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The influence of competition, cooperation, and player relationship in a motor performance centered computer game

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ABSTRACT

We conducted an experiment to study the effects of goal structure in multiplayer gaming (competition vs. cooperation) and relationship type between players (positive pre-existing relationship [friends] vs. no pre-existing relationship [strangers]) on player motivation (as indicated by perceived effort put into the task), goal commitment, and performance in playing a balloon popping game. The cooperative goal structure was found to lead to greater effort put into the game than the competitive goal structure. In addition, playing with friends resulted in a stronger commitment to the in-game goals than playing with strangers in the cooperative goal structure context, yet no difference was found between playing with friends and playing with strangers with regard to goal commitment in the competitive goal structure context. A moderated mediation relationship was found among the variables. Theoretical contributions to the current literature on goal structure and motivation, practical implications for exergame design, and directions for future research are discussed.

1. Introduction

Competition and collaboration with other players are important game mechanics frequently used in computer and video games. Anecdotally, most game designers and players agree that these mechanics increase engagement and motivation. However, empirical evidence on the impact of such mechanics is limited. It is important to investigate whether incorporating multiplayer modes can engage and motivate players more, and if so, how different types of multiplayer goal structure (e.g., competition, co-op, or team collaboration) impact player engagement and motivation.

Another important factor to consider in multiplayer gaming is the social context of gameplay; in other words, relationship type among players. Video game players were once limited to solo gaming or playing with a couple of friends. With the advent of the Internet, online features of video games have become pervasive in the current video game environment, enabling people to play together remotely. Players can now play with friends or thousands of complete strangers. Does it matter if the designers match up players to play against a friend or a stranger?

Computer and video games have a vast range of genres. The multiplayer modes of competition and collaboration may function differently with different genres. One type of video game that is becoming increasingly popular is the exergame or active video game, which requires players to exert physical effort and use their body movements to play (e.g., games played on *Xbox Kinect*). For the purpose of encouraging more physical exertion in such games, would a competitive or cooperative multiplayer mode be more motivating? Would the relationship type among the players moderate the effects of the multiplayer goal structures of competition and cooperation?

To enhance theoretical understanding of how competition and cooperation—two fundamental goal structures—interact with the relationship type in video gaming, and to provide design guidelines for video games that focus on motor performance, we conducted a factorial between-subjects experiment to examine the effects of goal structure (competition vs. cooperation) and the relationship type between players (positive pre-existing relationship [friends] vs. no pre-existing relationship [strangers]) on player performance, motivation, and goal commitment in a motor activity-centered computer game. In the following section, we first review the relevant literature in the area of goal structures of competition and cooperation, particularly focusing on their impact on motor performance. We then review the literature on the effects of relationship in competitive and cooperative contexts.

2. Literature review

2.1. Multiplayer goal structure: competition and cooperation

Competition and cooperation are normally conceptualized as different types of goal structures (Deutsch, 1949a, 1949b). Competition occurs when people attain goals only if others do not; cooperation occurs when people attain goals only when others also

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attain their goals (Johnson, Johnson, & Stanne, 1986). Competition is also an innate element of most digital games, in which players compete either against the machine or other players (Williams & Clippinger, 2002). Competition is one of the most important mechanisms to increase motivation and positive gaming experience in entertainment games (Vorderer, Hartmann, & Klimmt, 2003). Cooperation, either with none player characters (NPCs) or other players to attain a common goal, is a design pattern that has been around since the inception of games, yet has very few research studies associated with it (El-Nasr et al., 2010).

2.1.1. Performance

The fields of psychology and human relations have extensive studies on competition and cooperation (Deutsch, 1949a, 1949b; Goodman & Leyden, 1991; Stanne, Johnson, & Johnson, 1999; Tauer & Harackiewicz, 1999, 2004). A plethora of research has been conducted regarding the effectiveness of these different goal structures on motor and cognitive performance. In the domain of motor performance, a meta-analysis found that cooperation led to a higher level of performance than individual and competitive conditions in general (Stanne et al., 1999). In particular, cooperation promotes performance for tasks high in means interdependence (tasks that require individuals to coordinate their efforts as they work on the task). Both competition and cooperation lead to a similar level of motor performance for tasks high in means independence (Stanne et al., 1999). It needs to be noted that this meta-analysis categorized studies that combined competition and cooperation modes together with pure cooperation studies. Some evidence has shown that there is no difference between pure competition and pure cooperation in motor performance (Tauer & Harackiewicz, 2004). Given the inconsistent findings regarding the effect of cooperation and collaboration on motor performance, we propose the following research question rather than a hypothesis in the context of playing a means independent, motor activity-centered game.

> Research question (RQ1): Which multiplayer goal structure, competition or cooperation, results in better performance in a motor activity-centered game?

2.1.2. Motivation

Motivation is another outcome that has been studied extensively in the context of goal structures of competition and collaboration. Competition is a common motivating strategy, particularly for extrinsic rewards (Tjosvold, Johnson, Johnson, & Sun, 2006; Vallerand & Losier, 1999). However, evidence regarding the influence of competition on motivation is mixed. Some studies found that competition undermined motivation. For instance, competition was found to be negatively related to participants' motivation to play a *Wii Fit* game (Song, Kim, Tenzek, & Lee, 2010). Participants were either told that they were competing against others or playing by themselves without any competition among players. Participants who played by themselves were significantly more motivated to participate and enjoyed the experience more than those in the competition condition. Deci and his colleagues also found that competition undermined motivation: Participants who had competed against a confederate were less likely to return to the activity during a free-choice period than those who were not involved in competition (Deci, Betley, Kahle, Abrams, & Porac, 1981). However, there is also evidence suggesting that competition can have positive effects on motivation, depending on individual differences and the task (Epstein & Harackiewicz, 1992; Reeve & Deci, 1996; Tauer & Harackiewicz, 1999).

Literature regarding the impact of cooperation on motivation is relatively limited. Tauer and Harackiewicz (2004) found that there was no difference between pure competition and pure cooperation on motivation as measured by enjoyment in a motor performance context. Given that there is mixed evidence regarding the effect of competition on motivation, and little evidence regarding the effect of collaboration on motivation in a motor performance context, we propose the following research question.

> RQ2: Which multiplayer goal structure, competition or cooperation, results in greater motivation in a motor activity-centered game?

2.1.3. Goal commitment

Goal commitment is defined as one's determination to reach a goal in the goal setting theory (Locke & Latham, 1990). Goal commitment is an important antecedent of motivation and engagement, as the goal will not have any motivating effect until the individual is committed to achieving it (Klein, Wesson, Hollenbeck, & Alge, 1999). As this theory implies, when individuals are committed to a goal, they will have the intention to extend effort toward goal attainment, persist in pursuing the goal over time, and not be willing to lower or abandon the goal. At the individual level, empirical studies demonstrated that goal commitment contributed to performance (Klein et al., 1999) and physical effort perseverance (Tenenbaum et al., 2005). In a cooperative group setting, goal commitment was also found to contribute to group performance (Aubé & Rousseau, 2005; O'Leary-Kelly, Martocchio, & Frink, 1994). Similarly, goal commitment was found to increase task performance in a competitive setting (Allscheid & Cellar, 1996). It is suggested that competition can increase performance through the setting of and/or commitment to difficult goals (Locke, Latham, & Erez, 1988). However, limited empirical evidence is available regarding the effects of competition or cooperation on goal commitment. In a motor performance and endurance context, competition was not found to increase goal commitment in comparison to no competition (Lerner & Locke, 1995). We are not aware of any study that compares the effects of competition vs. cooperation on goal commitment. As competition and cooperation are essentially goal structures (Deutsch, 1949a), it is worthwhile to investigate how these two different goal structures impact goal commitment.

> RQ3: Which multiplayer goal structure, competition or cooperation, results in greater goal commitment in a motor activity-centered game?

2.2. Cooperation, competition, and relationship type

Previous research has examined potential moderators for the effect of competition and cooperation, including task means (Aubé & Rousseau, 2005) and gender (Van Vugt, De Cremer, & Janssen, 2007). However, very limited research has explored the potential moderating effect of the relationship type. Moreover, the existing studies are mostly situated in cognitive tasks in the organizational setting (Jehn & Shah, 1997; Parise & Rollag, 2010). Examining the relationship type among multiple players in the gaming context has significant real-life implications because multiplayer mode is becoming a default feature that enables game play between friends (with a positive pre-existing relationship), as well as strangers (with no pre-existing relationship) over the Internet; yet virtually no research on how the relationship type influences the game experience in the different multiplayer modes is available.

2.2.1. Performance

Numerous studies have shown that team cohesion is strongly correlated to performance in the collaboration context, since mem-

bers of highly cohesive teams are more motivated to participate in activities to advance the team goals (e.g., Evans & Dion, 1991). Teams with individuals who have positive pre-existing relationships are more cohesive than teams with individuals who have no pre-existing relationships (Parise & Rollag, 2010).

Research on conflict suggests another way in which stronger positive pre-existing relationships (e.g., friendship) can improve task motivation and performance in the collaborative setting. For instance, recent research by Jehn and Shah (1997) experimentally confirmed that conflict experience is one of the primary ways in which interpersonal relationships may enhance task performance, in particular, cognitive tasks. First, better interpersonal relationships can result in fewer administrative conflicts. Those who are more familiar with each other's strengths and weaknesses (Deutsch, 1969; Levine & Moreland, 1990) and work habits (Goodman & Leyden, 1991) may have fewer coordination problems and administrative conflicts. Second, better interpersonal relationships can also reduce emotional conflicts and thereby increase task performance. Friends who have strong positive pre-existing relationships, presumably have an affinity toward each other, which means less dissatisfaction and fewer emotional conflicts. Fewer administrative conflicts and emotional conflicts enable team members to focus more on the task at hand, and results in higher task performance. This finding was obtained with regard to cognitive tasks. To the best of our knowledge, there was no literature on how relationship type impacts motor performance in a cooperative setting. Therefore, we propose the following research question.

RQ4: Will teams of friends (with a pre-existing positive relationship) achieve a higher level of performance than teams of strangers (with no pre-existing relationship) in a cooperative goal structure context of playing a motor activity-centered game?

2.2.2. Motivation and goal commitment

Highly cohesive teams are more likely to make individual sacrifices, conform to team norms, and focus on team goals (Prapavessis & Carron, 1997). Additionally, these highly cohesive teams have a stronger "tendency for a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs" (Carron, Brawley, & Widmeyer, 1998, p. 213). Teams of friends, due to their existing social bonds and expected interactions in the future, will have strong team cohesion. Very cohesive teams (e.g., teams of friends) should display higher commitment to the team goals, and increase team members' motivation on the task, than less cohesive teams (e.g., teams of strangers). In addition, high team cohesion can also reduce the social loafing effect, where people exert less effort in groups than when participating alone (Karau & Hart, 1998; Karau & Williams, 1993). Thus, the following hypotheses are proposed.

Hypothesis (H)1: Teams of friends (with a pre-existing positive relationship) will have greater motivation on tasks than teams of strangers (with no pre-existing relationship) in a cooperative goal structure context of playing a motor activity-centered game.

H2: Teams of friends (with a pre-existing positive relationship) will be more committed to the team goals than teams of strangers (with no pre-existing relationship) in a cooperative goal structure context of playing a motor activity-centered game.

While there is limited research examining the moderating effect of relationship in the cooperative setting, there is virtually no prior work on the effect of relationship in the competitive setting. Therefore, we pose the following research question.

RQ5: How might relationship types affect (a) performance, (b) motivation, and (c) goal commitment in a competitive goal structure context of playing a motor activity-centered game?

Finally, as goal commitment is the antecedent of motivation and performance, relationship type might also interact with goal structure (i.e., the goal structure effect may be different depending on whom the individual plays with). We therefore explore these additional research questions.

RQ6: Is there a moderated mediation between the variables goal structure (independent variable), relationship type (moderator), goal commitment (mediator), and performance (dependent variable)?

RQ7: Is there a moderated mediation between the variables goal structure (independent variable), relationship type (moderator), goal commitment (mediator), and motivation (dependent variable)?

3. Method

3.1. Participants

Participants ($N = 158$) were recruited from an undergraduate communication class at a large Midwestern university. They received extra credit for participation. Participants' ages ranged from 18 to 23 years old, with a mean of 19 years. Sixty-three percent of participants were male; 37% were female. With regard to race, 116 (73%) of the participants reported they were white, 22 (14%) were black, 12 (8%) were Asian, five (3%) were native Hawaiian, one was native Indian, and two did not disclose race information. Ten (6%) also identified themselves as Latino or Hispanic.

3.1.1. Stimuli

A balloon popping game designed by Master's students in the game design specialization was used to test the fundamental mechanism regarding the interaction of multiplayer mode and relationship type among players. The game involved the player quickly clicking the mouse to pop the balloons shown on the screen, under a time constraint, with the goal of obtaining the highest score. The physical exertion focused on the players' fingers and wrist.

The game had a single player version and two multiplayer versions. The single player version was used to introduce the game to our participants and to obtain baseline measures of their performance (number of balloons popped). In the single player version, the player saw her real-time performance score and a timer. The two multiplayer versions allowed the players to play over the Internet either competitively or cooperatively. In the competitive multiplayer mode, each player saw her real-time performance score, the real-time performance score of her competitor, the game handicap (to help match the skill levels of the players), and a timer. In the cooperation mode, each player saw her own real-time performance score, the real-time performance score of her collaborator, the real-time team combined score, the goal, and a timer.

3.2. Procedure

Participants first completed a brief online recruitment survey to gauge their video game skill level and time spent regularly playing games. Those who reported no experience with video games (about 5% of those who completed the recruitment survey) were not eligible for participation. Eligible participants were invited to sign up for a gaming session. Each session had either one pair or two pairs of participants. The eligible participants recruited from

the class were also required to bring a friend over the age of 18 to the lab.

Upon arrival at the lab, the participants read and signed the consent form. If only one pair of friends showed up, they were randomly assigned to either compete or cooperate with each other. If two pairs of friends showed up, they were randomly assigned to one of the four conditions: (1) compete with friend, (2) compete with stranger, (3) cooperate with friend, (4) cooperate with stranger. The experimenter made sure that neither pair of friends knew the other pair of friends.

Each participant was informed of the assigned condition and played the game over the Internet with another participant (either a friend or a stranger), either competitively or cooperatively. All participants first played a single player version of the balloon popping game. They were instructed to try their best to pop as many balloons as possible in two continuous 150-s trials. The scores of the two trials were recorded.

In the competition conditions, the participants competed against each other in the balloon popping game for 300 s. They were informed before playing the actual 300-s game that the two 150-s trial scores would be used to apply the handicapped score, ensuring that the two competitors were matched in terms of skill level. They were told that the winner of the 300-s competition would be the one who popped more balloons after handicap adjustment, and the winner would be entered into a drawing for a $100 Amazon.com gift card. The handicapped score was calculated as follows: If participant A had a combined score of 700 in the two 150-s trials, and participant B had a combined score of 680 in the two 150-s trials, a handicap score of 20 was applied to participant B in the 300-s actual play for entry into the $100 Amazon.com gift card drawing. Real-time performance scores of the player and her competitor (with handicap included) were shown on the screen.

In the cooperation conditions, the participants worked together on a team of two to play the balloon popping game for 300 s. The goal of the cooperation game was to pop more balloons than their combined scores on the two individual 150-s trials. If the two players as a team reached their goal, they would both be declared the winners. If the two players as a team did not reach their goal, neither of them would be declared the winners. They were told before the 300-s game that the winners would be entered into a drawing for a $100 Amazon.com gift card. After playing the game for 300 s in the actual test, the players were informed whether or not they were winners. Then they proceeded to take a post-test questionnaire.

3.3. Measures

3.3.1. Manipulation check

The participants were asked whether they competed or cooperated with another player.

3.3.2. Performance

Performance was measured by the actual number of balloons popped by the player in the 300-s game.

3.3.3. Motivation

Motivation was measured by adopting the Effort Subscale of the Intrinsic Motivation Index (McAuley, Duncan, & Tammen, 1987). The participants used a 7-point Likert-type scale anchored by "strongly disagree" and "strongly agree" to rate the four statements: "I put a lot of effort into this;" "I tried very hard on this activity;" "I didn't put much energy into this" (reversely coded); and "I didn't try very hard to do well at this activity" (reversely coded) ($\alpha = .77$).

3.3.4. Goal commitment

Goal commitment was measured by five items adopted from previous studies (Hollenbeck, Klein, O'Leary, & Wright, 1989; Tziner, Kopelman, & Livneh, 1993): "I was determined to achieve the goal of this game;" "The goal of this game was important to me;" "Quite frankly, I didn't care if I achieved the goal of the game or not;" "It wouldn't take much to make me abandon the goal of the game;" and "I was committed to pursuing the goal of the game" ($\alpha = .87$).

3.4. Data analysis

Analysis of Covariance (ANCOVA) with relationship type and goal structure as the independent variables, controlling gender, gender composition (same gender composition vs. opposite gender composition), and trial performance score, was conducted to answer RQ1. ANCOVAs with relationship type and goal structure as the independent variables controlling gender and gender composition were conducted to answer RQ2 and RQ3. Independent-sample t tests were employed to answer RQ4, RQ5a, RQ5b, and RQ5c, and to test H1 and H2. Multiple regressions were conducted to test the moderated mediation model to answer RQ6 and RQ7.

4. Results

Among the 158 participants, 11 (7%) did not pass the manipulation check and four (2.5%) encountered technical difficulty during gameplay. Data of the remaining 143 participants were included in the analysis.

4.1. Performance

ANCOVA revealed no significant main effect of goal structure, $F(1,136) = .007$, $p = .94$, or main effect of relationship type, $F(1,136) = .28$, $p = .60$, or interaction effects, $F(1,136) = .004$, $p = .95$, for individual actual performance score in the 300-s actual game. In other words, answering RQ1, there was no difference between the goal structures of competition ($M = 686.21$, $SD = 79.04$) and cooperation ($M = 693.17$, $SD = 67.98$) in terms of performance. The t test also revealed that there was no performance difference between teams of friends ($M = 691.76$, $SD = 67.35$) and teams of strangers ($M = 694.76$, $SD = 69.68$) in a cooperative goal structure context, $t(68) = .18$, $p = .86$, answering RQ4. Similarly, there was no performance difference between teams of friends ($M = 682.29$, $SD = 89.06$) and teams of strangers ($M = 690.46$, $SD = 67.54$) in a competitive goal structure context, $t(71) = .44$, $p = .66$, answering RQ5a. Although we did not formalize a research question or hypothesis with regard to the trial performance score and the actual test performance score, paired t test demonstrated that for all participants, regardless of whether they competed or cooperated with a stranger or friend, their performance score in the 300-s actual test ($M = 689.62$, $SD = 73.66$) significantly improved from the two combined 150-s trials ($M = 661.68$, $SD = 69.27$) when they played in the single player mode in which they were asked to try their best, $t(142) = 8.45$, $p < .001$.

4.2. Motivation

A significant main effect of goal structure was found with regard to motivation, $F(1,137) = 8.43$, $p = .004$, $\eta^2 = .06$. Specifically, participants who played the game cooperatively ($M = 6.08$, $SD = .95$) were more motivated and put forth more effort than participants who played the game competitively ($M = 5.57$, $SD = 1.07$), answering RQ2. No significant main effect of relationship type was found, $F(1,137) = 1.86$, $p = .18$. No interaction effect was found,

$F(1,137) = .02$, $p = .88$. The t test indicated that there was no difference for motivation (effort put in the game) between teams of friends ($M = 6.18$, $SD = .86$) and teams of strangers ($M = 5.96$, $SD = 1.04$) in the cooperative goal structure context, $t(68) = .98$, $p = .33$. Therefore, H1 was not supported. Similarly, the t test indicated that there was no difference for motivation (effort put in the game) between teams of friends ($M = 5.70$, $SD = 1.15$) and teams of strangers ($M = 5.44$, $SD = .98$) in the competitive goal structure context, $t(71) = 1.00$, $p = .32$, answering RQ5b.

4.3. Goal commitment

A significant main effect of goal structure was found with regard to goal commitment, $F(1,137) = 13.53$, $p < .001$, $\eta^2 = .09$. Specifically, participants who played the game cooperatively ($M = 5.73$, $SD = 1.15$) were more committed to the goal than participants who played the game competitively ($M = 4.91$, $SD = 1.41$). No significant main effect of relationship type was found, $F(1,137) = .08$, $p = .78$. Significant interaction effect was also found, $F(1,137) = 4.77$, $p < .05$, $\eta^2 = .03$. Since the interaction effect was found, simple effects analysis was conducted to see whether the interaction effect qualified the main effect. The simple effects analysis revealed that the effect of goal structure was only significant when playing with friends, answering RQ3. The t test results revealed that playing with a friend ($M = 5.98$, $SD = 1.02$) resulted in greater goal commitment compared to playing with a stranger ($M = 5.44$, $SD = 1.23$) in the cooperative goal structure context, $t(68) = 2.01$, $p = .048$. Therefore, H2 was supported. However, the t test revealed that playing with a friend ($M = 4.71$, $SD = 1.52$) did not differ from playing with a stranger ($M = 5.13$, $SD = 1.27$) for goal commitment in the competitive goal structure context, $t(71) = 1.26$, $p = .21$, answering RQ5c. The t test results were consistent with the simple effects analysis results.

4.4. Moderated mediation analysis

Since no main effect of multiplayer mode was found for performance, there was no moderated mediation relationship between the variables goal structure (independent variable), relationship type (moderator), goal commitment (mediator), and performance (dependent variable), answering RQ6. Moderated mediation analysis was conducted to answer RQ7, following the procedure introduced by Muller, Judd, and Yzerbyt (2005). Three models need to be tested, where Y is the dependent variable, X is the independent variable, Mo is the moderator, and Me is the mediator.

$$Y = \beta_{10} + \beta_{11}X + \beta_{12}Mo + \beta_{13}XMo + e_1 \text{ (Model 1)}$$

$$Me = \beta_{20} + \beta_{21}X + \beta_{22}Mo + \beta_{23}XMo + e_2 \text{ (Model 2)}$$

$$Y = \beta_{30} + \beta_{31}X + \beta_{32}Mo + \beta_{33}XMo + \beta_{34}Me + \beta_{35}MeMo + e_3 \text{ (Model 3)}$$

To establish moderated mediation, in Model 1, b_{11} needs to be significantly different from 0, while b_{13} should not. In Models 2 and 3, either (or both) of two patterns should exist: both b_{23} and b_{34} are significant, or both b_{21} and b_{35} are significant. The multiple regression results met the above requirement and demonstrated that there was a moderated mediation among the variables goal structure (independent variable), relationship type (moderator), goal commitment (mediator), and motivation (dependent variable), answering RQ7. Table 1 summarizes the multiple regression analyses to test the moderated mediation.

5. Discussion

The current study examined the effects of goal structure (competition vs. collaboration) and relationship type between players (with a pre-existing positive relationship [friends] vs. with no pre-existing relationship [stranger]) on performance, motivation, and goal commitment in a motor activity-centered computer game. No main effect of relationship type was found with regard to any of the dependent variables. However, the cooperative goal structure was found to lead to higher motivation than the competitive goal structure. In addition, playing with friends rather than strangers enhanced players' commitment to their game goals only in the cooperative condition. A moderated mediation relationship was also found among the variables goal structure (independent variable), relationship type (moderator), goal commitment (mediator), and motivation (dependent variable). These findings provide a number of contributions to the current research on goal structure and motivation and have practical implications for the design of exergames. We will discuss them one by one in the following section.

First, this study adds evidence to the effects of competition and cooperation on motor performance. In the context of playing a digital game that is task-independent, motor activity-centered, and skill-irrelevant, our finding with regard to performance is consistent with previous studies involving non-mediated motor performance activities: cooperation and appropriate competition result in similar motor performance (Stanne et al., 1999; Tauer & Harackiewicz, 2004). However, our finding also indicated that cooperation resulted in greater motivation and effort in comparison to competition. We speculate that the motive of competition (Franken & Brown, 1995) might be a potential moderating variable. Whether people compete to improve their performance or to win may impact their motivation and effort.

What is unique about the motor task we implemented in this study is that it requires the players' determination to exert effort in order to perform well. This is very similar to the so-called exergames or active video games. This type of game is different from other genres of games, such as strategy games that require more cognitive effort and pre-existing skills or knowledge. We consider that the implications of our findings are most relevant to motor activity-centered games, such as exergames, which have the potential to be used as physical activity promotion tools (Peng, Lin, & Crouse, 2011). Our findings suggest that if the designers and researchers intend to motivate and engage players in the exergames for physical activity, it is important to include a co-op mode. Additionally, although it was not a central research question, our data demonstrate that all participants improved significantly from their trials (single player mode) to the multiplayer modes (competition or cooperation), suggesting that exergame design should also include multiplayer modes. However, this needs to be interpreted cautiously for the following reasons. First, the players were instructed to try their best in the trials, yet were given the chance to win an extrinsic reward in the actual game, which would also be a factor to increase motivation and effort. Second, the single player mode was always before the multiplayer mode. Training effect could possibly explain the difference.

Another unique feature of the task we implemented was that we were able to apply a handicapped score to better match individuals. As previous literature suggests, there are two types of competition: appropriate and inappropriate (Stanne et al., 1999). Appropriate competition meets four conditions: (1) there is not a heavy emphasis on winning; (2) opponents are equally matched, creating a challenging competition, and providing each person with a realistic chance of winning; (3) the rules of the competition are clear and straightforward, making for a fair competition; and

Table 1
Summary of multiple regression analyses for the moderated mediation analysis.

Predictors	Model 1		Model 2		Model 3	
	b	*t*	*b*	*t*	*b*	*t*
X: Goal structure	.52 (b_{11})	2.11*	.32 (b_{21})	1.02	.36 (b_{31})	1.85
Mo: Relationship type	.25 (b_{12})	1.07	−.42 (b_{21})	−1.39	.51 (b_{32})	.93
XMo: Goal structure × relationship type	.03 (b_{13})	.09	.96 (b_{23})	2.24**	−.51 (b_{33})	−1.80
Me: Goal commitment					.50 (b_{34})	6.54***
MeMo: Goal commitment × relationship type					−.01 (b_{35})	.92

*** $p < .001$.
** $p < .05$.
* $p < .05$.

(4) participants are able to gauge their progress relative to their opponent. We consider the competition we implemented in our study as appropriate competition.

The provision of an extrinsic reward calls for more discussion about intrinsic motivation and extrinsic motivation. Motivation can be thought of as a continuum, with values and rewards depicted by intrinsic (internal) elements at one end, and by extrinsic (external) factors at the other (Ryan & Deci, 2000). Intrinsic motivation is something that motivates a person internally, without external reward or consequences. Simply put, it is doing something for the sake of doing it. It is the "inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities to explore and to learn" (Ryan & Deci, 2000, p. 70). Extrinsic motivation is influenced by external factors, such as peers, society, or family (Ryan & Deci, 2000). Jogging for the sake of enjoying the act of jogging is intrinsically motivated. Jogging to lose weight or lifting weights to look more attractive physically is extrinsically motivated. The current study involves the chance to win a monetary prize (the chance is about 1 in 150) and leans more toward extrinsic motivation. Therefore, generalizing the results to intrinsically motivated activities (e.g., playing games purely for fun) may be limited. Future study should explore whether and how the reward structure (intrinsic vs. extrinsic) influences the effects of the goal structure.

Another contribution of this study is the inclusion of an important moderating variable—relationship type—in the study of competition vs. cooperation in motor activities. To the best of our knowledge, this variable has never been studied in such a context in the past. Although we did not find any main effects of relationship type on the dependent variables, relationship type was found to be a significant moderator. Not surprisingly, cooperating with a friend elicited greater goal commitment than cooperating with a stranger. However, competing with a friend did not differ from competing with a stranger in terms of goal commitment. This implies that if an exergame is implemented to increase physical activity, it is best to include a co-op mode and match participants with whom they have a pre-existing relationship, to expect that they would commit to the exercise goal.

While our study was conducted in a game playing context, our results may also be generalized to many other contexts that involve using competition and cooperation to motivate and engage users. In fact, gamification (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011; Müller, Peer, Agamanolis, & Sheridan, 2011)—the use of game design techniques and mechanics to engage audiences or to solve problems in non-gaming interactive systems—is increasingly drawing attention from researchers. The goal structures of competition and cooperation are common game mechanics that can be widely implemented in a non-gaming context. For instance, to motivate people to engage in physical activity, individuals can be given the goal to compete with others in terms of running a certain number of miles, or to cooperate with others to run a set number of miles combined. Based on the findings from this study, we probably should expect that pairing people with friends to run a set number of combined miles will be the most effective strategy.

There are some limitations in this work that offer great opportunities for future exploration. One is that participants in our study played the game in a single lab session. It is unclear how our findings would hold up over repeated game plays. It would be interesting and necessary to study how the effects of relationship type and competition–cooperation goal structures on game experience would remain the same or differ in a repeated game playing context. In addition, we focused on a motor activity-centered game in our study. The findings may not be generalizable to other types of games. Further research is needed to explore how goal structure and player relationship impact performance and motivation in other types of games, such as strategy games that require more cognitive effort. Third, the game used in the current study is quite simple and involves only one game mechanic in order to control for confounding variables. The findings may not be generalizable to games with many complex mechanics. It will be interesting to examine how these complex mechanics interact with each other to influence performance and motivation. Finally, while our participants were not engaged in conversation with each other, in real-life game play, communication between players may interact with social relationships to further effect the players' game experience. Future research is needed to investigate whether and how conversation between players influences the outcomes.

In conclusion, this study provides evidence that different multiplayer goal structures can have different impacts on players' motivation and engagement. In addition, the relationship between the players also matters. In general, the cooperative game mode enhanced game play, compared to the competitive game mode, in terms of motivation. Playing with friends induced greater goal commitment than playing with strangers in the cooperative game mode. The current study adds evidence to the literature on goal structures of competition and cooperation and motivation, as well important design guidelines for motor performance-centered digital games such as exergames.

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