The Player Number Growth in Social Browser Games

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Abstract.

The steeply growing amount of players of social games on Facebook motivate to analyze the influencing factor, which lead to these successes. This research delivers a model, which qualitatively describes the causes and effects for this development and shows how to simulate a development prognosis. The model uses the methods of System Dynamics and considers the influence of the game design, advertising and supporting processes towards motivation and satisfaction of players.

The spreading features of popular browser games focus on viral marketing within Facebook. Players for example report their successes via pin board entry to their friends. Likewise especially rare items are distributed, if players react to pin board entries of their friends. Lastly the donation of in-game items helps the players to motivate their friends to take part in the game. With the potentially high number of players social networks are perfect for the verification respectively falsification of complex dynamic models. Therefore a prototype of an ideal game is in development to be integrated into Facebook and to deliver further knowledge.

Social Games as a Growing Market of Interest

During the world wide economic crisis several formerly little regarded markets gained a quite new attentiveness for their above-average performance. Amongst them there is the market of electronic gaming and the niche of social browser games in particular, which attracted a high notice because of the superior players interest in Zynga's Farmville on Facebook (Dybwad 2009, Takahashi 2009, MacMillan 2009). Since last year the user count of Facebook, Farmville and their alternatives grows constantly. Pretty much the same is true for the profit of the game developers of this subject (Mediabiz 2010). With the integration of social network features and users into the games, something which demonstrates a complete new way to spread and distribute an application, the interest in the topic which factors make social games that successful grows. (Takahashi 2010)

It is by now well known that the business model of item selling, which is used by most of the game providers, is profitable (Arrington 2010, Takahashi 2009). The users acceptance of spending small amounts of money through micro payment services like PayPal to improve their gaming experience has ascended to a significant level (Cashmore 2009). Furthermore browser game development costs are still incomparable minor versus the costs of full-scale client or single-player game productions. The size of the teams differ considerably, agile programming methods can be used, server capacities are scalable with the success and the time to market is brief (Liew 2008).

Player Growth as a Dynamically Complex Problem

Despite the prosperousness there still have been little analysis of this phenomena so far. Intention of this research is not only the determination of the factors that account for the success of social games but also their weighting and their development during the games life cycle. The matter of this study accordingly is the number of players and its change over time periods.

As the spreading of a social game within a social network is a complex problem with multiple factors to be regarded a stock & flow diagram is used. Advantages lie in the possibility to determine factors iteratively and being able to approximate the problem step-by-step. Furthermore with System Dynamics methods and appropriate software it is possible to simulate the variation of the determined factors over a time period to get information about their meaning within the total model. The model described in the following presents an approach towards the answers to the raised questions. It is designed with the help of literature from different areas: For details about game design and motivation Schell (2009), Günther et al. (2008), Hunicke et al. (2004) and Maslow (1943) are referred. Factors dealing with supporting quality are quantified on the basis of work of Ludewig, Lichter (2010), and Kappel et al.(2004). General input for the development of social systems is coming from Weinberg (2009). The System Dynamics specific methods used in the model are described in the collected edition of Strohhecker and Sehnert (2008).

The System Dynamics Model

The following Model is designed in Vensim Software PLE Version 5.9. There are four different stock levels influenced by three flow variables, which can be seen in Fig. 1. The stock level [Amount of Remaining Potential Players] describes an upper bound and represents in this example the amount of Facebook users, which can never be exceeded by the three remaining stock levels. This upper bound is negatively influenced by the flow variables [Players Ignoring Invitation] and [Players Adopting]. It is assumed that the former will most likely never join the game after ignoring an invitation and thus are kept in the Stock of [Players Ignored Invitation] in the model. The later are counted within the level of

[Players] as long as they do not leave the game through the flow variable of [Players Leaving], which in turn will increase the level of [Players Left].

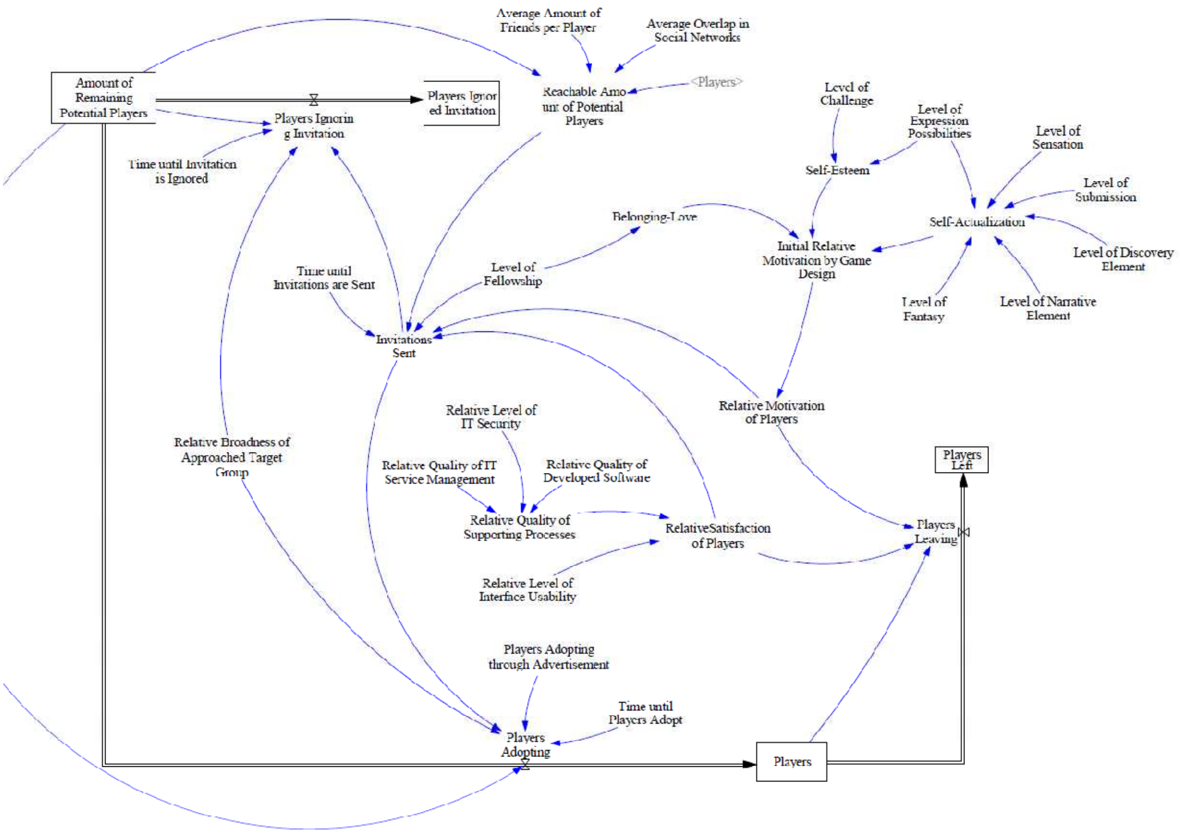

Fig. 1 The "Player Number Growth in Social Browser Games"-Model

With the start of the simulation and a small amount of players in the game, the scope of these players reaching their friends with invitations is less than the amount of potential players. This is described with the auxiliary of [Reachable Amount of Potential Players], which is calculated as follows:

$$\begin{aligned}&Reachable\ Amount\ of\ Potential\ Players\\&\qquad = MIN(Amount\ of\ Remaining\ Potential\ Players, INTEGER((100\\&\qquad - Average\ Overlap\ in\ Social\ Networks)/100 * Players\\&\qquad * Average\ Amount\ of\ Friends\ per\ Player)\ )\end{aligned}$$

The more players there are, the more average friends a Facebook user has and the less overlap there is within the social network, the more potential players can be reached by means of existing players. This scope has a direct influence towards the Amount of [Invitations Sent]. It is assumed that only satisfied and motivated players do invite their friends to accompany them within the game. In accordance with Milling (2008) there are social delays until influencing effects are active to the full extent. Therefore the amount of invitations follow this function:

$$\begin{aligned}&Invitations\ Sent\\&\qquad = \ INTEGER(SMOOTH3(Level\ of\ Fellowship/100\\&\qquad * Relative\ Satisfaction\ of\ Players/100\\&\qquad * Relative\ Motivation\ of\ Players/100\\&\qquad * Reachable\ Amount\ of\ Potential\ Players, Time\ until\ Invitations\ are\ Sent))\end{aligned}$$

With the help of the System Dynamics function smooth3() the S-shaped development of sent invitations can be designed. The constant [Time until Invitations are Sent] declares the delay. Such a delay is also used for the modeling of the adoption rate of players.

$$Players\ Adopting = MIN(Amount\ of\ Remaining\ Potential\ Players, INTEGER(Relative\ Broadness\ of\ Approached\ Target\ Group/100 * Invitations\ Sent, Time\ until\ Players\ Adopt) + Players\ Adopting\ through\ Advertisement)$$

A constant that synthetically adds players through advertisement into the game is defined with [Players Adopting through Advertisement]. To scale down the [Amount of Potential Players] with players that ignore current and future invitations a factor [Players Ignoring Invitation] is defined.

$$Players\ Ignoring\ Invitation = MIN(Amount\ of\ Remaining\ Potential\ Players, INTEGER(SMOOTH3((100 - Relative\ Broadness\ of\ Approached\ Target\ Group)/100 * Invitations\ Sent, Time\ until\ Invitation\ is\ Ignored)))$$

Equally to the invitations and adoptions, users do ignore invitations with delay. It is assumed that invited users, who do not adopt the game, will ignore any invitation sooner or later. A period after which this happens can be set in [Time until Invitation is Ignored].

The flow variable [Players Leaving] furthermore describes the amount of players that quit the game and is defined like this:

$$Players\ Leaving = MIN(Players, INTEGER(((100 - Relative\ Motivation\ of\ Players))/100 * (100 - Relative\ Satisfaction\ of\ Players)/100 * Players))$$

Given that the amount of [Invitations Sent] increases as well as the amount of [Players Leaving] decreases with a high [Relative Amount of Motivated Players] this auxiliary should be explained.

Motivation and Satisfaction

Around the [Initial Relative Motivation through Game Design] needs of human beings according to Maslow (1948) are placed. It is assumed that the physiological needs and the needs for safety cannot be fulfilled by an online social game and that furthermore households with internet access do already meet these needs (Günther et. al. 2008). The needs for [Belonging-Love], [Self-Esteem] and [Self-Actualization] however can be fulfilled by eight different pleasures formulated by Hunicke et. al (2004) and Schell (2008). The more a game concentrates on these kinds of pleasures the more players it shall motivate.

Next to the motivation level of players there is the level of satisfaction with the game application. This satisfaction is highly dependent to the [Relative Quality of Supporting Processes], which in turn depends on three factors: the [Relative Quality of Developed Software], the [Relative Quality of IT Service Management] and the [Relative Level of IT Security]. The satisfaction is also influenced by the constant [Relative Level of Interface Usability] (Hitz, Leitner 2004). For simplification the factors for evaluating these quality levels are not described within this work. Large relevant literature on these topics is available in many languages.

Feedback loops and causes trees

To identify the important influencing factors towards the main stock levels of interest, feedback loops are analyzed. Vensim shows the following loop for the factor [Players] (Table 1).

Loop Number 1 of length 1
Players
Players Leaving
Loop Number 2 of length 3
Players
Reachable Amount of Potential Players
Invitations Sent
Players Adopting
Loop Number 3 of length 5
Players
Reachable Amount of Potential Players
Invitations Sent
Players Ignoring Invitation
Amount of Remaining Potential Players
Players Adopting

Table 1 Feedback loops for stock level [Players]

It is trivial that the flow variables [Players Adopting] and [Players Leaving] have influence towards [Players]. Furthermore [Invitations Sent] play a role in Loop Number 2 as well as in Loop Number 3. The causes tree for the flow variable [Players Adopting] is shown in Fig. 2.

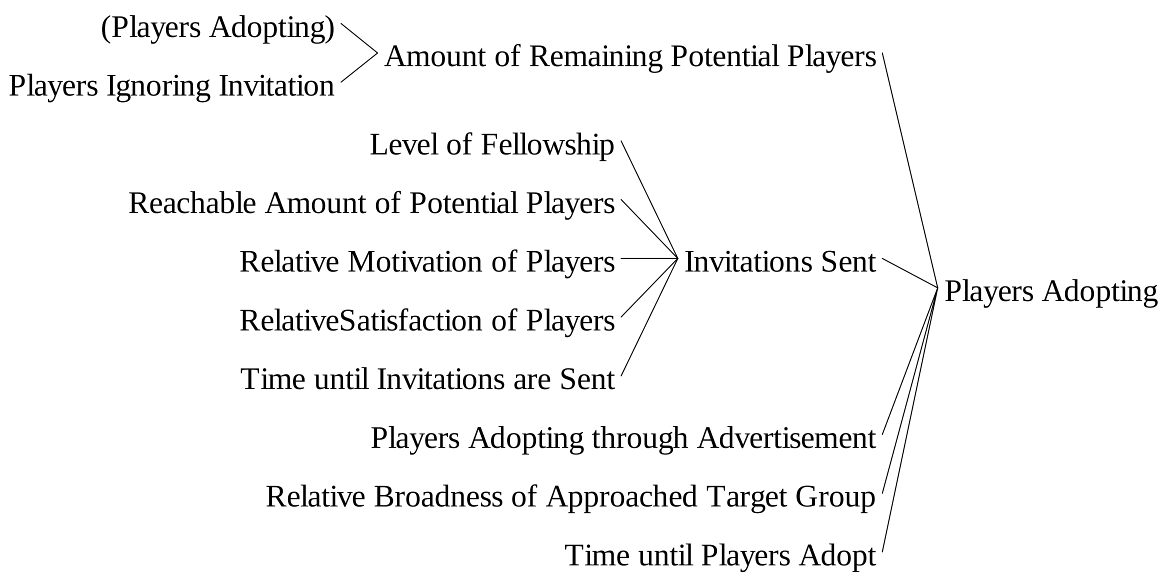

Fig. 2 Causes Tree for [Players Adopting]

The causes tree for the flow variable [Players Leaving] is shown in Fig. 3.

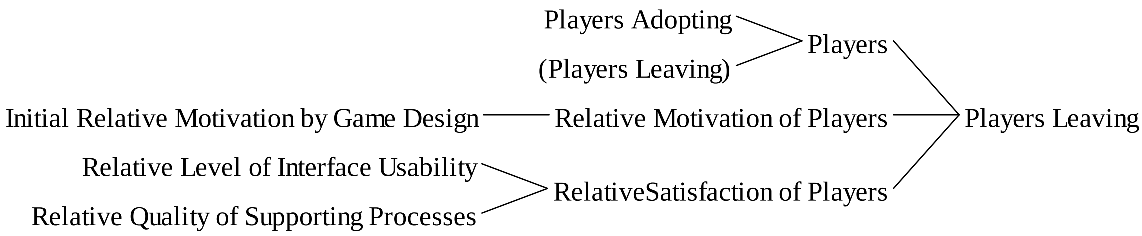

Fig. 3 Causes tree for [Players Leaving]

The causes tree for the auxiliary [Invitations Sent] is shown in Fig. 4.

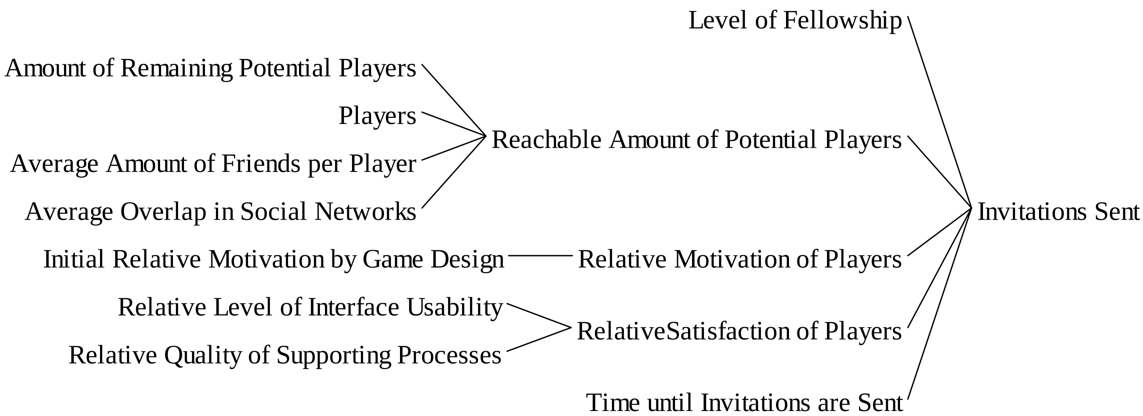

Fig. 4 Causes tree for [Invitations Sent]

It is observed that the important constants, which can be influenced during the game development process, are those which are responsible for the motivation respectively the satisfaction of the players. The following simulations therefore concentrate on different input values for the constants calculating [Initial Relative Motivation by Game Design] (Fig. 5) and [Relative Satisfaction of Players] (Fig. 6).

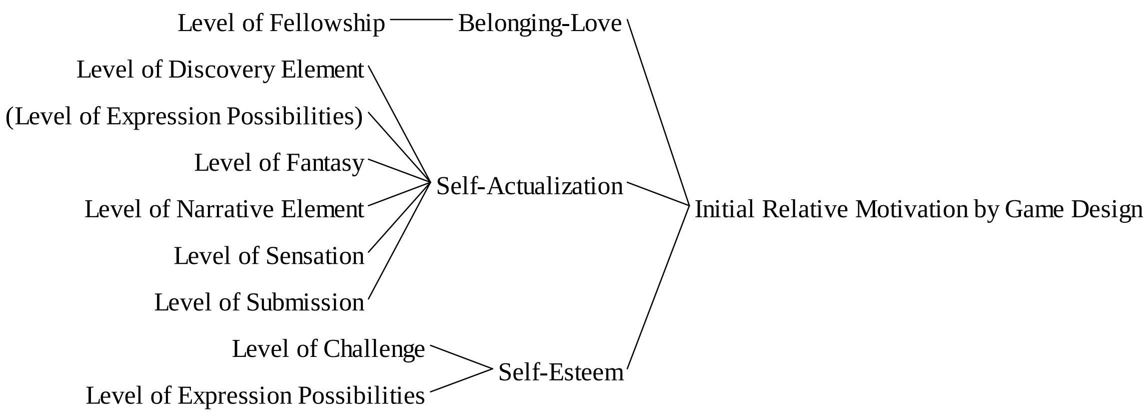

Fig. 5 Causes tree for [Initial Relative Motivation by Game Design]

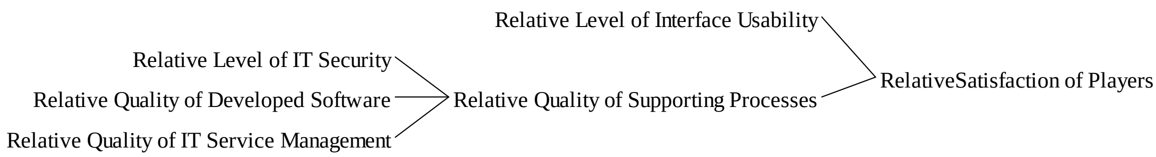

Fig. 6 Causes tree for [Relative Satisfaction of Players]

Simulation Results

The simulation results are calculated based on different values for the input factors [Relative Level of IT Security], [Relative Quality of IT Service Management], [Relative Quality of Developed Software] and [Relative Level of Interface Usability] for the auxiliary variable of players satisfaction on the on hand. On the other hand the input factors [Level of Fellowship] and [Level of Challenge] are consulted to represent the auxiliary variable of players motivation. For the results four different simulations A, B, C and D are executed. The factor values for each simulation can be read in Table 2. The other game design factors influencing [Self-Actualization] and [Self-Esteem] are kept at a level of 0%. For the simulation an amount of Facebook users of 180 million is considered in the inital value of [Amount of Remaining Potential Players]. The simulation is run over a time period of 90 days with a daily update interval.

Factor	Simulation A	Simulation B	Simulation C	Simulation D
Relative Level of IT Security	50%	50%	80%	80%
Relative Quality of IT Service Management	50%	50%	80%	80%
Relative Quality of Developed Software	50%	50%	80%	80%
Relative Level of Interface Usability	50%	50%	80%	80%
Level of Fellowship	50%	80%	50%	80%
Level of Challenge	50%	80%	50%	80%

Table 2 Factor values for simulations A, B, C and D

In the following the results for four different output variables are shown in four figures. Dependent on the simulation the devolution of the stock level [Players], the flow variables [Players Adopting] and [Players Leaving] and the auxiliary variable [Invitations sent] are drawn in Fig. 7, Fig. 8, Fig. 9 and Fig. 10.

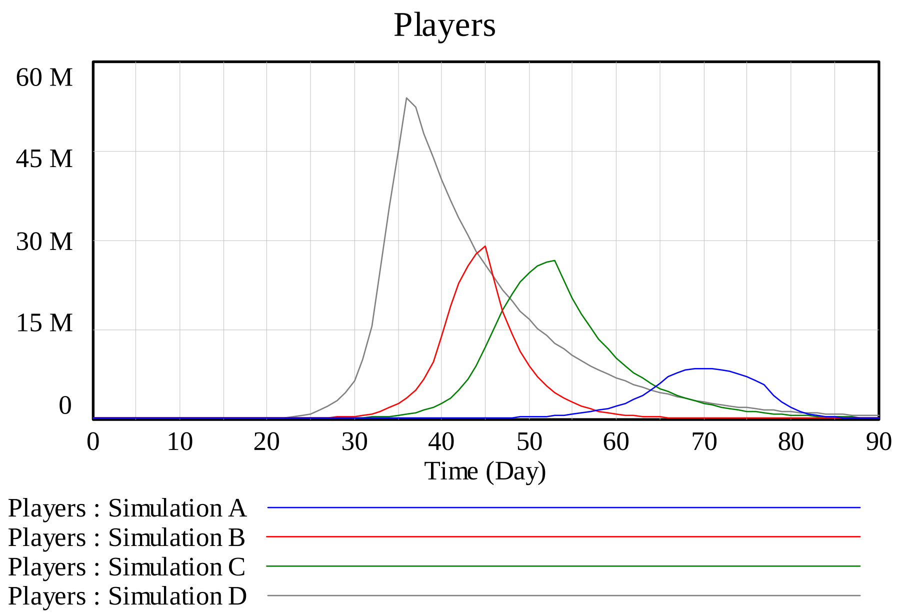

Fig. 7 Simulation results for stock level [Players]

Fig. 7 shows that increasing the motivation by improving the game design mechanics [Level of Fellowship] and [Level of Challenge] between simulation A and simulation B from 50% to 80% results in a change of the maximal amount of players from about 7 million to over 28 million. It is also noticed that the maximum level will be reached on day 45 after release in simulation B instead of day 70 in simulation A. Changing the factors to the values of simulation C, which means lowering the [Level of Fellowship] and the [Level of Challenge] to 50% again and increasing the quality of the supporting processes up to 80%, results in a maximum amount of players of 26.5 million on day 53. For the last simulation run C the values of all considered factors are set to 80%, which will result in a quicker, earlier and higher player growth up to 53 million players on day 36.

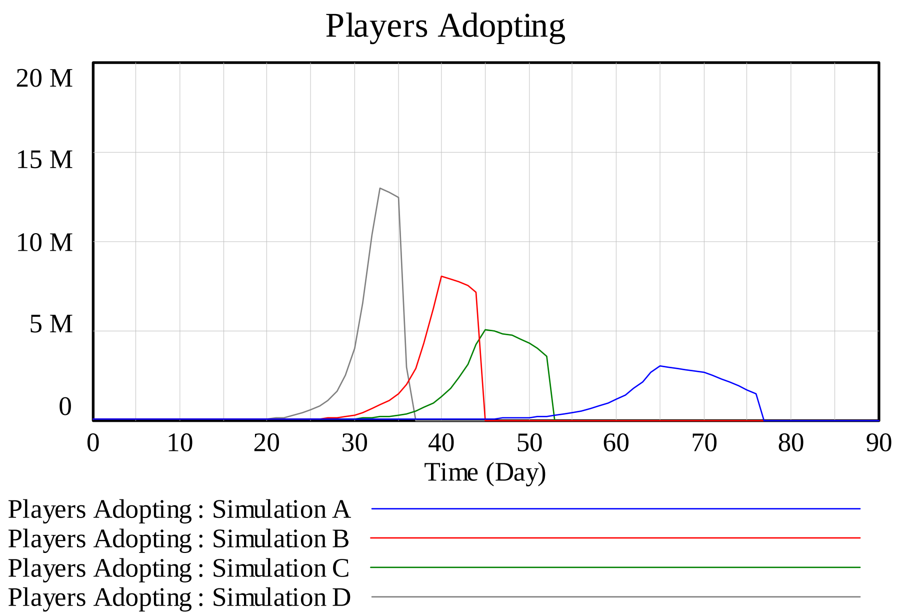

Fig. 8 Simulation results for flow variable [Players Adopting]

The higher the quality of the supporting processes and the higher the motivation of the players, the earlier a maximum of players will be reached and the higher this maximum will be. This is by reason of the amount of players adopting the game. In fact Fig. 8 shows that the adoption rate is higher and on earlier days for the simulation D compared to the simulations A, B and C. Also the period, over which players adopt the game is shorter, so that the complete amount of potential players is considered earlier.

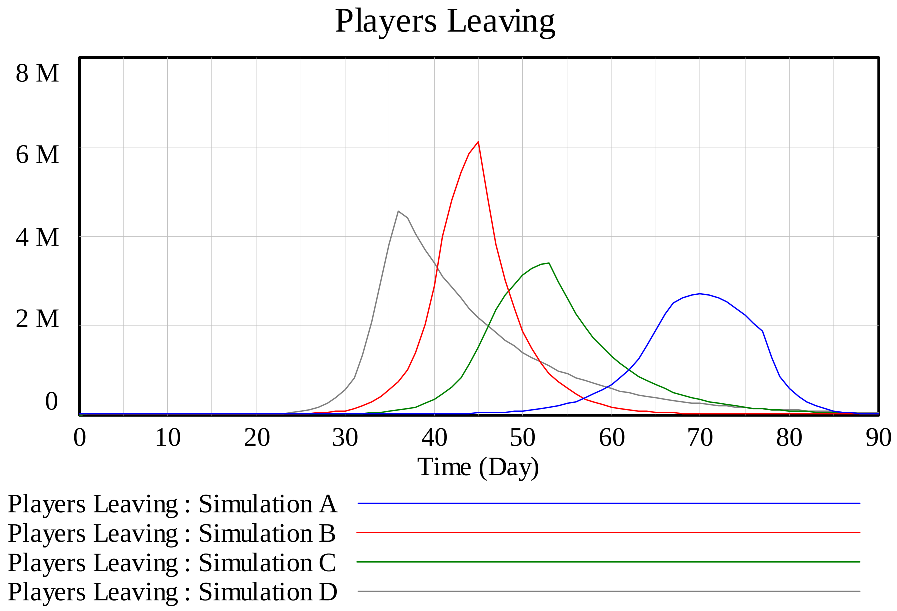

Fig. 9 Simulation results for flow variable [Players Leaving]

Fig. 9 furthermore shows the amount of [Players Leaving] the game. While more players adopt the game in simulation B than in simulation C, the amount of players leaving is higher as well. The comparatively low satisfaction rate leads to a high fluctuation. This is confirmed by simulation D, which shows that players begin to leave the game as early as they adopted, but in less numbers. The graph of [Players Leaving] in simulation D also proceeds more evenly.

The diagram showing the amount of [Invitations Sent] is Fig. 10. It explains why the number of players raise earlier with higher satisfaction and motivation rates. In simulation D the invitations are sent out earlier than in the simulations A, B and C. Another progress that can be observed is the fact that the higher motivation and satisfaction are, the earlier the complete scope of considered Facebook users is reached, which results in a steep decline of sent invitations.

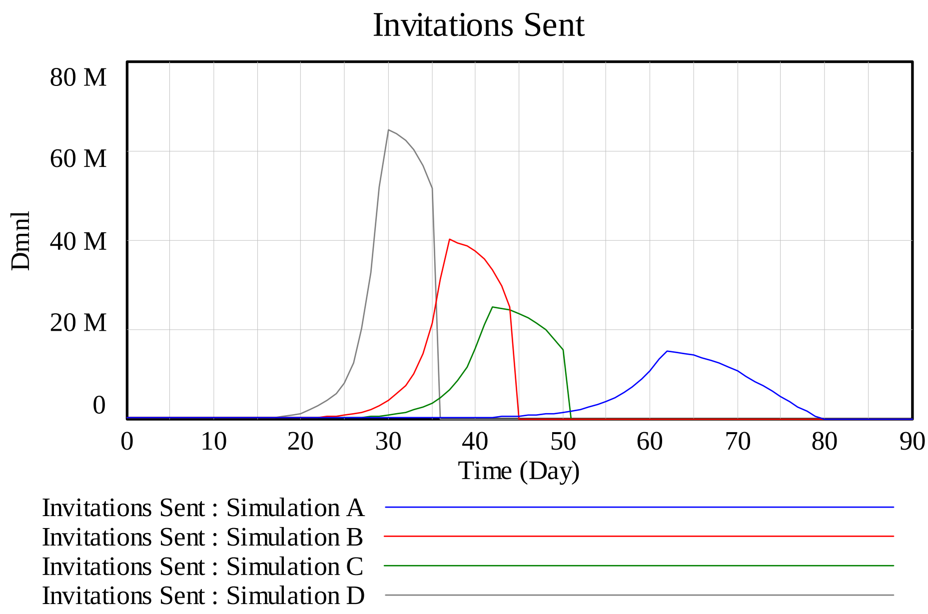

Fig. 10 Simulation results for auxiliary variable [Invitations Sent]

Limitation of Simulation Results

What can be learned from the models simulation results is which influences different factors have to the overall objective. Current limitations of the model are a number of static factor values though. Adoption rates through invitations are approximated based on best practices for example. Furthermore it is intended to insert factors of social media marketing and community management into the model, as can be seen in the distinction between [Inital Relative Motivation by Game Design] and [Relative Motivation of Players]. According to Weinberg (2009) these institutions can be utilized to get authentic information from the users about which application improvements should be integrated into the development-cycle. Also in this model it is not yet being distinguished between new players to the game and regular players, who return periodically. It can be assumed that these two levels of players show different characteristics towards their satisfaction and motivation when cumulated into two groups.

To improve the model and to reconfirm the influencing factors an empirical method is proposed. Therefore a prototype of an ideal social game is currently in development.

A Prototype-Game of Predefined Satisfaction and Motivation Levels

The requirements for the prototype directly deduce from the model. To meet the requirements of the quality for the supporting processes a high level in development, service and security is needed. The prototype should be free of unexpected failures, have a user friendly interface and be secure against hijacking of data of any kind. A full documentation of the activities within or surrounding the game is seen as a matter of course. On the other hand the prototype needs to fulfill different kinds of motivation causes by offering the pleasures mentioned. A high concentration to the [Level of Fellowship] and the [Level of Challenge] is recommended.

Limitations of the prototype will be the competition against already available, well spread social games like Farmville. It can be expected that the performance will be significantly weaker, still similarities in the function of growth of player numbers should be observable.

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