

# PROMOTING RECIPROCITY-BASED COOPERATION BY DUAL LAYER GAMIFICATION

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## KEYWORDS

Gamification, Cooperation, Reciprocity, Image Scoring.

## ABSTRACT

This paper presents a conceptual platform of gamified systems with a dual layer structure and reports on the prototype implementation for promoting reciprocity-based cooperation in targeted social contexts. Level 1 gamification is intended to leverage our innate ability to support cooperative relationships by engaging in altruistic behavior towards those who exhibit altruistic behavior, and the addition of Level 2 gamification is intended to induce gameful experience by a diversity of strategies. Coupling of these two layers can promote intrinsic motivation for performing altruistic behavior and at the same time making others perform altruistic behavior. We report on the prototype implementation of the platform and the knowledge gained from its preliminary evaluations repeated since July 2013.

## INTRODUCTION

Digital games have pervaded our daily life and human culture on an unprecedented scale while analog games have existed in human culture since the dawn of recorded culture (McGonigal 2011). Furthermore, they are growing beyond entertainment. *Gamification* is a relatively new term whose first documented use dates back to 2008 (Deterding et al. 2011), and can be defined as using game elements, game mechanics, and game thinking in attempt to engage people, motivate action, promote learning, and solve problems in non-game contexts (Deterding et al. 2011; Kapp 2012; Seaborn and Fels 2015). The typical gamification approach is based on adding game elements (e.g. points and badges) to make a target task more engaging.

While gamification is more and more employed in the design of digital services, interfaces and interactive systems, gamification is widely criticized by academic and game designers. Deterding summarized the criticism towards the existing gamification just adding a layer of game elements rather than taking a systematic approach to the design of the experience: not systemic, reward-oriented, not user-centric and pattern-bound (Deterding 2013).

Recently, aiming at the users of popular and typical gamified applications (Foursquare, Nike+ and GetGlue), Rapp investigated qualitatively how the most common

gamification techniques impact users' subjective experiences (Rapp 2015). The result was that as their familiarity with the gamified features increased, participants characterized the usage of the apps as repetitive, static and scarcely rewarding.

Simply stated, based on these criticisms and findings, gamification which merely adds a layer of game elements motivating through external rewards promotes a simple behavior pattern that does not require learning or thinking and is unable to maintain the level of engagement.

Responding to the criticisms and aiming for the best utilization of gamification, this paper presents a conceptual platform of gamified systems with a dual layer structure. We report on a prototype implementation focusing on creating an opportunity to observe and learn own and others' altruistic behavior and further to promote altruistic behavior in targeted social contexts, and also on its preliminary evaluations.

## RECIPROCITY-BASED COOPERATION

One of the most significant problems in interdisciplinary research fields, including evolutionary biology, ecology, economics and sociology is to explain social behaviors such as cooperation (Darwin 1871; Hamilton 1996; Arita 2012). Cooperation seems to be difficult to reconcile with natural selection. Why should one individual help another under Darwinian natural selection?

Theoretical explanations for the evolution of cooperation are broadly classified into two categories, although both are not mutually exclusive: direct fitness benefits and indirect fitness benefits (West et al. 2011). A cooperative behavior yields direct fitness benefits when the reproductive success of the individual who performs the cooperative behavior is also increased while a cooperative behavior can be also explained by indirect fitness benefits if it is directed towards other individuals who carry genes for cooperation (Hamilton 1964).

Reciprocity is a key mechanism classified into the first category whereby the evolution of cooperative or altruistic behavior may be favored by the probability of future mutual interactions. There are again two types of reciprocity: direct and indirect (Figure 1). Direct reciprocity is a tit-for-tat exchange of benefits by two individuals. Therefore, the evolution of cooperation by direct reciprocity requires repetitive interaction presumably in a small group. In

contrast, indirect reciprocity occurs when an altruist is rewarded by third parties for behaving generously towards others, in other words, A helps B, making it more likely that C will later help A. Furthermore, another type of indirect reciprocity can be identified if an act of altruism causes the recipient to perform a later act of altruism in the benefit of a third party, in other words, A helps B, making it more likely that B will later help C. The former is referred to as downstream reciprocity while the latter upstream reciprocity.

Theoretically, the evolution of cooperation based on upstream reciprocity is considered to be difficult. For example, Nowak and Roch showed that upstream reciprocity enables the evolution of cooperation only in combination with another mechanism such as direct reciprocity or spatial reciprocity (the effect of forming clusters on the promotion of cooperation dynamics) (Nowak and Roch 2007). Hereafter, we refer to downstream indirect reciprocity simply as indirect reciprocity.

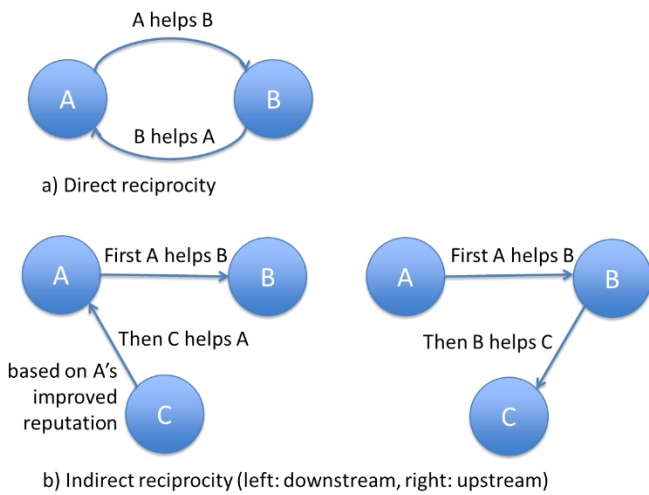


Figure 1: Classification of Cooperative Reciprocity: a) Direct, b) Indirect (left: downstream, right: upstream)

The most influential model for indirect reciprocity (Nowak & Sigmund 1998) was based on a simple reputation measure called *image score* that increases when the individual is observed to give aid. Evolutionary simulations using randomly chosen pairwise encounters between members of a population showed that cooperation could be established through discriminatory strategies which helped those with higher image scores.

Besides the theoretical work towards understanding the evolution of the cooperative behavior, many studies with behavioral experiments have provided strong support for indirect reciprocity based on some kind of reputation system. Milinski and others performed the experiments in which subjects could transfer money to a third-party without the possibility of direct reciprocation and showed that reputational incentive works well at maintaining high levels of cooperation (Milinski et al. 2002). Wedekind and Milinski also showed that in an experimental setting, participants of the high image score received money more frequently than those with a lower image score (Wedekind and Milinski

2000). Furthermore, according to reputation-based cooperation theories, individuals should be more cooperative than when alone. It was indeed shown that even under conditions of anonymity, presenting participants with stylized eyespots on a screen (Haley and Fessler 2005) or a robot constructed with objects that are obviously not human with the exception of its eyes (Burnham and Hare, 2007) make them cooperative.

## PROMOTING COOPERATION BY DUAL LAYER GAMIFICATION

### Basic idea

Aiming for the best utilization of gamification, we extend the basic gamification scheme (Figure 2) and design an abstract platform with a dual-layer structure utilizing gamification (Figure 3). Level 1 is designed to directly promote a targeted behavior of users using typical game design elements (e.g. points and badges), while Level 2 is designed to interact with Level 1 by manipulating the elements of Level 1, possibly resulting in affecting the behavior of users indirectly.

In this paper, we describe a prototype termed *DERC* (Dual layer gamification Encouraging Reciprocity-based Cooperation) as an instance of the dual-layer gamification scheme, in which altruistic behavior of each user is intended to be promoted by quantifying and sharing the image score of each member (in the context of indirect reciprocity). The supposed dynamics caused by adding Level 2 mechanics (i.e. betting on the change in other's image score) is not straightforward in general. As is described later in this section, a reasonable behavior induced by it is to promote altruistic behavior of (non-altruistic) others.

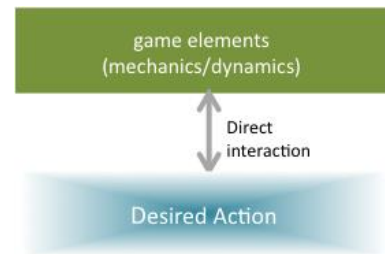


Figure 2: Basic Gamification Scheme

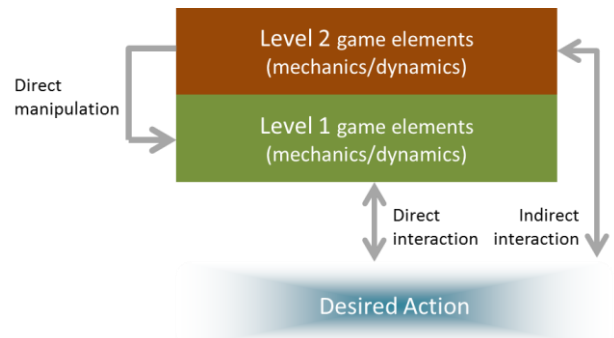


Figure 3: Two Layer Gamification Scheme

## Level 1 gamification

Image score, that is one of the core elements of the theory of indirect reciprocity, is quantified and shared as *points* in Level 1 layer. We seem to have a psychological disposition helping the image scoring mechanism work and thus making altruistic behavior adaptive, to a greater or lesser extent. In this sense, gamification here is used for leveraging our innate ability to support cooperative relationships between humans instead of creating some new motivation to do a target behavior by offering an extrinsic reward.

In the Level 1 system (Figure 4b)), each user anonymously approves some behavior from another user as altruistic. When User A approves User B as the most altruistic member towards A (or the people including A), some proportion of points (10% in the prototype) of A is moved to B. All users select a user every set timing that depends on the situation the gamified system was introduced (e.g. every after meeting or until Friday night every week). If a user does not select, one of the users is selected randomly.

The approval of altruistic behavior completely depends on its recipient, and this uncertainty can create an opportunity for thinking and learning concerning how to perform better altruistic behavior, in contrast with the case of simple money systems with a certainty (Figure 4a)). The adopted point-collection mechanism can also create a specific innate drive to increase own points other than pure motivations which typical gamification systems create (e.g. respects from others and self-actualization). As the increase in points of B is proportional to the points of A, B is better off doing altruistic behavior to a user with more points. Therefore, if a user wants to increase the probability to get altruistic behavior, she should increase her points in some way.

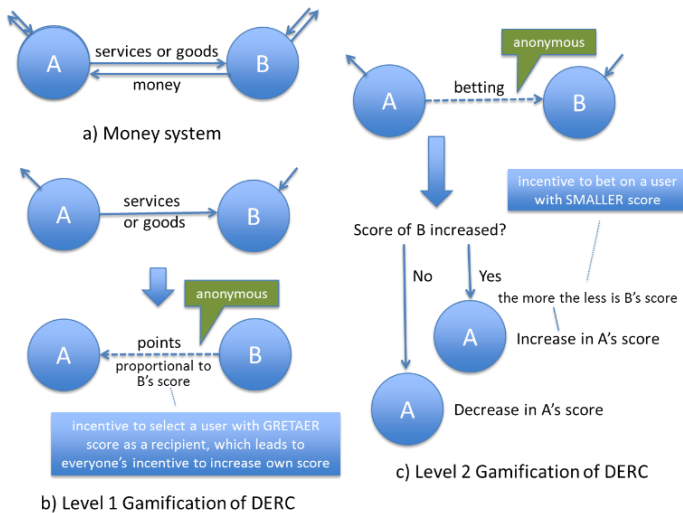


Figure 4: Basic Operations in a) Simple Money System, b) Level 1, and c) Level 2

## Level 2 gamification

Adding Level 2 gamification can give users a gameful experience by manipulating the points of users in Level 1. For this purpose, in the prototype, we introduce a betting

system applied for predicting which user will increase her points (Figure 4c)). Specifically, users can bet their arbitrary points on a user likely to increase her points by the next set timing. When selecting, the odds (multiplier) are assigned to users and are presented to all users. If her prediction is correct, she will receive her bet points multiplied by the odds corresponding to the user she bet on. Otherwise, she will lose a half of her bet points.

A possible behavior which Level 2 system can generate is to increase the probability of an increase in the points of the User A whom she bet on by assisting A in performing altruistic behavior. As an additional mechanism, the system assigns greater odds to persons with fewer points. The intention of this design is that users who are not altruistic should have more opportunities to become altruistic. Suppose that this gamified system is introduced for making regular discussion more fruitful and User A just bet on User B. A successful strategy for A to increase the points of B should be to bring up a subject concerning programming in the next meeting if he is good at programming.

## Loop dynamics induced by dual layer gamification

Engagement is the most important aspect all gamification projects aim at. It should be attained using some continuous loop dynamics. Figure 5 (top) shows a basic loop dynamics consisting of motivation -> targeted action -> reward. Gamification projects tried to achieve the loop dynamics, which, however, seems very difficult as is shown by Rapp (Rapp 2015).

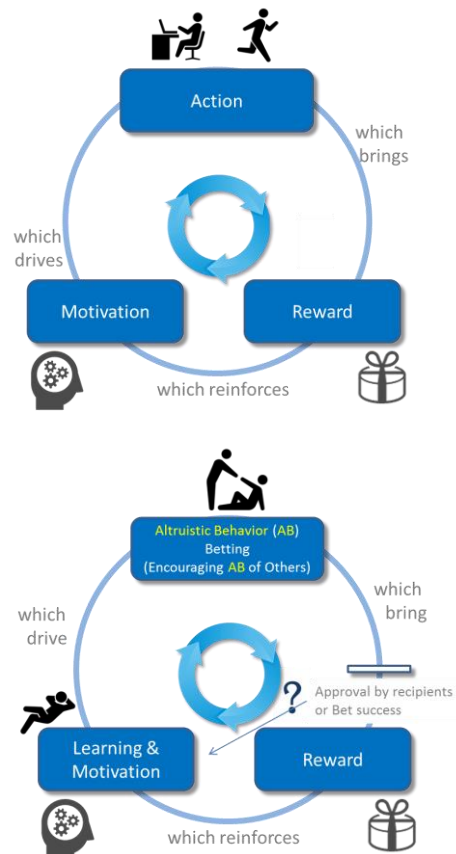


Figure 5: Loop Dynamics of Basic Gamified System (top) and the System with Two Layer Gamification (bottom)

The platform has a dual-layer structure shown in Figure 5 (bottom), which expands the strategies of users and aims at achieving a loop dynamics to promote intrinsic motivation by providing users with gameful experience. Users are promoted to consider and learn what kind of behavior will be positively accepted by each specific member or how the advantage of each member is utilized. It should solve or reduce the pattern-bounded problem resulting in a decreasing the intrinsic motivation of users.

In general, this type of mutual surveillance or evaluation using gamelike techniques can increase the psychic cost (i.e. the uncomfortable sensation of being watched and measured) which might stifle creativity and flexibility (Manjoo 2014). However, multiple ways of scoring including approved altruistic behavior and successful betting, and anonymity and randomness in approving altruistic behavior can decrease the psychic cost. For example, a user with a high score is not necessarily altruistic, but might be just good at betting.

## PROTOTYPE IMPLEMENTATION AND PRELIMINARY EVALUATIONS

### Prototype implementation DERC

DERC was implemented as a web application using HTML, PHP and Java script. The database component was implemented using SQL. Users can access DERC to see the change of her own points, select the most altruistic user to her or select a user she wants to bet on. According to the approval of altruistic behavior and the success of betting, points of all users are updated at the fixed timing. Odds are assigned on an equal interval basis with 1.2 to the member with the most points and 3.0 to the member with the fewest points.

DERC can be introduced into basically any kind of social groups where altruistic behaviors are needed. It will be customized depending on the situation into which it is introduced. Hereafter, two cases are assumed in the explanation. In Case 1, DERC is introduced to some organization or community in order to increase altruistic behavior in not specific but general social relationships, and in Case 2, DERC is introduced to regular meetings to activate the discussion.

The DERC user interface is specially designed for use with smartphones and tablets (Figure 6). In case 1, by the end of the period, each user selects a user who is most altruistic towards her during the period, and, if she wants, bets some her points on a user who is likely to increase his points during the next period considering his odds. In Case 2, after each meeting, each user selects a user who said something most useful to her during the meeting, and, if she wants, bets some points on a user who is likely to say something good in the next meeting also considering his odds. The administrator user interface allows a person who introduced DERC to the group or organization to see the status of system utilization and the usage history of each user (Figure 7).

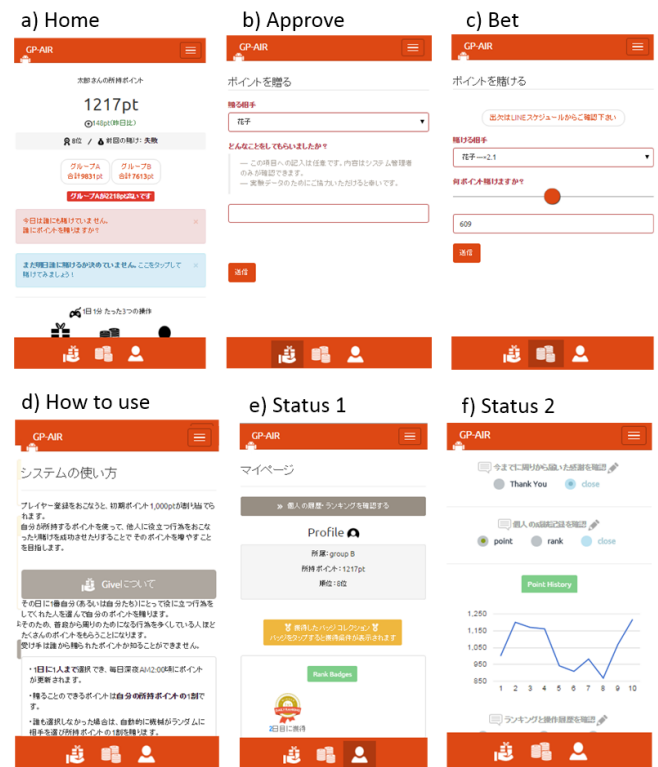


Figure 6: Screen Shots of User Interface

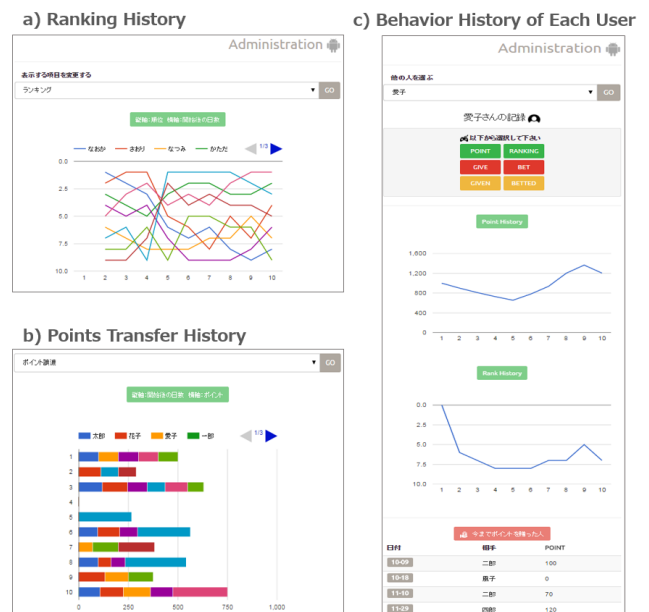


Figure 7: Screen Shots of Administrator Interface

### Preliminary evaluations

We have conducted preliminary evaluations with the prototype DERC seven times since July 2013. The first four evaluations were very preliminary in the sense that their purpose was to develop and improve the basic design of the platform, and the users were the approximately 20 volunteers in our laboratory. The targeted situations were general social

relationships (six times) and discussion at meetings (once). The recent three evaluations were conducted with approximately 10 volunteers each from ACE (action group for cross-cultural exchange) in Nagoya University (twice) or GRAMPUS, Nagoya University American football team (once), all targeted to general social relationships. Each of the recent three evaluations conducted questionnaire surveys two or three times: before (, in the middle of) and after each period, which asked the change in the consciousness, attitude and behavior concerning altruistic behavior from various perspectives, mainly using a multiple choice format.

The results of the conducted evaluations, especially with the current implementation described above, can be summarized as follows.

- 1) Almost all users enjoyed the gameful experience and few users felt the psychic cost.
- 2) Approximately a half of the users did an altruistic behavior promoted by DERC.
- 3) Successful Level 2 gamification needs successful Level 1 gamification. In other words, the motivation to access DERC and increase her points supports the consideration of the betting. After realizing that, we implemented a badge system from which badges can be obtained by satisfying various conditions (Figure 8).
- 4) There was a diversity of strategies to get points. For example, some users focused more on Level 1 (performing altruistic behavior) and some more on Level 2 (successful betting).
- 5) It was gradually shown that making a person make another person be altruistic is difficult more than we had thought. Few users behaved as our Level 2 design intended. However, we believe that this type of process of trial and error itself is essential to improve social relationships, for example, from the perspective of *action research* (Reason and Bradbury 2007).
- 6) Some unexpected comments were obtained in questionnaire responses, including the one that the user became altruistic towards non-users and out of the period, affected by DERC. Although there is no intention here to generalize this comment, it would be important when considering whether the enhanced motivation was intrinsic or extrinsic (Ryan and Deci 2000).



Figure 8: List of Badges (left) and Fulfillment Conditions to Unlock Them (right)

## CONCLUSIONS

This paper proposed a platform of gamified systems with a dual-layer structure, responding to the criticisms that conventional gamification simply with a layer of game elements promotes a simple behavior pattern that does not require learning or thinking and is unable to maintain the level of engagement. We focused on the promotion of altruistic behavior in daily social contexts and presented preliminary evaluations of the prototype implementation. The implemented prototype was designed primarily for promoting cooperation based on the theory of indirect reciprocity with image scoring. However, we believe that emphasizing the altruistic behavior by quantifying and sharing the image score tends to have a positive effect on other mechanisms including direct reciprocity and upstream indirect reciprocity.

The most familiar difficulty when understanding the evolution of cooperation or designing a better society (e.g. mechanism design) is the free-rider problem. In the proposed system, altruistic users tend to increase their points, and the users whose behaviors are not approved as altruistic are considered as free riders. At the same time, there is another way for increasing points and furthermore, being free riders without seeming to be free riders: betting. However, the most successful strategy of free riders is to let other free riders be altruistic. Utilization of free riders for eliminating free riders might be the most remarkable feature of DERC.

The platform could be extended in several directions. We are implementing real-time version of DERC for stimulating discussions, in which during meetings, using a small dedicated device each participant approves a remark of another participant as altruistic, and it will be recognized by vibration of the device. Another promising direction might be incorporation of population structure (groups) expecting the effect of multilevel selection (Ichinose and Arita 2008), or consideration in the game dynamics, of mental representation (e.g. theory of mind) (Arnold et al. 2015).

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