Analyzing psychological goals in gamified applications using i*

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Abstract. This paper presents a model-based approach to guide the design of gamified applications. The models enable a structured representation and analysis of the social and intentional dimensions of the actors involved in the organizational context of the gamified system. The proposed notation (called GStar) makes use of the agent- and goal-oriented features of the i* modeling framework. The main contribution of this work is to bring the social and intentional aspects, which are usually treated in an ad hoc manner in the design of gamified systems, to the core of a modeling approach. This approach supports the analysis of the consequences of the inclusion of each gamification element and facilitates the evaluation by the designer of different alternatives, contributing to a project more suitable to the organizational context and more capable of fulfilling the established goals.

Keywords: gamification · social modeling · i* framework.

1 Introduction

There are many definitions for Gamification in literature. The most widely used presents Gamification as the "use of game design elements in non-game contexts" [1]. This definition implies that Gamification is not about building complete games, but rather about the utilization of some parts (game design elements). Another definition goes beyond and includes the goal of gamification: “Gamification refers to a product improvement process through the development of gamified experiences aiming at supporting value creation for users.” [2]

The fact that it deals with human motivation makes the project of gamified applications a complex task, since it implies the need to understand the user’s psychological perspective. The Self-Determination Theory (SDT) indicates, for example, that details such as the meaning of a reward - whether it is perceived or not as a symbol of competence - have a significant role in the reward’s ability to motivate a person [3]. Another critical challenge of gamification is related to the fact that its interventions can affect directly or indirectly the behavior of the users. It is often not trivial to evaluate the effects and possible side effects of implementing a gamification element. Taking an example of an organizational environment with a strong collaborative culture, the implementation of a leaderboard can create excessive competition between people that can undermine the

group's social cohesion and collaboration. Besides, the source of gamification innovation (games) are complex, multifaceted, and therefore, their characteristics are challenging to transfer to other contexts. [4]

In this context, this work aims at proposing a modeling method to help analysts and designers to deal with the complexity, especially from a psychological and social point of view, of designing a gamification application. This method is based on the use of GStar, an extension proposed by this work to the agent-oriented and goal-oriented framework i* [8].

The research methodology used to guide the development of the proposed extension was the Design Science Research. Successive suggestion / development / evaluation iterations were carried out, first to explore the possibilities of modeling gamified applications with an agent/goal oriented modeling approach (framework i*), and then to extend this approach to better suit the context of gamification.

2 GStar: extending the i* framework

The i* modeling language is flexible and satisfactorily represents the dependencies, intentions, and potential conflicts between actors in an organization. It has been extended to include concepts from different domains, including security, software development, and autonomic computing systems [9] [10]. In the case of gamification, it is possible, through some extensions, to improve readability and increase the framework's ability to represent the design of gamified systems.

Gamification can be understood as a way of influencing the user's motivation to manifest certain desirable behaviors through the satisfaction of psychological drivers. These drivers are associated with the satisfaction of basic psychological needs that are the precursors of human motivation [5]. Based on this understanding, this work proposes three new concepts from the gamification domain: target behaviors, gamification elements, and psychological drivers.

The basic principle for the representation of the new concepts is the adherence to the original view of the i* modeling language. The i* framework is goal-oriented. The three new concepts are represented by intentional elements already included in i*, being differentiated from the original ones by symbols attached to the visual elements. This allows the use of analysis techniques developed in the context of i* without the need for adaptations and facilitates the use of modeling tools originally developed for i *. Figure 1 shows the proposed representation for the new concepts:

Fig. 1. Gamification concepts notation

– **Target behaviors**: behaviors that the designer wants to incentivize through the implementation of the gamified experience.

- **Gamification elements**: game design mechanisms selected by the designer to create the gamified experience. They are represented through a game related goal, from player's point of view. For example, points can be represented by " Earn points ", and leaderboards by " Improve on the leaderboard".
- **Psychological drivers**: The main drivers related to gamification are competition, status, achievement, self-expression, and altruism.

3 Beehive design analysis

For illustration, we consider the design of the Beehive system, a private social network implemented inside IBM reported in [6]. The purpose of the platform is to foster social interactions among employees, promoting a channel that facilitates the creation and maintenance of personal and professionals relationships. The network provides a profile page where users can share photos and lists. Users can connect with other users, building their social network, and also comment on any profile, photo, or list on the site. Three gamification elements were implemented in beehive: points, leaderboards, and levels. Users were randomized into two groups, control and experimental. Users in the control group used a version of the site without gamification, i.e., they could not see any information on how to earn points or any other information related to the scoring system. Users in the experimental group used the gamified version; they were able to visualize their score and that of other users, including those of the control group. [6]

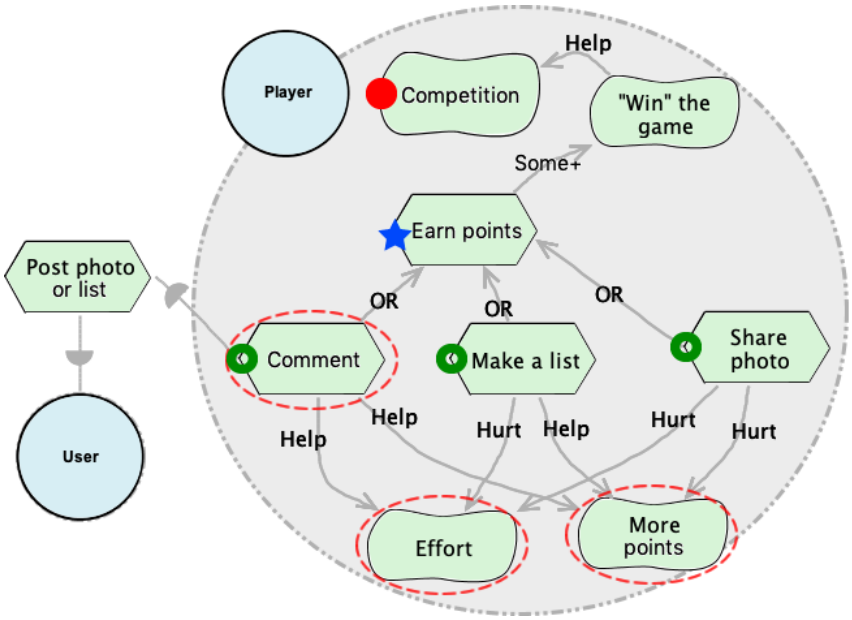
Users' engagement in the experimental group increased after the deployment of the gamification experience, but the result was not sustainable. In the second week after the implementation of gamification, the activity reduced significantly, and three weeks later the engagement measured by the average amount of shared content per user was already at the same levels as the control group. The authors of the study believe that the reasons behind the decrease on engagement in the experimental group after the first week of implantation of gamification were related to the fact that some users, after achieving an intermediate level, were satisfied and stopped contributing [6]. The following section presents an analysis of the Beehive design using the model-based approach presented by this work and other possible explanations for the results obtained by the implementation of the gamification experience in the Beehive system. The Beehive design was analyzed following a simple process: for each gamification element implemented the following steps were followed: (1) Analysis question(s), (2) Modeling and (3) Analysis and conclusion.

3.1 Points

The points system analysis was guided by two analysis questions: (1) What are the implications of the point system?, and (2) Assuming that users are engaged in the competition, and behave in a way that maximizes their chances to "win" the game. How would those users behave considering the designed point system? If users are engaged in the competition, they will behave in a way that raises their

chances to win, i.e., they will seek to increase their score, and thus improving their positions in the leaderboards. As shown in Figure 2, there are three ways to earn points in Beehive: commenting (15 points), posting a list (10 points), or sharing a photo (5 points). In a competitive environment, engaged users will naturally prioritize activities that require less effort and reward with more points. As shown in Figure 2, in Beehive, the activity that demands the least effort is also the one that rewards with the highest number of points, which is *Comment* (this is highlighted through the dashed circles). Another important aspect easily seen in the model of Figure 2 is that, since comments are posted on photos and lists, they depend on them being previously created to exist.

Fig. 2. Earning points in Beehive



Gamified experiences that provide the driver competition can provide a sense of competence to its users, which is one of the basic needs postulated by the Self-Determination Theory (SDT) [5]. Also according to the SDT (Cognitive Evaluation sub-theory), people's perception about the meaning of the origin of this competence (in the case of competition) is essential to define the effects on motivation [7]. Attributing the highest amount of points to the activity that demands less effort compromises the meaning of the competition because competitive users will tend to excessively perform that activity. If there is a way to take advantage of the system to earn points more easily (for example by overdoing simple comments like "cool!" and "awesome!"), users will quickly realize it, and the result is the decline of interest in competition as it ceases to be able to provide any sense of genuine competence. Another implication of this distortion

is the possibility of promoting imbalances in the types of content created by the users, since users may prioritize sharing comments over any other content. This may negatively affect the network since comments depend on previously created lists and photos to exist. Therefore, if there are fewer lists and photos, there will be fewer comments as well, and fewer reasons for users to re-visit the site.

The hypothesis that the point system may result in a disproportional increase of comments is corroborated by data that shows the evolution of the average amount of content created per user on the experimental group [6]. This indicates that users have understood the point system and have chosen to add more comments than other types of content that reward with fewer points. Also, interviews conducted by the authors of [6] at the end of the experiment showed that some participants deliberately focused on adding comments to the site because the point system rewarded more comments than other contents. All this suggests that the decision to reward comments with more points led users to favor comments in order to advance more quickly in the competition.

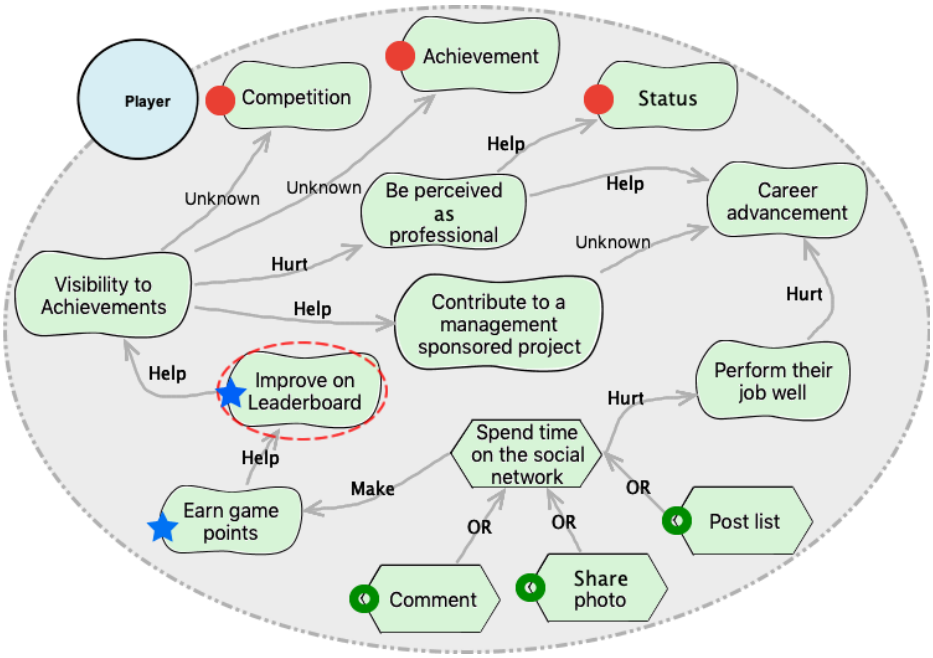
3.2 Leaderboard

According to the SDT, performance-contingent rewards, as long as they are perceived as a sign of competence, and therefore having an informational character, positively affect people's intrinsic motivation [3]. Leaderboards are closely related to the competition and status drivers, and when well designed, provide positive informational feedback and project a positive image of the best-placed users. Therefore, the visibility provided by leaderboards should be perceived as a symbol of competence. This characteristic influences users engagement since most of them welcome this visibility for its positive effects both on their self-image/self-esteem (drivers competition and achivement) and on the image perceived by other people (driver status).

To understand the meaning of this visibility provided by the leaderboards, one needs to understand what it takes to reach the top in terms of performance. And from that, try to understand how people perceive the best performers. To guide the analysis, the following analysis question was outlined: What are the implications of the leaderboards? To improve their positions in the leaderboards, users need to earn game points. As shown in Figure 3, this is done when the user actively spends time on the social network, commenting, sharing photos or lists. Due to the triviality of these activities, the best-placed users will be users who simply spend more time on the social network.

The fact that to climb to the top of the leaderboards is only necessary to spend more time on the social network, together with the fact that it is possible to "cheat" by overdoing frivolous comments to move faster in the game severely affects the leaderboards experience. In addition, as shown in Figure 3, users who spend more time on the network, and therefore can secure the best places in the leaderboards, will have less time to perform their main work activities, which conflicts with the goal of advancing their careers. This may also be perceived by others as unprofessional behavior, affecting both the status driver and the soft-goal of advancing the career.

Fig. 3. Beehive leaderboards implications



The analysis above suggests that the designed incentives in the Beehive gamification experience fail to provide the satisfaction of the basic needs which are precursors to human motivation. The SDT states that rewards, such as awarding points and visibility to the best performers, without providing a sense of competence both for the individual (self-esteem) and for their peers (reputation), are not effective in increasing people's motivation. Perhaps the only positive aspect, as shown in Figure 3, is that when the user is visible among the most participatory users of the social network, the employee is showing himself engaged in a project sponsored by the company's management.

4 Conclusion

The presented approach promotes a structured evaluation of the insertion of each gamification element, supporting the analysis of the implications of the proposed incentives concerning the user's intentional perspective. The Beehive social network analysis example shows how the model-based approach proposed by this work supports the identification of challenges and conflicts of interest that otherwise might not be noticed by designers. The identification and consideration of these inconsistencies already during the design phase, besides mitigating the project risks, may lead to significant savings to the organization and the development of a tool more adherent to the organizational context. Due to space limitations, this paper presents only an outline of the proposed approach, a more

comprehensive presentation can be found in [11], including other examples and an empirical case study.

Case studies have been carried out to illustrate and validate the usefulness of the proposed method. Still, a more formal and comprehensive evaluation would be an important contribution to investigate further the practical utility of the presented approach. A possible way to approach this is through interviews with gamification specialists. A structured evaluation by experts with experience and practical knowledge on gamification projects would further support the practical utility of the proposed model-based approach.

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