THE EFFECTS OF MESSAGE FRAMING ON MOTIVATION AND PERFORMANCE IN CYCLISTS

A Thesis
by
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Abstract

THE EFFECTS OF MESSAGE FRAMING ON MOTIVATION AND PERFORMANCE IN CYCLISTS

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Self-determination theory (Deci & Ryan, 2000) posits that humans are growth-oriented organisms who seek out challenges and improve their capacities. The theory states that the provision of three basics needs (competence, autonomy and relatedness) will determine a person's motivation to pursue such challenges. The interaction between the athlete and coach can have a profound effect on athlete motivation and performance (Mageau & Vallerand, 2003). A coach can use either controlling or supportive message framing to convey information to the athlete that can affect the provision of basic needs and affect the athlete's motivation (Ryan, 1982). Cycling is a physically and mentally challenging sport that requires high amounts of self-determination to succeed. Cyclists often complete training on their own and communicate with a coach through an online platform. The wording of written messages while communicating online between athlete and coach can convey either controlling or supporting messages that can affect athlete motivation and performance. On the basis of self-determination theory, the purpose of this study was to determine whether either a controlling or supportive message given prior to a cycling ergometer test to exhaustion would alter perceived competence, perceived

autonomy, motivation and performance in a group of amateur cyclists (N = 11; Nine Male, Two Female; 43.6 ± 10.3 years). No significant differences were found in perceived competence, perceived autonomy, motivation or performance between supportive or controlling conditions. However, differences between the two groups when comparing separate bivariate correlations (pre-task competence valuation and post-task perceived competence ($r = -0.738$), controlling; perceived competence and perceived autonomy, supportive ($r = 0.666$); autonomous motivation and time-to-exhaustion ($r = -0.674$), controlling) do suggest that controlling or supportive message framing has a relationship to these variables. Future research is needed to determine the full effects of a written message on motivation and performance in athletes in a remote coaching setting. This avenue for research also may have implications for the general population while communicating remotely in an increasingly virtual world.

Acknowledgments

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Dedication

To mom and dad, my two best friends, who have given me their unending love and support.

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Introduction

Motivation is an important factor in sports performance, yet motivation changes drastically depending on the athlete's environment (Mageau & Vallerand, 2003). When an athlete perceives their environment to be supportive of their basic needs, they will have a higher level of intrinsic motivation. Higher levels of intrinsic motivation will often lead to better athletic performance (Mageau & Vallerand, 2003). The concept of Self-Determination Theory (SDT) postulates that the provision of the three basic needs (autonomy, competence, and relatedness) will determine one's motivation to pursue an activity (Deci & Ryan, 2000). Autonomy relates to one's perception of control over a situation, competence describes one's belief that they possess they skills necessary to succeed, and relatedness is one's sense of belonging within a community (Deci & Ryan, 2004).

A competent person believes that they possess the skills necessary to be successful in an activity. When competence is enhanced for a given activity, such as sport, motivation is also enhanced (Mageau & Vallerand, 2003). However, competence must also work congruently with autonomy in order to elicit intrinsic motivation (Fisher, 1978). Autonomy is supported when one feels in control of their actions and they view the activity as an expression of themselves (Deci & Ryan, 1985). When an individual feels controlled or pressured by the environment, autonomy will not be supported for that activity (Ryan, 1982). For an athlete, this would mean it is essential that a sporting environment provide both competence and autonomy for them to remain motivated to participate in their sport.

The athlete's interaction with those around them (peers, coaches, family) is one of the primary determinants of the athlete environment and thus has a profound effect on athlete motivation and regulation (Cho & Baek, 2020; Gagné, 2003; Gillet et al., 2010; Mageau &

Vallerand, 2003; Mertens et al., 2018). When interacting with others, the same information can be conveyed differently, which can have a positive or negative effect on an individual's perceived competence and autonomy. This concept is known as message framing. (Reeve & Deci, 1996; Reynolds, 2006; Ryan, 1982; Vansteenkiste et al., 2005). The idea of message framing is particularly relevant in sports settings when a coach is interacting with an athlete. When attempting to motivate, console, or describe situations to athletes, a coach must use language that the athlete will perceive as supportive so that motivation can be enhanced (Mageau & Vallerand, 2003).

Past research within the general population has demonstrated that a controlling message, which creates expectations for a specified outcome, decreases perceived autonomy, competence, self-determined motivation and performance relative to informational framing. Informational message framing provides an individual with useful information about a task but does not attach any expectations. (Deci et al., 1994; Koestner et al., 1984; Reeve & Deci, 1996; Ryan, 1982; van de Ridder et al., 2015; Vansteenkiste et al., 2005). While these constructs have been well tested with the general population, few studies have applied the concept of message framing in sports settings.

Limited research in a sporting context has demonstrated that providing verbal feedback in either a controlling or informational manner following an activity can significantly change both motivation and performance in athletes in subsequent attempts of the activity (De Muynck et al., 2017; Fransen et al., 2018; Mertens et al., 2018). However, to the best of our knowledge, there is no research exploring how a written message (rather than a verbal message) can affect motivation or performance in athletes. The previous research has also only provided feedback *after* a first attempt at the activity (De Muynck et al., 2017; Fransen

et al., 2018; Mertens et al., 2018). It is possible that a learning effect may have accounted for some of changes in performance and perceived competence rather than the feedback itself.

To date, research in this area has only used team and/or skill-based sports (De Muynck et al., 2017; Fransen et al., 2018; Mertens et al., 2018). Most skill-based sports have practices that are conducted in a face-to-face setting, where athletes directly interact with the coach. The present research uses cycling, an endurance sport with different demands compared to other sports. Due to the nature of many endurance sports, such as cycling, endurance athletes may be coached remotely. In this type of coaching scenario, the athlete's training is prescribed over an online platform with the athlete and coach communicating primarily via email or text. Since there is minimal face-to-face interaction in this setting, it is essential that a coach understands how to frame messages in an informational manner rather than a controlling one to enhance motivation. (De Muynck et al., 2017; Mertens et al., 2018). Another unique aspect of cycling is that training is often done alone. In a typical team setting, peers may compete with or support one another when doing a challenging activity, which aids in motivation (Strauss, 2002). In contrast, the endurance athlete often does not have anyone to monitor their training in real-time and they must have high levels of intrinsic motivation to successfully complete a session. It is therefore important that a coach use the limited amount of interaction they have with an athlete to facilitate an athlete's perceived autonomy and competence. Accordingly, it would seem a successful endurance coach must understand the art of constructing messages that support an athlete's intrinsic motivation. To better understand the role of message framing in this setting, the purpose of this study was to examine how message framing would affect motivation and performance in cyclists performing an ergometer test to exhaustion.

Hypotheses:

(1) controlling message framing will elicit lower levels of perceived autonomy relative to supportive message framing, (2) controlling message framing will elicit lower levels of perceived competence relative to supportive message framing, (3) controlling message framing will elicit lower time-to-exhaustion on a cycling ergometer relative to supportive message framing.

Review of Literature

Self-Determination Theory and Motivation

SDT, originally proposed by Deci and Ryan (1985), embraces the notion that all human beings are growth-oriented organisms that possess an innate desire to seek out challenges, improve their capacities, and achieve goals that they have deemed personally important. SDT explains that personal growth does not occur automatically, rather that certain environments can either support or hinder growth (Deci & Ryan, 2000). SDT posits three basic psychological needs (competence, autonomy, and relatedness) that are required for growth and development (Deci & Ryan, 2004). For the purpose of this study, we will only focus on two: *competence* and *autonomy.*

Competence describes one's desire to seek out challenges and enhance skills within realms where they feel capable (Deci & Ryan, 2004). Put into practice, one will have very little motivation to pursue an activity where they do not believe they will succeed (Deci, 1975). In a sporting context, when an athlete believes that they are capable of completing a difficult task, they will have a higher degree of self-determination and be more likely to succeed. (Mageau & Vallerand, 2003).

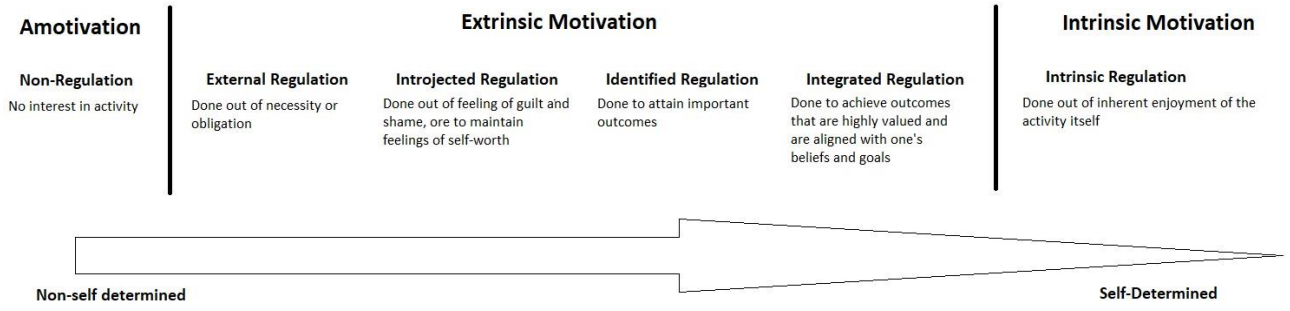
Autonomy describes one's perception of control over a situation. When one feels as though they are choosing their own path, they begin to see their pursuits as an expression of themselves and value them as personally important (Deci & Ryan, 1985). When the environment can provide these basic needs, one will experience higher levels of motivation to fully pursue a goal (Deci, 1975).

The different levels of motivation fall along the motivation continuum. This continuum describes different levels of regulation, or how much one values an activity (see Figure 1).

On one end of the spectrum, one is completely amotivated for an activity and will lack any intention to act. They have no interest in the activity itself or any outcomes that will result from it (Deci & Ryan, 2004). When one is extrinsically motivated, one does not enjoy the activity itself, but rather values the outcomes of that activity (Deci & Ryan, 2000, 2004). The lowest level of extrinsic motivation, external regulation, describes situations where a person does something out of obligation or necessity, for example, an uninteresting job that is done solely to earn a paycheck. The next level of motivation on the spectrum, introjected regulation, describes a situation where one does something out of guilt or shame, or to maintain their sense of self-worth. Introjected motivation is often imposed by societal norms or significant others. In the next level of motivation, identified regulation, one begins to personally identify with, and value the outcome of a particular activity, although these outcomes might not be aligned with one's core beliefs or interests. When someone has the highest level of extrinsic motivation, integrated regulation, the outcomes of an activity are highly valued and aligned with their goals, interests and beliefs (Deci & Ryan, 2004). While they are participating volitionally, they are ultimately motivated by highly valued outcomes rather than out of inherent enjoyment of the activity itself. The highest end of the motivation continuum is intrinsic motivation, whereby a person values an activity such that they view it as an expression of themselves and find inherent enjoyment in participating in the activity.

Figure 1

Motivation Continuum (Deci & Ryan, 2004)



In sport, athletes who are intrinsically motivated by their sport view their participation as a reward on its own. Many athletes are motivated by the extrinsic rewards of competition and prestigious accomplishments, but the most successful athletes must have a level of integration whereby their sport is seen as a reflection of who they are as an individual and their satisfaction is not contingent upon sporting success or failure (Gagné, 2003; Mageau & Vallerand, 2003; Weinberg & Butt, 2014). Because of this intrinsic motivation, the athlete is not controlled per se by important outcomes. They do place importance on them, but the outcome of events do not determine their self-worth or forthcoming levels of motivation. When the intrinsically motivated athlete fails, he or she will use it as a learning experience (Weinberg & Butt, 2014).

In contrast, an extrinsically motivated individual is solely focused on specified outcomes that come from either themselves or others around them. This attitude undermines

autonomy because the result of a competition is not completely controllable (Mageau & Vallerand, 2003). An individual who is focused solely on outcomes will be controlled by that outcome, but one who is focused on the task rather than the outcome is completely in control of their surroundings. The uncertainty of outcomes puts the ego-involved competitor's self-worth in a very unstable environment (Ryan, 1982). When someone inevitably fails, their ego is threatened. When this occurs repeatedly, they may see themselves as "not cut out" for their sport, the repeated battering of their ego from failure may decrease their motivation. Since success is the primary source of satisfaction for the extrinsically motivated athlete, the athlete might find little enjoyment in practicing his or her sport after repeated failures and may even quit their sport. Acutely, an extrinsically motivated athlete is more likely to give up if they are having a bad day to protect their ego because trying and failing is a worse alternative (Weinberg & Butt, 2014).

A task-oriented individual defines success by personal improvement. They feel competent by becoming a better athlete relative to their own past performances. A task-oriented athlete will display greater autonomy because their focus is on their own improvement, which is within their control. Conversely, an ego-oriented individual will only feel competent if they are better than their peers and/or competition. This causes a loss of autonomy because one cannot control their peers and/or competition. Thus, the highly ego-involved competitor is more extrinsically motivated and will likely not perform optimally (Duda, 1989; Mageau & Vallerand, 2003).

Needs Support and Message Framing

An individuals' interactions with others around them will largely determine their perceived needs support and subsequent levels of motivation. The messages that people send to one another contain either a controlling or informational aspect (Ryan, 1982). A controlling message will cause a person to perceive the context as pressuring them towards specified outcomes, which undermines autonomy (Ryan, 1982). An informational message, however, provides the individual with useful information about a task but does not create a sense of pressure towards a particular outcome (Ryan, 1982). Verbal or written feedback may be provided to enhance one's perceived competence by ensuring them that they are capable of a task, but these messages will only enhance motivation if they also support autonomy (Deci & Ryan, 2000; Fisher, 1978). If the feedback creates pressure towards a certain outcome of how the person "should do" based off of their capabilities, they are likely to feel less motivated (Deci & Ryan, 2000; Fisher, 1978; van de Ridder et al., 2015).

Additionally, ego-involvement must be considered. A controlling message may suggest that an outcome is representative of the individual's self-worth. In this scenario, one's ego (a person's sense of self-esteem) is threatened, and they will respond by trying to prove their worthiness (Deci & Ryan, 2004). If the individual does not meet expectations, they will become less focused on the task and more concerned with how their peers perceive them (Ryan, 1982). They may even fail to give their best effort because trying their hardest while not reaching their goal is perceived as a threat. In contrast, an informational message that does not specify outcomes and promotes task-involvement, where the individual is not concerned with the outcome but is rather focused on completing the task to the best of their ability (Deci & Ryan, 2004).

A controlling environment where an individual's ego is threatened is thought to decrease intrinsic motivation. Past research has shown that framing a message as controlling and ego-involving decreases motivation and performance (Deci et al., 1994; Koestner et al., 1984; Reeve & Deci, 1996; Vansteenkiste et al., 2005). More recent research has applied message framing in health and exercise settings. Autonomy supportive environments have been shown to promote regulation of health behaviors, increase enjoyment and even improve biological markers (Crum & Langer, 2007; Puente & Anshel, 2010; Werle et al., 2015).

Application to Sport

The sport coach is one of the primary manipulators of the sporting environment (Mageau & Vallerand, 2003). If coaches are to increase motivation, resilience, and longevity for their athletes, it is crucial to create a needs supportive environment. A coach can promote an autonomy supportive environment in a variety of ways. A coach can provide opportunities for choice, such as allowing an athlete to decide between workout routines (Cordova & Lepper, 1996). They can also allow an athlete to set their own goals rather than creating expectations that may be interpreted as pressuring (Weinberg & Butt, 2014). A coach should also explain reasons for rules and workouts thereby promoting motivation by making tasks seem more meaningful (Cordova & Lepper, 1996; Deci et al., 1994; Mageau & Vallerand, 2003; Werle et al., 2015). A coach must also acknowledge an athlete's feelings and perspectives which helps an athlete feel as though they are respected and that their voice is being heard (Mageau & Vallerand, 2003). A coach should not use controlling language (should, have to, must) that creates expectations for an outcome, but rather direct the athlete's attention towards their effort and prompting them to do their individual best (De Muynck et al., 2017). Provision of positive feedback is also an important component to a

supportive environment. Positive feedback is accomplished by telling athletes what they are doing right and showing them *how* to do a task better. This is in contrast to negative feedback, which points out flaws and tells athletes what *not* to do (De Muynck et al., 2017; Fransen et al., 2018; Mertens et al., 2018; Mouratidis et al., 2008). Many observational studies have confirmed the legitimacy of self-determination theory and sport, confirming that autonomy supportive behaviors by coaches and parents increase satisfaction and motivation (Cho & Baek, 2020; Gagné, 2003).

Theoretically, higher levels of motivation should translate to greater performance in the sporting context. Previously mentioned studies (Koestner et al., 1984; Ryan, 1982; van de Ridder et al., 2015; Vansteenkiste et al., 2005) have indeed confirmed this idea. However, relatively little research has assessed how a needs supportive environment translates to performance in sports. Mouratidis et al. (2008) found that providing positive feedback which told students they were doing a "great job" increased perceived competence and autonomy during a shuttle run activity and enhance motivation towards future participation. De Muynck et al. (2017) found that pressuring message framing that created expectations about how an athlete "should" or "must" do on a tennis exercise decreased perceived autonomy and competence relative to autonomy-supportive messaging. The researchers also found a significant link between perceived competence and performance. In another study by Fransen et al. (2018), basketball players received either encouraging (competence supportive) or neutral feedback following a drill. During the following attempt, the group that received encouraging feedback increased perceived competence and intrinsic motivation relative to the other group. The competence supportive feedback also resulted in better performance in the following drill. Mertens et al. (2018) reported similar findings among basketball players.

This research illustrates the significance of message framing in sport. However, each of these studies gave feedback following an introductory session and assessed how feedback influenced performance on following attempts. One possible limitation of this research is that the athletes were already familiarized with the activity on the second attempt. This may have also increased competence and performance independent of message framing. Research in which a message is framed *before* an activity has become familiar, akin to previously mentioned studies (Koestner et al., 1984; Reeve & Deci, 1996; Ryan 1982; Werle et al., 2015), have not been addressed in a sporting context. The wording of a message can have a profound effect on motivation and performance (De Muynck et al. 2017; Fransen et al., 2018; Mertens et al., 2018; van de Ridder et al., 2015; Vansteenkiste et al., 2005). In sporting contexts, the further effects of message framing is worth continued exploration.

The Present Research

This study will be unique in several ways. First, it will describe an activity using either supportive or controlling framing *before* the activity has been attempted. Second, it will not rely on the face-to-face coaching tested in previous research by conducting the study remotely. Most studies assessing message framing have been in a face-to-face setting (Deci et al., 1994; De Muynck et al., 2017; Fransen et al., 2018; Koestner et al., 1984; Mertens et al., 2018; Mouratidis et al., 2008; Reeve & Deci, 1996; Ryan, 1982; Vansteenkiste et al., 2007; Werle et al., 2015), this experiment will remove this relational aspect to focus on how *only* a written message can change the athlete's perceptions and performance. This is a particularly relevant issue with the increasing popularity of online training programs. Third, this study will use trained cyclists. Endurance sports are much different than other skill-based sports studied in previous research. The skill-based sports studied in prior research requires a

higher level of concentration but often do not test one's physiological capabilities to the same extent as endurance sports (Mouratidis et al., 2008). By using mentally challenging test to exhaustion on a cycling ergometer, this study will assess the power of message framing when undertaking solo endurance activities. The purpose of this study is to examine the effects of written message framing on performance and perceived competence, autonomy, and motivation in competitive cyclists performing an ergometer test

Methods

Participants

Following approval by the Appalachian State University IRB, nine male and two female cyclists aged 18-55 were recruited to participate. All participants raced at an amateur (Category 3-5) level and trained 7-13 hours per week. To be included in the study, participants had to have trained regularly for cycling for at least three years prior and been between the ages of 18-55 years old. Participants had to be healthy and free from any chronic diseases that would have compromised their ability to safely complete the test. They were required to have access to a home cycling ergometer equipped with a power meter and use a heart rate monitor. Prior to study participation, participants filled out an informed consent and questionnaire to ensure that they had met all criteria for participation.

Measures

Using a ramp test protocol as described by Rønnestad et al. (2020), participants warmed up at 100w for five minutes then power was reduced to 50w for the start of the ramp protocol. Power was then increased by 25 W every minute and the participants were instructed to stop the test when cadence dropped below 60rpm for more than five seconds. The highest achieved power (W_{max}) was established by taking the power at the last completed stage. The framed intermittent interval test consisted of a 20-minute warm-up followed by 30 seconds at 100% W_{max} alternating between 15 seconds at 50% $W_{max.}$ The participants repeated this cycle until voluntary exhaustion (See Appendix 1).

Pre-participation Measures

Prior to taking part in the study, participants completed the Task and Ego Orientation Questionnaire (TEOSQ) (Duda, 1989). The TEOSQ is a 13-item questionnaire rated on a five-point Likert-type scale that is used to assess task orientation and ego orientation in sport situations. Previous research with athlete populations has demonstrated a Cronbach's alpha coefficient for the task subscale of .88, and for the ego subscale .86 (Barić & Horga, 2007). See Appendix 2 for TEOSQ measures.

During Participation Measures

Participants were given two questionnaires before each framed session, adapted from Mouratidis et al. (2008). Prior to performing the framed sessions, the participants were asked to assess pre-task competence (how confident they felt about the activity) and pre-task competence valuation (how much they valued doing well on the activity). These measures would be used to assess motivation levels prior to completing the test to track any changes between conditions.

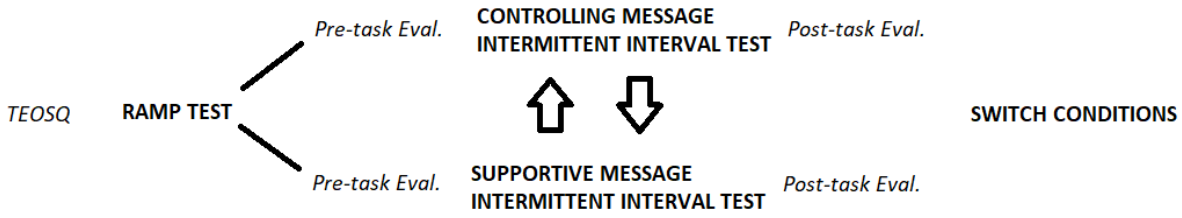
Following the sessions, participants filled out a second questionnaire to assess perceived competence (how well they felt they performed the task), motivation (how much they enjoyed the task), and perceived autonomy to assess task vs. ego-orientation (See Appendix 3). Performance was quantified by the time-to-exhaustion (TTE) during the intermittent interval test. TTE was determined by the time point at which participants reached exhaustion and could go no further. Absolute power output was not factored because the prescribed power outputs were the same relative to each participant.

Procedures

The study –a randomized crossover design, consisted of an unframed ramp test (RT) to establish baseline power zones and two framed intermittent interval sessions, one with controlling and the other with supportive message framing. These workouts were spaced out over a span of five days, with an easier session separating the intense sessions for a total of five sessions. This was done remotely, and all communication was done online. Participants used home ergometers equipped with power meters. To mask the real purpose of the study, participants were told that the study would be examining the effects of repeated exercise bouts on performance.

Figure 2

Study Design



RT consisted of an unframed ramp test protocol to establish a power target for the subsequent sessions (Rønnestad et al., 2020). No particular message framing was used for either group and the participants were only given the necessary information to understand the purpose of the session and complete it properly. Following the RT, participants sent their power files for review to ensure compliance with the test protocol and were given instructions for the subsequent sessions.

The participants were then randomly assigned to complete an intermittent interval session accompanied with either controlling message framing (CF): "*This test is a measure of your capability in cycling. You must continue the test until you cannot successfully complete*

a full repetition, or your data will not be valid. For this particular test, we will be analyzing the relation between your HR recovery between intervals and how it relates to where the workout lies in the training week," or with supportive message framing (SF): "*This workout will be a good challenge, but it will produce some really valuable data so try to do as many reps as you can. Just take it one interval at a time, keep your cadence up on the recovery portions, and do your best! For this test, we will be examining total reps completed and how this relates to where the workout lies in the training week."*

Following completion of the first session, the participants switched conditions and completed the session with the alternate message framing. The participants did not know what the second session would be until after they had completed the first session. Two easier sessions were inserted in between RT, SF, and CF. This was to allow participants time to recover, but also to serve as a "distraction" from the framed sessions to mask the purpose of the study. No particular message framing was used for the easier sessions. Even though SF and CF were the same tests, different explanations were given for SF and CF to explain how the workouts would be assessing different physiologic parameters. This was intended to direct the attentional focus of the participants towards the different message framing of the workouts and to create the perception that the workouts required a different attentional focus.

All participants were instructed to perform both tests in a familiar setting (where they usually train) and to make sure that they had a fan and towel. Participants were not allowed to look at any videos or use any training related applications but were allowed to listen to music. They were instructed to complete both sessions well rested with no strenuous high intensity exercise the day before either test. The participants were instructed not to change anything about their normal diet and to consume a carbohydrate-based meal or snack 1-2

hours before the sessions. To ensure this protocol was followed, the participants answered questions in the follow up survey to verify they did not change their normal routine.

Statistical Analysis

Upon completion of the testing, all data were imported from Qualtrics into SPSS version 27 (*IBM Corporation 2020*), cleaned and organized. Basic descriptive data were reported as frequency and percentage or mean ± SD. Inferential statistics were then analyzed using SPSS. Paired sample t-tests were used to compare performance and survey measures for the two conditions and Pearson correlations were performed between all pertinent variables (confidence level $P < 0.05$).

Results

Descriptive Statistics

Eleven participants (nine male, two female) with a mean age of 43.6 ± 10.3 years were recruited to participate. Participants trained an average of 9.68 ± 3.95 hours. Average W_{max} was 338 ± 84.1 watts (see table 1)

Table 1

Descriptive Statistics

	Min	Max	Mean	Std. Deviation
Age	26.0	54.0	43.6	10.3
Height (cm)	160	186	177	6.98
Weight (kg)	50.0	78.0	71.3	7.58
Wmax (watts)	210	483	338	84.1
Time/Week (hours)	4.0	17.5	9.68	3.95

Paired sample T-test found no significant differences between controlling and supportive message framed interval workouts (95% confidence interval). All four null hypotheses are thus accepted. See Table 2 for details.

Table 2

Paired Samples T-test

	Mean	Std. Deviation	t	Two-Sided p
Pre-Task CV	-0.138	0.839	-0.520	0.615
Pre-Task Comp.	-0.268	0.943	-0.899	0.392
Competence	0.000	0.933	0.000	1.000
Autonomous Mtv.	-0.291	0.724	-1.271	0.236
Perceived Aut.	-0.337	1.11	-0.959	0.363
TTE (seconds)	602	1.61x103	1.242	0.242

Pearson Correlations

Pearson correlations were performed for supportive and controlling message framing interval workouts. Results showed a significant correlation between time spent training per week and self-reported functional threshold power (FTP) estimate ($r = 0.693$), ego orientation and FTP estimate ($r = 0.765$), task orientation and FTP estimate ($r = 0.753$) and task orientation and time per week training ($r = 0.843$). In the controlling message framing condition, a significant inverse correlation was found between pre-task competence valuation and post-task competence ($r = 0.738$). A significant inverse correlation was found between time-to-exhaustion (TTE) and autonomous motivation in the controlling message framing condition ($r = -0.674$). In the supportive message framing condition, a significant correlation was found between competence and FTP estimate ($r = 0.684$), perceive autonomy and FTP estimate ($r = 0.801$) , pre-task competence valuation and autonomous motivation ($r = 0.666$), and post-task competence and perceived autonomy ($r = 0.732$). Please see Table 3 and Table 4 for on the next page for correlation matrices.

Table 3

Correlations-Supportive Message Framing

	FTP Estimate	Time/Week	Ego	Task	Pre-Task Competence Valuation	Pre-Task Competence	Competence	Autonomous Motivation	Perceived Autonomy
Time/Week	0.693**								
Ego	0.765**	0.383							
Task	0.719*	0.843**	0.170						
Pre-Task CV	0.01	0.078	-0.077	0.197					
Pre-Task Competence	-0.051	-0.281	0.090	-0.401	0.541				
Competence	0.684*	0.421	0.582	0.447	0.246	0.347			
Autonomous Motivation	0.078	0.167	0.096	-0.005	0.607	0.666*	0.359		
Perceived Autonomy	0.801**	0.398	0.730*	0.390	0.101	0.269	0.732*	0.256	
Time-to-Exhaustion	-0.006	0.145	0.425	-0.214	-0.082	0.148	0.395	0.072	0.402

*$p < .05$. **$p < .01$. ***$p < .001$

Table 4

Correlations – Controlling Message Framing

	FTP Estimate	Time/Week	Ego	Task	Pre-Task CV	Pre-Task Comp.	Competence	Autonomous Mtv.	Perceived Aut.
Time/Week	0.693*								
Ego	0.765**	0.383							
Task	0.719*	0.843**	0.170						
Pre-Task CV	0.389	-0.730	-0.442	0.010					
Pre-Task Comp.	-0.105	-0.033	-0.298	0.089	0.35				
Competence	0.518	0.201	0.471	0.180	-0.738**	-0.246			
Autonomous Mtv.	0.101	-0.005	-0.176	0.256	0.246	0.038	-0.275		
Perceived Aut.	-0.196	0.439	-0.424	0.248	0.075	0.204	0.011	-0.159	
TTE	0.171	-0.117	0.238	-0.067	-0.437	-0.28	0.333	-0.674*	-0.253

*$p < .05$. **$p < .01$. ***$p < .001$

Discussion

The purpose of this study was to examine how message framing would affect motivation and performance in cyclists performing an ergometer test to exhaustion. It was hypothesized that there would be significantly lower levels of perceived autonomy and competence in the controlling message framing condition than in the supportive message framing condition. It was also hypothesized that there would be a significantly shorter time-to-exhaustion in the controlling message framing condition than in the supportive message framing condition.

The hypotheses tested this study were not supported by the data; there were no significant differences for any variables between the two groups. While there is no way to determine cause and effect, some of the significant correlations within groups do suggest a relationship between levels of motivation and the different message framing conditions. These significant correlations could indicate that, had the sample size been larger or the study modified, there may have been some significant differences between the two groups.

The first notable correlation is that pre-task competence valuation is significantly inversely correlated with post-task competence in the controlling condition only. This result could suggest that the more participants valued doing well prior to the activity, the worse they felt about their efforts afterwards. It is possible that the controlling message framing directed the participants attention to the outcome of the test rather than their effort (Ryan, 1982). The statement *"This test is a measure of your capability in cycling. You must continue the test until you cannot successfully complete a full repetition, or your data will not be valid,"* directs the participant's attention away from the task and promotes ego involvement. As a result, even if participants gave their best effort, they did not feel as though they did a

good enough job of meeting the standard that the investigator had demanded for the data to be considered "valid." Since the exact standard of the outcome was not specified, participants had no means of knowing whether their efforts were good enough or not. This is in-line with the motivational model proposed by Mageau and Vallerand (2003), who explain that a controlling environment creates the perception that a coaches' approval is contingent upon an athlete's objective performance rather than their effort. This correlation was not found in the supportive message framing condition. Since *"do your best"* was the only directive given to participants, they may have felt as though they performed better simply because they gave their best effort. Individuals with higher perceived competence use more self-referenced criteria to define their own success (Barić & Horga, 2007), this could explain why the inverse correlation between pre-task competence valuation and post-task perceived competence was observed in only the controlling condition.

Applied to a sports setting, the inverse correlation between pre-task competence valuation and post-task perceived competence may depict how a pressuring environment can contribute to an athlete feeling as though they are not good enough despite their best efforts. In the athlete's eyes, if they are not meeting the perceived standards of a coach, there will be a decrease in perceived competence and autonomy, thus causing a decline in motivation as theorized by Deci & Ryan (1985) and Mageau and Vallerand (2003). As shown by De Muynck et al. (2017), positive framing, task-oriented enhances players competence and intrinsic motivation. In cycling, coaches should use supportive language that promotes task-orientation to promote athlete competence and autonomy.

The second notable finding is that perceived competence and autonomy were significantly correlated in the supportive condition only. This finding is not unexpected.

Mouratidis et al. (2008) reported a significant positive correlation between competence and autonomy during a positive or negative framed shuttle run task using the same questionnaire as this research. This relationship between competence and autonomy has also been reported by De Muynck et al. (2017) for both a positive and negative framed tennis exercise. However, in the current study there was no significant correlation between these two variables in the controlling group, suggesting that one or both of these variables was impacted in some way by the controlling message framing, thus negating the correlation between competence and autonomy. One explanation is that, by telling the participants that they "must" complete a task to exhaustion, autonomy could have been decreased (De Muynck et al., 2017; Ryan, 1982) even though they still felt capable of the task and competence had been maintained. This could be particularly true if it was the second time the participant had done the test as the participant would already have known what to expect.

An unexpected finding was that autonomous motivation was significantly inversely correlated with time-to-exhaustion in the controlling group only. This is the opposite of what might be expected since a higher level of autonomous motivation should lead to greater intrinsic motivation (Gillet et al., 2010; Puente & Anshel, 2010) and subsequently performance (Deci & Ryan, 2000). A higher level of autonomous motivation means that the participant was motivated to give their best effort because they enjoy the process of taking on a challenge (Deci & Ryan, 1985). In essence, the participant was prepared to voluntarily give their best efforts for their own enjoyment. The controlling message framing could have decreased the participants' desire to push further during the test since they may have felt as though they were completing the task for someone else, rather than for themselves as a function of non-self-determined motivation (De Muynck et al.; 2017; Deci & Ryan, 1985;

Ryan, 1982). This finding, combined with the finding that pre-task competence valuation was inversely correlated with post-task perceived competence in the controlling group, indicates that highly motivated athletes might be impacted by a controlling environment to a greater extent than athletes who are less invested in their sport.

Limitations

This study was the first of its kind to examine the effects of message framing in a remote coaching setting, while there were no significant differences between the two conditions, the differences in correlations between the conditions does suggest that controlling or supportive message framing do have had an impact on competence, autonomy, and performance in some manner. As with all research, there were limitations with this study. Due to financial limitations that did not allow for payment of participants, recruitment for a week-long study with no monetary incentive made it difficult to achieve an acceptable sample size. In any case, the researcher did not wish to compensate participants because a monetary incentive could have impacted the participants' motivational focus. Another limitation was that the study was designed with a crossover design rather than a parallel design. The participants motivation may have been impacted by whether it was their first or second time doing the test. Participants may have felt more motivated on the second attempt because they wanted to beat their prior best regardless of the message framing or they may have been less motivated because they did not want to do the test again. Furthermore, participants might have known more what to expect and could have performed differently as a result. They may have been more prepared mentally for such a demanding task, or they may have learned how to better gauge their effort. A parallel design with an additional control group could have produced significant results between groups, but the required

sample size for this design was not feasible. Finally, since the study was done remotely, it was not possible to control for all extraneous variables such as nutrition, hydration, or outside stressors that may have impacted participants' motivation. However, these uncontrolled variables are similar to what would be encountered in a real-world setting, which is what this research was attempting to replicate. There was also a potential for inaccuracies with the participants' equipment between the two tests and between participants as each individual was using their own equipment.

Conclusion

While there were no significant differences in the paired sample T-test between the two conditions, the differences in correlations between the conditions does suggest that controlling or supportive message framing did have an impact on competence, autonomy, and performance in some manner. The wording of a written message can impact perceived autonomy, competence and performance in endurance athletes in a remote coaching setting. Further research is needed to determine the true impact of message framing in this context. This study presents an exciting new avenue for understanding how written messages can affect one's perception of their environment. Further research in this area may have implications not only for the athletic population but also for the general population in everyday life while interacting remotely with others in an increasingly virtual world.

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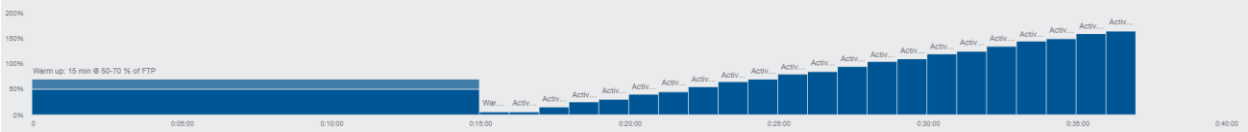
Appendix A

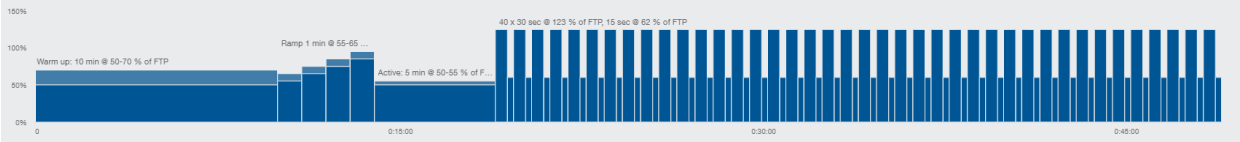
Ergometer Tests

Ramp Test Protocol (Rønnestad, 2020)



Participants warmed up at a steady pace. Power was then reduced to 25w and increased in 25 W increments every minute until the participants reached volitional fatigue at which point the test was stopped. W_{max} was calculated by taking the power at the last completed stage

Intermittent Interval Test



Participants warmed up at a steady pace and completed a short warm-up ramp. After a 5 minute recovery period, power alternated between 100% of W_{max} for 30 seconds and 50% of W_{max} for 15 seconds until participants reached volitional fatigue at which point the test was stopped. Time-to-exhaustion was taken from the time the intermittent interval bout began until the time participants reached exhaustion.

Appendix B

TEOSQ

Task and Ego Orientation in Sports Questionnaire (TEOSQ) 1-5 Likert scale (1= strongly disagree, 5 = strongly agree)

1. Very few riders have my unique skillset in cycling. (ego)
2. When I accomplish a new goal it motivates me to improve even more. (task)
3. I can ride better than my friends. (ego)
4. Others can't ride as well as I can. (ego)
5. I like getting stronger because it is fun to do. (task)
6. Others make lot of mistakes in races and I don't. (ego)
7. My success comes from my hard work. (task)
8. I train really hard. (task)
9. I win a lot of races. (ego)
10. When I accomplish something I get even more motivated. (task)
11. I am great at cycling (ego)
12. I am always trying to learn how to better myself. (task)
13. I always give my best no matter what. (task)

Appendix C

Pre- and Post- Task Questionnaire

Survey measures (Adapted from Mouratidis et al. 2008) 1-5 Likert scale (1= strongly disagree, 5 = strongly agree)

Pre-task competence valuation

1. It is important to me to do well on this task
2. I care very much about how I do on the task.
3. I am looking forward to this challenge.

Pre-task perceived competence

4. I feel confident in my ability to do this task.
5. I am able to achieve my goals in this task.
6. I feel able to meet the challenge of performing well in this task.

Manipulation check –performance evaluation

1. How poorly or well did you do on the task?

Perceived competence

1. I feel that I did well on this activity.
2. I think I did pretty well at this activity, compared to what others might do.
3. I felt strong during this activity
4. I felt like I could have done better on this task (Reversed)
5. I felt like I gave my best on this activity

Autonomous motivation (Stem item: Why did you engage in this task?)
Intrinsic

1. Because I love to work hard and get stronger
2. Because it's fun to see what I am capable of
3. Because I enjoyed the challenge

Perceived Autonomy

1. I was concerned if I would be able to do this task well enough (reverse)
2. I felt pressured to perform well on this task (reversed)
3. I was ready to give my best on this task
4. I was thinking about how others might do on this task compared to me

Vita

Landry Bobo was born and raised in Colorado Springs, Colorado. He attended The Classical Academy K-12 school before pursuing a degree in Health Science from the University of Colorado-Colorado Springs, where he graduated cum laude in 2019. Wishing to further his education in the field, he attended Appalachian State University in Boone, North Carolina where he graduated with a Master of Science in Exercise Science in 2022. Landry is an elite amateur cyclist, cycling coach, and loves the outdoors.