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Social Media and the Effect on Social Comparison, Recovery, and Motivation Measures in High-Intensity Functional Fitness Athletes (HIFT)

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SOCIAL MEDIA AND THE EFFECT ON SOCIAL COMPARISON, RECOVERY, AND MOTIVATION MEASURES IN HIGH-INTENSITY FUNCTIONAL FITNESS ATHLETES (HIFT)

by

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ABSTRACT

The use of social media in high-intensity functional fitness (HIFT) athletes facilitated social comparisons that affected recovery and motivation. Purpose: The purpose of this study was to use social comparison theory to investigate the impact that short workout videos had on heart rate (HR), heart rate recovery (HRR), rating of perceived exertion (RPE), perceived recovery status (PRS) and time to completion. Methods: Thirty-three individuals who identified as HIFT athletes participated in this study (age: 30.45 years ± 6.59, height: 169.41cm ± 8.69, weight: 73.07 kg ± 13.65). The participants were made up of 57.6% (n=19) female and 42.4% (n=14). Participants were randomized and put through three conditions of a control, elite athlete video and recreational athlete videos which were shown before completing a HIFT workout of: 3 rounds of 10 pull-ups, 15 push-ups, 20 sit-ups, and 25 air-squat. The following data was collected between each round: HR, HRR, RPE, PRS, and time. Athletes were asked to fill out the Iowa-Netherlands Comparison Orientation Scale to assess social comparison during the treatment conditions. Descriptive statistics were run to determine means and standard deviations for all data. The data was checked for normality. Questionnaires were analyzed for reliability and scores were compared using dependent samples t-test. A repeated measures ANOVA was run between total averages using an alpha level of .05 and between rounds with Bonferroni correction using an alpha level of .002. Results: Significant differences in social comparison were found in the elite video condition (3.68 ± .62, p= .046) while RPE showed significant differences in the elite video condition (14.41 ± 1.84, p=.023). Time to completion showed significant differences in both conditions of recreational (11.25 mins ± 1.22, $p < .001$) and elite (11.15 mins ±1.28, $p = .011$) as well as in between round comparisons ($p < .001$) with

participants finishing 8.4 seconds faster in the recreational video condition. Conclusion: Social comparison during exercise is used as a motivator to push athletes. Social comparison during exercise is possible and further investigation should be completed to understand the effects on physiological and psychological measurements in high-intensity exercise.

INDEX WORDS: Social, Social media, Videos, Motivation, Social comparison, High-intensity functional fitness.

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I finished this despite what others may have thought about my ability

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CHAPTER 1

INTRODUCTION

The use of social media has been on the rise since its inception in the 1990s (Bercovici, 2010). By 2011, more than 82% of the world's population over the age of 15 logged onto a social media website as compared to 7% in 2007 (Perrin, 2015). By 2020, it is projected that 42% of the population worldwide will have logged onto social media (Boulianne, 2019). The rapid

expansion has placed social media ahead of traditional media (e.g. newspapers, magazines, or television) in popularity (Bell & Dittmar, 2011; Perrin, 2015; Tiggermann & Miller, 2010). Social media allows people to interact with other users and is consumed in a variety of ways: individuals use it for personal use, companies use it to advertise and communicate with consumers, and various communities use it to communicate about their shared interests (Siapera, 2017). Social media encompasses a wide variety of platforms including blogs, social networking sites, email, chat, and discussion forums (Treem, Dailey, Pierce, & Biff, 2016). More specifically, social media sites (SMS) are web-based technologies where individuals can interact by sharing, discussing, developing, and modifying various types of content (Kietzmann, Hermkens, McCarthy & Silvestre, 2011). The current highly recognized SMS are Facebook, Twitter, Instagram, YouTube, LinkedIn, and Tumblr (Abu-Shanab & Alsmadi, 2019; Boulianne, 2019; Curran & Hesmondhalgh, 2019).

The health, sport, and fitness communities capitalize on the interactive capabilities within SMS. Social media allowed sport and fitness enthusiasts to develop communities where members can share nutrition tips, workout routines, personal records (often referred to as personal best) on movements, workouts, lifestyle routines, and much more (Pegoraro, 2010). Within the HIFT community, athletes and followers use social media to interact as well. Social media has benefited athletes of all levels because novice and recreational athletes can interact with elite athletes. (Gomillion, Gabriel, Kawakami, & Young, 2017). Elite HIFT athletes are those who compete in international events in elite divisions and are ranked in the world while recreational HIFT athletes are those who participate for leisure and have a much lower rank. An example of an elite HIFT athlete interacting with their supporters is the athlete uploading a lifting or workout routine video and interacting with their supporters through comments, shares,

and reaction expressions (like, laugh, heart, sad, or hate button) to acknowledge the content was viewed. (Gomillion, Gabriel, Kawakami, & Young, 2017). Social media has proven to be valuable because it provides opportunities for continuous interactions for users within specific communities.

The growth in popularity of HIFT workout routines is credited to content shared and uploaded on internet websites. HIFT developers used an open sourced format where routines, movements, and results were available through the internet for anyone interested in the workouts (Mulvaney, 2005). The driver for such development was the notion that fitness routines that were exclusive and inaccessible inhibited growth within the fitness industry. With continued sharing and collaboration online, the fitness model of HIFT proved to evolve and reach a larger audience of people. a variety of members of all skill levels are working out alongside one another in a workout modified for every ability (Mulvaney, 2005). Glassman (2007) argued that knowledge of HIFT workouts, techniques, and lifestyles should be shared openly and freely, and therefore, used various websites to engage users and build a following (Gomillion et al., 2017). HIFT style workouts were credited to Greg Glassman (2007), who was a personal trainer, instructing his clients to share their workout results on a common website where each person saw the results (Belger, 2012). Glassman (2007) learned that the online exchange created a community for his clients and started creating videos for his clients who were traveling. The videos were made public so other people could also follow the workout plans. SMS like YouTube, Facebook and HIFT branded websites served as a space for exercise demonstrations, online discussions, and a repository for workout results (Herz, 2014). As a result, the HIFT community in the gym and online saw a development of a collaborative culture as members were encouraged to record their scores for all members to see and compare (Heywood, 2015). Even individual gyms found value

in using online platforms to provide news updates, share daily workouts, and track members' progress (Whiteman-Sandland, Hawkins, & Clayton, 2018). SMS have benefited gyms that partake in them to grow their communities beyond physically being in the gym. Yet, the use of the platforms varies to suit each community and environment.

HIFT is a constantly varied high-intensity functional fitness program (Glassman, 2007). The regimen aims to optimize ten fitness domains of: cardiovascular endurance, stamina, strength, flexibility, power, speed, coordination, agility, balance, and accuracy (Amos, 2006). HIFT workouts combine a variety of movements from sport disciplines such as Olympic weightlifting, gymnastics, and cardiovascular activities to create a workout of the day (WOD) (Claudino et al., 2018). During the WOD, exercise movements are combined in various repetition and set schemes to focus on creating adaptions in specific fitness domains (Claudino et al., 2018). WODs can be measured by the number of rounds completed, the number of exercises completed in a duration of time, total time taken to complete the entire workout, or by completing movements at certain time intervals. HIFT participants exercise in a group setting and because participants are encouraged to record scores on gym whiteboards or on mobile applications, HIFT participants may compare their abilities to others. As social comparison is common within social media, HIFT settings create an environment where comparisons of other members' progress, accomplishments, and abilities become a norm. Not only will athletes see others' scores on the whiteboard, but during a workout, high performing athletes may become a target/goal for others (Broakman, 2018).

Social media allows people to share a snapshot of a piece of their lives, and in many instances, the content appears to be positive and perceived as being perfect to the onlooker (Hogue & Mills, 2018). HIFT athletes post personal records, workout results, and near perfect

movements (Fardouly, Diedrichs, Vartanian, & Halliwell, 2015). Such positive posts drives followers to engage in a cognitive process of comparison between appearance, goals, achievements, and ability. Festinger (1957) described this cognitive process employed when a person determines his or her social and personal worth compared to other people as social comparison. Individuals compare their characteristics, fortunes, faults, and opinions to those of others to develop an understanding of this own social standard (Festinger, 1954). These social standards gathered during a comparison are important subjective benchmarks for people to use for self-improvement and self-enhancement (Suls, 1977). There are different ways individuals engage in the process. Festinger (1954) explained that the comparison process is three directional: upward, lateral or downward. Each direction of comparison deals with comparison standards that are determined by the individual using them to be either above, below, or similar to their own abilities and social standing.

Upward social comparison is adopted by individuals comparing themselves to a higher subjective standard (Mussweiler et al., 2004). This can be seen with a recreational HIFT athlete comparing their abilities to an elite HIFT athlete. Upward social comparisons can be helpful for individuals to justify how close or how 'good' their abilities are to a higher standard and can be used by athletes as a motivator for improved performance (Mussweiler et al., 2003, Thornton & Arrowood, 1966). Downward social comparison is adopted by individuals comparing themselves with a lower or inferior subjective standard. Downward comparison is present in HIFT settings when a HIFT gym member of more than a year compares themselves to a new member who has no athletic background. Downward social comparison is derived from an ego-enhancing motive satisfied by a lesser comparison to improve performance or appear more capable than another person (Suls, 1977). Lastly, lateral comparison is adopted by an individual evaluating themselves

with reference to similar individuals (Wills, 1981). In HIFT gyms, lateral social comparison can be seen when athletes compare themselves with someone similar in ability to themselves. The motive for lateral comparisons stems from the need for self-verification of the individuals own abilities (Wills, 1981).

Social comparisons can vary in impact on the athlete's mental state. Frequent reliance on these comparisons may result in an individual that is negatively influenced by the need to compare (Feinstein et al., 2013; Swallow & Kuiper, 1992). The psychological consequences of frequent social comparison include negative impacts on self-esteem and traits such as depression and anxiety (Sherlock & Wagstaff, 2018). The direct extent of these emotional traits is understood, their relationship to an athlete's psychological disposition before an exercise bout has not been investigated. As social comparison increases competitive behaviors, it may also impact an athlete's heart rate (HR), heart rate recovery (HRR), rating of perceived exertion (RPE), and perceived recovery status (PRS). Research has demonstrated that physiological measures of heart rate (HR), heart rate recovery (HRR), rating of perceived exertion (RPE), and perceived recovery status (PRS) do have components that are influenced by psychological factors (Borg, 1973; Hassmen, 1990; Morgan, 1973; Pandolf, 1977; Watt & Grove, 1993). The response of HR can be influenced by pleasant and unpleasant emotional states (Abercrombie, Chambers, Greischar, & Monticelli, 2008). Abercrombie and colleagues (2008) found that HR deacceleration, or a change in beats per minute (BPM) was -4.71bpm in pleasant and -5.52 bpm in unpleasant emotional states as compared to -3.60 bpm with neutral emotional states. While HRR is used as predictive tool for cardiovascular mortality, the technique of using it as a predictor of emotional state is rather novel (Bunn et al., 2017). Bunn et al. (2017) assessed mood states before a submaximal exercise test and reported no significant difference between states

such as anger, depression, confusion, fatigue, and tension. Scholars (Carver, Coleman, & Glass, 1976; Morgan, 1973) investigated the idea that RPE can be influenced by psychological factors. RPE can be influenced by factors of personality and anxiety (Morgan, 1973). Carver, Coleman, and Glass (1976) explored RPE changes in oxygen consumption (VO_2) when comparing athletes of Type- A and Type-B personality traits. It was found that at the same VO_2, type- A reported lower RPE ratings than type- Bs. This finding suggests that psychological factors do contribute to RPE measurements.

The use of social media applications through mobile devices has increased opportunities for users to view content. Users are exposed to unlimited amounts of photos, videos, and posts that may motivate them to engage in social comparison, but on a quicker and more subconscious level. This behavior is similar to the technique of motivational priming. Motivational priming creates temporary activation states which influences a response to a subsequent stimulus (Bargh, 1990). The technique involves introducing a stimulus before participants are asked to complete a task (Bargh, 1990). Based on the type of priming (e.g. music/audio, video, and verbal), scholars can examine how the interaction between external information influences a person's perception and evaluations, motivations and behaviors (Bargh, 1990). Furthermore, introducing individuals to priming stimuli before completing a task can influence their behaviors in performance. However according to Loizou and Karageorghis (2015), priming has rarely been investigated in relation to exercise and motor tasks.

The purpose of this study was to use social comparison theory to investigate the impact that short workout videos have on HR, HRR, RPE, PRS and time to completion in HIFT athletes. It is hypothesized that:

1) The level of social comparison will differ between the video watching conditions.

2) HR, HRR, RPE, PRS, and time to completion will differ between the video watching conditions.

CHAPTER 2

METHODOLOGY

Purpose of the Study

The purpose of this study was to use social comparison theory to investigate the impact that short workout videos have on HR, HRR, RPE, PRS and time to completion in HIFT athletes.

Experimental overview

This study consisted of 33 HIFT athletes between the ages of 18-45 years old. Participants completed a modified HIFT workout called Barbara once a week on three occasions. Four videos of HIFT athletes completing modified Barbara were developed for this study: One male recreational athlete, one female recreational athlete, one male elite athlete, and one female elite athlete. Videos were used as a primer before exercise bouts within the workouts and were randomized between each data collection session. Each session contained one of three trials: baseline, recreational HIFT athlete video, or elite HIFT athlete video. In the baseline trial, video clips were not shown. In the video trials, participants were shown video clips before the first round of the workout and during the three-minute rest intervals. Once a round was completed and the rest interval started the following items were recorded: HR, HRR, RPE, PRS, and time to completion. HRR was calculated as the difference between HR taken five seconds following exercise and HR a minute after. At the end of each video condition, participants were prompted to complete the Iowa-Netherlands Comparison Orientation Scale (INCOM).

Participants

Thirty-three individuals who identified as HIFT athletes participated in this study (age: 30.45 years ± 6.59, height: 169.41cm ± 8.69, weight: 73.07 kg ± 13.65). The participants were

made up of 57.6% (n=19) female and 42.4% (n=14). Participants' had an average of 4.1 years ± 2.1 of HIFT experience. The inclusion criterion for this study included: adults ages 18-45, participated in HIFT training at least three days a week, and could complete 10 kipping, butterfly, or strict pull-ups in under a minute. Participants were excluded from this study if they did not have the mobility to squat below parallel when asked, did not have the ability to complete a push up while keeping core engaged through the whole movement, and had any injuries which limited them from completing the exercise protocol. Other criteria for this study included participants being able to commit to 3 consecutive weeks of testing.

Instrumentation

High-intensity functional training exercise protocol. A HIFT workout called *Barbara* was modified for this study. Barbara without modifications included 5 rounds of 20 pull- ups, 30 push-ups, 40 sit-ups, and 50 air- squats with three-minute rest intervals. Modified Barbara for this study included three rounds of 10 pull-ups, 15 push- ups, 20 sit- ups, and 25 air- squats with the three-minute rest for data collection purposes. The exercise repetitions were cut by half compared to full Barbara because high repetitions (700 total repetitions) were not repeatable weekly for all levels of athletes. Full Barbara time to completion ranges between 25-50 minutes (http://www.crossfit.com). The modifications, therefore, reduced the total repetitions to 210 and time of completion ranged between 10-20 minutes.

All movements were completed to HIFT standards (see Appendix C), and participants were provided with instructions and pictures of standards before their first testing session. Participants were verbally reminded of the standards before their second and third testing session. Pull-ups could be executed as strict, kipping, or butterfly. The pull-up started with arms fully extended, feet not touching the ground, and in a dead hang. The participant moved through

the motion from dead hang to chin over with the bar. The pull-up was completed once the chin was over the bar. Push-ups were executed by the athlete starting in a plank position on hands with arms locked out and toes touching the floor. The participant moved through the movement by lowering himself/herself down until their chest touched the ground and then pushing back up to the starting plank position. Push-ups were completed when the participant returned to the starting plank position. Sit-ups were executed using an ab-mat which was placed underneath the lower back. Legs were relaxed in a butterfly position with the soles of the feet pushed together and knees spread apart on the ground. The movement started in a seated position. The participant moved through a full range of motion by laying back on the ab-mat, reaching their hands over their head to touch the floor and then reaching their hands forward to a sitting up position and touching their toes. The movement was complete when the athlete touched his/her toes and was in a upright position. The air- squat was executed with the athlete standing tall with shoulders, hips, and knees aligned. The participant then flexed his/her knees to full range of motion with the hip-crease below parallel and then stood back to the starting position with the knees locked out. The repetition was completed when the athlete came back to standing.

Social comparison questionnaire. The Iowa-Netherlands Comparison Orientation Scale (INCOM) scale (Gibbons & Buunk, 1999) contained 11 items where participants were given statements about their social comparison practices based on a five-point scale ranging from strongly disagree to strongly agree. The INCOM has been established as valid and reliable (Cronbach's $\alpha = .90$) in the United States and the Netherlands (Gibbons & Buunk, 1999). The categories of the 11 items referenced: making comparisons with loved ones; paying attention to one's own and others' accomplishments, evaluating accomplishments through comparison, comparing sociability, not comparing or denying comparison to others; comparing life

accomplishments, exchanging opinions and experiences with others, interest in similar people's thoughts, interest in similar other's comping strategies, gaining knowledge through others thoughts, and lastly, making no comparison of personal life situation (Gibbons & Buunk, 1999). For the purpose of this study, items 4, 8, and 10 were discarded due to low reliability (Cronbach's $\alpha = .72$). The INCOM questionnaire can be scored either as one construct or separated into two constructs. Items 1-6 were designed to assess the construct of 'ability' and items 7-11 were designed to assess the construct of opinion. The INCOM is based on a Likert scale that is scored by using a mean factor score. A higher score than the mean represents individuals with a general tendency to use social comparisons, while a lower score suggests the opposite (Gibbons & Bunnk, 1999). For the full questionnaire, see Appendix B.

Heart rate and heart rate recovery. Heart rate (HR) was taken using the Polar Heart Rate monitor and watch. To calibrate and activate the monitor, the watch was synched before each use. Participants' HRs were taken seven times during each testing: before starting the exercise, two times during both rest periods, and twice at the conclusion of the workout. Initial HR values were taken before exercise with the participant at rest for one minute. HR was taken again five seconds after each round and another measurement taken a minute after the previous time. Heart rate recovery (HRR) was calculated by the change between HR 5 seconds after exercise and after the first minute of rest (Shetler al., 2001).

Rating of perceived exertion. Rating of perceived exertion (RPE) was taken using the Borg Rating of Perceived Exertion Scale to measure the participant's perceived intensity level following the completion of each bout (Borg, 1973). The participant was asked to rate their level of intensity with the scale that starts with level 6 being 'no exertion at all' to 7 being 'extremely light', 9 being 'very light', 11 being 'light', 13 being 'somewhat hard', 15 being 'hard', 17 being

‘very hard’, 19 with ‘extremely hard” and 20 being ‘maximal exertion’ (Borg, 1973). The 6-20 RPE scale has been shown to be valid and reliable in a variety of exercise types and settings including high intensity exercise (Borg, 1973; Lamb, Eston, & Corns, 1999; Skinner, Hutsler, Bergsteinova, & Buskirk, 1973) (see Appendix D for full chart).

Perceived recovery status scale. Perceived Recovery Status Scale (PRS) was used to determine how recovered the participant felt before starting the next round. PRS was asked during the rest to the participant before going into the next round. The scale starts with 0 “very poorly recovered”, 2 “not well recovered”, 4” somewhat recovered”, 5 “adequately recovered”. 6 “moderately recovered”, 8 “well recovered”, and 10 “very well recovered” (Laurent et al., 2011). Ranges 0-2 were related to declined performance, 4-6 were related to similar performance, and 8-10 were related to improved performance (Laurent et al., 2011). The PRS scale has been shown to be valid and reliable in a variety of exercise types and settings including high intensity exercise (Jones, Bishop, Richardson, & Smith, 2006; Laurent et al., 2011) (see Appendix E for full chart).

Elite and recreational athlete videos. The videos used in this experiment were created by volunteers. The volunteers were asked to complete modified Barbara with three-minute rest and to stay in the camera frame the entire time. The background music was to be kept to a minimum or no music was used which was similar to participants’ gym environments.

The male and female volunteers identified as elite athletes because they were ranked in the top 5% in the world based on the Open which is a HIFT worldwide competition. The male volunteer has participated in HIFT regional events (3), HIFT games, which is also a worldwide competition (1), and the female participant finished the Open top 100 in the region for three years and top 50 in the last year. Both athletes have qualified for the HIFT sanctioned event

called Wodapalooza going in ranked in the top 10 out of 60 competitors. In the video of these athletes, all movements were unbroken, and the athletes had strategy for the placement of equipment.

The male and female volunteers that identified as recreational athletes were individuals who have been doing HIFT style workouts for at least three years. The volunteers completed the Open and ranked in the top 50% of the world. The volunteers both were able to complete pull-ups but had to take small breaks between some repetitions. The recreational athletes did not have a strategy for equipment placement and had to stop or slow down their pace to complete the workout.

The videos were uploaded on YouTube where participants could see the timestamp of how long athletes worked and how long various movements took to complete. Instead of showing the participants the whole video at the beginning of the session, participants were shown the bout they were about to do before performing the movements.

Experimental Design and Procedures

The study was approved by the IRB at Georgia Southern University before the start of data collection. Participants were recruited from local HIFT gyms through fliers and social media posts. The methods of the study were explained, and the participants completed an informed consent form in accordance to IRB requirements. The experiment was made up of three different trials including a baseline and two video conditions using the elite and recreational athlete videos described earlier. Each condition was randomized, counter-balanced, and tested once a week for three weeks.

For the baseline condition, participants were fitted with a Polar heart rate monitor and taught how to use on the Borg RPE scale and PRS scale. Points of performance for each exercise

were reviewed as well. Initial HR was recorded while the athlete was at rest. Then, a clock was started for a 10 second countdown to begin the workout. As the participant moved through the workout, repetitions were counted by the research team. If they did not adhere to the HIFT movement standards (Appendix C), the repetition was not counted and needed to be completed again. Five seconds after the completion of the first round, HR1 was taken. During the rest period, HR2 was take at the 1:05 mark along with RPE. PRS was at the 2:45 mark. The participant was given a 10 second countdown at the 2:50 mark to signal when to start. This was repeated for three total rounds and time to completion was taken for each round and the overall time it took for the participant to finish the workout.

For video trials, the participants were shown the elite or recreational video as they were randomized for each condition. Once fitted with the Polar heart rate monitor, participants were reminded on how to use the Borg RPE scale, PRS scale, and points of performance for each exercise. The participants were instructed to watch the video of an athlete completing the same bout. For example, when the participant was going into round one of their workout the researcher showed the video of round one of the athlete's video. When given the 10 second countdown, the same data collection procedures for the baseline condition was completed. Once the entire workout was completed, the participant completed the INCOM questionnaire in reference to their HIFT experience during the workout. This same procedure was completed for both the elite and recreational videos.

Statistical Analysis

Statistical Package for Social Sciences (SPSS) software version (23.0) was used to analyze all measurements. Descriptive statistics were run to determine the means and standard deviations for all data. For measurements of HR, HRR, RPE, PRS, and time to competition total

means, an alpha level of .05 was used during examination. HR, HRR, RPE, PRS, and time to completion were also examined between each round utilizing an alpha level of .002 using a Bonferroni correction. The data was checked for normality through a Shapiro-Wilks test and for skewness and kurtosis. Next, the data was scanned for any outliers or errors and the homogeneity of variance was checked through a Levene's test. For time to completion and RPE, a Greenhouse-Geisser correction was applied due to a violation of sphericity. Reliability analyses were run on the INCOM scale using Cronbach's alpha. The INCOM was analyzed as a single construct. In order to determine if there were significant differences between the INCOM scores for elite and recreational conditions, a dependent t-test was run. To determine significant differences between HR, HRR, RPE, PRS, and time to completion for baseline (no video) and video conditions, a repeated measures ANOVA was for total averages and between round data. ANOVAs were followed with a polynomial contrast to determine where significant different were present. Effect sizes for each comparison were calculated using Cohen's d for the dependent t-test and partial eta squared for the ANOVAs. For Cohen's d, a small effect size was d= 0.2, medium effect size was d=0.5, and a large effect size was d=0.8. For partial eta squared, a small effect size was $\eta^2 = 0.2$, medium effect size was $\eta^2 = 0.13$, and a large effect size was $\eta^2 = 0.26$.

CHAPTER 3

RESULTS

Elite and Recreational Video Conditions

For the video condition, a dependent t-test confirmed that there was a significant difference in levels of social comparison depending on the type of video watched ($t = 2.08$, $p = .046$). It was found that when participants watched videos of the elite HIFT athlete ($3.68 \pm .62$), they experienced higher levels of social comparison on the INCOM scale than when they watched the recreational HIFT athlete ($3.46 \pm .66$). The findings indicated a small effect size (Cohen's $d = 0.34$) between the level of social comparison between the elite and recreational video.

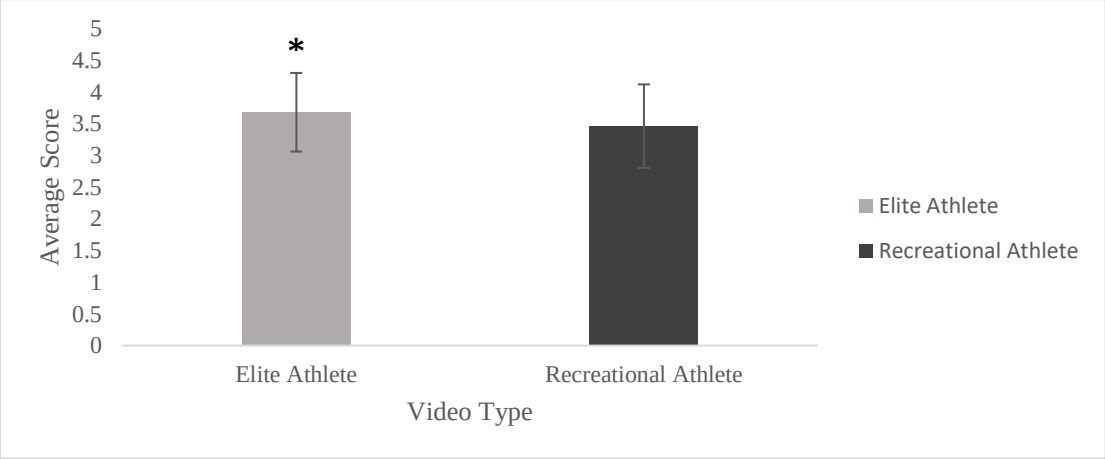

Figure 1: Average INCOM questionnare scores with standard deviations for Elite and Recreational athlete video. Significance is denoted by an asterisk (*).

Heart Rate

Using a repeated measures ANOVA, no significant differences in HR were revealed based on type of video watched ($\lambda = .91$, $F (2, 31) = 1.57$, $p = .22$). The mean values across included the

baseline (129.94 bpm ±13.5), elite HIFT athlete video (126.56 bpm ± 8.44), and recreational HIFT athlete video (127.13 bpm ± 8.10). The HR did not significantly change based on the video watched. There were no significant differences between HR between rounds for each condition.

Heart Rate Recovery

To examine differences in HRR, a repeated measures ANOVA revealed no significant differences based on type of video watched ($\lambda = .88$, $F(2, 31) = 2.14$, $p = .14$). Mean values across included the baseline condition (26.65 bpm ± 9.53), elite HIFT athlete video (29.65 bpm ± 14.21), and recreational HIFT athlete video (30.37 bpm ± 10.27). There were no significant differences between HRR between rounds for each condition.

Perceived Recovery Status

A repeated measures ANOVA revealed no significant differences in PRS based on type of video watched ($\lambda = .97$, $F(2, 31) = .44$, $p = .65$). Mean values across the baseline (6.04 ±1.81), elite HIFT athlete video (5.89 ± 1.71), and recreational HIFT athlete video (5.81± 1.40). There were no significant differences between PRS between rounds for each condition.

Time to Completion

A repeated measures ANOVA with polynomial contrast revealed a significant difference in TTC based on type of video watched ($\lambda = .59$, $F(2, 31) = 11.01$, $p < .001$). There was found to be a large effect size ($\eta^2 = .42$) based on video watched. Once applying a Greenhouse-Geisser adjustment, tests of within-subjects effects showed significance as well ($F(1.36) = 5.60$, $p = .014$). After the adjustment, a large effect size ($\eta^2 = .15$) remained. Among participants, mean values were significantly different between baseline (11.64 mins ± 1.38) and the elite HIFT athlete video (11.15 mins ±1.28, $F(1) = 7.37$, $p = .011$). A large effect size ($\eta^2 = .19$) was shown between baseline and the elite video. Significant differences were also observed between

baseline and the recreational HIFT athlete video (11.25 mins ± 1.22, F (1) = 20.27, p < .001). There was found to be a large effect size (η^2= .39). No significant differences were found between the elite HIFT athlete video and the recreational HIFT athlete video. Between rounds, after a Greenhouse-Geisser adjustment, a repeated measures ANOVA with polynomial contrast revealed significant differences in TTC in round 2 of the workout (λ = .69, F (1.5) = 11.01, p = .000). There was a large effect size (η^2 = .256).

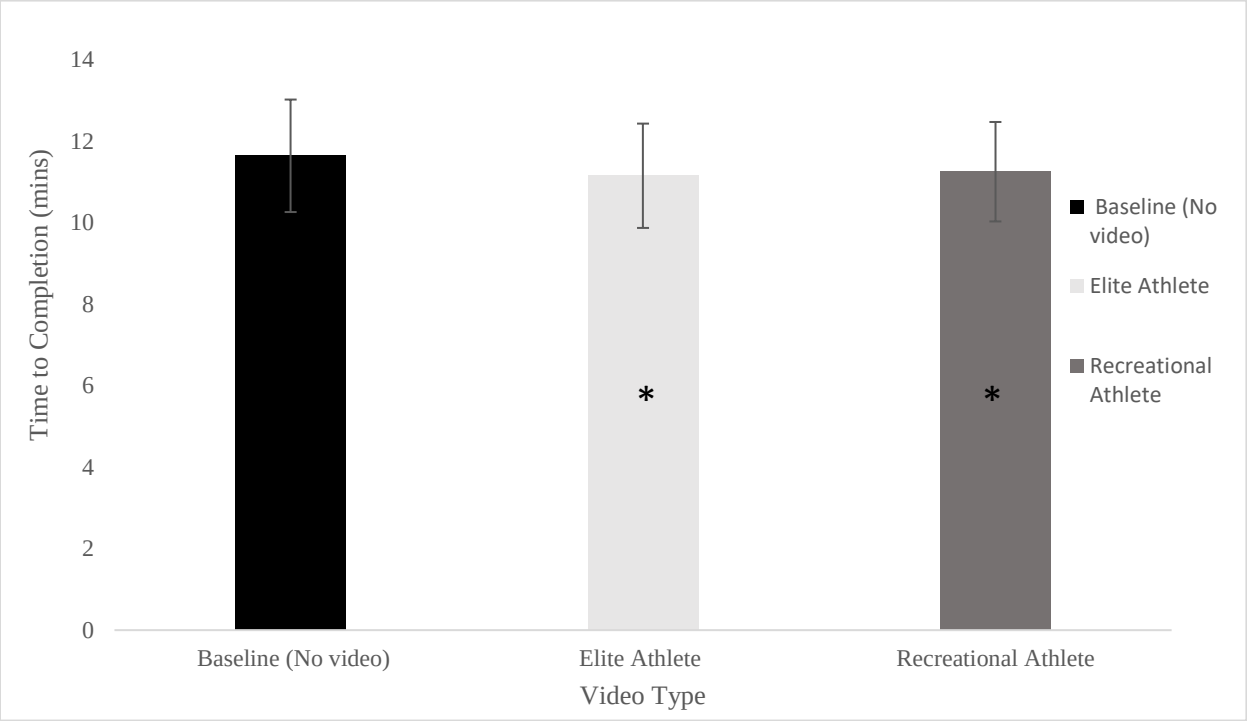

Figure 2: Average time to completion and standard deviations for baseline, elite, and recreational athlete video condition. Significance is noted using an asterisk *.

Rating of Perceived Exertion

A repeated measures ANOVA revealed significant differences in RPE based on type of video watched (λ = .77, F (2, 31) = 4.52, p = .019). Before correction, a large effect size (η=.23) was shown based on type of video watched. After applying a Greenhouse-Geisser adjustment, tests of within-subjects effects showed significance as well (F (1.66) = 4.39, p = .023) and there

was found to be a medium effect size (η^2 = .12). Among participants, mean values were significantly different between baseline (14.41 RPE ± 1.84) and the elite HIFT athlete video (15.21 RPE ± 1.90, F = 21.01, p = .005). Additionally, there was found to be a large effect size (η^2 = .22) between the baseline and elite video RPE. No significant differences were observed between baseline and the recreational HIFT athlete video (15.08 RPE ± 2.00).

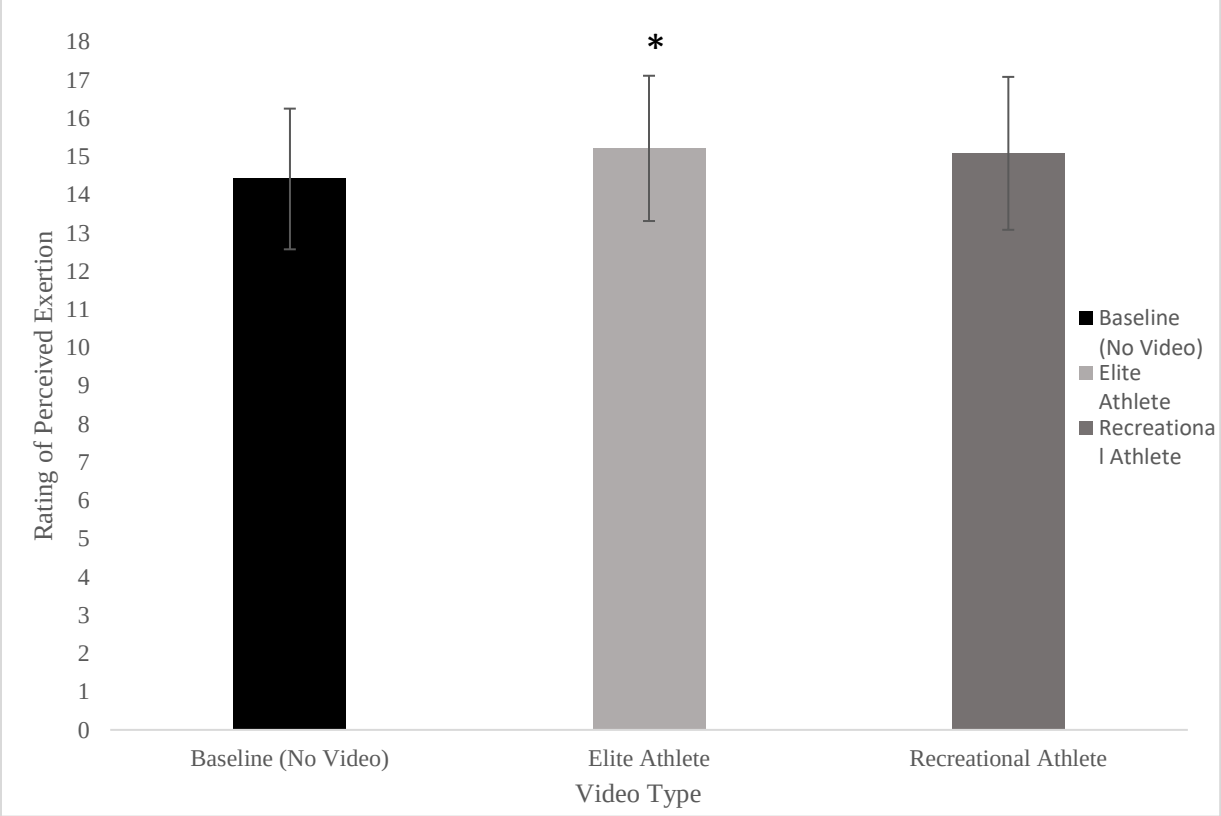

Figure 3: Rating of perceived exertion means and standard deviations for each video condition are shown here. Significance is denoted by an asterisk

CHAPTER 4

DISCUSSION

The present study used social comparison theory to investigate the impact that short workout videos have on heart rate (HR), heart rate recovery (HRR), rating of perceived exertion (RPE), perceived recovery status (PRS), and time to completion in HIFT athletes. The hypotheses for this study were partially supported. Hypothesis 1 stated: the level of social comparison will differ between the video watching conditions. The findings indicated that the level of social comparison did increase when participants watched the elite HIFT athlete video. Hypothesis 2 stated: HR, HRR, RPE, PRS, and time to completion will differ between the video watching conditions. This prediction was partially supported with measurements of RPE showing a change when participants viewed the elite HIFT athlete video and time to completion decreasing for the elite and recreational HIFT athlete video. Time to completion also showed a decrease in round 2 of the exercise protocol when participants watched the recreational HIFT athlete video as well. The findings provide a look at the specific exercise variables that are affected by video stimuli.

The findings supported hypothesis one as participants exhibited higher levels of social comparison when they watched the elite HIFT athlete video before executing the workout. This finding is consistent with Tiggeman and Polivv's (2010) research with college-aged female participants that when shown idealized body image content, social comparison levels increased. Festinger (1954) argued that people evaluate their abilities by comparisons with those who are not too divergent from themselves. As the participants watched the unbroken movements of elite athletes who strategized their set-up, participants began comparing their own movements and set-up to the higher standard. Social comparison has been evaluated by Mussweiler et al., (2004)

in reference to athlete ability using college students. The students were primed with a low and high standard of athletic ability using images before being asked to evaluate their own athletic ability. The findings of the investigation concluded that participants evaluated their athletic ability after the priming task to be higher when being exposed to the high standard of athletic ability. Furthermore, in this investigation, social comparison levels were higher for the elite video, but the practical significance suggests that participants used social comparisons regardless of what video was watched.

Another major finding of this study partially supported the second hypothesis with changes in RPE. The changes in RPE seen in this investigation are consistent with previous investigations completed by Barwood et al., (2009) who used priming on high-intensity athletes during high-intensity exercise bouts and found participants working at higher intensities. Another investigation by Hall, Ekkekakis and Petruzzello (2005) using college students asked participants to complete a 15-minute treadmill test using varying intensities of 20% below, at, and 10% of maximal oxygen uptake ($VO_{2\ max)}$ ventilatory threshold. The participants used in the investigation rated their RPE to be higher when exercising at higher levels of $VO_{2\ max.}$ The results of their investigation determined that the relationship between RPE and psychological variables decreases with exercise intensity. In the current investigation, RPE increased due to participants engaging in social comparison and working harder by either avoiding poor performance or performing at a higher level. However, since the intensity of the exercise was high, any psychological factors that affect exercise were attenuated. The participant working harder would in turn increase RPE due to increased perception of effort due to central and local fatigue.

The most pivotal finding in this investigation was that participants took less time to complete the workout when they watched both videos when compared to the baseline. These

findings are consistent with Magaraggia et al. (2014) who used college students to complete a motivational priming task before a submaximal exercise test. Their findings indicated that the motivational priming task made their participants reach for more ambitious exercise goals. In relation to this present investigation, the video conditions that the participants watched pushed them to higher goals or standards for their performance shortening the time it took for them to finish overall and between rounds.

There were many limitations within this study. First, participants were not restricted from testing if they exercised or had caffeine 24 hours prior to testing. Therefore, some participants did workout within the 24-hour window and some participants did have caffeine within the 24-hour window. Second, there was a limitation with collecting HR before the first workout. There was no standardized warm-up, so some participants had a complex warm-up and started with a higher initial HR while others who had less of a warmup and had a lower initial HR. Third, some participants were not focused on each bout of the video the entire time; this was only observed in the recreational videos. This could have impacted the social comparison being made. Third, the questionnaires used in this study were not developed by the research team and some items were difficult for participants to answer in the context of the video and workout completed. Fourth, there was a limitation in sample size and demographics. Due to HIFT gyms having expensive membership dues (Waryasz, Suric, Daniels, Gil, & Eberson, 2016), the population used in this study would more likely come from middle to upper classes households. Additionally, the HIFT membership ages range from 24-34 years old (Waryasz, Suric, Daniels, Gil, & Eberson, 2016). Due to these limited demographics, there was limitation in who participated in the study.

Future research would include a qualitative component. This would be significant to the study as participants made various comments about movements, strategies and technique while

watching the videos. As participants were surprised by the speed and fluidity of the elite athlete's movements, there were numerous comments comparing the person on the video's performance which created a standard. Further, participants discussed butterfly pull-ups being the most advanced movement and wanting to try to learn to do the movement. In contrast to these standards, participants questioned the recreational athletes' depths in squats. Lastly, participants compared their pull-ups and repetition scheme to the recreational athlete and at times found similarities between themselves and the standard on the video. Less common statements used included downgrading the athlete's ability and saying they did not perform the workout very well. Some participants mentioned that they would probably do the workout movements better than the videos presented to them.

There are various directions in which this study could go in the future. First, the study could focus on specific SMS like Facebook, Instagram, or similar platforms and investigating the effect on exercise variables. Second, the intensity of exercise could be manipulated to examine changes in exercise variables across time. Third, the study could utilize pre-screening questions about social media usage to determine the participants level of social media involvement and familiarity. Fourth a questionnaire specific to this study encompassing social comparison and social media usage would provide a deeper understanding of how, why, and when people compare themselves to others. The questionnaire would need to include deeper qualitative investigations into this study and similar studies may be helpful in determining what factors participants focus on when viewing SMS content. Understanding more about SMS usage and its effect on athletes may help trainers and coaches develop practices that work to optimize performance and limit distraction.

In conclusion, the findings of this study showed that social comparison levels were higher when participants watched elite athletes complete the same workout as they were given. Measurements of RPE also increased when participants were completing the workout after watching the elite video condition. Lastly, time to completion in the recreational and elite video conditions were shorter with athletes working harder in round two of the workout. Ultimately, social comparison during exercise is possible, but understanding its effects is more difficult under high-intensity exercise conditions.

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APPENDIX A

LITERATURE REVIEW

Growth and Impact of Social Media

Social media is defined as a group of internet-based applications that build on creation and exchange of user generated content (Kaplan & Haenlein, 2010). Social media allows people to interact with other users and is consumed in a variety of ways: individuals use it for personal use, companies use it to advertise and communicate with consumers, and various communities use it to communicate about their group identities and interests (Siapera, 2017). Social media has become an integral part of modern society for over 86% of adults in the United States between the ages of 18-29 (Perrin, 2015). Since its conception in the 1990s, social media has surpassed traditional media in popularity. As traditional media represents various forms of print (e.g. magazines, newspapers, flyers, and newsletters), social media is more accessible because information is shared electronically through internet platforms and applications (Kietzmann, Hermkens, McMarthy, & Silvestre, 2011). Instead of professionals working for mainstream media outlets producing information or news that is often delayed due to press release times, through social media, news and media can be created and shared immediately within the platform (Lassen, 2006). Websites, platforms and applications are collectively referred to as social media sites (SMS) which have a number of benefits. These benefits include: users creating personal profiles which may be short or extensive; users can create and share content (Filo, Lock, & Karg, 2014); users can update followers about their personal interests, successes, whereabouts, and well-being, through posts, pictures, and videos (Burke, Marlow, & Lento, 2010); users can create, join, and/or develop virtual groups or relationships with other users (Ellison, Steinfield, & Lampe, 2011); and lastly, users can follow and interact with other users

who have similar interests to gain advice, support, and share perspectives (Burke, Kraut, & Marlow, 2011). SMS are websites and mobile applications like Facebook, Twitter, Instagram, and YouTube. Each of these applications function differently, and their platforms are diverse as they target various demographics of users (Couldry, 2012).

Categories and Types of SMS Platforms

The following section provides the history, description, and functions of the various SMS applications. There are various types of SMS that operate differently from one another to carry information to their intended audiences. For example, some platforms can only fully function on mobile devices while others fully function on mobile applications and websites. Users are encouraged to interact with their personal and virtual networks within the platform and take advantage of each ones unique features (Kietzmann, Hermkens, McMarthy, & Silvestre, 2011).

Facebook fully functions as a social media website and mobile application. It was developed in 2003 under the name FaceMash with the intention to allow users to compare two female Harvard students to one another to rank the women's attractiveness (Brugger, 2015). In 2004, the name was changed to Facebook and the founder's new mission was to create a universal website to connect people around the university (Nadkarni & Hofmann, 2012). Later that year, Facebook opened to other universities in the United States and in 2005, expanded to universities in the United Kingdom (Wan, Kumar, & Bukhari, 2008). The popularity of Facebook and students' abilities to network with other people drew the attention of numerous universities, businesses, and high schools, and therefore, in 2006, Facebook went public allowing membership for anyone over the age of 13 (Hargittai, Schulta, & Palfrey , 2011). Since its inception, the platform has evolved to allow users to provide an extensive personal profile, upload single photos or albums, join public or private interest groups, interact with businesses

and professional entertainers, share and read local, national and international news, and so much more. In other words, the platform is used for users to share details and interests in their personal lives through status updates, creation of groups, location check-ins, photo sharing, and full-length videos. People that use Facebook typically are students, athletes, musicians, and businesses (Yang, 2012).

Twitter was created in 2006 as a microblogging site (Kwak, Lee, Park, & Moon, 2010). The typical layout for a user's profile included a photo and two to three lines of text that could be used to describe the user and profile (Hutto, Yardi, & Gilbert, 2013). The original purpose was to follow and track the activities of friends and famous people (Kwak, Lee, Park, & Moon, 2010) through tweets. Tweets are posts that were 140-characters or less where users shared thoughts, activities, and news (Hambrick, Simmons, Greenhalgh, & Greenwell, 2010). Recently, Twitter's format has evolved and doubled the character limit used in tweets to 280 characters along with photo, videos, and links (Gligoric, Anderson, & West, 2018). Twitter uses a condensed format and allows small glimpses into the user's perspective favoring smaller text updates (Hambrick, Simmons, Greenhalgh, & Greenwell, 2010). This allows people to read the headlines of news articles and click on a link for a longer story or get quick glimpses of popular stories or interactions. Due to its condensed format, Twitter attracts individuals who are focused on sharing short content with high impact (Gligoric, Anderson, & West, 2018). This makes it a popular platform for athletes, celebrities, and public figures (Gligoric, Anderson, & West, 2018).

Instagram emerged in 2010 to allow users to post photo content with small captions. (Hu, Manikonda, & Kambhampati, 2014). When looking at an Instagram profile, there is a short section that users can edit with descriptions that tell about their interests or profile content. The photos uploaded on the profile can be edited with various filters and lighting by users in order to

personalize their content (Hu, Manikonda, & Kambhampati, 2014). Users' profiles can be public or private. Users can *follow* other users which means having access to their profile and getting updates when changes have been made (Cheung & Ting, 2014). When a user has a private profile, others have to request to be a follower. Interactions occur by looking at photos and commenting below or clicking a button that shows the user likes the content. All the content users follow makes up a newsfeed. In 2013, the platform evolved to allow users to post 15-second video content that later was extended to 60 seconds (Smith & Sanderson, 2014). In 2015, Instagram added the messaging feature so users could interact privately with other users (Smith & Sanderson, 2014). The photo and video content is appealing to users as nothing has to be read to understand the content of what has been posted. People that use Instagram are typically more focused on photographic content and include models, artists, athletes and businesses (Lee, Lee, Moon, & Sung, 2015).

Twitter and Instagram took full advantage of using hashtags (#) to organize users' photos and push their content to a larger audience (Hu, Manikonda, & Kambhampati, 2014). The hashtags served as markers for ideas, emotions, locations, and subjects featured in the image or video. The purpose of hashtags includes emphasizing a post, critiquing or passing judgment, expressing humor, identifying subjects, and bringing awareness to a cause (Daer, Hoffman, & Goodman, 2014). Hashtags were like searchable keywords to help users seek out and follow a group of images that matched their interests (Hambrick, Simmons, Greenhalgh, & Greenwell, 2010). If a user wanted to implement a hashtag into their content, they would go to the comment section of a post and use the # symbol followed by the word or phrase of their choosing to categorize the post.

YouTube was created in 2005 (Burgess & Green, 2018). The original purpose was to create a simple and easy way to share videos on the internet (Burgess & Green, 2018). YouTube enabled people to upload, publish, view, and stream videos using standard equipment such as a camcorder and internet browser (Burgess & Green, 2018). Users were able to upload an unlimited amount of video and connect with other users to circulate content (Burgess & Green, 2018). Users profiles are known as an individual's YouTube channel. On the channels, users provide video of content which they created or shared. Users can subscribe to one another's channel based on their interests and hobbies. The content generated by these users include a variety of categories like sports, music, comedy, and lifestyle channels. YouTube differs from the other SMS as it was always created to share content outside of the website as videos can be shared on other platforms and even through other networking systems like email by providing the HTML codes (Burgess & Green, 2018).

Social media not only provides connections within the application, but also through links to other applications. For example, Facebook users can take links of content seen on YouTube to share them on their Facebook newsfeed. This cross-platform sharing, also called platform-swinging, helps users spread their content and bring in new users to a platform (Tandoc, Lou, & Min, 2018). More than 56% of adult social media users participant in more than one platform (Greenwood, Perrin, & Duggan, 2016). The mobilization of social media applications like those described above has made it easier for users to switch between accounts and view continuous content on their viewing devices (Naeem, 2019). The linkage between multiple platforms increases the size of networks (Madianou, 2015).

Active vs. Passive Usage of Social Media

The phenomenon of social media is that it was the first of its kind to enable people to be interactive and provide an environment for two-way communication. Yet despite such environment, users are not always active and instead can be passive users. In this section, I will provide a brief overview of how users can actively and/or passively participate in social media platforms.

Active participation is when users share content, comment or click the like button (or some form of recognition that the post was observed) (Pagani, Hofacker, & Goldsmith, 2011). Active participation can generate discussion, content, and approval or disapproval about content (Pagani, Hofacker, & Goldsmith, 2011). The interactions increase social capital and influence between users and followers (Pagani, Hofacker, & Goldsmith, 2011). Further, the interaction has the ability to reach beyond user's network to gain traction and attention in another group of users (Pagani, Hofacker, & Goldsmith, 2011). For example, in sport and fitness, users may comment on another athlete's content about various topics including their progress, training, and even to congratulate them on a recent achievement (Kovacs & Doczi, 2019). These comments can be seen by other users who may contribute to the conversation sharing similar perspectives, tips, and experiences while participating in similar training (Kovacs & Doczi,2019). Not only is the user who posted the original content participating in active usage, but also other users comment, share, and discuss topics. Together, the overlap of posting and commenting pushes content to become more visible outside of their created or joined social network within the SMS (Brennan & Croft, 2012).

Passive participation, also referred to as *lurking*, is a behavior in which the user refrains from posting, liking, following, or commenting on other users' posts (Pagani, Hofacker, &

Goldsmith, 2011). Passive users keep levels of engagement low while observing posts and comments by other users (Burke, Marlow, & Lento, 2010). Due to conservative social media interaction, passive users do not actively contribute to discussions (Nechaev, Corcoglioniti, & Giuliano, 2017). Without engagement, passive participation also does not push content around social networks to reach new followers (Nechaev, Corcoglioniti, & Giuliano, 2017). As social media usage on portable devices is more widespread, passive participation of SMS becomes easier because users are able to pick up their devices and scroll through content regardless of location and time without interacting with the content (Shaw, Timpano, Tran, & Joormann, 2015).

Social Media and Sport Media

The sport and fitness industry has benefited from SMS and Web 2.0 as they enhance the way sport and fitness media can be consumed and delivered (Hutchins & Rowe, 2012). Instead of viewing televised sports traditionally, users have shifted their habits to utilize handhelf tablets and smartphones. These actions indicate the shift in social media consumption increasing second screen behaviors (de Zuniga, Garcia-Perdomo, & McGregor, 2015). Second screen behaviors provide viewers with more opportunities to use social media sites to comment and share opinions with others who share the same interests (Cunningham & Eastin, 2017). Social media has been called a *disruptive innovation* in sport as it has changed the outdated single medium framework of sport consumption like TV and print media to one that enables fans and viewers to participate and spread media (Pegoraro, 2013). Van Belleghem (2011) described the communications between fans as the *water cooler effect* with spikes in social media activity happening between breaks and events that were televised. Fans can discuss favorite athlete performance or seek opinions about the event from other users. Goel (2015) conducted an investigation using Twitter

and reported that the number of tweets posted by a viewer correlated closely with engagement in the sporting event being viewed. The use of social media to engage in discussion between fans has prompted athletes and sporting networks to rethink strategies and to generate revenue.

SMS serve as a way for sport networks and athletes to generate potential fans without spending an exorbitant amount of money (Smith, Ditizio, & Clinton, 2019). Due to SMS creating an online environment that embraces communication and collaboration between fans, companies and athletes can spread news and content cheaply with little footwork (Mohammadkazemi, 2015). Athletes may use social media to increase their following by communicating directly with their audience (Fisher, 2009). Individual athletes, like those seen in the HIFT Games, interact with their followers by providing information about their training, nutrition, personal lives, and/or achievements. Witkemper (2012) found that an athlete's Twitter content and fan interaction was the most important motivator to fans for continued consumption of second screen media. The social networks created through online interactions are important as users discuss favorite athletes, movements and workouts, or even a personal fitness journey inspired by other athletes. In other words, as SMS allows users to track their fitness progress, document their workouts, check into gym locations, and document their nutrition, it also allows for everything to be shared and discussed with the online communities

High-Intensity Functional Fitness and SMS

The growth of popularity in HIFT workouts is credited to interactions on various social media platforms. From its conception, HIFT developers used an open sourced fitness format with participants virtually collaborating in workouts, results, and movements to develop a fitness paradigm (Glassman, 2007). Glassman (2007), credited for the development of HIFT style workouts, shared workouts on a common website for athletes to complete. The website went on

to offer demonstrations and discussion amongst the community (Herz, 2014). The information from these web-based networks trickled down to the gym culture. HIFT athletes could view content posted online to learn the movements featured in a workout and have the opportunity to complete the workout (Heywood, 2015). This information was available to anyone who followed the HIFT main website (Heywood, 2015).

As a fitness paradigm, HIFT routines are constantly varied, high-intensity, functional fitness (Glassman, 2007). The program aims to optimize ten fitness domains of: cardiovascular endurance, stamina, strength, flexibility, power, speed, coordination, agility, balance, and accuracy (Amos, 2006). HIFT programs combine movements from the following disciplines: Olympic Weightlifting, gymnastics, and cardiovascular activities (Claudino et al., 2018). The combination of movements in a workout are referred to as the workout of the day (WOD) (Claudino et al., 2018) HIFT workouts stress both the aerobic and anaerobic energy pathways (Amos, 2006). The HIFT philosophy is to be accessible for a diverse population because every movement can be modified for various fitness levels (Amos, 2006). For example, newer athletes who may not be able to complete a full pull-up can have the movement modified to either banded pull-ups, ring rows, or using a jumping pull-ups technique. The modification of movements for different fitness levels helps to ensure that the program is accessible for elite level athletes and beginners all in one class setting.

HIFT training facilities and group sessions have been described as an *immersive* (Heywood, 2015), high social form of exercise (Dawson, 2015). The immersive sense of community is due to the supportive communal atmosphere. Most gyms share the WOD on applications, websites, and SMS. Workout results are tracked using gym whiteboards and applications like Wodify (Powers & Greenwell, 2016). Gym members may photograph, record

and share pictures from the workout on social media (Powers & Greenwell, 2016). They also use their personal social media accounts to track progress and compare results. HIFT settings differ from traditional gym settings because members of different skill levels are working alongside one another. Further, members are encouraged to engage in friendly competition and cheer others on as they finish a workout. Some HIFT workouts can be completed in a group which foster a sense of teamwork through socialization, encouragement, and strategies to finish. Due to the setting and ways in which the workout results are tracked, comparisons are common. Athletes may want to move like another person (e.g. performing advanced level gymnastic movement, lifting heavier, running faster) or have results similar or better than another athlete (e.g. having a sub-3 minute Fran is shown as a good score). Not only will athletes see others' scores on the whiteboard, but during a workout, high performing athletes may become a target for others to beat by racing for a faster time or lifting a heavier weight.

Social Comparison

Social Comparison Theory is a social psychology theory developed by Festinger in 1954. The foundation of social comparison theory centered on the way individuals' process information in relation to their own social standing (Festinger, 1954). The direction of social comparison can also have an influence on how individuals rate their abilities. Social comparison influences self-perception, affective reactions, motivation, and behavior (Mussweiler, Ruter, & Epstude, 2004). Festinger (1954) suggested that, for individuals to evaluate their weaknesses, they do so by comparing their own characteristics, fortunes, and faults to those of others. Social comparison can be shown with HIFT athletes when they compare their accomplishments to other athletes on SMS to assess and validate their abilities. The information collected by the athlete

from their comparison can be used as a method to evaluate strengths or weaknesses based on another person's performance.

Social comparison theory examines how individuals rate themselves compared to others using upward, downward, and lateral comparisons (Mussweiler et al., 2004). Upward social comparison is when an individual compares themselves with a standard higher than their own ability. An example of upward comparison is when recreational HIFT athletes compare their ability levels to elite HIFT athletes. Downward social comparison, on the other hand, is characterized by individuals comparing themselves with a lower or inferior subjective standard. An example of downward comparison is when an intermediate level HIFT athlete who has been participating for three years may compare themselves to a beginner level athlete who is new to HIFT work out routines. Lastly, lateral social comparison is characterized by an individual comparing their abilities to someone that is similar in their level of proficiency. While early social comparison theory emphasized upward and downward social comparison, weak evidence was found on the influence of lateral comparisons.

The socially comparing oneself to others can serve as a tool for a variety of reasons. Festinger's (1954) Social Comparison Theory argues that people compare themselves to others to obtain an accurate self-view or what the individual may perceive as accurate. Each one of these comparisons can either serve a purpose for self-enhancement or assimilation which is described as the belief that one could obtain the same status as the target comparison. When using upward social comparisons users engage in a more positive thought process because they believe they can assimilate or become that standard (Wheeler & Suls, 2007). Further investigations into upward comparisons was completed by Lockwood and Kunda (1997) using college students who were asked to read a campus newspaper that described an over achieving

student. Once completed they were asked to give open ended rating of themselves and the student. It was found that the participants saw the over achieving student as a means of self-enhancement and a goal to aspire to reach. Downward social comparisons have been said to be employed when the user feels threatened to feel optimistic about their social standing. Bardel, Fontayne, Colombel, and Schipof (2010) completed an investigation using downward comparisons in tennis players and found that the positive evaluations the players had about themselves decreased when they lose to a player of inferior ranking. This was said to happen due to the tennis players loss being a confirmation of their ability. Further research into the use of upward and downward social comparisons and their use directly tied to sport is limited.

Scholars examined the psychological effects of viewing social media. Sherlock and Wagstaff (2018) examined women's psychological health in relation to video usage on Instagram. The participants indicated that the higher frequency of social media use correlated with negative emotions/mental states of depressive symptoms, self-esteem, and anxiety. Similarly, Stapleton, Luiz, and Chatwin (2017) examined the impact of exposure to social-media based social comparison in young adults aged 18-29 years. Participants reported that when self-worth is dependent on approval from others, users experience negative emotional outcomes due to comparing their abilities, looks, and qualities, to others. This research highlights the negative impact social comparison can have on social media user's mental health.

There are strong links between social comparison theory and behavior. Scholars continue to examine the positive and negative behaviors linked to social comparisons (Lyubomirsky & Ross, 1997; Lyubomirsky, Tucker, & Kasri, 2001; VanderZee, Buunk, & Sanderman, 1996). Social comparisons can be used for individuals as a coping mechanism, to manage negative emotion, or for self-enhancement (Diener and Fujita, 1997). Kleinke and Miller (1998) found a

linear relationship in college-aged participants between well-being and how much higher they rated themselves in relationship to their peers. Participants who felt like they measured up to their peers in college during a social comparison task, had a better sense of well-being. However, these positive influences in behavior are temporary and through more frequent social comparisons, negative emotional states like sadness and depression can arise (White, Langer, Yariv, & Welch, 2006). Swallow and Kuiper (1992) focused their research on participants in a depressed state and found that those individuals made more social comparisons than theirs peers resulting in a continuation of their negative emotional outcome. Giordano, Wood, and Michela (2000) argued that unhappy people make more frequent social comparison. Therefore, social comparisons can lead to destructive behaviors in groups of people who are already in a negative mental state (Swallow & Kuiper, 1992). These behaviors include lying to protect oneself, lying to protect others, unmet cravings, jealousy, defensiveness, and regret (Swallow & Kuiper, 1992). These destructive behaviors may provide short-term benefit to the offender but lead to a long-term cost (Tice & Baumeister, 1997) which can create short-term relief while reinforcing behavior of judging oneself against others (White et al., 2006).

As previously stated, HIFT environments normalize comparisons and competition and understanding the effect of them on the athlete is important. The comparisons may be harmful to athletes as they set standards for themselves based off another person's ability levels. Athletes encounter negative impacts of social comparisons and their mental states are also impacted. Additional destructive behaviors athletes may use is trying to avoid failure or being overly competitive (Wood, 1996). Athletes who observe or anticipate a poor performance (i.e., where the other athlete may be performing better than them) experience a social pressure to behave competitively to reduce the discrepancy between them (Garcia, Tor, & Schiff, 2013). For

example, seeing another HIFT athlete complete a movement better or faster may elicit a drive to push closer to their ability. Depending on if the athlete succeeds or fails, these social comparisons can weigh on self-esteem. Sonstroem (1997) found a positive change in self-esteem brought on through social comparisons when an athlete wins a game. For example, athletes who felt like the opponent was above their ability, found an increase in self-esteem when winning due to feeling more confident in their ability. Bardel (2010) investigated tennis players on the effects of social comparison and match result on sport state self-esteem changes. Bardel's (2010) findings suggest that social comparisons based on ability and performance results were variables that influenced perceived athletic competence.

Types of Motivational Stimuli in Exercise

In exercise, there are a variety of stimuli that can be used for influencing the mental and emotional state of an athlete. A stimulus is defined as an object or event that elicits a response (Skinner, 1959). There are multiple types of motivational stimuli: verbal, auditory, and video. Verbal motivation is based on words and speech. This can be done a variety of ways including chanting and cheering from the crowd or other participants. For example, Nato et al. (2015), used verbal phrases to encourage participants such as "Very well!", "Let's go!", and "You can do it!". Verbal encouragement is said to be an effective form of motivation due to its ability to foster learning, effort, and motivation (Andreacci et al., 2002). Verbal motivation can be in the form of cues from a coach or positive phrases from fans and the audience. Verbal encouragement stimulates the athlete's natural tendencies of engagement and psychological growth helping to increase perceived competence (Andreacci et al., 2002). For example, positive words of encouragement can confirm to the athlete their competency in the task. Verbal encouragement may also help to promote efficacy and the ability to achieve intrinsic motivation (Nato et al.,

2015). Amagliani, Peterella, and Jung (2010) found that while measuring peak muscle force using various types of encouragement conditions in college women, verbal encouragement was found to be an important factor in eliciting peak force from the participants during a knee extension task. However, Campenella, Mattacola, and Kimura (2000) found that verbal motivation was not effective in college students as it had no effect on their male or female participants during concentric peak torque of the quadriceps and hamstring. In reference to aerobic testing, Moffatt, Chitwood, and Biggerstaff (1994) found that during maximal exercise testing of competitive runners, verbal encouragement was shown to elicit an 8% to 18% increase in the time to exhaustion. Meaning, that the participants were able to delay fatigue and keep exercising.

Audio and musical motivational stimuli is another popular mode of stimulation due to its ability to be used in a variety of settings. Athletes and gym goers may listen to music during a workout or may use music before a workout to get *pumped* or *psyched up* (Bishop, Karageorghis, & Loizou, 2007). The ergogenic effects of music have also been investigated. Music may help an athlete synchronize motor and physiological responses during exercise. For example, elite runner, Heile Gebrselassie, reported that when exercising to high tempo music, especially if it was a hit song, helped him to optimize his pacing when winning a 5000m race (Simpson & Karageorghis, 2006).

Further, audio and musical stimuli can manipulate emotional responses (Bishop et al., 2007). Bishop and colleagues (2007) suggested that the right music can be a tool to enhance arousal, shift attentional focus, boost self-efficacy, and encourage psychological skill focus. When looking at high-intensity participants, music may be used to shift focus from exercise discomfort (Karageorghis & Terry, 1997). To encourage exercise behavior, music has been used

as a form of dissociative attentional stimuli to *dull* or dissociate from unpleasant exertion induced sensation (Brownley, McMurray, & Hackney, 1995). This *dulling* and dissociation may create room for psychological coping strategies and confidence improvement (Brownley et al., 1995). Specifically, for high-intensity athletes, Chow and Etnier (2017) found high-intensity athletes used more dissociated focus during the task when there was music.

Lastly, video motivation can also enhance sport performance in a variety of ways. Video motivation is often combined with music to enhance its effectiveness (Simpson & Karageorghis, 2006). Video footage of high-level athletes demonstrating mastery could manipulate the self-efficacy of an individual as part of a combined music and video intervention (Bishop & Forzoni, 2006). Forzoni (2006) suggested that music and video combination used as an intervention to motivate high-intensity athletes helped create positive feelings of confidence and bring back feelings of previous positive performances. Using music along with visual stimulation helps to further enhance the effect of video stimulation due to the idea that it stimulates areas of the brain for complete emotional processing (Baumgartner, Lutz, Schmidt, & Jancke, 2006). Yet it has been shown that music-only is superior to video-only stimuli during a low intensity cycle test (Nethery, 2002). In reference to peak force production during the cycle test, the video condition combined with verbal encouragement was the most successful in eliciting a response. However, there is a gap in research on video-only stimuli with HIFT athletes and the impact this priming method has on performance and social comparison.

Motivational Priming

Motivational priming is a technique that creates temporary activation states (Bargh, 1990). The technique involves introducing a stimulus before participants are asked to complete a task (Bargh, 1990). Based on the type of priming, scholars can examine how the interaction

between environmental information influences a person's perception, evaluations, motivations, and behaviors (Bargh, 1990). Individuals are unaware of their behaviors and perceptions which play a role in these types of processes and techniques. An often-used example is when images of soda are shown before a movie starts, which unconsciously persuades people to purchase a drink (Radford, 2007). However according to Loizou and Karageorghis (2015), priming has rarely been investigated in relation to exercise and motor tasks.

To illustrate the use of motivational stimuli in an exercise content, Magaraggia, Dimmock, and Jackson (2014) applied this principle during submaximal exercise. The test involved using motivational sentence priming with words. This means that participants were given a group of motivational phrases that were scrambled and out of order. Using the phrases of motivational words, participants who were primed with this material during this study displayed longer and more ambitious exercise goal times than the control group (Magaraggia et al., 2014). Music/audio motivational stimuli has also been introduced as a method of priming. Loizou and Karageorghis (2015) used music and video priming with high-intensity athletes prior to an anaerobic capacity test or Wingate test. They found that the music condition resulted in a significant increase in anaerobic performance than the control. Loizou, Karageorghis, and Bishop (2014) found that video-music priming within a high-intensity setting, increased positive exercise feelings of liking, arousal, and pleasure during the exercise bout. This conclusion supported the idea that psychological priming can be used to alter an athlete’s mental state prior to exercise. Barwood, Weston, Thelwell, and Page (2009) investigated priming during high-intensity exercise bouts and used music and video priming. The scholars found that this intervention did lead to the motivated group working at a higher intensity while RPE stayed the same; suggesting a shift in perception. This discovered link brings forth another concept of

measuring rating of perceived exertion RPE) and heart rate (HR). Both measurements can be influenced by psychological variables that could be manipulated by motivational priming. The applied significance of using motivational priming is the idea that SMS usage happens before an exercise bout and for a small amount of time. Further investigation is of the interest that SMS use may cause a psychological shift in RPE and HR.

Physiological and Psychological Measurements

Rating of perceived exertion (RPE) and perceived recovery status (PRS). Rating of Perceived Exertion (RPE) is the subjective measure of intensity, effort, strain, discomfort, and fatigue that is experienced during physical exercise (Robertson & Noble, 1997). The most common method of measuring RPE in adults is the use of the Borg 6- 20 followed by the Borg Category Ratio- 10 Scale (CR10) (Foster et al., 2001).The Borg RPE scale is used in exercise science primarily to monitor exercise intensity and help link the relationship between exercise intensity and the individual (Day, Mcguigan, Brice, & Foster, 2004). The Borg 6-20 scale has been known to be synonymous with heart rates (HR) between 60 to 200 beats per minute (bpm) (Koivula & Hassmen, 1998). With this understanding, changes can be made to the prescribed exercise intensity of aerobic or resistance training (Koivula & Hassmen, 1998).

While RPE has been used in different exercise settings, there are physiological and psychological factors that result in variation in ratings (Borg, 1973). Factors such as age, type of physical work performed, anxiety, cognitive style, and personality may influence rating (Borg, 1973; Hassmen, 1990; Morgan, 1973; Pandolf, 1977; Watt & Grove, 1993). The physiological factors make up about two thirds of variance in RPE while psychological factors may explain the remaining third (Morgan, 1973; Pandolf, & Cafarelli, 1973). The physiological basis of the RPE measurement is based on the individual considering sensations at the local and central level.

Local level of sensations is those experienced in the exercising muscle and joints while central sensations are those experienced by the cardiopulmonary system (Koivula & Hassmen, 1998). The individual must process this information concerning sensations from the local and central level to give an overall RPE. The sequence of processing this information and interpreting cues from different systems of the body could result in variations between RPE measurements depending on the individual's information-processing capacities.

Psychologically, RPE can be based on factors that deal with cognition like personality, motivation, and emotion. Personality traits like anxiety and depression influence RPE (Morgan, 1973). Morgan (1973) demonstrated that anxious and depressive individuals at moderate workloads (600 kpm) tend to underestimate RPE. Extroverts were found to under estimate RPE at heavy workloads (900-1500 kpm). Carver, Coleman, and Glass (1976) explored RPE changes in VO2 when comparing type-A and type- B athletes. It was found that at the same VO2, type- A reported lower RPE ratings than type- Bs. Motivational factors may also influence RPE. Weiner (1981) suggested that affective cues (emotional cues) are important precursors of cognition. Internal affective cues are those that are caused by personal emotion like anger or happiness. While external affective cues are caused by other individuals acting on the performer's RPE. Psychological factors that influence RPE have been researched, but there is still much left to be understood about emotional state, and personality traits.

Another measurement used to assess and monitor athlete status during and after an exercise bout is called Perceived Recovery Status (PRS). Similar to the basis of RPE, PRS is concerned with the athlete's perception of how they feel or think they feel. While the body of literature is limited in understanding the psychological influences of PRS, it is otherwise a valid measurement that is used physiologically during exercise much like resistance training (Sikorski

et al., 2013). PRS helps trainers and researchers monitor an athlete's recovery to determine if the training protocol is beneficial, to minimize and manage fatigue, and to quantify the sensations an athlete may feel (Sikorski et al., 2013). While PRS has been used in high-intensity exercise settings, it was applied to determine if it was a less invasive technique for measuring muscle recovery and damage during resistance training (Sikorski et al., 2013). Other investigations using PRS examined high-intensity exercise by correlation. Laurent et al. (2011) assessed athlete sprint time and PRS values. There was found to be a negative correlation between the two measurements, meaning as sprint time increased, PRS levels decreased (Laurent et al., 2011). The development and use of PRS is relatively new in relation to other measures such as RPE. Unlike similar measures such as RPE, the psychological influences that may influence the value has not yet been applied.

Heart rate (HR) and heart rate recovery (HRR). HR provides a noninvasive measure to predicting and monitoring cardiac activity. The increase in HR seen during exercise is caused by an increase in sympathetic innervation along with a decrease in parasympathetic drive (Tulumen et al., 2011). This results in an increase in stroke volume and cardiac output to supply the body and working muscles during exercise (Tulumen et al., 2011). Following exercise, the parasympathetic system sets the stage for recovery, slowing HR down back to baseline (Shetler et al., 2001). HRR can be defined as the difference between HR at peak exercise and HR taken one minute after a workout (Shetler et al., 2001). An abnormal heart rate recovery was defined as a reduction of 12 beats per minute or less from the heart rate at peak exercise to 1 minute after the cessation of exercise in a cool-down period (Cole, Blackstone, Pashkow, Snader, & Lauer,1999).

There are a variety of factors that can influence HRR. Some of these factors pertain to the exercise intensity and type (Daanen, Lamberts, Kallen, Jin, & Meeteren, 2012). Considering that HRR is measured after an exercise bout, high-intensity exercise may result in high heart rates that are more likely to create a larger decrease in heart rate after discontinuing the exercise (Daanen, Lamberts, Kallen, Jin, & Meeteren, 2012). The mode of exercise, whether it is endurance or resistance training also influences HRR. In endurance exercise, HRR yields higher values for running (32 ±14 bpm) then for cycling (27 ± 10) due to higher aerobic demands. Otsuki et al., (2007) observed that both strength (26.6%) and endurance-trained (29.8%) subjects showed HRR that was faster than the control.

Besides just the physiological influences of HR and HRR, these values can also be indicative of emotional state (Bunn et al., 2017). HR is a commonly used psychophysiological measure related to autonomic nervous system activity that is used in emotion research (Anttonen & Surakka, 2005). HR has thought to be able to discriminate between pleasant and unpleasant emotions (Anttonen & Surakka, 2005). It has been known to decelerate in response to visual and auditory emotional stimulation (Anttonen & Surakka, 2005). Unpleasant stimuli have been known to show a stronger deceleration in HR ($-.35$, $p < .01$) in individuals with higher mean HR (Abercrombie, Chambers, Greischar, & Monticelli, 2008). In response to pleasant pictures, there was also a stronger deceleration in HR ($-.30$, $p < .05$) in individuals with higher mean HR (Abercrombie, Chambers, Greischar, & Monticelli, 2008). These findings were also in line with the trend that Anttonen and Surakka (2005) found. The literature regarding HRR and emotional states is lacking. In a recent investigation completed by Bunn et al. (2017), there was no significance found in the prediction of HRR and several mood factors including anger, confusion, depression, fatigue, tension, and vigor after submaximal exercise. While it is said that

psychological stress and feelings of fatigue influence one's recovery by increasing sympathetic nervous system activity (Pronk, Crouse, & Rohack, 1995), the lack of significance was surpassing. Further investigations on this topic may be needed to determine a clearer link.

APPENDIX B

SCALE FOR SOCIAL COMPARISON ORIENTATION (INCOM, IOWA-NETHERLANDS COMPARISON ORIENTATION SCALE)

We would like to find out how often you compare yourself with other people during your HIFT workout experience. To do that, we would like to ask you to indicate how much you agree with each statement below by writing the numbered responses in the blanks next to each statement.

Response scale for all items:

1. I disagree strongly
2. I disagree
3. I neither agree nor disagree
4. I agree
5. I agree strongly

(Continue to next page for full questionnaire)

1. I often compare myself with others with respect to what I have accomplished in life	1	2	3	4	5
2. If I want to learn more about something, I try to find out what others think about it	1	2	3	4	5
3. I always pay a lot of attention to how I do things compared with how others do things	1	2	3	4	5
4. I often compare how my loved ones (boy or girlfriend, family members, etc.) are doing with how others are doing	1	2	3	4	5
5. I always like to know what others in a similar situation would do	1	2	3	4	5
6. I am not the type of person who compares often with others	1	2	3	4	5
7. If I want to find out how well I have done something, I compare what I have done with how others have done	1	2	3	4	5
8. I often try to find out what others think who face similar problems as I face	1	2	3	4	5
9. I often like to talk with others about mutual opinions and experiences	1	2	3	4	5
10. I never consider my situation in life relative to that of other people	1	2	3	4	5
11. I often compare how I am doing socially (e.g., social skills, popularity) with other people	1	2	3	4	5

APPENDIX C

HIFT MOVEMENT STANDARDS

Air Squat

Starting Position

- Knees and hips fully extended

Movement

- Hip crease must be below the knee crease

Finish Position

- Hips and knees fully extended

Push-up

Starting Position

- Arms extended

Movement

- Lower chest and thighs to the ground
- One full movement off the ground

Finish Position

- Complete at full arm extension

Abmat Sit-up

Starting Position

- Soles of the feet together
- Hands touch the ground behind head

Movement

- Complete with the shoulder above hips and spine extended

Finish Position

- Complete at full arm extension

Pull-Up

Starting Position

- Arms fully extended from dead hang on rig

Movement

- Pull body upwards toward the bar

Finish Position

- Complete when chin is higher than the bar

APPENDIX D

BORG RATING OF PERCEIVED EXERTION SCALE

Rating	Perceived Exertion
6	No exertion
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

Appendix E

Perceived Recovery Status Scale