

## **Towards Social Serious Games**

Johannes Konert, Stefan Göbel, Ralf Steinmetz  
Technische Universität Darmstadt, Darmstadt, Germany  
johannes.konert@kom.tu-darmstadt.de  
stefan.goebel@kom.tu-darmstadt.de  
ralf.steinmetz@kom.tu-darmstadt.de

**Abstract:** Serious Games for Learning provide a pedagogically thoroughly designed game play experience. Still players need to pause the game when they are stuck with a misunderstood game quest and seek for help in less structured sources like online bulletin boards or in a talk with other players. The knowledge exchange about approaches to game quests, the game play personalization and interactivity can be enhanced by adding Social (Game) functionality to Serious Games. User-generated content is then provided to other players in game and solutions can be discussed and assessed (Peer Education concepts).

The proposed middleware GENIUS provides game developers with the methods to use Peer Education concepts for Knowledge Sharing in Serious Games.

**Keywords:** Serious Games, Social Games, Knowledge Exchange, Online Social Networks, Peer Education

### **1. Introduction and Motivation**

*Serious Games for Learning* are traditionally designed as single player games where learning targets have been designed as a story-based path through the game by pedagogues. Control of learning outcomes are made by quests and tasks a player has to solve (Shute et al. 2009). In case the learning curve is not perfectly adapting to players' abilities, they are stuck in the game. Often this means to pause the game and seek in internet bulletin boards for help. Finding the right and correct hints related to the current context in the game in a suitable level of detail without reading too much about future game quests' solutions can be a time-consuming and frustrating interruption of the gaming and learning experience. *Serious Games* can therefore be enhanced by functionality enriching the games with benefits known from *Online Social Networks*. Thus, by integrating an exchange of user-generated content into the game, hints and solutions of other players can be automatically provided. Helping others in a community-based structure can be motivating and fosters knowledge exchange and is known as the concept of *Peer Tutoring* (Westera & Wagemans 2007). Additionally open format quests can be used in games. These are most valuable for diagnosis of misconceptions and help in acquisition of problem-solving competencies (Prediger et al. 2008). Solutions to such quests could be assessed by other players to support learning by teaching, assessment and reflecting over others' solutions. This is known as the concept of *Peer Assessment* (Stepanyan et al. 2009). Beside this, connecting players with their *Online Social Network* can enhance interactivity and personalization of game play by social network metrics or peers' contributions. In this paper we propose an approach towards this type of Serious Games and will describe our framework concept with two main components enhancing Serious Games with social (game) concepts: *User-generated Content Exchange* and *Game Influencing*.

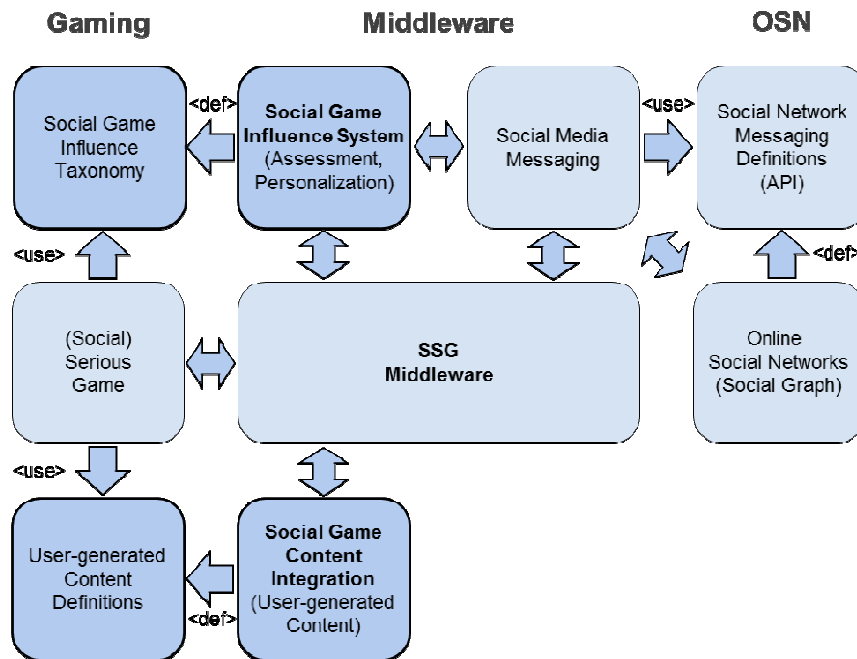
### **2. Related Work**

Adaption and personalization of game play to optimize game flow (Chen 2007) and learning experience has been investigated before in the field of *Serious Games* (Göbel et al. 2010). The conditions to foster knowledge exchange between peers have been investigated for multiplayer concepts and collaborative learning scenarios (Hämäläinen et al. 2006). The communication and social interdependencies between players are as well investigated by game design research for *Social Games* (Järvinen 2010). Immediate feedback design and elaborate ways of guiding the player through new learning material are found in the research on tutorial systems (Ritter et al. 2007). Still the potential of *Peer Education* is not fully used (Damon 1984). Several sources emphasize benefits of *Peer Tutoring* and *Peer Assessment* for learning, more social, communicative and problem-solving competencies (Mohammad et al. 2009; Westera & Wagemans 2007).

### **3. Methodology**

The focus of the proposed architectural concept (framework) named GENIUS is the enhancement of (existing) *Serious Games* with content-centered functionality for *Knowledge Sharing* among peers (players) using existing Online Social Networks (see architecture scheme in Figure 1). Even though the approach is extendable to any computer game or content-related software application the focus is

on *Serious Games for Learning* that are mostly designed as adventure games where learners explore the learning content in a story-based game environment. The following two enhancing components are designed:



**Figure 1:** scheme of *Social Serious Games* middleware architecture  
 <def>: definition, <use>: usage

### 3.1 User-generated Content Exchange

When tasks (quests) in such games have to be solved, complex games allow several approaches to reach this aim. Even so the game has been thoroughly designed and help is available in the game e.g. by descriptions and dialogs with non-player characters (NPCs), players can have misconceptions about the rules or goals related to the current task. This can lead to frustration because the game does not provide proper feedback. In this case players are forced to pause the game, search in bulletin boards or may ask other players for hints. The found results might be misleading, too detailed or too brief and players might read more of the solution as they need, because the content generated by other players is not tied detailed enough to the game level, quest and context of play.

In GENIUS-enhanced *Serious Games* the players can save game play related content (text, image, video; enriched with meta-data) into the middleware database. Such a storage can as well be done by the game engine automatically and transparent to the user. The content is then used for recommendations in case (other) players need hints. The provision of content can be done automatically or on request by the player. The content itself is categorized as question, information, hint or solution for a specific quest. Additionally to the game-integrated storage and retrieval of user-generated content a web-frontend allows the browsing, rating and commenting, too. Thus players can share their knowledge in a bulletin board-like structure and explore other players' approaches, opinions and (best) solutions (*Peer Tutoring* concept and *Learning by Example*). For games that allow open solutions to quests that challenge the creativity and lead to solutions not easily assessable by computer-algorithms, the community-based structure allows other players to assess the solutions (*Peer Assessment* concept and *Learning by Teaching*). By combining the judgment of several other players a thorough rating can be calculated and the game engine can integrate the rating into further game flow. In brief the difference to the commonly available bulletin board systems is the automatic synchronization and organization of content according to the levels and quest-structure of the computer game that as well has access to the content, rating and comments.

### 3.2 Game Influencing

The above mentioned sharing of content to increase gameplay experience and knowledge acquisition primarily connects players already using the game. Beside this, the *Game Influencing* component of the middleware focusses on connecting a game player with his social network around. Thus two effects can be achieved:

First, the awareness for the *Serious Game* can be increased as the news posts spread in social networks directly affect viral propagation; especially if it is not only a posted message, but a call for participation (as described in the next effect).

Second, knowledge from outside the game community can be drawn into the gameplay. Technically the middleware provides the possibility to spread news (posts) to friendly social network users and offers an interface to ask the receivers of posted messages to participate in votes or content uploads. Game designers using the middleware create and enable such a *Game Influence* instance via the provided *Application Programming Interface* (API) by selecting type of influence (e.g. multiple choice, gap text, image upload), timeout and scope. The middleware spreads the news according to the scope, e.g. to former players or non-player friends. The participation results can then be pulled by the computer game and be integrated in further gameplay. These influence kinds are manifold. To the best of our knowledge no taxonomy of game influence kinds from online social networks to one's personal gameplay and vice versa exist. Thus one currently ongoing aspect of the research is the creation of such a structure.

#### 4. Implementation

The GENIUS middleware is currently implemented as a server-based Java SE servlet application providing the API as HTTP-Request methods delivering the results as *JavaScript Object Notation* (JSON) structures. Additionally the middleware offers a web-frontend realized with *Google Web Toolkit* (GWT) to browse, rate, comment and administer the items from *User-generated Content Exchange* as well as to participate in the *Game Influencing* by votes or uploads.

Internally GENIUS uses a *Structured Query Language* (SQL) database and a component-based concept providing the individual API methods for the two middleware components to game designers. Furthermore a GENIUS core implementation provides authentication and social network connection functionality to all components as well as database access and HTTP request handling.

In cooperation with a game company currently one currently developed *Serious Game* has been connected to GENIUS and uses the offered components. Additionally several student projects are in progress to enhance and evaluate the functionality of the middleware concept.

#### 5. Early and expected results

First interviews with senior game developers from industry indicate that the connection of *Serious Games* and *Online Social Networks* with the special focus on content exchange among players and especially in both directions (from and to the social networks) is of great potential. During development the awareness has been won that mainly three aspects are challenging and critical for the acceptance of such a concept:

First, a conversion and integration of different content types (including proprietary game specific content) that can be displayed within the game as well as within the web-frontend is needed. Second, an abstraction from social network specific structures helps to keep game developers independent from changes in OSN's APIs. Third, the independent usability of each component of the middleware without the need to support all aspects within a game concept increases usability and acceptance.

When first prototypes from student projects are finished we plan to evaluate the functionality with users (players) to find evidence for the following hypotheses:

- H1: Players of a *Serious Game* with GENIUS functionality reach further levels in the game and have a better acceptance of the game
- H2: Players of a *Serious Game* with GENIUS functionality have better learning outcome (knowledge of the learning domain covered by the game)
- H3: The GENIUS middleware is accepted by game developers and valued as helpful to develop *Serious Games* with *Peer Education* functionality.

#### 6. Acknowledgements

Parts of this work are funded by the HA Hessen Agentur (HA 258/11-04).

#### 7. References

- Chen, J., 2007. Flow in Games (and Everything Else). *Communications of the ACM*, 50(4), p.31-34.
- Damon, W., 1984. Peer education: The untapped potential. *Journal of Applied Developmental Psychology*, 5(4), p.331-343.
- Göbel, S. et al., 2010. Personalized, Adaptive Digital Educational Games using Narrative Game-based Learning Objects. *Entertainment for Education. Digital Techniques and Systems*, p.438-445.
- Hämäläinen, R. et al., 2006. Learning to Collaborate: Designing Collaboration in a 3-D Game Environment. *The Internet and Higher Education*, 9(1), p.47-61.

- Järvinen, A., 2010. Social Game Design for Social Networks. *PlayGen*. Available at: <http://playgen.com/game-design-for-social-networks/> [Accessed January 22, 2011].
- Mohammad, A.L.S., Guetl, C. & Kappe, F., 2009. PASS: Peer-ASSESSment Approach for Modern Learning Settings. In *Advances in Web Based Learning-ICWL 2009: 8th International Conference, Aachen, Germany, August 19-21, 2009, Proceedings*. Springer-Verlag New York Inc, p. 44.
- Prediger, S., Selter, C. & Dortmund, U., 2008. Diagnose als Grundlage für individuelle Förderung im Mathematikunterricht. *Schule NRW*, 6(3), p.113-116.
- Ritter, S. et al., 2007. Cognitive tutor: applied research in mathematics education. *Psychonomic bulletin & review*, 14(2), p.249-55.
- Shute, V.J. et al., 2009. Melding the Power of Serious Games and Embedded Assessment to Monitor and Foster Learning. In U. Ritterfeld, M. Cody, & P. Vorderer, eds. *Serious Games: Mechanisms and Effects*. New York, USA: Routledge, pp. 295-321.
- Stepanyan, K. et al., 2009. Student Engagement with Peer Assessment: A Review of Pedagogical Design and Technologies. *Advances in Web Based Learning-ICWL 2009*, p.367-375.
- Westera, W. & Wagemans, L., 2007. Help me! Online Learner Support through the Self- Organised Allocation of Peer Tutors. In *Abstracts of the 13th International Conference on Technology Supported Learning & Training*. Berlin: ICEW GmbH, pp. 105-107.