Designing Cooperative Gamification: Conceptualization and Prototypical Implementation

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ABSTRACT
Organizations deploy gamification in CSCW systems to enhance motivation and behavioral outcomes of users. However, gamification approaches often cause competition between users, which might be inappropriate for working environments that seek cooperation. Drawing on the social interdependence theory, this paper provides a classification for gamification features and insights about the design of cooperative gamification. Using the example of an innovation community of a German engineering company, we present the design of a cooperative gamification approach and results from a first experimental evaluation. The findings indicate that the developed gamification approach has positive effects on perceived enjoyment and the intention towards knowledge sharing in the considered innovation community. Besides our conceptual contribution, our findings suggest that cooperative gamification may be beneficial for cooperative working environments and represents a promising field for future research.

Author Keywords
CSCW systems; gamification; cooperation; collaboration; design research; innovation community; experiment.

ACM Classification Keywords
H.5.3. Information interfaces and presentation (e.g., HCI): Group and Organization Interfaces - *computer-supported cooperative work*

INTRODUCTION
During recent years, information systems have been increasingly enriched with design features originating in the field of computer games. This rising phenomenon is typically called *gamification* and has raised significant interest in industry [30] and academia [24,28,47]. For instance, business analysts have estimated that over 50% of organizations managing innovation processes will gamify their business by 2015 [15]. Reviews of scientific gamification studies [24,47,60] have shown that gamification is applied in various contexts, specifically including computer supported cooperative work (CSCW) systems, such as crowdsourcing approaches [47], online communities [18,19] and intranets [48]. Typically, gamification is used with the intention to positively influence human motivation and behavior [10,24,47,60]. Numerous empirical studies provide indicators for the effectiveness of different gamification implementations, however the understanding of the phenomenon is still in its infancy [24,47]. Most of the research that has been conducted on gamification has focused on studying approaches that motivate users by social comparison and competition or by setting personal goals (e.g. [5,18,33,37,44,48,74]). Gamification approaches that engage individuals to cooperate and, therefore, to strive toward a shared goal or purpose [11,65] have been of minor focus in gamification [5,7,17] and game-design research [40] thus far. This is somewhat surprising, since information systems that support users to cooperatively create joint outcomes, such as crowd-creation platforms [16], innovation communities [3,29] or co-creation approaches, are rising and demand incentive approaches that promote cooperation, rather than competition. The joint development of ideas [3,29], the creation of wiki contents [61], open source development projects [1] and many more group work scenarios may profit from incentives that engage individuals to form groups and support collective intentions [64]. On the other hand, massive multiplayer online games (MMOG) and cooperative video games demonstrate that people enjoy playing together. Many of these games show that design features, such as team challenges or complementary abilities, can engage millions of players to form virtual teams, guilds or clans in order to exchange game-related knowledge, develop shared strategies and cooperate to achieve common goals [6,8,13,31,50,58,70].

Thus, *we are aiming to understand the design of cooperative gamification for CSCW systems.*

In this paper, we are drawing on the social interdependence theory [11,32] and previous work on gamification [9,28] to propose a novel classification framework for gamification features, to characterize cooperative gamification features and to conceptualize cooperative gamification. Using the example of an innovation community of a large German engineering company, we present an exemplary design of a cooperative gamification approach and results from a first experimental evaluation. Finally, we close with a discussion

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on our findings, gathered insights on the design of cooperative gamification and an outlook on future planned studies.

COOPERATIVE GAMIFICATION

Classification of gamification features

Looking at incentive mechanisms in the information systems field, gamification is one of the most popular developments in recent years [20,24]. Especially, in context of CSCW systems, such as crowdsourcing approaches or innovation communities, gamification is used to increase motivation and participation [24,47,73]. Following Huotari & Hamari [28], gamification can be considered as the use of design features known from (video) games with the aim to give rise to similar experiences as games commonly do. In order to explain the effects of gamification, gamification is often conceptualized as the enriching of a system or service with *motivational affordances* [71,72] for gameful experiences [9,28,33]. In the HCI field the term affordance has become established and refers to "the actionable properties between an object and an actor" [71,72]. Motivational affordances comprise features of an object that can stimulate certain motivational needs of an actor [71,72]. The conceptualization of gamification features as motivational affordances highlights several important characteristics of gamification: (1) the offering of stimuli designed with the intent to address motivational needs and invoke mental states such as flow experience; (2) the possibility to influence behavior; (3) and that the adoption is always voluntary and influenced by subjective perceptions [28]. Several studies indicate that gamification affordances can increase intrinsic motivation of actors in a given activity and influence behavior (see [24,47,60] for an overview).

Although many empirical studies have shown positive effects of various gamification features in different contexts, science has just begun to understand gamification in more detail [9,24,28,47,60]. Publications that have focused the conceptualization of the gamification phenomenon or the effects of gamification in a specific context, highlight that the setting of *goals* and the providing of immediate, positive feedback about the achievement of these goals are essential characteristics of gamification implementations [5,10,20,24,33,42,44,53,74]. Therefore, the *goal-setting theory* [41] has often been applied in order to explain and analyze the effects of gamification features, such as points, badges or leaderboards [18,21,33,36,44,53]. On the other hand, several empirical studies indicate that considerable differences exist between cooperative, competitive and individualistic gamification features, such as leaderboards, badges or team challenges [7,17,37,43,44]. However, frameworks to explain and compare the effects of different gamification features are missing. Based on the insight that the setting of goals is obviously a fundamental part of gamification and a possible reason for the effects of different gamification features, we propose to classify gamification features along their applied goal structures. We assume that this could help to understand and describe the differences of various gamification features more precisely.

The social interdependence theory [11] has often been used to explain and study the effects of different goal, task and reward structures on psychological and behavioral outcomes [32,62,63]. The theory with an external validity and generalizability rarely found in the social sciences [32] has also been adapted to the context of video games to differ between individualistic, cooperative, competitive and cooperative-competitive game designs [40]. Following the theory, game designs can be seen as *individualistic* when individual actions have no effect on others (*no interdependence*), *cooperative* when individual actions promote the goals and actions of others (*positive interdependence*) or *competitive* when individual actions obstruct the goals and actions of others (*negative interdependence*) [40]. In individualistic games the players commonly compete against given or self-defined goals and constraints (e.g. unlock a badge, reach the next level, achieve a better result than in the last round, solve a puzzle with a maximum number of moves, beat the time), whereas in cooperative, competitive or cooperative-competitive game designs players interact with other players and try to achieve goals that are related to the multiplayer environment (e.g. surpass the result from another player or achieve a shared goal). Since gamification approaches apply the same goal and reward structures as games commonly do [10], the social interdependence theory is highly compatible to conceptualizations of gamification and can provide a contribution to the classification of gamification approaches.

Drawing on the social interdependence theory [11,32,62] we propose to classify gamification features into: (1) *individualistic gamification features,* which provide motivational affordances for gameful experiences without creating interdependence between goals of individuals (e.g. by the setting of independent goals); (2) *cooperative gamification features*, which provide motivational affordances for gameful experiences by using goal structures that invoke positive goal interdependence (e.g. the setting of shared goals); and (3) *competitive gamification features,* which provide motivational affordances for gameful experiences by using goal structures that invoke negative goal interdependence (e.g. the setting of competitive goals). In accordance with Liu et al. [40], we also adopted the concept of (4) *cooperative-competitive gamification features* that provide motivational affordances for gameful experience based on groups, with positive goal interdependence within and negative goal interdependence between the groups (e.g. a team competition) [40,63] (Figure 1). Numerous psychological studies that have been conducted with the aim to analyze situations with individualistic, cooperative or competitive goal structures (e.g. [63] see [32] for an overview) indicate that cooperative structures can promote greater efforts than individualistic or competitive approaches. Furthermore, these studies indicate that group work scenarios with positive goal interdepend-

ence can promote the creation of positive relationships and support psychological health [32]. Therefore, we assume that gamification approaches, which promote cooperation rather than competition, can be of particular interest for the use in CSCW systems that support cooperative work and the creation of joint outcomes, such as crowd-creation platforms, innovation communities or co-creation approaches.

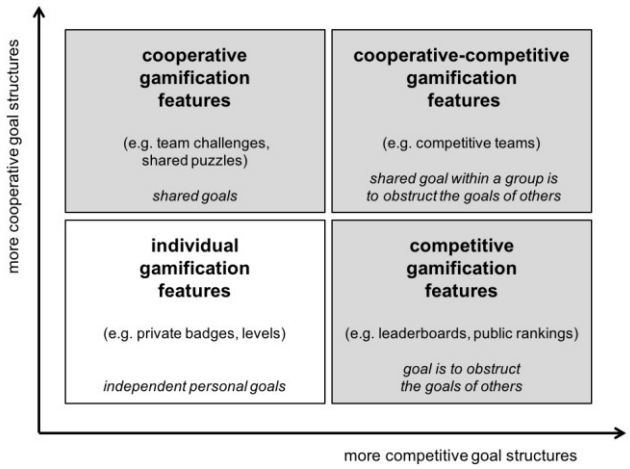

Figure 1. A classification of gamification features

Design characteristics and requirements of cooperative gamification features

The above conceptualization of cooperative gamification features implies two essential design characteristics of cooperative gamification features:

First, cooperative gamification features *apply goal structures that can invoke positive goal interdependence between two or more individuals*. Second, in accordance with the general conceptualization of gamification [9,24,28], cooperative gamification features *offer motivational affordances for gameful experiences* [28]. The combination of both describes cooperative gamification features as a unit consisting of the cooperative nature and the expected effects. These characteristics can also be seen as requirements for the design of cooperative gamification features. Existing research on cooperation, cooperative games and motivational affordances can help to further understand these characteristics and support the design of cooperative gamification features.

Previous research in context of the social interdependence theory identified that situations in which individuals cooperate require positive goal interdependence between two or more individuals or in other words that the "amount or probability of a person's goal attainment is positively correlated with the amount or probability of another obtaining his goal" [12]. In such situations individuals can benefit, if they combine their efforts and cooperate. As described above, gamification commonly uses the setting of goals and immediate feedback as mechanism to influence behavior and psychological outcomes [18,24,33,44,74]. Studies that have been conducted in the context of sports [63] or education [32,45] indicate that situations with positive goal interdependence can be designed by setting *shared goals* or by creating positive correlation between individual goals. Research on cooperative game design [13,55] found that cooperative video games typically implement shared goals by providing quests or challenges to many players simultaneously that can be completed through cooperation in a group. In addition, several design patterns for creating positive correlations between individual goals and for stimulating promotive interactions can be found in cooperative video games [13,55]. These patterns include e.g. *special abilities* (abilities that can only be used to support other players), *complementarity* between players (e.g. abilities that complement each other), *special rules for teams* (e.g. rules that protect users who cooperate), *limited resources* (limitations that encourage sharing) or *intertwined goals* (the setting of different goals, which require mutual support for their achievement) [13,55]. Empirical studies on the effects of these patterns indicate that most of them, but especially the setting of shared goals, can have strong effects on enjoyment, excitement and cooperative behavior (expressed in form of active knowledge exchange, mutual assistance, as well as the development of shared strategies) in several popular cooperative video games [13]. Similar results have been found by psychological studies about the effects of cooperative goal structures on perceived enjoyment and performance [63]. Therefore, we assume that design patterns of cooperative games, but especially the setting of shared goals, are promising approaches to design cooperative gamification features. The positive effects of the above mentioned cooperative game design patterns on enjoyment [13] indicate that the application of these patterns may be suitable to invoke gameful experiences in gamified applications. However, since cooperative game design in general [40] and cooperative gamification in particular [5,7,17] has been studied less to date, little thoughts were made on the motivational affordances of cooperative gamification features.

The theory of motivational affordances has often been used in context of gamification to conceptualize and design gamification approaches [9,24,28,33]. This conceptualization highlights that gamification affords a subject: the opportunities to experience the satisfaction of motivational needs when interacting with a gamified artifact. Based on this theoretical consideration, gamification literature recommends to design gamification features with the intention to satisfy needs in the way as games commonly do (e.g. focus on mastery, curiosity or competence satisfaction) [10,28,33]. One possible approach to design motivational affordances has been suggested by Zhang [71,72]. His work proposes 10 design principles related to five different motivational sources for the design of motivational affordances. These principles focus the fulfilling of basic human needs and include the design for (1) *autonomy and the self*; (2) *competence and achievement*; (3) *social*

relatedness; (4) *power, leadership, and followership* and (5) *emotion and affect*. Previous research on gamification identified *competence satisfaction* as a core factor for the experience of enjoyment in individualistic and competitive gamification approaches [10,22,33,53]. The setting of challenging goals and instant feedback are part of Zhang's design principles for *competence and achievement* and have often been applied by designers of gamification approaches with the aim to create motivational affordances for gameful experiences [5,10,24,25,28,33,42,53]. In cooperative video games, challenging goals are often designed as team challenges that can only be overcome or lead to better results by cooperation and mutual support [13,54,55]. Research on motivational factors in online multiplayer games indicate that in addition to *competence*, cooperative games can satisfy the need for *social relatedness* (4) [54,56]. Especially, s*ocializing* with other players, the desire to form *meaningful relationships with others*, as well as satisfaction from *being part of a group effort* have been identified as important motivational gratifications of players of online games with cooperative features [58,70].

Consequently, we assume that cooperative gamification features may provide motivational affordances for gameful experiences through both, competence satisfaction by the setting of goals and instant feedback, as well as the experience of social relatedness by its social aspects. Therefore, it could be recommended that designers of cooperative gamification features should focus Zhang's [71,72] design principles for *competence satisfaction* (2), but also the principles for *social relatedness* (3), which include the support of human-human interaction and the representation of social bounds.

Cooperative gamification approaches

Our classification above helps to identify and describe different features of gamification approaches. However, a recent review of gamification implementations [47] indicates that gamification approaches may contain manifold gamification features, including combinations of cooperative, competitive and individualistic features that in sum motivate specific behavior. On the basis of the literature discussed above and considering the behavior that causes a gamification approach, we define *cooperative gamification, as the use of gamification features that promote cooperation*. This does not exclude the use of different features in a cooperative gamification approach. However, based on the social interdependence theory that identified positive interdependence as essential requirement for every cooperative behavior [11,32], we postulate that the core of every cooperative gamification approach is a cooperative gamification feature that invokes positive goal interdependence.

Innovation communities as exemplary application area for cooperative gamification

Innovation communities are typical CSCW systems that support the collaborative creation of ideas in organizations. Typically, competitions and incentives such as prizes or career opportunities are used in innovation communities to engage participants to share and discuss ideas [38]. With the rise of gamification, the use of competitive gamification approaches is gaining popularity in innovation communities [29,33,46,59,73]. However, empirical studies indicate that strong competitive configurations can have negative effects, such as a decrease of peer feedback, perceived enjoyment or quality of ideas [3,17]. On the other hand, gamification features with a social and more cooperative character seem to be particularly suitable for increasing participation [59] and idea quality [29] in innovation communities. For example, Scheiner [59] found that social points, which allow users to reward the contributions of others, are more important for long-term motivation and participation in an innovation community than other individualistic and competitive gamification features. The study emphasizes that a reason for their positive effects may be the motivational affordances cooperative gamification features provide, especially those that are based on the fulfilling of social needs, such as the need for social belonging. Several studies indicate that cooperative gamification may be particularly useful to engage peer feedback (comments from other users) in corporate innovation communities (cf. [29,34,73]), which in turn can positively impact the quality of user-generated ideas [2,3,69]. Therefore, it could be expected that further knowledge on the design of cooperative gamification approaches that motivate knowledge exchange, will provide a contribution to the design of successful innovation communities [3,29,59,73] and similar CSCW systems.

RESEARCH DESIGN

With the aim to investigate the design of cooperative gamification approaches and their practical application in modern CSCW systems, we apply the design science research (DSR) methodology [27,52]. Its key characteristic is that it seeks to extend boundaries of current research by creating new and innovative artifacts that solve practical problems based on theoretical and conceptual knowledge [27]. Hevner [26,27] describes DSR projects as an "embodiment of three closely related cycles" (Figure 2). First, the relevance cycle that inputs practical problems of a contextual environment and provides opportunities for field tests. Second, the rigor cycle that provides grounding theories as well as existing design knowledge and adds new design knowledge from the research to the growing scientific knowledge base. Third, the design cycle, which is the core of every DSR project and compromises the iterative construction, evaluation and refinement of a design artifact. Our project focuses on the practical problem of low cooperation and participation in CSCW systems. Drawing on the above described conceptualization of gamification and the social interdependence theory, we suggest that cooperative gamification may be an appropriate, innovative solution to motivate cooperation in CSCW systems. According to DSR we build an exemplary instantiation of a cooperative gamification approach as DSR artifact and

evaluate it in two design cycles [26,27]. In the following we describe our first DSR cycle, which encompasses the instantiation of the above specified theoretical concept of cooperative gamification, as well as a first evaluation of the thus developed prototype with users of the contextual environment (Figure 2). Whereas this first cycle focuses the theoretical conceptualization and investigation of the design of cooperative gamification, the empirical effects of cooperative gamification will be mainly investigated in the second cycle. Based on the insights we gather in the first cycle; we will refine the artifact in the second cycle.

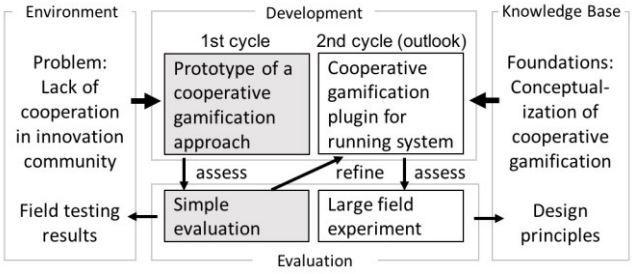

Figure 2. Design Science Research project based on [26,27]

We have chosen an innovation community of a large German engineering company with around 1.400 active members as practical object for our research. This community has been selected for three reasons: First, innovation communities can be found in many large organizations and are typically used as platforms to support the cooperative development of new innovations [2,33,73]. Second, during the last years, the activity in this community decreased noticeably from around 498 comments on ideas in 2013 to 279 comments in 2014. Third, previous research on cooperation identified peer feedback and knowledge exchange (such as comments in an innovation community) as a typical form of cooperative interaction [32,51]. The innovation community we selected for this research provides employees the possibility to submit new ideas and evolve those over four stages from ideation to realization. By using a comment feature members of the community can discuss ideas, exchange knowledge and rate ideas. Previous studies on innovation communities showed that cooperation of participants in form of constructive discussions and the sharing of knowledge is crucial for the output quality of such systems [3,14,57,69]. Therefore and under consideration of previous research on gamification in innovation communities [29,34,59,73], we assume that a cooperative gamification approach, which increases the motivation to exchange knowledge and to provide peer feedback, can be beneficial for the investigated community. In the following we describe the design of a cooperative gamification approach for this community.

DESIGNING A COOPERATIVE GAMIFICATION FEATURE FOR AN INNOVATION COMMUNITY

In order to design a cooperative gamification feature, we followed a two-step approach. First, we conducted interviews with active users of the innovation community, to better understand the context and the target group. Second, we designed a cooperative gamification feature for the considered community that instantiates the above defined design characteristics of cooperative gamification features.

The majority of methods on the design of gamification (see [10] for an overview) suggests a detailed analysis of the context and the users in order to understand the problems and opportunities of the given situation. Therefore, we conducted semi-structured interviews with active users of the innovation community. The system administrator carefully selected 15 participants from different hierarchical levels and with different age, gender and experience in using the system, in order to represent the entire population of users. The interviews were conducted in German during working hours on a voluntary basis and took 26 minutes on average. The interview guideline was grounded in goal-setting [33,36,41] and knowledge-sharing [4] theories, contained open questions and focused concrete use cases in the system. Here, we took a specific look on experiences, individual motivations and personal problems, related to the sharing of knowledge and discussion of ideas within the innovation community. The results indicate that almost all interviewees that have published ideas wish to get more peer feedback on their ideas, especially in the first stages of the stage-based ideation process. We also identified that the lack of motivation to provide feedback on ideas of others relies mainly on the following perceptions: (1) that inputs are not recognized by others; (2) that feedback has no or little influence on ideas; (3) that using the system is boring and work-related. During our analysis we identified 3 different types of users: (I) users that are generally not interested in supporting ideas of others, (II) users that are motivated to give peer feedback but expect that their contribution will not be recognized and (III) users that often give feedback and like the possibility to share thoughts, help others and enjoy socializing in the community. A more detailed analysis of these different user types showed that community members who are intrinsically interested in an idea are also generally willing to provide a contribution to this idea. Furthermore, the interviews indicate that users who provided feedback in the past, did that with the intention to support the success of ideas and to help the inventors. However, we also recognized that several users of the system, which have given feedback, did often not perceive themselves as part of a team that develops the idea.

Guided by our theoretical approach and based on the insights from the interviews, we designed a cooperative gamification feature for the considered innovation community. Several interviewees reported that their contribution behavior is positively linked with the goal to support the success of an idea. Therefore, we decided to choose the success of an idea as the core of our gamification feature. Inspired by the idea that a rocket development could be used as visual metaphor for the development and success of an idea, we created a set of graphics that could be used to

visualize the success of an idea in the four-stage ideation process of the community. For stage 0 (initial setup of a new idea) we used the visualization of an inventor's garage, for stage 1 (ideation) the development of the rocket engine, for stage 2 (maturation) the development of the main body and finally, for stage 3 (project preparation) the nose and the launch of the rocket (Figure 3, Figure 4). Furthermore, we designed a set of different unlockable visual objects for each of these four visual scenes. We linked the unlockable visual objects of each stage with the writing of comments. If no comments were provided the visualization of the rocket was "naked", but by writing comments, members of the community got the possibility to unlock various visual rocket elements, such as color strips, engines, wings, windows etc. and background elements such as planets, UFOs, a mobile sculpture, robots etc. (see Figure 4).

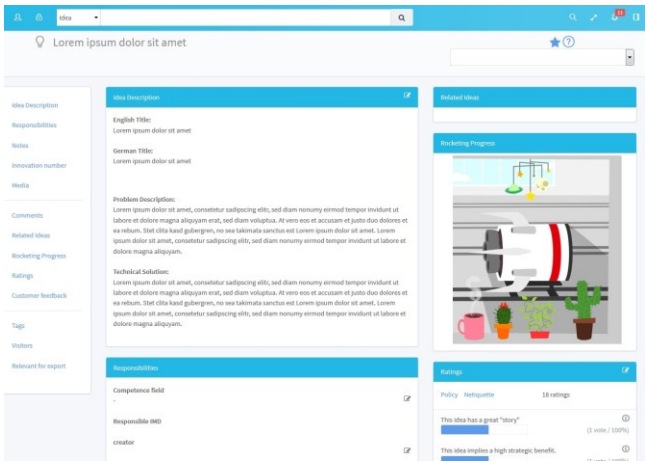

Figure 3. Screenshot of an idea within the gamified innovation community

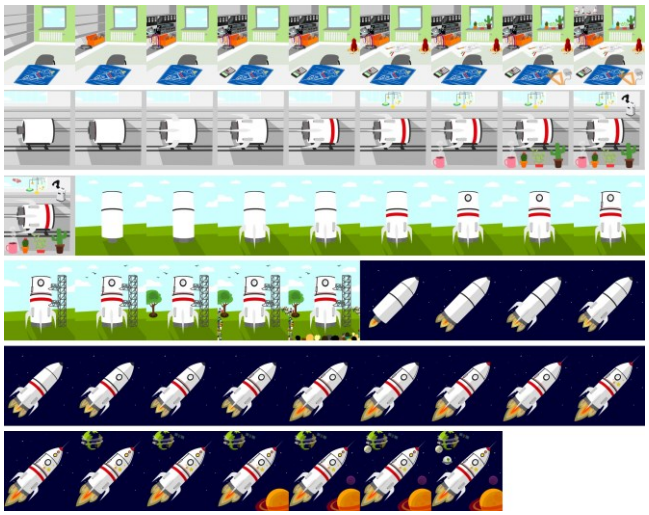

Figure 4. Examples of unlockable elements

In other words, we have created a mechanism that rewards the writing of comments for an idea, by unlocking visual objects for the visualization of an idea. We assume that the possibility to achieve a "rich" visualization for an idea could act as a *challenge* and *shared goal* for users that are interested in the success of this idea. The implementation of our mechanism ensured that the contribution of different users is required to unlock all visual features of an idea rocket (cf. *special abilities* pattern of Rocha et al. [13,55]). Consequently, a rich visualization can only be achieved through cooperation. Based on [32] positive goal interdependence exist when individuals perceive that they "can attain their goals if and only if the other individuals with whom they are cooperatively linked attain their goals". Therefore, we expect that our gamification feature, which defines a rich visualization of an idea as a clear and explicit (shared) goal and creates mechanism-based mutual dependences between the users, could arouse positive goal interdependence. Especially, among users who share an affinity for a particular idea and are interested in the public representation of this idea.

Furthermore, we followed Zhang's principles [71,72] with the aim to design an approach that provides motivational affordances. Zhang recommend the use of *challenging goals* and *instant, positive performance feedback* in order to extend information systems with motivational affordances for competence satisfaction. Previous research on knowledge sharing indicates that helping others by providing valuable knowledge can be challenging and a source for competence satisfaction, especially in organizational contexts [39,67]. Our approach attempts to support this by providing instant positive performance feedback after submitting a comment to an idea. This feedback appears in form of a popup with a short 'thank you' message and the option to unlock one of three randomly selected visual elements for the corresponding idea rocket. Research has shown that the use and promotion of unlockable visual objects as reward for performing specific activates is a common goal setting practice of gamification [18,19]. Furthermore, the study of Jung et al. [33] shows that such gamification-based positive performance feedback related to the submitting of comments provides a suitable approach to create motivational affordances for competence satisfaction in innovation communities. We therefore assume that unlocking visual features by writing comments may offer motivational affordances for competence satisfaction.

In order to address the need for social relatedness, our gamification feature was designed with the intent to make the cooperative behavior more clear and tangible. Following Zhang's [71,72] design principles we designed the cooperative rocket graphic as a visualization, which demonstrates that each individual contribution is part of a group effort. Previous research emphasizes that the perception to be part of a cooperative effort may cause experiences such as social relatedness, social relevance and again, competence satisfaction [54,56]. Therefore, we expect that our approach may provide a motivational affordance for the experience of social relatedness, similar to other cooperative game designs with shared goals [54,56,58].

To summarize, grounded on the above described theories we assume that the presented gamification approach fulfils both requirement of cooperative gamification features (Table 1). Consequently, we expect that the designed cooperative gamification feature may increase cooperation in form of knowledge exchange and peer feedback in the considered community.

Theoretical justification	Derived requirements	Design decisions
Social interdependence theory [32]	Cooperative gamification features should create situations with positive goal interdependence.	Setting of a shared goal that can be achieved by cooperation and visualization of the cooperation progress.
Motivational affordance theory [71,72]	Gamification features should provide motivational affordances for gameful experiences.	Providing opportunities for competence satisfaction, as well as the experience of social relatedness.

Table 1. Meta-requirements and design decisions

Instantiation of the feature as part of a cooperative gamification approach

In cooperation with our partner company, we developed an instantiation of the proposed cooperative gamification feature as a plugin for the innovation community. As described above, a cooperative gamification approach may contain different types of gamification features. A recent, comprehensive review of the use of gamification in crowdsourcing recommends the use of manifold gamification features in crowd-creation approaches that seek for creative and heterogeneous contributions [47]. Therefore, we assume that a combination of the presented cooperative gamification feature with e.g. individualistic gamification features, such as private badges or a level system, might invoke stronger and more appealing gameful experiences and increase the overall effects. Badges seems to be an appropriate addition, since they also utilize the setting of challenging goals in order to provide motivational affordances for competence satisfaction [18,19]. Following previous research, which found that badges can positively influence contribution behavior in communities [19], we defined several goals related to contribution and helping behavior and linked them with several unlockable private (by default not visible to other users) badges, such as a badge for writing more than 5 comments.

EVALUATION

With the aim of investigating the effectiveness of the designed gamification approach for the considered community, we conducted a simple experiment in a field setting. Following the gamification conceptualization of Hamari [24,28] and the concept of motivational affordances [33,71,72], gamification features influence motivation and behavior of users. Therefore, we selected both, an indicator to operationalize the psychological outcomes and an indicator to operationalize behavioral intentions. Several studies found positive effects of gamification on perceived enjoyment [24,47,49] and positive correlations between enjoyment of gamification approaches and behavioral outcomes [23,24]. Recent reviews of empirical studies on gamification [24,47] found that perceived enjoyment is typically considered as an indicator for the motivational affordances a gamification approach provides. Especially, motivational affordances that satisfy human needs, such as the need for competence or social relatedness, have been identified as source of enjoyment [28,56,70]. Our prototype was designed with the intention to provide motivational affordances that target these needs. Therefore, we assume that *perceived enjoyment is higher with the developed gamification approach than without* (H1).

In order to operationalize the intention to cooperate we measured the intention to *share knowledge* in the considered innovation community. Several empirical studies indicate that, generally, gamification approaches can have positive effects on participation behavior [17,33,37,43,47] and knowledge sharing [66] in similar CSCW systems. On the other hand, previous studies in organizational [51] and educational [32] contexts indicate that promotive interactions, such as knowledge sharing [51], are typical outcomes of positive goal interdependence. The gamification approach that is presented in this paper has been designed with the intention to support positive goal interdependence and engage cooperative behavior in form of peer feedback and knowledge exchange. Therefore, we propose that the *developed cooperative gamification approach will increase the intention to share knowledge in the considered innovation community* (H2).

Experimental Design

We developed a complete new user interface for the considered innovation community to minimize novelty effects of a solely gamification plugin. Based on this interface we created two versions, one with gamification (treatment T) and one without (control C). The experiment was carried out in a meeting room at our partner company with current users of the innovation community. 50 users have been selected by the system administrator and were invited to participate in voluntary individual sessions of 60 minutes during the working hours. Finally, 42 participated. We randomly divided the participants into a treatment and a control group, 21 participants each. The experiment was performed on a computer, where we opened one of the two implemented versions. Participants of the treatment group, started with a predefined set of ideas on the screen. They were asked to select an interesting idea and to provide a comment to that idea. In this context, the cooperative gamification feature (the rocket) was visualized beside the idea. After posting a comment, the participants were informed by a popup about the unlocked rocket feature and were able to witness the sequence-change of the rocket visualization. During the experiment this task was repeated with other ideas, in order to demonstrate that further parts can be unlocked for the rocket. Next, the participants of the treatment group were asked to submit a new idea. Finally, the profile page was shown to the user, where in the

gamified version, the personal achievements (e.g. overview of supported rockets, a score that represents the personal contribution performance and unlocked badges) could be explored. Participants of the control group followed a comparable process, in which they searched for an idea, selected an idea, left a comment to this idea and submitted a new idea. Finally, also their profile pages in the new interface design were demonstrated. All data were collected using a digital questionnaire immediately after the simulation. We collected demographic information, level of experience with the analyzed community (five-point Likert scale very low – very high) and frequency of use (five-point Likert scale very seldom - very often) as control variables. In order to validate the realism of the experiment, we asked the participants to rate the perceived realism of the experiment with two items "I think the simulation was realistic" and "I believe it is likely that I execute the simulated activities during work" [68] on a seven-point Likert scale (strongly disagree - strongly agree). Differences between the two groups were measured by eight items in the questionnaire (Table 2), which asked for perceived enjoyment (four items) and knowledge sharing intention (four items) on seven-point Likert scales (strongly disagree - strongly agree). All items were based on previously published research and were asked in random order.

Perceived enjoyment	based on [23]
"I find the experience of using the innovation community enjoyable."	
"I find the experience of using the innovation community pleasant."	α 0.792
"I find the experience of using the innovation community exciting."	
"I find the experience of using the innovation community interesting."	
Knowledge sharing intention	based on [4]
"I intend to provide my information about manuals, methodologies and models for members of the innovation community more frequently in the future."	
"I intend to share my experience or know-how with other members of the innovation community more frequently in the future."	α 0.917
"I intend to provide my 'know-where' or 'know-whom' to other members of the innovation community more frequently in the future."	
"I will try to share my expertise from my education or training with other members of the innovation community more often."	

Table 2. Questionnaire constructs, corresponding items and reliability of the constructs

Age	**<30**	**30-39**	**40-49**	**50-60**	**>60**
#	C:2 T:2	C: 9 T: 13	C: 6 T: 6;	C: 4 T: 0	0

Table 3. Age of the participates

Results

Age (Table 3), gender (each group 4 female, 17 male), level of experience with the analyzed community (mean C: 3.09 T: 3.14), as well as the frequency of use (mean C: 2.83 T: 2.85) was homogeneous distributed in both groups. The application of Pearson's Chi-Squared tests found no significant difference between the two groups.

We conducted Mann-Whitney tests to investigate the effects of gamification on the dependent variables, according to our hypotheses H1 and H2. For perceived enjoyment and knowledge sharing intention the medians were higher in the group with gamification and the tests showed one-tailed significant differences between the control and the treatment group (Table 4).

The realism of the experiment was rated high with a median value of six for each group and item, which is equal to "I agree". This gives an indication that the participants have perceived the experiment as realistic, which supports the evidence of the measured effects. We assessed the internal consistency of the dependent variables by computing Cronbach's alpha coefficients for each of the constructs. Both (0,792 and 0,917) showed an acceptable internal consistency (Table 2).

Dependent variables		**Perceived Enjoyment**			**Knowledge sharing intention**		
	n	M	SD	p	M	SD	p
Control	21	5	1.4	.0003**	4	1.4	.001*
Treatment	21	6	1.1		5	0.9	

M=median (1=low; 7=high); *exact p < .01; **exact p < .001 (1-tailed)

Table 4. Results

DISCUSSION

The findings indicate that the analyzed gamification approach may increase the perceived enjoyment of users of the innovation community (H1). This result is in line with numerous gamification studies (e.g. [23,35,49], cf. [24,47]) and typically interpreted as an indicator for the motivational affordances a gamification approach provides [24,28,47]. Consequently, we assume that the presented cooperative gamification approach enriches the innovation community with motivational affordances. We also measured a significant increase in the intention to share knowledge within the considered innovation community by the use of gamification (H2). This indicates that the developed gamification approach has the potential to increase motivation of community members to exchange knowledge, provide peer feedback and support other community members in the development of their ideas. Previous research in context of the social interdependence theory found that such kind of promotive interaction (e.g. knowledge exchange or mutual assistance) is an essential aspect of cooperation and a result of positive goal interdependence [32]. Therefore, our findings indicate that the presented gamification approach may, increase the behavioral intention to cooperate.

Based on these findings, we assume that the presented gamification approach fulfills the derived meta-requirements (Table 1) and represents an example of

cooperative gamification. Furthermore, our results give an indication that cooperative gamification meets the expectations. Although no comparison between different gamification features has been conducted in this research project so far, our results show that both, perceived enjoyment as typical psychological outcome of gamification features, as well as behavioral intentions can be influenced by cooperative gamification approaches.

LIMITATIONS

Although our study provides some reasonable indications for the possible effects of cooperative gamification, the small sample size, the operationalization with only two variables, the measurement of perceptions and intentions, the short duration, the selected evaluation method and the generalizability of our experiment are strong limitations of the presented evaluation. As described above, we see this experiment as a first cycle of an ongoing design science research project (Figure 2). In the next cycle we will roll out different versions of the developed gamification prototype in the innovation community of our industry partner to conduct a large field experiment. Our goal is to offset the limitations of the preliminary evaluation and to derive empirically tested design propositions about the design of cooperative gamification. Additionally, we will examine the differences of several gamification features, in order to determine whether more manifold cooperative gamification approaches, as highlighted by Morschheuser et al. [47], will increase the outcome and effectiveness of gamification solutions that try to engage creative and heterogeneous contributions. Nevertheless, we are convinced that the theoretical contribution and the empirical insights provided in this paper extends the boundaries of current gamification research (cf. [5]) and may already help designers of CSCW systems to design cooperative gamification approaches.

CONCLUSION

In this paper, we conceptualize cooperative gamification and provide theoretical foundations for the design of cooperative gamification approaches. Furthermore, we present a novel classification framework for gamification features, which allows to subdivide gamification elements along their applied goal structures into individualistic, cooperative, competitive, and cooperative-competitive gamification features. In order to investigate the design of cooperative gamification and to examine the practical applicability of the proposed framework, we developed an exemplary cooperative gamification approach for an innovation community of a large German engineering company. We demonstrate that design patterns of cooperative video games, such as the setting of shared goals, as well as design principles for the design of motivational affordances can support the development of cooperative gamification features. As part of an ongoing research project on the effects of cooperative gamification, this paper also reports the results from a first experimental evaluation of the developed approach. Our results indicate that the developed approach can have positive effects on perceived enjoyment and the intention towards knowledge sharing in the considered innovation community. This encouraged our industry partner and us to further investigate the empirical effects of cooperative gamification in future research. Based on this study and previous research [5,7,17], we can summarize that cooperative gamification is a less researched but promising research field. Compared to typical competitive or individualistic gamification approaches, cooperative gamification seems to be an interesting alternative, especially for crowdsourcing platforms, innovation communities, co-creation approaches and other CSCW systems. We are confident that our classification and the derived design principles for cooperative gamification features will help designers of CSCW systems to design more effective and purposeful incentive mechanisms. We hope that this paper will encourage other researchers to develop and investigate cooperative gamification approaches and that our contribution provides a foundation to guide future research in this new direction.

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