | 176 | 191 | Frequency |
| Current status | 21.8 | 28.7 | 22.1 | 27.3 | Percent |
| | 126 | 166 | 128 | 158 | Frequency |

In the past social networks were initially built around large offline communities such as universities (c.f. Facebook, StudiVZ). Therefore the information provided was and still is connected to university backgrounds such as the type of the university or the course of studies. The university or school attended is disclosed to the entire network by 61.4 % of participants and limited to contacts/friends by 29.2 %. Information about the course of studies is also provided to unknown people very frequently. 57.4 % give this information to anybody on the network and 29.1 % limit this information to their friends.

Out of all social network members, 88.2 % disclose their real name and 10.2 % choose not to give away this information. 33.2 % of users limit the access to their real name only to their friends. The

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nickname does not appear to be a privacy issue for users of social networks. In fact, 65.1 % of them let the entire network access this information.

According to our results, 91.1 % of participants uploaded a real picture of themselves. Only 6.7 % choose not to do so and 25.4 % decided to let only friends access this information. Out of the 278 respondents that indicated to have uploaded a fun picture instead of a real picture, 99 (17.1 % of all users of social networks) indicated to disclose it to friends only. The remaining 179 (31 %) participants have made this information accessible to the entire network.

Altogether 96.6 % of participants disclose their sex. 79.1 % of social network users let the entire network access information on whether they are female or male and 17.5 % of them only let their friends know.

In comparison to professional networks where about 55 % disclose information about their current employer, only 17.6 % of users of social networks provide this information to unknown persons. Here the difference in the purpose of social networks and professional networks can be seen. As mentioned before, professional networks are rather work-oriented than the university-oriented social networks. This difference can also be seen in the amount of data disclosed about the participants' interests. Nevertheless the amount of information about interests disclosed in both networks is almost the same, 47.4 % and 41 % for social networks and professional networks respectively.

About 42 % of participants indicated that they are disclosing their favourite music, books movies and quotes to the entire network. The real date of birth is accessible for the entire network in 42.6 % and limited to friends for 39.6 %.

Concerning private contact information the users tend to be more restrictive with their data. 52.2 % of users restrict their private e-mail-address to their contacts only and 26.1 % do not disclose this information at all. Almost the same applies to the on campus residence. While 32.9 % of respondents do not live on campus, another 35.8 % decides not to give this information away. The majority of users disclosing this information only let their friends know where they live. Instant messaging contacts are given away more freely than other contact information details. 17.6 % decided to give the entire network access to their contacts and 42.4 % prefer to restrict this information to their friends.

Connected contacts such as friends are displayed to the entire network by 39.8 % of participants and 48.4 % have chosen to limit this data to their friends only.

## A.7 Content sharing networks

| | Unknown Persons | Friends | Do not disclose | Does not apply | |
|---|---|---|---|---|---|
| Real name | 10.9 | 20.9 | 55.3 | 12.8 | Percent |
| | 35 | 67 | 177 | 41 | Frequency |
| Invented name or nickname | 75.3 | 9.4 | 9.1 | 6.3 | Percent |
| | 241 | 30 | 29 | 20 | Frequency |
| Real picture | 20.3 | 15.3 | 47.2 | 17.2 | Percent |
| | 65 | 49 | 151 | 55 | Frequency |
| Fun picture | 23.8 | 7.8 | 36.3 | 32.2 | Percent |

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| | | | | | |
|---|---|---|---|---|---|
| | 76 | 25 | 116 | 103 | Frequency |
| Gender | 43.1 | 12.5 | 33.4 | 10.9 | Percent |
| | 138 | 40 | 107 | 35 | Frequency |
| Real date of birth | 12.5 | 15.9 | 57.5 | 14.1 | Percent |
| | 40 | 51 | 184 | 45 | Frequency |
| Invented date of birth | 8.8 | 4.7 | 39.7 | 46.9 | Percent |
| | 28 | 15 | 127 | 150 | Frequency |
| E- mail-address | 8.1 | 27.8 | 51.6 | 12.5 | Percent |
| | 26 | 89 | 165 | 40 | Frequency |
| Address | 1.3 | 10.6 | 70 | 18.1 | Percent |
| | 4 | 34 | 224 | 58 | Frequency |
| Phone number | 1.3 | 11.3 | 69.4 | 18.1 | Percent |
| | 4 | 36 | 222 | 58 | Frequency |
| Instant messaging contact | 9.1 | 17.8 | 53.1 | 20 | Percent |
| | 29 | 57 | 170 | 64 | Frequency |
| Interests | 27.5 | 13.8 | 43.4 | 15.3 | Percent |
| | 88 | 44 | 139 | 49 | Frequency |
| Groups | 30.6 | 10.6 | 43.1 | 15.6 | Percent |
| | 98 | 34 | 138 | 50 | Frequency |
| Website | 24.1 | 10 | 43.8 | 22.2 | Percent |
| | 77 | 32 | 140 | 71 | Frequency |
| Favourite music | 31.9 | 10.9 | 41.6 | 15.6 | Percent |
| | 102 | 35 | 133 | 50 | Frequency |
| Photo album | 16.9 | 18.4 | 42.5 | 22.2 | Percent |
| | 54 | 59 | 136 | 71 | Frequency |
| Friends and contacts | 20.6 | 19.1 | 44.1 | 16.3 | Percent |
| | 66 | 61 | 141 | 52 | Frequency |
| Self-made Videos | 25.3 | 9.7 | 34.1 | 30.9 | Percent |
| | 81 | 31 | 109 | 99 | Frequency |
| Country | 46.3 | 13.1 | 31.9 | 8.8 | Percent |
| | 148 | 42 | 102 | 28 | Frequency |
| Comments | 44.1 | 12.5 | 27.8 | 15.6 | Percent |
| | 141 | 40 | 89 | 50 | Frequency |

Altogether 320 participants indicated that they are members of content sharing networks. The general tendency implies that users are more restrictive giving away their personal data then when using the previous types of communities.

Only 10.9 % of users disclose their real name to the entire network and 55.3 % decided not to give this information away to anybody. Therefore most users are using nicknames. In fact 75.3 % of participants disclosed their nickname to the entire network.

Concerning the pictures uploaded, real pictures and fun pictures are almost evenly balanced. Unknown persons have the possibility to see the real pictures of 65 persons (20.3 % of overall content sharing network users) and the fun pictures of 76 participants (23.8 %).

Other information that is disclosed to the entire network quite freely is gender (43.1 %), country (46.3 %) and comments (44.1 %). The rest of the personal data is quite restricted. 57.5 % do not indicate

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their real birthday, 70 % refrain from indicating their address, 69.4 % choose not to give away their phone number, 53.1 % do not disclose their instant messaging contact and around 40 % do not publish photo albums or friends lists.

Self-made videos are given away more frequently. Altogether 25.3 % decided to let unknown persons see this information. Other data indicated to the entire network are interests (27.5 %), groups (30.6 %), personal website (24.1 %) and favourite music (31.9 %).

Summarizing it can be said that for content sharing networks users either decides to disclose the information to the entire network or to not disclose it at all. Only a smaller minority of participants restricts information to their friends only.

## A.8 Social news network

| | Unknown Persons | Friends | Do not disclose | Does not apply | |
|---|---|---|---|---|---|
| Real name | 30.1 | 17.6 | 38.2 | 14 | Percent |
| | 41 | 24 | 52 | 19 | Frequency |
| Invented name or nickname | 67.6 | 5.9 | 10.3 | 16.2 | Percent |
| | 92 | 8 | 14 | 22 | Frequency |
| Real picture | 33.8 | 8.8 | 36.8 | 20.6 | Percent |
| | 46 | 12 | 50 | 28 | Frequency |
| Fun picture | 27.9 | 4.4 | 29.4 | 38.2 | Percent |
| | 38 | 6 | 40 | 52 | Frequency |
| Gender | 52.2 | 8.1 | 25 | 14.7 | Percent |
| | 71 | 11 | 34 | 20 | Frequency |
| Real date of birth | 16.2 | 14 | 49.3 | 20.6 | Percent |
| | 22 | 19 | 67 | 28 | Frequency |
| Invented date of birth | 4.4 | 3.7 | 37.5 | 54.4 | Percent |
| | 6 | 5 | 51 | 74 | Frequency |
| E- mail-address | 16.9 | 21.3 | 45.6 | 16.2 | Percent |
| | 23 | 29 | 62 | 22 | Frequency |
| Address | 2.2 | 8.1 | 65.4 | 24.3 | Percent |
| | 3 | 11 | 89 | 33 | Frequency |
| Phone number | 1.5 | 6.6 | 66.9 | 25 | Percent |
| | 2 | 9 | 91 | 34 | Frequency |
| Instant messaging contact | 11 | 10.3 | 49.3 | 29.4 | Percent |
| | 15 | 14 | 67 | 40 | Frequency |
| Relationship status | 10.3 | 10.3 | 50 | 29.4 | Percent |
| | 14 | 14 | 68 | 40 | Frequency |
| Workplace | 11 | 10.3 | 50 | 28.7 | Percent |
| | 15 | 14 | 68 | 39 | Frequency |
| Interests | 33.8 | 5.9 | 36.8 | 23.5 | Percent |
| | 46 | 8 | 50 | 32 | Frequency |
| Groups | 16.9 | 11 | 42.6 | 29.4 | Percent |

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| | | | | | |
|---|---|---|---|---|---|
| | 23 | 15 | 58 | 40 | Frequency |
| Website | 30.1 | 11.8 | 34.6 | 23.5 | Percent |
| | 41 | 16 | 47 | 32 | Frequency |
| Political interests | 8.1 | 11.8 | 51.5 | 28.7 | Percent |
| | 11 | 16 | 70 | 39 | Frequency |
| Favourite music | 29.4 | 5.1 | 41.2 | 24.3 | Percent |
| | 40 | 7 | 56 | 33 | Frequency |
| Favourite books | 27.2 | 5.1 | 42.6 | 25 | Percent |
| | 37 | 7 | 58 | 34 | Frequency |
| Favourite movies | 27.2 | 5.9 | 41.2 | 25.7 | Percent |
| | 37 | 8 | 56 | 35 | Frequency |
| Photo album | 16.2 | 16.2 | 37.5 | 30.1 | Percent |
| | 22 | 22 | 51 | 41 | Frequency |
| Friends and contacts | 16.2 | 19.1 | 39.7 | 25 | Percent |
| | 22 | 26 | 54 | 34 | Frequency |
| Country | 44.1 | 9.6 | 28.7 | 17.6 | Percent |
| | 60 | 13 | 39 | 24 | Frequency |

Social news networks are providers of services such as Blogger, Twitter or Digg. Out of the 856 participants of the PICOS community questionnaire, 136 indicated to be members of social news networks. The privacy preferences and information disclosed is similar as in content sharing networks. Information is either given away to the entire community or not given away at all. Only exception to this are the e-mail address that is provided to more friends (21.3 %) than unknown persons (16.9 %) and the friends that are in 19.1 % of cases displayed for friends. Only 16.2 % provide this information to the entire network.

30.1 % of users decided to display their real name to the entire community but the majority of 38.2 % decided not to provide this information. As in the case of content sharing networks, the nickname is used more frequently. In fact in 67.6 % of cases the nickname is disclosed to the entire community.

Again as in content sharing networks, the information disclosed most at the time are gender (52.2 %) and country (44.1 %). Every other type of data is given away less frequently. For example favourite music, books and movies are displayed in about 27 % of cases and interests and website in 33.8 % and 30.1 % respectively.

Every other information is preferably not disclosed at all, such as address (65.4 %), phone number (66.9 %), political interests (51.5 %) or instant messaging contact (49.3 %).

## A.9 Online gaming Community

| | Unknown Persons | Friends | Do not disclose | Does not apply | |
|---|---|---|---|---|---|
| Nickname | 88.2 | 6.3 | 3.1 | 2.4 | Percent |
| | 112 | 8 | 4 | 3 | Frequency |
| Real name | 4.7 | 31.5 | 52 | 11.8 | Percent |
| | 6 | 40 | 66 | 15 | Frequency |
| Real picture | 6.3 | 17.3 | 59.8 | 16.5 | Percent |

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| | | | | | |
|---|---|---|---|---|---|
| | 8 | 22 | 76 | 21 | Frequency |
| Fun picture | 29.1 | 8.7 | 38.6 | 23.6 | Percent |
| | 37 | 11 | 49 | 30 | Frequency |
| Gender | 49.6 | 18.9 | 24.4 | 7.1 | Percent |
| | 63 | 24 | 31 | 9 | Frequency |
| Real date of birth | 13.4 | 22.8 | 51.2 | 12.6 | Percent |
| | 17 | 29 | 65 | 16 | Frequency |
| Invented date of birth | 10.2 | 2.4 | 38.6 | 48.8 | Percent |
| | 13 | 3 | 49 | 62 | Frequency |
| Game play statistics | 57.5 | 13.4 | 17.3 | 11.8 | Percent |
| | 73 | 17 | 22 | 15 | Frequency |
| Groups | 43.3 | 17.3 | 26.8 | 12.6 | Percent |
| | 55 | 22 | 34 | 16 | Frequency |
| Friends and contacts | 20.5 | 31.5 | 33.9 | 14.2 | Percent |
| | 26 | 40 | 43 | 18 | Frequency |
| Character achievements | 47.2 | 20.5 | 14.2 | 18.1 | Percent |
| | 60 | 26 | 18 | 23 | Frequency |
| Character skills | 44.9 | 22 | 13.4 | 19.7 | Percent |
| | 57 | 28 | 17 | 25 | Frequency |
| Interests | 24.4 | 22 | 35.4 | 18.1 | Percent |
| | 31 | 28 | 45 | 23 | Frequency |
| Instant messaging contact | 9.4 | 30.7 | 37 | 22.8 | Percent |
| | 12 | 39 | 47 | 29 | Frequency |
| Website | 18.1 | 16.5 | 38.6 | 26.8 | Percent |
| | 23 | 21 | 49 | 34 | Frequency |
| Country | 53.5 | 18.9 | 18.1 | 9.4 | Percent |
| | 68 | 24 | 23 | 12 | Frequency |

Most recently online gaming communities such as World of Warcraft, SecondLife or Steam have emerged and hence also increased in popularity. Through the PICOS community questionnaire we could address 127 members of gaming communities.

The results show that 88.2 % of participants disclosed their nickname to the entire community and 31.5 % only let friends access their real name. This again underlines the finding, that nicknames are disclosed more freely than the real name.

Another factor that is disclosed to the community is the sex. In fact 49.6 % of participants give the entire community the possibility to find out if they are male or female. Real pictures are not displayed frequently – 59.8 % of participants neglect to show images of them. The same also applies to the real birth date (51.2 %). One type of information disclosed frequently within gaming communities is the country of origin (53.5 %).

Information connected to the game played is more frequently published to the community. For example the game play statistics (57.5 %), character achievements (47.2 %) and character skills (44.9 %) are mostly displayed to the entire community. These results can derive from the fact that players want to compete with each other and therefore want to show their friends as well as their enemies how skilled they are.

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Online gaming communities show again the tendency to disclose certain types of information only to friends and contacts. This includes the real date of birth (22.8 %), other friends and contacts (31.5 %) and instant messaging contacts (30.7 %).

Summarizing the tendency to merely disclose information connected to gaming to the entire community and information that is more private only to known contacts can be discovered.

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## A.10 Mobile Communities

| | Unknown Persons | Friends | Do not disclose | Does not apply | |
|---|---|---|---|---|---|
| Real name | 0 | 50 | 50 | 0 | Percent |
| | 0 | 4 | 4 | 0 | Frequency |
| Nickname | 87.5 | 12.5 | 0 | 0 | Percent |
| | 7 | 1 | 0 | 0 | Frequency |
| Real picture | 37.5 | 12.5 | 50 | 0 | Percent |
| | 3 | 1 | 4 | 0 | Frequency |
| Fun picture | 25 | 25 | 37.5 | 12.5 | Percent |
| | 2 | 2 | 3 | 1 | Frequency |
| Gender | 75 | 0 | 25 | 0 | Percent |
| | 6 | 0 | 2 | 0 | Frequency |
| Real date of birth | 0 | 25 | 62.5 | 12.5 | Percent |
| | 0 | 2 | 5 | 1 | Frequency |
| Invented date of birth | 12.5 | 0 | 37.5 | 50 | Percent |
| | 1 | 0 | 3 | 4 | Frequency |
| E-mail-address | 0 | 25 | 75 | 0 | Percent |
| | 0 | 2 | 6 | 0 | Frequency |
| Phone number | 0 | 25 | 75 | 0 | Percent |
| | 0 | 2 | 6 | 0 | Frequency |
| Groups | 12.5 | 25 | 50 | 12.5 | Percent |
| | 1 | 2 | 4 | 1 | Frequency |
| Friends and contacts | 25 | 25 | 50 | 0 | Percent |
| | 2 | 2 | 4 | 0 | Frequency |
| Interests | 37.5 | 12.5 | 37.5 | 12.5 | Percent |
| | 3 | 1 | 3 | 1 | Frequency |
| Instant messaging contact | 12.5 | 12.5 | 37.5 | 37.5 | Percent |
| | 1 | 1 | 3 | 3 | Frequency |
| Country | 75 | 0 | 25 | 0 | Percent |
| | 6 | 0 | 2 | 0 | Frequency |
| Photo album | 25 | 25 | 37.5 | 12.5 | Percent |
| | 2 | 2 | 3 | 1 | Frequency |
| Current location | 12.5 | 37.5 | 50 | 0 | Percent |
| | 1 | 3 | 4 | 0 | Frequency |

The concept of mobile communities (i.e., communities involving mobile phones) is quite new and hence does not have so many members yet. Through the PICOS community questionnaire we could gather 8 participants of mobile communities.

Users of mobile communities appear to be more privacy aware, since 50 % of them do not disclose their real name and the remaining 50 % only disclose it to their friends. Also in mobile communities there can be seen a tendency to rather disclose the nickname to the entire community instead (87.5 %). Concerning real pictures of oneself, 37.5 % disclose this information to the entire community. The

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gender is disclosed to the entire community by 75 % of mobile community users. The same applies to one's country of origin and 37.5 % disclose their interests to the community.

Information that is not shared with anybody is the real date of birth (62.5 %), e-mail-address (75 %), the phone number (75 %), the joined groups (50 %) and friends and contacts (50 %).

## A.11 Information Disclosure Index (IDI)

To be able to compare and cluster user according to their information disclosure behaviour we developed an index based on the data provided by the users. The index is calculated the following way: For every item the user discloses to unknown persons he gets 1 point, for every item he discloses to friends he gets 0.5 points, for not disclosing he gets 0 points, and then the mean is taken. Items that the user specified as 'does not apply' are not considered in the process. The overall information disclosure index is calculated as the mean value of all single IDIs of the different types of communities.

According to the calculation methods resulting values can vary between 0 and 1, with 0 meaning the person does not disclose any information to anyone and 1 meaning all information is available to everyone.

In the following sections the influence of several variables on the IDI is analyzed. Due to the explorative (and not hypothesis-driven) character of our research and the non-perfect-randomness of the user acquisition we do not use statistical hypothesis testing. We rather show the results including an estimation of confidence intervals and interpret the answers as indications but not hard facts.

Please also note that all results for the mobile community have to be interpreted especially carefully, as this category comprises only 8 users. Also when interpreting the category other special care is needed, as this category applies to very different entities from user to user.

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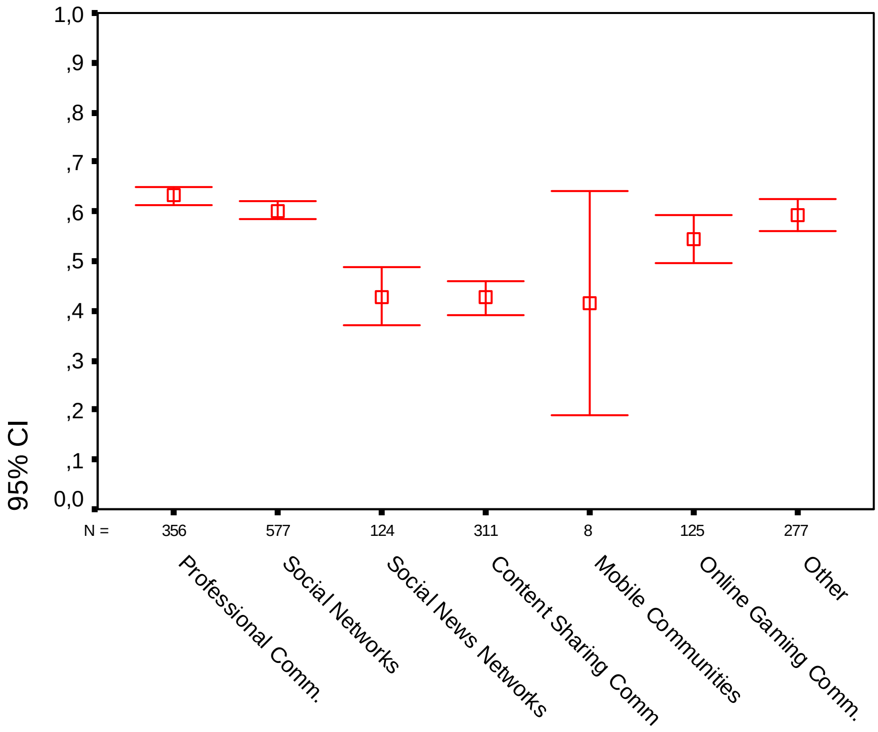
### A.11.1 Differences between community types



**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Dev. |
|---|---|---|---|---|---|
| Professional Comm. | 356 | ,03 | 1,00 | ,6318 | ,1839 |
| Social Networks | 577 | ,02 | 1,00 | ,6009 | ,2220 |
| Social News Networks | 124 | ,00 | 1,00 | ,4293 | ,3201 |
| Content Sharing Comm. | 311 | ,00 | 1,00 | ,4268 | ,3075 |
| Mobile Communities | 8 | ,06 | ,78 | ,4151 | ,2686 |
| Online Gaming Comm. | 125 | ,00 | 1,00 | ,5443 | ,2770 |
| Other | 277 | ,00 | 1,00 | ,5921 | ,2633 |

The figure above shows the information disclosure index for the different community types. A first distinctive feature that attracts attention is that users of professional communities and social networks seem to disclose more information about them than users in the context of social news or content sharing. Gaming communities seem to be in the middle of these two.

The main distinction seems to be whether an online community is intended for networking purposes (social or professional), or if the community character mainly is important to foster a specific goal (such as news filtering or content sharing).

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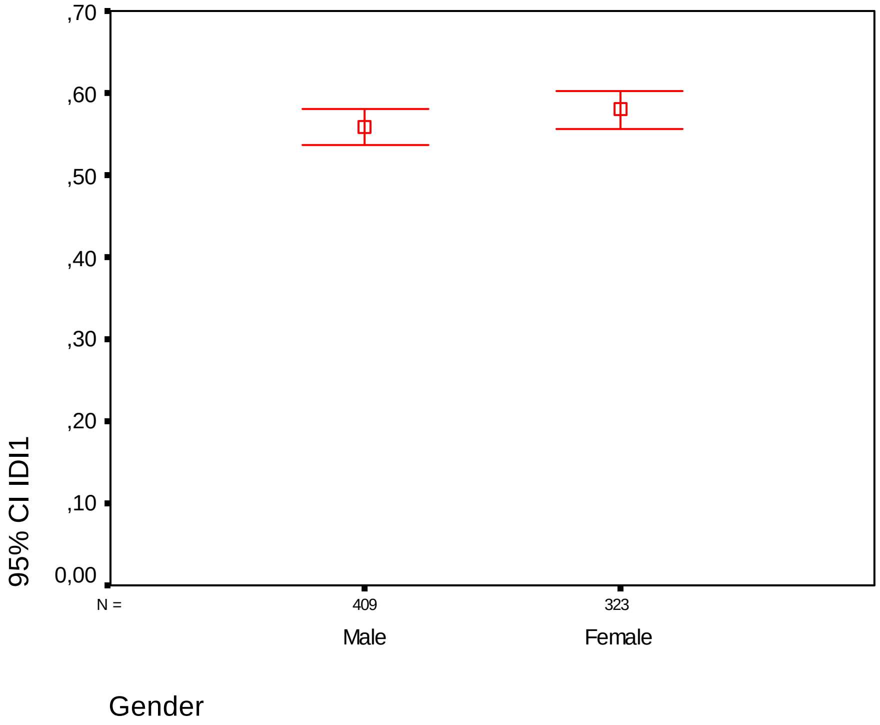
### A.11.2 Gender



The figure above showing the means and confidence interval for IDI of male and female users indicates no major difference in their information disclosure behaviour. Woman make slightly more information available, but the confidence interval is overlapping with the men's, so no clear trend can be interpreted. Analyzing the data on a community type level shows the same picture, there are no major differences between genders with regard to this aspect.

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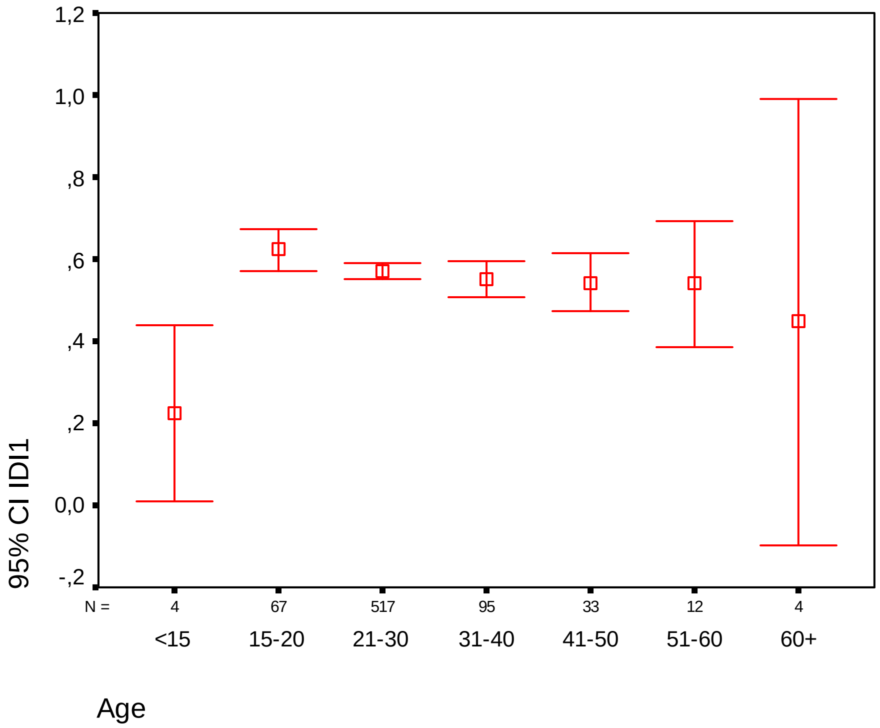
### A.11.3 Age



Not considering the two extreme age groups due to the low frequency the information disclosure is slightly decreasing with age, i.e., older people to disclose slightly less information than young ones. A striking characteristic of the distribution is that users between 15 and 20 years are especially willing to disclose information.

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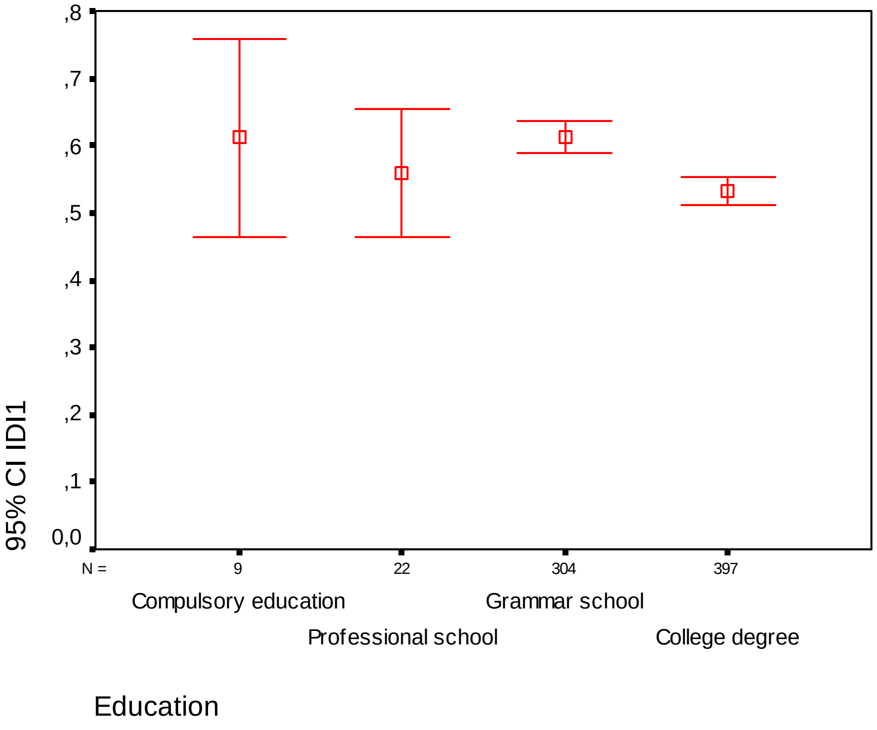
### A.11.4 Education



Again considering only the categories with relatively high frequencies (grammar school, college degree) there seems to be a clear trend that people with higher education are more cautious to whom they disclose their information.

This is especially relevant as people with higher education are also more likely to estimate the involved risks and privacy threats more realistically. This emphasizes the need for good ways to communicate security and privacy issues to all users.

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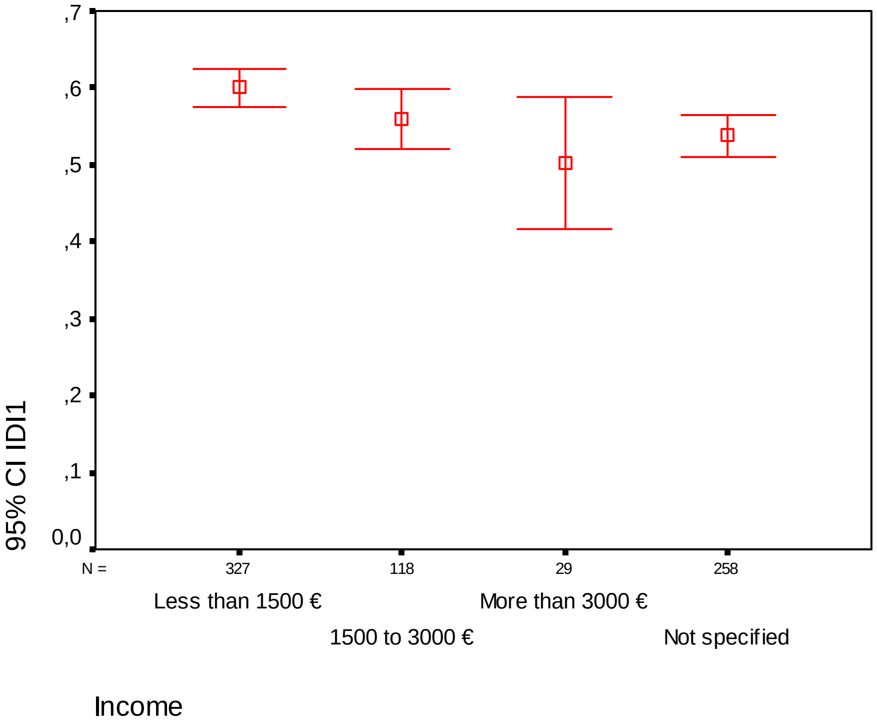
### A.11.5 Income



The IDI is negatively related to the income i.e., the more money a user earns the less likely he is to disclose information in online communities. Please note that this is only a tendency, as the confidence intervals are overlapping. These results are also consistent with the previous section, as better educated persons typically have a higher income.

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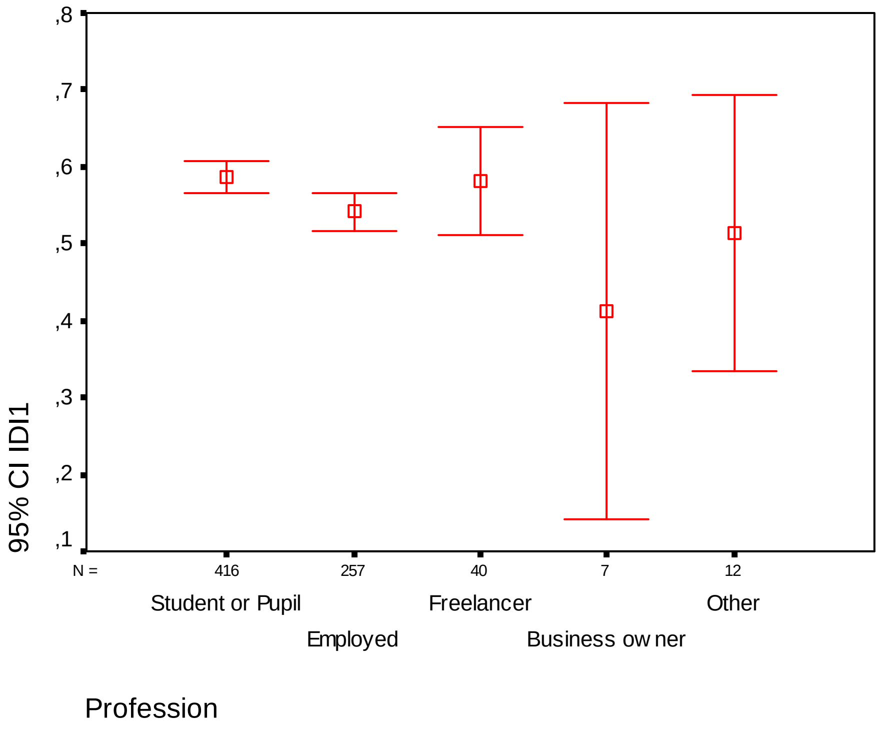
### A.11.6 Profession



When looking on the influence of the profession on the IDI (again without considering categories with low frequency) students seem to be a little more willing to provide data than employed persons.

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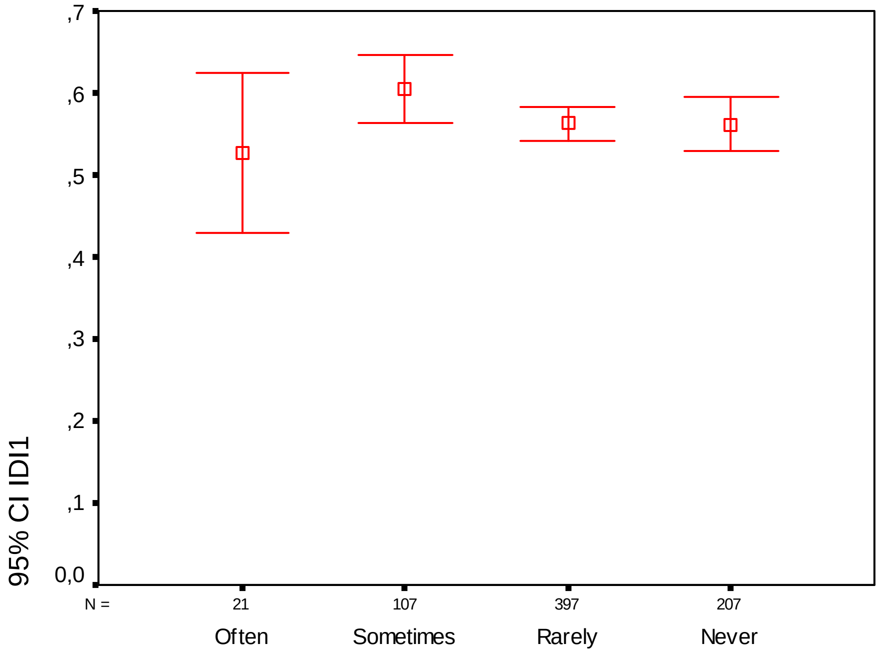
### A.11.7 Computer experience



When you work with computers you need help …

Contrary to our expectations computer skills seem to have no major influence on the disposition to reveal private data or not in online communities. Our expectation was that people who do not need help with computers would also be more aware of privacy risks and therefore provide less information, but this theory is not supported by the available data.

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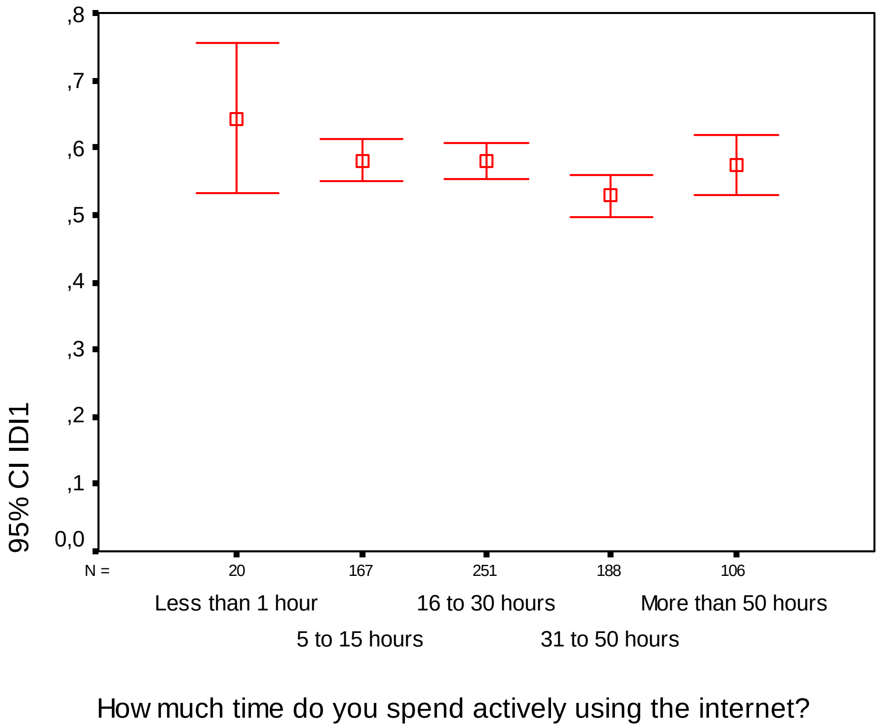
### A.11.8 Online time



There is no prevailing trend in the relationship of IDI and spend online time per week. The IDI for the category ‘31 to 50 hours’ is a little lower than the others, but this is difficult to interpret, as for more than 50 hours the IDI increases to the previous level again.

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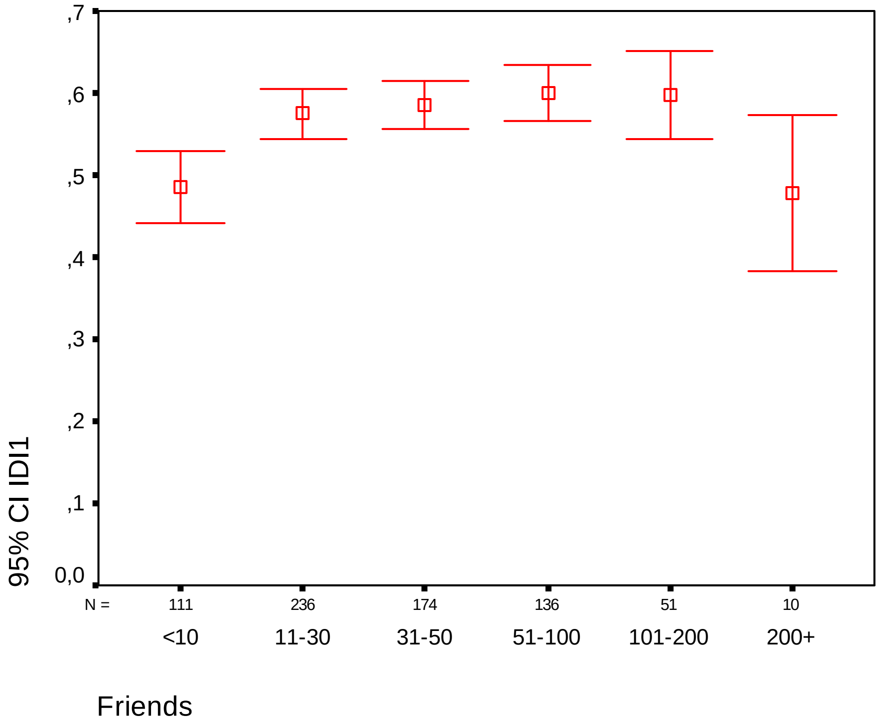
### A.11.9 Number of friends



There figure above showing the relationship between the IDI and the average number of friends a user has within a community suggest a positive correlation (not considering the 200+ category). The more friends a user has the more information he is willing to share.

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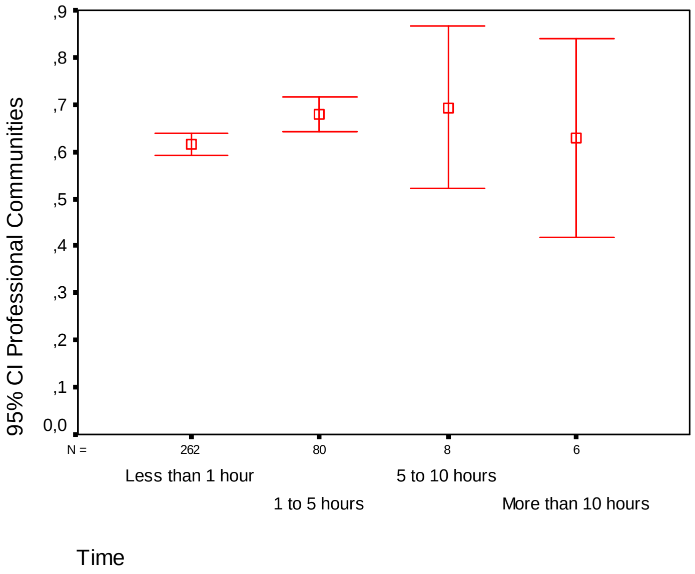
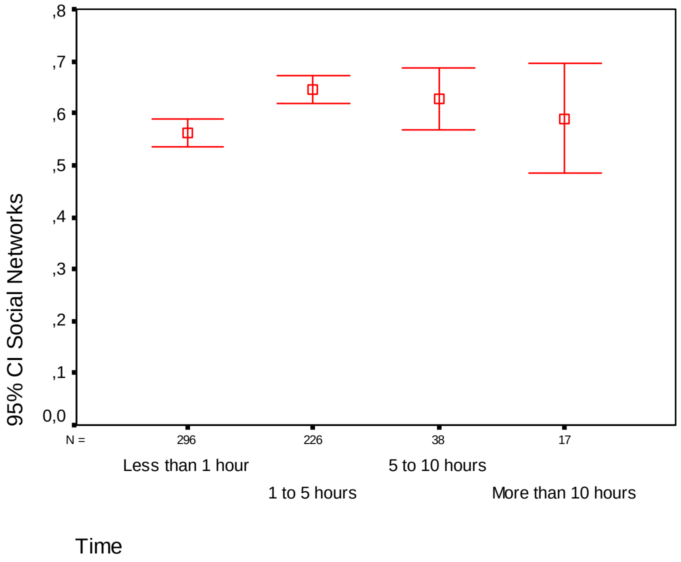
### A.11.10Community time

The following figures show the relationship between IDI for a community and the time actively spend using it or communicating with it. Due to the low number of responding users the graphic for the mobile community is not included.





The two networking communities – professional and social – show the same trend: Usage time in most cases is less than 5 hours, and the more time users are spending on the site the more information they do provide. This is not increasing anymore with a further increase in time.

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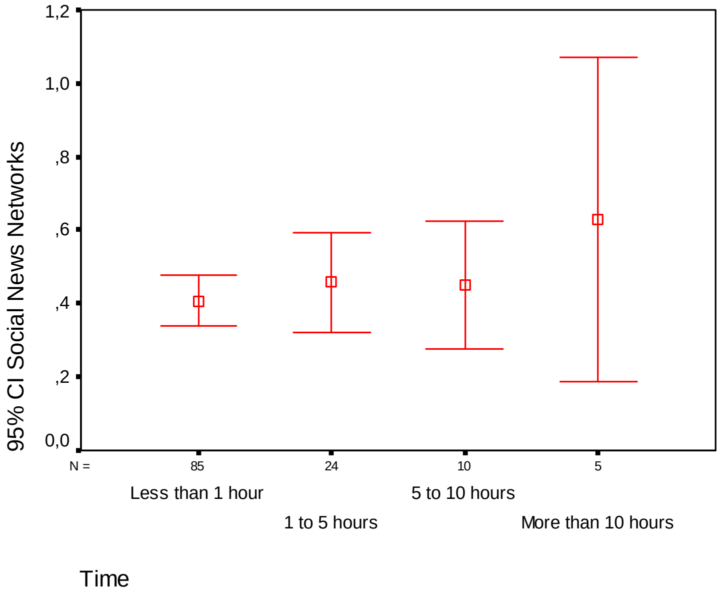

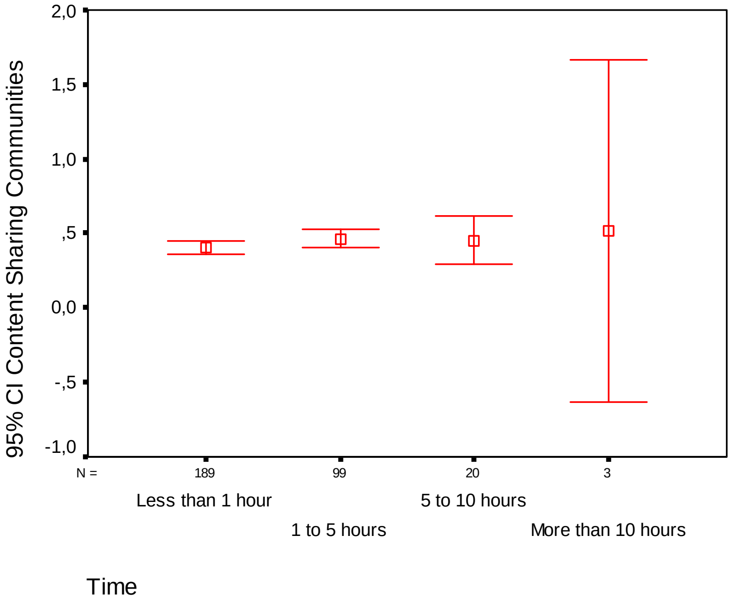

Social news and content-sharing communities to not show such an explicit increase in IDI, and the level of IDI is lower in general.

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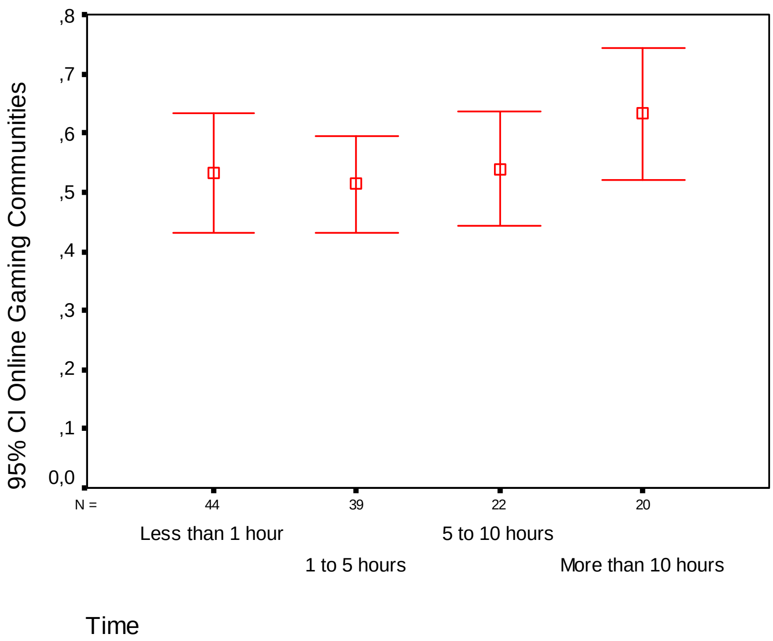

The gaming community also doesn’t show the increase in IDI compared to the networking sites.

### A.11.11 IDI & Trust

The following five figures show the relationship between the users’ statement of how much they trust the respective communities and their information disclosure behaviour on that community. Again, results for mobile communities are not show due to the small number of user participating in the questionnaire. The figures indicate a very clear correlation for all community types.

This is also a good indicator that the constructed IDI is a valid means to characterize user behaviour.

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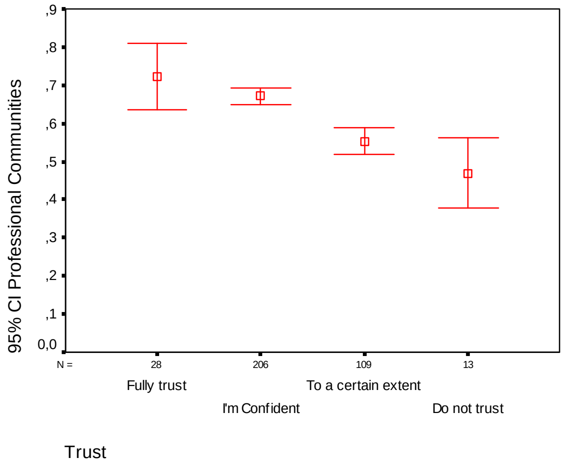

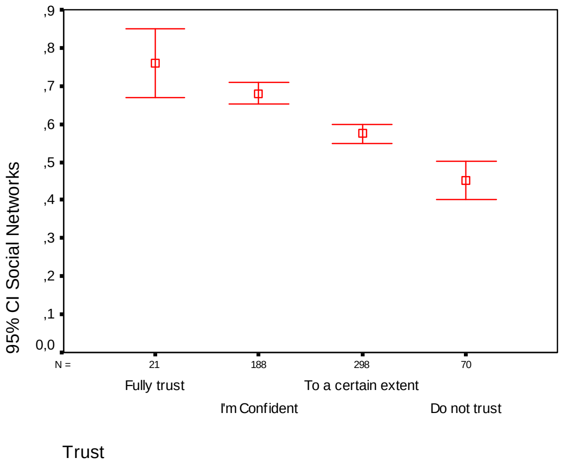

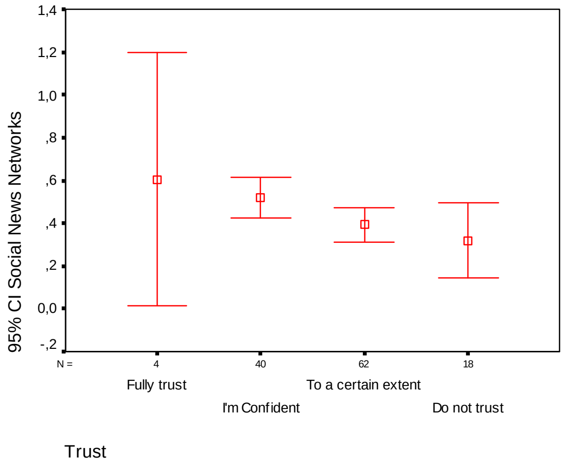

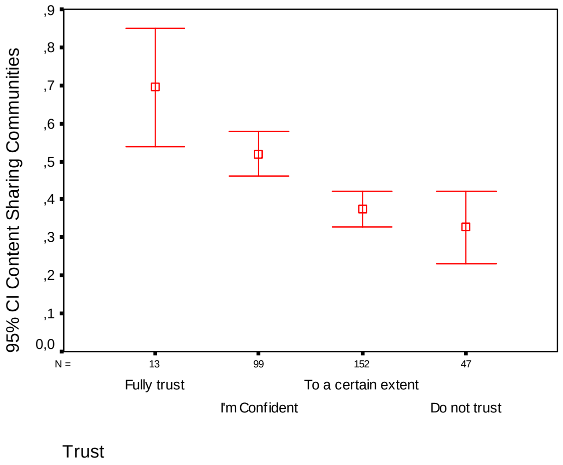

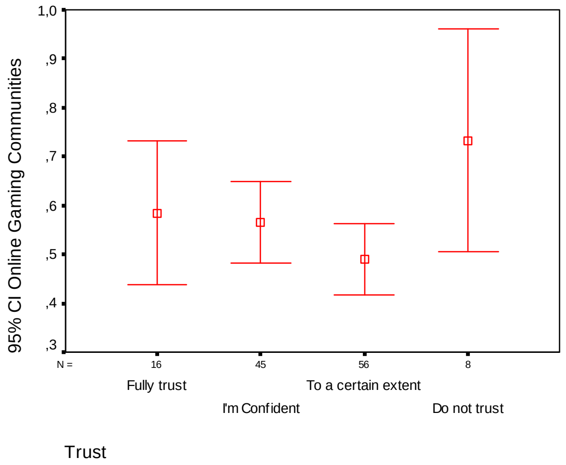

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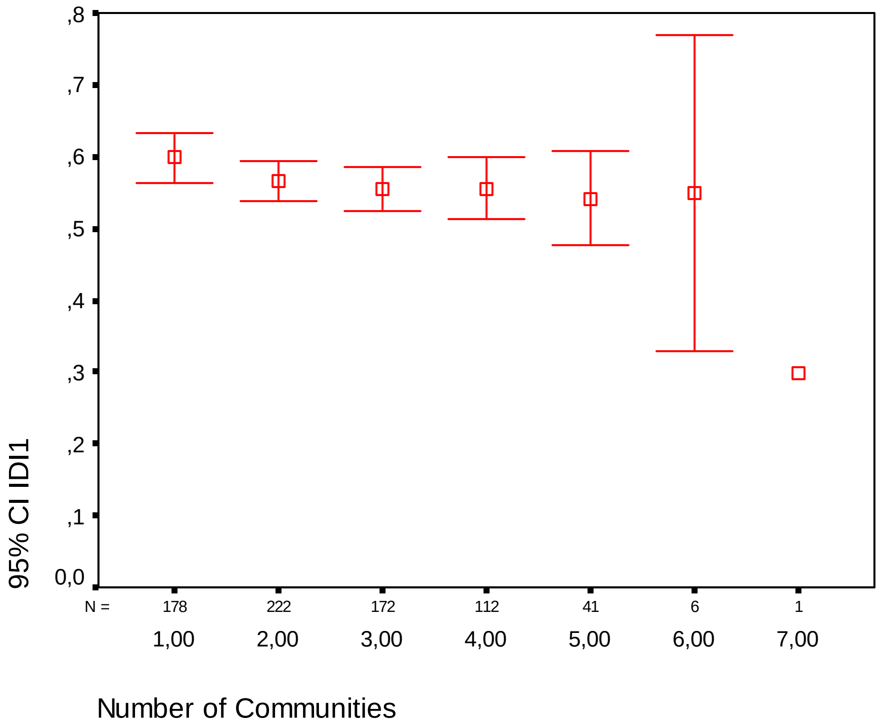
## A.11.12Number of communities



The figure above shows the relationship between the number of different community types a user stated to participate in and the disclosure of information. The disposition to disclose information seems to be fairly unrelated to the number of different community types the users are participating in.

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