Affective Teamwork: A Comparative Study on the Effectiveness of Emotional Interaction and Collaboration Between Players in Cooperative Survival Games

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ABSTRACT

Multiplayer survival games such as 'Among Us' and 'Dead by Daylight' create collaborative activity between players by eliciting emotional responses. This study aims to compare and evaluate how effectively the interfaces of these two games do this. A comparative study in two stages was conducted with 11 participants with varying levels of experience with each game. The participants played each game and completed a survey of each examining the emotions they elicited and how intensely the participant felt it, as well as how this emotional response affected their interactions with other players. The findings of the study support one hypothesis, that strong emotional responses lead to collaborative activity; and contradicts the other, that photo-realism amplifies emotional responses to stimulus from the interface. The study identifies 'Among Us' as the more effective game in terms of affective design, however 'Dead by Daylight' was found to encourage collaboration more frequently.

CCS CONCEPTS

• **Human-centered computing** → *Empirical studies in collaborative and social computing*; *User interface design*; *Heuristic evaluations.*

KEYWORDS

emotion, collaboration, video games, interfaces, graphical user interface, effectiveness, comparative study

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1 INTRODUCTION

1.1 Understanding Survival Games

A multiplayer survival game is a piece of entertainment software wherein players can work both together and against each other to survive the circumstances of the game [1]. Most games that are recognised as part of the survival genre focus on a persistent open world with the aim of crafting and collecting items with few if any winning conditions. This study focuses on the subgenre of round based player versus player cooperative survival games.

These kinds of games have a limited number of players, a set time frame, and a round based structure. Usually one group of players aim to survive the pursuits of another group of, or a singular player [20]. Often the former group of players aim to complete a set of goals or tasks in order to escape or defeat their opponent(s) [3]; while the latter must capture, incapacitate, sabotage, or kill the first group in order to attain their own victory.

The survival game genre emerged in the early 1990s with games such as 'UnReal' world [7], however it is considered to have come to prominence with mainstream audiences as a result of the rising popularity of 'Minecraft' [14]. The trend for cooperative survival games may also be attributed to Minecraft due to its advertising slogan "Better together", encouraging multiplayer collaboration. The popularity of cooperative survival rose with 'Don't Starve Together' [8] and other similar games, which actively required players to collaborate. As the market for survival games began to saturate in the "Survival Renaissance" [17], developers began to diverge from the genre's core mechanics to fill unexplored niches in design.

1.2 Games in Focus

'Dead by Daylight' [11] and 'Among Us' [10], the games that this study aims to investigate, are two such divergent projects. Both shy away from the more commonly seen post-apocalyptic and zombie apocalypse settings, 'Dead by Daylight' by leaning hard into traditional horror/thriller themes, 'Among Us' by its lighthearted science fiction setting.

These two games, though different in their look and feel, share the fundamental gameplay mechanics of a cooperative survival game, as previously described. In 'Dead by Daylight' the "survivor" group must work together to repair power generators in order to escape, while avoiding another player in the role of the "killer". When the killer injures or captures a survivor the rest of the group can work together to save them.

Similarly in 'Among Us', a group of up to 10 "crewmates" work together to complete tasks about their spaceship, completing these tasks results in a victory for the crewmates. However, up to 3 of the crewmates may be "impostors" who aim to kill all of the crewmates. When a player discovers the body of a killed crewmate, they can call

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an emergency meeting, where all players discuss who is responsible and vote to eject their suspect from the ship.

1.3 Evaluation Criteria

As noted, the games chosen for this study have a strong collaborative focus in their gameplay, with players working towards a common goal. As collaboration is so essential to the experience offered by these games it is worthwhile investigating how effectively their interfaces encourage collaboration.

It can be suggested that all games elicit emotional responses from players [19], however in multiplayer games these emotions may affect the way in which the player engages with both teammates and opponents. As such, determining the most effective means of eliciting emotional responses from players to guide their actions is of value to development studios across a range of game genres.

1.4 Definition of Key Terms

In the terms of this study, "effective" is taken to mean two things, depending on its context. The first definition relates to the emotional impact of an interface element. If the appearance of, or engagement with a part of the game's interface elicits a distinct and potent emotional response from the player, it can be deemed "effective". In the secondary instance elements of the game's interface are considered to be "effective" if the emotion response they have elicited leads to a change in the way players interact with each other, either positively or negatively.

It is also important for the purposes of this study to define "collaboration" more specifically. The obvious meaning is of players on the same team working together towards the predetermined goal of the game. However, this study also takes collaboration to mean all players, regardless of team or goal, working together in terms of performing their roles as best as possible for the sake of creating an enjoyable experience within the game. This can be simplified by saying that for the purposes of the study competition is collaborative.

1.5 Hypotheses

This study investigates two hypotheses. The first is that the horror oriented interface of 'Dead by Daylight' will elicit more powerful emotional responses from users than the brightly coloured interface of 'Among Us'. This assumption is predicated on the style of 'Among Us' being detached from reality, and its gameplay being more relaxed in pace; while 'Dead by Daylight' is photorealistic, and conveys a sense of urgency to the player that will amplify emotion responses to stimulus from the interface.

The second hypothesis is that strong emotion responses will lead to players collaborating more consciously with one another, especially in instances where the emotional stimulus is a result of another player's actions. An example being when another player is captured in 'Dead by Daylight', or a body is found in 'Among Us'.

2 RELATED WORK

There are a number of topics that require investigation in order to effectively explore the connection between emotional interaction and interplayer collaboration. Focus must first be placed on measuring emotions elicited from playing games, and identifying the standards and guidelines of affective design. This is then followed by consideration of multiplayer game design, in particular the efficacy of collaborative and competitive interplayer interaction.

2.1 Measuring Emotional Interaction

Research carried out by Regan Mandryk and M. Stella Atkins [13], focusing on methods of observing emotion during interaction with play technology bears a number of valuable insights. In this study participants played a sports game under differing conditions. They played against a computer, against a friend, and against a stranger, however the focus was not on these variables so this study has no value identifying interplayer trends. The researchers modeled participants' emotional responses on a modified interpretation of the Affect Grid [21]. This led to the study transforming data collected from participants into five emotional states that are relevant to gameplay: boredom, challenge, excitement, frustration, and fun.

The study succeeded in identifying a method for accurately quantifying emotional states continuously during gameplay experiences using physiological metrics such as galvanic skin response (GSR) and cardiovascular activity measurements. The data indicated that positive emotions such as excitement and fun were felt more strongly by participants than negative ones such as frustration.

The findings of Mandryk and Atkins support the process and suppositions of this study in a number of ways. During the process of designing the questionnaires for this study the emotional labels applied by Mandryk and Atkins were often used in questions where participants had to specify how interactions with the game made them feel. Also their process of evaluating the data from physiological metrics to subjective self-reports from their participants indicates that such self-reported data can be reliable, as in that instance the data from self-reports followed the same trends drawn from objective data. It should be noted however that while users can effectively express their attitudes, they are not able to reliably self report their behaviour [16]. As such, the data collected from user completed questionnaires in this study should be considered most valuable for identifying emotional interactions with the game. To more effectively determine how these emotions affect collaboration, observational studies would be preferable.

2.2 Affective Game Design

A study into effective affective UI design for games by Daniel Johnson and Janet Wiles [12] proposes that games are designed to generate positive emotions, and are most successful when they create "flow" for the player. Flow being a state of concentration, deep enjoyment, and total absorption in an activity [5], this paper determines how game design impacts flow when disregarding Nielsen's heuristic evaluation guidelines [15]. The argument is made that flow is essential to an enjoyable experience for players, and that challenges outweighing the players' skill level will lead to anxiety, disrupting flow.

The study identifies a number of contraventions of Nielsen's HCI guidelines that both facilitate and interrupt flow. Of the former kind there are two noteworthy examples: the first is the manner in which some games deliberately present a very limited amount of information to the player. This approach contributes to an increased immersion in the game, with fewer distractions to impede the user

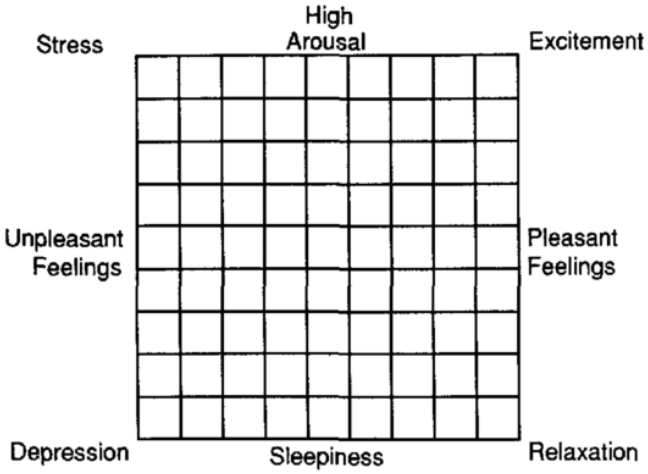

Figure 1: The Affect Grid, a method of plotting emotional responses from James Russell's 1989 article: "Affect Grid: A single-item scale of pleasure and arousal."

from their main task. The second is the use of limited controls used for multiple purposes. Johnson and Wiles point out that in the case of consoles this is a necessity, however it is also a prevalent design decision in keyboard and mouse controls. The consequence is that the user has fewer controls to remember, reducing the amount of mistakes they are likely to make. Where design decisions that interrupt flow are concerned, there is only one noted in the paper with consequence to this study. It is argued that many games have poorly designed menus which sacrifice readability for aesthetics, and that this problem extends to the in-game interface. This can lead to difficulty and frustration on the player's part, interrupting flow.

The evaluation of game design interrupting flow poses interesting questions regarding the design of the two games being considered in this study. Both 'Dead by Daylight' and 'Among Us' both use mechanisms that interrupt flow, in 'Dead by Daylight' the player will often fail a skill check and suffer a setback, or have to flee the killer. In 'Among Us' the player is disrupted from their task any time another crewmate calls an emergency meeting. As a result due consideration will have to be given to how much the emotional responses reported by participants are the consequence of flow disruption.

2.3 Collaboration in Video Games

An exploration of communication, competition and collaboration in online games by Brian Winn and John Fisher [24] seeks to identify effective design methods in a number of successful games contemporary to the study. They argue that a game's emotional impact can be heightened through playing with and against other human players, rather than a computer operated character, as a computer based opponent cannot shame you [2]. The paper makes the case that both collaboration and competition is a compelling aspect of online gaming, through a shared sense of glory and teamwork, and by and by making the player a part of something bigger than themselves.

While competition and collaboration may emerge organically from interpersonal communication between players, Winn and Fisher conclude that they should be explicitly built into the gameplay experience, as social incentives and rewards for player engagement amplify gameplay. It is cautioned however that player to player competition and collaboration should be carefully balanced. They acknowledge that it can be difficult for multiplayer games to place the determining factor of victory on player skill, as a level playing field must be created between players. Games that give players equal abilities succeed in this as the only advantage one player has over another is experience, however games where progression is rewarded with new abilities create instability between players. Designers must therefore be careful that new players are not driven away by more powerful experienced players.

The points raised by Winn and Fisher highlight a few key differences between 'Among Us' and 'Dead by Daylight'. The former has no kind of progression system, players always have the same limited set of abilities and so there is a reliably level playing field. In 'Dead by Daylight' however, players collect points for in-game actions that can be used to unlock bonuses and new abilities. This presents a concern regarding the data for this study, as the progression level of both the participants and the random players they shared matches with could not be accounted for; it can be assumed that there was a wide range of disparity. As such some participants who were less experienced with the game may have been working with or competing against players who had a significant advantage, and so their interactions with other players may have been influenced by this.

2.4 Player Versus Player Design

Daniel Shafer's article on player versus player games aims to determine how certain gameplay factors affect hostility and enjoyment [22]. The study aims to bridge a supposed gap between research into video games as a trigger for violence, and video games as a source of enjoyment. Shafer describes a "complex process of enjoyment of entertainment", here he acknowledges that games can and do cause negative feelings such as sadness and frustration, however they can still be enjoyed [23]. It is argued that frustration is produced in gameplay by a player's opponent hindering their success.

Shafer's study examined differences between multiplayer player versus player (PvP) and solo player versus environment (PvE) games. The study supported the hypothesis that losers would report more hostility and frustration in PvP games, however the hypothesis that players of PvP games would report higher enjoyment of the game than PvE players was not supported by the results. From this data Shafer infers a correlation between PvP experiences and a more intense feeling of frustration.

These results indicate that this study should expect to find participants report negative emotional interactions, in particular frustration, in the PvP games being investigated. However, Shafer's study had participants engage in 1 versus 1 gameplay, while this one explores gameplay in groups of 5 and up to 10. As such the anonymity afforded by larger group sizes may allow for frustrating incidents to result in less negative interaction between players [6].

3 METHOD

3.1 Questionnaire Design

The study was carried out with a mixed methods approach that combined numerical data regarding the participants' emotional responses with qualitative data about their interactions with other players. This approach was chosen as attempting to interpret participants' emotional response intensity from an open question would likely have led to serious inconsistencies within the data, while deriving meaningful inter-player interactions from quantitative data would have been entirely unachievable.

The two questionnaires shared a format of five 3 part questions, each question was accompanied by an image of the interface element. The first question aimed to identify the emotion participants experienced in response to an interface element in the relevant game. Depending on the interface element being considered the suggested emotions differed, though 4 options were always given based on anecdotal experiences in the games. The participants also had the option to add their own response if needed, allowing for any emotional responses that had not been anticipated.

The second question would gauge the participant's emotional response on a scale of 1 to 10, with 1 indicating the emotion was barely present and 10 indicating that it was felt very intensely. And the third question allowed participants to write openly about how they perceived the emotional response they recorded had affected their interactions with other players. This question proved the most problematic under the self guided nature of the study, in a few cases the participants offered very brief responses with little meaningful insight into their actions toward other players.

As the content of the two games differs significantly each questionnaire interrogates five largely unrelated interface elements. For 'Dead by Daylight' the questionnaire focuses on the following:

- The skill check interface, a circle that appears on screen when the user attempts to repair a generator or heal a fellow survivor. The player must press the button or key stated by the interface when the marker travelling around the circle is inside the denoted wedge.
- The teammate hooked indicator, a black circle that shows the silhouettes of teammate and the killer in the location where the killer has just trapped another player.
- The killer radius warning, a heartbeat sound effect that increases in volume the close the killer gets to the player. This is the only non-visual element investigated across both games, thus posing an issue of inconsistency.
- The escape killer bar. When the player is captured by the killer they have a chance while being carried to a hook to wriggle free, a bar appears at the bottom of the screen that the player must fill by "mashing" two buttons/keys.
- The end of game review screen, there are five discrete sections to this screen, however the focus of this study was the first section, which shows the player's overall progression and the areas in which they were most effective in the game. It also indicates whether the team won or lost.

In the case of 'Among Us' the following interface elements were reviewed:

- The starting screen, after the game is launched from a social lobby each player is shown their role: either Crewmate or impostor.
- The body reported screen, which appears when someone discovers the body of another cremate and reports it.
- The voting screen, after a body is reported there is a brief countdown while the players discuss who they think is responsible, after this time the players vote for their suspect.
- The ejection screen, which shows the voted suspect being thrown into lava, out of an airlock, etc. Depending on the settings of the game lobby this screen may display whether the ejected player was an impostor or not.
- The killed by impostor screen, when a player is killed by the impostor a fast moving, cartoonishly violent animation plays showing them die. After this the player can continue as a ghost, unable to communicate with anyone else.

As mentioned, none of the elements being interrogated in one game directly correspond to any in the other. As such for the sake of effective comparison, similarities had to be drawn based on the general context of the elements, as well as the expected range of emotions they might elicit.

The start screen of 'Among Us' was paired with the end screen of 'Dead by Daylight', as both represent a change of play state, and both convey information that is likely to either please or frustrate the participant. For example one participant may prefer to play as a crewmate in 'Among Us', and be anxious to play as an impostor as they lack the skill.

The team mate hooked element in 'Dead by Daylight' was compared with the body reported screen in 'Among Us'. These elements indicate a significant change in the circumstances of the game, as a player has been removed from play.

The killer radius effect from 'Dead by Daylight' and the ejection screen in 'Among Us' both represent an increased threat to the player; the sound effect because it indicates a nearby danger, and the ejection screen because the player is now more likely to be a victim or a suspect.

The player killed by impostor screen in 'Among Us' parallels the escape attempt bar less directly than the other pairings, as the former is an unavoidable fact while the latter is presents an opportunity to avoid death. However, both are the pinnacle of danger to the player in their respective games.

Finally, the skill checks from 'Dead by Daylight' are compared with the voting screen in 'Among Us'. If failed, the skill check draws the attention of the killer toward the player and any nearby teammates, increasing the risk of capture. Similarly, if players vote for the wrong person in 'Among Us', the impostor now has fewer obstacles between themselves and victory.

3.2 Structure

Each participant was asked to play each of the two games for a suggested period of thirty minutes to an hour, and immediately after each session complete the appropriate questionnaire. Initially it was intended that participants would play each game in groups with one another, in order to limit outside variables such as matchmaking issues or players disrupting the normal game play loop. However, it was determined that scheduling participants into groups would be

Table 1: Summary of mean emotional intensity

Game	Mean Intensity	SD
'Among Us'	6.910	0.726
'Dead by Daylight'	6.090	2.271

logistically troublesome and would also present issues preserving the anonymity of participants. As such each participant played the games in their own time and at a pace they were comfortable with, in some regards this benefited the study, as participants were more likely to be in a state similar to how they usually play games.

3.3 Participants

In total the study had a sample size of 11 participants. Naturally, this small sample size means that the conclusions drawn from this study can only be considered preliminary. The process of procuring participants was fraught with issues throughout. Requests for participants were sent out through a number of game focused Discord communities where there were a number of individuals who would have suited the study. This yielded no results however, which may have been as the time period over which the study was conducted overlapped with the holiday season.

Ultimately responses came only through direct requests to individuals with whom I was already reasonably well acquainted. In a few instances these individuals reached out to others who they knew would be able to participate, and so a few more participants were gained.

The was composed of 9 male and 2 female participants, of these 4 had previous experience playing 'Dead by Daylight', and 10 had previous experience with 'Among Us'. This inconsistency of familiarity with the games was the most significant concern during the study, as most of the participants were learning how to play 'Dead by Daylight' while also attempting to focus on their emotional reactions to the game. The study would have benefited from a participant pool with more robust experience with both games.

4 FINDINGS

For the purpose of the study the effectiveness of each game's affective design and its effect on collaboration is based on how intensely participants reported feeling emotions as a result of certain interface elements, as well as whether or not these responses encouraged inter-player collaboration.

Overall it has been found that the interface of 'Among Us' has a higher mean emotional response intensity of 6.910, however 'Dead by Daylight' presents a standard deviation of 2.271 (Table 1). As such 'Among Us' can be expected to produce emotional responses within a more reliable range of intensity, while 'Dead by Daylight' will on average elicit a wider range of emotionally intense responses but may also be expected to produce more intense responses (Figure 2). For more in depth comparison the findings of this study will be discussed in the interface element pairs established previously.

4.1 Start Screen and End Screen

The mean emotional response intensity for these two interface elements is very similar, the start screen of 'Among Us' at 6.727 and

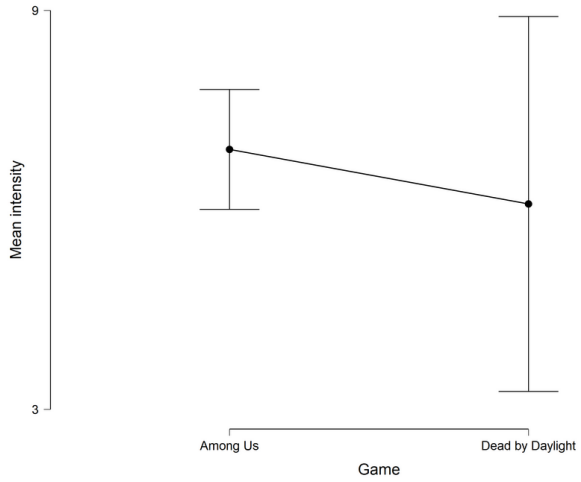

Figure 2: Independent Samples T-Test showing mean emotional response intensity for 'Among Us' and 'Dead by Daylight'.

Table 2: Comparison of mean emotional intensity for start screen and end screen

Interface Element	Mean	SD
'Among Us' - Start Screen	6.727	1.954
'Dead by Daylight'- End Screen	6.090	2.119

the end screen of 'Dead by Daylight' at 7.091. The two also have close standard deviation (Table 2), however the latter element has both the higher mean and standard deviation (Figure 3).

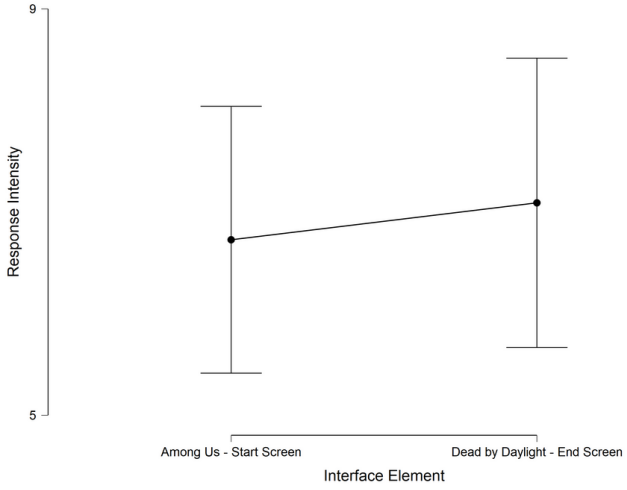

Figure 3: Mean emotional intensity for 'Among Us' start screen and 'Dead by Daylight' end Screen

Table 3: Frequency of emotional responses to start screen and end screen.

Emotion	Frequency	Percent
'Among Us' - Start Screen		
Anxious/focused	1	9.091
Disappointed	1	9.091
Excited	6	54.545
Nervous	2	18.182
Relieved	1	9.091
Satisfied	0	0
Total	11	100.000
'Dead by Daylight' - End Screen		
Anxious/focused	0	0
Disappointed	2	18.182
Excited	0	0
Nervous	0	0
Relieved	4	36.364
Satisfied	5	45.455
Total	11	100.000

Table 4: Comparison of mean emotional intensity for body reported screen and teammate hooked interface element.

Interface Element	Mean	SD
'Among Us' - Body Reported	6.364	1.362
'Dead by Daylight'- Teammate Hooked	7.273	1.191

Participants reported feeling "excited" on seeing the 'Among Us' start screen more than any other emotion combined with 55% of responses (Figure 4), while for the 'Dead by Daylight' end screen 46% reported feeling "satisfied", while 36% reported feeling "relieved", and the remainder "disappointed" (Table 3).

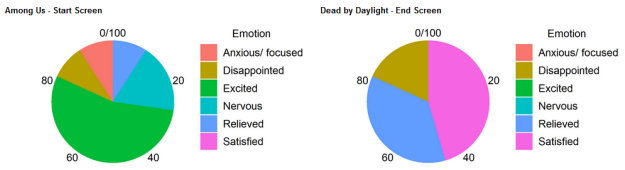

Figure 4: Pie chart showing distribution of emotions reported by participants for start screen and end Screen.

4.2 Body Reported and Teammate Hooked

The standard deviations for the body reported and teammate hooked interface elements are within 0.2 of one another, indicating that both elements elicit similar ranges of emotional intensity (Table 4). However, the teammate hooked element has a notably higher mean response intensity of 7.273 (Figure 5).

When presented with the body reported screen participants overwhelmingly reported feeling "curious", with 73% responding as such.

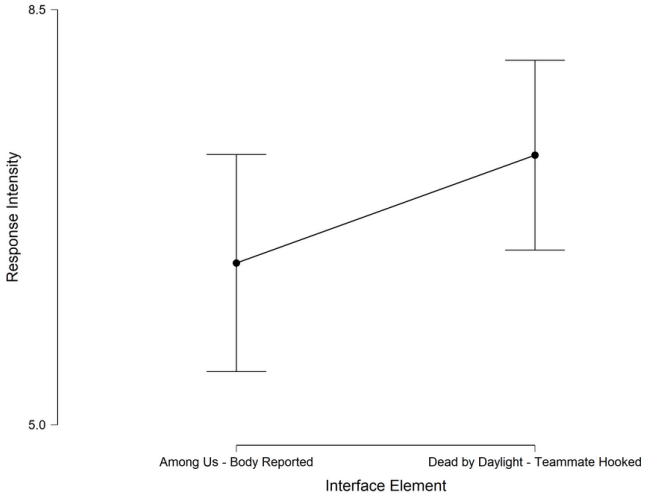

Figure 5: Mean emotional intensity for body reported screen and teammate hooked interface element.

Table 5: Frequency of emotional responses to body reported screen and teammate hooked interface element.

Emotion	Frequency	Percent
'Among Us' - Body Reported		
Annoyed	1	9.091
Cautious	0	0
Curious	8	72.727
Determined	0	0
Nervous	2	18.182
Relieved	0	0
Worried	0	0
Total	11	100.000
'Dead by Daylight' - Teammate Hooked		
Annoyed	0	0
Cautious	1	9.091
Curious	0	0
Determined	5	45.455
Nervous	2	18.182
Relieved	1	9.091
Worried	2	18.182
Total	11	100.000

To a lesser extent 18% of participants reported feeling "nervous", and 9% felt "annoyed" (Table 5). Meanwhile 46% of participants reported feeling "determined" when they were shown a teammate being hooked, with the remainder reported feeling "nervous" and "worried" at 18%, or "relieved" and "cautious" at 9% (Figure 6).

The majority of participants reported acting suspiciously toward other players after the body reported screen appeared in 'Among Us', as well as being defensive if they were the impostor. In 'Dead by Daylight' participants largely reported the same reaction to seeing a teammate hooked. Most attempted to rescue the teammate or

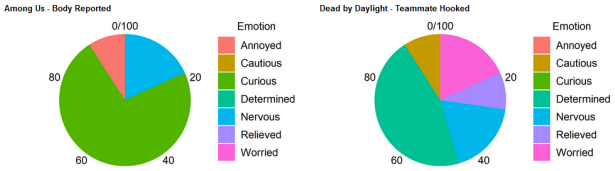

Figure 6: Pie chart showing distribution of emotions reported by participants for body reported screen and teammate hooked interface element.

Table 6: Comparison of mean emotional intensity for the player ejection and killer radius effect elements.

Interface Element	Mean	SD
'Among Us' - Player Ejection	6.545	1.695
'Dead by Daylight'- Killer Radius	8.091	1.044

assist in their rescue indirectly, while a few reported wanting to help but being prevented by anxiety in the situation.

4.3 Ejection Screen and Killer Radius Effect

The killer radius effect in 'Dead by Daylight' has a mean emotional response intensity of 8.091, almost 1.5 points higher than the 'Among Us' player ejected screen (Table 6). The killer radius effect also presents a much lower standard deviation of 1.044, indicating that it is both more effective and more consistent at eliciting emotional reactions(Figure 7).

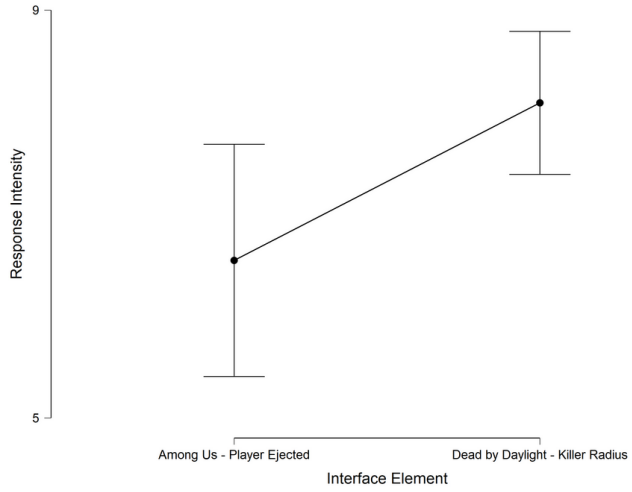

Figure 7: Mean emotional intensity for the player ejection and killer radius effect elements.

The main emotions felt by participants when interacting with the player ejected screen in 'Among Us' were "nervous" and "relieved", both at 36% of the response pool, though 18% of participants reported feeling "excited", and the remainder "cautious" (Figure 8).

Table 7: Frequency of emotional responses to player ejection and killer radius effect elements.

Emotion	Frequency	Percent
'Among Us' - Player Ejection		
Anxious	0	0
Cautious	1	9.091
Excited	2	18.182
Nervous	4	36.364
Panicked	0	0
Relieved	4	36.364
Worried	0	0
Total	11	100.000
'Dead by Daylight' - Killer Radius		
Anxious	1	9.091
Cautious	0	0
Excited	4	36.364
Nervous	0	0
Panicked	1	9.091
Relieved	0	0
Worried	5	45.455
Total	11	100.000

Comparatively the killer radius effect caused 46% of participants to feel "worried", while another 36% felt "excited" (Table 7).

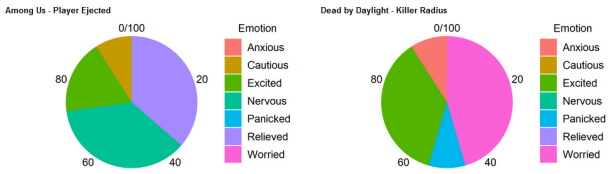

Figure 8: Pie chart showing distribution of emotions reported by participants for player ejection and killer radius effect elements.

Many participants expressed that seeing a fellow player ejected in 'Among Us' left them feeling more suspicious of other players, and so their actions became more cautious around them. Some reported that as the game continued they stayed closer to players they felt they could trust. Most participants reported that upon hearing the killer radius sound effect in 'Dead by Daylight' they fled from other players. Some expressed that their goal was to lead the killer away from the others, though a few also stated that their intention was purely self preservation.

4.4 Killed by Impostor and Escape Attempt

The mean emotional response intensity of the interface element showing players getting killed in 'Among Us' is 8.182, the highest of any of the elements being investigated here, especially those in 'Among Us' (Figure 9). It is also significantly higher than the mean response intensity elicited by the escape opportunity in 'Dead by Daylight' by 2.27 points (Table 8).

Table 8: Comparison of mean emotional intensity for the killed by impostor and escape attempt interface elements.

Interface Element	Mean	SD
'Among Us' - Killed by Impostor	8.182	1.8888
'Dead by Daylight'- Escape Attempt	5.909	2.119

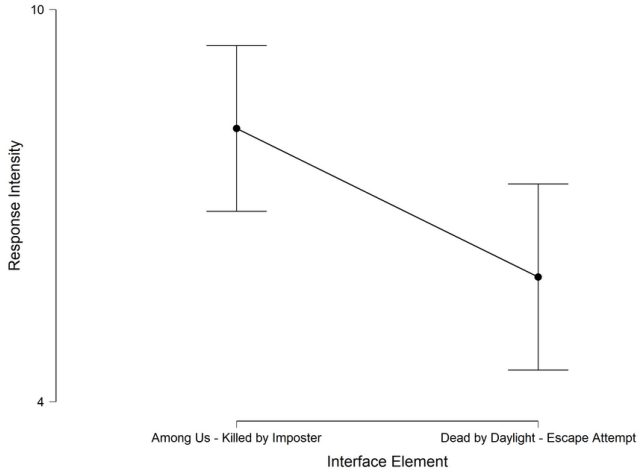

Figure 9: Mean emotional intensity for the killed by impostor and escape attempt interface elements.

73% of participants reported feeling "surprised" when the 'Among Us' interface showed them being killed by an impostor, while 9% reported feeling "shocked". The remaining 18% felt "frustrated" (Table 9). In 'Dead by Daylight' 46% of participants reported feeling "determined" when presented with the escape attempt bar, while 18% felt "cautious" and "nervous" respectively. The remaining participants were evenly split between feeling "resigned" and "surprised" (Figure 10).

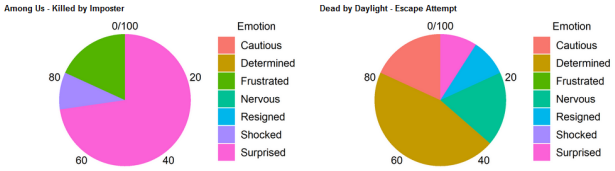

Figure 10: Pie chart showing distribution of emotions reported by participants for the killed by impostor and escape attempt interface elements.

Participants expressed a range of effects that their emotional response had on their interactions with other players. Some stated that they focused more heavily on the player who killed them in later rounds, others attempted to learn from their death in order to better identify an impostor in future. Some also expressed that it furthered their suspicion of other players generally. Almost all

Table 9: Frequency of emotional responses to the killed by impostor and escape attempt interface elements.

Emotion	Frequency	Percent
'Among Us' - Killed by Impostor		
Cautious	0	0
Determined	0	0
Frustrated	2	18.182
Nervous	0	0
Resigned	0	0
Shocked	1	9.091
Surprised	8	72.727
Total	11	100.000
'Dead by Daylight' - Escape Attempt		
Cautious	2	18.182
Determined	5	45.455
Frustrated	0	0
Nervous	2	18.182
Resigned	1	9.091
Shocked	0	0
Surprised	1	9.091
Total	11	100.000

Table 10: Comparison of mean emotional intensity for the voting screen and skill check interface elements.

Interface Element	Mean	SD
'Among Us' - Voting Screen	6.545	1.695
'Dead by Daylight'- Skill Check	7.091	1.136

participants reported that when they were presented with an opportunity to escape the killer in 'Dead by Daylight' they took it, though did not expect to succeed. Most expressed that they began to depend on their teammates to save them.

4.5 Voting Screen and Skill Checks

The skill checks in 'Dead by Daylight' present a mean emotional response intensity of 7.091, approximately 0.5 points higher than that of the 'Among Us' voting screen (Table 10). The former also has a notably lower standard deviation value of 1.136, indicating that it can more reliably elicit more intense emotional reactions than the latter (Figure 11).

When interacting with the voting screen in 'Among Us' 63% of participants reported feeling "cautious", while a further 27% reported feeling "nervous" (Figure 12). 46% of participants reported that the skill check in 'Dead by Daylight' made them feel "panicked", while 27% felt "confident" and another 18% felt were "determined" (Table 11).

A number of participants reported that while voting in 'Among Us' they were careful not to make conclusions about other players too quickly, and most paid close attention to how other players voted. Some expressed that they often voted the same way as a

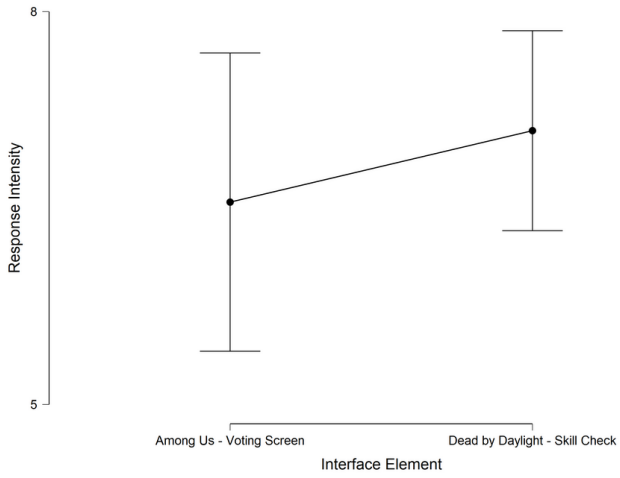

Figure 11: Mean emotional intensity for the voting screen and skill check interface elements.

Table 11: Frequency of emotional responses to the voting screen and skill check interface elements.

Emotion	Frequency	Percent
	'Among Us' - Voting Screen	
Cautious	7	63.636
Confident	0	0
Determined	0	0
Hesitant	0	0
Nervous	3	27.273
Panicked	0	0
Relieved	1	9.091
Total	11	100.000
	'Dead by Daylight' - Skill Check	
Cautious	0	0
Confident	3	27.273
Determined	2	18.182
Hesitant	1	9.091
Nervous	0	0
Panicked	5	45.455
Relieved	0	0
Total	11	100.000

certain group of other players to maintain their trust. While interacting with the skill checks in 'Dead by Daylight' many participants reported that they would try to work on them alongside their teammates in order to increase their chances of success, however one participant expressed frustration at another player for failing to pass a check.

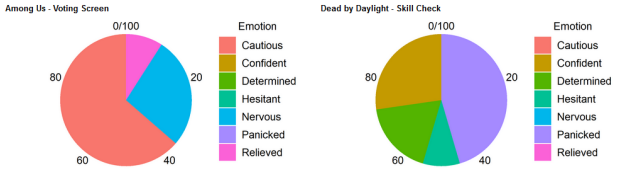

Figure 12: Pie chart showing distribution of emotions reported by participants for the voting screen and skill check interface elements.

5 CONCLUSIONS AND DISCUSSION

5.1 Overall Comparison

The aim of this study was to investigate the effectiveness of affective design in two contemporary multiplayer survival games, and how this influenced inter player collaboration. 'Among Us' was chosen for its current popularity with an unusually wide range of players [9]. 'Dead by Daylight' was chosen as its look and feel are antithetical to those of 'Among Us', while still sitting among the most popular live service games [4]. The research has explored the emotions elicited by interface elements in these games, as well as how intense these emotional responses were, and how they affected player interactions.

Overall, 'Among Us' proved on average to be more effective in eliciting emotional reactions from players, and doing so within a more consistent range of intensity. However, while it elicits less intense emotional responses on average 'Dead by Daylight' elicited the most intense emotional responses, though it also produced the least intense as well. This would seem to indicate that the traditional horror styling employed by 'Dead by Daylight' is less reliable at eliciting emotional responses than the slapstick cartoon style of 'Among Us'. Further to this, the interface elements presented to the player at key moments in 'Dead by Daylight' are considerably smaller than those in 'Among Us', and so draw less attention to themselves as emotional stimulus. As such the first hypothesis presented is not supported by the data of this study.

5.2 Elicited Emotions

On average 'Among Us' elicited more positive emotions from participants, such as excitement, curiosity and relief. It did also elicit negative emotions such as nervousness, anxiety and frustration, however these occurred significantly less frequently. 'Dead by Daylight' on the other hand consistently elicited negative emotions more than positive ones. Participants reported feeling worried and panicked at a significantly higher rate than most other emotions. However, one positive emotion was elicited with almost as much frequency as these: determination. These results may show a correlation between the nature of the interface interactions presented to players and the emotions they feel as a result. In 'Dead by Daylight' interaction with the game's interface is often based on a sense of urgency; for example escaping from the killer before you are placed on a hook, or timing a skill check event right to avoid detection.

By comparison the interface interactions in 'Among Us' are casually paced. The many small tasks the players undertake, though not examined by this study, can be completed at the player's own

pace. Even the voting screen, which has a timer, does not rush players to decide. These findings suggest that the first hypothesis of this study, that the sense of urgency in 'Dead by Daylight' would amplify emotional responses, is not entirely without merit and may require further evaluation.

5.3 Effects on Collaboration

Participants reported significantly more interaction and consideration towards other players in 'Dead by Daylight' than in 'Among Us'. In the former, situations where the participants reported feeling determined, mostly when seeing a teammate get hooked or when trying to free themselves, they also reported a sense of responsibility toward their team either through trying to save their teammate or to free themselves so as not to endanger another player. Similarly, when participants heard the heartbeat indicating the killer's approach, some reported deliberately leading the killer away from other players.

In 'Among Us' there were fewer reports of such obvious collaboration. In situations such as a body being reported and the voting screen most participants reported feeling suspicious of other players, however some participants also indicated that these interactions would lead to them staying closer to players they believed to be trustworthy. Most participants reported that when the interface showed them being killed by an imposter it affected their interactions with that particular player going forward, many stating that they attempted to identify behavioural patterns that would help them identify other imposters.

This data would indicate that the generally negative emotions elicited by 'Dead by Daylight"s interface encourages players to support one another more than those elicited by 'Among Us', which seed distrust between players. This could be attributed to the mechanics of the game, in 'Dead by Daylight' players face an easily identified and shared threat, while 'Among Us' hides the threat from players and forces them to see one another as a potential threat. Despite this in-built disparity, this study has identified that there is a pattern between the intensity of an emotional response and the degree of collaborative activity players engage in. As such the second hypothesis of this study, that strong emotional responses, especially when the result of a player's actions, will engender collaboration between multiple players in a survival game.

5.4 Considerations for Improved Study

As previously noted, there are a number of disparities between the two games being considered in this study. The victory conditions for them differ significantly, and it is very likely that this study did not effectively consider this when evaluating the meaning of the emotional responses generated when interacting with the games' interfaces. This could be negated in further research on the topic by defining clearly before commencement of data collection how players are expected to respond to specific interface elements, circumstances, and outcomes.

Similarly, the options participants were given in the questionnaires to identify their emotions were inconsistent, as they were based on anecdotal data. Better consideration should be given to the specific emotions participants are expected to experience when interacting with each interface in order to generate a standardised list of options to be presented with every question of the questionnaires. This approach would remove the need for a participant defined "other" response on the questionnaire, significantly reducing inconsistencies with data evaluation.

Finally, the sample size of this study was significantly smaller than desired, and the lack of data calls into question the validity of the claims made in the study. It could be argued that the ongoing COVID-19 pandemic has created circumstances that make effective data collection difficult, under normal circumstances the processes of this study could have been more effective. Ideally participants would take part in scheduled in person group play sessions so that variables such as lobby size, external communication between players, and "trolling" behaviour [18] could be limited. This process would also have opened this study to a larger sample size, as participants engaging remotely were required to already own both games being investigated. This higher number of participants would greatly enrich the data collected and provide more substantive results.

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