

An Analysis of Peer Presence Social Group Dynamics to Enhance Player Engagement in Multiplayer Games

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Abstract—In this paper, we seek to identify game design paradigms that enhance the player experience for multiplayer games in regards to engagement and immersion through social group dynamic emphasized level design based on peer presence. In order to identify these paradigms, we developed a 2D platform game consisting of several scenarios designed to invoke different sub-categories of peer presence social group dynamics such as group cohesion, peer pressure, leader-observer social identity role distribution and black sheep effects. We argue that risk and reward core game mechanics can be carried out or reinforced by the social group dynamics phenomena. A group of participants was monitored through gameplay, and administered surveys prior to, as well as following the game experience.

Our study successfully found game design patterns which highlight specific behaviors within group dynamics, especially group cohesion and time-sensitive decision making with regards to peer pressure, which, compared to the single-player control group, increase players engagement and immersion during multiplayer gameplay. Our investigations into these player behavior patterns aim to help game designers enhance player experience in multiplayer games.

Index Terms—MMO, Massively Multiplayer Online, Game Design, User Study, Social Group Dynamics, Engagement, Immersion, Multiplayer

I. INTRODUCTION

Games that allow more than one person to play in the same game environment at the same time – either locally or over the internet – are known as multiplayer games. These types of games were developed early in the history of computer games and come in different flavors such as Massively Multiplayer Online Games (MMO). Multiplayer games, and especially MMOs in recent years, have become a cultural and social phenomenon with relevant shares of the game industry revenue. Early multiplayer game designs focused on replacing non-player characters with human players and essentially kept single player paradigms in their design choices. Since the boom of social media, more studies took place in understanding and facilitating social group dynamics [1] as a means for engagement and immersion [2] as well as how to quantify multiplayer, and especially MMO data. The definition of an MMO in scientific literature is to be a highly graphical 2-D or 3-D environment, where players can interact with the game, but also with other human players through "avatars" [3]–[5]. The size of concurrent players is not defined nor

the specific conditions regarding social interaction. However, the main gameplay feature that differentiates MMOs is social dynamics.

This contribution analyzes group dynamics in multiplayer games by investigating several scenarios on a 2D (pseudo-massively) multiplayer platformer. We chose to distill social interaction into its most basic form: peer presence. Although, for MMOs, most modern games of this type involve in-game textual and audio communication as well as complex avatar identity building, we believe that these features are not necessary to study the basic multiplayer game design patterns used in this study. We focus on the overall multiplayer and the general MMO core mechanics rather than the specific MMORPG social interaction mechanics. We aim to understand social group dynamics by equipping a group of participants with a simple identity and put them in a multiplayer environment with different scenarios. Some of these scenarios are designed as "standard" platform levels, some require player to player interaction, collaboration, and competition. By adding other player characters to the game, we seek to identify design patterns where peer presence distinctly contributes to engagement and immersion. To stay in platform-game terminology, the scenarios are also referred later as 'levels' and its sub-levels as 'sections'.

Engagement and immersion in computer games can be described as playful problem solving of a set of gameplay situations which include: objectives, challenges, and rewards [6]. This results in operant conditioning regarding the challenge-reward system. This conditioning can be done through positive reinforcement as well as punishment [7], [8]. Often, game designers create core mechanics which let the player evaluate risk and reward, and toggle anxiety to counterbalance boredom [9]. Multiplayer games, on the other hand, have the potential to offer conditional feedback through social group dynamics by observation and interaction (imitation or direct instruction) with other players [10], [11]. To assess engagement and immersion in games, several methods exist in literature [12]–[15].

The groups in MMOs are mostly collectives [16], which are characterized by large groups of individuals who display similar actions or outlooks. Most MOBAs (Multiplayer Online Battle Arena Video Games) and MMORPGs (Massively multiplayer online role-playing games) consist of this group

type, which is subject of our investigations. Within collectives, other group types such as social groups and primary groups exist [17], but not part of our investigation. Group formation starts with a psychological bond between individuals [18]. In case of a game, this can be cooperative and/or competitive.

Group dynamics are the underlying processes that give rise to a set of norms, roles, relations, and common goals. For each group member, there is a state of interdependence, through which the behaviors, attitudes, choices, and experiences of each member are collectively influenced by the other group members [19]. Norms are the informal rules that groups adopt to regulate members' behavior. Norms refer to what should be done and represent value judgments about appropriate behavior in social situations and have a powerful influence on group behavior. They are a fundamental aspect of group structure as they provide direction and motivation. There are several types of norms, but our interest, in particular, is the descriptive norm, which is a perception of how other people are actually behaving, whether or not their behaviors are approved of [20], [21].

Values are goals or ideas that serve as guiding principles for the group [22] and can be finishing the game or interacting with others like getting help to progress the game. Roles can be defined as a tendency to behave, contribute, and interrelate with others in a particular way. Roles may be assigned formally, but more often are defined through the process of role differentiation [23]. Individual behavior is influenced by the presence of others. Studies have found that individuals work harder and faster when others are present [24].

Acquiring a leading role in MMOs serves the risk and reward mechanic and can lead to reinforcement or, in the case of failure by the leader, subversion of other players' expectations about the current section of the game. In a competitive environment, this failure may induce schadenfreude and can raise ethical questions [25], as well as contribute to one player's black sheep effect [26].

II. METHODOLOGY

A. Game and Testing Setup

We developed a 2D platformer with 5 scenarios (levels), consisting of several sections emphasizing standard platform levels with a focus in peer presence. When playing the multiplayer 2D platformer, our participants were asked to be in the same room and share their in-game identity, the color of the avatar, before the game starts. A survey was conducted prior to, and following the game experience. A control group played all scenarios (except scenario 2, due to its multiplayer dependent game design) in single-player mode.

Our game consists of a main screen, an introduction to the gameplay, and 5 different scenarios. These scenarios have the same theme regarding social group dynamics, and consists of several sections: 4 sections for scenario 1, 3 sections for scenario 2, 2 sections for scenario 3, 3 sections for scenario 4 and one sections in scenario 5. Before the player starts the game, one must choose a certain color for their own avatar and communicate this to the whole group. Once the game starts, all

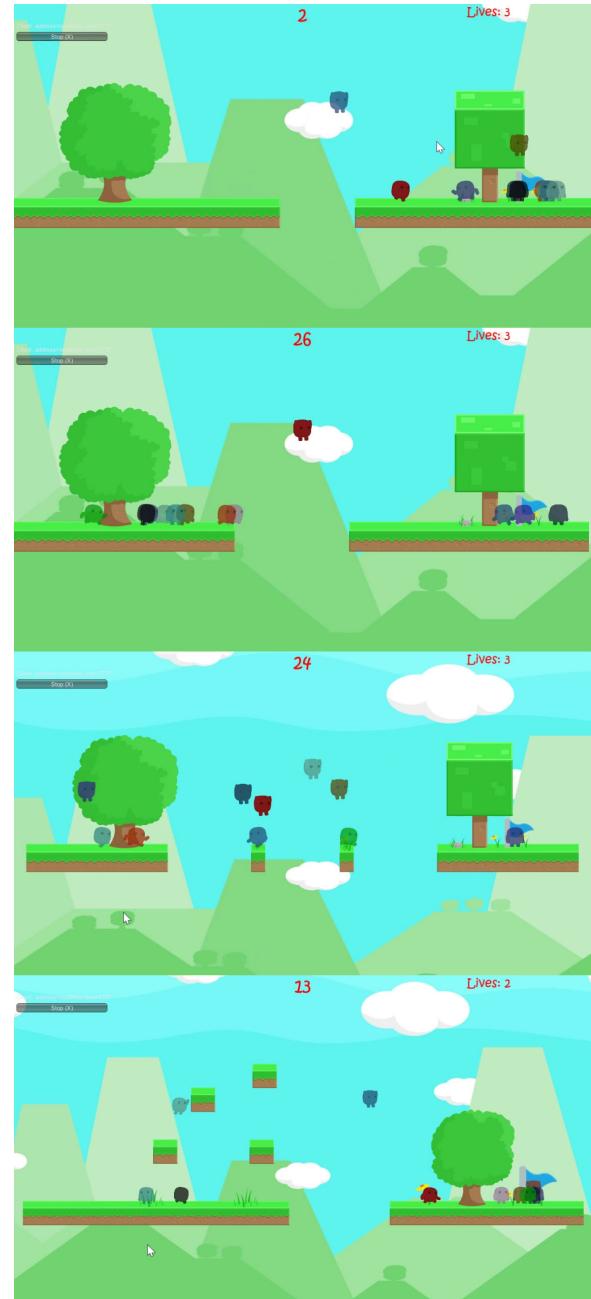


Fig. 1. The first scenario consists of 4 different section, which are themed around one or several pits in the middle of the section, with progressive difficulty to overcome this obstacle.

other players have a 50% transparency in order to differentiate between the player and the rest of the group. Having their names as text next to the avatar was impractical due to the high amount of players. The participants needed to direct the avatar to a goal, which is represented by a flag. Every player has 3 lives per section. If a player uses all three lives, then they will need to wait for all others to finish the section until continuing to the next one. After finishing the game, the players are redirected again to a final questionnaire.

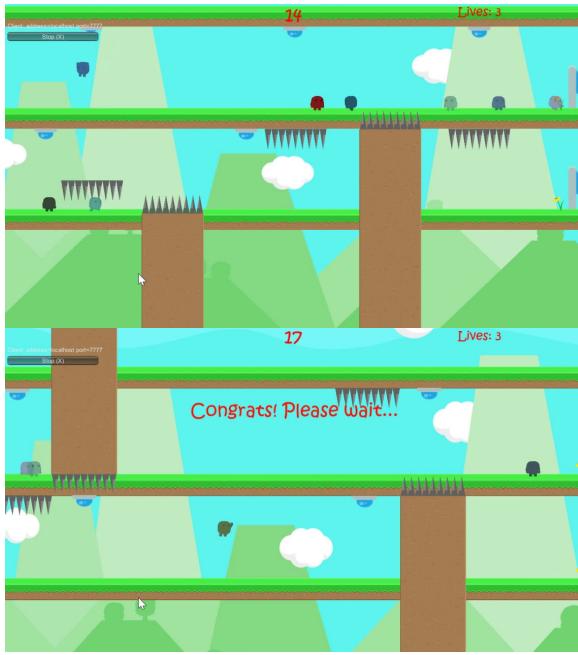


Fig. 2. Scenario 2: On the top is the first and second section of this scenario, since the two groups swap their track in the second section, however the section design is reused. On the bottom side is the third section, where progress is only possible by teamwork of both groups.

1) *Scenario 1:* In this scenario, the participants will find 3 sections with gaps in the middle, see Fig. 1. The first section's single gap width is designed to not be of a challenge. The second section appears to be exactly the same as the first, except that the gap is slightly larger and to overcome it, the players must jump at the very last moment. The change in distance of the gap between sections one and two is small enough to not be noticeable to the eye, but still provides a significant change to gameplay. The third section has a very wide gap, which is spanned by two narrow platforms, spaced equally apart. The last section's gap can only be jumped over from an elevated platform. The scenario analyzes group membership and social identity. Optimal distinctiveness theory suggests that individuals have a desire to be similar to others, but also a desire to differentiate themselves, ultimately seeking some balance of these two desires (to obtain optimal distinctiveness) [27]. Since there are clear and visible threats in this scenario, we anticipate some players to lead on, while others observe the leader's outcome first. Positive reinforcement can be gained in both roles and both outcomes – success and failure. Failing leaders confirm the role as observer and failing observer induce a positive risk and reward feedback to others. Additionally, there is the peer pressure to not become the black sheep of the group by falling into the pit.

2) *Scenario 2:* The three sections of this scenario consist of two tracks with the players split equally into groups A and B which persist between sections, with either group occupying their own track, see Fig. 2. Group A has no obstacles between them and the goal, but they may also jump to hit any of the three buttons that trigger spikes to fall onto group B's

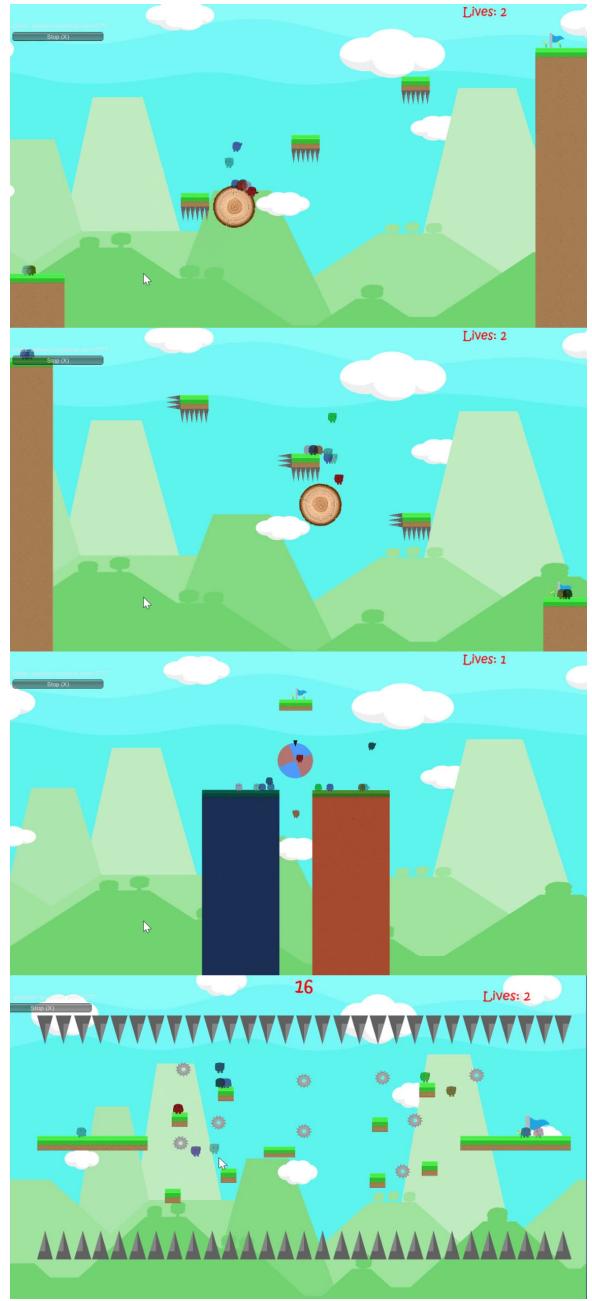


Fig. 3. The top two pictures are representing section one and two of scenario 3. The third one from the top is section 1,2 and 3 of scenario 4, since the level design stays the same, and the only section of scenario 5 is at the bottom.

track. The track that group B is located on is blocked by three walls. To lower these walls, the players of group B must jump to hit a button that moves the walls out of the way for a short amount of time. To add to the difficulty, the spikes that group A trigger to fall on group B are placed just before the wall. In the second section, the roles are flipped, and group B is at group A's mercy. This induces group cohesiveness, which strengthens group connection and performance [28], and becomes important when the roles of the two group toggle. This scenario was set up this way to give group A the choice to

either run straight to the goal or prolong finishing the section in order to make the section harder for group B.

We investigate the effect of group B's gained cohesion and the consequences on their attitude towards group A. The scenario's last section is once again split into two tracks to follow. Here, each group is blocked by one wall that can only be moved by the opposite group. In addition to the walls, each group has the ability to trigger spikes to fall on the other group. The spikes are triggered by the blocked group and fall on the unblocked group in the area just before the button, which triggers the wall to move out of the way.

The section is designed to encourage cooperation under already existing tensions between both groups. Group A must unblock group B in order for group B to be able to reach the button to unblock group A. Group A may choose to help group B, or they may all choose to finish the section, leaving group B stranded. The spikes add another layer to the problem. If one side spikes and kills the other while they are trying to help unblock them, then the victims may feel like the other side is ungrateful, and will refuse to help unblock anyone else in the future. The complexity of the situation based on past events should contribute to the immersion and overcome the group cohesion, which is now an obstacle.

3) *Scenario 3*: In this scenario, players encounter a moving, rolling log that they must balance on, see Fig. 3. In the first section of this scenario, players spawn on a platform in the bottom left of the screen, with the goal platform being in the top right. Between the two platforms is a rolling log that oscillates between the spawn and goal platform. Players must jump onto the rolling log and ride it to the finish. While they ride, they must move opposite the direction of the rolling in order not to fall off. There are three small platforms positioned in the path of the log with spikes on their underside. These spikes will kill players unless they jump on top of the platform, wait until the log has reached the other side, and then jump back onto the log. The second section has its platform positions switched but the idea is the same. The players must ride the log to the finish, hopping on three platforms that block the log's path along the way. This setup should release some tensions due to already gained experience.

Too slow players may miss the log's first pass. Those will have to watch the other players as they tackle the section. Players will learn the correct strategy for completing the section from peer observation under stress. The highly dynamic situation occupies the players with pure survival, therefore the role distribution into leaders and observers is not given in this scenario. Due to increasing anxiety, the players might tend to take the average position of the crowd and perceive the crowd as a safety zone, which strongly increases group cohesiveness.

4) *Scenario 4*: The three sections of this scenario are identical and consist of 2 wide pillars of the same height, with the goal platform situated far above both pillars – too far to simply jump there, see Fig. 3. The two pillars are close enough that players are able to jump from one to the other. A color-wheel is placed in the middle of the section and starts spinning. The wheel is textured with the colors of the two

pillars. The colors are evenly spaced, and the wheel is set to spin for a random duration. Once the wheel stops, one of the two pillars is selected by a pointer on the top of the wheel. The chosen pillar then slowly elevates to the height of the goal platform, while the other one quickly descends, killing the players on it. Consequently, the players quickly discern what is going on, predict where the spinning wheel will land, and choose the correct pillar in time.

We anticipate that the players will not only pay attention to the wheel but also their peers. Shortly before the wheel stops spinning, a decision becomes imminent and the tension peaks – players need to decide to go with the crowd and serve herd mentality [29], [30] or break out and make their own decision.

5) *Scenario 5*: In this scenario, players spawn on a platform on the left side of the screen, with the goal platform being on the right of the screen. Between the spawn and goal, platforms are a scattering of small, disconnected platforms and obstacles, see Fig. 3. Players must find the correct path to reach the finish.

The players will learn which path is the easiest to take to the finish. Here, the players will occupy different roles. Some will lead on, while others observe the leader's progress. However, a short timer is running to make pressure to finish the section in time and induces awareness of where one player's progress is set in comparison with the others, which results in peer pressure.

B. Questionnaire

Prior to and immediately following the game experience, players were required to complete a mandatory questionnaire that assessed the user experience. A unique ID is created for each player to serve as a connection between the logged data by the game and the questionnaire, providing anonymity. We collected demographics (age group, location, gender, ethnicity, highest education, annual household income, employment, and marital status) in the first survey prior to the game, as well as time spent playing video games per week, level of game experience and engagement, preferred game genre, reason for playing games, level of experience playing MMO games, and platform of choice for playing games.

Following the gameplay, we asked the players to take a questionnaire regarding engagement from J. H. Brockmyer et al (2009), the Game Engagement Questionnaire (GEQ) [15] for each of the 5 scenarios, assessing presence, flow, absorption, dissociation and immersion through 19 questions. The survey also asks the question, "How was the multiplayer aspect in this scenario impacting your engagement and immersion?" in the form of a short text answer. These text answers per scenario are analyzed for common subjects and summarized for each scenario later in this work.

Questions about teamwork perception, level of interaction, if dying in-game has any meaning for engagement, and if the focus was on level progression versus group member observation (observe others or risk going first) were asked in regards to the overall experience. We also included a trap question to weed out random answers (if triggered, we rule out the data from this participant).

We removed scenario 2 for our control group, due to its teamwork-dependent design. To avoid bias, the control group did not play the multiplayer version of the game.

C. Group Demographics

We tested in sum 62 participants, who took the pre- and post-questionnaire. 16 participants were part of the single player control, 48 in the multiplayer main group. 69.8% were male and 30.2% female. The 'other' option for gender wasn't checked. The uttermost majority lives in California, one is from Arizona, two from Europe. 56.1% stated, that dying in-game has no effect on their engagement and 43.9% would rather risk and lead on than observe the other players first. For the age distribution and ethnic affiliation, highest education and hours spent for gaming weekly, see Fig. 4. Further on game-related questions regarding preferred game-genre and the reasons for playing games are displayed in Fig. 5 and 6.

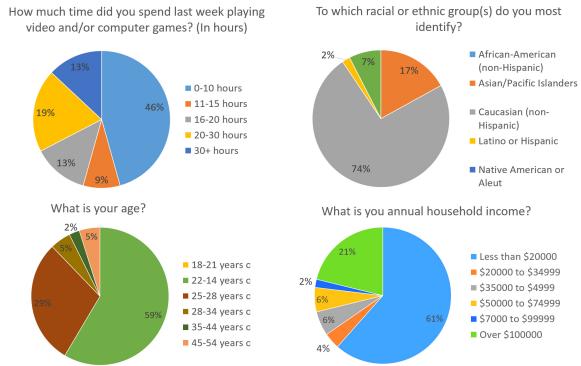


Fig. 4. Demographic results regarding time spent per week, race/ethnics, age and annual household income. The exact question asked on the pre-questionnaire is on top of its corresponding pie-diagram. Items not found in the pie-diagrams were not selected by our group.

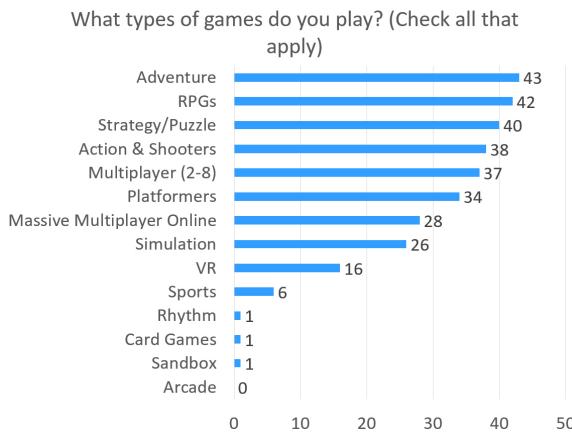


Fig. 5. Players Reasons for Playing Games. Multiple answers to the question "What type of games do you play" were possible.

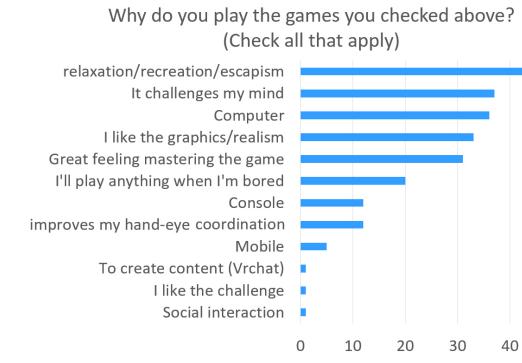


Fig. 6. Players Reasons for Playing Games. Multiple answers to the question "why do you play the games you checked before" were possible.

III. RESULTS

A. Analysis

Looking at Fig. 7, one can see the ratings of the GEQ for level 1 "The Pit", level 2 "Decisions", level 3 "Rolling Log", level 4 "Spinning Wheel" and level 5 "Floating Platforms". Here, we already grouped all items of the GEQ into presence, flow, absorption, dissociation and immersion. For detailed answers, see Fig. 10, 11, 12. The second level was rated highest in absorption and dissociation due to its complexity (as post-interviews revealed, see III-B). It was the only scenario which focused on group cohesion, requiring teamwork. Level 4 was rated highest for immersion and flow and presence was rated highest for level 3, also ranked second for immersion.

Overall Game Engagement Questionnaire Multiplayer

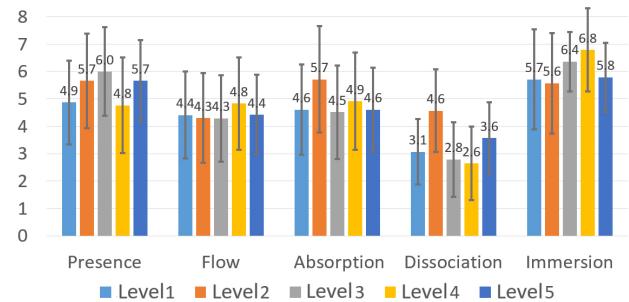


Fig. 7. Over all levels Game Engagement Questionnaire taken from our multiplayer testing group of n = 48 players. The grey bars on the top of the bars indicate the standard deviation.

Our control group played scenario 1, 3, 4 and 5, with scenario 2 being omitted due to its teamwork dependent progression, as seen in Fig. 8. Contrary to the multiplayer results, the highest ranked in terms of presence was level 5. In terms of flow and dissociation, level 3 ranks highest while there is a significant peak for absorption for level 4. Most immersive, according to the GEQ was level 1. Clearly, in single-player mode, with peer absence, the ranking is completely different. Looking at Fig. 9, there is a significant gain in presence and

immersion for level 3 and 4 for the multiplayer group as well as less flow and dissociation for level 3.

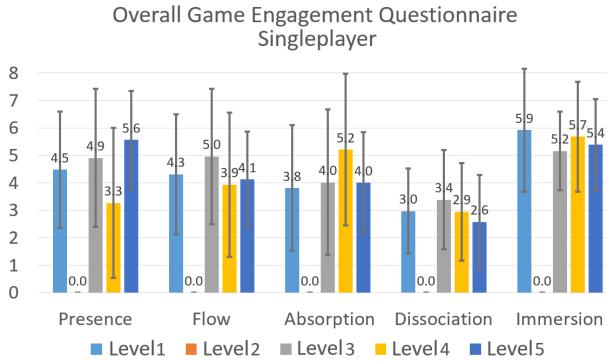


Fig. 8. Over all levels Game Engagement Questionnaire taken from our control group of $n = 16$ players of the single player version. Note, that due to the second levels design, the single player mode only covers level 1,3,4 and 5.

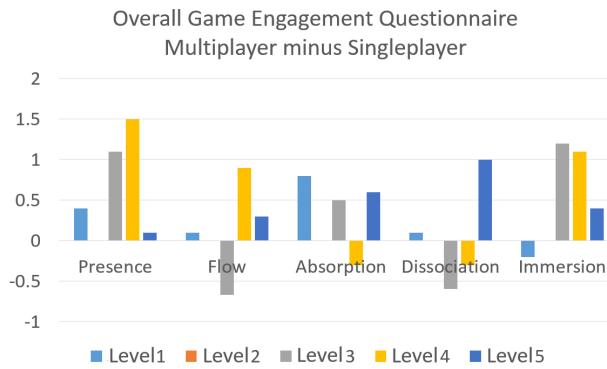


Fig. 9. Singleplayer minus Multiplayer GEQ. Level 2 data was omitted, since single-player participants did not take part in this level.

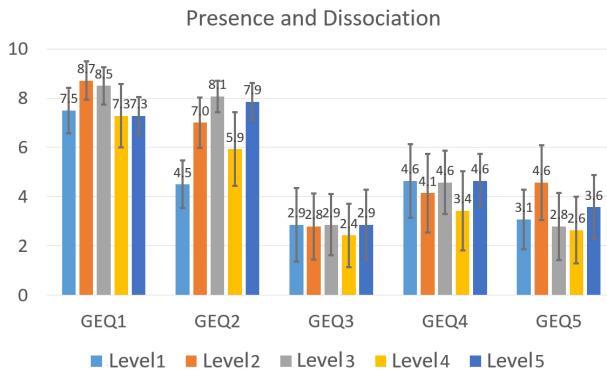


Fig. 10. Detailed results of the Game Engagement Questionnaire per level. Presence and dissociation are values summed up of several items (GEQ question 1 - 5) of the GEQ, see J. H. Brockmyer et al [15].

To gain a better understanding of the relations, we investigated the difference in the GEQ by splitting all participants into two groups. The first group are players who observe their peers first, before attempting to finish a section, and the second

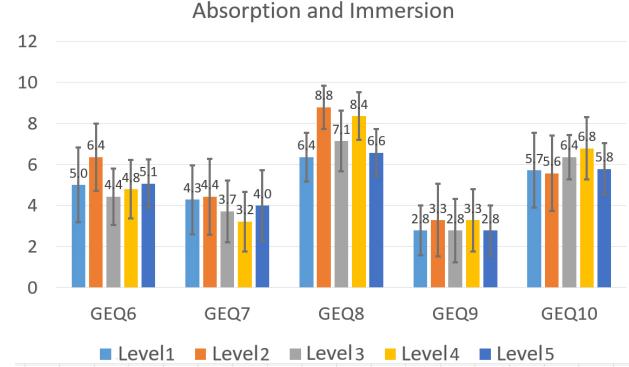


Fig. 11. Detailed results of the Game Engagement Questionnaire per level. Absorption and immersion are values summed up of several items (GEQ question 6 - 10) of the GEQ, see J. H. Brockmyer et al [15].

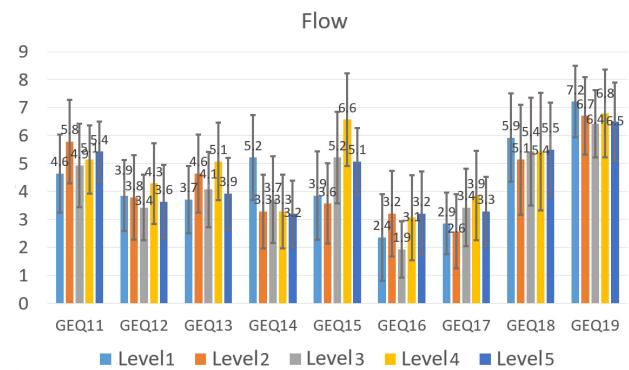


Fig. 12. Detailed results of the Game Engagement Questionnaire per level. Flow is a value summed up from several items (GEQ question 11 - 19) of the GEQ, see J. H. Brockmyer et al [15].

group are players who prefer to risk death and attempt the obstacles immediately, see Fig. 13. With this partition, we found the dissociation and immersion results of each group vary the most. For the dissociation, the teamwork-focused level 2 peaked more for the 'risk and lead' group while players who observed first were more dissociated with level 3 and 4. However, immersion is significantly higher for the 'risk and lead' group for level 1 and 3.

Players were also separated by how they answered the question, "Were you concerned more with your progression in the game or your opponents?" on a Likert scale between 0 and 10. Those who gave a value of 5 or more are one group, while those who gave a value less than 5 are the other group. This delineation can be seen in Fig. 14. Again, dissociation and immersion differ most, but surprisingly, the immersion values differ largely for level 1 and 2 for participants with a social focus, while they are less dissociated in level 3 and 4.

B. Per level post-interview results

Level 1, which was designed to investigate the effect of different group roles on gameplay, also induced peer pressure. This is shown in the players' comments, such as, "Other players speeding through the level pressured me to go and miss a platform", "Made me want to beat everyone there.",

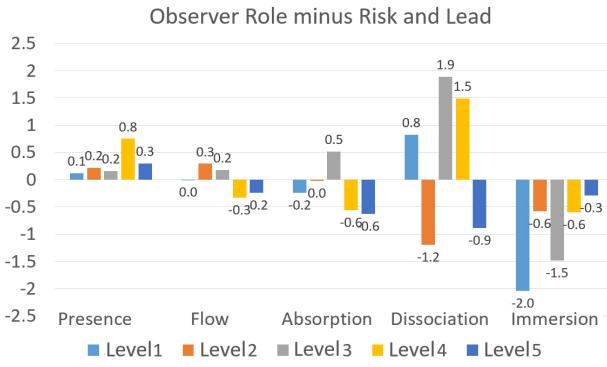


Fig. 13. GEQ: Difference between two groups of players A minus B. Group A is "observing first" players while group B consists of "risk and lead" ones, based on the post-survey question "For decision making in-game (where to go, when to jump, etc), would you say your strategy is..".

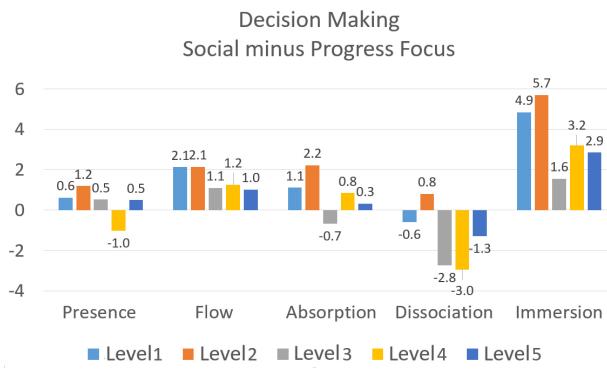


Fig. 14. GEQ: Difference between two groups of players A - B. A threshold of 5 (out of a scale 0 - 10) was chosen to separate group A (≥ 5) from group B (< 5) for the Likert scale question "Were you concerned more with your progression in the game or your opponents?".

"It made me play a lot more recklessly.", and "It made you feel like you had to go as fast as everybody else". However, the majority of participants commented that engagement was based on seeing others fail (excerpts): "Felt like I wasn't alone when I failed jumps which made me feel better when I fell off, or when I completed the map", "Rather entertaining to watch others efforts", "It was amusing to see others miss one of the two jumps", and "It was funny to watch everyone leap off and die". These comments coincide with the data shown in Fig. 13 and Fig. 14 for players who tend to observe others first and who are more concerned with their peers than with their progress.

The second level required teamwork in order to finish the level. However, the first two sections split the player into two groups in a highly competitive situation, generating group cohesion inside the groups. The cohesion can be seen in these comments (excerpts): "This is the level where you realize power corrupts absolutely", "someone killed me so I returned the favor haha", "Having the top players able to pull the trigger on me was a touch frustrating (in a fun way), but the chance to turn it around was devilishly fun", and "It was funny after we figured out the people on top were murdering us". Competitive

thinking must be resolved in the scenario's last level in order for each group of players to progress, which can be seen in comments like "The necessity of interaction made this level fun", "Having a bit of control over who gets to pass or not is entertaining.", and "Completely reliant on the actions of others. You are not solely in control." Players in an observer role tend to be less dissociated see Fig. 13, while people who were more concerned with their peers than their progress seem to be highly immersed, see Fig. 14.

In level 3, analogous to scenario 2, group cohesion was an important level design choice. The exception to this is that the players are not interacting with their peers, nor are the players too far distributed from each other. Rather, players are concentrated on the same location: the rolling log. The dynamic nature of the log and the need to constantly move the player in order to stay on it explains the reduced focus on peers, seen in Fig. 14, but increases presence for people who value shared burden with their peers seen in Fig. 13. The importance of peers in this scenario's design is reflected as increased presence and immersion in Fig. 9. It is also visible in the comments (excerpts): "It made the game more fun because everybody is trying to get to the same spot and you can't go faster than everybody else", "Other players just contribute to crowding effects", "Made it feel more engaging to see multiple people jump and fall off together", and "I was one of the first across, so it was pretty fun to watch the others scramble to avoid the spikes and shout encouragement".

The theme in level 4 was peer pressure, with an additional reward-condition for paying attention to the wheel closely. When the wheel slows down, each player had to decide whether to stay on their platform or jump to the other. This decision was also influenced by peer pressure. The following comments underline our findings: "There was an element of tension watching the players on the other side, hoping I was right and if I wasn't, hoping to be able to recognize it in time", "it was interesting with the red and blue columns and seeing how others went back and forth", "the level was slow and fully subject to chance, the hype of the other players was the only enjoyable aspect", "It was definitely interesting to see how others may have been influenced by the choices of the other players.", and "Not really engaging, but fun to watch what everyone else did". This scenario had an increased effect on dissociation and presence for peer observing players, rather than for the ones focused on progression as can be seen in Fig. 13 and Fig. 14.

The last level is an exemplary single player platform level, with several paths to reach the goal. The nearly identical presence, flow and absorption rating in singleplayer versus multiplayer mode, see Fig. 9, underlines the design impact on the gameplay. Similar to the first level, players were distributed into leader and observer roles, with some of the observing players having planned their progress ahead, while others followed some leaders into traps. The overall influence on playing with a social focus, which we investigated in Fig. 13 and Fig. 14 is marginal, except a higher immersion for social-focused players. A summary of the comments underlines this

(excerpts): "watching people try different routes and fail in different places was very interesting", "it was interesting to see which paths others took", "The difficulty of this course led me to focus more on myself than everyone around me. It was a little frustrating to see others finish when I couldn't.", "It was fun to watch people fail after I had completed the level", and "It was interesting to see who caught what nuances of how to clear this level".

IV. CONCLUSION

We designed five scenarios to highlight different aspects of social group dynamics in massively multiplayer games such as group role distribution, group cohesion, and competitive and cooperative social interaction. A group of players in multiplayer mode was tested against a control group in singleplayer mode. Scenarios with a singleplayer design focus held similar responses regarding engagement for both groups, indicating that peer presence is not sufficient for engaged play.

However, an increased presence, flow, and immersion was noticed in scenarios that focused on social group dynamics. In particular, competitive, cooperative, or non-interactive (but with shared risk/reward gameplay moments) group cohesion was observed in these scenarios.

V. FUTURE WORK

Further research should investigate the effect of self-validation by introducing a level-review mechanism after each game stage. Such a level-review should include player rankings to highlight positively associated attributes like fastest level completion, as well as worst performance, which we would plan to display in a short video clip. In addition, like and dislike buttons could offer a way for players to evaluate their peers, and would likely lead to an increase in social interconnection. Changes in player behavior and engagement would need to be investigated further upon these modifications.

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