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# Video Game Personalization via Social Media Participation

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**Abstract.** Social Media and user-generated content can be used as a 'call for action' to let users contribute content to other users' multimedia experience. If combined with Serious Games and used for knowledge exchange among peers, Social Media content can be used to influence and enrich one's gameplay experience as well as raise attention of connected persons in an Online Social Network (OSN) environment. In this paper we will describe the technical setup of a serious game connected to an OSN (here: facebook) via a social communication middleware. Befriended persons that are currently online can contribute content to specific calls from the game via a dynamically generated web interface that is linked to published notifications in the OSN. Results of a first study show that both, game player and connected people of the OSN, appreciate the personalization and participation via user-generated content that is integrated into the game play.

**Keywords:** Social Serious Games, Middleware, Adaptation, Personalization, Social Media, Influencing.

## 1 Motivation and Target

Social Media is not only used for social interaction, exchange of opinions and self-expression, but is as well strongly used for documentation, knowledge transfer (peer tutoring) and rating of creative solutions of others (peer assessment) [KaHa10]. Thus, learning with social media is practiced in a mostly informal way. The content of user-generated items and the interactions among the users have become a research focus due to the impact this content-based knowledge exchange can have. The factors and technological solutions that determine successful and effective use of Social Media have to be found.

Learning of domain specific issues by game-based training, collaborative problem solving and immersive 3D simulations is a rapidly growing field of Serious Games. More generally, computer games keep the player immersed into the game play by adapting the difficulty of challenges to the player's abilities dynamically. Besides keeping a player in this channel of game flow, personalization of the game content

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itself can increase immersion and acceptance of the Serious Game - and thus the acceptance of learning content integrated into the game [GWRS10].

Both, Social Media content and participation of other users in Online Social Networks are promising sources for personalization and individualization of game play experience for the player. Moreover, inviting befriended users to influence the game play, contribute own creative content and participate in the game play of the player is expected to increase awareness of players' activities and achievements outside of the game, raise curiosity for the game among users not playing yet and not at least entertain the players' social environment by the possibility to contribute in a creative way to their friends game play experience.

## 2 Related Work

The benefits of Serious Games for learning have been investigated for several application areas. Even though collaborative gaming for training and simulation is as well one of the manifold areas of Serious Games, the focus of this work is on educational games, which are mostly single-player and focus on adaptation of difficulty, speed and game content to the players' gaming and learning profiles [GWRS10]. These types of games are used as an addition in school class lessons as well as to spark interest in covered learning topics for users playing in their leisure time.

Beside this, Social Media has proven its benefits for learning in specific contexts as well. Web-based platforms like SocialLearn[1] from The Open University for learning content exchange among students use the creation of Social Media content as a way to activate their learners and improve the content quality for every participant. Thus, leaners take as well the role of teachers and learn by consuming, creating, changing, and assessing content and tutoring each other [BrGo03].

From a pedagogical point of view, the benefits of Peer Education (tutoring and assessment) have been investigated and described by Damon [Damo84]. More recent studies focusing on virtual environments emphasize the interest into peers' tasks solutions for assessment and the positive aspects of peer tutoring [LDUC11].

First steps towards the interconnection of (Serious) Computer Games and Social Media are the manifold Social (Casual) Games available free to play online. These are games that are casually played or with easy to use interfaces which are connected to OSNs [LoGo04]. Ines de Loreto and Abdelkader Gouaïch identify Asynchronous Play as one important characteristic of such games. Players interact by e.g. exchanging items or favors, but do not have to be online or in the game at the same time. As Nick O'Neill states in his criteria list about Social Games, these games are mostly turn-based and casual games connected to OSNs, but still Multiplayer in a sense that there is an awareness of others' actions in games [Onei08]. We summarize his four criteria as Casual Multiplayer, which means a single-player game play, but multiplayer atmosphere due to asynchronous play and awareness – and thus interplay - of the activities of others. Aki Järvinen describes in the design framework for social network

[1] http://sociallearn.open.ac.uk/, last accessed 11/14/2013

games how the structure of an OSN can be integrated into game play and how a beneficial interdependency with (and impact to) the OSN can be achieved (what he describes as four interacting parts) [Järv10]. We summarize his criteria as Beneficial Social Media Interaction. Finally, we add the concept of Coopetition to describe such games. It results in game design using mostly cooperative actions and choices for players and bears competition indirectly (e.g. by leaderboards). Consequently, game activities cannot be used disadvantageous and targeted on specific users.

In summary, a Social (Casual) Game can be defined as a video game satisfying the criteria of Asynchronous Play, Casual Multiplayer, Beneficial Social Media Interaction and Coopetition.

Architectural frameworks providing support to create Social Serious Games do not exist yet (to the best of our knowledge). Still, major game studios like Blizzard, Electronic Arts or Sony have their own OSNs to interconnect players and foster their creation and exchange of game related content[2]. Their computer games update player profiles via proprietary API, but do not allow participation or influencing of game play from the OSNs to the games. Other middleware solutions exist to maintain players online profiles independently of specific game studios and their OSNs [HBRS09].

## 3 Research Questions and Approach

As we focused in earlier publications on the benefits of Social Media content for learning and knowledge exchange in Serious Games the focus is here on the personalization and participation aspects [KRMG12]. From the motivation the following research questions have been derived:

- **RQ1:** Will befriended users of a (serious) game player react to OSN-placed posts and have a positive perception of it? (Viral marketing aspect)
- **RQ2:** Will they accept the concept of contributing content to a friend's game play? (Activation of environment)
- **RQ3:** How well will participants value the technical implementation of the concept? (Functionality aspect)
- **RQ4:** Will players appreciate such participation from outside within their game play? (In-game perception)

To investigate the research questions we created a social middleware (SoCom) connecting the prototype of a commercial Serious Game that is currently under development on one side with the OSN facebook on the other side. The SoCom middleware works as an abstraction layer to allow game developers to easily connect to several OSNs and start participations via calls to an Application Programming Interface (API). The extensions added to the serious game and the resulting possible participations used by befriended users in the OSN are described. Finally, we show the setup for the first study, questionnaire results and relate them to the research questions.

[2] See e.g. Blizzard's `http://www.battle.net/`, last accessed 11/14/2013.

# 4 The SoCom Architecture and Functionality

To enhance (existing) educational games with Social Game functionality the SoCom architecture provides three major modules for game developers: Content Integration (CI), Peer Group Formation (PG), and Game Adaptation (GA).

The Content Integration (CI) is for storage and retrieval of user-generated content for knowledge exchange among players. Beside major content types (text, image, audio) it supports any proprietary content identifier and binary data. Metadata adds semantic information concerning the type (question, hint, solution) and the related game context [KRMG12].

The second module, Peer Group Formation (PG), allows a sophisticated grouping of players to form learning groups based on multi-dimensional criteria [KBGS13].

The third module, Game Adaptation (GA), enables game developers to adapt the game play experience to the player's individual social network environment. Therefore developers can access the profile data and social network metrics or open new participations by using and parameterizing pre-configured influence patterns (for details see following section 4.1).

As the functionality of the first two modules is described in other publications, the following sections focus on Game Adaptation (GA).

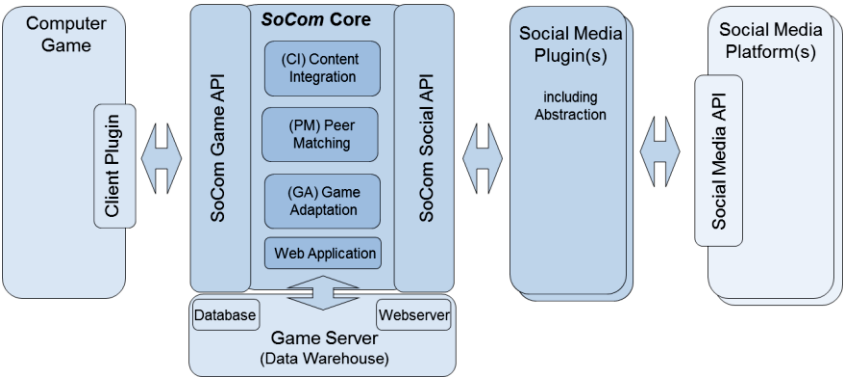


**Fig. 1.** SoCom Architectural Model

## 4.1 Game Adaptation Module

To personalize the game for the player a developer can access two different types of content via the GA module: OSN profile data of the player and uploaded content or voting results of participations. The OSN profile data is provided in a normalized form. Thus game developers can process data from different OSNs simultaneously without respecting naming or formatting differences e.g. of friend lists or hobbies. Moreover, accessing uploaded content to personalize the game play offers diverse and new chances to enrich the game as game developers can themselves decide which participation offers they provide and ask users connected with the player to contribute. For this purpose the GA module offers a three-step procedure for participations.

First, the game developer creates a new participation via the API. The only mandatory parameters are the headline question and the type of provided content (text, audio, video or proprietary). Other parameters allow setting pre-defined answers (choices), a timeout, the minimum and maximum number of selectable items and whether or not newly added answers (if enabled) are visible to others. These parameters allow a variety of different participations: from single-choice or multiple-choice to picture uploads and voting as well as selecting n of m items.

Second, the SoCom middleware collects the content provided by OSN users (if upload is enabled) and stores voting results. Therefore, SoCom publishes messages in the supported OSNs (see Fig. 2). The OSNs used are determined and configured by the users in their settings. Depending on the characteristics of each OSN, SoCom publishes a wall post, a feed message or group message(s) containing a description and offers a hyperlink to follow the call for action.


**Fig. 2.** Call for Participation as published on facebook


**Fig. 3.** Participation of type text with free answers. All texts are in German (due to study scenario).

The hyperlink will direct the interested participants to a dynamically created web-frontend. It generates a voting and/or upload page respecting the settings mentioned before (for result, see Fig. 3). Users can add new options (if allowed) and can vote for existing answers as well.

Third, the game instance can pull the results of the participation from the SoCom middleware and use such information in the game (depending on the desired effects and game characteristics). For example, several provided pictures uploaded by users can decorate the wall of an office in a 3D first person game and signs attached to them can name the contributors.

## 5 Social Serious Game Prototype

For a first study and investigation of the research questions we needed an existing Serious Game suitable to add the extensions and connect it to SoCom in order to let users enrich the game play of a friend from the OSN. We decided to use and extend an existing game (despite developing a new one) due to following reasons: (a) The target use case for *SoCom* is the extension of existing educational games, (b) An existing game, created by a professional game studio, is expected to better fulfill the user experience expectations of the players.

Thus, we used the prototype of a freshly developed 3D third-person point and click adventure that is created by game studio DECK13 from Frankfurt, Germany. As the game is not released yet, the title may be BizConsulter in the following sections.

Target group of the game are students who are potentially interested to start a career in the consulting business. In the game the player takes the role of a trainee who stands in for his mentor in a client project. The player is confronted with real world problems related to communication issues typical for consulting business (see Fig. 4).

## 6 Implementation

**Game Client Side.** For better usability client side stubs are provided for game developers. These stubs allow local method calls and hide the communication channel implementation between client and SoCom middleware server. Still, the server-side API is completely documented and condensed in public interface definitions (one for each module CI, PG and GA) which are implemented by the client stubs. Currently clients are available for C++, C#, the game engine Unity 3D[3] (via C#) and PHP5. The server side APIs expect HTTP GET or HTTP POST requests with the parameters as documented. All methods return JavaScript Object Notations (JSON) for results, that may contain error codes and messages (e.g. for missing or invalid parameters) or the result.

**Server Middleware Core.** The SoCom middleware and its modules are implemented using Java 1.6 SE Servlets running on a Jetty v8.0.3[4] servlet container and web server.

[3] Unity 3D game engine, Unity Technologies, see `http://unity3d.com/`, last accessed 11/14/2013

[4] Apache License 2.0 and Eclipse Public License 1.0-based Jetty webserver, see `http://www.eclipse.org/jetty/`, last accessed 11/14/2013


**Fig. 4.** Scene 'Mission-Takeover' of BizConsulter game

For persistency an abstraction layer interface has been designed to store and retrieve the objects. It is currently implemented for the relational database HyperSQL[5].

For the extensibility the existing modules (currently CI, PG and GA) register their namespace for the Uniform Resource Locator (URL) scheme. All sub-paths of the registered patterns (and HTTP parameters) are managed by the modules themselves.

**OSN Side.** For each OSN a plugin implements the necessary SoCom interface to allow calls routed through by SoCom core. The plugins provide a list of supported methods (posting, voting, etc.) to allow game developers to disable game functionality depending on the support.

**User Frontend.** The user frontend is implemented as a Google Web Toolkit v2.5 (GWT) application running on the same Jetty instance as the Server Middleware Core. If the user opens a URL pointing to a SoCom participation, the GWT client-side code extracts the participation ID from the URL and fetches the participation data in JSON format from the server-side methods and renders the elements in the user's browser. Currently the user frontend can display all combinations of selectable predefined options and upload components. For user-provided options the name and time of upload is displayed and a link is set to the SoCom player profile (see Fig. 3).

## 7 First Study

### 7.1 Setup

The study was conducted on 22nd of November 2012 with students enrolled in the Master's degree studies for Computer Science at our university (N=5, 1f/4m, aged 21-27). Due to privacy protection each participant was given a new facebook test account. All these accounts have been made friends among each other before and profiles are left clean. So, each test person was instructed to first set the first name

[5] BSD-License based *HyperSQL*, see `http://hsqldb.org/`, last accessed 11/14/2013.

and an individual profile picture to allow some identification with the profile. Then they were divided randomly into two groups to allow an A-B-Test setup. Group A first played the game, group B was instructed to fill out the provided facebook profile with further information, upload pictures and be aware of the events in their surrounding social network as they would usually when using facebook. The study was then divided into four phases:

**Phase One (15min).** Members of group A played each a simplified subset of the game that can be finished within the provided time. Members of group B used their facebook profile, added more information and reacted to events they may be aware of.

During the game play of test persons from group A, the game instances created and published new participation possibilities via the SoCom GA module on facebook which could be seen and activated by members of group B. Additionally, the game published success messages of gathered achievements with screenshots from the game on the players' facebook wall. These messages could be as well liked and commented by the members of group B.

**Phase Two (10min).** Members of both groups filled out parts of the Influence Questionnaire (IQ) (see following Section 7.3) and members of group A filled as well the User Experience Questionnaire (UXQ) to assess their game play experience.

**Phase Three (15min).** Roles were switched. Now members of group B played the game and members of group A were advised to use the provided facebook profile, add information and react on events.

**Phase Four (10min).** The IQ was completed by both groups and members of group B filled the UEQ for their game play experience.

After the phases a discussion round with all test persons was conducted for additional 30 minutes to collect insight into their perception, opinions and suggestions for future version of the game and participation possibilities.

### 7.2 Evaluated Participations

The simplified game play of BizConsulter can be divided into 8 scenes the player plays in a more or less sequential order: Mission-Takeover, Retrieval-of-Presentation-File, Call-for-Action-Accountant, Assistant-Convincing, Progress-Report, Retrieval-of-Archive-File, Delivery-of-Files, Mission-Success. As it is not essential to know the scene details, we only describe here the creation of participations and the retrieval of results as well as the retrieval and usage of OSN profile information.

For Mission-Takeover the game instance requests the players name, gender and city of residence and replaces all naming of the players avatar in dialogues by the real name. Additionally the location of the 'customer's headquarter' in BizConsulter is set to the hometown of the player. Depending on the gender of the player different participations are created and send via SoCom to facebook. If the player is male, the OSN friends are offered to contribute a name suggestion for the female assistant of the male senior accountant (mainly used for scene Assistant-Convincing). If the player is female, the OSN friends are asked to name the male senior accountant (mainly used

for scene Call-for-Action-Accountant). When the user selects the dialog option "Yes, let's do it" to take over the job, the game publishes as well an achievement message on the wall with a screenshot. In the following scenes the provided names are used within dialogs to name the NPCs accordingly.

In brief, OSN users can create name suggestions or vote for answers submitted by others before. The name with the most votes is used in all NPC dialogs (if there is a tie, it is chosen randomly). The screenshots and messages can be 'liked' and commented. This influences the cooperativeness of the assistant (dialogue difficulty).

### 7.3 Questionnaire(s)

The UXQ is partly based on the user Experience Questionnaire of Lennard Nacke [Nack09]. The reliability of the UXQ has been shown before by evaluations in cognitive psychology with other game prototypes [GöGH13]. In summary, the UXQ measures 17 aspects with 3 items each to calculate from overall 51 items scores for the User Experience with the game and an overall User Experience score. All items are encoded on a 10 point Likert scale with 0 as lowest value (disagreement) and 10 as highest value (agreement).

The IQ is a new questionnaire and targets four aspects to measure: A1: Viral marketing perception of game activity, A2: Activation of environment, A3: technical functionality and A4: in-game perception of contributed content and personalization.

Similarly to the UXQ each aspect is measured with at least 3 items which are as well encoded on a 10-point Likert scale. The aspects focused by the IQ are attributed to the research questions (A1 for RQ1, A2 for RQ2, A3 for RQ3, and A4 for RQ4).

### 7.4 Results

All four IQ-aspects have been rated by participants above 6.5 (mean=7.13, $\sigma^2$=1.95). The mean sum score for User Experience is 3.62 ($\sigma^2$=1.8) and is in no case above 4.76. All participants reached the game end within 10 to 18 minutes (mean=13.6min, $\sigma^2$=8.8). None of the person-related values like age, gender, hours of computer game playing, time to game end or group membership (A/B) correlates significantly with the measured IQ-aspects A1-A4 or the UXQ sum measure. A diagram plot of the results split into both groups A (first playing game, then facebook) and B (first facebook, then game) is drawn in Fig. 5.

Based on these first indications the research questions can be answered as followed:

**RQ1:** *Will befriended users of a (serious) game player react to OSN-placed posts and have a positive perception of it (IQ measure A1=IQ4+IQ5+IQ6)?* **Yes**, with a mean value of 6.87 for A1 the users rate it clearly as positive and recognize the posts made by the game within the OSN. Their interest in games with such participation functionality has been raised (IQ6 mean=6.6) and they agree to have read the messages more active due to participation possibilities (IQ4 mean=8.75). In conclusion, the participants do want to recognize when a 'call for participation' is offered.

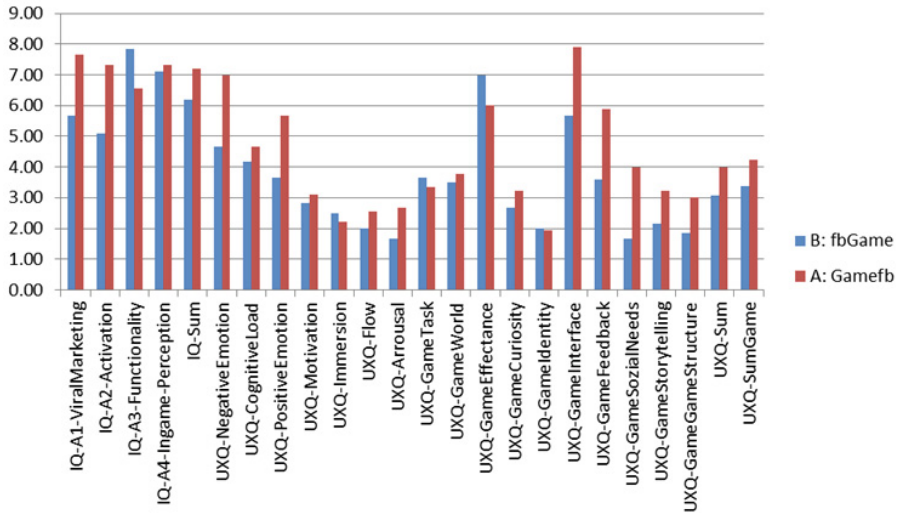


**Fig. 5.** Results of Questionnaires IQ and UXQ

**RQ2:** *Will they accept the concept of contributing content to a friend's game play (IQ measure A2=IQ12-IQ9-IQ10)?* **Yes**, with a mean value of 6.43 users like the idea of contributing content to a friend's gameplay. Still, as seen with reversely encoded question IQ9 (mean=6.8) the users felt they need more information about the game context which they will contribute content to. Thus it is targeted for next versions of *SoCom* to display context data next to the vote and upload form of the website to assist participating users in their content contribution (or voting) decision.

**RQ3:** *How well will participants value the technical implementation of the concept (IQ measure A3=IQ11+ IQ13+IQ14)?* **Positively**, with mean value of 7.01 users appreciate the technical usability. Orientation and usage was rated good in IQ13 (mean=7.0) and they had all functionality expected for the tasks at hand as rated with IQ14 (mean=7.8). As the main visible GUI users interact with is the website generated for taking part in participations, it can be assumed that the GWT-based realization with the AJAX-based dynamic interface was an adequate choice to allow quick and intuitive participation by votes and/or uploads.

**RQ4:** *Will players appreciate the participation from outside within their game play (IQ measure A4=IQ1+IQ2+IQ3-IQ7-IQ8)?* **Yes**, with mean value of 7.24 this value is the highest of the IQ measures (A1-A4). The users value the positive impact of contributions from their friends as well as the personalization aspect. Negative associations have not been reported in IQ7 and IQ8 ($mean_{IQ7}$=2.4, $mean_{IQ8}$=3.4).

Thus the main aim of the study that is reflected in the title of the paper is: Personalization of a video game via social media participation appears to be possible. For the scenario of our study participants reported positively as well from the aspect of being asked for participation while outside of the game (as OSN member) as well as the aspect of perceiving the participations within the game.

### 7.5 Interpretation

In addition to answering the main research questions, the collected data provides insight into differences among the user groups (A/B), leaving room for interpretation.

Even though the differences in values for the IQ measures and UXQ measures between the group A (first playing the game) and B (first using facebook) are not significant, some tendencies can be seen in the data.

First, members of group B have been on average 2.67 minutes faster in finishing the game. Beside other unmeasured effects, this can be interpreted to be an effect of their participations before. Thus, users which know from their facebook usage which types of questions and possible participation they recognized before, may try to reach the corresponding game scenes faster to see which content others contribute for them. Curiosity might thus be a factor increasing game play speed.

Second, as shown in Fig. 5, there is a strong difference between the low UXQ-Sum value (mean of all UXQ values) and the IQ values. Due to the short game play and linearity of the game story the users seem to be bored from the game even though it was graphically designed with one of the newest game engines. It can be assumed that a longer, more complex, and adaptive game play may as well increase the effects of participation possibilities as more variety is possible in 'calls for participation'.

Third, Fig. 5 shows the highest percental difference between the user groups A and B within the IQ measures for the aspects *A1 Viral Marketing* and *A2 Activation*. As the participants of group A knew from the game play experience how well they enjoyed the contributed items from the other users (of group B), it seems to be valid to assume that they had an increased motivation to pay attention to messages published in the name of the playing users of group B (higher value for A1).

## 8 Conclusion and Future Work

With the described middleware architecture SoCom we offer a solution to enable game designers to add social participation possibilities to their computer games. Such functionality can support the personalization and enrichment of game play with profile data and metrics from a player's Online Social Network (OSN) as well as user-generated content that is contributed by the player's friends. After pointing out the current state of the art in Social Media for personalization, participation and learning, the field of Serious Games has been introduced. With the focus on improving a players experience by personalization with data from Social Media, the criteria necessary for a Social (Casual) Game have been derived. Afterwards, the identified research questions have been addressed: First, by the introduction of the architectural solution SoCom. Second, the key facts concerning its implementation were named. Third, the study setup and results are described and interpreted. In the study we focused on the connection of the Serious Game BizConsulter with the OSN facebook. Here, tendencies could be found that answer the stated research questions positively. We found indication that participation of users from OSNs has beneficial effects on the users awareness of participations, the contribution of content and on the receiving players.

Even though the described study corroborates our opinion of the benefits achievable by using Social Media and active participation of OSN users to personalize and enrich the game play experience of Serious Game players, a follow up study could

benefit from a much greater scope with more participants as well as a longitudinal study to prevent the positive bias of users for new functionality. As participants suggested during discussions after the study, more types of participation possibilities as well as more contextual information are expected to increase the positive effects.

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