Faster is Better: The Speed of Player Character Growth affects Enjoyment and Perceived Competence

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ABSTRACT

The Self-Determination Theory (SDT) predicts that people tend to be proactive and engaged in activities that can satisfy three specific intrinsic needs: 1) the need for competence: the innate desire to grow our abilities, 2) the need for autonomy: the innate desire to be the causal agent of our own life, 3) the need for relatedness, or for meaningful interactions with others. The SDT turned out to be a highly successful tool for investigating video games under several perspectives. In more than 15 years of research, it has been constantly found that the most successful, engaging, and fun video games are the ones that satisfy the intrinsic needs of competence, autonomy, and relatedness. Here, we put to the test the SDT predictions by manipulating the amount of reward given to the player within a commercial video game, *Torchlight II* - in opposition to applied games and gamified application used in previous studies. Game metrics, video recordings, and self-reported feedback have been collected and analyzed from two groups of video game players that participated in a 60-minutes play session: a) the control group played the standard version of the game, while b) the experimental group played a version of the game that provided five times the amount of rewards. Results showed that the speed of player character growth affected the participants' perceived competence and their enjoyment of the game, although the game metrics indicated that the two gameplay sessions were objectively almost identical. Considerations for games researchers and game designers are presented.

CCS CONCEPTS

• Human-centered computing → User studies; Empirical studies in HCI; • Applied computing → Computer games;

KEYWORDS

Self-determination theory; Game Design; Rewards; Video Games;

INTRODUCTION

Video games have been catching the attention of academics since their infancy as an industry during the eighties [12]. One of the most researched topics is the motivational power of this media and why video games are so successful at engaging their users [1, 2, 17, 26] – as also demonstrated by the emergence of the "gamification" phenomenon [5], see [11] for a recent review. The Self-determination Theory, a macro theory of human motivation, proposes that people behaviors are determined by three specific intrinsic needs: 1) the need for competence or the innate desire to take part in activities which allows us to feel capable and effective, 2) the need for autonomy or the need to experience freedom in the activities we choose, 3) the need for relatedness or the need to feel a sense of meaningful connection to others [3, 4, 20, 21]. In more than 15 years of research, a number of researchers applied SDT specifically on video games and constantly found that the most successful, engaging, and fun video games are the ones that satisfy the intrinsic needs of competence, autonomy, and relatedness [17, 18, 22]. However, those studies focused on testing SDT predictions using different commercial video games thought to differ *a priori* in needs satisfaction [9, 22], or some specifically created ones [10, 15]. In the present study, SDT has been put to test by manipulating one single feature of a commercial video game – thus maintaining a high level of control on the experimental conditions, and at the same time retaining a high degree of ecological validity. Our hypothesis was that by improving the amount of reward given to the player, the need for competence would be satisfied to a greater extent, with a positive influence on enjoyment.

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RELATED WORK

Ryan, Rigby, and Przybylski [22] tested the validity of SDT by employing several commercial video games. For example, in study number 2 (ibid. p. 353), they pre-selected two titles according to their position in a game ranking survey, and they anticipated that participants would rate the amount of their perceived competence and autonomy satisfaction differently. The high-rated title would be better at satisfying the psychological needs identified by the SDT, while the low-rated game would be lacking at doing so.

In a following work, Rigby and Ryan [18] went beyond the general differences between games (i.e., good or bad) and they described in greater detail the role of game design elements in affecting the satisfaction of psychological needs. They reviewed a great variety of video games genres: music games, shooters, sports/driving games, platformers, role-playing games, etc.

A similar approach (but this time empirical) has been taken by Johnson et al. [10] and Phillips et al. [16] in the study of a specific game mechanic: the impact of virtual rewards on the player experience. They created a videogame with three levels of rewards and found that effort, enjoyment, and presence significantly increased when all rewards were present in comparison to the conditions in which only some of them were presented to the players.

Peng et al. [15] created an exergame where specific SDT needs supporting features were manipulated: for example, the need for competence was satisfied with the support of 1) a dynamic difficulty adjustment mechanism, b) a "heroism meter", i.e., a cumulative score, c) achievements badges for the player. In the context of gamification studies, similar empirical researches have been performed by Sailer et al. [23], and Meckler et al. [14]: specific game design features have been manipulated in two repetitive and not particularly stimulating nor motivating tasks: a "handling of materials and supplies" simulation and an image annotation (i.e., tagging) task.

In summary, SDT predictions have been empirically tested using either a) commercial video games in a general context [19], or b) non-commercial video games [e.g., 10, 16, 17] or gamified activities in a controlled context [e.g., 14, 24]. Here, we wanted to close the gap by employing a commercial video game with the manipulation of a specific game design feature, i.e., the amount of reward given to the player.

EXPERIMENT

According to SDT, a video game player will appreciate to a greater extent the video game that is better at satisfying their needs for competence, autonomy and relatedness. We hypothesized that the same video game can be preferred *over itself* if the amount of reward for any accomplishment within the game is enhanced.

A comparison was performed between two versions of a commercial videogame: the "standard" one, and a second version with an enhanced XP reward curve (cf. later) Please note that everything else has been kept constant across the two experimental groups we compared. The "enhanced reward" version of the game should obtain more success because of its ability to satisfy to a greater extent the need for competence, thus eliciting a higher level of enjoyment [18, 22].

Among the various game design features, the reward curve has been chosen because it is considered one of the most impactful and ubiquitous features in game design and gamification [11, 22].

THE VIDEO GAME

The game employed in this study was *Torchlight II* [19], an action-role playing video game. A role-playing game (or RPG) is a game genre where the player controls the actions of one character (or more characters within a group, called *party*) that embarks on a series of difficulty-increasing quests in a narratively well-defined world. This player character has quantifiable features such as a *level number* and several *attributes* expressed by a score. Character progression is used as an essential measurement of achievement: successful advancements in the game translate into experience points (*XP points*) through which the player character can "level up" to new powers and skills [26]. In *Torchlight II*, every new level provides the player with attribute points that they can use to improve their player character in: Strength (increases weapon damage), Dexterity (increases the chance to dodge enemy attacks and perform critical strikes), Focus (increases magic damage), and Vitality (increases health). At the core of the game, there is a loop between playing, collecting, and improving as in figure 1.

Figure 1: *Torchlight II* gameplay loop.

The additional term "action" in "action-RPG video game" specifies that the gameplay is focused more on dynamic aspects (such as combat and exploration), and less on logic (such as puzzles).

In summary, genre distinguishing features of action–RPG games are: 1) a strong emphasis on character development, 2) a considerable freedom for the player to choose their own way to play the game – thanks to a great number of game contents (i.e. missions, enemies, equipment, etc.), 3) a higher accessibility in comparison to traditional RPGs. These three features justified the choice of using *Torchlight II* in the experiment: a game with a gentle learning curve that could guarantee adequate support of the needs of competence, autonomy, and relatedness.

THE VIDEO GAME: MANIPULATION

The core of the game implies gathering experience points in order to level up, and thus improve the player character's attributes. In turn, these improvements allow the player to undertake even more difficult quests, unlock game areas with more dangerous enemies, and dedicate their attention to more rewarding activities – in turn, this speeds up the improvement process.

Obtaining XP is a central part of the gameplay of *Torchlight II*. Each kill of an enemy will give the player some of it, while finished quests give even more. The amount of XP points that each activity releases to the player (the XP reward curve) is carefully determined by game designers who set their vision of what is the "right" way of playing. Also, the relationship between the number of XP points and the thresholds for leveling up (the XP thresholds curve) has to be carefully set by game designers according to their vision. The common strategy is to build a progressive curve: players quickly level up during the early stages of the game (i.e., the XP points needed to level up are in the tens) but they have to collect more points in order to reach higher levels (i.e., the XP points needed to level up are in the tens of thousands and more).

However, more than a game design strategy, this is the direct application of the Weber-Fechner law, which describes the relationship between the actual change in a physical stimulus and the perceived change, established by the founders of psychophysics in 1860 [6]. In the context of role-playing games, players need a logarithmic increase of XP to feel the same progress pace when the leveling up curve is represented by a linear relationship [7]. In *Torchlight II*, designers used, to a similar result, a linear function for the XP reward curve and a quadratic function to represent the XP thresholds curve.

Here, a new experimental condition has been introduced by multiplying by a factor of 5 the standard XP reward curve, which serves as a control condition. The manipulation has been made using the embedded game editor which allowed to change the game under several aspects. In figure 2, the standard condition is represented with a dotted black line (1x XP reward curve); the experimental condition is represented with a black line (5x XP reward curve); the XP threshold curve (dotted red line) remained the same.

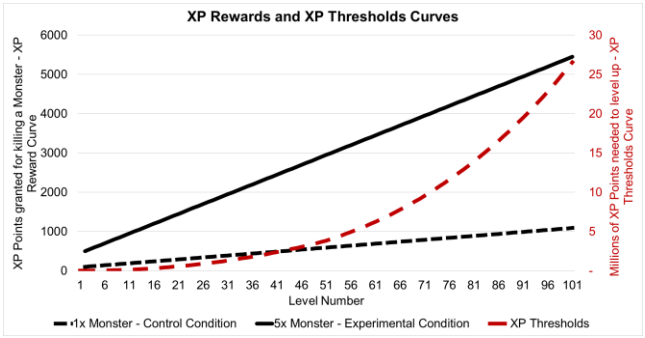

Figure 2: The XP reward curve (dotted black line) and XP thresholds curve (dotted red line) of the standard *Torchlight II*. The continuous black line represents the modified XP reward curve.

MEASURES

Two types of feedback have been collected during the experiment: 1) objective and 2) subjective feedback.

Objective measures concerned all the events that happened during the gameplay session, with a focus on participants' actions in the game. The objective measures were collected in three moments during the session: 1) after 20, 2) 40, and 3) 60 minutes of play. To simplify the analysis

of the data, they have been grouped into three sets: 1) Interactions with the Player Character, 2) Interactions with the Environment, 3) Interaction with the Enemies. The first group consisted of the actions related to the player character improvements; the second group included the result of the exploration and interactions with the environment; the third group summarized the actions taken during combat.

Subjective measures concerned participants' thoughts and attitudes towards the video game. Five scales of the Intrinsic Motivation Inventory (IMI) [13, 24] have been employed to assess participants' 1) enjoyment, 2) perceived competence, 3) effort, 4) felt pressure and tension, 5) perceived choice. 30 items on a 7-point Likert-type scale have been translated to Italian and proposed to participants in random order at the end of the session. In addition, a survey with four questions was submitted during the session in three intervals: after 20, 40 and 60 minutes of play. These questions assessed the perceived 1) speed of leveling up, 2) progression in the game, 3) difficulty of the gameplay, and 4) attachment to the game.

PARTICIPANTS

A profiling questionnaire was employed among university students to identify gamers with the following characteristics: 1) be familiar with the PC gaming control layout (i.e., keyboard and mouse), 2) be familiar with the action-RPG video game genre, 3) have not played the commercial video game *Torchlight II*. From a total of 23 respondents (22 males, 1 female), 14 met the above requirements and were subsequently contacted and invited to participate in the study. All accepted and took part in the experiment. Participants were all males, aged between 21 to 37 years old (mean age = 26.35; SD = 3.9).

PROCEDURE

Upon arrival, participants were informed about their gameplay sessions and spontaneous voice comments being recorded. After providing consent, they were instructed on their task: they had to play *Torchlight II*, as they were at home, for a total of 60 minutes, and to compile two questionnaires at specific times during the session. The player character type was kept constant: all used the *Embermage* class with identical statistics at the start – but they were free to assign points to the four attributes at will during the session. Every 20 minutes, they were asked to compile a brief survey while the experimenter was retrieving the objective data relative to the previous 20 minutes of gameplay. After 60 minutes, they were asked to compile the IMI questionnaire. During the test, the experimenter sat behind the participant for giving support if requested, and for observing the PC monitor and taking notes about relevant in-game behaviors. At the end of the session, participants received a debriefing detailing the goal of the research. All participants played on an ASUS ZenBook flip s UX370UA notebook with a 13.3 inches monitor; a Tecknet cordless optical mouse and keyboard have been employed for controlling the pointer instead of the standard touchpad in order to faithfully reproduce the standard PC gamers set-up with this type of games.

ANALYSIS

Objective and subjective data collected within the sessions were analyzed using a mixed Analysis of Variance (ANOVA) with two independent variables: 1) between-subjects "XP reward condition" and 2) within-subjects "Time". The subjective data collected with the IMI scale at the end of session was analyzed with a univariate ANOVA.

RESULTS

Interactions with the Player Character. As expected, participants assigned to the experimental condition saw more significant growth in the level of their player character in comparison to the control condition ($F_{(1,12)}$=45.194 p<.001). Post-hoc comparisons showed that the most substantial difference happened within the first 20 minutes of play, although the difference met statistical significance throughout the session – see figure 3.

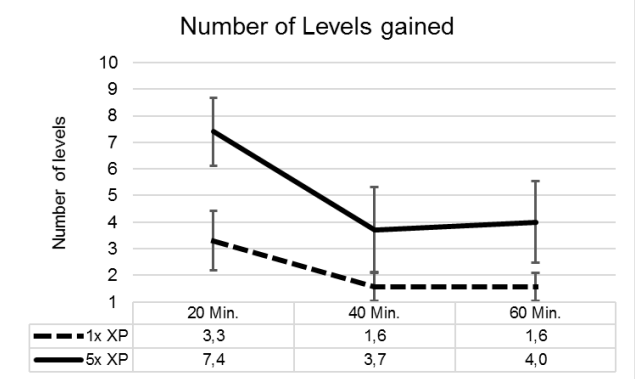

Figure 3: The mean number of levels gained in the two conditions during the session. Error bars represent standard deviation.

Consequently, the number of points assigned to the four attributes is higher in the experimental condition. However, when considering the percentage of points assigned to the four attributes, we found that only Strength is close to significance (p=.056): participants in the 5x XP

condition invested more points on improving their attack power - see figure 4.

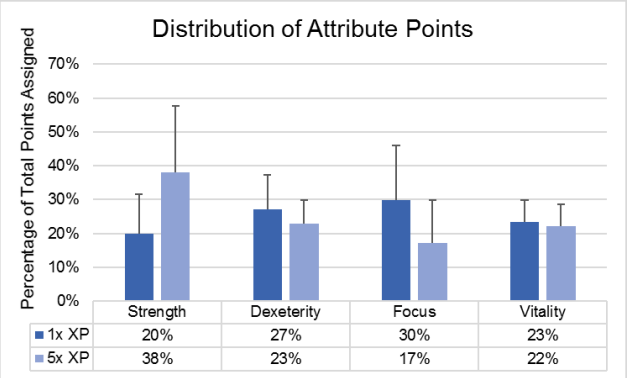

Figure 4: The distribution of attributes points across Strength, Dexterity, Focus and Vitality. Error bars represent standard deviation.

Interactions with the environment. No significant differences were found for the following game metrics: collected gold, steps taken, completed missions, traps activated, portals used, collected loot. The only significant result concern the number of destroyed objects: participants in the control conditions destroyed more objects (1x XP: 60; 5x XP: 44; $F_{(1, 12)}=10.265$ $p<.01$).

Interactions with the enemies. Again, no significant differences were found between the 1x and 5x XP conditions for the number of enemies killed (normal and bosses), health potions used, player character deaths, maximum damage taken The only significant result concern the maximum damage inflicted with one hit: 5x XP participants inflicted more damage (1x XP: 99; 5x XP: 135; $F_{(1, 12)}=11.24$ $p<.01$).

Subjective experience. Participants assigned to the experimental group rated the speed of leveling up faster than the control condition (1x XP: 4.1; 5x XP: 5; $F_{(1,12)}=5.562$ $p<.05$). The significant interaction ($F_{(1.59, 19)}=4.709$ $p<.05$) and post hoc comparisons showed that the ratings differed only in the first 20 minutes. On the other hand, there is no difference between how participants rated progression (1x XP=4.9; 5x XP=4.7; p=0.708), difficulty (1x XP=2.8; 5x XP=3.1; p=.46), and attachment to the game (1x XP=3,3; 5x XP=4.8; p=.09).

IMI scales. Reliability of the five scales has been tested using Chronbach's Alpha: the range of values were between .946 for the Interest/Enjoyment scale and .604 for the Effort/Importance scale. Significant differences have been found in two scales: Interest/Enjoyment (1x XP=3.5; 5x XP=5; $F_{(1,12)}=4.759$ p=.05) and Perceived Competence (1x XP=4.2; 5x XP=5.3; $F_{(1,12)}=5.368$ $p<.05$). The graph in figure 5 depicts the scores in the five scales.

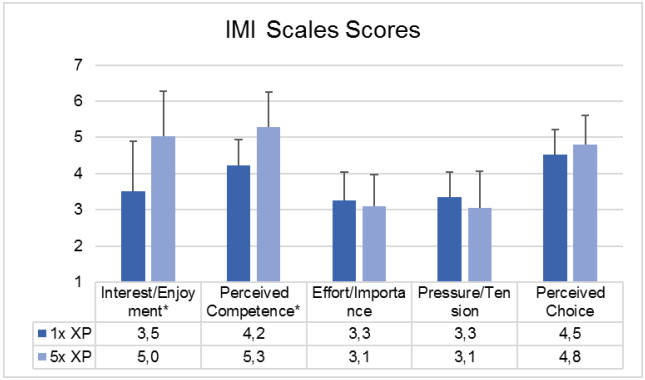

Figure 5: IMI scores for Interest/Enjoyment, Perceived competence, Effort/Importance, Pressure/Tension, and Perceived Choice.

DISCUSSION

The purpose of this research was to test whether increasing the XP points given to the players for any in-game accomplishments in an action-RPG game could lead to a higher level of competence satisfaction and consequently to a higher enjoyment of the game, as predicted by the Self Determination Theory.

Two groups of video game players were asked to play two different versions of the game *Torchlight II*: the commercially available version, and a modified version that granted players with five times more XP points. Objective data were compared between the two groups in order to control for any difference in the gameplay (i.e., what they did). Subjective data ware compared to search for differences in their experience of the game (i.e., what they think), and to test our hypothesis.

Our results indicate that perceived competence ratings were indeed higher for the participants assigned to the enhanced XP reward condition. Also, the Interest Enjoyment subscale received higher ratings in this condition. It is interesting to note that participants were aware of this boost in XP because they rated the speed of leveling up as faster in comparison to the control condition. However, they did not experience the gameplay differently from the control condition: both groups rated progression as rather adequate, difficulty as low, and attachment to the game as average. The few objective differences found concern expected and derivative results: the number of levels gained, attribute points assigned, maximum damage inflicted.

Taking these results together, it is reasonable to conclude that the XP reward manipulation was able to elicit a higher degree of perceived competence and enjoyment without altering the original designers' vision since no substantial differences have been found in the way participants played the game. Designers may take advantage of this result by balancing their titles accordingly.

This research is our small contribution to bridging the gap between the academic and business cultures [8].

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