

Rapid Communication

Collaborate and Share: An Experimental Study of the Effects of Task and Reward Interdependencies in Online Games

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ABSTRACT

Today millions of players interact with one another in online games, especially massively multiplayer online role-playing games (MMORPGs). These games promote interaction among players by offering interdependency features, but to date few studies have asked what interdependency design factors of MMORPGs make them fun for players, produce experiences of flow, or enhance player performance. In this study, we focused on two game design features: task and reward interdependency. We conducted a controlled experiment that compared the interaction effects of low and high task-interdependency conditions and low and high reward-interdependency conditions on three dependent variables: fun, flow, and performance. We found that in a low task-interdependency condition, players had more fun, experienced higher levels of flow, and perceived better performance when a low reward-interdependency condition also obtained. In contrast, in a high task-interdependency condition, all of these measures were higher when a high reward-interdependency condition also obtained.

INTRODUCTION

THE MASSIVELY multiplayer online role-playing game (MMORPG) is a representative type of online games in which many users can play a role-playing game simultaneously in a shared environment.¹ What distinguish a MMORPG from a single-user game are the shared experience, the collaborative nature of most activities, and the rewards of participating in those activities. The experience of collaborative play has been found to increase

gamers' enjoyment and the popularity of the game. For this reason, most online games, especially MMORPGs, are designed to generate interdependencies among players that lead them to interact with each other. Interdependence is the extent to which a person depends on or relates to others.² Design features for interdependencies in the context of MMORPGs induce a player to depend on, relate to, or interact with other players.

Despite the importance of interdependencies in MMORPG games, few studies have offered empir-

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ical validation of the causal relationships between interdependencies and player perceptions and performance. The dearth of empirical validation may stem from the technical difficulty of manipulating the interdependencies at work in them.

Drawing from prior studies of interdependency in psychology and sociology, this paper presents two game design features, task and reward interdependency, and offers research hypotheses regarding their impact on players' perceptions and performance. To test our hypotheses, we conducted a controlled-experiment study using an existing full-scale MMORPG and manipulating the two interdependencies by modifying the source code of the game. The results indicate that the two interdependencies have a significant interaction effect on the performance and perceptions of MMORPG players.

INTERDEPENDENCY

The core of a group is the interdependence among its members.² Interdependence is often the main reason for forming groups in the first place, and it is generally taken to be a defining characteristic of groups.³ MMORPGs have two primary types of group: the party, which comes together to complete a particular task and may disband when it is done, and the guild, a community based on long-term common interests.

We focused on two forms of interdependency—task and reward interdependency—frequently mentioned as important design features. We have chosen these two forms because what draws many players to MMORPGs is the shared experience: the collaborative nature of most tasks and the rewards of achieving them collectively.

Task interdependency is the degree to which an individual's task performance depends on the efforts or skills of others.⁴ Task interdependency can vary from very low, as in a task performed by one person who has all resources necessary to complete it, to very high, as in a collective task whose successful completion absolutely depends on the input of multiple individuals.⁵

Reward interdependency is the extent to which the rewards an individual receives depend on the performance of his or her colleagues.⁶ Thus, unlike task interdependency, reward interdependency is a function of the distribution of work outcomes. A reward system with the highest interdependency is one in which rewards accrue to the group on the basis of collective performance and are distributed among members equally, independent of individ-

ual performance, as in an organization-wide profit-sharing scheme. Such a scheme is also called equity reward allocation.⁷ A scheme with low reward interdependency is one in which rewards are earned on the basis of individual performance, as in, for example, the commission a salesperson receives for completing a sale. This type of scheme is also called parity reward allocation.⁸

RESEARCH HYPOTHESES

We hypothesize that there will be an interaction effect between task and reward interdependencies on fun, flow, perceived performance, and objective performance in MMORPGs. When task interdependency and reward interdependency are high, players will have more fun, will be more likely to experience flow, will perform better, and will perceive their performance as better. When task interdependency is high, players exchange more information—for instance, planning how to defeat opponents and coordinating their attack. Players also assist one another more through task-driven interactions, as when they collaborate to save the life of a team member who is close to death; while they continue the battle, the injured player may rest and recuperate, and later, when others are in trouble, he or she may help them in turn. This interdependency builds trust and intimacy among players and also motivates them to maintain good relationships with each other. A system that divides rewards equally will preserve the group's harmony and invite players to recall times past when they helped or were helped by other members. Any unease a player might feel at not getting his or her due should be offset by the pleasure taken in feelings of companionship and good will—pleasure that should form a basis for having fun and experiencing flow. Also, a player's trust in the system may also lead him or her to more vigorous efforts and thus to better perceived and objective performance. In sum, in a high task-interdependency condition, the bonds of cooperation should lead players to have more fun, more flow, and better performance if reward interdependency is high.

Conversely, we predict that in a low task-interdependency condition, players will have more fun, experience greater flow, and perceive and demonstrate better performance, when a low reward-interdependency condition also obtains. When task interdependency is low, each player attacks opponents individually and is mostly unaware of what other team members are doing. Players exchange information about monsters or the location of other

team members less frequently than players in a high task-interdependency condition. Thus, whether a player lives or dies is mostly in his or her own hands. A player in this position will likely prefer to receive rewards for his or her own performance rather than an equal share of the group's rewards. This arrangement will seem fairer and may create pleasurable feelings of independence, self-sufficiency, and achievement—feelings that will make the game fun to play and induce an experience of flow. Also, a sense of distributive fairness should lead players to make more vigorous efforts, enhancing their performance both objectively and in their own perceptions. In sum, in a low task-interdependency condition, players' autonomy should lead them to have more fun, more flow, and better performance if reward interdependency is low.

METHOD

A pretest was conducted to establish the experimental design and procedure. Two results from the pretest are worth mentioning. First, we detected huge individual differences among participants in their feelings about and performance in the games. Accordingly, we set all independent variables in the experiment as within-subject factors. Thus, the main experiment had a 2 (low vs. high task interdependency) \times 2 (low vs. high reward interdependency) within-factor design. Second, a standard experimental session of one or two hours was found to be too short to provide subjects with typical MMORPG situations. Therefore, it was thought appropriate to conduct the experiment in three sessions over three consecutive days.

Participants

Eighteen people who had never played a MMORPG before were recruited to participate in the study in order to minimize differences of familiarity and skill. The average age of the subjects was 23.4. Genders were balanced.

Experimental apparatus

We constructed our own MMORPG system using three personal computers and a game server to which only study participants had access. The server used a manipulated version of a free, popular commercial MMORPG. Thus, our testing environment was not just a mock-up with limited functions but a full-blown MMORPG with professional-quality graphics and sound and full func-

tionality. Subjects felt they were playing a real MMORPG.

To create two levels of task interdependency, we varied the strength of the monsters players would encounter. For the low task-interdependency condition, subjects could play the game individually, even though they were part of a team: that is, most monsters were weak enough that one player could kill them without any help from other team members. In this condition, each monster dropped one item when killed. Conversely, in the high task-interdependency condition, most monsters were more powerful than the players, and subjects could only kill them by working together. In this case, we had each monster drop three items when they died.

We manipulated reward distribution to create a pure individual (low interdependency) allocation and a pure group (high interdependency) allocation. In the low reward-interdependency condition, subjects earned items according to their own performance in killing monsters: they received items dropped by monsters they killed on their own, and the items dropped by monsters killed collaboratively fell nearest the player who had the greatest part in the victory. In the high reward-interdependency condition, the program was manipulated so that all items earned by killing monsters were distributed equally, regardless of individual performance, after each game period.

Procedure and measures

All participants came to the laboratory three times over three consecutive days. In all cases, subjects played the game separately from other players, in a room of their own, but in the company of an experimenter. In order to minimize the effect of the experimenters' presence, we used a standard script and ensured that no subject was accompanied by the same experimenter twice. All game devices were the same in all rooms.

On the first day, all participants were shown how to play the game: how to move the character, attack monsters, pick up items, and so on. On the second and third days, subjects played the game together in teams of three. Though in their own rooms for the duration of play, subjects could interact with their team members through chat windows on the screen. On the second day, some teams played in the low task-interdependency condition and others in the high task-interdependency condition. On the third day, each team played in the task-interdependency condition they had not played in the day before.

Meanwhile, all dependent measures except objective performance were based on items from the

paper-and-pencil 10-point Likert scale questionnaire administered after each session of play. Questions were adopted from prior related studies. Fun was an index of three adjectives: enjoyable, exciting, and fun.⁹ Flow was an index of three items following Novak et al.¹⁰ Perceived performance was an index of three items following Hsu and Lu.¹¹ Finally, objective performance was measured as the number of items a player obtained during play.

RESULTS

All analyses were based on a full-factorial 2×2 analysis of variance (ANOVA), with task interdependency and reward interdependency as within factors.

As hypothesized, there were significant interaction effects between task and reward interdependencies on fun ($F(1,17) = 5.04, p = 0.038, \eta^2 = 0.229$). In the low task-interdependency condition, participants had more fun when they received rewards on the low interdependency scheme. Conversely, in the high task-interdependency condition, participants had more fun when they received rewards on the high-interdependency scheme.

There were also significant interaction effects between task and reward interdependencies on flow ($F(1,17) = 4.62, p = 0.046, \eta^2 = 0.214$). In the low task-interdependency condition, participants experienced more flow when they received rewards on the low-interdependency scheme. Conversely, in the high task-interdependency condition, subjects experienced more flow when they received rewards on the high-interdependency scheme.

Our hypotheses on perceived performance were also supported: there were significant interactions between interdependencies on perceived performance ($F(1,17) = 6.03, p = 0.025, \eta^2 = 0.262$). In the low task-interdependency condition, participants thought they showed a stronger performance when they received rewards on the low-interdependency scheme, while in the high task-interdependency condition, subjects felt they had a stronger performance when they received rewards on the high-interdependency scheme.

Finally, there were no significant interaction effects between task and reward interdependencies on objective performance ($F(1,17) = 0.01, p > 0.05, \eta^2 = 0.001$).

CONCLUSION

We predicted interaction effects between the task- and reward-interdependency conditions on player

perceptions and performance. A controlled experiment supported most of our hypotheses: in the high task-interdependency condition, players had more fun and experienced greater flow when a high reward-interdependency condition obtained. Conversely, in the low task-interdependency condition, players had more fun and experienced greater flow when the low reward-interdependency condition obtained. As for performance, while our hypotheses for perceived performance were supported, those for objective performance were not. That is, in the high task-interdependency condition, though players did not actually perform better under the high reward-interdependency scheme, they perceived that they did. Similarly, in the low task-interdependency condition, players performed no better under the low reward-interdependency condition but perceived that they did.

The inconsistency between objective and subjective performance can be explained in terms of different kinds of rewards: rewards of facility, which are objective, and rewards of glory and distinction, which are perceived.¹² The former in this case would include items won by killing monsters, the latter such things as getting all the way to the end of a game, completing a particularly difficult quest, or defeating the designs of clever opponents. Players in the high task-interdependency condition have killed powerful monsters together and thus share the rewards of glory with their team members. Equal distribution of rewards of facility (items) might lead them to identify more strongly with their team, to feel the shared glory more vividly, and thus to assess their own performance more positively. Conversely, in the low task-interdependency condition, the rewards of glory accrue not to the group but to each individual player. Players are likely to feel proud primarily of their own performance—and thus to feel more glory and to assess their own performance more generously when rewards are allocated according to achievement. These operations are independent of their objective performances, which appear not to be affected by reward interdependency.

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