Player Enjoyment and Trust in Board Games with Gameplay Challenge and Robotic Facilitation: A Preliminary Investigation

Shannon Barrett
University of Lancashire
45 Fylde Rd, Preston PR1 2XQ
SBarrett6@lancashire.ac.uk

Christianna Owen
University of Lancashire
45 Fylde Rd, Preston PR1 2XQ
CPetrichou@lancashire.ac.uk

Jonathan Edwards
University of Lancashire
45 Fylde Rd, Preston PR1 2XQ
JEdwards8@lancashire.ac.uk

This preliminary study investigated how gameplay challenge and robot facilitation influence player enjoyment and trust in a robotic game facilitator. Twelve participants played three board games with varying challenge levels, including one facilitated by a telepresence robot. Player experience was measured using the Game Experience Questionnaire (GEQ), while trust was assessed using the Multi-Dimensional Measure of Trust v2 (MDMT). Results showed significant differences in immersion, tension/annoyance, and negative affect across gameplay conditions. The robot-facilitated game produced the highest average experience ratings, while moral trust increased following interaction. These findings provide preliminary evidence that gameplay context and robotic facilitation can positively influence player experience.

Board Games. Telepresence robots. Human-Robot Interaction (HRI). Enjoyment. Flow. Trust. Challenge.

1. INTRODUCTION

Board games are widely recognised as enjoyable social activities that are easily accessible and promote interaction, entertainment, and cognitive engagement. However, player enjoyment often relies on balanced gameplay, well-designed rule systems and an appropriate level of challenge. Achieving balance between challenge and enjoyment is essential for creating engaging board game experiences.

As robots and Artificial Intelligence (AI) become increasingly integrated into social and collaborative environments, they also present new opportunities to facilitate entertaining experiences, such as acting as facilitators of a game. Understanding whether players exhibit trust in a robot is therefore important for evaluating its effectiveness in supporting engaging gameplay. This preliminary study investigates player enjoyment in board games with varying challenge levels while also examining perceptions of a robot acting as a game facilitator.

We present two research questions which we attempt to answer in this novel study;

- RQ1: How do challenge and robot facilitation influence player enjoyment?
- RQ2: To what extent do participants trust the robot as a game facilitator and how does the interaction impact their trust?

2. BACKGROUND

2.1 Enjoyment & Challenge

Players are less likely to continue playing or replay a game if they see it as boring, difficult or overly complicated (Ballou and Deterding, 2023; Strojny, Strojny and Ręblas, 2023). Beyond gaming, enjoyment and autonomy are key drivers of engagement across many activities (Kaçay et al., 2026; Hill, Coughlan, and Mackinnon, 2024), although the factors contributing to enjoyment can vary depending on the nature of the activity.

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Alexandrovsky et al. (2024) investigated players' disengagement and the process of exiting gameplay. They found that disengaging with a game is a multi-step process, considering the state of the player, game and other environmental factors, such as available time to play, predefined goals, and cognitive exhaustion. Their findings show that disengagement is not solely driven by negative gameplay experiences; emotional state often contributes to negative disengagement, highlighting the importance of considering multiple factors when designing engaging and balanced experiences.

2.2 Flow

Csikszentmihalyi (1990) defines flow as:

> the state in which people are so involved in activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it.

He explains that individuals are most likely to experience flow when the challenge presented by an activity is appropriately balanced with their perceived skills. Within this balance, participants remain fully engaged, experiencing enjoyment, a sense of agency and sustained concentration. Failing to maintain this balance can lead to boredom or frustration, reducing both engagement and enjoyment. As a result, flow theory has become one of the most influential theories for understanding enjoyment in both board games and video games.

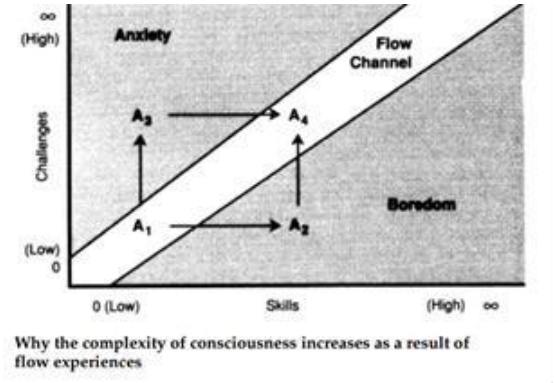

Figure 1: *Image of Flow Diagram from (Csikszentmihalyi, M., 1990) with indications of player progression.*

Wojtasiński et al (2025) investigated the relationship between perceived skill, challenge and flow. Using responses from online board game players, the authors found that the balance between skill and challenge was an important predictor of flow. Participants reported greater flow when their perceived skills slightly exceeded the challenge presented than when the challenge exceeded their perceived skills. These findings suggest that, although balancing challenge and skill is fundamental to achieving flow, players benefit most when they feel competent at a difficult challenge.

2.3 Self-Determination Theory

Self-Determination Theory (SDT), proposed by Ryan and Deci (2000), is a framework for understanding the causes of intrinsic motivation and psychological wellbeing. The theory suggests that individuals must fulfil three basic psychological needs: autonomy, competence and relatedness, to experience intrinsic motivation. When these needs are supported, individuals are more likely to participate in activities because they find them inherently enjoyable rather than for external rewards. Board games are often considered particularly supportive of these needs, as they encourage shared decision-making, social interaction and opportunities for players to develop competence. However, gameplay experiences which fail to meet these needs can reduce intrinsic motivation and engagement, ultimately diminishing player enjoyment. SDT has been widely used to explain player enjoyment and motivation within games research.

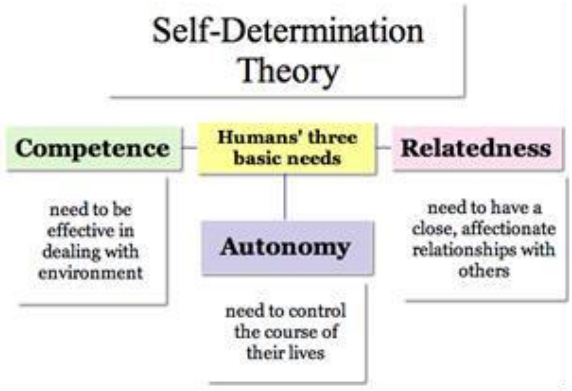

Figure 2: *Image showing humans' three core psychological needs from Self-Determination Theory (Dunlap, J., 2016).*

2.4 Autonomous Robots & Trust

The notion of building autonomous entities dates back thousands of years. Nowadays, a considerable variety of interactive humanoid robots are used in a range of settings, including education, research, and elderly care. For this paper, the term robot refers to social, physically embodied, autonomous and interactive agents who possess some anthropomorphic characteristics (physical and/or cognitive) (Darling, 2016). Advanced robots learn from large datasets and utilise neural networks, leading to the development of more autonomous and adaptive agents (Tulli, 2024). This has led to sophisticated interactions between humans and machines which often mirror human-human relationships (Obaigbena et al., 2024). This extends HRI to include Human-AI interactions and collaborations, making these relationships even more complex. The 'Computers Are Social Actors' (CASA) paradigm suggests that humans unconsciously apply the same social heuristics used in human interactions to computers, as they evoke

similar social attributes to humans (Reeves & Nass,1996). Therefore, by further examining the effects of human–robot relationships through experimental approaches, potential users are given the opportunity to engage directly with a humanoid robot, offering valuable feedback for robotic design and development.

The omnipresence of trust, both as a concept and as a term, often leads us to believe that it is a straightforward, easily understood idea. However, literature demonstrates that trust is a multidimensional and often abstract construct, for which no single, precise, and universally accepted definition exists (Abbass, Scholz and Reid, 2018; Kok and Soh, 2020; Schäfer, Esterbauer and Kubicek, 2024). Trust is a property of the human user in relation to the robot. On the other hand, trustworthiness is a property of the robot and not of the user. Hence, a human user may not trust a trustworthy robot (and vice versa) (Kok and Soh,2020).

We adopt the definition of trust established by Malle and Ullman (2021), which defines it as:

> a dyadic relation in which one person accepts vulnerability because they expect that the other person's future action will have certain characteristics; these characteristics include some mix of performance (ability, reliability) and/or morality (honesty, integrity, and benevolence).

To conclude, given the increasing utilisation of robots in everyday settings (Gómez, 2025), the understanding of human-robot trust is essential to uphold high-quality interactions and ensure that the evolving relationship between humans and machines remains effective and beneficial.

2.5 Robots & Games

Advanced robotic technology allows for robots to transition from tools to teammates as well as playmates (Lewis, Sycara and Walker, 2018). Researchers have been incorporating robots in games for years to better understand aspects of HRI (Xin, M. and Sharlin, E., 2007; Jerčić, Hagelbäck and Lindley, 2019; Rato et al., 2022; Yong et al., 2023). As robots have started to further resemble human beings, they can enhance the quality of socially engaging interactions in games by taking on roles as playmates, collaborators, and facilitators. However, player experience with a robot is multidimensional (Inal, Mishra, & De, 2026). A variety of human–robot game structures have been explored, with most studies focusing primarily on one-human–one-robot and one-robot– multiple-humans settings. Overall, several studies have shown that collaborating with robots in games can increase participant enjoyment and lead to an overall positive gaming experience (Leite et. al 2008; Usui and Yoshida, 2026; Inal, Mishra and De,2026).

Correia et al. (2016) measured the level of trust participants felt towards their human or robot partner during a card game. The study concluded that humans are willing to trust a robot as a partner; however, the level of trust varies according to their prior experience and knowledge. For example, participants who had previously interacted with the robot showed a higher level of trust after the game in comparison to those who had not. These findings suggest that the development of trust towards robots may need longer-term or repeated interactions.

Overall, numerous factors can influence human-robot trust, including the robot itself, the human, and the environment. Human characteristics such as comfort around robots, culture, and personality have been shown to have an impact. In addition, both the quality of human-robot collaboration and the communication styles of human and robot play important roles in shaping trust (Hancock et al, 2021). From the robot perspective, empirical evidence finds a link between system reliability and trust. Hence, declining system reliability might undermine user trust and lower expectations (Lewis, Sycara and Walker, 2018).

3. METHODOLOGY

3.1 Participants

Twelve participants (N = 12) took part in this study, as part of a research activity day hosted for college students. Participants were between the ages of 16 and 18. As this was an early exploratory study, a small sample was considered appropriate for gathering initial results and testing the methodology.

3.2 Procedure

Three board games were selected to provide distinct gameplay experiences while varying the level of expected challenge and method of facilitation. To reduce fatigue throughout the study and ensure sustained engagement, the three games varied in their mechanics, objectives, and play style. All games were physical, using boards and/or cards, and required active player engagement due to their multiplayer, turn-based nature.

Harry Potter Monopoly was selected as the control, due to its widespread familiarity and straightforward gameplay. The game requires relatively low cognitive demand, with players relying on simple decision-making, chance and social interaction. As a result, it was expected to provide an enjoyable experience without significant challenge.

A French language version of *Cluedo* was selected to introduce a higher level of challenge, as no participants spoke French. Although the core mechanics remained the same, the unfamiliar language was expected to increase the cognitive

demands placed on participants, requiring them to interpret clues and communicate with each other to establish meaning and context. This condition was designed to examine how increased challenge influences player enjoyment.

The social deduction game One-Night Ultimate Werewolf was selected to investigate perceptions of robot facilitation. Unlike the previous games, One-Night Ultimate Werewolf requires an impartial moderator to guide gameplay, reveal information and manage player interactions. In this condition, these responsibilities were performed by the AV1 robot, a humanoid telepresence torso.

Telepresence robots can be controlled remotely by humans to give participants the illusion that the robot is completely autonomous, known as the Wizard-of-Oz approach. A member of the research team played pre-recorded audio scripts, facilitating gameplay. The voice was an AI-generated, childlike, male voice with a neutral accent. Participants were not informed that the robot was controlled remotely by a human until the end of the experiment.

A within-subjects design was employed to enable all participants to complete the three board game conditions. This design enabled comparison of player enjoyment across the different challenge levels. Participants were divided into two groups of six. Each group played each game for 45 minutes before rotating to the next game. The order of sessions for each group is illustrated in Appendix A1. Two human facilitators were available throughout to monitor gameplay, address any technical or procedural issues, and administer and collect participant questionnaires.

3.3 Measures

To evaluate participants' experiences across the different game conditions, the Game Experience Questionnaire (GEQ) (Ijsselsteijn, Kort and Poels 2013) was used. The GEQ was selected as it measures multiple relevant aspects of player experience. These factors enable investigation of how varying levels of gameplay challenge influence enjoyment, allowing comparisons between different gameplay experiences. As discussed by Law, E., Brühlmann, F., & Mekler, E. (2018), some previous studies have inconsistently reported how the GEQ was used and administered. To address this, the present study utilised the 33-item 'Core Module', which was administered immediately after each game session.

The Multi-Dimensional Measure of Trust v2 (MDMT) was used to measure perceived trust of the robot. Developed by Ullman and Malle (2020), it is designed to be an instinctive and comprehensive measure of trust primarily used in HRI settings. The MDMT v2 consists of twenty items across five differentiable dimensions of trust. These dimensions are organised into two broader factors of trust: Performance Trust and Moral Trust (see Table 1). Performance trust refers to the participant's confidence that the robot can complete a given task, in our case, the facilitation of the game, while moral trust refers to the trustor's confidence that the robot will act morally and fairly. To assess trust, we used two parallel forms (each containing ten items) provided by the authors as the pre-test and post-test measures. One form was administered before the game started and one after it finished. Each item was evaluated on an 8-point rating scale from 0 (Not at all) to 7 (Very), and had a "Does Not Fit" option, which aims to prevent forced ratings.

Table 1: *MDMT v2 Dimensions (Ullman and Malle, 2023)*

Performance Trust **Reliable Subscale**	**Performance Trust** **Competent Subscale**	**Moral Trust** **Ethical Subscale**	**Moral Trust** **Sincere Subscale**	**Moral Trust** **Benevolent Subscale**
Reliable	Competent	Ethical	Truthful	Benevolent
Predictable	Skilled	Principled	Genuine	Kind
Dependable	Capable	Moral	Sincere	Considerate
Consistent	Meticulous	Has Integrity	Candid	Has Goodwill

4. RESULTS & DISCUSSION

4.1 Challenge & Enjoyment

GEQ measures are used to identify initial trends in enjoyment, challenge, flow, and other aspects of player experience. Each item of the GEQ is rated on a five-point Likert scale ranging from 0 ("not at all") to 4 ("extremely"). Due to the exploratory nature of this preliminary study and the small sample size, these statistics are merely indicative of patterns and not meant to be considered definitive evidence. Table 2 presents the full ratings for each game across all GEQ categories.

Table 2: *The average rating for each game across each aspect of the GEQ.*

Components	**Game**		
	Monopoly	Cluedo	Werewolf
Competence	*2.1*	*1.9*	*2.6*
Sensory and Imaginative Immersion	1.3	1.4	2.6
Flow	1.3	1.4	2.1
Tension/Annoyance	0.9	1.7	0.3
Challenge	0.8	1.4	1.2

Negative Affect	1.1	1.6	0.4
Positive Affect	2.5	2.2	3.2

These results suggest that there were differences in player experience across the three games. As anticipated, *Monopoly* produced moderate levels of competence (Mean = 2.1) and the lowest challenge score (Mean = 0.8), suggesting that participants felt capable and perceived the game as relatively easy. This aligns with expectations that a familiar game with simple mechanics would provide low cognitive demand. Consistent with prior literature on flow, the reduced challenge may have contributed to the lowest flow and immersion scores observed.

Cluedo created the highest perceived challenge (Mean = 1.4) and tension/annoyance (Mean = 1.7), likely reflecting the additional difficulty introduced by using the French language version.
Competence was lowest, showing the participants felt less capable when playing, and potentially frustrated, as seen in their significantly higher tension/annoyance score. Although *Cluedo* demonstrated slightly higher flow and immersion ratings than *Monopoly,* the increased challenge appeared to cause greater frustration, suggesting that the demands of the game may not have been fully balanced with participants' perceived ability.

One-Night Ultimate Werewolf, facilitated by the telepresence robot, produced the highest scores across several positive gameplay dimensions, including competence (Mean = 2.6), immersion (Mean = 2.6), flow (Mean = 2.1) and positive affect (Mean = 3.2). This suggests the game's social and interactive nature*,* combined with robotic facilitation, created a highly engaging experience. The much lower tension/annoyance score (Mean = 0.3) indicates that participants experienced little frustration, despite the game involving complex concepts such as deception and social deduction. The novelty of interacting with the robot may have further enhanced engagement.

Overall, the descriptive results indicate that higher enjoyment was not necessarily associated with greater challenge. While *Cluedo* introduced the greatest challenge, it also produced the most frustration. In contrast, *Werewolf* achieved the strongest overall experience by providing an engaging balance of challenge and competence.

A Shapiro-Wilk test showed that all GEQ components except Flow followed a normal distribution ($p > 0.05$; Figure A2). Therefore, nonparametric tests were used to maintain a consistent analytical approach despite lower statistical power. A Kruskal-Wallis test was then conducted, with statistical significance set at $p < 0.05$.

Significant differences were observed for sensory and imaginative immersion, tension/annoyance, and negative affect (Table 3), indicating that game type influenced specific emotional and experiential responses. However, no significant differences were found for competence, flow, challenge or positive affect. Although descriptive differences were found, they did not reach statistical significance, likely due to the sample size and reduced statistical power of non-parametric testing.

Table 3: *Results of the Kruskal-Wallis test (Kruskal, W.H. and Wallis, W.A., 1952).*

GEQ Factor	X^2	df	p
Competence	2.22	2	0.329
Sensory and Imaginative Immersion	7.51	2	0.023
Flow	4.81	2	0.090
Tension/Annoyance	8.24	2	0.016
Challenge	4.19	2	0.123
Negative Affect	9.05	2	0.011
Positive Affect	4.11	2	0.128

The significant effects for immersion, tension/ annoyance, and negative affect align with descriptive findings, where *Werewolf* produced higher immersion scores and lower frustration scores than the other games. This suggests that although overall enjoyment was similar, differences in game structure, such as language barriers, influenced specific aspects of player experience. These findings provide preliminary evidence that gameplay context, including robot facilitation, may influence specific aspects of player experience. The increased immersion and reduced negative effect observed during *Werewolf* suggest that social interaction and novel interface may contribute to engagement alongside the mechanics of the game itself.

4.2 Measuring Trust

For every participant, we calculated the average score for each subscale. For Performance Trust, we calculated the Competent and Reliable subscales, and for Moral Trust, we calculated the Ethical, Sincere, and Benevolent subscales, in accordance with the MDMT v2 scoring procedure (Ullman & Malle, 2023). We then calculated Moral Trust and Performance Trust as the average of their respective subscales: *Moral Trust = (Ethical + Sincere + Benevolent) / 3 and Performance Trust = (Competent + Reliable) / 2 (See Table 4).*

The analysis found no change in Performance Trust, with only minor subscale variations: a minor decline in Reliability and an increase in Competence. This indicates that the robot met participants' expectations. However, the interaction enhanced

their opinion of the robot's competence and abilities and reduced perceived reliability of the robot. This imbalance of expectations vs reality may have affected trust (Lewis, Sycara and Walker, 2018). Descriptive analysis indicated a moderate increase in Moral Trust, with average scores rising from 3.11 to 3.89, representing an increase of 0.78. However, the ethical scale was lowered, while sincere and benevolent increased, indicating that the interaction had a stronger influence on perceptions of goodwill and sincerity.

The subscale averages were strongly affected by the high number of “Does Not Fit” responses. This suggests that participants struggled to apply or evaluate some of the dimensions within the questionnaire, particularly those relating to moral characteristics, resulting in missing responses across several subscales.

As participants interacted with the robot for the first time during the game, there may not have been enough time to develop meaningful trust, as found by Correia et al. (2016). Moreover, the decrease in some results post-interaction can be attributed to robot communication issues, such as delays, a lack of non-verbal cues, and its inability to participate in natural dialogue. As a result, although the robot “played” its role in the game correctly, it did not participate in the team's conversations or jokes. This aligns with current research, which reveals that non-verbal cues, as well as natural communication between humans and agents, impact robot trust (Zörner et al., 2021; Heron and Lau, 2026; Pinto-Bernal, Biondina and Belpaeme, 2025). Lastly, people's prior expectations of a robot can impact their experience when they meet one (Bartneck et al., 2024). Simply, when robots satisfy their user’s expectations, they elicit greater trust (Hancock et al, 2021).

Table 4: *The average rating per subscale.*

Subscale (Pre-test)	**Rate (Pre-Test)**	**Subscale (Post-test)**	**Rate (Post-test)**
Average Competent	4.63	Average Competent	4.67 ↑
Average Reliable	4.88	Average Reliable	4.83
Pre-test Average Performance Trust	**4.75**	**Post-test Average Performance Trust**	**4.75**
Average Ethical	4.05	Average Ethical	3.41 ↑
Average Sincere	2.65	Average Sincere	4.68 ↑
Average Benevolent	2.20	Average Benevolent	3.67 ↑
Pre-test Average Moral Trust	**3.11**	**Post-test Average Moral Trust**	**3.89 ↑**

5. CONCLUSION

This preliminary study investigated how gameplay challenge and robot facilitation influence player enjoyment, gameplay experience, and perceptions of a robotic facilitator. Consistent with previous research (Csikszentmihalyi 1990; Ryan and Deci 2000), the findings suggest that player experience may be shaped by both gameplay structure and facilitation method, though these effects are complex and nuanced.

The results suggest that challenge influenced player experience, but increased challenge did not directly reduce enjoyment. While *Cluedo* produced higher levels of tension/annoyance and negative affect, it did not significantly reduce overall enjoyment when compared with *Monopoly* as initially expected. This may be because the language barrier encouraged greater discussion and collaboration between participants, introducing additional social interaction. In contrast, *Werewolf* produced the most positive overall experience, with higher ratings across several enjoyment-related dimensions.

Limitations of this study include the small sample size, the use of the GEQ as opposed to alternative measurements such as the Player Experience Inventory (PXI) (Abeele et al. 2020), as the GEQ may not fully capture aspects unique to board game experiences, and that each game was not tested across all experimental conditions (control, increased challenge, robot facilitation). Moreover, the games' differences in mechanics and objectives are worth noting, as these variations affected our ability to clearly isolate the impact of certain factors such as gameplay challenge and the role of the robot.

Overall, this preliminary study provides early evidence of the potential for robots to support engaging social gameplay experiences while highlighting the importance of balancing challenge with player ability. Although trust was moderate towards the robot without significant fluctuations pre- and post-test, the robot-facilitated game had the highest level of enjoyment. Future research should include larger samples, a wider range of games, and experimental designs that test each game across all conditions, including standard gameplay, increased challenge, and robot facilitation. Additionally, a few supplementary qualitative questions could provide more depth into the multifaceted nature of trust. These would help determine whether the observed benefits are attributable to the presence of the robot itself, the social nature of the game, or the novelty of interacting with a robotic facilitator. To further explore trust, this study could be extended to measure how anthropomorphic the robot was perceived and would benefit from incorporating a more advanced robot with more natural communication abilities.

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7. APPENDIX

Table A1.

Table A1: *The order of games for each group to play.*

Game Order		
Session No.	Group 1	Group 2
1	*Monopoly*	*Cluedo*
2	Cluedo	Werewolf
3	Werewolf	Monopoly

Table A2.

Table A2: *Results of the Shapiro-Wilk test (Shapiro, S.S. and Wilk, M.B, 1965).*

GEQ Factors	*W*	*p*
Competence	*0.975*	*0.573*
Sensory and Imaginative Immersion	*0.955*	*0.148*
Flow	*0.927*	*0.020*
Tension/Annoyance	*0.955*	*0.146*

Challenge	*0.944*	*0.067*
Negative Affect	*0.946*	*0.076*
Positive Affect	*0.950*	*0.107*