How Disclosing Skill Assistance Affects Play Experience in a Multiplayer First-Person Shooter Game

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ABSTRACT
In social play settings, it can be difficult for people with different skill levels to play a game together. Player balancing that provides skill assistance for the weaker player can allow for enjoyable play experiences; however, previous research (and conventional wisdom) has suggested that skill assistance should be kept hidden to avoid perceptions of unfairness. We carried out a study to test how disclosing skill assistance affects player experience. We found – surprisingly – that disclosing assistance did not harm play experience; players were more influenced by the benefits of equalized performance resulting from assistance than by their knowledge of the assist. We introduce the idea of attribution biases to help explain why awareness was not harmful – people tend to take credit for their successes, but attribute failures externally. We discuss how game designers can incorporate skill assistance to build multiplayer games that improve experiences for a wide range of players.

Author Keywords
Aim assistance; FPS games; game balancing; Fitts’s Law; disclosure; multiplayer games; skill gap; social play

ACM Classification Keywords
K.8.0. General: Games

INTRODUCTION
Multiplayer games are intended to provide a fun experience for everyone. However, in competitive games where players’ skill levels are different, the play experience can be unsatisfying for both stronger and weaker players. For skilled players, play becomes uninteresting because there is little challenge [1], while for weaker players, the game is frustrating because there is little chance of succeeding [15]. There are many situations where these mismatches can occur (e.g., social play with friends or family).

Player balancing provides assistance for less-skilled players (or hindrances for more-skilled players) in order to make games more competitive and more engaging [6,8,32]. It is different from other forms of game balancing in that player balancing focuses on creating an equal opportunity for all players to win, and intentionally gives weaker players an in-game advantage to compensate for skill differences. Player balancing has been studied in several video games (e.g., in a 2D shooting gallery [6], in an auto racing game [8], and in a 3D first-person shooter [32]). Player balancing has been shown to work well: both to balance game performance (significantly reducing score differences and equalizing other aspects such as lead changes [32]) and to improve game experience. Balancing can lead to increased engagement and fun for both stronger and weaker players, without negatively affecting players’ perceptions of fairness [6,8,32].

Although the way that balancing mechanisms affect game performance is well understood, less is known about how balancing affects experience. In particular, the degree to which players are aware of the assistance is a factor in player balancing that researchers have suggested may have a large effect on experience. Previous work has suggested that when assists are obvious (e.g., the differential powerups in Mario Kart), players will see the game as less fair [14,15]. This may lead to reduced enjoyment because weaker players feel that the system is playing for them, or because stronger players feel that they are being cheated. As a result, previous balancing schemes have taken the approach that effective balancing mechanisms should be hidden: for example, prior studies have kept the type and strength of the assist concealed [6,32], and have attempted to reduce noticeability by spreading the assistance across several variables [8].

However, the assumption that awareness of balancing will harm play experience [5,15] has not been empirically validated. To investigate this issue and determine whether disclosed assistance really is a problem for player balancing, we carried out a study of expert and novice players in a First-Person Shooter (FPS) game that included skill assistance techniques to balance the players’ performance.

Expert-Novice pairs played the game in three conditions: one in which players were balanced, but the assist was not revealed (concealed assistance); one in which players were balanced, and the assist was revealed to both players (disclosed assistance); and one in which no assist was present and nothing was said about balancing (no assistance). We took several measures to assess both the effectiveness of the balancing scheme on performance, and how disclosing the
assist affected play experience. We used six experiential measures that could be affected by disclosing the assist:

- **Enjoyment**: previous work has already shown that balancing increases enjoyment for both players – but does disclosing the assist reduce enjoyment?
- **Perceived competence**: will less-skilled players feel less competent if they know that the computer is assisting them, or will they feel more competent because their performance is better against the other player?
- **Relatedness**: will people feel less connected to the other person if they know that the computer is assisting them, or will they feel more connected because they are more equal in performance?
- **Suspense**: when people are aware of the assist, will people feel that the outcome of the game is pre-determined?
- **Tension**: how does disclosing the assist affect players’ perceptions of pressure during the game?
- **Attribution**: how does disclosing the assist change the way that players explain the cause of their performance (i.e., by attributing their success to themselves (internal) or to outside forces such as the system (external))?

The results of our study provide several new insights into the ways that player balancing changes play experience:

- First, we confirm previous results that player balancing significantly reduces score difference, significantly increases perceived competence for weaker players, and significantly increases enjoyment for both players compared to a non-assisted game.
- Second, we show that for all experience measures, disclosing the assist does not significantly change experience compared to concealing the assist, suggesting that players may be more influenced by their performance than by knowledge of the cause of that performance. For example, relatedness was higher with balancing, even when the balancing was disclosed.
- Third, we show that for experienced competence, disclosing the assistance did cause significant interaction effects with expertise. Disclosing the assist increased the perceived competence of the stronger player, but not the weaker player. This suggests that awareness affects player experience differently for experts (who receive no assistance) and novices (who receive assistance).
- Fourth, disclosing assistance also led to changes in how players attribute their performance, which was different for experts and novices. When assistance was concealed, there was no difference in attribution; however, when it was disclosed or when there was no assistance, experts attributed their performance more internally (more to themselves) than novices did.

These results overturn conventional wisdom about disclosing the presence of balancing. Our study suggests that for some measures of play experience, the benefits of balanced play matter more than awareness of an assist. As such, our work shows that disclosing assistance does not appear to be detrimental to the player experience, as has been previously proposed, and still provides the benefits of balanced play. Our study provides the first detailed exploration of how disclosing assistance actually affects play experience, it offers explanations for these unexpected findings, and gives information that can help designers build multiplayer games that provide a better play experience for everyone.

**RELATED WORK: GAME BALANCING**

There are several kinds of game balancing that address different aspects of gameplay. One main type considers difficulty balancing – that is, whether the difficulty level of the game matches the skill level of the player [9]. Optimal difficulty balancing means that the game does not cause either anxiety or boredom [29], leading to a more enjoyable experience [7]. In multiplayer games, however, difficulty balancing is complicated, because the difficulty of the game is determined by the skill of the other player.

In multiplayer contexts, difficulty-balanced games should ensure that all human players should have an equal opportunity to win [3]. **Player balancing** is the term that refers to this type of balancing – and this is very different from other forms of game balancing that attempt to ensure that all there is no dominant strategy or resource [13]. It is very difficult to compensate for every possible variation of skill level between players, but it has been demonstrated that when players are more evenly matched, enjoyment is increased for everyone [6,17,32].

**Types of Player Balancing**

There are several ways to balance player abilities and competition in multiplayer games. Previous game research presents four general categories: difficulty adjustment, matchmaking, asymmetric roles, and skill assistance.

**Difficulty Adjustment**

Gameplay balancing can be achieved by adjusting the difficulty level of the game statically or dynamically. The static approach allows players to choose from predefined difficulty levels. In multiplayer games, this may take the form of handicaps, or can involve manipulating the capabilities of units or access to resources. The lack of flexibility in these systems, however, can lead to situations where the difficulty does not match the player’s ability [18].

Dynamic difficulty adjustments change game difficulty based on player performance [3]. For example, in **Left 4 Dead**, the number of zombies that spawn is determined by how well the players are doing. Previous research has suggested that some players can exploit these systems better than others [3], which can make players feel cheated [14].

**Matchmaking**

Matchmaking systems are present in many popular competitive games such as **Dota 2**, **StarCraft 2**, and **Halo**. Matchmaking systems attempt to match players of equal skill or ranking [3]. The drawback to these systems is that there may not be enough players to perform accurate matching (something that is particularly true in social play settings).
In addition, player rankings do not take into account temporary changes in an individual’s performance.

**Asymmetric Roles**

Some multiplayer games try to balance gameplay by providing different roles that are better suited for different expertise. For example, Blizzard’s *World of Warcraft* allows players to choose a character whose primary role is to damage enemies, defend other players, or heal allies [24]. This allows players to support the team by choosing a role well suited to their strengths, even if they lack specific skills. This kind of balancing can be a problem because it doesn’t allow players to practice the skills they lack, and may implicitly force people into certain roles.

**Skill Assistance**

Player balancing techniques can differentially assist the core mechanics that are needed to play a multiplayer game—such as steering in driving games, or aiming in shooting games. Aiming assistance (algorithmic changes that alter the accuracy of targeting movements) help weaker players hit their targets more often when they shoot and has been shown to help balance multiplayer FPS games [32].

Aim assists have been shown to be an effective player balancing technique in equalizing performance in first person shooter games [31]. However little work has investigated how player enjoyment might be affected if players were aware of assistance being present in the game. Initial previous research, however, has suggested that disclosing assistance would harm experience [5].

**Effects of Player Balancing on Game Experience**

When balancing for skill, it is generally assumed that designers should keep assistance hidden, so that players do not feel that the game system is unfair [15,17] and so that the assisted player’s self esteem is not harmed [14]. Previous work on player balancing has shown that player balancing can equalize game outcome in 2D and 3D shooting games without being obvious to players [6,31], can improve weaker players’ feelings of competence and fairness [32], and can improve enjoyment for both players [15,32]. An experiment with novices and experts competing against simulated drivers in a racing game showed that combining several techniques improved balance, was preferred by both experts and novices, increased the perceived competence of novices, and did not detract from the experience of experts [8]. Player balancing has even been shown effective in balancing play for people with very different physical abilities in parallel play—recent research showed that applying a combination of balancing approaches allowed people in wheelchairs to compete in a Dance Dance Revolution clone against an able-bodied competitor [14].

Although several studies have demonstrated effective player balancing, there are only a few that examine whether disclosure of the assistance affects experience. In Gerling et al.’s study with a Dance Dance Revolution clone [14], the authors explored how different balancing approaches affected the self-esteem of pairs of players in the context of a game that is symmetric (i.e., both players do the same activity at the same time), and uses body-based input that requires exertion. Their intention was to design an exergame that could be played both by able-bodied users and players in wheelchairs. Although assistance was never explicitly disclosed to players, the input balancing scheme provided a static difficult adjustment to one player, in that they were given a different step chart and score multiplier, which was visible to the players. They found that input balancing reduced feelings of self-esteem in both players as compared to a related approach of time balancing—another static difficulty adjustment that gave weaker players a longer time interval in which a step counted as a hit, thus remaining less visible to players. However, input balancing was also less effective at lowering score differential, so the two approaches did not equally balance play. In addition, their study used a game in which the two players each competed against the game system and not directly against each other. Gerling et al.’s work suggests that providing assistance by visibly lowering game difficulty for one player can harm self-esteem. We explore balancing in a very different environment—that of a first-person shooter, in which players compete against each other—and explore dynamic skill assistance as the balancing mechanism, which by nature is equally effective whether or not it is disclosed to players.

Awareness of balancing was also explicitly explored in group play [5]. These findings suggest a negative influence of awareness on the efficacy of assistance as well as specific aspects of the player experience. These results, however, are based on description of observations of the session and not statistical analysis [5].

**RELATED WORK: ATTRIBUTION**

Balancing play through skill assistance manipulates the perception of achievement experienced by players, which can be explained using social psychology theories. A large area of research is dedicated to understanding how people create explanations about what happens to them. These explanations help people to understand “why something happened”. Psychologists call this process attribution. Attribution Theories try to explain how people assign causes to events in their lives and how these causal beliefs determine cognition, emotion and behavior [30]. Weiner’s attribution theory deals specifically with the process of dealing with success and failure [34,35,36]. According to Wiener’s theory, an achievement attribution can be described on three dimensions:

- **Locus of control**: whether the performance is caused by the actor (internal) or outside forces, such as the situation or another person (external).
- **Stability**: whether the internal or external cause is stable (a cause that cannot change) or unstable.
- **Controllability**: The extent to which future task performance is under the actor’s control (can the actor influence the cause of the achievement).
For example, consider a student failing an exam. The student can develop different explanations about why he failed this exam: bad luck with respect to the questions asked (external, unstable, uncontrollable), unfair expectations of the teacher (external, stable, uncontrollable), his own intelligence (internal, stable, uncontrollable) or the effort he put into studying (internal, unstable, controllable). The way the student attributes the failure has direct impact on how threatening this event is for his self-esteem, how he expects to perform in future exams, and how motivated he is to work for the next exam. [36] The explanation of not having worked hard is more likely to result in higher motivation for the next exam than the explanation of not being intelligent.

When we use skill assistance in a game we externally manipulate the achievement of the player. This will likely affect the attribution style of the player. Common sense would suggest that a player who is knowingly assisted would tend toward attribute their performance to the assistance (external). A player who is unaware of being assisted might tend to attribute their performance to their skill (internal). In order to measure this, we created a scale to measure the perceived locus of control (internal vs. external) of players for a specific game session.

**STUDY DESCRIPTION**

This study builds on previous work by Vicencio-Moreira et al. [32], which established that player balancing through skill assistance increases enjoyment of both assisted and unassisted players. Our study investigates how disclosing player balancing affects experience. We matched participants with differing skill levels and had them play four rounds. The first round was a training round, in which participants learned the game by playing a 10-minute single-player round (with no assistance) against medium-difficulty AI-controlled enemies, in which the controls were explained. The next three rounds were the three experimental conditions: Control (no assistance), Concealed Assistance (assistance given without players being aware they were being assisted), and Disclosed Assistance (assistance given and players were told they would have assistance).

The presentation of these three conditions was balanced by a Latin Square, which meant that some participants played a game with disclosed assistance before one with concealed assistance. There is thus a risk of participants detecting the hidden assistance. Previous research presented the disclosed assistance condition last [5], but we chose the Latin square method to prevent a confound between order and play conditions. We tested whether the sequence of conditions influenced our results before analyzing the data (see below).

**Apparatus**

We developed a custom game using the Unreal Development Kit (UDK), with the UnrealScript language, Visual Studio 2010, and the NFringe add-on. The study used the default UDK “Deck” map for all rounds, customized to be smaller to accommodate only two players. All sessions were played on identical 64-bit Windows 7 machines with comparable Intel i3 processors and NVidia GTX graphics cards, 8GB RAM, Razor Imperator mice, and 22-inch LCD monitors with 60 Hertz refresh rates. Each participant was allowed to set custom mouse sensitivity. Data were sent to a Microsoft SQL Server database.

**Figure 1** (A) assistance level (B) score

**Participants**

We recruited 21 pairs of participants, who were each compensated with $10. Participants ranged from 18-39 (mean=24.3). Participants were asked to fill out a questionnaire about their gaming habits and FPS experience to gauge their experience level and sort them into a “novice” or “expert” category. Players were not told that they were paired in expert-novice pairings to avoid relative performance expectations. Skill level was verified by watching their performance during the training round. Players were seated in the same room, but could not see each other as visual dividers separated them. Although they were able to speak to one another, they were wearing headphones, and in practice, did not communicate during the study.

**Task**

At the start of each session, the pair was told that the study was investigating how enjoyment changes over time. After the single-player training round, players were instructed to join the server and play a 1-on-1 deathmatch game. At the end of each round, players completed subjective surveys.

Before the disclosed assistance condition, the players were told that the weaker player would be assisted and that the level of assistance would depend on their relative performance (the score differential). During the disclosed condition, the level of assistance for each player was displayed in a box on the left side of the screen (shown in Figure 1). In all three conditions, the score of each player was displayed on the right side of the screen.

Our game used standard FPS controls: movement was controlled with the standard WASD scheme and the mouse was used to change the pitch/yaw. When an opponent was “killed” by a player, the surviving player’s health was reset
back to 100%. The players started each round with an assault rifle and a pistol; the assault rifle had a higher rate of fire than the pistol but did less damage.

**Skill Assistance**

We used a version of the ‘Combo’ player balancing technique used in earlier work [32], due to its success in balancing play and increasing player enjoyment. Combo provided both aim assistance and damage modifiers (decrease incoming and increase outgoing damage).

The Combo technique provided assistance dynamically depending on the performance of the player. The system had ten levels (1-10), in which a higher level results in a stronger assistance effect. The assistance level was determined by the score differential between the two players. For example, if player A’s score was 5, and player B’s score was 4, then player B’s assistance level was 1.

Aim assistance was provided using a technique called Bullet Magnetism – a technique that adjusted and improved aiming for weaker players [31]. In the game, bullets were shifted toward the opponent who was standing in a threshold range determined by the level of assistance. In the UDK system, bullet magnetism was implemented by adjusting a shot vector toward the first enemy that was within a threshold range from the normal bullet path (100 UDK Units * level-100).

Damage adjustment was triggered when a player was receiving assistance. Adjustments depended on the level of assistance – the player’s outgoing damage was increased (original damage + 5*level), while their incoming damage was simultaneously decreased (original damage - level).

The original implementation of Combo gave both players a small red icon to denote the location of the opponent [32]. This indicator could be seen behind walls, and would indicate when the opponent was behind the player. Due to the fact that it clearly indicated that assistance was being applied, this was not included in our implementation.

**Dependent Measures**

To measure the effects of disclosing assistance, we asked the participants to fill out a survey after each condition. The survey included the following instruments:

*Player Experience of Needs Satisfaction (PENS)*: PENS measures the perceived satisfaction of the psychological needs of Competence, Autonomy and Relatedness as well as the Immersion of a player in a game [27].

*Intrinsic Motivation Inventory (IMI)*: IMI measures Interest-Enjoyment, Effort, and Pressure-Tension a player felt during the game [21]. The IMI scale also measures perceived competence, which we left out because the construct is already measured in PENS.

*Suspense*: We used Moulard’s suspense scale [22].

*Attribution*: We could not find game-related attribution questionnaires – existing instruments refer to very specific events or causes and are domain specific. We therefore created a game-specific questionnaire. Based on attributional measurement in other domains [11], we created a scale that was designed to measure how internally (as supposed to externally) a player attributed their achievement in a game session. The scale consisted of 7 items that the player rated on a 5-point Likert Scale (1 = strongly disagree, 5 = strongly agree).

<table>
<thead>
<tr>
<th>Question</th>
<th>Scale</th>
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<tbody>
<tr>
<td>I feel like I had very little influence over my score in this game.</td>
<td>(Inverted)</td>
</tr>
<tr>
<td>It was up to me how well I did in this game.</td>
<td></td>
</tr>
<tr>
<td>My effort and ability determined the score of this game.</td>
<td></td>
</tr>
<tr>
<td>The score of this game reflects directly on my Skill.</td>
<td></td>
</tr>
<tr>
<td>The score of the game would have been the same no matter how hard I would try.</td>
<td>(Inverted)</td>
</tr>
<tr>
<td>The score of the game was mostly caused by things other than myself.</td>
<td>(Inverted)</td>
</tr>
</tbody>
</table>

**Table 1. Player Attribution Scale Items**

The items exhibited high internal consistency with a Cronbach’s alpha coefficient of .83. The mean of the scale was 3.6 (SD=.75, min=1, max=5) and skewness and kurtosis values indicated a normal distribution. The scale can be interpreted as an indicator for how internally (as opposed to externally) a player attributes her achievements in the game. A high score indicates internal attribution; a low score indicates external attribution.

**Data Analyses**

We first conducted a one-way analysis of variance with condition order as a between-subjects factor and assistance type as a within-subjects factor on our main measures of interest (perceived Competence and Attribution) to determine whether experiencing the disclosed assistance condition before the concealed assistance condition significantly affected experience. There were no significant between-subjects effects, thus we did not consider order of condition presentation in future analyses.

We conducted a repeated-measures multivariate ANOVA (RM-MANOVA) with assistance type (no assistance, concealed assistance, disclosed assistance) as a within-subjects factor and Expertise (whether the participant was the weaker or stronger player) as a between-subjects factor on the dependent measures of Performance (Kills), Experience (Competence, Autonomy, Relatedness, Immersion, Pressure, Suspense, Enjoyment, Effort), and Attribution, treating each participant as a case and with \( \alpha \) set to 0.05. Sphericity assumption violations were corrected using the Huynh-Feldt method of adjusting the degrees of freedom. We controlled for Type 1 error by using Bonferroni-corrected pairwise comparisons.

Our sample was of a reasonable size (N=42) to draw conclusions in a repeated-measures design; however, we report eta-squared values to give an indication of the amount of
variance explained by each significant effect. We conducted a post-hoc power analysis using G-Power. Given our sample size of 42, an α set to 0.05, and estimated medium effect sizes (f = 0.25), our statistical power is 0.89 thereby allowing us to assume the null hypothesis when no significant differences were found [10].

RESULTS
We present our results by answering the research questions about the balancing efficacy, and the effects of awareness on experience and attribution.

Player Balancing Performance Check

Did player balancing work?
Our balancing algorithm was based on earlier work [32] and designed to keep games as close in score as possible.

The RM-MANOVA for number of kills showed a significant interaction between expertise and assistance type (F(1,745.7)=58.9, p=.000, η²=.61); pairwise comparisons showed that there was a significant difference in the number of kills between weaker and stronger players when no assistance was applied (p<.001), but not when assistance was concealed (p=.542) or disclosed (p=.062); see Figure 3. These results show that providing assistance balanced player performance better than providing no assistance, regardless of whether or not assistance was disclosed.

Player Experience

Did disclosing assistance affect perceived competence?
As expected, there were main effects of expertise (F(1,38)=20.2, p=.000, η²=.35) and assistance type (F(2,76)=9.3, p=.000, η²=.20) on perceived competence. Stronger players felt more competent than weaker players and pairwise comparisons showed that that player competence was lower when no assistance was provided than when assistance was concealed or disclosed (p=.012, disclosed p=.001). There was no difference in perceived competence between concealed and disclosed assistance (p=.748). These results need to be interpreted in the context of the significant interaction between expertise and assistance type on competence (F(2,76)=21.4, p=.000, η²=.36). As Figure 3 shows, weaker players felt more competent when assistance was provided (concealed: p<.001, disclosed: p<.001), but there was no difference between concealed and disclosed assistance (p=.99). Stronger players felt less competent with concealed assistance than disclosed assistance (p=.036) or no assistance (p=.036), but had no difference between disclosed assistance and no assistance (p=.99). To summarize, disclosing assistance affects perceived competence for the stronger player (who knows the opponent is being helped), but not the weaker player (who is being helped).

Did awareness of assistance affect enjoyment and effort?
As expected, there were main effects of expertise (F(1,38)=8.5, p=.006, η²=.18) on enjoyment and invested effort (F(1,38)=5.5, p=.024, η²=.13). Stronger players enjoyed playing more (mean=4.0, SE=0.08) than weaker players (mean=3.5, SE=0.11) and also put more effort (mean=3.7, SE=0.08) into play than weaker players (mean=3.4, SE=0.08). There was also a main effect of assistance type (F(1,70)=4.1, p=.024, η²=.10) on enjoyment. Pairwise comparisons showed that there was no difference in enjoyment when assistance was concealed or disclosed (p=.200); enjoyment was lower when players were not provided with assistance at all than when assistance was concealed (p=.45). As Figure 2 shows, when assistance was disclosed, the mean of player enjoyment was higher than when no assistance was provided; however, this difference was not significant (p=.601). There was no interaction between expertise and assistance type on enjoyment (F(2,76)=0.66, p=.519), which suggests that enjoyment was lower in the unassisted condition for both types of players.

There was no main effect of assistance type on invested effort (F(2,76)=0.13, p=.882) or interaction of assistance type and expertise on effort (F(2,76)=0.05, p=.947), which suggests that stronger players put more effort in regardless of whether or not assistance was provided and whether or not players were made aware of it.

Did awareness affect other aspects of experience?
The RM-MANOVA showed significant effects of assistance type on relatedness (F(1,70)=3.8, p=.031, η²=.09), and

Figure 2. Means ± SE of play experience measures, by condition (*p<.05). Higher values indicate more experience of that construct.
Higher numbers indicate more perceived competence, more experienced tension, and more internal attribution.

suspense \((F_{1.6,6.2}=5.8, \ p=.008, \ \eta^2=.13)\). Pairwise comparisons showed no difference in suspense when assistance was disclosed or concealed \((p=.467)\), but felt more suspense when concealed assistance was provided than when no assistance was provided \((p=.006)\). However, although Figure 2 shows how suspense was rated on average higher when assistance was disclosed over no assistance, this difference was not significant \((p=.200)\); see Figure 2.

Figure 2 also shows that there was no difference between concealed and disclosed assistance \((p=.99)\) on relatedness. It shows that providing either type of assistance increases relatedness, but that only disclosed assistance was significantly higher than no assistance \((p=.039)\); concealed was not \((p=.172)\).

There was no significant interaction between assistance type and expertise on suspense or relatedness.

There was a significant interaction between expertise and assistance type on the pressure/tension experienced by players \((F_{2.76}=9.8, \ p=.000, \ \eta^2=.20)\). As Figure 3 shows, weaker players experienced more pressure than stronger players when no assistance was provided \((p=.002)\) than when concealed assistance \((p=.765)\) or disclosed assistance \((p=.780)\) was provided. This suggests that both players experience similar levels of tension when either type of assistance was provided, but that stronger and weaker players experienced tension differently when not assisted.

**Player Attribution**

Did awareness of assistance affect how players attributed their performance?

There was a main effect of expertise on attribution \((F_{1.38}=6.7, \ p=.014, \ \eta^2=.15)\), with stronger players attributing their performance more internally than weaker players; however, this needs to be interpreted in light of the significant interaction between expertise and aiming assistance on attribution \((F_{2.76}=3.6, \ p=.032, \ \eta^2=.09)\). As Figure 3 shows, stronger players attributed their performance more internally (i.e., to their own ability) than weaker players when no assistance was provided \((p=.006)\), but that this difference was not present when assistance was concealed \((p=.906)\).

However, when assistance was disclosed, there was again a difference in attribution between weaker and stronger players \((p=.029)\). When players know about assistance, even though the score is equalized, and games are balanced, experts attribute their performance more to their abilities and novices attribute their performance more to the system, compared to when assistance is concealed.

**Summary of Results**

Our results show differences in experience when weaker players are assisted in order to balance play; however, we also show that making players aware of this assistance does not significantly harm experience over concealing the assistance. Specifically, we showed that when concealed assistance is provided, performance (in terms of kills) is equalized between the stronger and weaker player; the weaker player feels more competent; and experienced tension is equalized. In addition, both players feel more suspense and enjoy the game more when assistance is used.

When assistance is disclosed, performance is still equalized in terms of kills, and experienced tension is still the same between the weaker and stronger players. However, disclos-
ing assistance increases the gap in perceived competence between weaker and stronger players. This effect can likely be explained by the way in which players attribute their performance. When no assistance is provided, stronger players attribute their performance more internally (i.e., to their own abilities) than weaker players; this difference goes away when assistance is concealed, but returns when assistance is disclosed. Finally, these effects translate into greater enjoyment for both players when assistance is concealed (over no assistance); however, when assistance is disclosed, this difference is no longer significant.

Interestingly none of our effects show significant differences between the disclosed and concealed assistance. Descriptively, some values are lower when assistance is disclosed assistance compared to when it is concealed; however, those differences would not constitute large or even medium effects. The difference between disclosed and concealed assistance only becomes apparent when looking at interactions with expertise and only for perceived competence and player attribution.

**DISCUSSION**

In the following sections we return to the main question underlying the research (whether disclosing a balancing mechanism harms play), and also provide explanations for our main results, discuss the ways that the setting for gameplay affects player perceptions, and outline ways that our results can be used by designers and researchers.

**Does Disclosure Harm Experience?**

Our original goal was to test the assumption that disclosing a player-balancing scheme would harm experience for both players (e.g., [5,6,14,15]). Our results clearly show that, for our social play setting (as contrasted to a competition), conventional wisdom is incorrect – disclosure did not make the experience worse for either player, compared to concealing the assist. Although means for some measures were lower in the disclosed condition than in the concealed condition (e.g., enjoyment and suspense, see Figure 2), these differences were not significant – and as described earlier, a post-hoc power analysis suggests that we had sufficient power to find medium or large differences between the concealed and disclosed conditions. In addition, some measures of experience were higher when assistance was disclosed (e.g., competence and relatedness, see Figure 2).

This is a surprising and important finding, because previous work suggests that disclosure will diminish the players’ enjoyment [5, 8,17] – that awareness will make players feel cheated, because the game is no longer a fair comparison of the players’ relative skill [14]. In addition, strongly negative reactions to assistance can be observed in real gaming communities when they discuss players using assistance techniques like “aimbots” in FPS games or chess computers in online chess matches [19].

Our results, however, suggest that when designing for play situations that are social in nature, game designers do not need to go to great lengths to hide the presence of a player-balancing scheme, and rather, can make information about balancing explicit.

**Why Was Disclosure Not Harmful?**

We propose five reasons for our main result, based on the overshadowing effect of experienced performance, the game setting, the implicit contract between players, and people’s willingness to provide an internal attribution for their own success.

**Performance is more relevant than disclosure**

Our results suggest that player experience is strongly tied to a player’s performance in the game – particularly for the weaker player – even when that performance is adjusted by an assistance technique.

When play was balanced, regardless of whether or not assistance was disclosed, there was no longer a difference in perceived competence or tension and pressure, and overall, both weaker and stronger players perceived the balanced game as more suspenseful and more enjoyable – suggesting that a “close race” is more exciting for players than an unbalanced competition. This aligns with research showing that players’ enjoyment peaks when they hold a small advantage over their opponent [1,2] and that peak suspense occurs when players slightly trail their opponent [1].

For the weaker player, this effect may also be coupled with people’s willingness to over-attribute success internally [30], described below. For the stronger player, disclosing the assist was also beneficial because it provided them with an explanation for their reduced performance (e.g., their rating of their own competence went up in the disclosed condition, as described earlier).

**Engagement is more relevant than disclosure**

The game we tested provides an engaging experience, and the effects of assistance were difficult for players to identify (i.e., people still had to move, aim, and shoot as they would in an unassisted game). Even when players were told about the assist, the moment-by-moment experience of the game told a different story – one that reinforced people’s feelings that they were in control of the character, and that they were responsible for the outcome of the game. Overall, the resilience of measures – such as enjoyment – to the disclosure of assistance is an important result that makes it possible for designers to consider making balancing mechanisms explicit in games (discussed below).

**The game setting changes expectations**

Player balancing is based on an assumption of a “social play” setting, in which people want to have fun with friends and family [13]. Even though social play may involve competitive games, this setting is very different from “purely competitive” settings: in social play, the emphasis is on relationship enactment through games; in competitive play, the purpose of playing is to compare player skill [33].

These two settings lead to different expectations from the players about how the system should behave, and can ex-
plain the different responses to the ideas of balancing and assistance. In social-play settings, assistance allows people who normally would not enjoy playing together to have a more engaging game. In purely competitive settings, assistance violates the core assumptions that both players have the same starting conditions and that the outcome of the game is purely dependent on their skill [33]. In our study, participants thought they were testing a game in order to investigate player enjoyment. We never instructed them to play competitively or made comments about performance or scores. It is therefore reasonable to consider our results in the context of social rather than competitive play. Additionally, relatedness (i.e., connection to the other person) was highest when people were aware of the assist, which may suggest that players were interpreting the game setting more as one that involved social play. It is also important to note that players in our study were mostly not familiar with one another – so a pre-existing relationship is not needed in order to convince people to adopt the expectations of a social-play setting.

The players’ implicit contract to allow assistance
When players enter into any play situation, they engage in an implicit social contract about rules and behavior [28]. The attitudes that we have observed regarding aim assistance can be partly explained by the different contracts that arise from different play settings. In a purely competitive setting, the implicit contract states that players measure their skill while competing against each other, and that the use of assistance without prior agreement violates the contract (i.e., it is cheating). In social play, the contract implies that both players are willing to accept changes to the game in order to promote the goals of the setting, and under this contract, assistance to the weaker player is not a violation (e.g., nobody would give a child a head start and then complain about cheating). There are also interesting variations on this idea – for example, assistance can sometimes be formalized and used even in purely competitive play, as seen in golf (where handicaps can mean that weaker players can win even with inferior scores).

Attribution biases vs. effects of disclosure
The final issue relates to the ways that players attribute their success. The conventional wisdom about skill assistance assumes that neither weaker nor stronger players would enjoy aware assistance: weaker players would know that their success is false, and stronger players would feel cheated out of success. In a world where people perceive themselves rationally and without bias, this would probably be the case; however, attribution research shows that people are affected by a range of biases that appear to protect or enhance self-evaluation. People tend to take credit for their successes (self-enhancement bias) and attribute failures externally (self-protection bias) [30].

In our study, weaker players seemed to overestimate their own influence on their achievements even when they knew they were being assisted (i.e., internal attribution was not lower in the disclosed assist condition compared to the no-assist condition). Stronger players seemed to attribute their reduced performance to the assistance, possibly also reducing any feelings of being threatened by the challenge (i.e., internal attribution was lower in the disclosed condition compared to no assist).

Implications for game designers
Our work experimentally investigates how disclosing assistance affects play experience. Although more work is needed to confirm and generalize our findings, there are still some basic lessons that designers can take from our research. First, the main finding of our study was that disclosure of a skill assist does not negatively affect enjoyment or suspense for either the stronger or the weaker player, even in the competitive first-person shooter genre. This suggests that designers should be able to reveal the presence of assistance when it is in place. In fact, the effects of awareness were so innocuous in our study that it might be the safer choice for designers to reveal the assist even when a balancing technique is easy to conceal to avoid the potential costs of making players feel betrayed in their trust of a game system when a hidden balancing mechanism becomes publicly known. Conventional wisdom suggests concealing assistance, but our study shows that game companies should feel free to use disclosed skill assists to balance play.

However, this lesson must be taken in context – a clear underlying principle in our work is that player expectations can be very different depending on the play setting, and designers need to set up their games to match those expectations. It seems to be more important for designers to add features that change games when all parties understand that they are in social play settings rather than in other settings such as pure competition.

For example, an option in the game setup (e.g., “Balance for social play”) could be enough to provide awareness of the manipulation, and could even allow players to configure the balancing scheme (e.g., changing the type, strength, or responsiveness of the scheme). Configuration could further help to match the characteristics of the assistance to the requirements of the type of play (and the resulting implicit social contract as described above).

Directions for further research
There are several ways in which our research can be extended and generalized:

- Interaction with player type. Different play styles and player types [23] may respond differently to disclosure. For example, “achiever” player types may be less willing to accept assistance compared to “socializers” [23].
- Other game genres. Our results are limited to the constraints of the FPS setting. We plan to replicate our study in other genres that are commonly seen in both competitive and social play settings (e.g., fighting games such as Nintendo’s Super Smash Bros.).
• Effects of different presentation. We tested one type of information presentation about the assist (an indicator shown on the game’s score display). Other presentations may have stronger or different effects – for example, if the game emphasized the system’s help every time an assisted player scored a kill, it might affect play experience more than a less overt presentation.

• Further studies of attribution bias. Further studies will improve understanding of how attribution changes in different contexts – both in terms of self-enhancement and self-protection biases, and in terms of the role of immersion in changing attribution.

• Further studies of play setting. The expectations and social contracts that arise from different play settings can have a large impact on other aspects of game design. To date, little work has been done to identify the details of these different settings.

CONCLUSION
Playing games together has been a way for friends and family to foster social connections with each other; however, it can be difficult for people with diverse gaming skills to play together. Player balancing through skill assistance can bridge the gap in gaming abilities, opening new opportunities for social play. Conventional wisdom and previous research has suggested that skill assistance should be kept hidden to avoid perceptions of unfairness; however, systematic evaluation of the effects of awareness on the various aspects of player experience has been lacking.

We investigated the effects of disclosing assistance on player experience and found that, contrary to popular opinion, awareness of assistance did not detract from play experience. Attribution biases help explain why awareness was not harmful – people tend to take credit for their successes, but attribute failures externally. Our results support this notion – when assistance is disclosed, stronger players attributed their performance more internally and weaker players attributed more externally.

When players enter into a play situation, they engage in an implicit social contract about rules and behaviour – in competitive play, the contract may favour transparency of skill, even if that results in highly unbalanced matches. However, in social play, the contract implies that both players are willing to accept changes to the game in order to gain the benefits of balanced play in terms of supporting an uncertain and balanced outcome, which ultimately leads to a more enjoyable shared play experience.

ACKNOWLEDGMENTS
We would like to thank NSERC and the GRAND NCE for funding, members of the interaction lab at the University of Saskatchewan for feedback, and our participants.

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