

A Community Success Model for Gaming Communities

Yiwei Cao, Anna Glukhova, Ralf Klamma, and Dominik Renzel
 Informatik 5, RWTH Aachen University, Ahornstr. 55, D-52056 Aachen, Germany
 Email: {cao,glukhova,klamma,renzel}@dbis.rwth-aachen.de

Abstract – Community satisfaction has become a crucial aspect for success of emerging multimedia information systems. For measuring community satisfaction we propose a community success model (CSM) based on the seminal DeLone & McLean IS Success Model. CSM combines quantitative data collected through automatic monitoring of service usage with qualitative extracted from automatically generated questionnaires. As proof of concept we propose to apply our CSM to evaluate innovative community supporting services created within our regular lab course “Gaming Communities” at RWTH Aachen University. Video gaming is part of our new media culture, entertaining people of all ages. The satisfaction of gaming community members can influence the success of a game and therefore presents a relevant object of investigation for CSM.

I. INTRODUCTION

Nowadays, communities of practice [21] as well as social networks [3], [7], [8] rapidly shape diverse communities on different scales, ranging from small niche groups to hundreds of millions of users. Among them, gaming communities emerge and have massive evolutions. Computer games have become prevalent entertainment in our today’s life. A 60 page-long report of a survey conducted lately by PEW/Internet shows that computer games become an essential life element of all teens in the USA [15]. The human desire for playing online and video games creates a booming market of gaming consoles (e.g. Wii, Xbox, PS3), handheld consoles (e.g. PSP, Nintendo DS), a big variety of online games (e.g. World of Warcraft and GuildWars) and virtual worlds (e.g. SecondLife). Consequently, gamers build up gaming communities to share experiences, since the communication is vitally important for the community existence [13], [16], [18], [24].

Community support is important for both game development and community building [1]. Firstly, in most of today’s online games players have to solve problems as a group, which implies the need for communication among members, requires engines for group building, etc. Secondly, Lehnhart et al. [15] report that close to 50% of US teenagers play online games with people they know in their offline lives. Community support can allow integration of offline friend circles into online communities. Thirdly,

community services enhance competition within games, which builds up customer loyalty as a consequence. Obviously, games and gaming communities are strongly intertwined and experience permanent co-development.

In principal, gaming communities make use of synchronous as well as asynchronous communication techniques. On the one hand, gamers can leave an asynchronous message to the community. Gamers discuss new game features, argue about problems they encounter at playing, give and seek advice about gaming strategies via forums, wikis, blogs and social networking sites (e.g. www.wow-europe.com, www.gamingwelt.com/, and www.wiiinsider.de). On the other hand, all modern games provide direct in-game communication, such as built-in chat modules support, team building, strategy discussions, etc. Thus, communication is not restricted to a simple message exchange, but also involves further service functionality. For example, in WOW players can trade goods like special items, weapons, gold, etc. (www.worldofwarcraft.com/info/basics/trading.html). It is essential to design a successful community structure in online multiplayer games [8].

However, the design of successful virtual communities is a challenging process. Due to the huge variety of both gaming devices and game concepts, no universal community support strategy is possible. Moreover, new requirements for context-based services for gaming communities come up with next-generation mobile applications, which are featured as accessing multimedia anywhere at anytime with low-cost handsets, systems and charges, but high data transmission rates.

Besides well-known technical success factors (e.g. efficiency, stability, etc.), community satisfaction is a crucial aspect to measure success of community information systems. Thus, success measures are not only stakeholder but also system dependent [16]. Based on conventional IS success models such as the DeLone and McLean (D & M) IS Success Model [5], we propose a community success model (CSM) to analyze requirements and evaluate the success of community information systems. Community satisfaction measurement is carried out in terms of community factors, system ubiquity, and user mobility. In short,

community success is based on user satisfaction and participation. Wenger concludes the characteristics of Communities of Practice (CoP) [21] as Joint Enterprise (JE), Mutual Engagement (ME), and Shared Repositories (SR), which are in line with the following community aspects by Whittaker et al. [22]. They can be well applied to building up gaming communities as follows:

- A shared goal or interest that provides the reason for being a part of the community (JE): gamers' similar goals to play and win games;
- Shared activities between members (ME), here between gamers;
- Intense interactions and strong ties (ME), esp. important for online multiplayer games;
- Support between community members (ME) also for online multiplayer games;
- Access to shared resources (SR) such as gaming forums etc.;
- Social conventions, languages, or protocols (SR) are associated with the context of gaming communities.

In terms of mutual engagement of communities and shared repositories based on certain social conventions, a common cultural background plays an important role. It can be reflected by the spatiotemporal distribution of gamers. Hence, time and location monitoring of communities shows joint activities and interactions among gamers. Gaming community satisfaction can be measured by assessing whether these aspects are well covered.

To explore the concept, we employed the proposed CSM to evaluate gaming community satisfaction within our regular lab course "Gaming Communities". During the course, students were asked to develop value-added gaming community oriented services, which requires the assessment of community needs and interests in advance.

CSM has been used to evaluate the success of multimedia community services through automatic monitoring of service requests and the presentation of online questionnaires as proof of concept.

The rest of this paper is organized as follows. In Section 2 we introduce the idea and settings of our lab course "Gaming Communities" to launch starting points of communities and community satisfaction. The student projects are introduced in Section 3 as case studies. The design of CSM is introduced in Section 4. Section 5 illustrates the evaluation scenario of using CSM to analyze gaming communities. Finally, section 6 provides a summary and presents our ongoing research work and open issues.

II. THE ANATOMY OF GAMING COMMUNITIES

We provide an insight into gaming communities through our regular lab course "Gaming Communities", held by Information Systems at RWTH

Aachen University in summer terms. This lab aims at prototyping of value-added services for gaming community support. Every participant has to prepare a one-page expose about his/her ideas. At the beginning of the semester, the three best proposals are selected as projects to be fulfilled and students are divided in three groups accordingly. During the rest of the semester, an iterative process beginning from the identification of community needs and ending with the community tests of the implemented tools is performed. The results of each process step are reflected in four reviews.

In our lab, we give participants leeway in the selection of devices and games for their projects. The lab is equipped with different kinds of consoles: Nintendo Wii, Microsoft Xbox 360, Sony PS3, Sony PSP, iPhones and Nokia smart phones of the N95 series. All of these platforms have online access.

For each of them we provide a software development kit (SDK), available for studying purpose and non-commercial use. For example, to develop on Nintendo Wii a Wii browser called "Internet Channel" [9,19] can be used. Internet Channel is an Opera-based browser, for which, like for any other browser, JavaScript application can be created. In contrast to programming with JavaScript for Wii, applications for the Xbox can be developed with Visual C#. The XNA Game Studio Express is an Xbox SDK especially designed for non-professional game production (www.xbox.com/en-US/dev/default.htm). The situation with the Sony PS3 differs from its competitors, because PS3 is already equipped with a Yellow Dog Linux operating system. This allows a huge range for homebrew applications to be developed and is entirely sanctioned by Sony.



Figure 1. Mobile gaming devices

Investigation of gaming communities formed around the big variety of mobile gaming device (Figure 1) players are also the task of our lab. For mobile gaming development we suggest the use of the Sun Java Wireless Toolkit (WTK). WTK is a state-of-the-art toolbox for developing wireless applications based on the J2ME Connected Limited Device Configuration (CLDC) [10] and Mobile Information Device Profile (MIDP) [11]. Applications developed with WTK run

on all compliant cell phones, mainstream personal digital assistants, and other small mobile devices. The toolkit includes an emulation environment, performance monitoring and optimization features as well as documentation and examples for developers to demonstrate how to quickly deliver efficient and successful wireless applications to market (<http://java.sun.com/products/sjwtoolkit/>).

Solely the knowledge about available programming tools for game development is clearly not enough for the creation of gaming community information systems. Besides their technical realization the most challenging part is an in-depth analysis of gaming communities about their needs and desires. In order to help our students to collect this knowledge, several activities are carried out. In the introductory meeting we explain the meaning of the general community term followed by a round-table discussion among students and supervisors about gaming communities and their needs. As the gaming experience of all participants varies from professional to casual gamers, many different opinions are usually expressed and different needs emphasized. Thus, the students get an opportunity to learn the subject from different points of view, which is essential considering the diversity of existing gaming communities. The two successful community oriented projects “Nintendo DS Mixed-reality Treasure Hunt” [17] and “MyGLife” [23] are presented in the same meeting as case studies.

Furthermore, during the course several lectures and invited talks on communities and game development contribute to the expansion of the student’s knowledge of the gaming world. The next step, which should help students to understand the gaming community’s desires, is to provide weekly gaming sessions in our lab. Besides the development and programming tasks, students are also required to present their results to convince the audience of their achievements (see Figure 2).



Figure 2. Gaming Community lab final presentation

Obviously, many different community oriented services and features in games already exist on the market. In our lab we are looking for innovative ideas. Therefore a thorough market study has to be performed

by the lab participants. For information exchange the Basic Support of Cooperative Work (BSCW) [2] system is used.

III. CASE STUDIES OF GAMING COMMUNITIES

At the beginning of summer term 2008, students proposed projects with a wide coverage. Topics included e-Sport support, universal Player versus Player (PvP) /Player with Player (PwP) platforms, massively multiplayer online role-playing game (MMORPG) communities, etc. Three clusters were identified within over ten projects and taken over by three student groups. During the semester, 3 groups of students worked on 3 projects respectively: Civilization IV – Conquer the New World (G1), Babel: PvP/ PwP on iPhones (G2), and empirical research on gaming communities (G3).

G1 has identified that many multiplayer gamers have difficulties in finding appropriate opponents. Often, players differ in their abilities, interests etc. To find adequate opponents, the students developed a community website where players can register for Civilization IV multiplayer matches. How well a player integrates into a particular match setting is determined by an algorithm based on the analysis of player abilities and preferences. Four dimensions are taken into account. Age, winning strategy, experience and game scenario are combined as a weighted sum. The result is represented in the order in which the matches are presented to the user. In order to improve the comparability of match results, the students created their own Civilization IV scenario based on the conquest and colonization of America between 1500 and 1850.

G2 called their project Babel which targets mobile Apple iPhone gaming communities. The enlarged screen display, multimodality of touch screen, and the lately released built-in GPS-localization functionality of iPhones have attracted the communities of both gaming developers and the gaming players. However, until now gamer community support is quite limited. Babel helps players to locate and communicate with nearby players. A chat tool on the iPhone was developed, using Apple’s service discovery protocol “Bonjour”. Player communities are supported through internal communication management and automated comparison of installed games within community etc. The results have been presented on the official iPhone SDK emulator.

G3 found that gaming has undergone a transition from a niche hobby to a part of everyday culture, with the most prominent examples of professional gaming in Korea and the success of World of Warcraft. This transition alongside with the advance of Internet use has created a new kind of social environment, commonly known as virtual life. The students have created an online survey at www.gamingrealities.net for investigation of those gaming environments with particular regard to the interaction between gaming and

career, relationships as well as social groups. The answers of 837 participants worldwide were statistically analyzed and published in [6].

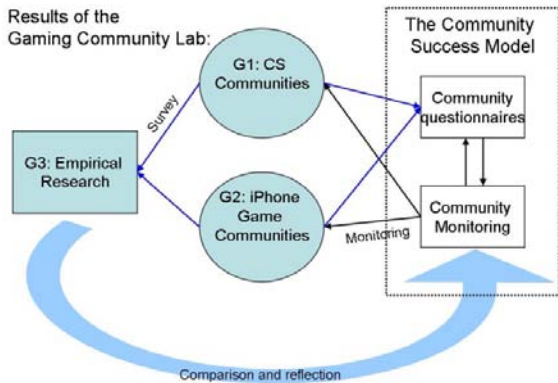


Figure 3. Gaming Community Lab results for the Community Success Model

All projects G1, G2 and G3 can be divided in two categories (cf. Figure 3). G1 and G2 focused on the creation of community supporting services, G3 on an empirical research on gaming communities. Community satisfaction with the services developed within both projects G1 and G2 presents an interesting object of investigation as it can reflect the success of these innovations. At the same time, the information collected from empirical research on gaming communities helps to understand and interpret results gained from measuring community satisfaction based on the CSM.

IV. DESIGN OF THE COMMUNITY SUCCESS MODEL (CSM)

Invention does not directly imply success. If nobody has implemented an idea before, there is still a chance, that there is actually no need for it. In his investigation on multiplayer online role-playing games Yee [24] found out three essential factors for the gamers: achievement, social and immersion. The social community oriented factor is subdivided in socializing (casual chat, helping others, making friends), relationship (personal, self-disclosure, find and give support) and teamwork (collaboration, groups, group achievement). Despite all concrete examples from the Yee model listed above, a choice of items to adopt for certain gaming community needs to be performed. Such decisions are normally based on personal experience and assumptions. At that point the usefulness of CSM becomes obvious. In general, the measurement of community information system success requires a reliable and valid model. Therefore, a number of model aspects must be clarified in advance. Existing success models with respective dimensions and factors were surveyed. While designing CSM, we also had the following questions in mind: How can measures be classified? Which scales should be used? How will data be obtained/stored for individual measures? What techniques can be used to analyze/improve/validate CSM quality?

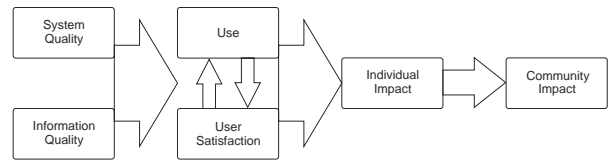


Figure 4. The D&M IS Success Model (adapted from [5])

The DeLone & McLean IS Success Model [5] (cf. Figure 4) has been identified as a well-established success model due to the fact that its validity was proven by many independent empirical studies. In this model, all IS success factors are categorized into six dimensions. System quality and information quality affect use and user satisfaction, which lead to the individual and even organizational impact. Thus, it seemed acceptable to adopt all six dimensions from the original model, and to choose an appropriate subset of related factors for each dimension, as it is recommended by the authors. However, the original model definitely lacks certain factors that characterize current information systems with respect to the partially interrelated concepts *multimedia* and *mobility*. Although mentioned implicitly with the success dimension Organizational Impact, success factors of CoPs are not pointed out explicitly. CSM is the result of the model building process by extending the D&M IS Success Model by current concepts and customizing to gaming community information systems.

Based on our previous research on MobSOS [12], a testbed for mobile multimedia community services, we constructed the CSM model in the following way. The first step consisted of a certain process of preselecting success factors and possibly augmenting and restructuring a transformed list resulting from this first step. The next step was to classify and design measures for each of the success factors as well as to find appropriate means of obtaining them. However, before actually starting the design process it was inevitable to become clear about model building and validation techniques to be used.

If the causal interrelationships between individual dimensions are neglected in order to simplify the representation, the model structure can be reduced to the taxonomy as depicted in Figure 5. The complete model is thereby decomposed into the following six overall success dimensions: System Quality (SQ), Information Quality (IQ), Use (U), User Satisfaction (US), Individual Impact (II), and Community Impact (CI) (renamed from Organizational Impact).

Each dimension is made up of a set of factors, and each factor is represented by a set of proxy measures. Table

I provides a complete overview of all factors to be covered. In this straight taxonomy, the CSM success dimensions constitute the first level elements, where the only difference to the original D & M IS Success Model [5] is the dimension name “Community Impact”

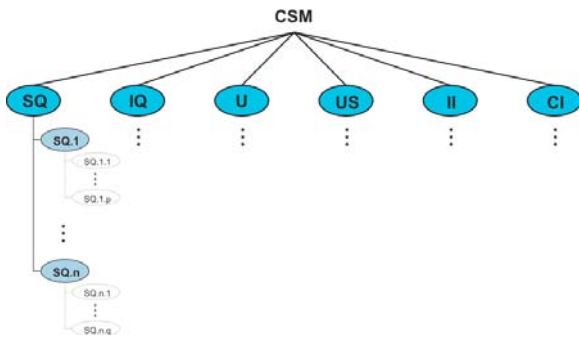


Figure 5. The Community Success Model - Taxonomy of Dimensions, Factors and Measures

instead of “Organizational Impact”. Second-level elements represent individual factors of the respective success dimensions. Finally, third-level elements represent proxy measures captured in the context of a given factor of a specific success dimension. They are considered as important aspects to measure the overall success of gaming community systems, including community satisfaction.

We describe a process aiming at combining well established universal and rather modern success factors specific to the three concepts *communities*, *multimedia* and *mobility*, in order to create the CSM as a compact, however comprehensive success model for gaming community services. The main tasks to be performed are the following:

- Reduction of initial comprehensive list of success factors from the literature survey
- Augmentation of reduced list by missing crucial factors
- Disambiguation of individual success factors by appropriate renaming
- Definition of measures for all success factors

Initial point was a marginally modified version of a list of success factors containing 145 success factors including traditional factors from [5] as well as current factors from more recent work e.g. [4], [14]. This initial list was then reduced according to the relevance grades for overall services success, applicability to updated usage, clarity in meaning, accessibility and computability, and acquisition with a minimal number of unambiguous items.

In detail, in some cases it was possible to cause reduction by merging factors with similar meanings (e.g. “Currency” and “Timeliness”). Some of the factors were renamed to prohibit disambiguation for a better understanding.

Table I presents the results from the aforementioned process with regard to community IS success measurement. All factors are related to the dimensions Use, User Satisfaction, Individual Impact, and Community Impact respectively, which can be mapped to the three principal characteristics of communities of practice. Community information system success can be proved by observing community evolution, by reducing number of critical applications, by improving

community productivity and so on. These factors can also be used to evaluate the success of gaming communities and applied to measure the satisfaction with new services.

TABLE I. COMMUNITY IS SUCCESS FACTORS

Dimension	Factor ID	Factor
Use (JE)	U.1	Number of Users
	U.2	Number of Communities
	U.3	Number of Method Invocation
	U.4	Number of Information Units Accessed
	U.5	Type of Information Used
	U.6	Duration of Use
	U.7	Routinization of Use
	U.8	Frequency of Use
	U.9	Regularity of Use
	U.10	Purpose of Use
User Satisfaction (ME)	US.1	Overall satisfaction
	US.2	Software satisfaction
	US.3	Information Satisfaction
	US.4	Perceived Enjoyment
	US.5	Perceived Criticality
	US.6	Perceived Privacy
Individual Impact (ME), (SR)	II.1	Learning
	II.2	Information awareness
	II.3	Information recall
	II.4	Improved Individual Productivity
	II.5	Individual Power or Influence
	II.6	Personal Evaluation of IS
Community Impact (JE)	CI.1	Community Evolution
	CI.2	Number of Critical Applications
	CI.3	Range and Scope of Application
	CI.4	Improved Community Productivity
	CI.5	Contribution to Community Goal Achievement
	CI.6	Encouragement of Collaboration
	CI.7	Encouragement of Innovation

V. COMMUNITY MONITORING

One key concept with community IS system success measurement is the inference from monitored user behavior (U). The use of a lab prototype by community members needs to be monitored in order to estimate the community satisfaction with the developed service. The collected CSM data should be processable with statistical standard tools, e.g. SPSS [20]. The aforementioned MobsSOS testbed provides built-in support for mobile context and service usage monitoring. Monitoring basically consists of logging basic communication between client and server. Higher level measures are derived from recorded monitoring data. For each particular measure we provide derivation rules in form of SQL query statements, which could be applied by a CSM request analysis and presentation module to calculate a value for the measure in a later stage.

The entity relationship diagram in Figure 6 depicts all involved entities, their attributes and relationships among themselves. The basic unit is a *request* bound to

a session. To support mobility evaluation, *mobile context information* is taken into account for requests.

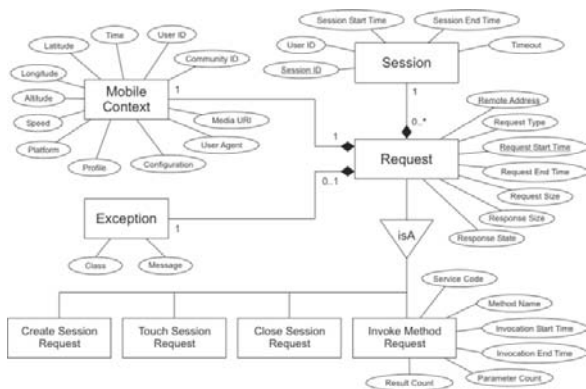


Figure 6. ER diagram for MobSOS monitoring data

Furthermore, subjective data on service success can be recorded in online questionnaires generated by a survey module provided by the MobSOS testbed [12]. We aimed to combine measures derived from monitoring and questionnaire data in order to determine the quality of students’ prototypes in supporting gaming communities.

In summary, monitoring of the service usage is based on the MobSOS testbed and applied to the CSM. Additional information is extracted from the automatically generated questionnaires. As a proof of concept, our lab performs case studies in two phases. Lab participants use CSM to evaluate the community satisfaction within already existing gaming communities to understand the community needs. Furthermore, the success of their prototypes can also be assessed by CSM.

Several examples of the extracted information by means of applying CSM are presented below. An important finding for service developers for gaming communities was as follows. If participants submit high ratings on personal satisfaction with technical realization, presented information, multimedia content and perceived enjoyment, they also rate for high service success. Against all expectations, it is interesting that our analysis shows hardly any correlation between service security and success.

TABLE II.
STATISTICS OF SERVICE CALLS

Services	Mean time of a service call (sec.)	Sum of all calls (min.)	Number of calls
Expert	31.24	342.8	544
Mailbox	1.89	13.2	285
Story	1.37	386.56	10128
User	10.79	39.15	1301
Total	4.71	781.71	12258

In order to give a proof-of-concept that new multimedia community services, in particular gaming community services, can be monitored easily with the MobSOS testbed, we performed a preevaluation of a

multimedia community service for digital multimedia storytelling. Sample monitoring statistics of various services around digital multimedia story production are listed in Table II. In that sense, community-based digital multimedia storytelling is also applicable in the domain of gaming communities. Gamers need to find experts to share gaming experiences, to communicate and to enjoy personalized game storylines. The aforementioned evaluation shows, that in principal CSM is also applicable to gaming community services. However, this statement must be confirmed by including a wider service portfolio into further analysis.

VI. CONCLUSIONS AND FUTURE WORK

In this paper, we propose a community success model (CSM) to measure community satisfaction. As proof of concept, CSM has been well evaluated on a multimedia community service for storytelling. Furthermore, CSM can be employed for the measurement of gaming community satisfaction with regard to service support of gaming community information systems. CSM evolved as a combination of the well-developed D & M success model and the augmentation by modern mobile multimedia community aspects. The importance of gaming communities in our contemporary gaming world serves as a motivation for our Gaming Community Lab at which community oriented value-added services are developed. In the course, students aim to create an innovative community supporting software. However, the social needs of communities are very difficult to define in advance. In order to estimate those we proposed the application of CSM.

We have made a step to measure the success of a given community service as a combination of different technical and human factors, which is still an open question addressed in this research area. Considering the variety and complexity of communities, CSM needs to be evaluated not only on gaming communities but also on different other communities. Further community satisfaction measures need to be considered for the CSM in order to improve CSM model quality in future. More monitoring data is currently gathered, and more concrete and precise evaluation questionnaires are to be generated.

At the same time, it will also be challenging to make an in-depth comparison of the community satisfaction using the two distinctive as well as compulsory approaches: community monitoring community (the monitoring service) and community observing community (the questionnaires tool).

ACKNOWLEDGEMENTS

This work was funded by the Excellence Initiative of German National Science Foundation (DFG) within the research cluster “Ultra High-Speed Mobile Information and Communication” (UMIC) and the DFG project CONTICI. Special thanks are due to all the students of the lab course Gaming Communities in Summer Term 2008.

REFERENCES

- [1] L. von Ahn, and L. Dabbish: Designing games with a purpose. *Communications of the ACM*, Vol. 51, No. 8, August 2008, pp. 58-67.
- [2] W. Appelt. WWW Based Collaboration with the BSCW System. In: *Conference on Current Trends in Theory and Practice of Informatics*, pages 66-78, 1999.
- [3] Y. Cao, M. Spaniol, R. Klamma, and D. Renzel. Virtual Campfire - A Mobile Social Software for Cross-Media Communities. In: K. Tochtermann, H. Maurer, F. Kappe, and A. Scharl, editors, *Proceedings of I-Media'07, International Conference on New Media Technology and Semantic Systems*, J.UCS (Journal of Universal Computer Science) Proceedings, pages 192-195, Graz, Austria, September 5-7, 2007, Springer-Verlag.
- [4] D. Chalmers and M. Sloman. Survey of Quality of Service in Mobile Computing Environments. Research Report 98/01, Department of Computing, Imperial College London, 1998.
- [5] W. H. Delone and E. R. McLean. Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, 3(1): 60-95, 1992.
- [6] D. Dugosija, V. Efe, S. Hackenbracht, T. Vaegs and A. Glukhova: Online Gaming as Tool for Career Development, R. Klamma, et al. (Eds.): *Proceedings of the First International Workshop on Story-Telling and Educational Games (STEG'08) at EC-TEL 08*, Maastricht, the Netherlands, CEUR-WS.org, 2008.
- [7] N. Eagle and A. Pentland. Reality Mining: Sensing Complex Social Systems. *Journal of Personal and Ubiquitous Computing*, 10(4): 255-268, 2006.
- [8] M. Ginsburg and S. Weisband. Social Capital and Volunteerism in Virtual Communities: the Case of the Internet Chess Club. 2002. In: *Proceedings of the 35th Annual Hawaii International Conference on System Sciences (HICSS'02)*, pages 2225-2234, Jan. 7-10, 2002.
- [9] D. Gump. Wii Opera SDK. <http://wiioperasdk.com/>, last visited: Mar. 2008.
- [10] Java Community Process (JCP). JSR 139 - Connected Limited Device Configuration (CLDC), Version 1.1, March 2003.
- [11] Java Community Process (JCP). JSR 118 - Mobile Information Device Profile (MIDP), Version 2.1, November 2005.
- [12] R. Klamma, D. Renzel and M. Spaniol. Mobile Context Aware Semantic Multimedia Tagging on the MobsOS Testbench. In: *Proceedings of 9th International Workshop on Image Analysis for Multimedia Interactive Services (WIAMIS '08)*, Klagenfurt, Austria, May 7-9, 2008.
- [13] J. Leikas, H. Stromberg, V. Ikonen, R. Suomela, and J. Heinila. Multi-User Mobile Applications and a Public Display: Novel Ways for Social Interaction. In: *Fourth Annual IEEE International Conference on Pervasive Computing and Communications, PerCom 2006*, 13-17 March 2006.
- [14] J. M. Leimeister, P. Sidiras, and H. Krcmar. Success Factors of Virtual Communities from the Perspective of Members and Operators: An Empirical Study. In: *HICSS '04: Proceedings of the Proceedings of the 37th Annual Hawaii International Conference on System Sciences (HICSS'04) - Track 7*, page 70194.1, Washington, DC, USA, 2004, IEEE Computer Society.
- [15] A. Lenhart, J. Kahne, E. Middaugh, A.R. Macgill, C. Evans, J. Vitak: *Teens, Video Games, and Civics: Teens' gaming experiences are diverse and include significant social interaction and civic engagement*, PEW internet & American life project, The John D. and Catherine T. MacArthur Foundation, Sep. 16, 2008.
- [16] N. Nova, F. Girardin, and P. Dillenbourg. 'Location is not enough!': an Empirical Study of Location-awareness in Mobile Collaboration. In: *IEEE International Workshop on Wireless and Mobile Technologies in Education, 2005 (WMTE 2005)*, pages 21-28, Nov. 28-30, 2005.
- [17] S. K. Shimbun. Nintendo DS Mixed-reality Treasure Hunt. <http://www.pinktentacle.com/2008/02/nintendo-ds-mixed-reality-treasure-hunt/>, last visited: Dec. 2008.
- [18] M. A. Smith and P. Kollock, editors. *Communities in Cyberspace*. Routledge, London, New York, 1999.
- [19] Opera Software. The Internet Channel: Web Browsing for your Wii. Last visited Dec. 2008. <http://www.opera.com/products/devices/nintendo>
- [20] Statistical Product and Service Solutions (SPSS). <http://www.spss.com>, last visited: Jan. 2008.
- [21] E. Wenger. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, Cambridge, UK, 1998.
- [22] S. Whittaker, E. Isaacs, and V. O'Day. Widening the Net: Workshop Report on the Theory and Practice of Physical and Network Communities. *SIGCHI Bulletin*, 29(3): 27-30, 1997.
- [23] World Wide Workshop. MyGLife. <http://myglife.org>, last visited: Dec. 2008.
- [24] N. Yee. Motivation of Play in Online Games. *Cyber Psychology and Behavior*, (9): 772-775, 2007.

Yiwei Cao is a doctoral researcher at the Information Systems group at RWTH Aachen University. She receives a diploma in computer science from RWTH Aachen University and a bachelor in architecture from Shanghai Tongji University. Her research interests are multimedia community information systems, metadata standards for multimedia, spatial data and cultural information, and mobile social software.

Anna Glukhova is a researcher at the Information Systems group at RWTH Aachen University, Germany. She holds a diploma in computer science from RWTH Aachen University. Her research interests include Requirements Engineering, Analysis of Digital Social Networks, and Design of innovative Social Software.

Ralf Klamma is a senior researcher at the Information Systems group at RWTH Aachen University. He has visited the Massachusetts Institute of Technology, Cambridge and has been a substitute professor at the universities of Chemnitz and Passau. His research interests include theory and utilization of information systems, organizational memories and workflow management, virtual community support, social software, electronic learning and professional training.

Dominik Renzel is a Diploma student and a student researcher at the Information Systems group at RWTH Aachen University. He has been involved in developing several multimedia community information systems within many research projects.