# How Power Dependency and Player Personalities affect Cooperative Behaviors between Players

**Mohamad Nabil Oueida, Xiangxi Zhang**
Northeastern University
360 Huntington Ave
Boston, MA 02115
oueida.mo@northeastern.edu, zhang.xiangx@northeastern.edu

**Shantanu Gupta, Ajith Krishnan Muralidharan, Kevin Zhan**
Northeastern University
360 Huntington Ave
Boston, MA 02115
gupta.shan@northeastern.edu, muralidharan.aj@northeastern.edu,
zhan.ke@northeastern.edu

## ABSTRACT

Most, if not all, multiplayer games have a huge imbalance of teamwork and individualism that contribute very highly to the player experience. This aims to aid in understanding the cooperation and player behavior within a cooperative multiplayer game known as "Gambit's Gauntlet," which was designed with this study in mind. Our primary focus is to examine how players in cooperative games can be affected by player behavior and Level Design that affects the balance of Power Dependency (Emerson, 1962) between players when working in a team and whether they can be affected by categorized cooperative sections between levels, team dynamics based on personality types and player skills. The game pushes and tests players on their tolerance for working as a team, and we aim to study this through our qualitative and quantitative tests that would involve analyzing gameplay recordings, surveys, and personality assessments. Our goal is to learn and observe patterns that can affect cooperation, frustration, conflict, and player motivation, which can be an insightful start to creating the perfect game environment by testing all these factors. We also learn about the elements required in cooperative gameplay and how cooperative gameplay can be hindered. We decided to look at Power Dependency, specifically Power Dependency Imbalances (Emerson, 1962) in a dyadic relationship or Cooperation. Our Methodology consists of pre and post-surveys to a playtest testing Power Imbalances and Power Dependency (Emerson, 1962) between unfamiliar participants via our Capstone Cooperative Game "Gambit's Gauntlet." The levels used for our playtest were designed to create a power imbalance between players to help us understand how unfamiliar players respond to each other and how they would react when switching the power dependency between them. These behaviors were measured via annotating play sessions by tracking Behavioral Markers (Farah et al. 2022) that we find during gameplay. This playtest had a total of 16 male participants, with ages ranging from 18-30, who were all based around the Boston area, with a mix of university students and young professionals from multiple cultural backgrounds. Thanks to our research and our playtest, we were able to find that power dependency Imbalance done via Level Design encourages communication and cooperative behaviors between players since they will take on the imbalance

and accommodate each other for the sake of completing the common goal, which is beating a cooperative game that demands both their involvement and cooperation.


## Keywords

Cooperation, Teamwork, Trust, Personality, Level Design, Behavior, Frustration, Conflict, Power Imbalance, Power Dependency, Familiarity, Leadership


## INTRODUCTION

“Gambit’s Gauntlet” is a two-player split-screen puzzle platformer game where players must work together to solve physics and platforming puzzles. Games are complex ways of studying real-world interaction, teamwork, cooperation, and player personalities through a gameplay experience. Our primary goal is to study our playtesters more extensively and precisely than previously done. That way, we can understand player personalities and behaviors better, which would help us identify how power dependency imbalances can affect cooperation between different personality combinations. We implemented a pre-game survey with a Personality test and paired up participants based on low familiarity to test the limits of cooperation and personality compatibility. Our goal was to explore what aspects/sections of our game would affect player behavior and cooperation and identify features in our game that can trigger negative behavior or such feelings in players.

To analyze this rigorously, we took inspiration from "Evaluating Team Metric in Cooperative Video Games" (Farah et al. 2022), which involves categorizing and coding all cooperative and competitive factors in our game and analyzing our gameplay video to see if they trigger any of the behavior markers that arise from cooperative gameplay or competitive gameplay; quantitative analysis would be beneficial for us to understand player cooperation during the gameplay experience.

To summarize, our research would shed light on what promotes or hinders teamwork/cooperation and how player communication between different personalities can affect gameplay. We would also focus on environmental settings and level design to help evaluate and identify factors designed toward cooperation that affect cooperation or prosocial behavior in games. Finally, our research will provide insight into how players cooperate under power imbalance circumstances.

## BACKGROUND

This study is influenced by various previous works about Power Dependency, Cooperation, Levels of Familiarity, and personality traits that impact player behavior. Our methodology utilizes this pre-existing research to build a framework for our analysis and to relate our findings to the literature.

### Team Metrics and Cooperative Behaviors

The article “Evaluating Team Metric in Cooperative Video Games” (Farah, 2022) inspired our research heavily. The study coded three cooperative games' cooperative

and competitive features and players' reactions as behavioral markers. By video recording, the research found the frequencies of behavioral markers and the highest rate of features that trigger corresponding behaviors. The study shows a clear path to quantifying the relationship between content and player actions. The team further decided to put each feature and behavior marker on a timeline map to better understand the relationship between the events around the marker.

## Power Dependency

The article "Power Dependence Relations" (Emerson, 1962) defines Power and Dependency for our study and has helped us define how we designed sections of our levels. Dependence of, for example, Participant A on Participant B is directly related/proportional to Participant A's investment in goals that are directly affected/dependent on Participant B and inversely related to the ability of Participant A to achieve those goals without the relationship without Participant B. So if Participant A can easily achieve their goals without Participant B, since it is inversely related, then the Dependency of Participant A on B would be low and vice versa.

Power was also defined in the same article. The Power of Participant A over Participant B is inversely related to how much resistance Participant B would show to a request or demand from Participant A. Based on these definitions, the article goes on to explain what power dependency relationships are. The Power of Participant A over Participant B is equal to how much Participant B is dependent on Participant A. Leading us to the equation that we used to define sections of our levels.

Power Depency Equation: Pab = Dba

For example, a high dependency on Participant B would mean Participant B would be more willing to take requests and demands from Participant A, signifying that Participant A has more power over Participant B in this relationship. The equation would look like this: Pab > Pba, then Dab < Dba.

## Cooperation

In the article "Gut or Game? The Influence of Moral Intuitions on Decisions in Video Games" (Joeckel, 2012), the researcher finds out that the participants are more likely to show random violations when they have lower moral salience than those with high salience. It means that if the game design triggers players' moral salience, there is a high possibility that it will restrict their violent behavior. Our study is focused on finding how power dependency imbalance can affect cooperation. Our team expects that lowering the moral salience can also lower the effect of moral choice since different people have different moral stances. Decreased moral judgment allows the player's personality to take more effect when they face a choice and, in turn, affects the overall cooperative experience.

The article "How to ameliorate negative effects of violent video games on cooperation: Play it cooperatively in a team" (Greitemeyer, 2012) found that while cooperating, even when players are exposed to violent settings, they will still cooperate if they have a common goal. Each level should have a clear goal for both participants to reach. We want to test the players' decision-making process under different conditions that might affect cooperation. To control the different

conditions, we used the Big Five Personality Test from “Is Basic Personality Related to Violent and Non-Violent Video Game Play and Preferences?” (Chory, 2010). The article uses the five-factor personality model, which includes extroversion, emotional stability, agreeableness, conscientiousness, and openness. Moreover, the result shows that a combination of high openness and low agreeableness will be more likely to favor violent games. We took the article result as guidance and decided to use the Big Five Personality as part of the pre-survey so that we could add another variable to the research.

## Familiarity

Regarding pairing up the participants, the team now has a more specific requirement rather than only having an age range. The article “Familiarity in Team-Based Online Games: The Interplay Between Player Familiarity and the Concepts of Social Presence, Team Trust, and Performance”(Hudson, 2015) talks about how the familiarity “Early trust” between two players has an impact on their trust, more familiar with one and another, familiar teammates can come with this pre-existing high level of trust and that impacts the players' actions during cooperative or team-based games which could hinder our results. The familiarity between two participants will build up team trust in the game way quicker than a pair of strangers would be able to, and it is some variable that is unwanted in the current study since we want to see what could potentially break that trust formed by priming for a cooperative experience. Therefore, the team decided to collect the names of potential participants first and divide them into different groups based on their familiarity level.

## METHODS

Chart of Power Dynamics Per Level:

Power Imbalance/Dependency Equations: As per “Power Dependence Relations” (Emerson, 1962), we can represent a power dependence relation as a pair of equations: Pab=Dba Pba=Dab.

## Obstacle Design

### *Level 1*

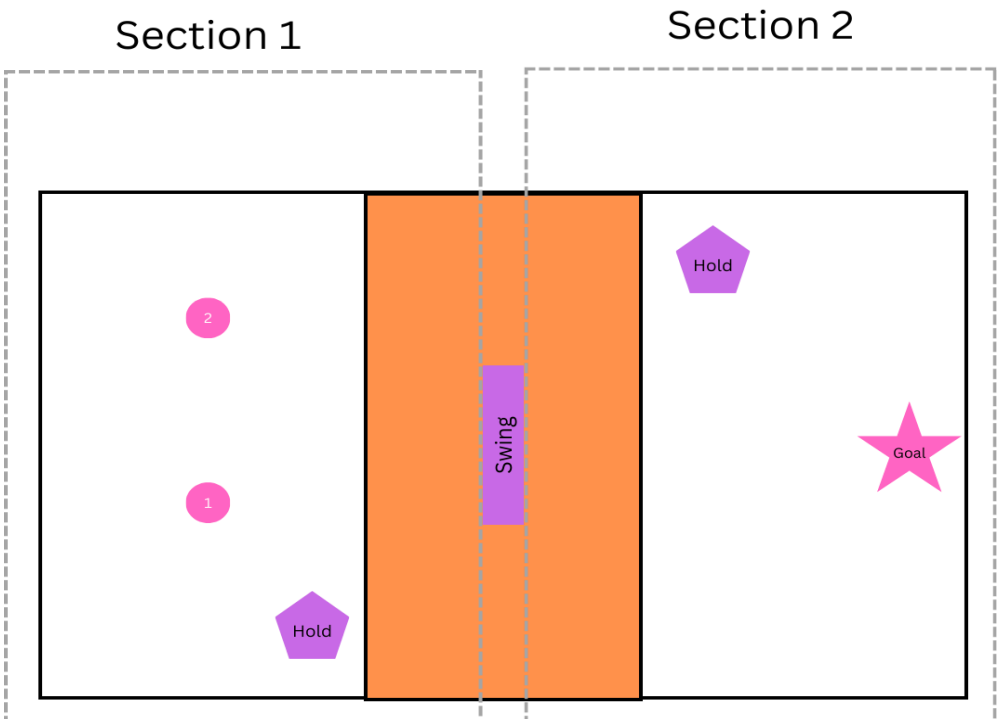



**Figure 1:** Level 1 Level Design Sketch

Level 1 utilizes a symmetrical design where players alternate roles. The Power Dependency Condition is Pab = Pba, so Dab = Dba. The players can choose who takes on which role before attempting the obstacle. Players will choose their roles and form their cooperative relationship, with Player 1 (for example) jumping to the swing Depending on Player 2, who has to hold the button in Section 1. Once Player 1 crosses the Lava Gap and is in Section 2, they now must hold the button so that Player 2 can use the swing and get across so they can both reach the goal.

## *Level 2*

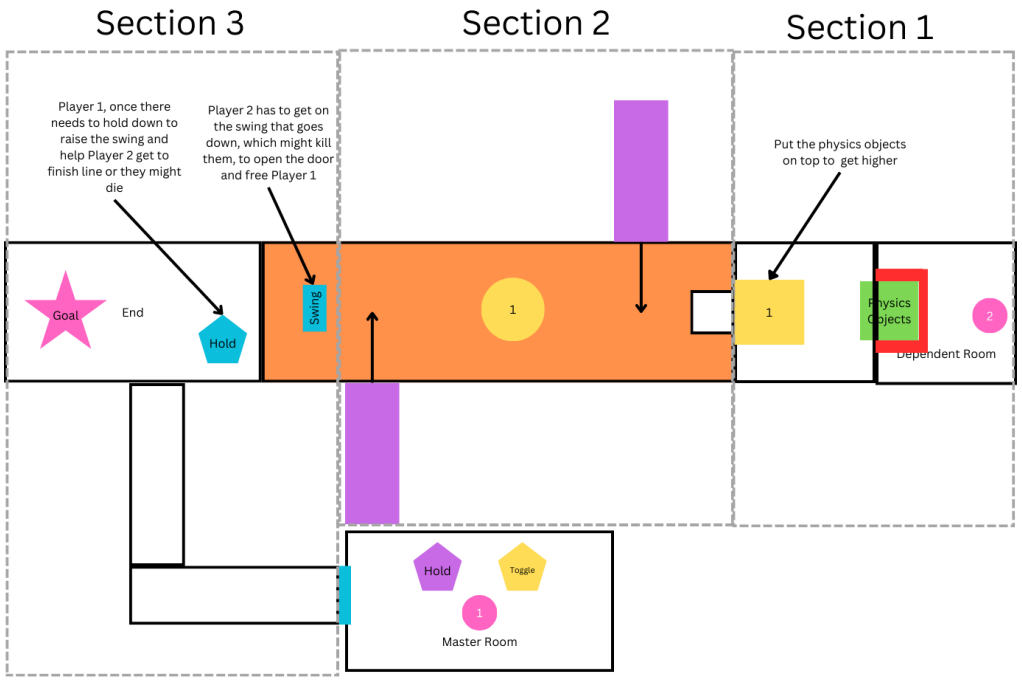



**Figure 2:** Level 2 Level Design Sketch

Level 2 utilizes an asymmetric design where one player has significantly more power over the other. The Power Dependency Condition is Pab > Pba, so Dab < Dba. Player 1 is in the Master Room, where they can use the button as they see fit to affect the level and progress of Player 2. Sections 1 and 2 are sections where Player 2 fully depends on Player 1 for them to progress through the level.

**Section 1** is easy and offers no risk for Player 2 to die, but they are still dependent on Player 1.

**Section 2** requires Player 1 to manipulate the level to ensure Player 2's progress and survival of the section. Player 2 is highly vulnerable without Player 1's help.

**Section 3** involves Player 2 putting themselves at risk to clear Player 1's path. Even though Player 2 is helping Player 1, Player 1 still has to go and use a button to save Player 2. This section offers Player 2 a bit more power over Player 1, but Player 1 is still the one with the power to affect Player 2's survival.

### *Level 3*

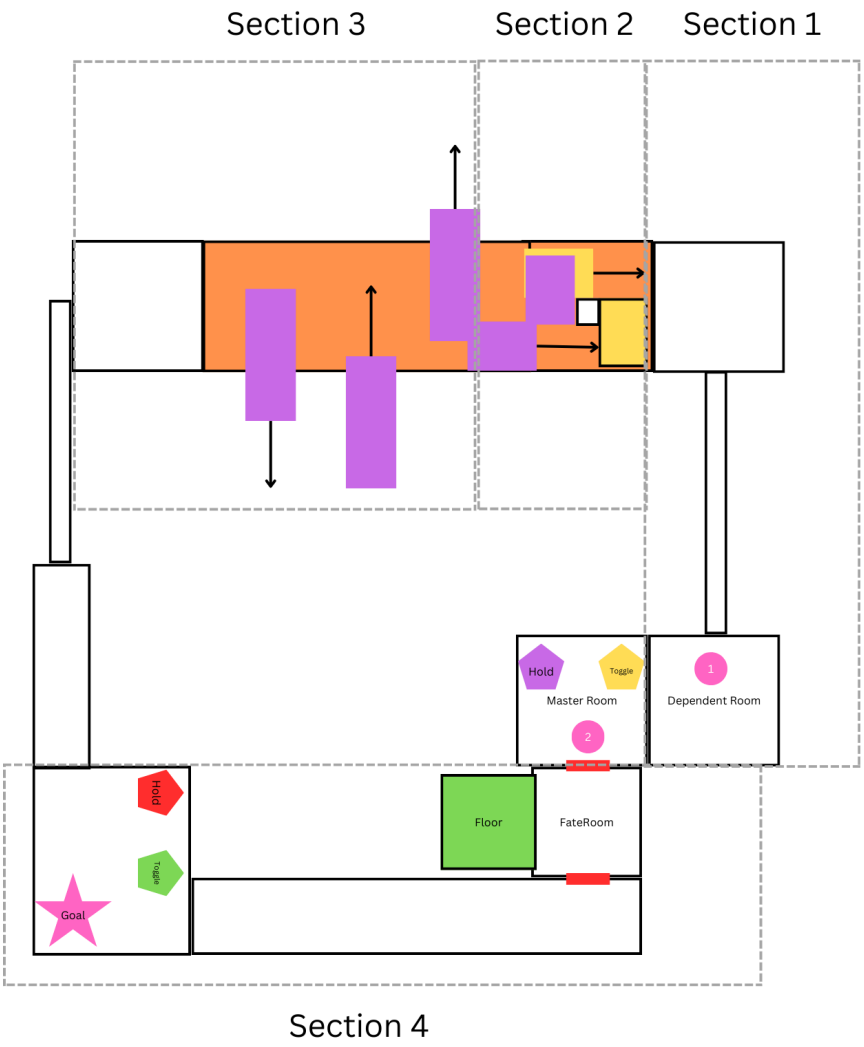



**Figure 3:** Level 3 Level Design Sketch

Level 3 utilizes an asymmetric design where one player has significantly more power over the other, but the roles are swapped from Level 2. The Power Dependency Condition is Pab < Pba, so Dab > Dba.

**Section 1** is fairly straightforward. Player 1 depends on Player 2 to press a button that would open the door and give them access to Section 2.

In **Section 2**, Player 1 depends on Player 2 to manipulate the level by holding a button that affects the moving wobbly Platforms to be used by Player 2 to cross this section.

In **Section 3**, Player 1 also directly depends on Player 2 to manipulate the Level and can't progress without their help and attention.

Finally, **Section 4** is a small section where the rolls do reverse, and Player 2 depends on Player 1 to open some doors for them to reach the goal together.

## Research Question

How does the imbalance of power resulting from level design in a game affect the level of cooperation between 2 players?

The independent variable in our research question is the balance of power. The dependent variable is the level of cooperation between 2 players. Our objective is to see what affects Cooperation between players meeting for the first time, especially when affected by Power Imbalances implemented via the Game Design where we will make players have an imbalance of dependency on each other (i.e., One Player X will have more control than Player Y, Player Y depends on Player X to be able to proceed, making Player Y more dependent on Player X).

## Playtest Protocol

Participants were recruited primarily using the convenience sampling method, as most of our participants have personal connections to the testers and are physically able to travel to the testing site. Participants were grouped in pairs based on a lack of familiarity with each other to prevent previous relationships or early trust from skewing our results.

Before any information is collected, players will be sent a waiver and informed that their participation is voluntary, and they are free to exit the trial and request their data be deleted at any point for any reason. After this, participants are sent a demographics survey before the trial to gather further information on factors that may influence our participants' behaviors.

### *Briefing*

Once participants arrive at the testing site, they will be briefed on the nature of the trial. Participants are welcomed, introduced to any present testers, and thanked for their participation in our study. Players are informed of our testing protocol and that their gameplay, Audio, and Video will be recorded through a screen recording program and an external Camera. At this stage, we remind the players that their participation is entirely voluntary, and they can withdraw from the study at any point. The participants are also made aware the researchers can intervene during this playtest if participants show signs of harmful or disruptive behaviors.

### *Warm-up Discussions*

Before proceeding with the playtest, we engaged in small talk with the testers to help them feel comfortable. This includes a light discussion about the participants' impressions of 3D action and puzzle platformers, as well as any previous experiences they feel comfortable sharing, as well as their preferred genres and types of games.

### *Play Session*

During the playtest, each participant must cooperate with their teammate to complete a series of obstacle courses, which require players to depend on each other to complete them successfully. Participants are asked to utilize the "think aloud" protocol to provide us with detailed impressions of their thought process and

Emotional state. During the test, participants are discreetly monitored in case intervention is necessary due to technical issues or harmful behaviors. This also provides a way to gather impressions of the game and the participants in real time.

Participant Observation:

We observed and analyzed player actions during the playtest. Sessions were recorded using Open Broadcaster Software (OBS), which used screen recording for gameplay and a webcam and microphone for the participants' faces and voices. During the playtest, we observed and looked for certain behaviors as well as any unexpected behaviors from our participants. We are also doing this to find any bugs or fixes in our game.

Behavioral Marker Check-List:

Based on a table from "Evaluating Team Metric in Cooperative Video Games" (Farah, 2022), we used a checklist/table to help us analyze the participants' reactions at each level where there are shifts in power within the team. When analyzing the video recordings of the playtest, we used the Behavioral Markers (Farah et al. 2022) table below (Table 1) to cross reference and annotate what behaviors were triggered in our participants during the playtest by what element of our level.

| **Constructs** | **Behavioral Markers** |
|---|---|
| **Backup Behavior:** Teammates provide resources and task-related efforts to another teammate when an imbalance is recognized (Rosen et al., 2011) | **BB1**: Closed-loop backup. Teammates are responding to a help request, verbally or behaviorally.<br><br>**BB2**: Proactive backup. A player is supporting a teammate proactively without being asked to.<br><br>**Voluntary Sharing (VS):** Sharing in anticipation of a need or to avoid imbalance. |
| **Mutual Performance monitoring** (Salas et al., 2005)**.** | **MPM**: Players maintain an awareness of each other's performance to identify any imbalance or needs. |
| **Implicit Coordination:** when teammates anticipate the team's needs and adjust their behaviors without explicit communication (Salas et al., 2015). | **IC1**: Team members engaging in individual acts that benefit the team.<br><br>**IC2**: mutually coordinated performance without explicit communication or planning. |
| **Team Leadership** (Salas et al., 2005). | **TL1**: Team member facilitating solving puzzles, organizing resources, guiding individuals, and coordinating actions |
| **Explicit Coordination:** involves using explicit communication to align the | **EC1**: Teammate reporting their status, location, or resources' level to their team. |

| | |
|---|---|
| team's plans, goals, actions, and knowledge(Salas et al., 2015). | **EC2**: Teammates engaging in timing and synchronizing their movements through communication. |
| **Planning:** a cooperative team task necessary to solve problems and face environmental changes(Rosen et al., 2011). | **Situational assessment (SA)**: Collecting informational cues essential to solving a team problem or obstacle.<br><br>**Mission analysis (MA)**: Cooperative problem-solving and brainstorming of potential solutions.<br><br>**Strategy formulation (SF)**: Generating a sequence of actions to reach the goal. |
| **Adaptability:** Team's ability to recover after failing or a deviation from the original plan is noticed (Rosen et al., 2011). | **Contingency planning (CP)**: Developing plan alternatives.<br><br>**Reactive strategy (RS)**: Developing a new sequence of actions after sudden changes.<br><br>**Behavioral adaptability (BA)**: Adjusting behaviors through trials and errors.<br><br>**Team learning (TL):** Explicitly reformulating what the team noticed or learned |
| **System Monitoring**(Rosen et al., 2011). | **SM**: Players scan the environment to determine available resources and the community's needs. (Rosen et al., 2011) |
| **Interpersonal Relationships** | **IR1:** Casual talks and conversations not related to the team tasks.<br><br>**IR2:** Joking and laughing together. |
| **Failures:** Failing due to lack of task skills or lack of team skills.Deaths (D); Revival (R).Waiting (W) | **Task-skills failure (F TSK**): For example, not knowing the right functions to press or not knowing how to solve a certain obstacle.<br><br>**Team-skills failure (F TMS)**: For example, not communicating or planning. |
| **Task Cohesion:** Teammates expressing their commitment and enthusiasm toward team goals (Sottilare et al., 2018) | **TC1**: Complimenting the team skills ("teamwork").<br>**TC2**: Expressing excitement ("Ready," “Let’s go”) |

**Table 1:** Constructs and Associated Behavioral Markers from "Evaluating Team Metric in Cooperative Video Games" (Farah, 2022)

Inter-rater Reliability:

We performed an Inter-Rater reliability check as part of our data analysis process. After gathering the data from our playtest, we combed through the data from our experiments individually and took notes. Afterward, we conducted a collective analysis where we cross-referenced our findings to verify our results.

### *Debriefing*

After the playtest, participants were asked a single casual, open-ended question as a way to gauge initial impressions. Specifically, "how did it go?" This provided us with information about the emotional state of the player at this point, as well as what aspects of the experience felt significant to them at the moment. This provided us with qualitative feedback on the game experience and the overall experiment.

After completion of the interview, players were thanked for their participation in the test. Participants will also be provided with resources to reach should they feel uncomfortable or distressed due to the tests. Any participants who were also Northeastern University students were provided with information about the university's health hand counseling resources. Those without access to university resources were encouraged to call 911 or the national suicide prevention hotline should they feel distressed.

## Data Collection Instruments

### *Surveys*

The pretest survey was used to gather demographic and background information relevant to our study, including experience level in relevant games and previous experiences with social interactions within multiplayer games. In addition to this, participants were required to complete a Big Five personality questionnaire. We gathered these results to see if Personality or any of our demographic data can show relevance to the Power Imbalance and the behaviors being shown.

The post-test survey was used to gauge the participant's impressions about their experience and their teammate. Participants were asked to rate themselves and their teammates using various performance metrics. This helps provide us with easily comparable impressions data showing positive vs negative impressions of players and their teammates. We can use this to verify whether a person's perception of their teammate matches their actions during gameplay.

All surveys are built using Google Forms.

### *Recording*

We used Open Broadcaster Software (OBS) to record all the gameplay sessions, as well as footage of our participants during the sessions through Cameras. We used this data to get qualitative impressions of our participants' performance, as well as to look for behavioral markers that indicate team constructs for our quantitative analysis (Farah et al. 2022). We broke down our playtest footage into sections, which

made it easier for us to identify and compare behavioral markers between test groups.

### *Interviews*

Players participated in a casual interview directly after the test session to provide us with a gut impression of the experience and information on the player's emotional state. Participants were asked a single casual, open-ended question. Specifically, "how did it go?" This provided us with information about the emotional state of the player at this point, as well as what aspects of the experience felt significant to them at the moment.

### *Google Sheets*

We utilized Google Sheets to analyze videos by allocating timestamps to each attempt with the attempts being Success and Failure in each Level and their respective Sections. We then filled out the Behavioral Marker Checklist (Farah et al. 2022) by observing the gameplay and communication of our participants that we recorded. For each test we had 2 members of our team go over the gameplay videos to perform an Inter Rater Reliability check. Finally, we used the checklist to group and clean data that would be further visualized on Tableau.

### *Tableau*

Using Tableau, we converted and visualized the raw data which allowed us to understand the data and compare the values between the Behavioral Markers (Farah et al. 2022) and the players' performance. Visualizing the data allowed us to make inferences based on the data we collected through our instrumentation tools.

## Player Experience Concept Study

## Qualitative

Before conducting the playtest, we asked our participants to complete a Pre-Game Survey via Google Survey to gather demographic data, which helped us pair up the participants for the playtest. The Pre-Game Survey was distributed well in advance before the day of the Playtest. After this, our participants were gathered into a list and sent to every other participant to check for any familiarity between them, which is what we wanted to avoid. This step was taken because an article from our Literature Reviews/Related Works, “Familiarity in Team-Based Online Games: The Interplay Between Player Familiarity and the Concepts of Social Presence, Team Trust, and Performance” (Hudson, 2015) states that familiarity has an effect on teamwork and can hinder results for a study on Cooperative Gameplay. After all, participants with familiarity tend to have early trust built in actual life before entering the game. Since we are studying what it will take for a player to disregard that trust with a teammate, early trust would hinder that.

Aside from familiarity as a metric for pairing up our participants, we also asked our participants to complete an online survey, “The Big Five Personality Test” (Extroversion, Neuroticism, Agreeableness, Conscientiousness, and Openness). After

completing the test, we requested the results from our participants in the pre-test survey.

In addition, we recorded audio and video aspects to examine gameplay and communication between our participants. We also performed an Inter-Rater reliability check as part of our data analysis process, where members of our team will comb through the findings from our experiments individually and later conduct a collective analysis to produce the best results possible from this experiment. After the playtest, we asked our participants to complete a post-game survey via Google Survey that featured open-ended questions and questions on a Likert Scale that provided us with qualitative feedback on our game and quantitative data regarding our player experience concept.

## Quantitative

For our Quantitative Data, we used a similar methodology to one deployed in one of the articles from our Literature Reviews/Related Works. "Evaluating Team Metric in Cooperative Video Games" (Farah, 2022), where the researchers have categorized each cooperative, competitive, and cooperative+competitive feature of their game and checked in gameplay videos which of these features triggered the behavior markers that are supposed to arise from Cooperative gameplay. We followed a similar methodology and categorized our cooperative, competitive, competitive + competitive, and aesthetic features such as setting. We created a list of behavior markers to look for while reviewing our participants' recorded playtest. This was used to monitor and examine whether specific aspects of our game could trigger a particular response from the participants. We split each recording into attempts on obstacles, with each death or completion of an obstacle being a failed or successful attempt respectively, each marked by a timestamp. We analyzed the test recordings by looking for the presence of behavioral markers during each attempt. This data would later be tallied for quantitative analysis in Tableau. Tableau allowed us to visualize our findings, enabling us to better compare results and analyze the behaviors based on the Behavioral Markers.

# RESULTS

We conducted a total of 8 tests which consisted of 16 participants who were put into groups of two and made to play our game. These are the results we gathered from our data analysis.

## Qualitative

During the playtest, we observed that the participants seemed patient and calm with each other because of low levels of unfamiliarity. The participants cooperated and did not seem to be frustrated by their teammates, certain instances showed that certain levels/sections of the game would seem frustrating to them, which motivated them to work together and brainstorm together to solve the section.

Participants were patient and seemed happy when their teammate was able to cross a certain obstacle, there were a few participant groups that involved a low-skill player to match up with a high-skilled player, but that did not trigger any negative behaviors. The higher-skilled participant would guide their teammates and wait until

their teammate was able to complete the task. Also, they would show traits of Team Leadership from the Behavioral Markers (Farah et al., 2022). There were a few instances where some participants would give back snarky comments to their teammate when they would be told to do something, but when the role reverses in the next section, they would get a chance to get back at them, “not so easy now, is it?”.

## Quantitative

### *Level 1 Results*

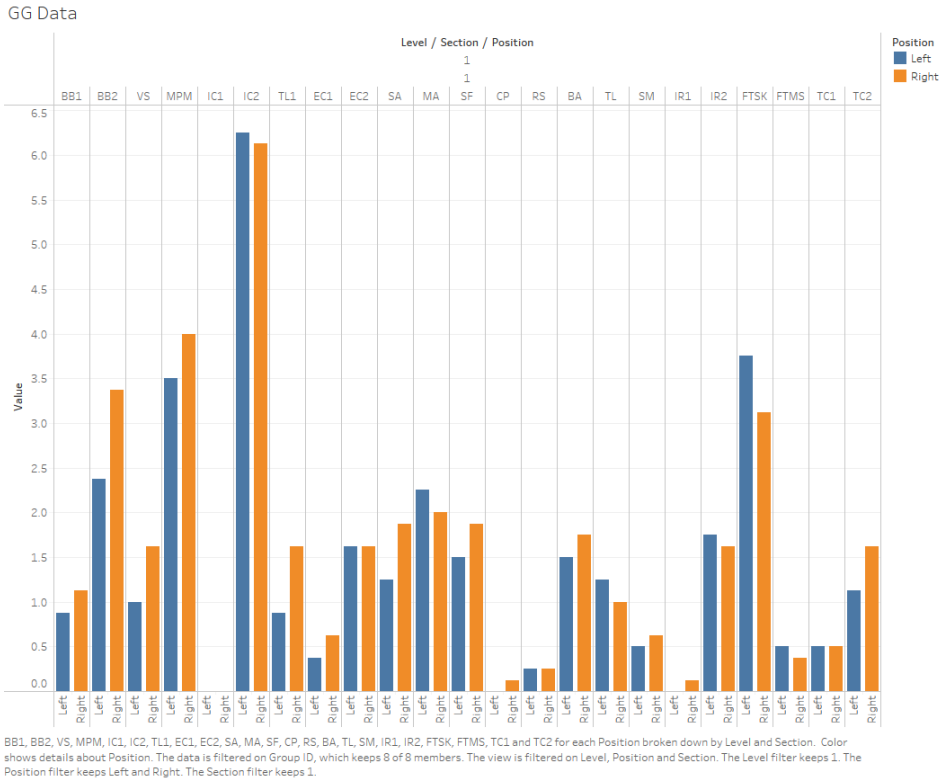



**Figure 4:** Behavioral Marker Graphs for Level 1 Section 1 of All Testing Groups

GG Average Data

| Level / Section / Position | | | BB1 | BB2 | VS | MPM | IC1 | IC2 | TL1 | EC1 | EC2 | SA | MA | SF | CP | RS | BA | TL | SM | IR1 | IR2 | FTSK | FTMS | TC1 | TC2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | Left | 0.875 | 2.375 | 1.000 | 3.500 | 0.000 | 6.250 | 0.875 | 0.375 | 1.625 | 1.250 | 2.250 | 1.500 | 0.000 | 0.250 | 1.500 | 1.250 | 0.500 | 0.000 | 1.750 | 3.750 | 0.500 | 0.500 | 1.125 |
| | | Right | 1.125 | 3.375 | 1.625 | 4.000 | 0.000 | 6.125 | 1.625 | 0.625 | 1.625 | 1.875 | 2.000 | 1.875 | 0.125 | 0.250 | 1.750 | 1.000 | 0.625 | 0.125 | 1.625 | 3.125 | 0.375 | 0.500 | 1.625 |

BB1, BB2, BA, CP, EC1, EC2, IC1, IC2, IR1, IR2, MPM, MA, RS, SM, SA, SF, TC1, TC2, TL1, FTSK, TL, FTMS and VS broken down by Level, Section and Position. The data is filtered on Group ID, which keeps 8 of 8 members. The view is filtered on Level, Position and Section. The Level filter keeps 1. The Position filter keeps Left and Right. The Section filter keeps 1.

**Figure 4.1:** Behavioral Marker Average Table for Level 1 Section 1 of All Testing Groups.

In Figure 4 and Figure 4.1, we observe that both players from all the test groups have high mutually implicit coordinated performance without explicit communication or planning (IC2), which is due to the fact of participants failing and replaying the level multiple times thus resulting in participants knowing what needs to be done. This would be a common occurrence in almost all the Levels and Sections, so we would like to focus on other Behavioral Markers.

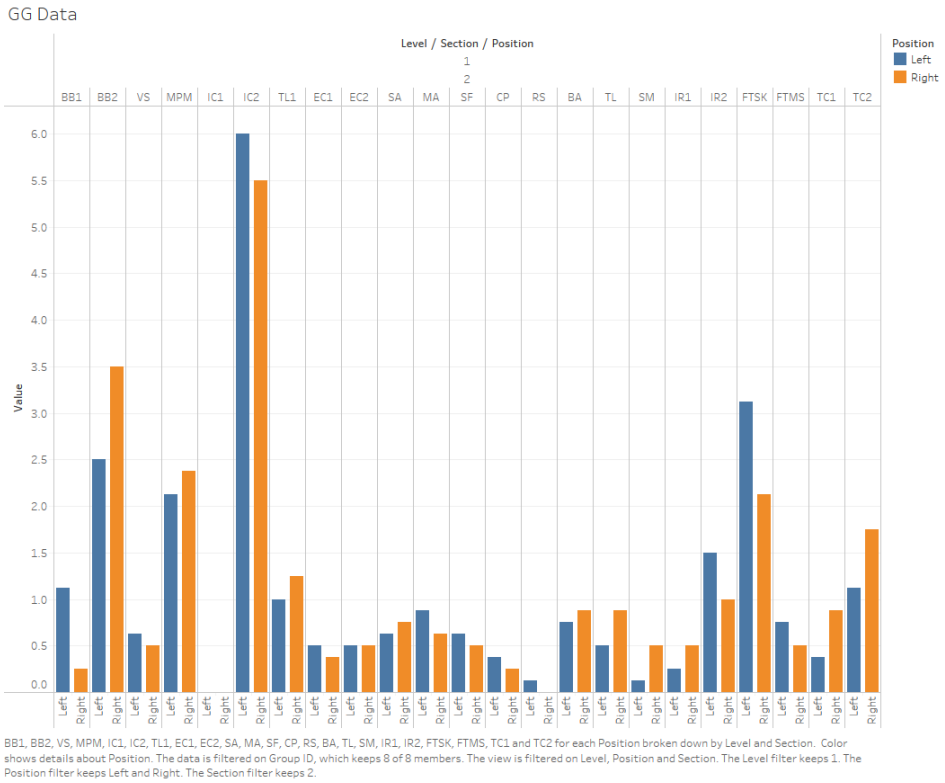



**Figure 5:** Behavioral Marker Graphs for Level 1 Section 2 of All Testing Groups

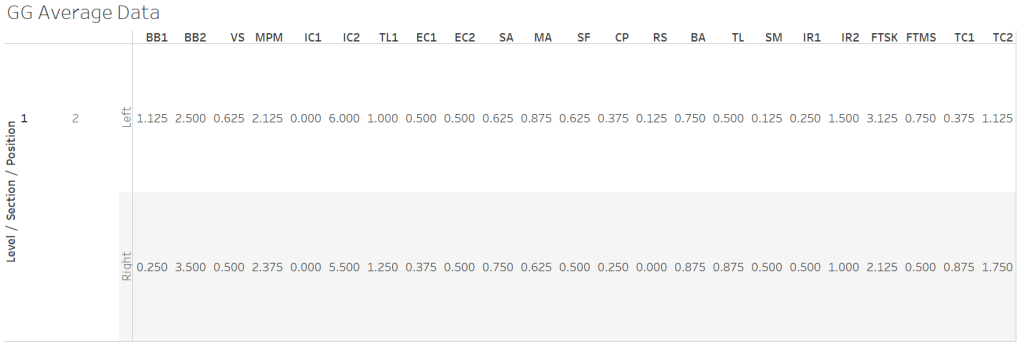


**Figure 5.1:** Behavioral Marker Average Table for Level 1 Section 2 of All Testing Groups.

In Figure 5 and Figure 5.1, the participants on the Right in all Groups of Level 1 Section 2 require Proactive Backup: A player supporting a teammate proactively without being asked to. Since the player on the Left has already made the jump, the player knows what would be required to make it easier for their teammate so that they could beat that particular section with ease.

Level 1 provided Players with a level where Pab = Pba and Dab = Dba and we can see how similar the results are between both tables as a result.

## *Level 2 Results*

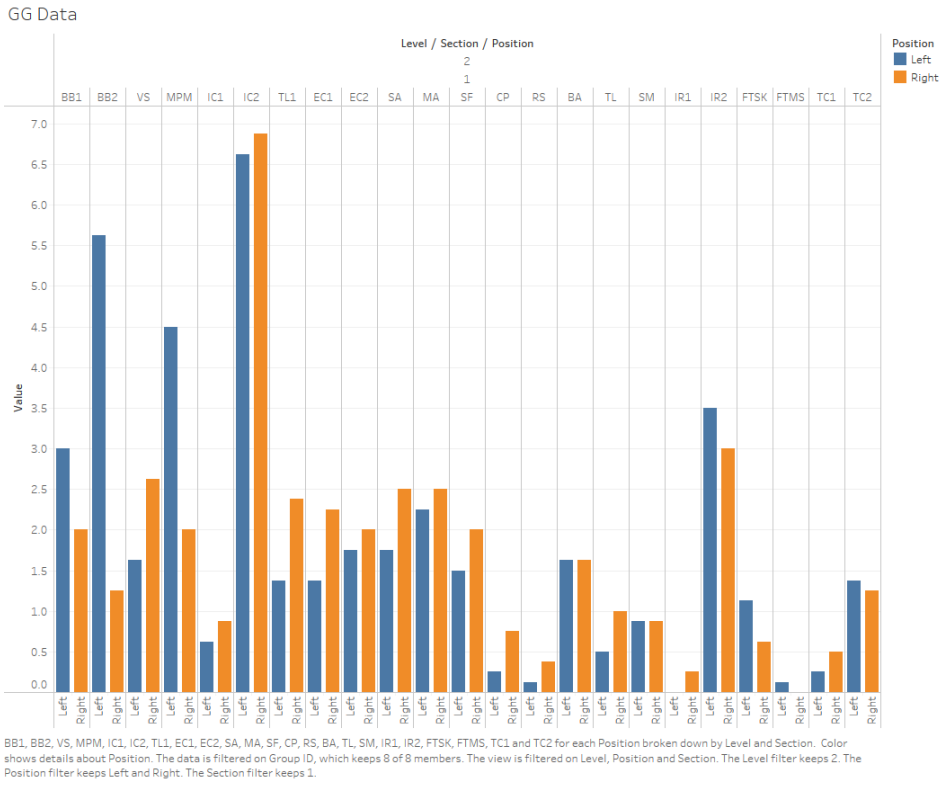



**Figure 6:** Behavioral Marker Graphs for Level 2 Section 1 of All Testing Groups

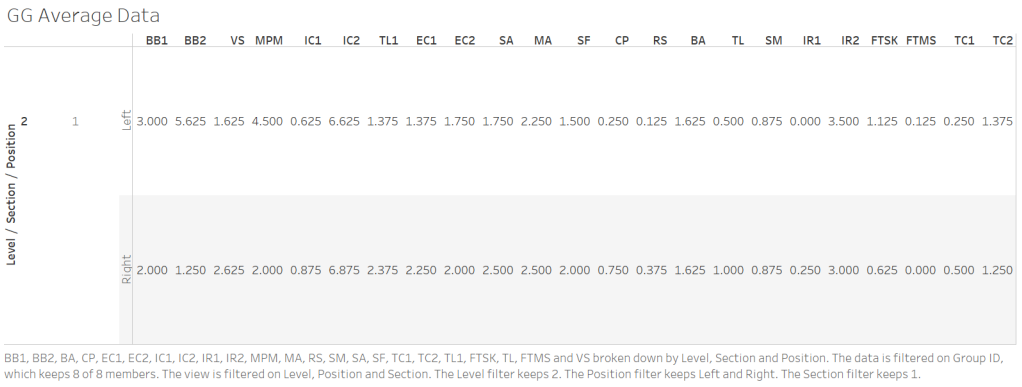



**Figure 6.1:** Behavioral Marker Average Table for Level 2 Section 1 of All Testing Groups.

In Figure 6 and Figure 6.1, we notice a lot of BB2 from the person on the Left (Who has more Power over the Participant on the Right, which depends on them), which means a player supporting a teammate proactively without being asked to. We have noticed that Proactive Backup (BB2) coincides with Mutual Coordination (IC2) since mutual coordination is coordination without communication, and proactive backup is backing up your teammate without communication. MPM was more relevant to Players on the Left who had control of the level and the progress of the Player on the Right. This shows how the Players with more power tend to monitor their dependent teammate's performance and accommodate the imbalance to help them progress through the level. We can also see that Voluntary Sharing, Self Reporting, and Team Leadership are high among the participants on the Right as they tend to call out the obstacles that they notice in front of them, asking the Left Player to help them get past it, which shows their dependency on the Left Player.

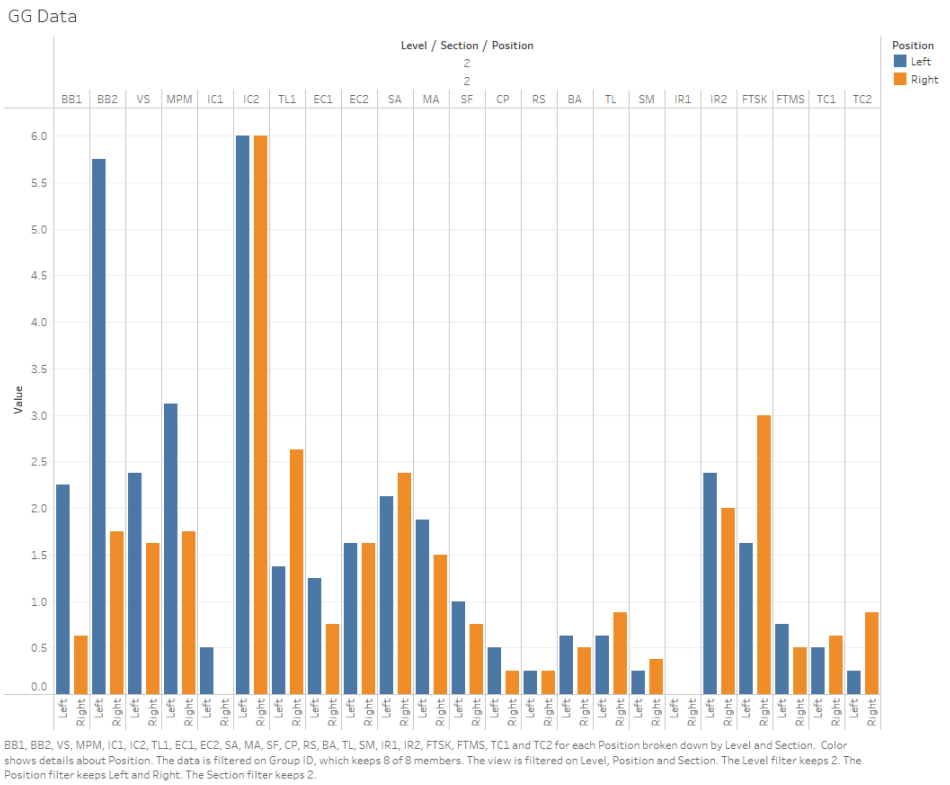



**Figure 7:** Behavioral Marker Graphs for Level 2 Section 2 of All Testing Groups

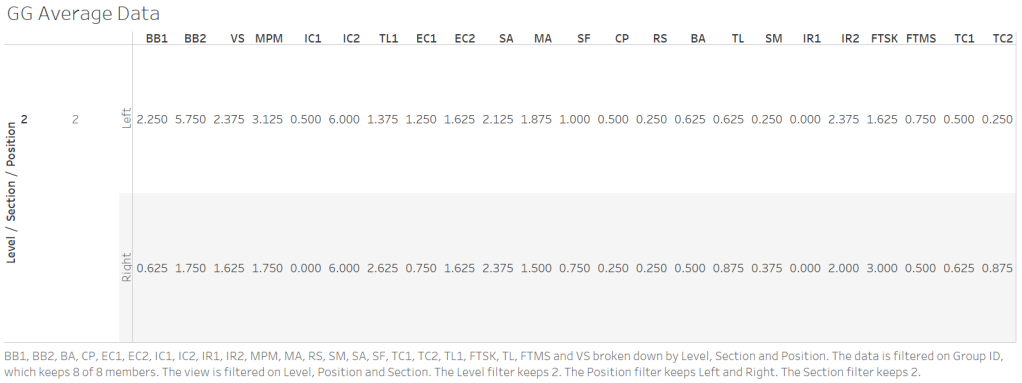



**Figure 7.1:** Behavioral Marker Average Table for Level 2 Section 2 of All Testing Groups.

In Figure 7 and Figure 7.1, this particular section required participants to coordinate a lot more than the previous sections. As a result, participants failed this section a lot more than the others. The participants eventually figured out a way to Mutually Coordinate with each other (IC2), and the person on the Left had a higher Proactive Backup (BB2) behavior because they knew when to control the switches to help their teammate get across the platforms. Also, the Left Player showcased a lot more Voluntary Sharing in this section, which may be due to how much control they have over the elements of that section, and they are sharing the information they

discover with their dependent teammate so that they might avoid mishaps or future imbalances in the game.

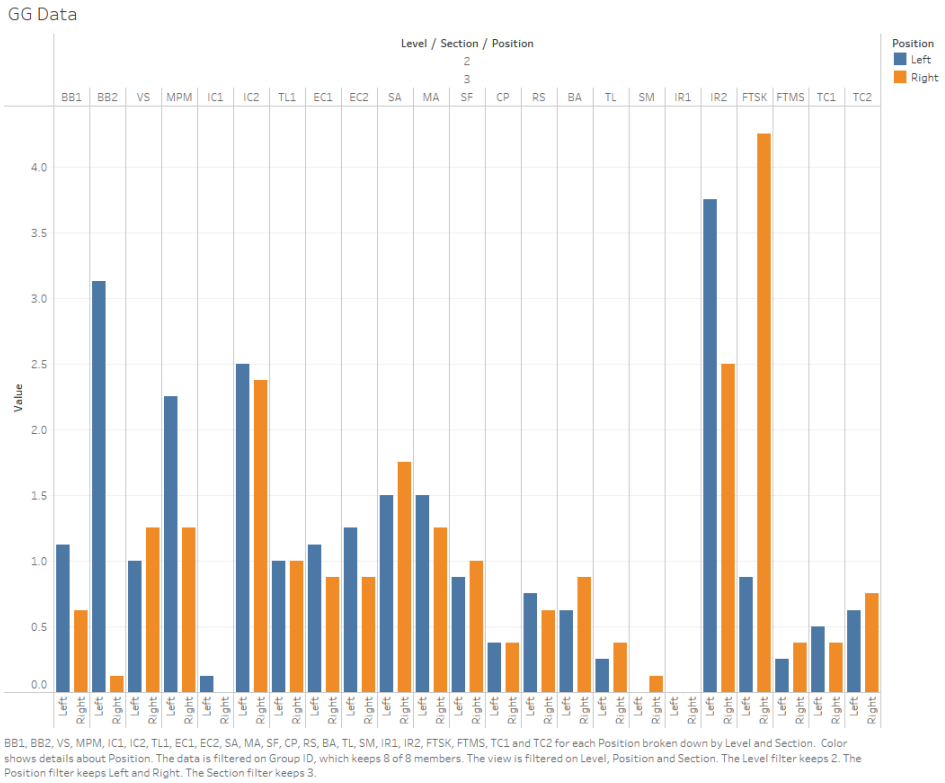



**Figure 8:** Behavioral Marker Graphs for Level 2 Section 3 of All Testing Groups.

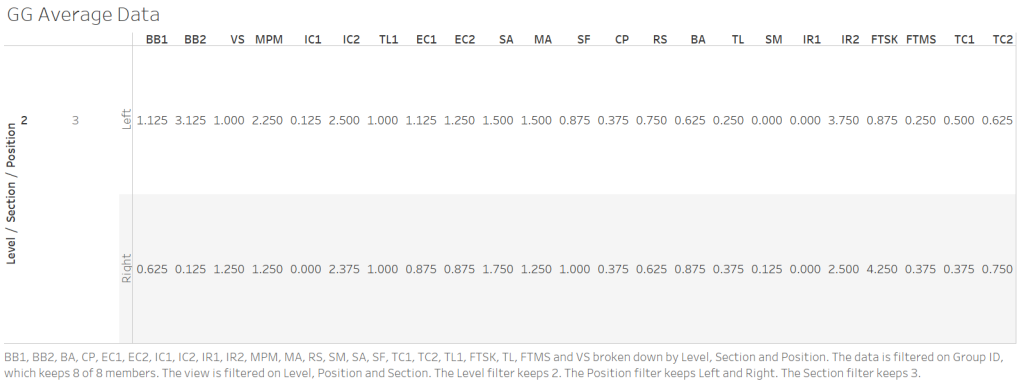



**Figure 8.1:** Behavioral Marker Average Table for Level 2 Section 3 of All Testing Groups.

In Figure 8 and Figure 8.1, a lot of participants failed this section because of the Right Participant trying to jump across and falling down the lava. At the same time, we notice that there is a common pattern that forms with the task failure of the Right Participant. The graph indicates that there was a form of Interpersonal Relationship, specifically Joking and laughing together (IR2) in the Behavioral Marker.

This indicates that the Right participant who failed the obstacle would trigger the teammate (Left Participant) to joke and laugh, eventually having both participants laugh about their failure.

Level 2 shows us how much the Participant on the Left, who has more Power over the Participant on the Right, is willing to back them up and perform altruistic acts for the sake of the team and the main goal of beating a level together. The Player on the Right tends to self-report, assess the situation, be a team leader, and ask for more favors/requests from the Left Player, and that shows how dependency on the other can create situations where requests are being asked and initiatives to lead take place. Through this visualization and analysis of Level 2's section, we can see that the Players in the Position of more power tended to support their teammates willingly and implicitly, while Players in the left Position who were more dependent were comfortable with demanding requests and delegating requests to their teammates.

## *Level 3 Results*

When analyzing the results of Level 3, we made sure that Players have switched Positions from the last Level. So whoever was on the Right is now on the Left, we directly changed the Positions of Power or Flipped the Power Dependency between Players to see how that would affect the subsequent level, in this case, Level 3. This switch in Power Dependence might trigger some new behaviors or showcase different behaviors than the previous levels, so it is important to make this note for analysis.

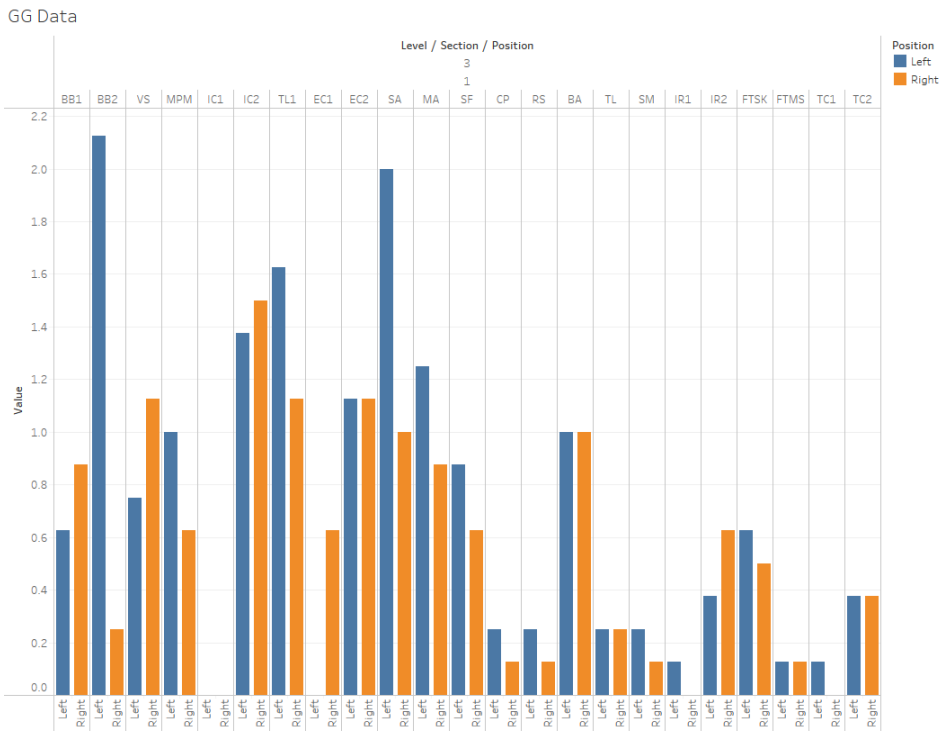


**Figure 9:** Behavioral Marker Graphs for Level 3 Section 1 of All Testing Groups

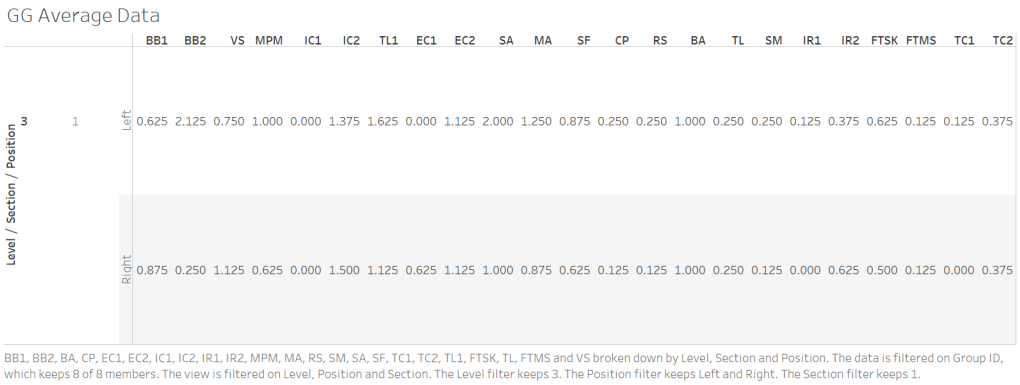
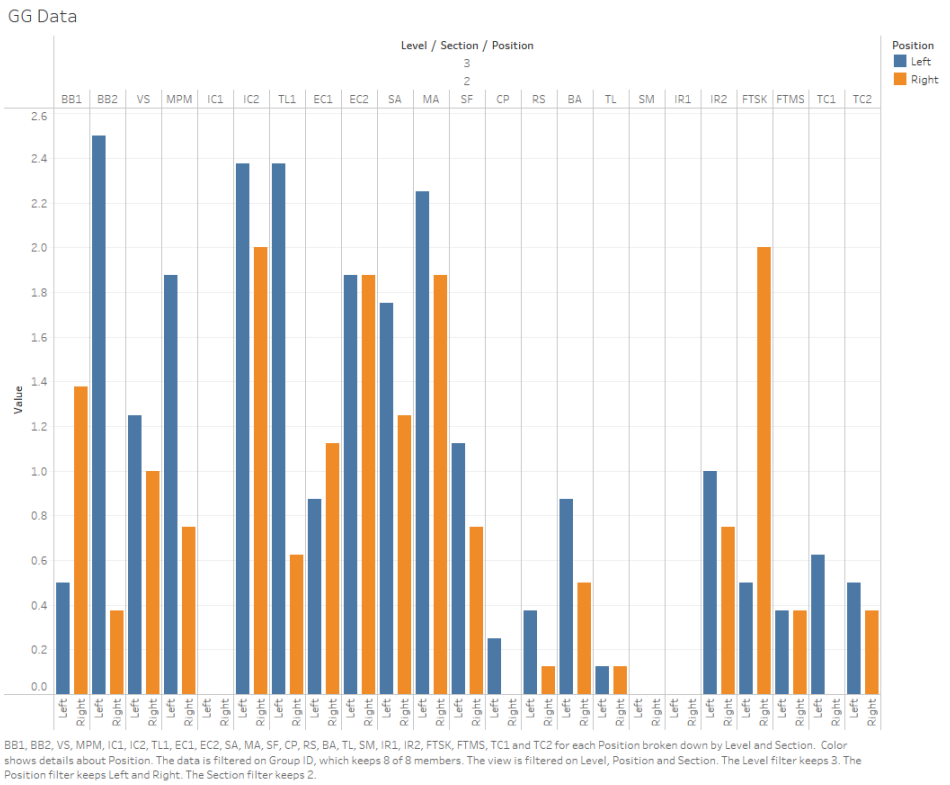



**Figure 9.1:** Behavioral Marker Average Table for Level 3 Section 1 of All Testing Groups.

In Figure 9 and Figure 9.1, the participants were unsure about both their location and the objective, which triggered the Situational assessment (SA) Behavioral Marker: Collecting informational cues essential to solving a team problem or obstacle. Once the participant on the Left figured out a way to solve the team problem or obstacle, the same participant triggered Proactive Backup (BB2): the player supporting a teammate proactively without being asked to. This pattern also triggered Team Leadership (TL1): Team members facilitated solving puzzles, organizing resources, guiding individuals, and coordinating actions because the team members knew exactly what needed to be done.




BB1, BB2, VS, MPM, IC1, IC2, TL1, EC1, EC2, SA, MA, SF, CP, RS, BA, TL, SM, IR1, IR2, FTSK, FTMS, TC1 and TC2 for each Position broken down by Level and Section. Color shows details about Position. The data is filtered on Group ID, which keeps 8 of 8 members. The view is filtered on Level, Position and Section. The Level filter keeps 3. The Position filter keeps Left and Right. The Section filter keeps 2.

**Figure 10:** Behavioral Marker Graphs for Level 3 Section 2 of All Testing Groups

GG Average Data

| Level / Section / Position | | BB1 | BB2 | VS | MPM | IC1 | IC2 | TL1 | EC1 | EC2 | SA | MA | SF | CP | RS | BA | TL | SM | IR1 | IR2 | FTSK | FTMS | TC1 | TC2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 2 | Left | 0.500 | 2.500 | 1.250 | 1.875 | 0.000 | 2.375 | 2.375 | 0.875 | 1.875 | 1.750 | 2.250 | 1.125 | 0.250 | 0.375 | 0.875 | 0.125 | 0.000 | 0.000 | 1.000 | 0.500 | 0.375 | 0.625 | 0.500 |
| | | Right | 1.375 | 0.375 | 1.000 | 0.750 | 0.000 | 2.000 | 0.625 | 1.125 | 1.875 | 1.250 | 1.875 | 0.750 | 0.000 | 0.125 | 0.500 | 0.125 | 0.000 | 0.000 | 0.750 | 2.000 | 0.375 | 0.000 | 0.375 |

BB1, BB2, BA, CP, EC1, EC2, IC1, IC2, IR1, IR2, MPM, MA, RS, SM, SA, SF, TC1, TC2, TL1, FTSK, TL, FTMS and VS broken down by Level, Section and Position. The data is filtered on Group ID, which keeps 8 of 8 members. The view is filtered on Level, Position and Section. The Level filter keeps 3. The Position filter keeps Left and Right. The Section filter keeps 2.

**Figure 10.1:** Behavioral Marker Average Table for Level 3 Section 2 of All Testing Groups.

In Figure 10 and Figure 10.1, this particular section had participants on the Left being more involved in problem-solving. The most prominent Behaviors triggered by the Participant to the Left based on the Behavioral Markers are Mission analysis (MA): Cooperative problem-solving and brainstorming of potential solutions, TL1: Team member facilitating solving puzzles, organizing resources, guiding individuals, and coordinating actions, IC2: mutual coordinated performance without explicit communication or planning and BB2: Proactive backup: A player supporting a

teammate proactively without being asked to, while also leading the team to solve the problem.

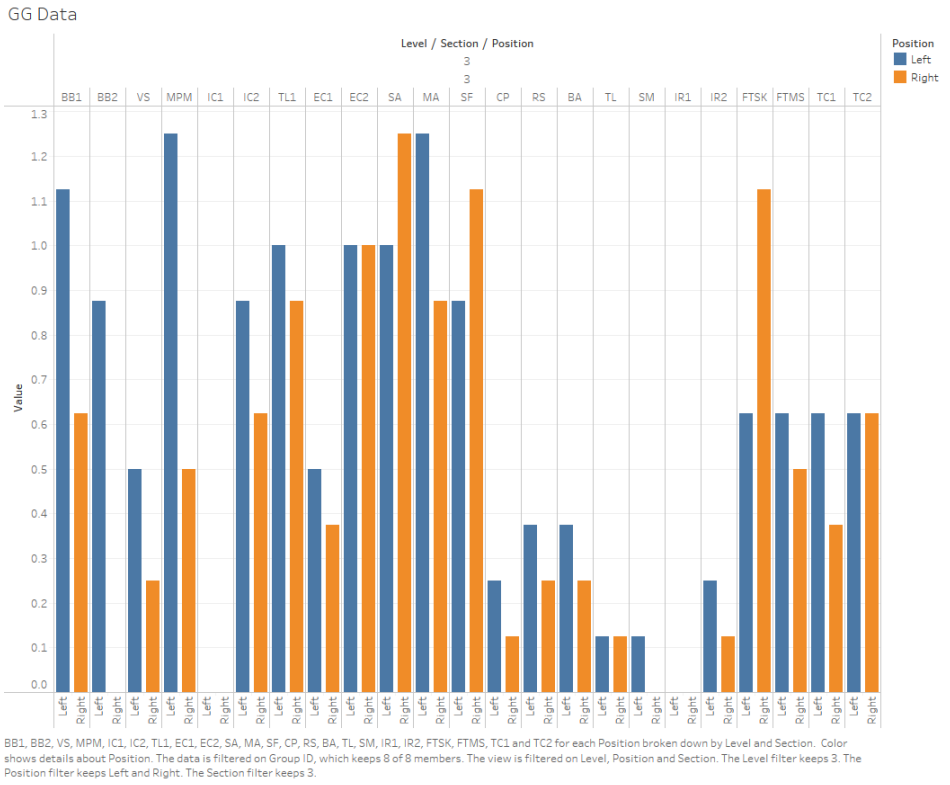



**Figure 11:** Behavioral Marker Graphs for Level 3 Section 3 of All Testing Groups

GG Average Data

| Level / Section / Position | | | BB1 | BB2 | VS | MPM | IC1 | IC2 | TL1 | EC1 | EC2 | SA | MA | SF | CP | RS | BA | TL | SM | IR1 | IR2 | FTSK | FTMS | TC1 | TC2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3 | Left | 1.125 | 0.875 | 0.500 | 1.250 | 0.000 | 0.875 | 1.000 | 0.500 | 1.000 | 1.000 | 1.250 | 0.875 | 0.250 | 0.375 | 0.375 | 0.125 | 0.125 | 0.000 | 0.250 | 0.625 | 0.625 | 0.625 | 0.625 |
| | | Right | 0.625 | 0.000 | 0.250 | 0.500 | 0.000 | 0.625 | 0.875 | 0.375 | 1.000 | 1.250 | 0.875 | 1.125 | 0.125 | 0.250 | 0.250 | 0.125 | 0.000 | 0.000 | 0.125 | 1.125 | 0.500 | 0.375 | 0.625 |

BB1, BB2, BA, CP, EC1, EC2, IC1, IC2, IR1, IR2, MPM, MA, RS, SM, SA, SF, TC1, TC2, TL1, FTSK, TL, FTMS and VS broken down by Level, Section and Position. The data is filtered on Group ID, which keeps 8 of 8 members. The view is filtered on Level, Position and Section. The Level filter keeps 3. The Position filter keeps Left and Right. The Section filter keeps 3.

**Figure 11.1:** Behavioral Marker Average Table for Level 3 Section 3 of All Testing Groups.

In Figure 11 and Figure 11.1, this section has high Behaviors for several Behavioral Markers that show how engaged both participants are. This particular section also has very few attempts which means that the players were able to work together easily to complete this section. The top Behavioral Markers by the participant on the Left are MPM: Players maintaining an awareness of each other's performance to identify any imbalance or needs, Mission analysis (MA): Cooperative problem solving and brainstorming of potential solutions, and BB1 Closed-loop backup: Teammates responding to a help request, verbally or behaviorally. The participants on the Right focused on Strategy formulation (SF): Generating a sequence of actions to reach the goal, Situational assessment (SA): Collecting informational cues essential to solving a team problem or obstacle, and EC2: Teammates engaging in timing and synchronizing their movements through communication.

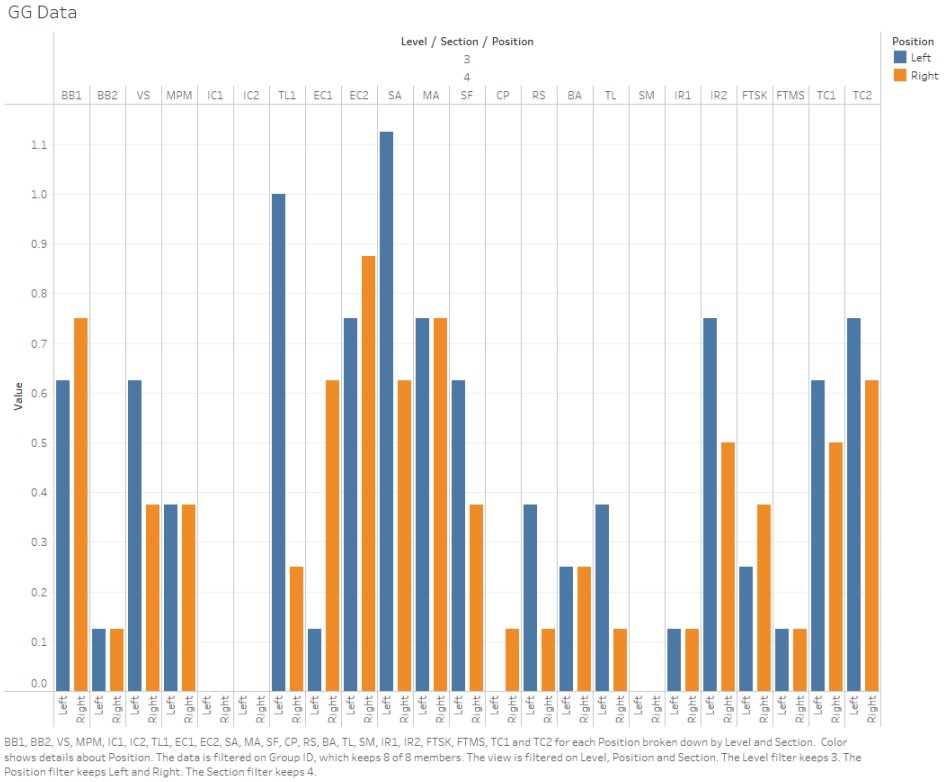



**Figure 12:** Behavioral Marker Graphs for Level 3 Section 4 of All Testing Groups

GG Average Data

| Level / Section / Position | | | BB1 | BB2 | VS | MPM | IC1 | IC2 | TL1 | EC1 | EC2 | SA | MA | SF | CP | RS | BA | TL | SM | IR1 | IR2 | FTSK | FTMS | TC1 | TC2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 4 | Left | 0.625 | 0.125 | 0.625 | 0.375 | 0.000 | 0.000 | 1.000 | 0.125 | 0.750 | 1.125 | 0.750 | 0.625 | 0.000 | 0.375 | 0.250 | 0.375 | 0.000 | 0.125 | 0.750 | 0.250 | 0.125 | 0.625 | 0.750 |
| | | Right | 0.750 | 0.125 | 0.375 | 0.375 | 0.000 | 0.000 | 0.250 | 0.625 | 0.875 | 0.625 | 0.750 | 0.375 | 0.125 | 0.125 | 0.250 | 0.125 | 0.000 | 0.125 | 0.500 | 0.375 | 0.125 | 0.500 | 0.625 |

BB1, BB2, BA, CP, EC1, EC2, IC1, IC2, IR1, IR2, MPM, MA, RS, SM, SA, SF, TC1, TC2, TL1, FTSK, TL, FTMS and VS broken down by Level, Section and Position. The data is filtered on Group ID, which keeps 8 of 8 members. The view is filtered on Level, Position and Section. The Level filter keeps 3. The Position filter keeps Left and Right. The Section filter keeps 4.

**Figure 12.1:** Behavioral Marker Average Table for Level 3 Section 4 of All Testing Groups.

In Figure 12 and Figure 12.1, this section has the least attempts across all levels/sections. The participants on the Left showed a very significant Behavioral Marker TL1: Team members facilitating solving puzzles, organizing resources, guiding individuals, and coordinating actions, Voluntary Sharing (VS): Sharing in anticipation of a need or to avoid imbalance, Situational assessment (SA): Collecting informational cues essential to solving a team problem or obstacle, IR2: Joking and laughing together, and TC2: Expressing excitement. The participant on the Left was significantly more active, responsive, and excited which also raised their Team Leadership qualities on the Behavioral Marker.

After analyzing the sequence of behaviors from Level 2 to Level 3 some behaviors are of note. In Level 2, Players on the right tended to act as team leaders and direct the Players on the Left who had more power over the level and themselves. Once getting to Level 3 and switching their Power Dependency between Players (The player on the Right is now on the Left), we can see that Players on the Left who were on the Right in Level 2 tended to keep being Leaders in their cooperative team. Perhaps after leading in Level 2, and being put in a position of control in the subsequent Level, they kept the leadership role and directed the other Player. Perhaps once Leadership is set between Players, it tends to remain for the majority of the rest of their play session.

## *Pre and Post-Survey Results*

Personality Table

| | Group ID / Participant ID | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Group 1 | | Group 2 | | Group 3 | | Group 4 | | Group 5 | | Group 6 | | Group 7 | | Group 8 | |
| | 3 | 17 | 1 | 6 | 7 | 14 | 9 | 15 | 11 | 20 | 5 | 12 | 2 | 8 | 0 | 18 |
| Agreeableness | 5.000 | 5.500 | 7.000 | 5.500 | 3.500 | 4.500 | 6.500 | 4.500 | 4.000 | 5.000 | 6.000 | 4.000 | 6.500 | 3.000 | 6.000 | 4.000 |
| Conscientiousness | 6.500 | 3.500 | 6.500 | 4.000 | 3.000 | 4.000 | 7.000 | 5.500 | 5.000 | 2.500 | 3.000 | 5.500 | 4.500 | 5.500 | 6.500 | 5.500 |
| Emotional Stability | 5.000 | 4.000 | 7.000 | 4.500 | 4.500 | 4.500 | 6.500 | 5.500 | 4.000 | 4.000 | 4.500 | 4.000 | 6.500 | 2.000 | 7.000 | 5.000 |
| Extraversion | 5.000 | 3.500 | 4.500 | 6.000 | 4.500 | 1.500 | 3.500 | 4.500 | 2.000 | 3.000 | 5.500 | 3.000 | 4.000 | 5.000 | 4.500 | 5.500 |
| Openness to Experiences | 5.500 | 5.500 | 5.000 | 6.000 | 3.500 | 6.500 | 5.500 | 6.000 | 5.000 | 5.500 | 4.500 | 5.000 | 4.000 | 7.000 | 4.500 | 6.000 |

Extraversion, Agreeableness, Conscientiousness, Emotional Stability and Openness to Experiences broken down by Group ID and Participant ID. The data is filtered on Level and Position. The Level filter keeps 1, 2 and 3. The Position filter keeps multiple members. The view is filtered on Group ID, which keeps 8 of 8 members.

**Table 2:** Personality Type Results from the Pre-Survey Personality Test.

Pre Survey Results Table

| | Group ID / Participant ID | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Group 1 | | Group 2 | | Group 3 | | Group 4 | | Group 5 | | Group 6 | | Group 7 | | Group 8 | |
| | 3 | 17 | 1 | 6 | 7 | 14 | 9 | 15 | 11 | 20 | 5 | 12 | 2 | 8 | 0 | 18 |
| Getting Upset with Teammates | 2.000 | 2.000 | 1.000 | 3.000 | 3.000 | 5.000 | 1.000 | 5.000 | 6.000 | 4.000 | 2.000 | 4.000 | 3.000 | 1.000 | 4.000 | 4.000 |
| Prefers to Lead | 4.000 | 3.000 | 3.000 | 4.000 | 4.000 | 4.000 | 2.000 | 5.000 | 6.000 | 4.000 | 6.000 | 3.000 | 4.000 | 3.000 | 4.000 | 6.000 |
| Willingness to take Directions | 5.000 | 5.000 | 6.000 | 5.000 | 5.000 | 5.000 | 7.000 | 6.000 | 5.000 | 4.000 | 5.000 | 5.000 | 4.000 | 6.000 | 4.000 | 4.000 |

Getting Upset with Teammates, Prefers to Lead and Willingness to take Directions broken down by Group ID and Participant ID. The data is filtered on Level and Position. The Level filter keeps 1, 2 and 3. The Position filter keeps multiple members. The view is filtered on Group ID, which keeps 8 of 8 members.

**Table 3:** Results of the questionnaire in the Pre Survey.

Post Survey Results Table

| | Group ID / Participant ID | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Group 1 | | Group 2 | | Group 3 | | Group 4 | | Group 5 | | Group 6 | | Group 7 | | Group 8 | |
| | 3 | 17 | 1 | 6 | 7 | 14 | 9 | 15 | 11 | 20 | 5 | 12 | 2 | 8 | 0 | 18 |
| Self Rated Performance | 4.000 | 7.000 | 6.000 | 4.000 | 4.000 | 6.000 | 6.000 | 5.000 | 6.000 | 5.000 | 5.000 | 6.000 | 5.000 | 7.000 | 5.000 | 5.000 |
| Teammate Performance | 6.000 | 7.000 | 6.000 | 6.000 | 6.000 | 6.000 | 7.000 | 5.000 | 4.000 | 7.000 | 7.000 | 6.000 | 7.000 | 7.000 | 6.000 | 5.000 |
| Teammate Ease of Collaboration | 7.000 | 7.000 | 7.000 | 6.000 | 5.000 | 7.000 | 7.000 | 6.000 | 5.000 | 7.000 | 6.000 | 7.000 | 7.000 | 7.000 | 6.000 | 7.000 |
| Felt Held Back | 1.000 | 5.000 | 1.000 | 5.000 | 3.000 | 1.000 | 1.000 | 5.000 | 2.000 | 1.000 | 1.000 | 2.000 | 1.000 | 2.000 | 1.000 | 4.000 |
| Lead the Team | 4.000 | 5.000 | 6.000 | 3.000 | 4.000 | 4.000 | 4.000 | 5.000 | 4.000 | 5.000 | 3.000 | 2.000 | 4.000 | 3.000 | 4.000 | 5.000 |
| Level of Comfort with Disagreeing | 6.000 | 4.000 | 6.000 | 4.000 | 2.000 | 1.000 | 5.000 | 2.000 | 5.000 | 1.000 | 2.000 | 5.000 | 7.000 | 5.000 | 1.000 | 2.000 |

Felt Held Back, Lead the Team, Level of Comfort with Disagreeing, Self Rated Performance, Teammate Ease of Collaboration and Teammate Performance broken down by Group ID and Participant ID. The data is filtered on Level and Position. The Level filter keeps 1, 2 and 3. The Position filter keeps multiple members. The view is filtered on Group ID, which keeps 8 of 8 members.

**Table 4:** Results of the questionnaire in the Post Survey.

BM in Sections

| | Level / Section / Position | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Level 1 | | | | Level 2 | | | | | | Level 3 | | | | | |
| | Section 1 | | Section 2 | | Section 1 | | Section 2 | | Section 3 | | Section 1 | | Section 2 | | Section 3 | | Section 4 | |
| | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right | Left | Right |
| Adaptability | 3.00 | 3.13 | 1.75 | 2.00 | 2.50 | 3.75 | 2.00 | 1.88 | 2.00 | 2.25 | 1.75 | 1.50 | 1.63 | 0.75 | 1.13 | 0.75 | 1.00 | 0.63 |
| Failures | 4.25 | 3.50 | 3.88 | 2.63 | 1.25 | 0.63 | 2.38 | 3.50 | 1.13 | 4.63 | 0.75 | 0.63 | 0.88 | 2.38 | 1.25 | 1.63 | 0.38 | 0.50 |
| Negative Comments | 1.38 | 1.50 | 0.75 | 1.00 | 0.75 | 2.88 | 0.38 | 0.75 | 0.63 | 1.38 | 0.38 | 0.38 | 1.00 | 0.50 | 0.50 | 0.38 | 0.13 | 0.13 |
| Planning | 5.00 | 5.75 | 2.13 | 1.88 | 5.50 | 7.00 | 5.00 | 4.63 | 3.88 | 4.00 | 4.13 | 2.50 | 5.13 | 3.88 | 3.13 | 3.25 | 2.50 | 1.75 |
| Task Cohesion | 1.63 | 2.13 | 1.50 | 2.63 | 1.63 | 1.75 | 0.75 | 1.50 | 1.13 | 1.13 | 0.50 | 0.38 | 1.13 | 0.38 | 1.25 | 1.00 | 1.38 | 1.13 |
| Backup Behavior | 4.25 | 6.13 | 4.25 | 4.25 | 10.25 | 5.88 | 10.38 | 4.00 | 5.25 | 2.00 | 3.50 | 2.25 | 4.25 | 2.75 | 2.50 | 0.88 | 1.38 | 1.25 |
| Explicit Coordination | 2.00 | 2.25 | 1.00 | 0.88 | 3.13 | 4.25 | 2.88 | 2.38 | 2.38 | 1.75 | 1.13 | 1.75 | 2.75 | 3.00 | 1.50 | 1.38 | 0.88 | 1.50 |
| IC2: Implicit Coordination | 6.25 | 6.13 | 6.00 | 5.50 | 6.63 | 6.88 | 6.00 | 6.00 | 2.50 | 2.38 | 1.38 | 1.50 | 2.38 | 2.00 | 0.88 | 0.63 | 0.00 | 0.00 |
| SM: Time/Lives | 0.50 | 0.63 | 0.13 | 0.50 | 0.88 | 0.88 | 0.25 | 0.38 | 0.00 | 0.13 | 0.25 | 0.13 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 |
| TL1: Team Leadership | 0.88 | 1.63 | 1.00 | 1.25 | 1.38 | 2.38 | 1.38 | 2.63 | 1.00 | 1.00 | 1.63 | 1.13 | 2.38 | 0.63 | 1.00 | 0.88 | 1.00 | 0.25 |

Adaptability, Failures, Negative Comments, Planning, Task Cohesion, Backup Behavior, Explicit Coordination, IC2: Implicit Coordination, SM: Time/Lives and TL1: Team Leadership broken down by Level, Section and Position.

**Table 5:** Behavioral Markers observed in Sections of each Level.

Based on the results from Table 5 we were able to gauge how Power Dependency Imbalance via our Level Sections affected Cooperation between two participants who were strangers with low levels of familiarity. Thanks to this table we can

gauge each behavior from each Player in each Position (Left Being More in Power while Right is more Dependent) while also keeping track of Levels and their respective sections. This will allow us to gauge the behaviors of each Player as they go through our levels in the order we set, letting us analyze how behaviors might change based on the level/section and how it changed over the progression of the game.

The first Pattern we tend to see is that the Player on the Left (In Control of Platforms) in almost all sections tends to show more Backup Behavior, which signifies that Participants with more Power over the other will support their teammates due to the imbalance at hand. The second pattern we have found is regarding Implicit Coordination and Planning. Implicit Coordination involves coordinating without any communication, and this is a lot more prevalent in levels/sections where players tend to fail more often. This is due to their learning and the rise of Planning on how to get through previous sections to get to their point of failure every time they fail. So Implicit Coordination, as well as Planning, rises in Players when they tend to repeat a level and learn from their failures as a result.

Finally, we can see that almost all behaviors tend to show in each section, and they tend to show higher numbers the more attempts the players have. Based on these results, we can say that Power Dependency Imbalance done via Level Design encourages communication and cooperative behaviors between players since they will take on the imbalance and accommodate each other for the sake of completing the common goal of beating a level, a section of it or the game as a whole.

## DISCUSSION

Our literature reviews mainly focused on players' familiarity with each other, and after the playtest, they developed a stronger bond with each other. Our research focused on unfamiliar participants working together in a cooperative environment, and post-playtest, the participants would not show any bond with each other. The participants seemed to be more understanding towards each other during the playtest. They would cooperate and laugh together, but the post-playtest familiarity level was the same as the pre-playtest familiarity level.

We were also expecting the low levels of familiarity between players to make their experience not as comfortable and make players showcase more negative behaviors that might hinder cooperation due to the lack of early trust that we have found in the article “Familiarity in team-based online games” Hudson, M., Cairns, P., and Nordin, A.I. (1970). What took place was pretty different from the outcome that we were expecting. Players were very polite, accommodating the imbalance in power between levels, and strived to be good samaritans throughout. This behavior might be due to them playing together in a physical room while being recorded by researchers. Due to their physical presence and need to uphold the image of goodwill, the Players were very nice and worked together well. The opposite of this behavior can be observed in Competitive Team-based FPS games because the players of said game are not being monitored in a public manner, and they tend to be toxic towards their teammates when there is a considerable gap in skill level, and the team’s success is affected by the lower skilled individual. To further prove this point

we can observe the good samaritan behavior among the majority of Online Streamers of said games since they are under the watchful eye of the general public when creating and streaming content.

To study this phenomenon, we would like to add more control groups to our study, friends and online strangers as pointed out by comments from our participants based on our research participants would probably be more critical of their teammate's performance and would show more negative behaviors hindering cooperation due to the lack of social pressure to uphold goodwill in front of researchers and other people.

Even though we don't have any literature discussing Leadership and Cooperation or Leadership within a Power Dependency Relationship, what we have found in our results is pretty interesting. Between Level 2 and Level 3, the Player on the Right became the player on the Left and now has more power and control. When these Players were in Level 2, they showcased leadership qualities, and moving to Level 3, they kept it and led their team to solve solutions. Based on this, we can see that when one player assumes leadership in the earlier levels, even though they were dependent on the other. When that relationship switches, they remain team leaders. This makes us question whether Team Leadership does not change once set by players, which is the case that we have seen even though there's a power dependency change between levels.

Our research shows a relation to Bourdieu's (Year) theory of power involving Habitus, Capital, and Fields. Habitus, in our case, can be previous knowledge and experiences of the participants in a social setting that they bring with them to the playtest. Capital in our case, would be the affordances that participants get at each level for them to hold power over the other. The buttons that control platforms are the Capital, and in our research, we appointed them to the players, usually in the Left Position. Finally, Fields are where culture and knowledge collide, which, in our case, are the levels and sections of our game. In our game, Capital is pre-determined based on who is in which position (for example, the Left position). Based on Bourdieu (Year), Capital and a new relationship will take place each time the settings change, which is very relevant to our research. Based on their Capital, players tend to assess each level differently. Some teams tended to have similar relationships even after the switch in power dependency, but Bourdieu's theory still applies to our case. For example, in terms of our playtest, we think that our participants were well-mannered and polite to their teammates because of their social and cultural backgrounds and their past events and experiences in social structures that shape their Habitus. Bourdieu states that in each context, the Habitus of the person will produce different patterns transferable between contexts and in our study's context. Players were being monitored by us and recorded for the entirety of the playtest, hence explaining the nice and polite behaviors throughout all teams coming from their past cultural and social expectations.

## Limitations

Our research provided us with a lot of insights into how cooperation and power imbalance go hand in hand. A few limitations that we came across were while we did perform the tests on unfamiliar participant groups, through our observations, we concluded that participants would be more aggressive and straightforward with

people they are familiar with rather than a participant they are unfamiliar with because they would be more comfortable with participants they are familiar with. Another limitation that we faced during the results analysis was that the participants who failed the obstacle/section/level because of low skill level were marked as Task-skills failure (F TSK): For example, not knowing the right functions to press, not knowing how to solve a certain obstacle. This particular Behavioral Marker is focused more on the player not knowing how to complete the obstacle/section/level because they are unaware of what needs to be done, whereas, in our study, the participants knew what needed to be done but failed the task due to low skill level or time.

As we discussed earlier, if we replicated our study, we predict that our participants could be more critical of their teammates' performance if placed in a more private setting. Even in such a scenario, there is a chance that they might still be hesitant to be negative about their teammates' performance due to the self-consciousness that occurs from being observed, recorded, and studied. Importantly, we think that players would be more critical if they were grouped based on trust and friendship (familiarity). In the next stages of our research, we would test this hypothesis, evaluating the relationship between familiarity and players' negative feedback to teammates. This would enable us to improve upon our findings and more fully answer our research question.

## CONCLUSION

From this research, we found that participants tended to accommodate the imbalance for the sake of completing the common goal, which needed both of their efforts. Similar to the article "Gut or Game? The Influence of Moral Intuitions on Decisions in Video Games" (Joeckel, 2012), instead of violence, we were expecting the power imbalance implemented via level design to impact cooperation negatively, but since the participants had a common goal in which both were needed, they were willing to go through and comply with their teammates for the sake of achieving this common goal.

Even though there was plenty of ordering around among our participants, we did not observe any of the exchanges between them to be negative or toxic towards their teammates. We believe they were more accommodating since even though there were power dependency imbalances between the two players when trying to achieve a common goal that would be beneficial to both, players were found to be more forgiving towards each other. This was observed a lot when it came to their multiple shortcomings in trying to beat a section of a particular level. Even though we observed some frustration among our participants during their failures, it was never directed toward their teammates and more so towards the game itself, which were marked in the "Negative Comments" Behavioral Markers during our analysis.

The Behavioral Marker "Implicit Coordination" involves coordinating without any communication, and this marker was observed to be a lot more prevalent in levels/sections where players were failing and had a tough time overcoming the obstacles. This marker is dominant due to their learning and hence the eventual appearance of the Behavioral Marker "Planning" when strategizing how to beat sections before the ones they kept failing. So Behavioral Markers such as "Implicit Coordination" and "Planning" were observed a lot in players when they tended to repeat a level and learn from their failures as a result.

Participants with more power over the other will tend to support their teammates due to the imbalance at hand, while the more dependent player will ask for more demands that will be supported. A common goal between players will tend to balance out the power dependency relationship implemented via the level design since they do need each other to reach that common goal. This shows that Cooperation, in our case, overshadowed the power imbalance and the negative behaviors we were expecting to see more of. But we do have to keep in mind how participant behavior was affected by the physical location and the fact that they were being monitored and recorded.

In conclusion, we can say that power dependency Imbalance done via Level Design encourages communication and cooperative behaviors between players since they will take on the imbalance and accommodate each other for the sake of completing the common goal of beating a level, a section of it or the game as a whole. Ultimately, we want the players to have a cooperative game that makes them feel tension and betrayal. The results from this study could help other game developers design their games to be more cooperative experiences by using interdependence and degrees of Power Dependency Imbalance between its players to promote more communication and cooperative behaviors.

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# APPENDIX

## Pre-Game Survey

Gambit's Gauntlet Pre-Game Survey

## Post-Game Survey

Gambit's Gauntlet Post-Game Survey

## Raw Data

Results - Cleaned

## Consent Form:

By signing this form, you consent to participate in this player experience experiment for our Capstone Game “Gambit’s Gauntlet”.

For this experiment, we will be gathering information/data before, during, and after the test. We will be collecting the following data:

1. Relevant demographics such as age, and gender.
2. Relevant background information relating to your previous experiment with multiplayer games.
3. Your personality type according to a quiz.
4. Your impressions of both the test, as well as your teammate.
5. Your behavior during the test

The experiment will be performed as follows

1. We will ask you to provide background information, as well as take a personality test.
2. You will be paired up with another participant who you are not familiar with.
3. You will play a local multiplayer game with another participant, during which your actions will be recorded.
4. We will ask you for your impressions of the experience, as well as provide you with a questionnaire to fill out about the experience.

All the data that we collect will be kept private, and all data used for presentation will be deidentified and anonymous.

You may choose to quit and/or leave at any point of the experiment and ask for your data to be erased and not used in our research.

Please enter your full name below if you agree to all these terms.

I, _____ agree to the above terms and am willing to participate in this experiment conducted by Team Extra Sauce for their Capstone.