COMMUNICATION EFFECTS ON EXERCISE DURATION OF WEAKER GROUP MEMBERS WITH VIRTUALLY-PRESENT PARTNERS

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ABSTRACT

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The purpose of this study was to examine the effects of encouragement on exercise duration within the conceptual framework of the Köhler motivation gain effect, which boosts task motivation for weaker group members in conjunctive tasks. Recent research on exercise with virtually-present partners found that encouragement attenuated the Köhler effect (Irwin, Feltz, & Kerr, 2013). The current study compared exclusive encouragement (e.g., "you can do it") and inclusive encouragement (e.g., "we can do it") as potential moderators of the Köhler motivation gain effect. Female and male college students (n = 240) were assigned to one of five conditions (individual-control, individual-with-encouragement, partner-no-encouragement, partner-inclusive-encouragement, partner-exclusive-encouragement) and each performed two blocks of isometric abdominal plank exercises. A significant motivation gain was observed in all partnered conditions compared to the control, $t(235) = 8.37$, $p < .001$. Encouragement from a virtually present partner, regardless of inclusivity, did not moderate performance outcomes attributed to the Köhler effect. Encouragement in the absence of a partner altogether also boosted exercise motivation over the control group, but to a lesser degree than the Köhler effect, $t(235) = 3.23$, $p = .001$. These findings suggest that encouragement from a superior partner does not moderate the Köhler effect in exergames. In games without a partner, an encouraging voice may be better than playing in silence.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

The American population is becoming increasingly sedentary and decreasingly healthy (Barnett, Cerin, & Baranowski, 2011; Daley, 2009). Less than 5% of U.S. adults adhere to the recommended guidelines for daily activity, and half of all persons who begin an exercise program drop out within 6 months (Dishman & Buckworth, 1996; Trojano et al., 2008). These changes have been accompanied by an increase in average time spent in front of a television screen (Daley, 2009). In response to declines in health in the U.S. population, an "active video gaming" trend ("exergames") is growing that involves kinetic, active involvement to get people on their feet and moving while allowing them to still enjoy an engaging gaming experience (Barnett et al., 2011; Lyons et al., 2011). The majority of the exergames on the market, however, have been reported to elicit light to moderate intensity energy-expenditure, which may not meet the American College of Sports Medicine recommendations for daily activity (Barnett et al., 2011; Biddiss & Irwin, 2010; Daley, 2009; Peng, Lin, & Crouse, 2011; White, Schofield, & Kilding, 2011). Fortunately, newly released games are becoming increasingly metabolically challenging (Daley, 2009; Lyons et al., 2011).

Though some of the newly released exergames may have the potential to be more physiologically challenging than earlier iterations, few are based on theoretical principles of group dynamics to boost motivation to continue to play the games. In order to optimize a game's effectiveness, minimize participant attrition from exergame programs, and encourage more wide-spread participation, future exercise video games should consider the integration of group dynamics principles of motivation into the games.

Research suggests that social support through partner and group exercise may facilitate exercise participation (Burke, 2006; Dishman & Buckworth, 1996), but for those without access to a fitness center or who suffer from social physique anxiety, group exercise may not be an option. Furthermore, interdependent group exercise situations where progress and outcomes are mutually determined (group performance outcomes are determined by the interdependent effort of both partners) have yet to be tested in the real world, despite research indicating that this may be a more effective method than traditional group programs (Feltz, Irwin, & Kerr, 2012; Feltz, Kerr, & Irwin, 2011; Irwin, Scorniaenchi, Kerr, Eisenmann, & Feltz, 2012). Thus, individuals for whom exercise gaming is the most appealing option, games that incorporate social dynamics that focus on social comparison, interdependence, and obligation may provide the most motivation.

A substantial body of research has been conducted over the last 15 years that has focused on the motivation gains of performing a physically taxing task collaboratively in a group (Hertel, Kerr, & Messé, 2000). Motivation gains in which weaker group members exert greater effort at a task than they would were they working individually, are referred to as the "Köhler Effect," named after a German industrial psychologist who first documented the phenomenon (Köhler, 1926; Köhler, 1927).

Motivation and performance gains for weaker group members occur with the greatest magnitude when moderate discrepancies of ability exist between partners, when the tasks are conjunctive, and with continuous feedback of both members' performances (Hertel et al., 2000; Kerr, Messé, Park, & Sambolec, 2005). Conjunctive tasks are those where the group's potential productivity is equal to the productivity of its least capable member (Hertel et al., 2000). That is, once the weaker member quits, the group can persist no longer.

Several recent studies (Feltz et al., 2011; Gockel et al., 2008; Hertel et al., 2000; Kerr et al., 2008; Irwin et al., 2013; Kerr et al., 2000; Kerr & Bruun, 2003; Kerr et al., 2007; Kerr et al., 2012; Kerr et al., 2013; Lount et al., 2000) have tested the Köhler effect (and a meta-analysis (Weber & Hertel, 2007) has documented its robustness (e.g., mean effect size d = .82). Additionally, a new program of research has demonstrated the utility of harnessing the Köhler effect to increase motivation in exergames and how the effect is moderated by task and features of a virtually presented partner (Feltz et al., 2011). This research has shown that exercising with a moderately superior partner led to a 24% improvement in effort in a series of abdominal plank exercises compared to exercising alone (Feltz et al., 2011). Further studies showed that the Köhler effect was most potent when one's partner was moderately more capable in ability compared with slightly or extremely more capable partners (Feltz et al., 2012); that the Köhler effect was unmoderated by a partner's dissimilarity in age (i.e., older than the participant) and/or weight (i.e., heavier than the participant) (Forlenza, Kerr, Irwin, & Feltz, 2012); and that there were no additional motivation gains from exercising with a moderately more capable partner who provides encouragement (Irwin, Feltz, & Kerr 2013).

Feltz and her colleagues used an exergame designed for the PlayStation 2 (PS2) gaming module for all of their studies. The software was EyeToy:Kinetic, a camera-based game that offers a variety of fitness activities. The EyeToy abdominal plank exercises within the strength module were used, which minimized the importance of motor skill and emphasized the effort of the task performance, since participants were instructed to hold each plank for as long as possible. The EyeToy displays images of the player on the TV monitor, and the player's movements serve as the interface to the games. Feltz and her colleagues adapted the game to

include a remote partner (confederate) who was presented virtually (e.g. visible over a 2-way video hookup) in the partnered conditions.

Most of the studies on the Köhler effect have restricted communication between teammates in order to control for extraneous effects. However, most exercising teammates do communicate with each other during the activity. In real group settings, words of encouragement are often exchanged between active partners (most typically from the more capable to the less capable, such as "keep going," "you can do it," "we can do it," or "try harder."), but the effect of such verbal encouragement is difficult to ascertain without controlling for content of the messages. Thus, in the study by Irwin et al. (2013), researchers investigated the effect of verbal encouragement by the virtually-presented partner on the weaker group member. The researchers theorized that verbal encouragement could have positive or negative effects on motivation depending on how the words are interpreted by the receiver. That is, the receiver of the encouragement (the weaker member) could perceive the encouragement (a) as supporting the receiver to do well, (b) as indicating the importance of the task to the encourager, or (c) as patronizing the weaker member, which would have a negative effect. Irwin et al. employed a 3 (conditions: individual, partner-without-encouragement, and partner-with-encouragement) x 2 (performance block) factorial design with college-age participants. Participants performed a series of five abdominal planking exercises which they were instructed to sustain for as long as they could, first alone in Block 1, and then, for the partnered conditions, with a same-sex virtually-presented partner in Block 2. As with other studies by Feltz and her colleagues, the participants in the partnered conditions exercised conjunctively with a virtual partner who was presented as moderately superior. In the verbal encouragement condition, a pre-recorded series of phrases of encouragement was played as coming from the virtually-presented partner every

15s (+/-3 s) with phrases such as “you can do it,” “you got this,” “keep it going,” “you’re doing good,” “stay strong here,” and “give it your best.”

Results supported the performance enhancing Köhler effect, but contrary to the researchers’ hypothesis, verbal encouragement mitigated effort gains (Irwin et al., 2013), contradicting both reasonable expectations and research on verbal encouragement in individual exercise tasks (Campenella et al., 2000; Guyatt et al., 1984; McNair et al., 1996; Moffat et al., 1994). The researchers surmised that the decrease in effort in the verbal encouragement condition may have been due to the language used; the virtual partner used the pronoun “you” when communicating with the participant, which may have been perceived as patronizing by the participant. This perception could decrease the appeal of the virtual partner, a problem that has been demonstrated to reduce gains from the Köhler Effect (Kerr & Seok, 2011; Kerr, Seok, Poulsen, Harris, & Messé, 2008). Phrases like “you can do it!” may have even served as a reminder of the participants’ relative lack of ability, which could have a negative impact on effort by increasing the perceived gap of ability – e.g., “they are too good to keep up with, persistence is futile” (Feltz et al., 2012; Köhler, 1926; 1927; Messé, Hertel, Kerr, Lount, & Park, 2002).

Irwin et al. offered, alternatively, that the “you” focused encouragement phrases could be interpreted, not as teammate support, but rather as a method of self-encouragement by the partner. The authors offered that “interpreting the message as self-encouragement might suggest to the participants that the supposedly superior partner was in fact struggling with the task, thereby creating doubt in the degree of the partner’s superiority” (p. 22). Unfortunately, the authors did not explicitly measure participants’ interpretations of the partner’s statements.

An alternate, more inclusive pronoun such as "we" may not be as ambiguous to the participant as the exclusive "you" in a team performance context. Inclusive pronouns have been shown to increase self-efficacy beliefs – one of the most influential performance related psychological constructs (Feltz, 1988), collective efficacy, and other performance indicators when used in self-talk exercises of verbal persuasion (Son, Jackson, Grove, & Feltz, 2011). Furthermore, the inclusive pronoun "we" has been associated with a higher level of interdependence, relational stability and longevity in dyadic relationships than exclusive pronouns such as "I" and "you" (Sillars, Shellen, McIntosh, & Pomegranate, 1997; Simmons, Gordon & Chambless, 2005), and use of plural pronouns may even increase feelings of interpersonal closeness (Fitzsimons & Kay, 2004).

To test whether exclusive language was indeed the factor mitigating the Köhler effect in Irwin et al.'s (2013) study, a partial replication and extension study with modified language was conducted for the purpose of this thesis. The current study included another verbal encouragement condition that used the more inclusive "we" pronoun. The study also assessed participants' interpretation of their virtual partners' messages and their attitudes towards and perceptions of their partner.

In addition, Irwin et al. (2011) also suggested that the feedback indicating the virtual partner's superiority on Block 1 and the constant veridical feedback indicating that participants were being outperformed by their partner on Block 2 may have overridden or diluted any self-efficacy-boosting effect that positive encouragement may have had on the participant. In order to test the motivation and efficacy boosting effects of positive encouragement, without the confound of social comparison with a superior partner, we included a verbal encouragement condition without the virtual partner performance. This individual with encouragement

condition used the same "you" statements as the virtual partner exclusive language condition. There is literature that has shown positive performance effects from verbal persuasion (Brown, 2003; Gould, Hodge, Peterson, & Giannini, 1989; Vargas-Tonsing, Myers, & Feltz, 2004; Wise & Trunnell, 2001). According to Social Cognitive Theory, self-efficacy beliefs, and therefore motivation, are derived from several factors, one of which is verbal persuasion in the form of encouragement from trusted peers, authority figures, or oneself (Bandura, 1977).

Primary Hypotheses

This study tested the following hypotheses:

Hypothesis 1: Compared to working alone with no encouraging statements, participants will exercise longer when working together with a moderately superior virtual partner, regardless of encouragement, under conjunctive task demands.

Hypothesis 2: Compared to working together with a moderately superior virtual partner who provides no encouragement, participants will exercise longer when working with a partner who provides encouraging statements that use the inclusive "we" pronoun.

Hypothesis 3: Compared to working together with a moderately superior virtual partner who provides no encouragement, participants will exercise longer when working with a partner who provides encouraging statements that use the exclusive "you" pronoun.

Hypothesis 4: Compared to working alone with no encouragement, participants will exercise longer when working alone with a trainer providing encouraging "you" statements.

Secondary Research Questions

In addition, the following exploratory research questions were addressed:

Does task self-efficacy change in tandem with motivation gains?

Do ratings of perceived exertion (RPE) change in tandem with motivation gains?

Does intention to exercise change in tandem with motivation gains?

Definitions

Conjunctive Task: the group outcome is determined by the least capable member.

Exclusive Language: language that uses exclusive pronouns such as “I” and “you.”

Inclusive Language: language that uses the inclusive pronoun “we.”

Exergames: video games that require physical exertion in order to play

Köhler Effect: motivation gains from working with a partner.

Self-efficacy: one’s belief that one will succeed in specific situations.

CHAPTER 2

REVIEW OF RELEVANT LITERATURE

The purpose of this chapter is to review the literature relevant to physical inactivity and means of its reduction. The chapter begins by addressing the health problems associated with physical inactivity. Next, the chapter delves into factors influencing exercise participation and adherence. This is followed by an exploration of group motivation theories including the Köhler effect. Finally, the chapter concludes with a review of the Köhler effect in exergames, including team communication and the use of language cues.

The Problem of Physical Inactivity

Declines in physical activity, especially in developed countries such as the United States, have been documented repeatedly (Brownson, Boehmer, & Luke 2005; Dumith, Hallal, Reis & Kohl, 2011; U.S. Department of Health and Human Services, 1996). While the importance of this change may seem obvious, little change has occurred in actual activity levels (Brownson et al., 2005). In a culture that prizes technological conveniences, physical activity is less necessary and people become less active. However, in the case of physical inactivity, conveniences now may often result in severe health repercussions later.

Physical inactivity is known to lead to the accumulation of body fat: low caloric expenditure without concomitant low caloric intake results in a caloric surplus that the human body stores in adipose cells. Over time, the excessive storage can accumulate and hinder both bodily movement and function. As essentially non-functional (non-contractile, non-supportive) tissue, excessive body fat is potentially burdensome on the bodily organs and supporting structures (Montani et al. 2004; Navina, 2011). Many comorbidities of obesity, including stroke, cardiovascular disease, some types of cancer, and diabetes type II, fall high on the list of leading

killers in America (Wen & Wu, 2012). While physical inactivity may be a clear logical precursor of obesity and many of these illnesses, some research has determined that physical inactivity alone, regardless of any other habits and a variety of physical traits including fatness, may be enough to increase risk of mortality (Bellocco et al., 2010; Esteghamati et al., 2012; Haapanen-Niemi et al., 2000; Patrick et al., 2005; Wei et al., 1999).

Of course, the problem extends beyond the scope of the individual. Nearly 5 million deaths in the world each year have been attributed to physical inactivity- roughly the same as that of tobacco cigarettes (Wen & Wu, 2012). If physical inactivity were decreased by as little as 25%, an estimated 1.3 million premature deaths per year could be averted and the average life expectancy would increase by nearly a year (Lee et al., 2012). It is estimated that in the United States alone, the economic burden of physical inactivity exceeds $23.7 billion per year and the amount continues to grow (Kohl et al., 2012; Wang, Pratt, Macera, Zheng & Heath, 2004). While this information may persuade an individual to begin an exercise program, the current guidelines for minimum daily physical activity remain daunting for many. Thankfully, mortality has been shown to decrease by 14% with just 15 minutes of physical activity per day – and 4% decreases with each additional 15 minutes beyond that (Wen et al., 2011). Of course, even with an attainable minimum, a key obstacle remains: can the public be convinced to actually *try* to exercise? While there are myriad factors influencing exercise participation, some of the most powerful are psychosocial in nature.

Psychosocial Factors Influencing Exercise Participation

The most prevalent psychosocial factors that can potentially influence exercise participation include perceived self-efficacy, perceived social support, and behavioral intentions.

These factors are based primarily on social-cognitive theories and principles of group dynamics. Each set of factors is elaborated in the paragraphs that follow.

Self-efficacy. Bandura (1977) defined self-efficacy as people's beliefs that they have the ability to perform a specific task. In terms of motivation, Bandura hypothesized that one's self-efficacy beliefs ultimately determined whether or not one would engage in a behavior and persist in the face of adversity (1978). Self-efficacy was determined to be derived from four sources: personal mastery experiences, vicarious experiences through observing others, verbal persuasion from trusted others, and physiological arousal level. Mastery experiences were proposed to serve as direct evidence of one's ability - that is, if one had performed the task before, the individual was likely to believe he or she could perform the task again. Vicarious experiences were theorized to operate similarly to mastery experiences – albeit to a lesser degree. By observing another person complete the task, it became easier to envision oneself performing the task. Verbal persuasion, or the encouragement from a trusted source or authority figure, was hypothesized to boost self-efficacy. Again, the effect of this route was expected to be weaker than mastery experiences and was believed to be contingent on the credibility of the persuader. Finally, Bandura predicted a relationship between self-efficacy and physiological arousal. An individual's interpretation of his or her own physiological changes (i.e., quickened heartbeat, palmar sweating, fatigue, etc.) as signs of fear or inadequacy could decrease self-efficacy; whereas, perceptions of ability could increase self-efficacy beliefs.

The concept of self-efficacy has been applied within the context of sport and exercise (e.g., Feltz, 1982; McAuley, 1985; Weinberg, Gould, & Jackson, 1979). Feltz tested Bandura's model of self-efficacy and an anxiety-based model of avoidance behavior on a high-avoidance

back-diving task and found that self-efficacy was a significant predictor of approach behavior to the task.

Self-efficacy also has been shown to predict effort on muscular endurance tasks (Weinberg et al., 1979; Weinberg, Gould, Yukelson, & Jackson, 1981; Weinberg. Yukelson, & Jackson, 1980). In a rigged competitive leg-endurance task, participants in Weinberg et al.'s (1979) study were randomly assigned to either a high or low self-efficacy condition, where participant self-efficacy was manipulated by identifying the confederate competitor as either a varsity track athlete who performed well on a related task (low self-efficacy condition) or an individual with a knee injury who had performed poorly on a related task (high self-efficacy). Despite both losing to the confederate, individuals in the high self-efficacy condition persisted significantly longer in trials when compared to individuals in the low self-efficacy condition who had experienced failure, lending support to Bandura's proposed relationship between self-efficacy and performance.

In terms of exercise behavior, McAuley, Lox, and Duncan (1993) found self-efficacy to strongly predict exercise adherence in older adults. The study was performed on middle-aged, sedentary adults who, 9 months prior, had participated in a 5 month structured exercise program. Self-efficacy measurements pertaining to physical activity (3 specific exercises) and adherence were collected at four points: before and after graded exercise tests first at the end of the 5-month program and then at the 9-month follow-up. Though self-efficacy beliefs at the end of the 5-month intervention predicted exercise adherence in the following 9 months, those beliefs tended to decline over time, as evidenced by significantly lower self-efficacy measures at the follow-up post-test. Interestingly, participation in the exercise test at the 9-month follow-up boosted self-efficacy to levels comparable to those reported at the end of the 5-month intervention. These

findings suggest that the relationship between self-efficacy and exercise behavior is reciprocal and dynamic, in that while self-efficacy predicts exercise behavior over time, acute behavior (e.g., mastery experiences providing updated performance information) can also modify self-efficacy.

Thus, self-efficacy has been shown to be an effective motivating factor in sport and exercise contexts as it relates to the initiation of a task, the persistence of effort at muscular-endurance tasks, and the adherence of exercise behavior over time.

Extensions of self-efficacy. Integrations of self-efficacy with other related theories as a determinant of performance have been noted (Bandura, 1982). Cognitive Evaluation Theory posits that positive changes in an individual's perception of competence (a similar concept to self-efficacy) along with attributions of performances to internal causes and a sense of relatedness to others will facilitate intrinsic motivation, which may in turn enhance the enjoyment derived from the activity (Deci & Ryan, 1985; Ryan & Deci, 2000). Thus, this thesis also examined enjoyment of the exercise activity.

Initiating the activity, however, required a difference explanation. The Theory of Reasoned Action, developed by Fishbein and Azjen (1975), stated that behavior was determined by behavioral intentions, which were in turn determined by attitudes about the behavior and subjective norms about the behavior (Ajzen & Fishbein, 1977; 1980; Fishbein & Ajzen, 1975). Intention has been identified, along with past behavior, as a powerful predictor of future behavior (Oulette & Wood, 1998). However, behavioral *intention* means little without belief in behavioral *ability*. Self-efficacy was added to the Theory of Reasoned Action as an agency-enabling mechanism to create the Theory of Planned Behavior (Ajzen 1991), where engagement in behavior was predicted to be highly contingent on perceived behavioral control, which may take

the form of self-efficacy beliefs. Research on intentions specific to exercise behavior has provided additional support for the Theory of Planned Behavior (Hagger, Chatzirsarantis & Biddle, 2002). A study by Downs, Graham, Yang, Bargainnier & Vasil (2006) investigated exercise intention and behavior in a longitudinal study on adolescents. Data were collected on past exercise behavior, attitudes, subjective norms, perceived behavioral control and intention pertaining to exercise behaviors. Intention was best predicted by perceived behavioral control and most predictive of past exercise behavior. In a study by Dzewaltowski, Noble and Shaw (1990), exercise intention in college age individuals was best predicted by perceived behavioral control and attitudes and strongly predictive of actual exercise behavior. The degree to which intention predicted behavior was only exceeded by self-efficacy perceptions. Even so, the importance of behavioral intention and its precursors – especially subjective social components - ought not to be discounted.

Social influence. Within the Theory of Planned Behavior model, subjective norms, or individuals' perceived attitude of their cohort regarding a behavior, is believed to be a predictor of behavioral intention. That is, if one perceives that others maintain positive attitudes and expectations of behavioral action, one is more likely to form intentions to engage in that behavior. Little support has been found for this relationship (Courneya, Nigg & Estabrook, 2000; Godin & Kok, 1996), however, and consequently researchers have argued that perceived social support, which can be viewed as a form of verbal persuasion within self-efficacy theory, may play a more significant role (Courneya & McAuley 1995a; 1995b; Courneya et al., 2000). In a study by Rhodes, Jones and Courneya (2002), 192 undergraduate psychology students completed surveys in large groups pertaining to the theory planned behavior, social support in exercise, and exercise habits. A 2 week follow up indicated that while subjective norms

contributed to exercise participation, social support was found to be independently predictive of both intention to exercise and perceived behavioral control. These findings suggest that social support may play a significant role in behavioral outcomes through two processes: reinforcing both intention and perceived self-efficacy. Indeed, humans are highly social creatures; existing and thriving within groups. The effect of social context on motivation changes in groups has been duly documented in a number of studies, examined below, on effort, motivation, and productivity in working groups.

Group Motivation Theories

Motivation in groups has been studied from a number of perspectives. Much of the literature has focused on motivation losses, or social loafing (Everett, Smith, & Williams, 1992; Karau & Williams, 1993; Williams & Karau, 1991; Williams, Nida, Baca, & Latané, 1989). However, recent research has focused on motivation gains in which performance increases within a group setting compared to individual performance (e.g., Weber & Hertel, 2007). Researchers have identified possible causes for both concepts.

Motivation losses. In 1913, Max Ringelmann observed an inverse relationship between group size and group productivity in a rope-pulling task: individuals exerted less force on the rope when working as a team than when pulling alone. He proposed two explanations: coordination losses, where the group was simply less efficient at the task than individuals, and motivation losses – also known as "social loafing"- where the individuals relied on their coworkers to exert the necessary effort to achieve the task and consequently exerted less effort themselves (cited in Kravitz & Martin, 1986).

According to Steiner's (1972) taxonomy of group tasks, coordination losses in a unitary (unable to be divided into subtasks), additive (task outcome is the sum of individual inputs), and

maximizing (outcome is dependent on quantity rather than quality) tasks, such as that used in the Ringelmann experiment – where potential productivity is equal to the summation of individual efforts - are an unlikely explanation for performance decrements. In a 1974 replication of Ringelmann's study, Ingham and colleagues were able to isolate coordination with the use of "pseudo-groups," where individuals in the group condition were blindfolded and performed the task with confederate teammates who refrained from actually pulling the rope. Individuals in the group condition expended less effort than when working alone. The false knowledge of a supportive team was enough to reduce the output of an individual rope-puller (Ingham, Levinger, Graves & Peckham, 1974). Consequently, motivation losses appear to be a more plausible explanation for performance decrements than coordination losses.

In a similar study, albeit with clapping and shouting instead of rope-pulling, Latané, Williams and Harkins (1979) found further evidence of social loafing. In their first experiment, the researchers instructed participants to shout as and clap as loudly as they could, both alone and as a member of a group. The groups produced markedly lower decibel levels than would be expected: the noise intensity increased from the individual condition, but not in proportion to the addition of group members. To determine whether the performance losses were due to a decrease in efficiency or a decrease in effort, the subjects were blindfolded and instructed to wear sound-dampening earmuffs. As with the first experiment, subjects failed to produce decibel level increases that would be expected with the addition of new noise sources. The researchers attributed these performance decrements to social loafing and proposed several possible explanations but ultimately explained social loafing with the Social Impact Theory. This theory essentially states that the impact of a social force is positively related to the ratio of sources (influential agents) to targets (receiving agents). That is, social impact *increases* when

the target number is fixed but source number is increased; whereas social impact *decreases* when the source number is fixed and the target size increases, such as with group membership (Latané 1981). Thus, in a performance situation where individual outputs are not identifiable, the resultant decrease in effort and output is logical (Latané et al., 1979). In addition to lack of identifiability as a possible cause for decreases in performance in a group environment, Baron and Kerr (2003) also suggested that group members may recognize that in some instances they may be able to free-ride on other group members' efforts, or may reduce their efforts rather than contribute to what they perceive to be more than their fair share of the collective effort.

A meta-analysis of 78 studies demonstrated social loafing to be a robust effect across several task domains and effort modalities (Karau & Williams, 1993). Several key elements were shown to consistently affect motivation in group contexts, namely: evaluation, task meaningfulness, group member familiarity, expectations of co-worker ability, and dispensability. The researchers determined that social loafing is reduced when individual performances within the group are readily identifiable to all involved, there is a moderate to high degree of personal involvement, when there are group-level comparison standards available, when individuals know or value their co-workers, when individuals do not expect their group to perform exceedingly well, and when individual contributions are seen as crucial to group outcome (Karau & Williams 1993). By increasing identifiability of group member performance, one's ability to hide in the crowd (Davis, 1969) is reduced, thereby reducing the likelihood of sub-par performances. Identifiability is also important to promote recognition for honest efforts to avoid feeling lost in the crowd (Latané et al., 1979), so group member contributions are seen as valuable and not doomed to be unrecognized and unrewarded. When contributions are not identifiable, uniqueness of an individual's contribution (i.e., one's indispensability) countervails performance

losses (Harkins & Petty, 1982). Unfortunately, in many collective tasks, individual performance data are not always readily identifiable or even easy to determine. Situations with highly cohesive groups are also less likely to witness "free-riding" effects, where individuals socially loaf because they know they can profit from the work of others without working themselves (Baron & Kerr 2003).

Thus, while the nature of some collective tasks may undermine motivation, when there are social pressures (e.g., when individuals may be held accountable for their output and group comparison information is available, when relationships produce a sense of obligation to the team, and when there are feelings of indispensability) and internal drives to perform (e.g., when involvement is high), motivation decrements may be avoided.

Motivation gains. While motivation losses in groups have been explored extensively, not all groups are consigned to diminishing performance returns. In the past 50 years, the field of group motivational processes has seen an accumulation of empirical research on the possibility of performance gains in group contexts. While competition is an important factor in some performance situations, cooperative groups such as those in industry (i.e., sales teams, factory lines, military units) and athletics (i.e., sports teams) are more prevalent. Of the social effects within these contexts, which produce motivation gains rather than decrements, the two most frequently cited are the social compensation effect and the Köhler effect.

Social compensation is the tendency for people to exceed individual performance expectations on a collective task to compensate for a weaker member (Williams & Karau, 1991). In a three-study series, Williams and Karau investigated the extent to which expectations of co-worker performance and personal involvement moderated motivation changes in group tasks. In the first experiment, individual tendency to trust others predicted their reliance on co-workers as

evidenced by loafing behavior on collective tasks (tasks requiring unique contributions from each member) but not on coactive ones (tasks completed in the presence of another). In the second two experiments, high co-worker ability or intended effort mitigated compensatory behavior from participants in collective tasks but not coactive ones. Perhaps most importantly, loafing prevailed over compensation regardless of co-worker output if the task was not valued by the participant. Thus, individuals who saw co-workers as unreliable, unwilling, or unable to fulfill their duty in a collective task were likely to work harder to ensure the end goal was met – but only when they were genuinely involved in the task or the *outcome held personal relevance* (Williams & Karau, 1991). The authors inferred from these findings that social compensation occurs as a result of concerns regarding one's own evaluation. That is, when an individual's reputation is on the line - as it is in a collective task with high meaningfulness where the outcome is directly reflective of the performers (e.g., highly competitive sports teams) – more capable and willing individuals will contribute in excess of their part to ensure that the group goal is met.

The Köhler effect. In contrast to social compensation, where stronger individuals pick up the slack of weaker group members, there are instances where weaker group members will exceed performance expectations under collective task demands. In the late 1920s, German industrial psychologist Otto Köhler first observed this phenomenon while studying male members of a Berlin rowing club. Köhler (1926) devised an experiment in which participants curled a weight for maximal repetitions individually, paced by a metronome, and then performed the same task again albeit yoked to a partner with twice the weight. While persistence was the objective in both individual and group tasks, the rules for each slightly differed. The dyadic task called for cessation of the activity once one member quit, thereby limiting the group's potential productivity to the productivity of the group's weakest member. Surprisingly, calculations of the

group potential, based on observed individual performances from preliminary trials, underestimated actual group performance. Actual group performance exceeded not only the performance of the weakest member but also the average of the two members - an effect which was replicated in a follow-up study with winch-winding (Köhler, 1927), but was moderated by the discrepancy in ability between partners (Stroebe, Diehl, & Abakoumkin, 1996; Witte, 1989). Köhler's task elicited the highest group productivity levels when the ratio of partner ability fell within the range of 3:5 to 4:5, with optimal performances occurring at a ratio of 3:4.

Upward social comparison. Subsequent experiments obtained similar results, confirming that moderate ability discrepancy is a prerequisite for the effect because it encourages upward social comparison – one of the two key psychological mechanisms underlying the Köhler motivation gain (Plante & Madden, 2010; cf. Seta, 1982; Stroebe, Diehl, & Abakoumkin, 1996.). Motivation gains derived from upward social comparison may be due to an elevation of the weaker member's personal performance goal as a result of a new performance standard or, perhaps, increased goal saliency through competition, with the objective being to outperform one's partner (Kerr et al. 2005). Regardless of whether group members view their partner as "raising the bar" or as a "rabbit to chase," performance comparisons between weaker group members and their stronger counterparts generally serve to boost motivation in weaker group members.

Availability of partner-related information. Partner ability discrepancy is not the only factor determining whether or not upward social comparison will occur, however. The availability of partner-related information – namely, ability and contribution – may moderate the Köhler effect. Partner ability needs to be known prior to working to elicit a discrepancy effect (Messé et al., 2002), and consistent performance updates facilitate social comparison by

continually reminding weaker members of their relative status in the task. An increase in the number of opportunities to compare (with consistent feedback) may cause greater motivation gains than in the conditions when either no feedback is provided or feedback is delayed until after trials (Hertel et al., 2008), but lack of feedback does not preclude the Köhler effect entirely– it merely attenuates it (Kerr et al., 2005). Part of this appears to be due to recency or frequency of partner performance updates. In Hertel and colleagues' study (2008), a 20 minute task was employed which found that if feedback was not promised until after the trial, motivation gains seen with continuous feedback failed to surface. Motivation gains remain intact, for the most part, when partner performance is fresh on the mind of the participants - even if delayed until after trials, as demonstrated in the results from a study by Kerr and colleagues (2005), which took only 2-3 min. per trial.

Identifiability. Though performance feedback undoubtedly serves as a vector for upward social comparison, it also serves to increase group member identifiability. That is, participants receive feedback about their partner's performances but are also aware that *their partner knows of their contributions to the team outcome*. The importance of identifiability of group member input was outlined earlier within the context of social loafing, and it applies to the Köhler effect as well. Unless highly involved with the task or performing an act of altruism, an individual has little reason to fully exert himself if he knows his own contribution (or lack thereof) will go unnoticed. While its ability to moderate upward social comparison is evident, availability of partner related information may also affect an individual's feelings of indispensability.

Social indispensability. In addition to upward social comparison, the Köhler effect is strongest when a task is constructed in such a fashion that it incurs feelings of indispensability within an individual in regard to her contribution to the group task outcome (Kerr & Bruun,

1983). According to Instrumentality x Value models of motivation (Karau, Williams, Bourgeois, Carlston & Eagly, 1993; Shepperd, 1993), individual motivation in a collective task is contingent upon the degree to which that individual values a positive outcome on the task and the importance of her contribution to the task to achieve that outcome. Thus, collective tasks where positive outcomes necessitate an earnest individual contribution will likely increase individual motivation. The conditions under which Köhler first observed his effect fulfilled this criterion: the nature of Köhler's weight lifting task, a conjunctive task where the group outcome was determined by the weakest individual performance, conveyed a high sense of instrumentality in the weaker group member. One way to determine if the task design is indeed as crucial as hypothesized is to vary how indispensable the weaker group member's efforts are (Steiner, 1972).

Task structure. In an experiment to test this prediction, Hertel, Kerr, Scheffler et al. (2000) compared the individual persistence alone and in groups under a variety of task demands, ones in which there was high instrumentality (conjunctive), and low instrumentality (additive). Participants performed an endurance task where they were instructed to hold a weight in an extended arm over a tripwire alongside a partner doing the same thing. In the conjunctive condition, the team score was determined by the performance of the weaker member (i.e. when the weaker member tripped the wire, the other had to stop). In the additive condition, the stronger member was allowed to persist for as long as possible with the team score being determined by the sum of member performances. Individuals in the conjunctive condition showed a robust motivation gain (45.7s), while the individuals in the additive condition showed significant, albeit less robust, change. Because both tasks allowed for upward social comparison

(weaker members in both groups could see their more capable partner), the difference in performance was attributed entirely to indispensability of the weaker group member.

Support for the instrumentality hypothesis was found again in computer-supported groups shortly thereafter (Hertel, Deter & Konradt 2003). Participants were instructed to assemble computer hardware packages for customer requests in such a way as to maximize sales – first alone, and then, if in one of the two group conditions, as part of an internet-connected group for the second round. Participants in all three conditions were promised a reward for correct assemblages, but the two group conditions had different stipulations. One group condition was additive, where if one member assembled a correct package for a customer, a reward was earned for the team, and the other group condition was conjunctive, where both team members had to assemble the package correctly in order for the reward to be disbursed, thus limiting the team productivity to the output of the weaker member. After each trial, participants in all groups completed a survey of their feelings with respect to instrumentality, effort, and enjoyment. Consistent with findings in other domains, actual group productivity and perceptions of individual effort were greatest in the conjunctive task condition, lending further credibility to the instrumentality hypothesis and highlighting the importance of task structure (Gockel, Kerr, Seok & Harris, 2008; Kerr et al., 2007;). Group performance did not exceed the actual potential, but only the predicted potential based on individual performances. It is important to note, then, that the conjunctive task paradigm does not cause individuals to exceed their predicted capabilities, but instead to realize their actual potential.

There are several plausible explanations for why additive task structure, which seems to offer the most promising potential for increasing total group output, fails to realize motivation gains like those seen under conjunctive task constraints. One such explanation is that an additive

task structure allows for "free-riding." That is, opportunistic individuals who recognize that they can reap the benefits of their coworker's superior effort or that their own effort contributes little to the team output, will tend to reserve energy and "free-ride" off their teammates (Kerr & Bruun, 2003; Williams & Karau, 1991). In the case of work under additive task constraints, where the reward is a financial incentive contingent on a relatively simple task and the more capable member is motivated to continue for his or her own sake, there is also a possibility of social compensation – unless, however, the lower-output member is in fact capable. Should the more capable team member realize her efforts are being capitalized upon by an opportunistic but capable partner, reductions in effort are soon to follow in what is referred to as the "sucker effect," where a capable partner will exert less to avoid being taken advantage of (Baron & Kerr, 2003).

Evaluation concerns. Both upward social comparison and feelings of indispensability (operating through consequent feelings of obligation) are strongest when group members are physically present, a phenomenon which has been attributed to evaluation concerns (i.e., concerns stemming from the potential of negative evaluation of others) (Lount et al., 2008). Lount and colleagues investigated the degree to which mutual observation of coworkers performing collective tasks (either physically present or virtually present) moderated the Köhler effect. In a task very similar to the one used in Hertel, Kerr and Scheffler (2000) experiments examining the Köhler effect, participants suspended a weight over a tripwire either side by side with a partner or concurrently with a partner in another room, visible through a video feed. Consistent with predictions, the greatest motivations gains were seen when coworkers were physically present. Virtually present coworkers induced motivation gains greater than the control condition (an individual persistence task), but those gains paled in comparison to the

physically present coworker. These findings were consistent both with Collective Effort Model (Karau & Williams, 1993), which postulates that evaluation potential will predict motivation gains, as well as Social Impact Theory (Latané et al., 1979), which suggests that social forces will be experienced at their greatest power when proximity between force and target is reduced, and virtual presence increases proximity and dilutes those forces. Resultant decreases in performance and motivation are likely due, at least in part, to a decline in self-presentation concerns over pending evaluation from others (Carron, Burke & Prapavessis 2004).

Gender composition. One potential moderator of evaluation concerns and social comparison processes is the group's sex composition. The majority of research on the Köhler effect has been restricted to same-gender teams, but the interaction of normative gender roles and task demands could play a role in one's motivation to persist in a mixed-gender team task. In an effort to investigate the degree to which group gender composition could moderate the Köhler effect, Lount, Messé and Kerr (2000) performed a study on 95 college students who completed four (two per arm) endurance exercises where they suspended their arm with a wrist-weight over a tripwire. All participants performed the first two exercises alone, and then were split in to one of three conditions: individual control, where they performed the second block alone, conjunctive same-gender, where they performed the task conjunctively with a same-sex confederate, or conjunctive opposite-gender, where they performed the task conjunctively with an opposite-gender confederate. Males and females used different weights so that task difficulty was relatively similar for both genders. This controlled for participant instrumentality, thereby restricting performance differences to social comparison processes associated with any potential gender differences. Results aligned with hypotheses, where both males and females received motivation gains from working with a partner in a conjunctive task, males working with female

teammates exhibited even greater motivation gains than males with male teammates, and female performances with male teammates demonstrated a high degree of variation. The researchers surmised that these differences would be due to normative beliefs of gender-expectations and the decidedly "masculine" nature of the task as a strength endurance exercise. Thus, males would be most motivated when working with an opposite-gender partner in order to fulfill his normative role, lest he be outperformed by a female partner and labeled the "weaker" of the two. Females who received additional motivation from working with a male partner were hypothesized to do so because they may have wished to defy their gender stereotype, while females who did not were hypothesized to do so because they wished to adhere to normative expectations. Unfortunately, the key measure the researchers had intended to use to distinguish between individuals who subscribed to normative gender expectations and those who did not - the Bem Sex-Role Inventory, 1974 - measured self-evaluation of traits rather than broad beliefs on the "should" and "ought" characteristics of gender roles. As such, little other than performance differences were left to be analyzed, and a variety of explanations were given for them, including variation in the social comparison process and self-presentation concerns (Lount et al., 2000).

Group identity. Because the strength of the Köhler effect hinges on feelings of indispensability, consideration of the conditions under which indispensability arises (i.e., under conjunctive task demands) and under which it matters (i.e., when there is a personal investment in the outcome or a sense of obligation to one's partner) is important. One key factor affecting the latter is the degree to which an individual identifies with his or her group (Kerr et al., 2008). Group cohesiveness, or the strength of the bond teammates have and their familiarity with one another, was demonstrated to facilitate motivation in collective tasks (Karau & Williams, 1997), but much of the research on the Köhler effect involved ad hoc groups where the relationship and

identity was limited to the shared goal and interdependence arising from the task structure. An early study on ostracism (Geller, Goodstein, Silver & Sternberg, 1974) suggested that individuals were unlikely to work hard if their payoffs in any way benefitted an individual who excluded them. To test how social exclusion could moderate the Köhler effect, Kerr and colleagues (2008) divided participants into three conditions each assigned to perform a persistence arm-lifting task – one control, who worked alone, one conjunctive, and one coactive. Participants in group conditions either proceeded from the first to second block of exercise with no intervention, or they participated in an electronic task that facilitated feelings of either exclusion or inclusion. Results from the study supported their hypotheses: ostracism attenuated the Köhler effect in conjunctive conditions, where participant exertion could benefit their ostracizing partners, but made little difference in the coactive condition where individual performances were independent of one another. The researchers concluded that social exclusion undermines group identity and, accordingly, hinders the indispensability mechanism by decreasing feelings of obligation, but has no effect on social comparison processes (Kerr et al., 2008).

The Köhler effect in exergames. Though traditionally applied to generic "working teams," Köhler's seminal study was on athletes performing an exercise task. Taking note of this and the subsequent research on the Köhler effect with virtually present teammates, researchers Feltz et al. (2011) identified the potential for the Köhler effect as one way to increase the effectiveness of exergames. They designed a study where 181 undergraduates were divided into four work conditions (individual control, coactive, additive, and conjunctive) and each performed two rounds of an exergame – first alone, and then, if in one of the partnered conditions, with a virtually present partner – designed for the PlayStation 2 gaming console. The exercise blocks consisted of five variations of an abdominal planking task and the user interface

showed a live webcam feed of the participant side-by-side with a software-generated trainer, who modeled the exercises. In the partnered conditions, the second block of exercises appeared the same as the first on the participant's screen, but a projected image of what appeared to be another exerciser (the teammate, a pre-recorded confederate) was displayed alongside it. Contrary to previous findings on the Köhler effect, motivation gains among coactive, additive, and conjunctive conditions were powerful but indistinguishable from one another. The researchers attributed the atypical pattern of motivation gains to either the inherently competitive nature of an exergame or the demotivating potential of the extrinsic reward (i.e., money) offered to successful teams (Feltz et al., 2011).

Extrinsic incentives. To test whether extrinsic incentives played a role, the same research team (Kerr, Feltz & Irwin, 2012) performed a similarly designed study with two blocks of abdominal planking exercises, albeit with only two task designs (individual control and conjunctive) and the added variable of the presence or absence of an extrinsic reward. Data from the two extrinsic reward conditions were borrowed from the initial 2011 study and compared with new data collected with the same protocol (for both the individual and conjunctive conditions) where an extrinsic reward was not offered. When working alone, individuals offered a reward responded similarly to those who were not, but conjunctive teams who were offered no financial reward persisted 43% longer their rewarded peers. The researchers noted several plausible explanations: extrinsic incentives could have undermined the social comparison process if participants saw partner performances not as reflections of ability but as reflections of partner desire for the reward, or extrinsic incentives could have decreased the sense of obligation to a partner if participants saw their performance as essential not solely for social reward, as with the non-incentive conjunctive condition, but as essential for a financial reward, which may or

may not have been valued by the participant (Kerr et al., 2012). While these findings are important to further our understanding of the Köhler effect and incentives for performing exergames, it seems unlikely that rewards such as those seen in most video games (tokens meaningless in the real world) would have a negative impact on the Köhler effect as significant as the one demonstrated by Kerr and his coworkers. Still, the study serves to underline the importance of upward social comparison untainted by motive-questioning of a superior partner and a sense of indispensability that leads to obligational motivation and personal investment in the team outcome.

Perpetual inferiority. Of course, when designing an exergame, one must consider the long term viability – motivation gains, while robust and consistent, are meaningless in an exergame context if a player discontinues use after just a few sessions. The effectiveness of the Köhler effect rests on ability discrepancy (to create upward social comparison) and indispensability, but perpetual inferiority presents a potential problem for ongoing exercise participation. Previous studies on the Köhler effect in exergames had examined the effect on a one-time persistence abdominal planking task, but for long-term health changes, repeated aerobic exercise bouts offer greater potential. As alluded to in the Feltz et al. (2011) study, the researchers (Irwin et al., 2012) divided participants into three conditions - individual control or a partnered condition (coactive or conjunctive) where they cycled with a superior virtually present partner for 6 separate days. Not only was there strong support for the Köhler effect in the conjunctive condition in the first trial, but performance in the conjunctive condition actually increased over the six trials - a remarkable finding made more remarkable when compared to moderate performance declines in the coactive and individual conditions (Irwin et al., 2012). The irrelevance of perpetual partner superiority over time with an aerobic task was also

supported by a study that investigated perpetual vs. intermittent partner superiority across two isometric task domains (Kerr et al., 2013).

Partner characteristics. Lastly, when considering implementation of the Köhler effect into exergame design, one must examine the characteristics of the partner (in addition to gender characteristics), which may affect either of the two functional mechanisms. Two factors which may serve to convey ability and may be relevant to social comparison are age and weight. Forlenza et al. (2012), utilizing a task design similar to the original Feltz et al. (2011) study, had participants perform a series of abdominal planking tasks over two exercise blocks either alone or with a partner who was either similar or dissimilar in age (college age or 48 years old) and similar or dissimilar in weight (average weight or obese). Unexpectedly, the Köhler effect was unmoderated by age, and males worked even harder when paired with an obese partner, suggesting that, in the realm of exergames, if partner dissimilarity does not impinge upon the social comparison processes or remove feelings of indispensability, the Köhler effect will persist.

Team communication. Appearance, however, is only one facet of partner-player dynamic in the Köhler-Exergame research series. Though verbal communication between partners was limited in most of the Köhler research, there are a number of studies that have shown verbal encouragement to increase performance in exercise tasks when used independently (Campenella, Mattacola & Kimura, 2000; Guyatt et al., 1984; McNair, Depledge & Stanley, 1996; Moffat, Chitwood & Biggerstaff, 1994). Additionally, as stated in Chapter 1, most exercising teammates communicate with each other during the activity. In real group settings, words of encouragement are often exchanged between active partners (most typically from the more capable to the less capable, such as “keep going,” “you can do it,” “we can do it,” or “try harder”), but the effect of such verbal encouragement is difficult to ascertain without controlling

for content of the messages. Thus, in the study by Irwin et al.(2013), researchers investigated the effect of verbal encouragement by the virtually-presented partner on the weaker group member. The researchers theorized that verbal encouragement could have positive or negative effects on motivation depending on how the words are interpreted by the receiver. That is, the receiver of the encouragement (the weaker member) could perceive the encouragement (a) as supporting the receiver to do well, (b) as indicating the importance of the task to the encourager, or (c) as patronizing the weaker member, which would have a negative effect. Irwin et al. employed a 3 (conditions: individual, partner-without-encouragement, and partner-with-encouragement) x 2 (performance block) factorial design college-age participants. Participants performed a series of five abdominal planking exercises which they were instructed to sustain for as long as they could, first alone in Block 1, and then, for the partnered conditions, with a same-sex virtually-presented partner in Block 2. As with other studies by Feltz and her colleagues, the participants in the partnered conditions exercised conjunctively with a virtual partner who was presented as moderately superior. In the verbal encouragement condition, a pre-recorded series of phrases of encouragement was played as coming from the virtually-presented partner every 15s (+/-3 s) with phrases such as "you can do it," "you got this," "keep it going," "you're doing good," "stay strong here," and "give it your best."

Results supported the performance enhancing Köhler effect, but contrary to expectations, verbal encouragement mitigated effort gains (Irwin et al., 2013). The researchers surmised that the decrease in effort in the verbal encouragement condition may have been due to the language used; the virtual partner used the pronoun "you" when communicating with the participant, which may have been perceived as patronizing by the participant. This perception could decrease the appeal of the virtual partner, a problem which has been demonstrated to reduce

gains from the Köhler Effect (Kerr & Seok, 2011; Kerr et al., 2008). Phrases like "you can do it!" may have even served as a reminder of the participants' relative lack of ability, which could have a negative impact on effort by increasing the perceived gap of ability – e.g. "they are too good to keep up with, persistence is futile" (Feltz et al., 2012; Köhler, 1926; Köhler, 1927; Messé et al., 2002).

Irwin et al. (2013) offered, alternatively, that the "you" focused encouragement phrases could be interpreted, not as teammate support, but rather as a method of self-encouragement. The authors offered that "interpreting the message as self-encouragement might suggest to the participants that the supposedly superior partner was in fact struggling with the task, thereby creating doubt in the degree of the partner's superiority" (p.22). Unfortunately, the authors did not explicitly measure participants' interpretations of the partner's statements.

Due to the coactive and relational dynamic of the Köhler effect, communication research in interpersonal relationships offers some insight to illuminate the unusual results of the Irwin et al. (2013) study. "Communication among group members should enhance collective effort when it enhances perceptions of task importance or social responsibility" (Karau & Williams, 1993, p. 702). An increase in team identity could foster feelings of social responsibility and subsequent obligational motivation gains to enhance the team outcome. As noted before, most groups in the Köhler research have been ad hoc groups, and "true" groups are defined as "individuals… [who] share a common fate [and] exhibit structured patterns of interaction and modes of communication," (Carron, Hausenblas & Eys, 1998, pp. 13–14). In the context of the present study, which hypothesizes that when a superior partner communicates inclusive encouragement and beliefs of joint ability ("We can do it!") the Köhler effect will be strengthened by

establishing and reinforcing a group identity and consequent feelings of obligation enacted through the indispensability mechanism.

Language cues. Strength of group identity and cohesiveness is known to be positively related to individual effort in group tasks (Karau & Williams, 1997; Kerr et al., 2008; Worchel, 1998). Though most real groups identify as such for a variety of reasons such as a common fate, shared goals or other similarities, it is possible to induce feelings of closeness and group identity through nothing more than subtle manipulations of language (Brewer & Gardner, 1996; Fitzsimons & Kay, 2004). Language has special and unique power in the social world in that the labels it provides determine and perpetuate the perceptions of an individual, a group, or the self, simultaneously describing qualities and ascribing values. One way to elicit the positive associations of a group identity in the absence of a true group is to merely prime individuals with collective language (Brewer & Gardner, 1996; Perdue, Dovidio, Gurtman & Tyler, 1990).

To demonstrate this phenomenon, researchers Brewer and Gardner (1996) performed a three study series on the effects of pronoun priming on perceived attitudinal similarity when reading ambiguous statements and, more notably, the production of social self-descriptions and declarations of group membership and a collective identity (1996). In experiments one and two, individuals were exposed either to inclusive pronouns such as "we" or "us," or to exclusive pronouns such as "they," "them," or "it," and then rated their degree of agreement with an ambiguous statement. Results supported the hypothesis that individuals would find similarity in indifference when primed with inclusive pronouns. The third experiment used a similar priming task but, rather than rating ambiguous statements, participants were asked to form spontaneous self-descriptions. Individuals primed with inclusive pronouns more frequently described themselves within a social context than individuals primed with exclusive pronouns or

adjectives. The pattern of their research suggested that, when primed with inclusive pronouns, individuals react with a tendency to relate to others, categorize themselves within a social context, and modify their self-perceptions to identify with a collective (Brewer & Gardner, 1996).

This tendency can even be used to increase perceptions of closeness in actual interpersonal interactions (Fitzsimons & Kay, 2004). In the first three studies of a four-study series, Fitzsimons and Kay investigated the effects of pronoun priming on perceptions of individual closeness, first in the context of a written, fictitious story (Experiment 1), next, in the context of an existing, ongoing relationship (Experiment 2), and finally in the context of a real-time interpersonal interaction (Experiment 3). In the first experiment, individuals read a story where characters referenced one another with either exclusive pronouns, highlighting their individual identities, or a single inclusive pronoun to instead identify them as a unit. Participants rated the characters, who referred to one another as a unit (via inclusive pronouns) as having a closer relationship than the characters who referred to one another with discrete, exclusive pronouns. Consequently, in the second experiment, participants were asked to recall a current, ongoing relationship of their own and record details of the relationship either with distinct, exclusive pronouns (i.e., "John and I…") or with the collective, inclusive pronoun (i.e., "we"). Participants in the collective pronoun condition rated their relationships as "closer, more intimate, and more important than did participants [in the exclusive pronoun condition]," (p. 551). Experiment 3 tested this effect in a live interaction with a confederate, where participants completed a fill-in-the-blank brainstorming task side by side with a confederate. Embedded in the task, sentences were structured to either refer to the participant and the confederate as a unit (inclusive pronoun) or as distinct entities (exclusive pronouns). After the brainstorming task, a

brief scripted interaction took place, after which the participant and confederate were separated and asked to reflect on their interaction. Participants in the inclusive language not only perceived their interaction as closer than those in the exclusive language condition, but they also predicted that, were they to interact in the future, their relationship with the confederate would be closer. Experiment 4 replicated Experiment 1 but included a post-experimental questionnaire to assess participants' ratings of character similarity, sharing of common fate, and perceptions of closeness. Consistent with the first three studies, results supported the hypothesized role of inclusive language in the formation and perpetuation of interpersonal relationship perceptions. The identification of inclusive language as potential causal factor in group identification and relationship development is promising in light of the aforementioned indispensability mechanism of the Köhler effect, the relationship dynamic required to optimize that mechanism, and the findings of Irwin et al.'s (2013) study.

While inclusive encouragement may bolster the Köhler effect, it should be noted that there is significant evidence that verbal encouragement alone (typically heard from a trainer, teammate, or coach) may also promote effort gains (Campenella et al., 2000; Guyatt et al., 1984; McNair et al., 1996; Moffat et al., 1994). Despite consistently helping performance, it is unlikely that encouragement alone – a unilateral approach to motivation - could provide the motivation gains seen with the Köhler effect, which offers increases in effort through at least two potently motivating social processes (i.e., upward social comparison and social indispensability.

CHAPTER THREE

METHOD

Design and Participants

The study employed a 5 (condition: individual-control, individual-with-encouragement, partner-without-encouragement, partner-exclusive-encouragement, partner-inclusive-encouragement) x 2 (Performance Block: Block 1 & Block 2) factorial design with repeated measures on the second factor. As with the Irwin et al. (2013) study, most of the data for two of the conditions (i.e., 35 participants in the individual-control condition and 40 in the partner-without-encouragement condition) were collected as part of the Kerr et al. (2012) and Irwin et al. (2013) studies. In the current study, a new wave of data were collected for the individual-with-encouragement (n = 50), partner-inclusive-encouragement (n = 49), partner –exclusive-encouragement (n = 46) conditions. Additional data in the two other conditions (10 per condition) were also collected to contrast the latter with those collected for the Kerr et al. (2012) and Irwin et al. (2013) studies to probe for possible history or cohort effects (total: individual-control n = 45; partner-without-encouragement n = 50, see Figure 3 *Participant flow* in Appendix K for an illustration of participant sources). Irwin et al. did not find any systematic differences between the two waves of data collection, because the lab settings, participant populations, and procedures for both data collection periods were identical. We also did not find any differences (see Chapter 4 Preliminary analyses). A one-way ANOVA examining potential differences between the control and partner-without-encouragement conditions from the data obtained during this wave of collected and the data used in the Irwin et al. (2013) study found no significant differences in exercise duration between waves according to the Tukey HSD procedure (ps > .97).

Students were recruited from introductory psychology (online) and kinesiology courses (online and face-to-face) at a large Midwestern university and were given course credit for participation. Students were recruited based upon their interest in exercise and were told they would be playing an exercise video game and performing abdominal planking exercises for as long as they felt comfortable. The final total sample consisted of 240 participants (121 female, 119 male) of college age (*M* = 20.32, *SD* 1.83). Overall the average participant was a sophomore/junior (mean of 2.86, SD 1.26 where 1=1st year, 2=2nd year, etc.).

Exercise Task

The task for this study was the same exergame designed for the PlayStation 2 (PS2) gaming module as used in the Feltz et al. (2011) study. The software used was EyeToy: Kinetic, that operates in conjunction with an additional accessory called the EyeToy, designed specifically for the PS2 system. The EyeToy is essentially a small camera that connects to the PS2 system via a USB cable and allows images of the user to be displayed on the TV monitor and interact with virtual environments supported by the software.

The abdominal plank exercises within the strength-training module of the EyeToy: Kinetic software were used for this experiment. These are a type of bodyweight exercise where participants are required to suspend their own body weight using their abdominal muscles. These exercises are also isometric in nature and require very little coordination, and thus are highly effort based. Each exercise targets the abdominal muscles, but there are slight differences between each.

On the first exercise, participants were face down on a cushioned mat, with legs extended straight, and they lifted their body upward by resting their elbows and toes on the mat and using their abdominals to lift their body. In this way, the body was in a straight line, the spine was

directly in line with their head and legs and nothing was touching the ground except for the elbows, forearms, and toes. In a similar fashion, the second exercise achieved the same elevated position, but the participant was on the left side with only the left forearm and left foot on the ground, emphasizing the use of the outer abdominal muscles. The third exercise was the same as the first exercise except that the participant had the left leg raised in the air and thus was be balancing on only the right foot, which emphasized the lower abdominal region. The fourth exercise was the same as the second, except the participant performed this on the right side. The fifth exercise was the same as the third, except the participant performed this with the right foot in the air (see Figure 1). Participants performed each exercise once within each of two blocks.

Measures

Effort. Effort was measured via task performance as the total number of seconds that the exercise will be held. Block scores were calculated by taking the summed total of the five exercises within each trial.

Self-efficacy (SE*).* Task SE was measured with a scale developed specifically for this program of research (e.g., Feltz et al., 2011). The measure contains five items, each corresponding to one of the five exercises within each trial. All items were preceded by the stem "What is the number of seconds that you are completely confident you can hold:" followed by "The first exercise"; "the second exercise" and so on for each of the five exercises. Respondents wrote in the number of seconds in a blank box following each item. The questionnaire was administered at three time points: once before Trial 1 (after the participant had watched a brief instructional video demonstrating the exercises), a second time before performing the five exercises at Trial 2, and a third time after Trial 2. A total SE score for each trial was calculated by taking the sum of the five items within each trial.

Ratings of perceived exertion (RPE*).* RPE was used to provide a subjective rating of participants' levels of exertion across conditions. RPE was measured using the 6-20 version of the Borg (1998) RPE scale. The scale ranges from 6-20 where 6 means "no exertion at all" and 20 means "maximal exertion." Participants were asked to rate their exertion at the end of each exercise, with particular reference to their perceived exertion at the moment right before the end of the exercise.

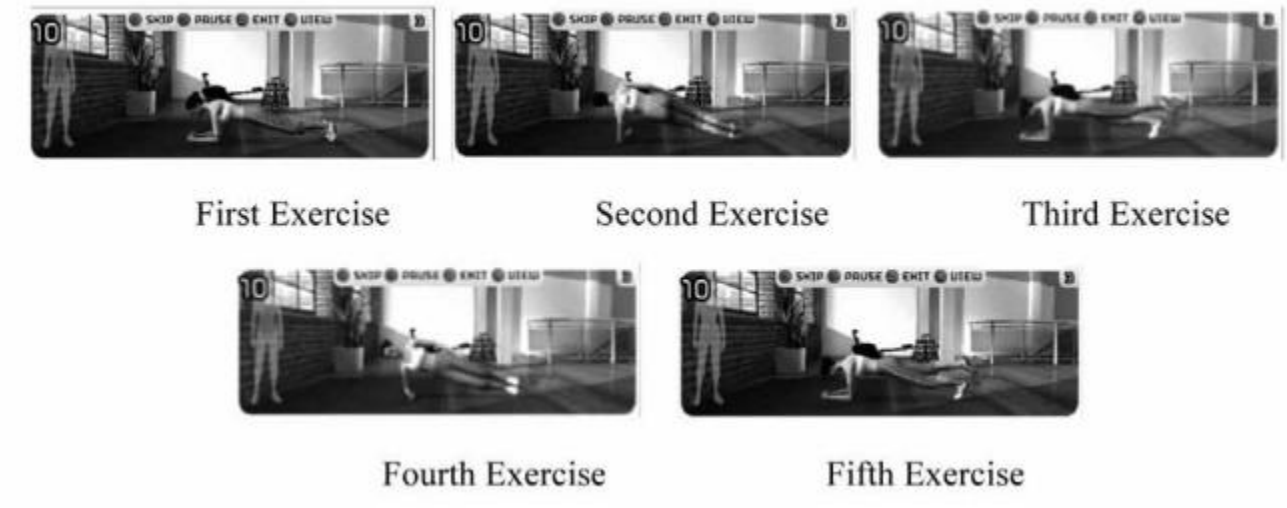
Task enjoyment. Task enjoyment was measured using a short 8-item version of the Physical Activity Enjoyment Scale (Kendzierski, 1991). Each item was rated on a 7-point bipolar scale beginning with the stem "Please rate how you feel at the moment about the physical activity you have been doing according to the following scales" (e.g., 1= "*I loved it*"; 7 = "*I hated it*").

Intention to exercise. Intention was assessed with a single item, "I intend to exercise tomorrow for at least 30 minutes" on a scale of -3 ("*Not at all true for me*") to +3 ("*Completely true for me*").

Post-experimental questionnaire. In addition to questions checking participants' understanding of the instructions and procedures, there were questions probing their perceived task ability, a rating of task difficulty, and a rating of effort expended on the task, each made on 8-point scales. Participants were also asked to rate their partner's relative ability on a 9-point scale (where 1 = *I am much more capable* and 9 = *my partner is much more capable*). Additionally, scaled questions measuring the participants' perception of the attitude of their virtual partner as well as their own attitude toward the partner (or trainer where appropriate) were employed to determine if or how language used by the virtual partner changes the relational dynamic. Participants were asked to answer the following questions with scaled response

options: “Did you compare your average planking time to that of your partner?” (with a response scale where 1=*no comparison* and 7=*maximum comparison).* “How do you think your partner would rate your performance?” (with a response scale where 1=*I performed very poorly* and 7=*I performed very well), “*How do you think your partner would rate your ability?” (with a response scale where 1=*my partner would rate me as very incapable* to 7=*my partner would rate me as very capable),* “As you were preparing to start the exercise, how important did you think your performance would be to the group score?” (with a response scale where 1=*my performance is not important at all* to 7= *my performance is very important),* “Was your partner (trainer) encouraging to you?” (with a response scale where 1=*my partner (trainer) was very encouraging to me* to 7=*my partner (trainer) was very discouraging to me), “*How much did your partner care about your performance?” (with a response scale where 1=*my partner did not care at all about my performance* to 7=*my partner cared very much about my performance), “*How did you perform as a team (how well did you work together)?” (with a response scale where 1= *my partner and I worked very well together* to 7=*my partner and I did not work well together at all), “*How much did you like your partner?” (with a response scale where 1=*I like my partner very much* to 7=*I strongly dislike my partner).* Specifically for the encouragement conditions, participants were asked, “Were the statements helpful to your performance?” (with a response scale where 1=*the statements hindered my performance* to 7= *the statements were very helpful to my performance*); “Did the statements boost your self-confidence for the task? (with a response scale where 1= *the statements strongly lowered my self-confidence for the task* to 7=*the statements strongly boosted my self-confidence for the task*); “Who was the partner encouraging?” (with three options: *A. You B. Her/himself C. Both*); “How did the statements affect your focus during the task?” (with a scale where 1=*distracting* and 7=*focusing*).

Figure 1. *Images of exercises performed*



Procedures

Before conducting this study, permission was obtained from the institutional review board. Before each session, an experimenter ensured that none of the participants had any disabling injuries to their arms, shoulders, back, or legs. Once an informed consent form had been signed, participants were asked to remove any wrist jewelry/watches.

Participants initially watched a brief instructional video from the PS2-Eye Toy Kinetic software in which a virtual trainer demonstrated the five exercises. A baseline measure of self-efficacy was then recorded. All participants then performed the first block of exercises, holding each of the five exercises for as long as they could and with 30s rest periods between each exercise. Immediately after each exercise, the participant reported his/her perceived exertion on the 15-point RPE scale. All participants were be given veridical feedback on their performance (i.e., the average of the number of seconds they held each exercise).

The work condition manipulation was introduced at this point. Participant in the individual-control condition simply rested for 10 minutes. Participants in the individual with encouragement condition were told that the lab had recorded a trainer's communication phrases to test if they should be built into the exercises, and that while they are performing the next block of trials they will be able to hear the trainer's voice. Then, they rested for the remaining time before the next trial block started.

Participants in the partnered conditions were told that another participant was being run simultaneously at another lab on campus, and that the two participants would be able to see one another over an internet video connection during future trials. The participants then met briefly with the other, same-sex participant in a controlled Skype-like interaction (we will refer to that other participant hereafter as "the partner"). In reality, the partner was an experimental confederate whose side of the interaction was pre-recorded. After the interaction, participants

were also be given bogus feedback on how well the partner performed on the first trial. That feedback score was 1.4 times the participant's own actual performance, since this appears to be the optimal discrepancy for inducing motivation gains (Messé et al., 2002). Participants were then told that they and their partners would be a two-person exercise team. In the two partner-with-encouragement conditions, participants were told that their partner would be able to communicate with them verbally during the next series of exercises but would not be able to respond to the participant. It was then further explained that the team score would be the persistence score of the first teammate to quit an exercise (i.e., as soon as either partner quit, the exercise was over). Following these instructions, all participants were again administered the self-efficacy measure.

Block 2 then began. The participant was only able to see the partner's image (which was actually prerecorded) before and during the exercise; the participant knew that the partner could likewise see his/her (the participant's) image. The images available to the participant suggested that s/he was always the first to quit each exercise. The video link was allegedly frozen as soon as either teammate quit an exercise and until just before the start of the next exercise. The participant, therefore, knew only that his/her partner had been able to persist longer, but not just how much longer. In the encouragement conditions, a pre-recorded series of phrases of encouragement was played through a set of computer speakers controlled by the experimenter. The phrases were be audible approximately every 15s ($\pm$ 3s) and followed a fixed progression: in the exclusive language condition, "you can do it," "you got this," "keep it going," "you're doing good," "stay strong here," "give it your best," and in the inclusive language condition "we" will be substituted wherever "you" is said. In the individual with encouragement, the same "you" phrases were provided through headphones in the same order as delivered at the same pace.

After Block 2 was over, the participant completed a series of questionnaires (self-efficacy, intention to exercise, enjoyment of physical activity, manipulation checks, and perception of partner). The participants were then debriefed, thanked, and excused.

CHAPTER 4

RESULTS

The purpose of this study was to examine the effects of encouragement on the Köhler effect in exergames. This chapter is organized into four main sections. The first section provides results on descriptive statistics and manipulation checks. The second section provides results of the preliminary analyses examining history and cohort effects. The third section provides results for the main hypotheses. A final, fourth section presents results on ancillary analyses used to help interpret the main hypotheses.

Descriptive Statistics, Confound Checks and Manipulation Checks

Correlations. Bivariate correlations were calculated between all major study variables. Table 1, below, shows correlations of all study variables with Block 1 and Block 2 performance and RPE.

Table 1

Correlations Between Study Variables, Performance, and RPE by Block

Variable	Performance 1	Performance 2	RPE 1	RPE 2
SE 1	.371**	.305**	.170**	.150*
SE 2	.439**	.477**	-.046	.042
SE 3	.345**	.370**	-.045	-.054
Intention to exercise in future	.162*	.100	.010	.041
Exercise enjoyment	.135*	.221**	.068	.112
Teamwork	.036	.192*	-.128	-.010
Liking	-.072	.081	-.248**	-.185
Prediction of partner's rating of S	.152*	.327**	-.003	.026
Prediction of partner's rating of S ability	.151*	.317**	.016	.036
Social indispensability	.070	.271**	-.021	.019
Upward social comparison	.115	.332**	.025	.097
Partner caring	.091	.267**	.001	.062
Communication encouraging	.053	.094	-.031	-.026
Communication helpful	.044	.141*	.018	.014
Communication confidence boosting	.084	.183**	.007	-.001
Communication focusing	.052	.127*	.020	.104

Table 1 (cont'd)

*p <.05. **p <.01

Notable patterns in these correlations include positive and significant relationships among all three self-efficacy measures with both performance blocks, Self-efficacy at Time 1 and RPE in both performance blocks, Performance at Block 1 and Intention to exercise in the future, and Exercise enjoyment and Performance in both blocks. In the partnered conditions, there was a positive and significant relationship between Block 2 performances and Perceptions of teamwork, Social indispensability, Upward social comparison, and Partner caring. There was a negative and significant relationship between RPE at Block 1 and Partner liking, suggesting that working hard increased the likelihood for resentment for a superior partner (i.e., "I just worked *so hard* and this person outworked me?"). In the encouragement conditions, perceptions of encouragement helpfulness, confidence boosting, and focusing were positively and significantly correlated with Block 2 performance, suggesting that participant perceptions of encouragement effectiveness were accurate.

Tables containing other correlations may be found in Appendix J. See Table 3 for correlations among Exercise endurance, Self-efficacy, RPE, Exercise enjoyment and Exercise intention. Table 4 contains correlations among responses to the partner information questionnaire items. Table 5 contains correlations among responses to the communication questionnaire items.

Missing data. For the main dependent variable, there was one count of missing data. No participants dropped out of the study before completing the session, though four were excluded from analysis because previous participation in a similar study was discovered after testing was complete.

Confound checks. Experimenters were asked to record signs of suspicion, discomfort, boredom, the presence of equipment failures, whether they thought a participant's fitness level or previous activity affected participants' performance, and whether the experimenter and participant knew each other prior to the study. Upon completion of data collection, participant responses to the open-response item in the post-experimental questionnaire "was there anything odd or unusual about the experiment" were also coded for suspicion (n = 29).

A 5 (Condition) x 2 (Sex) ANOVA on performance scores was performed, excluding all participants who showed signs of suspicion, discomfort, boredom, and any observed factors that may have influenced the integrity of the experiment (n = 61, see Table 6 in Appendix J). Results show a condition main effect, $F(4, 179) = 20.9$, $p < .001$, $\eta_p^2 = .33$, which did not differ when the same analysis was performed with these participants included (see Hypothesis Testing section). A post-hoc Tukey test revealed results statistically indistinguishable from the analyses performed with all participants. Consequently, the participants were included in all subsequent analyses. It is interesting to note, however, that of the 29 participants showing suspicion in the partner conditions, more than half were in the exclusive-encouragement condition, though a Chi-square test revealed no statistically significant difference in suspicion among the partner conditions.

Both male and female experimenters tested participants, but a 2 (Experimenter gender) x 5 (Condition) analysis found no performance differences by experimenter gender, $F(2, 240) = .071$, $p = .790$. Consequently, experimenter gender was excluded from all subsequent analyses.

Manipulation checks. An examination of the measure seeking whether or not participants in this data collection wave understood the rules and design of the game (Appendix H, Item 1) revealed no issues with participants' understanding of the condition they were in. All participants in the control condition (100%) reported correctly that they were performing the

exercises alone. Of the participants in the individual-with-encouragement condition who responded (98.0%), most (84.0%) reported correctly that they were performing the exercises alone. Of the participants exercising with a partner who responded to the item, (partner-without-encouragement, 100%; partner-exclusive-encouragement, 100%; partner-inclusive-encouragement, 97.9%), most participants exercising with a partner reported correctly that they were working with another person over an internet connection or were part of a 2-person team, whether their partner was silent (90.0%), their partner offered exclusive encouragement (93.5%), or inclusive encouragement (91.8%). An examination of the measure examining whether or not participants from this collection wave understood how their score was determined (Appendix H, Item 2) revealed no issues with participants' understanding of yoked scoring (i.e., they reported that their score was determined by their own score or the score of the weakest member). Participants in the partner-without-encouragement condition reported no incorrect responses, while most participants in the partner-exclusive-encouragement condition reported correctly (92.5%) and most participants in the partner-inclusive-encouragement condition reported correctly (88.4%).

Encouragement direction. One possible explanation that Irwin, et al. (2013) offered for the unusual results of their study was that participants mistook the partner's encouragement for self-encouragement, which could have undermined the perceived superiority of the partner (i.e., the partner was struggling and was granting audible self-affirmations). The perceived direction of speech with a single measure asking "whom was your partner talking to?" with answer options 1 = you, 2 = her/himself, and 3 = both. Participants in the partner-exclusive-encouragement condition reported the encouragement as participant-directed 63.0% of the time, as self-directed 13.0% of the time, and as directed toward both team members 24% of the time

suggesting that participants generally felt that the encouragement was, at least in part, directed toward them and was rarely seen as solely self-directed, and that Irwin et al.'s (2013) speculation that exclusive encouragement may have been mistaken as self-encouragement is not valid. Participants in the partner-inclusive-encouragement condition who responded to the item (95.9%) reported the encouragement as participant-directed 42.5% of the time, as self-directed 8.5% of the time, and as directed toward both team members 48.9% of the time, suggesting that inclusive encouragement was not perceived as directed at both exercisers more often than exclusive encouragement, but was also rarely perceived as solely self-directed.

Preliminary analyses

Stage 1 analyses looked for possible history or cohort effects attributable to the time interval between the new data and the data used by Irwin et al. (2013). In a 4 (Condition: Individual-control-old, individual-control-new, partner-without-encouragement-old, partner-without-encouragement-new) x 2 (Gender) ANOVA, a boost in exercise duration was observed for the partnered conditions in both sets of data (Condition main effect, $F(3, 95) = 19.57$, $p < .001$, $\eta_p^2 = .403$). A post-hoc Tukey test found no significant differences in exercise duration between the collection waves in the control condition ($p = .975$) and the partner-without-encouragement condition ($p = .977$). All means, standard deviations, by condition, gender, and trial block for all variables employed in the study are reported in Table 7 and Table 8 in Appendix J.

Hypothesis Testing

The main hypotheses made predictions regarding exercise duration and type of encouragement. Hypothesis 1 stated that compared to working alone with no encouraging statements, participants will exercise longer when working together with a moderately superior virtual partner under conjunctive task demands. Hypothesis 2 stated that compared to working

together with a moderately superior virtual partner who provides no encouragement, participants will exercise longer when working with a partner who provides encouraging statements that use the inclusive "we" pronoun. Hypothesis 3 stated that compared to working together with a moderately superior virtual partner who provides no encouragement, participants will exercise longer when working with a partner who provides encouraging statements that use the exclusive "you" pronoun. Hypothesis 4 stated that compared to working alone with no encouragement, participants will exercise longer when working alone with a trainer providing encouraging "you" statements.

Because the five exercises were small variations of one another, the total persistence (in seconds) across all five exercises was computed. In order to control for individual differences in strength and fitness, the primary dependent variable used was the difference score between both blocks (Block 2 – Block 1), to show any changes in persistence. This approach has generally produced the same pattern of results as using the Block 1 scores as a covariate in the analysis of Block 2 scores in previous research (Forlenza et al., 2012; Kerr et al., 2013).

A one-way ANOVA examining these difference scores resulted in a significant condition main effect, $F(4, 240) = 19.99$, $p < .001$. Planned contrasts were employed to test the four hypotheses as outlined in Table 8.

Table 2

Weighted values for planned contrasts of mean Block 2 – Block 1 difference scores.

	IC	IWE	PWE	PEE	PIE
Hypothesis 1	-3	0	1	1	1
Hypothesis 2	0	0	-1	0	1
Hypothesis 3	0	0	-1	1	0

Table 2 (cont'd)

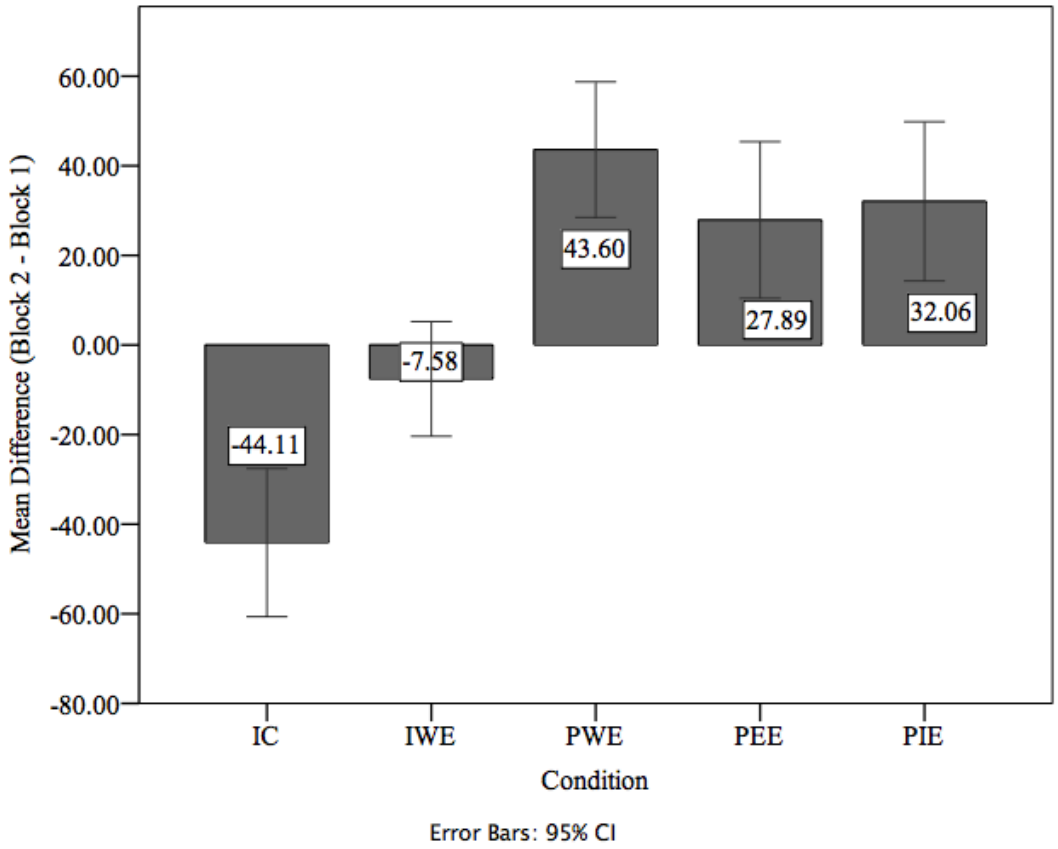
Hypothesis 4	-1	1	0	0	0

Note. IC = Individual-control, IWE = Individual-with-encouragement, PWE = Partner-without-encouragement, PEE = Partner-exclusive-encouragement, PIE = Partner-inclusive-encouragement.

Results of the planned contrasts demonstrated support for only Hypothesis 1, $t(235) = 8.37$, $p < .001$ and Hypothesis 4, $t(235) = 3.23$, $p = .001$, but not Hypothesis 2, $t(235) = -1.04$, $p = .298$ or Hypothesis 3, $t(235) = 1.40$, $p = .164$. Thus, participants paired with a partner all showed dramatic improvements in exercise duration from Block 1 to Block 2, whether their partner was silent ($M = 43.60$, $SD = 53.25$), provided exclusive encouragement ($M = 27.89$, $SD = 58.85$), or provided inclusive encouragement ($M = 32.06$, $SD = 61.87$) (see Figure 2), demonstrating a strong Köhler effect and providing evidence in support of Hypothesis 1. Individuals exercising alone received a performance boost when offered encouragement ($M = -7.58$, $SD = 45.03$) when compared to individuals exercising in silence ($M = -44.11$, $SD = 55.03$), providing support for Hypothesis 4. However, support was found neither for the original hypothesis of the Irwin et al. (2013) study that exclusive encouragement would boost the Köhler effect (Hypothesis 3) nor for the hypothesized superiority of inclusive encouragement over silence (Hypothesis 2).

Figure 2

Mean duration (s) of performance difference scores (Block 2 – Block 1) by condition.



Note. IC = Individual-control, IWE = Individual-with-encouragement, PWE = Partner-without-encouragement, PEE = Partner-exclusive-encouragement, PIE = Partner-inclusive-encouragement.

Ancillary Analyses

Exercise self-efficacy. Post-block efficacy judgments (the number of seconds participants estimated they could persist at each of the five exercises) were examined in a 2 (Block) x 5 (Condition) x 2 (Gender) ANCOVA, which included pre-block 1 self-efficacy scores as a covariate (i.e., each participant's estimate of her or his ability prior to performing any exercise) to control for chronic differences among participants of their self-efficacy belief pertaining to the task. As in previous studies, there was a Block main effect, $F(1, 240) = 8.58$, p

= .004, η_p^2 = .036, where participants were less optimistic about their potential for performance after Block 2 (adjusted *M* = 145.6s, *SD* = 80.11) than after Block 1 (adjusted *M* = 186.9s, *SD* = 92.56). Males were generally more optimistic about their performance than females, *F*(1, 240) = 7.96, *p* < .01, η_p^2 = .034. Unlike Irwin, et al.'s (2013) study, there was a condition main effect, *F*(4, 240) = 2.56, *p* = .034, η_p^2 = .043. Participants in both of the individual conditions reported lower self-efficacy estimates than participants in the partner-without-encouragement and partner-exclusive-encouragement conditions, an effect which disappeared after the second block for the individual-with-encouragement condition but not for the individual control (*p*s < .05).

Subjective effort. To determine the participants' subjective effort, one relevant variable was examined: the ratings of perceived exertion (reported after each exercise and averaged across exercises within blocks). Consistent with the previous studies, a 5 (Work condition) x 2 (Gender) x 2 (Block) analysis of RPE data found only a Block main effect: participants reported greater exertion at Block 2 (*M* = 14.82, *SD* = 1.83) than Block 1 (*M* = 14.10, *SD* = 1.77; *F*(1, 240) = 114.18, *p* < .001, η_p^2 = .33), as one might expect given the demands of the task. However, the discrepancy did not differ significantly among the conditions, suggesting that perception of effort did not accurately reflect effort expended (i.e., participants exercising longer did not report that they felt more fatigued.

Task evaluation. Overall task enjoyment was measured by means of the 8-item PACES scale. The mean (*M* = 4.09 on the 7-point scale, *SD* = .822) was not significantly different from the scale midpoint, *t*(239) = 1.72, *p* =.087, suggesting that the participants were, at worst, neutral regarding the task. A 5 (Condition) x 2 (Gender) ANOVA of the measure found a condition main effect, *F*(4, 240) = 2.87, *p* = .024, η_p^2 = .048. A post-hoc Duncan test showed that the mean scores of the individual-without-encouragement *(M* = 3.87; *SD* = .956) was significantly lower (*p*

< .05) than both the partner-inclusive-encouragement (M = 4.29, SD = .81) and the partner-exclusive-encouragement (M = 4.24, SD = .12).

Participants' post-experimental rating of the difficulty of the task was significantly higher than the scale midpoint (M = 4.89, SD = 1.63, p < .001), (t(236) = 3.64, p < .001) suggesting that participants found the task moderately challenging. A 5 (Condition) x 2 (Gender) ANOVA revealed no significant differences among groups on this measure, F(4, 237) = 1.63, p = .167.

Intention to exercise. Intention to exercise was assessed with a single item in the post-experimental questionnaire. The mean (5.63 on the 7 point scale, SD = 1.72) was significantly greater than the scale midpoint, t(239) = 14.67, p < .001, suggesting that in general, participants intended to exercise the following day. Unfortunately, the absence of a pre-intervention measure precludes any conclusion that the intention can be attributed to the experiment. A 5 (Condition) x 2 (Gender) ANOVA found no significant differences among the groups on this measure, F(4, 240) = 1.05, p = .380.

Perceptions of task ability. As a potential explanation for the deleterious effects of encouragement on the Köhler effect, Irwin et al. (2013) offered that encouragement undermined the participants' perceptions of their partner's superiority at the task. A 3 (Partner conditions) x 2 (Gender) analysis of a measure examining perceived partner ability revealed that participants were unaffected by the communication manipulation, F(2, 145) = 2.33, p = .101.

Social comparison. One of the two key components of the Köhler effect is upward social comparison. Because the previous study did not examine it directly, analysis was limited to the two partnered communication conditions. A 2 (Partner encouragement conditions) x 2 (Gender) analysis revealed a significant condition effect, F(1, 95) = 4.48, p = .037, η_p^2 = .047, where individuals who received inclusive encouragement from a partner (M =3.95, SD = .25)

reported a significantly lower rating of tendency to compare their performance to their partner's than participants who received exclusive encouragement (M = 4.72, SD = .26). Only the scores of the participants who received exclusive encouragement significantly differed from the mean (M = .72 higher than scale midpoint), $t(45) = 14.67$, $p = .003$, suggesting that participants in the inclusive encouragement condition compared themselves to their partners very little if at all.

Social indispensability. The second of the two key components of the Köhler effect is social indispensability. Because the previous study did not examine it directly, analysis was limited to the two partnered communication conditions. A 2 (Partner encouragement conditions) x 2 (Gender) analysis revealed a significant condition effect, $F(1, 95) = 4.89$, $p = .029$, $\eta_p^2 = .051$, where participants who received exclusive encouragement reported greater feelings of indispensability (M = 5.56, SD = 1.42) than participants who received inclusive encouragement (M = 4.75, SD = 2.00). Both groups were significantly higher than the scale midpoint, $t(94) = 6.26$, $p < .001$, suggesting that feelings of social indispensability were strong in both conditions.

Team perceptions. To assess perception of team coordination, a single item was analyzed: "How did you perform as a team (how well did you work together?)." Answers ranged from 1 = worked very well together to 7 = did not work well together at all. Because the previous study did not examine it directly, analysis was limited to the two partnered communication conditions. A 2 (Partner encouragement conditions) x 2(Gender) ANOVA found no significant differences between the groups, $F(1, 95) = .651$, $p = .422$.

Another 2 (Partner encouragement conditions) x 2 (Gender) analysis for perception of partner caring, measured with a single item "did your partner care about your performance," found no significant differences between the groups, $F(1, 95) = .003$, $p = .954$. There was, however, a significant interaction between the two, $F(1, 95) = 4.63$, $p = .034$, where both sexes

responded neutrally to inclusive encouragement, but males responded to exclusive encouragement with ratings of perceived caring significantly higher than the scale midpoint (M = 4.85, SD = 1.22), $t(19) = 3.10$, $p = .006$. This trend was not paralleled in responses to the measure examining how much participants liked their partner, where a 2 (Partner encouragement conditions) x 2 (Gender) analysis revealed no differences between groups, $F(1, 95) = .119$, $p = .730$.

Communication effectiveness. The participants' ratings of the effectiveness of the communication in the three communication conditions was calculated by examining the mean of three questionnaire items. Though four items assessed communication effectiveness, the reverse scoring of one item appeared to confuse some participants, as it failed to correlate to the other measures at the $p < .01$ level, so it was excluded from the analyses. A 3 (Condition: individual-encouragement, partner-exclusive-encouragement partner-inclusive-encouragement) x 2 (Gender) ANOVA found no significant difference among groups, $F(3,145) = .514$, $p = .599$, but the mean of all groups was significantly higher than the scale midpoint (M = 4.46, SD = 1.46), $t(144) = 3.77$, $p < .001$, suggesting that participants in all communication conditions felt that the words were beneficial to their performance.

CHAPTER 5

DISCUSSION

The primary purpose of this study was to test the efficacy of a superior internet partner (providing either inclusive encouragement, exclusive encouragement, or no encouragement at all) as a strategy for increasing the duration of a series of isometric abdominal plank exercises. Consistent with previous studies, participants exercising with a virtually present partner, where task outcome was contingent on the performance of the weaker participant, persisted for significantly longer than participants silently working alone (Feltz et al., 2011; Forlenza et al., 2012; Irwin et al., 2012; Irwin et al., 2013; Kerr et al., 2012; Kerr et al., 2013). Thus, we found evidence in support of our first Hypothesis, that compared to working alone with no encouraging statements, participants will exercise longer when working together with a moderately superior virtual partner under conjunctive task demands. This motivation gain is not unlike gains seen previously, providing additional support for the Köhler effect in exergames as a potentially viable method for achieving fitness goals.

Unlike Irwin et al.'s (2013) study, no significant performance differences were found among the partner conditions. Accordingly, we found no evidence in support of our second Hypothesis, that the use of the inclusive "we" pronoun would enhance the Köhler effect compared to working together with a moderately superior virtual partner who provides no communication. We also found no evidence in support of our third Hypothesis, that the use of the exclusive "you" pronoun would boost the Köhler effect. Given that the same materials for the partner-exclusive-encouragement condition were used in both studies, there are several potential explanations for the discrepancy between the Irwin et al. (2013) study and the present investigation. The mean performance difference of the partner-without-encouragement

condition Irwin et al.'s 2013 study (53.62 s) was one of the highest values for the Köhler effect in the studies employing this same task paradigm and was 10.02 s higher than in the present study. In addition, the mean for the partner with exclusive encouragement was 8.40 s lower in Irwin et al.'s (2013) study than in the present study. These discrepancies may have played a role in the failure to detect significant effects attributable to communication in the present study. Because mean performance difference scores in the partner without encouragement condition for the present study are more reflective of the motivation gains typically seen in this paradigm, it seems plausible that encouragement, regardless of inclusivity, does not attenuate the Köhler effect. Alternatively, it is possible that there was an error in the collection methods of the present study that resulted in a failure to obtain significance on a measure with such subtle variation between conditions (i.e., pronoun use and encouragement). It may also be possible that, due to the subtlety of the communication manipulation in the partnered conditions, the study did not reach sufficient power to obtain statistical significance between the partnered conditions with communication. Finally, given that performance in the communication conditions (PEE, M = 27.89 and PIE, M = 32.06) were not as short as the PEE communication condition in the Irwin et al. (2013) study (M = 19.49), it is possible that neither communication manipulation attenuated the Köhler effect.

Nevertheless, as with previous studies, participants' reported effort did not parallel actual performance scores. This suggests that encouragement (whether in the presence or absence of a partner), and especially the presence of a silent partner, can allow an individual to work harder than they think they are working. Perhaps more importantly, participants working with a partner receiving encouragement reported greater levels of enjoyment than when working silently alone. Given that exercise enjoyment plays an important role in exercise adherence (Wininger &

Parqman, 2003), inclusion of encouragement or some type of verbal interaction may be important for implementation in an exergame for long-term success as a realistic primary exercise modality.

Participants in all conditions reported strong intentions to exercise the following day, but due to the absence of a measure of this item before the intervention, these high levels cannot necessarily be attributed to gameplay. While it is possible that individuals already interested in fitness were more likely to enroll in the study than the average individual, the demographic would not suggest this. More plausibly, participation in strenuous exercise in the presence of an experimenter and sometimes a partner inspired or renewed fitness goals. Several participants indicated that they did not realize the inadequacy of their fitness level until after being outperformed by their virtual partner and left the session making remarks like "I really need to get in shape." Future studies may benefit from a baseline measure of this item to compare exercise intentions before and after exercise and identify changes attributable to gameplay.

Contrary to Irwin et al.'s (2013) findings, but consistent with the hypotheses they presented, self-efficacy did indeed vary by condition in this study, with all partner conditions reporting higher self-efficacy measures than both individual conditions after Block 1, an effect that disappeared for participants working alone with encouragement by the end of Block 2. This finding suggests that the disembodied verbal encouragement did indeed have a mild efficacy-boosting effect, as would be expected per Bandura (1977)'s postulated role of verbal persuasion in the formation of efficacy-beliefs. Despite this, according to both the self-efficacy measurements and actual performance values, which did not significantly differ among the partnered conditions, verbal persuasion did not seem to have a synergistic effect when combined with a superior partner. This could be indicative of a "ceiling" on the Köhler effect, in which

motivation has increased maximally and any motivation boosting qualities of verbal encouragement are limited by actual physical performance abilities. It could also be indicative of a manipulation weakness, as may be alluded to by the number of suspicious participants in the encouragement conditions. Although encouragement should have increased the self-efficacy and performance scores of participants in the partner-encouragement conditions, it is plausible that the lack of believability of the voices in those conditions could have undermined any performance-boosting potential. Though the removal of suspicious subjects from a preliminary analysis resulted in no significant differences, many participants (n = 29) showed or report signs of suspicion, especially in the encouraging-partner conditions. Participant laughter as a response to the initial "encouraging phrase" in those conditions was a recurring theme in experimenter reports, suggesting that the participants either found the actual voices humorous or simply too contrived (or with a timeline too prescribed) to be believable. It is also possible that the laugh may have been a nervous laugh that reflected discomfort with receiving encouragement in the presence of the experimenter, which may have highlighted the participants' lesser ability. However, upon retrospective analysis of the encouragement used, it is quite plausible that the participants found it difficult to believe the realism of the participant after hearing the encouragement, as the voices sounded unstrained (contrary to what would be expected when an individual is speaking with flexed abdominals), failed to reflect any fatigue as the session progressed, and failed to coincide with "times of need," where the partner would presumably give encouragement when the participant was struggling, as would be seen in a truly live interaction.

This realism, however, would not have been an issue in the individual-with-encouragement condition, where the encouragement was presented as pre-recorded and, as such,

could not have been perceived as deceptive. The attenuation of motivation loss from encouragement that is typically seen when working alone is especially interesting because typically research on encouragement in exercise has not used pre-recorded phrases like those used in the present study, but rather the encouragement of a live experimenter (Campenella, Mattacola & Kimura, 2000; Guyatt et al., 1984; Moffat, Chitwood & Biggerstaff, 1994; McNair, Depledge & Stanley, 1996). This suggests that perceived meaningfulness or honest intention to encourage may not be required for performance gain through encouragement. Lastly, it is possible that the mere novelty of a pre-recorded voice may have entertained or distracted participants, as suggested by Soltani and Salesi (2013), who saw a performance boost from participants hearing pre-recorded encouragement and music in a gaming situation with virtual avatars of co-exercisers.

Some support was found for the explanations offered by Irwin et al. (2013) for the lower performance scores in the encouragement condition in their study. Irwin et al. offered that the "you can do it!" encouragement may have been perceived by the participant as a method of self-encouragement, undermining perceptions of the partner's superiority, or may have seemed patronizing. Responses to the item assessing the participants' interpretations of the direction of communication suggest the participants in the partner-exclusive-encouragement condition occasionally misinterpreted the partner's encouragement as self-directed or team-directed. No differences in ratings of how much participants liked their partner were found, suggesting that the encouragement was not interpreted negatively as either patronizing or condescending: rather, most participants provided favorable ratings of the encouragement they heard, regardless of its source.

Despite insignificant performance differences between the partnered conditions with encouragement, a pattern emerged with questionnaire responses to two items assessing key social factors contributing to the Köhler effect: upward social comparison and social indispensability. The primary rationale for Hypothesis 2, that the use of the inclusive "we" pronoun would enhance the Köhler effect compared to a non-communicative partner, was that inclusive language would foster a stronger group identity and boost perceptions of indispensability by instilling a sense of obligation to one's partner. However, participants in the partner-inclusive-encouragement condition reported lower levels of social indispensability than those who received exclusive-encouragement, and reported no social comparison. It seems that social comparison and social indispensability may both rely, to some degree, on a self-focus by the weaker partner that emphasizes him or her as the weaker/indispensable partner that is absent or reduced by overt inclusion through the use of inclusive language. This relationship may conform to Self-Categorization Theory, which posits that as a collective identity becomes more salient, an individual's identity becomes obscured, as group members are seen as increasingly interchangeable (Turner, Oakes, Haslam, & McGarty, 1994). Specifically, the theory states that "when we think of and perceive ourselves as 'we' and 'us' (social identity) as opposed to 'I' and 'me' (personal identity, this is ordinary and normal self-experience in which the self is defined in terms of *others who exist outside the individual person doing and experiencing* and therefore cannot be reduced to personal identity" (Turner et al., 1994, pp. 454). By reducing the saliency of the self-focus or discrete *individual* identity, the opportunity to social compare is absent and any feelings of obligation to a group (i.e., indispensability) may be reduced because of a shift in the perception of self from individual (i.e., with personal ownership of performance) to group (i.e., a divided ownership of performance) by reducing perceived social impact (Latané et al.,

1979). Unfortunately, since most data for the partner-without-encouragement condition was collected in a previous wave where questionnaire items examining these factors were not employed, we have no baseline of these measures for comparison.

Though differences between the partner communication conditions were not observed in measures of teamwork, partner liking, or partner caring, the Gender x Condition interaction on responses indicating perceptions of partner caring suggests that exclusive encouragement indicates to male participants that the partner cares about them. One potential explanation for this finding is that males tend to exhibit more narcissistic traits and tend to be more "me" focused, and consequently may dislike being submerged in the group (Watson et al., 1987; Wright et al., 1989). While this phenomenon did not manifest in performance differences, it may be useful to keep in mind in the development of a virtual partner tailored to a specific individual.

Limitations

While performance differences observed in the Irwin et al. (2013) study were not reproduced here, a trend in line with those differences was seen, as the verbal encouragement conditions with virtually present partners had lower means than the no communication partner condition. It is possible that, after a re-examination of the manipulations, the lack of statistical differences in the current study may have been an artifact of poor manipulations (i.e., unauthentic and poorly constructed recordings). Encouragement may boost the Köhler effect if presented in a more persuasive manner (e.g., a labored, passionate voice), if presented at more opportune times (e.g., when the participant is struggling rather than at prescribed intervals), or if presented as the pre-recorded voice of an automaton or software generated partner (i.e., to avoid aversive reactions to detected deception).

In addition to the myriad potential problems with the materials used in this study, the researcher failed to control for participant language skills. It was evident that English was not the primary language of some participants, though no formal inquiry was made in to their familiarity with the English language and consequently this factor could not be examined as a confounding variable post data collection. Though responses to the communication questionnaire items indicate that, in general, communication was retrospectively perceived as helpful, verbal encouragement encountered during exercise may not have had the same visceral motivation boosting effect on a non-native English speaker as it would on a native English speaker. Future studies ought to check the native language of the participant as well as their familiarity (e.g., number of years in country) with the language used in the manipulation.

Future Directions

Future directions in a line of research pursuing the effects of communication in exergames ought to first address some of the issues presented in this study. To ameliorate any potential issues with the use of confederates, several solutions may be worth pursuing. The first could be to use trained actors as confederates whose encouragement would be perceived as more authentic. The use of a trained actor confederate for pre-recorded interactions and intra-exercise communication may increase believability. Another alternative is to avoid pre-recorded interactions altogether, and rather introduce confederates, live, over an internet connection but present in another room. Because fatigue may become an issue with a live, virtually-present partner, the exercise video could be pre-recorded while intra-game encouragement is delivered live via audio.

Examining the participants' familiarity with the English language could also be important in the design of future research. A communication intervention will undoubtedly diminish in effectiveness if the communication is not understood or detected.

It may also be prudent to investigate and optimize the pre-exercise web camera interaction. Though the interaction was consistent across partner conditions, neither of the confederates mirrored the emotions of the participants: they appeared to be neither friendly, nervous, nor as interested as their exercise partners. The male confederate is visibly older than the typical undergraduate college demographic, and the female confederate can even be seen looking up and away from the camera (seemingly rolling her eyes) at the time allocated for the participants' response to the "meet and greet" prompt. It is possible that first impressions formed from these interactions could have affected all subsequent verbal interactions, making them seem less genuine than they otherwise would have, though the researcher did not assess these factors directly. Accordingly, nonverbal immediacy (i.e., nonverbal behaviors that communicate liking and a generally positive evaluation) during the initial interaction may be worthwhile examining.

In order to eliminate all potential issues with the use of confederates while still ensuring the superiority of the partner, researchers interested in studying this topic may consider the development of an entirely software-generated partner or trainer. A soft-ware generated partner or trainer would rely upon either a prescribed timing for feedback, as used in this study, the input of an experimenter to deliver the feedback at times of need, or perhaps the direct input of the participant through the use of an "encouragement button." Ideally, a software-generated partner would be able to recognize times of need and could be tailored to specific exercisers. A software-generated, "smart" partner or trainer would preclude deception, confederate training, and could be programmed to interact with exercisers consistently in motivation-boosting ways.

However, the best methods to boost motivation through communication in this paradigm are still unknown.

Accordingly, an interesting avenue for future research may be an investigation of the nature of communication in real workout teams. The manipulations used in this study used only a few encouraging phrases, but it is possible that real exercisers use language quite different than that utilized here. Performing an observational study investigating what is said in real workout groups, how it is said, when it is said, and the vocal (e.g., inflection, tonality) and facial (e.g., smile, grimace, neutrality), characteristics of the communicators may illuminate the path for future projects. For example, is encouragement really used to "encourage" more than other types of performance information (e.g., "your form is breaking, hold it," in isometric tasks like in this study, "don't give up," in persistence tasks, and "you need to catch up" in pace tasks)? This type of investigation could include the observation of real, pre-existing working groups exercising in their natural environment or brought into the lab, or potentially the interaction of "first-time" exercise partners who, after meeting in a lab setting, could be instructed to exercise with each other and are merely "free to communicate as they would naturally." Subsequent interaction could be observed, recorded, and analyzed to empirically identify communication patterns between exercise partners.

This study examined the effect of encouragement on exergamers performing an isometric abdominal planking task. An examination of the effect of communication on endurance in rhythmic, aerobic exercise (e.g., cycling, rowing, and running) is warranted. Rhythmic, full-body exercise modalities offer greater potential cardiovascular health benefits than localized, isometric exercises.

Communication (especially encouragement) from trainers and partners in exergames intended for rehabilitation and physical therapy settings may prove to be useful, especially with older adults. Exergames have only recently begun to be explored as a delivery vehicle for rehabilitation-specific at-home training (Smith & Schoene, 2012). Because many declines in bodily function in aging adults occur in tandem with declines in self-confidence, limited social interaction, and a tendency to remain inside the home, the social aspects of a partner (i.e., communication) may be a crucial component of rehabilitation effectiveness.

Finally, communication in this study was restricted to one direction. Communication typically involves an exchange of information rather than merely delivery of it. Future studies may examine how encouragement between partners rather than encouragement from a designated source to a predetermined target, may affect the motivational climate.

Conclusions

The current study validates previous research (Feltz et al., 2011; Forlenza et al., 2012; Irwin et al., 2013; Irwin et al., 2012; Kerr et al., 2012; Kerr et al., 2013) that exercising with a moderately superior virtually-present partner can boost motivation and increase exercise duration, regardless of partner communication. Unlike Irwin et al. (2013), verbal encouragement, regardless of inclusivity, did not significantly moderate this effect. Encouragement in the absence of a partner elicited effort gains above exergaming alone without encouragement, but those gains paled in comparison to gains seen in partnered gameplay. Future research should examine the effect of communication from a software generated partner, different types of pre-exercise interactions, and the effects of different types of interpersonal communication (e.g., informative “we’re expending about 500 calories/hr.”, normative “you’re

falling behind me!", or irrelevant "it's a beautiful day outside!") on exercise duration in exergames.

APPENDICES

APPENDIX A

THE BORG SCALE OF PERCEIVED EXERTION

The Borg Scale

6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

APPENDIX B

SELF-EFFICACY BELIEFS

Please type in a numerical response in each of the boxes in response to the question.

What is the number of seconds which you are completely confident that you can hold:

The FIRST exercise (front plank)? _____

The SECOND exercise (right side plank)? _____

The THIRD exercise (right one-legged plank)? _____

The FOURTH exercise (left side plank)? _____

The FIFTH exercise (left one-legged plank)?_____

APPENDIX C

PHYSICAL ACTIVITY ENJOYMENT QUESTIONNAIRE

Please rate how you feel at the moment about the physical activity you have been doing according to the following scales (find the scales above and to the left of each row of checkboxes = ex. 1 = _____, 7 = _____)

1. 1= I loved it, 7 = I hated it

   1 2 3 4 5 6 7

2. 1= I felt bored, 7= I felt interested

   1 2 3 4 5 6 7

3. 1= I disliked it, 7= I liked it

   1 2 3 4 5 6 7

4. 1= I found it pleasurable, 7= I found it unpleasurable

   1 2 3 4 5 6 7

5. 1= I was very absorbed in this activity, 7= I was not at all absorbed in this activity

   1 2 3 4 5 6 7

6. 1= It was no fun at all, 7= It was a lot of fun

1 2 3 4 5 6 7

7. 1= It was very pleasant, 7= It was very unpleasant

1 2 3 4 5 6 7

APPENDIX D

INTENTION TO EXERCISE

Please respond to the following statement:

“I intend to exercise tomorrow for at least 30 minutes”

1. -3 = Not at all true for me, 3= Completely true for me

-3 -2 -1 0 1 2 3

APPENDIX E

PARTNER INFORMATION QUESTIONNAIRE

If you worked with a partner in the second block of exercises, please answer the questions below. Otherwise, skip ahead.

1. Did you compare your average planking time to that of your partner? (1= No comparison, 7= Maximum comparison)

   1 2 3 4 5 6 7

2. As you were preparing to start the exercise, how important did you think your performance would be to the group score? (1= My performance is not important at all, 7= My performance is very important)

   1 2 3 4 5 6 7

3. What is your partner's ability relative to your own? (1= I am much more capable than my partner, 4 = My partner and I are equally capable, 9= My partner is much more capable than me)

   1 2 3 4 5 6 7 8 9

4. How do you think your partner would rate your ability? (1 = My partner would rate me as very incapable, 7= My partner would rate me as very capable)

1 2 3 4 5 6 7

5. How do you think your partner would rate your performance? (1 = I performed very poorly, 7= I performed very well)

   1 2 3 4 5 6 7

6. How much did your partner care about your performance? (1= My partner did not care at all about my performance, 7 = My partner cared very much about my performance)

   1 2 3 4 5 6 7

7. How did you perform as a team (how well did you work together)? (1 = Worked very well together, 7 = Did not work together at all)

   1 2 3 4 5 6 7

8. How much did you like partner? (1 = I like my partner very much, 7 = I strongly dislike my partner)

   1 2 3 4 5 6 7

APPENDIX F

COMMUNICATION QUESTIONNAIRE

If you heart a trainer's or your partner's voice during your second block of exercise, please respond to the questions below. Otherwise, skip ahead.

1. Were the statements helpful to your performance? (1 = the statements greatly hindered my performance, 7 = the statements were very helpful to my performance)

   1 2 3 4 5 6 7

2. Did the statements boost your self-confidence for the task? (1 = the statements strongly lowered my self-confidence for the task, 7 = the statements strongly boosted my self-confidence for the task)

   1 2 3 4 5 6 7

3. Was your partner (or trainer) encouraging to you? (my partner [trainer] was very encouraging to me, 7 = my partner [trainer] was very discouraging to me)

   1 2 3 4 5 6 7

4. Whom was your partner talking to? (1 = you, 2 = her/himself, 3 = both)

   1 2 3

5. How did the statements affect your focus during the task? (1 = distracting, 7 = focusing)

1 2 3 4 5 6 7

APPENDIX G

ACTIVE PERFORMANCE QUESTIONNAIRE

1. How much interest would you have in participating in another exercise study like this one?

   1 = None at all, 8 = Very much

   1 2 3 4 5 6 7 8

2. How difficult did you find the exercises that you did today?

   1 = Not at all difficult, 8 = Extremely difficult

   1 2 3 4 5 6 7 8

3. How much effort did you exert when performing these exercises?

   1 = My absolute minimum, 8 = My absolute maximum

   1 2 3 4 5 6 7 8

1. How capable to perform these exercises do you feel?

   1 = Extremely incapable, 8 = Extremely capable

   1 2 3 4 5 6 7 8

APPENDIX H

MANIPULATION CHECKS

In which of the following conditions did you perform the last series of exercises? (check one)

1. (Except for the experimenter) I performed these exercises alone.
2. I performed these exercises with another person through an internet connection.
3. I performed these exercises with two other persons through an internet connection.
4. I performed these exercises as part of a two-person team.
5. I performed these exercises as part of a three-person team.

How was your score determined during the last series of exercises?

1. My score is the sum of the number of seconds I held each exercise.

2. My score is the average number of seconds I held each exercise

3. My score is the average of my team's score for each exercise, where the team's score is the number of seconds each exercise was held by the first team member to quit

4. My score is the sum of my team's score for each exercise, where the team's score is the number of seconds each exercise was held by the first team member to quit

5. My score is the average of how long I held each exercise and how long my partner held each exercise

6. My score is the sum of how long I held each exercise and how long my partner held each exercise

Was there anything confusing or odd about the experiment? (open answer)

What, in your own words, do you think the purpose of this experiment was? (open answer)

APPENDIX I

DEMOGRAPHICS

1. Height (inches) _____
2. Weight (lbs) _____
3. Sex (M) (F)
4. Age _____
5. Class
    a. 1st year
    b. 2nd year
    c. 3rd year
    d. 4th year
    e. 5th year
    f. >5th year
6. E-mail address _____

APPENDIX J

AUXILIARY TABLES

Table 3

Bivariate correlations of primary dependent variables.

Measure	1	2	3	4	5	6	7	8	9	10
1. Sum of block 1 performances	-									
2. Sum of block 2 performances	.774**	-								
3. Difference score (Block 2 – Block 1)	-.407**	.245**	-							
4. Sum of pre-block 1 self-efficacy scores	.371**	.305**	-.140*	-						
5. Sum of post-block 1 self-efficacy scores	.439**	.477**	-.004	.563**	-					
6. Sum of post-block 2 self-efficacy scores	.345**	.370**	.007	.506**	.750**	-				
7. Mean block 1 RPE score	.077	.037	-.097	.170**	-.046	-.045	-			
8. Mean block 2 RPE score	.122	.147*	-.015	.150*	.042	-.054	.837**	-		
9. Mean PACES score	.135*	.221**	.111	.090	.178**	.092	.068	.112	-	

Table 3 (cont'd)

10. Mean exercise intention score	.162*	.100	-.101	.099	.089	.024	.010	.041	.193**	-

Note. ** $p < .001$, * $p < .05$

Table 4

Bivariate correlations of responses to partner information questionnaire items.

Item	1	2	3	4	5	6	7
1. Teamwork	-						
2. Liking	.435**	-					
3. Partner's rating of performance	.332**	.210*	-				
4. Partner's rating of ability	.199*	.187	.917**	-			
5. Social indispensability	.137	.276**	.664**	.621**	-		
6. Upward social comparison	.124	.091	.650**	.599**	.778**	-	
7. Caring	.296**	.373**	.221*	.165	.382**	.176	-

Note. ** $p < .001$, * $p < .05$

Table 5

Bivariate correlations of responses to communication questionnaire items.

Item	1	2	3	4
1. Encouraging	-			
2. Helpful	.132	-		
3. Confidence Boosting	.272**	.825**	-	
4. Focusing	.142	.694**	.696**	-

Note. ** $p < .001$, * $p < .05$

Table 6

Frequencies of noted potential confounds.

Issue	*N*
Attire	17
Suspicion	31
Discomfort	0
Boredom	2
Equipment	6
Fitness	2
Activity	8
Know participant	2
Observer present	0

Table 7

Means and standard deviations of all study variables by condition.

	Condition				
	C	IE	SP	PEE	PIE
Variable	*M* (SD)	*M* (SD)	*M* (SD)	*M* (SD)	*M* (SD)
Block 1 performance	276.44 (86.14)	249.56 (92.3)	227.50 (95.90)	278.41 (106.81)	265.41 (106.99)
Block 2 performance	232.33 (75.06)	241.98 (74.83)	275.32 (97.73)	306.30 (99.15)	297.47 (93.37)
Block 2 – Block 1	-44.11 (55.03)	-7.58 (45.03)	43.60 (53.25)	27.89 (58.85)	32.06 (61.87)
RPE 1	14.09 (1.95)	14.22 (1.86)	13.77 (1.94)	14.18 (1.21)	14.28 (1.80)
RPE 2	14.88 (2.01)	14.56 (1.96)	14.59 (1.92)	15.11 (1.47)	14.99 (1.73)
SE 1	253.13 (442.02)	294.02 (153.81)	183.66 (112.04)	302.96 (173.22)	286.51 (145.31)
SE 2	158.73 (114.39)	178.74 (86.60)	192.22 (108.47)	218.83 (148.82)	185.53 (98.43)
SE 3	119.22 (84.24)	159.72 (100.52)	143.90 (78.21)	157.89 (113.17)	146.12 (78.13)
Intention to exercise	6.02 (1.45)	5.60 (1.81)	5.40 (1.81)	5.39 (1.87)	5.76 (1.60)
Exercise enjoyment	3.88 (.95)	4.09 (.86)	3.95 (.80)	4.24 (.60)	4.29 (.81)
Teamwork	-	-	-	3.96 (1.41)	4.14 (1.41)
Liking	-	-	-	5.06 (1.18)	4.96 (1.24)
Partner's rating of performance	-	-	-	2.17 (1.18)	2.63 (1.41)
Partner’s rating of ability	-	-	-	2.74 (1.41)	3.26 (1.71)
Social indispensability	-	-	-	5.57 (1.42)	4.76 (2.01)
Upward social comparison	-	-	-	4.72 (1.57)	3.94 (1.88)
Caring	-	-	-	4.15 (1.65)	4.22 (1.53)
Encouraging	-	4.70 (1.52)	-	5.27 (1.37)	5.17 (1.31)
Helpful	-	4.32 (1.75)	-	4.61 (1.36)	4.27 (1.62)
Confidence Boosting	-	4.40 (1.66)	-	4.50 (1.17)	4.41 (1.64)
Focusing	-	4.58 (2.01)	-	4.85 (1.48)	4.24 (1.70)

Note. C = Individual Control without encouragement, IE = Individual Control with encouragement, SP = Partner without encouragement, PEE = Partner with exclusive encouragement, PIE = Partner with inclusive encouragement.

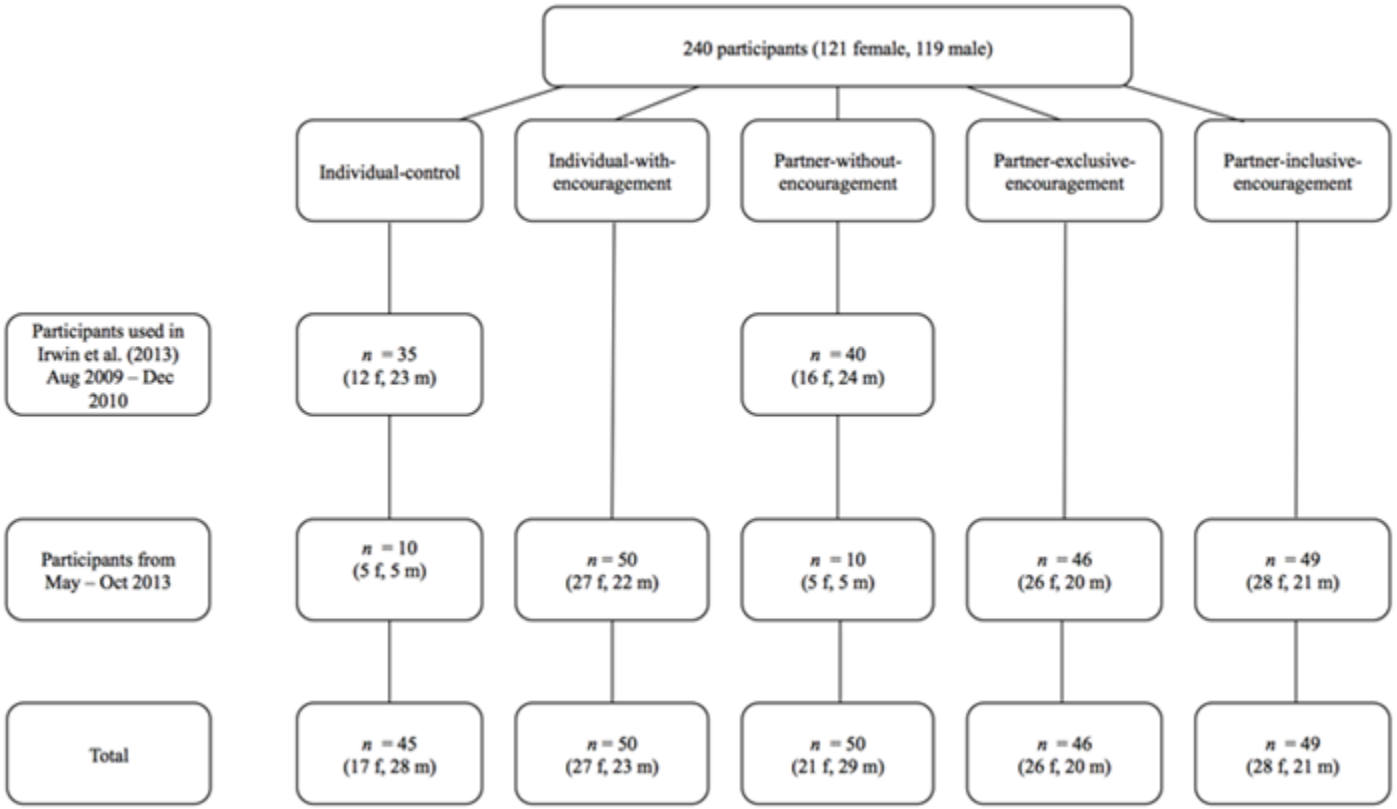
Table 8

Means and standard deviations of all study variables by gender.

	Gender Means	
	Female	Male
Variable	*M* (SD)	*M* (SD)
Block 1 performance	243.70 (81.44)	273.60 (112.11)
Block 2 performance	263.41 (87.92)	278.02 (96.96)
Block 2 – Block 1 Difference score	19.71 (58.70)	2.68 (66.40)
RPE 1	13.93 (1.67)	14.28 (1.87)
RPE 2	14.53 (1.75)	15.11 (1.86)
SE 1	223.79 (132.53)	302.61 (299.41)
SE 2	160.26 (93.63)	213.01 (124.75)
SE 3	126.93 (80.12)	164.17 (99.33)
Intention to exercise	5.60 (1.71)	5.66 (1.74)
Exercise enjoyment	4.10 (.93)	4.12 (.71)
Teamwork	4.26 (1.28)	3.94 (1.50)
Liking	4.97 (1.24)	5.06 (1.05)
Partner's rating of performance	1.75 (1.75)	1.93 (1.99)
Partner's rating of ability	1.47 (1.82)	1.40 (1.92)
Social indispensability	2.73 (2.90)	2.28 (2.88)
Upward social comparison	2.24 (2.46)	1.84 (2.51)
Caring	2.07 (2.28)	1.82 (2.36)
Encouraging	5.10 (1.45)	4.84 (1.41)
Helpful	3.12 (2.41)	2.54 (2.47)
Confidence Boosting	3.12 (2.39)	2.58 (2.47)
Focusing	3.20 (2.59)	2.64 (2.47)

APPENDIX K

Figure 3. *Participant flow.*



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