

**THE EFFECT OF STRESS MINDSET ON APPRAISAL TENDENCIES AND AFFECT**

**By**

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## **Abstract**

The overall aim of this thesis was to investigate the effectiveness of stress mindset on stress appraisal tendencies and positive and negative affect. Chapter 1 reviews the current literature on stress mindset and stress appraisals, and how they each relate to adaptive and maladaptive outcomes. Chapter 2 set out to investigate the relationships between stress mindset, challenge and threat appraisal tendencies, and positive and negative affect through a cross sectional study. Chapter 2 also investigated whether challenge and threat mediated the relationship between stress mindset and positive and negative affect. Chapter 3 built on Chapter 2's findings and used an experimental design to investigate the effectiveness of a brief online video intervention in manipulating stress mindset, appraisal tendencies, and positive and negative affect in university students. Chapter 3 also investigated the effectiveness of the intervention on challenge and threat appraisals, positive and negative affect and the interpretation of anxiety in relation to an upcoming assessment period. Chapter 4 discusses the collective results of both Chapter 2 and 3 and suggests avenues for future research.

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## **Chapter 1. GENERAL INTRODUCTION**

## General Introduction

1  
2           Stress is inevitable and happens in everybody's day-to-day life. It can occur in  
3 almost all situations whether it is a student completing an important exam or a surgeon  
4 performing life changing surgery. Stress can be defined as "a particular relationship  
5 between the person and the environment that is appraised by the person as taxing or  
6 exceeding his or her resources and endangering his or her wellbeing" (Lazarus and  
7 Folkman, 1984, p.19). Not everyone deals with stress in the same way, and individuals can  
8 be affected in different ways (Bhugra, 2004). Research has shown stress can have a  
9 negative impact on an individual's health and wellbeing (Vitetta *et al.*, 2005), as well as  
10 both motor (Bali, 2015; Khan *et al.*, 2012), and cognitive performance (Ell *et al.*, 2011).  
11 Therefore, even the simplest of tasks can be performed badly in the presence of stress  
12 (Driskell *et al.*, 2006).

13           Stress can have serious implications for an individual's physical health, repeated  
14 exposure to stress can cause serious health problems such as high blood pressure and  
15 higher risk of cardiovascular disease (Carroll *et al.*, 2009). Distress is associated with  
16 higher oxidative damage (Aschbacher *et al.*, 2013), which is highly associated with  
17 diabetes (Valko *et al.*, 2006), cancer (Poulsen *et al.*, 2012), and neurodegenerative diseases  
18 (Nunomura *et al.*, 2012). Stress can also have severe negative consequences for mental  
19 health (Seery, 2011). Exposure to stress in the form of stressful life events can cause  
20 ongoing long-lasting negative implications to someone's mental health (Thoits, 2010) and  
21 the accumulation of daily stressors is associated with depression and anxiety (Schönfeld *et*  
22 *al.*, 2016). The more the individual is exposed to the stress the more enhanced the  
23 implications are to that individual (Herman *et al.*, 2015).

1           Beyond health, stress can have negative impacts on performance which can include  
2 but is not limited to sports events, work, and exams. Research has shown that stress can  
3 lead to poorer performance and lower satisfaction in the workplace (Imtiaz *et al.* 2009).  
4 Furthermore, stress can elicit poorer decision making, lower organizational performance,  
5 and lower interpersonal performance which are all vital skills needed for successful  
6 performance and productivity at work (Leung *et al.*, 2008). Research has also shown that  
7 stress can have a negative impact on athletic performance (Bagheri *et al.*, 2018). This can  
8 also be indirectly by stress negatively impacting an individual's psychological wellbeing  
9 which in turn can cause poor athletic performance (Jones *et al.*, 2020).

10           There is also a strong association between high stress levels and poorer academic  
11 performance (Sohail, 2013; Tchen *et al.*, 2001). University students tend to be a population  
12 who display relatively high levels of stress compared to other non-clinical populations  
13 (Cámara *et al.*, 2012; Heermann, 2019). Previous research has shown that university is a  
14 very stressful time for individuals. This is thought to be because the outcome of whether  
15 students get their degree or not could impact their future and therefore, for most  
16 individuals is a very important time (Parada *et al.*, 2022). When individuals experience a  
17 lot of stress it becomes more difficult for them to cope with it (Herman *et al.*, 2015).  
18 Research shows stress can lower concentration levels ultimately leading to students  
19 underachieving in their academic performance (Khan *et al.*, 2013). Given the stress levels  
20 that student experience, it is perhaps not surprising that it can severely hinder student  
21 academic performance as well as health and wellbeing (Gustems-Carnicer *et al.*, 2019).

22           The evidence of the negative effects stress can have on an individual is clear to see.  
23 However, research also shows that stress is not always detrimental and at times can even  
24 have positive effects. For example, research shows that athletes can produce their best

1 performances whilst under pressure (Swann *et al.*, 2017). It has been suggested that the  
2 effects of stress could be related to the way an individual appraises stress (Folkman *et al.*,  
3 1986). It has been proposed that if you appraise stress more positively it can help improve  
4 your performance, and it is only when there is too much stress, or you appraise it  
5 negatively the stress can have negative effects on your performance (Abou Elmagd, 2016).  
6 Experiencing positive emotions during stress and appraising the stressful situation as a  
7 challenge has been associated with optimal performance. Stress is inevitable and while  
8 some stress can be removed, people are going to encounter stressful situations throughout  
9 life. Therefore, it seems more important to identify ways to prevent stress being  
10 detrimental and identify things can help people feed off it and perform better. One of the  
11 ways to prevent stress from being detrimental to the individual could be the mindset  
12 someone holds about stress.

13 Mindset can be described as a set of cognitive procedures; it is a set of beliefs that  
14 an individual holds (Gollwitzer *et al.* 2016; Boaler. 2013). Research has shown there are  
15 two views of mindset. The first is a fixed mindset which is the belief that capabilities such  
16 as personality and intelligence are fixed and simply cannot be changed (Yaeger *et al.*,  
17 2012), while the second is growth mindset which is the belief that capabilities can change  
18 and develop over time as they are not fixed (Dweck *et al.*, 2019). More modern research  
19 focuses on growth mindset and the fact that mindset can be malleable and adapted and  
20 changed over time (Yaeger *et al.*, 2012; Dweck, 2017). Once mindsets were viewed as  
21 malleable, researchers have investigated ways they can be successfully manipulated  
22 (Dweck, 2017). The early interventions were basic multisession lessons which were trying  
23 to show students that intelligence is malleable. The results of this study found those in the  
24 control group found a decline in grades whereas those in the growth mindset group did not



1 decline in grades (Blackwell *et al.*, 2007). Since then research has investigated different  
2 types of mindset.

3           One type of mindset which is relatively new to the literature is stress mindset.  
4 Stress mindset is the belief an individual holds about the consequences of experiencing  
5 stress (Crum *et al.*, 2013). There are two types of stress mindset; a stress-is-enhancing  
6 mindset and a stress-is-debilitating mindset (Crum *et al.* 2017). A stress-is-enhancing  
7 mindset is experienced when an individual believes that stress will be positive and  
8 beneficial for their learning, growth, development, and/or performance, while a stress-is-  
9 debilitating mindset is when an individual believes that stress will have negative impacts  
10 on their learning, growth, development, and/or performance (Crum *et al.*, 2013). Research  
11 has shown that a stress-is-enhancing mindset is associated with a number of positive  
12 outcomes such as positive emotions (Crum *et al.*, 2017), more effective coping methods  
13 (Casper *et al.*, 2017), and better physical wellbeing (Keech *et al.*, 2020). A stress-is-  
14 debilitating mindset by contrast is associated with greater negative emotions such as  
15 depression (Jiang *et al.*, 2019), negative impacts on health (Crum *et al.*, 2014), and  
16 avoidance coping (Crum *et al.*, 2013).

17           Previous research has shown that although stress mindset is an important  
18 determinant for how well someone copes and appraises stress, an individual's stress  
19 mindset is malleable and can be changed. Research has been conducted to identify  
20 methods that can alter stress mindset. Research has found that interventions can make an  
21 individual deliberately hold a stress-is-enhancing mindset even when stress is present  
22 (Goyer *et al.*, 2021). Some of the methods that have emerged to alter stress mindset  
23 include statements about the positives or negatives of stress for participants to read  
24 (Watermann, 2019), and thinking back to positive experiences (Ben-Avi *et al.*, 2018).

1 However, one of the most commonly used methods of manipulating an individual's stress  
2 mindset that appears to be effective is through the use of videos (Crum *et al.*, 2013). These  
3 videos are usually around 3 to 4 minutes long and include a mixture of text, pictures, and  
4 background sound to reinforce the positive or negative messages of stress (Crum *et al.*,  
5 2017).

6 Previous research has shown that watching a video reinforcing the benefits of stress  
7 can make an individual hold a more stress-is-enhancing mindset (Meyer, 2020). Previous  
8 research has also shown that after manipulating stress mindset to make it more enhancing  
9 with the use of a video, participants experienced an increase in positive affect (Crum *et al.*,  
10 2017). However, there is limited research on showing that manipulating stress mindset can  
11 lead to an increase in positive affect, therefore this thesis will outline and address some of  
12 these gaps.

13 Additionally, most of the previous video interventions that have taken place to  
14 manipulate stress mindset have been conducted in person (e.g., Crum *et al.*, 2013; Crum *et*  
15 *al.*, 2017). Given that this intervention technique involves watching a video which could be  
16 accessed on a portable electronic device, it would seem logical to examine whether these  
17 interventions are also effective online and in the absence of a researcher present. If  
18 effective, this would have the potential to considerably reduce the costs of stress mindset  
19 interventions and make the videos more flexible and accessible to people. This thesis will  
20 examine the effectiveness of online stress mindset videos in Chapter 3.

21 Beyond stress mindset, another factor which may impact the effect stress has on  
22 someone is how they appraise it. Individuals may appraise stress as a challenge or a threat.  
23 Challenge and threat appraisals are motivational states with challenge being associated  
24 with adaptive approaches to stress and threat being associated to maladaptive approaches

1 (Blascovich and Mendes, 2000). Lazarus and Folkman's (1984) early theory proposed that  
2 dependent how we appraise a situation will form the way we respond to it (Mikolajczak *et*  
3 *al.*, 2008). The theory suggests that a stressful situation triggers a primary appraisal in  
4 which the individual appraises the situation as a challenge, a threat, or a loss. Once this  
5 appraisal has been made secondary appraisals are then made where the individual assesses  
6 the resources to cope with the situation.

7         Since the inception of Lazarus and Folkman's (1984) theory, other challenge and  
8 threat theories and frameworks have been devised which have often tried to elaborate or  
9 explain the challenge and threat appraisal process in a slightly different way. The  
10 biopsychosocial model of challenge and threat (BPSM: Blascovich and Mendes, 2000)  
11 proposes that when met with a stressful situation the individual evaluates the demands of  
12 the situation first and then evaluates the resources to cope with that situation afterwards  
13 (Blascovich, 2008). A challenge appraisal is then said to occur when the individual  
14 believes that they have the resources (or nearly sufficient resources) to cope with the  
15 demands of the situation, while a threat appraisal is thought to occur if the individual  
16 perceived they do not have sufficient resources (Jamieson, 2017; Blascovich *et al.*, 2004).  
17 The BPSM is different to the way Lazarus and Folkman (1984) view challenge and threat  
18 as they propose the challenge or threat appraisal is made before the individual appraises  
19 how well they can cope. Conversely, the BPSM proposes that an element of being able to  
20 cope (in the form of appraising whether one has the resources to meet the demands of the  
21 situation) is important in determining whether the situation is appraised as a challenge or  
22 threat.

23         The Theory of Challenge Threat States in Athletes (TCTSA; Jones *et al.*, 2009),  
24 and its revised version (TCTSA-R; Meijen *et al.*, 2020) while devised as being athlete

1 specific are likely to be relevant theories to other populations experiencing stress. As well  
2 as attempting to amalgamate the BPSM along with Skinner and Brewer's model of  
3 adaptive approaches to competition, the TCTSA and TCTSA-R aims to explain why  
4 athletes may perceive situations as either a challenge or threat, how they in turn respond  
5 from a psychophysiological point of view, and how challenge and threat states can  
6 influence performance. Despite differences between the different theories and frameworks,  
7 the consensus across all is that a challenge appraisal is associated with more adaptive  
8 responses to stress and better performance, while a threat appraisal is associated with more  
9 maladaptive responses and poorer performance. Those who appraise the stressful situation  
10 as a challenge use more adaptive coping strategies in comparison to those who appraise the  
11 situation as a threat (Williams et al., 2018). A challenge state is also associated with better  
12 performance compared to a threat state in which performance is typically poorer (Jaimeson  
13 et al., 2018).

14           In addition to individuals appraising specific situations as a challenge or a threat,  
15 while this can differ depending on situations, Lazarus and Folkman (1984) also proposed  
16 that as well as situational factors, individual characteristics are likely to influence whether  
17 a situation is appraised as a challenge or a threat. Consequently, individuals could appraise  
18 the same situation differently. Factors such as personality and previous experiences all  
19 come into how an individual may appraise certain stressful situations. Consequently,  
20 individuals are likely to possess challenge and threat appraisal tendencies (i.e., the  
21 likelihood they tend to appraise stressful situations as a challenge and as a threat). Previous  
22 research has found that even at a trait level, different individuals rated situations  
23 differently meaning what might be a threat to one person might not be to another (Lucas et  
24 al., 2012). It is important to note that one person does not tend to hold one appraisal  
25 tendency for all stress, it will alter based on the stressful situation the individual is facing

1 (Copec *et al.*, 2022). For example, using a predominantly female athlete population, Moore  
2 *et al.*, (2019) found that the largest proportion of variance in challenge and threat  
3 appraisals was the interaction of who is evaluating the situation and what the situation they  
4 are evaluating. Consequently, while appraisal tendencies it will give an indication of the  
5 extent an individual is likely to appraise stress as a challenge or threat, the situation must  
6 also be considered. .

7         One individual characteristic which may relate to appraisal tendencies is stress  
8 mindset. Literature suggests stress-is-enhancing mindsets are related to more adaptive  
9 appraisals of stress such as challenge appraisals because individuals who view stress more  
10 positively tend to believe they have the resources to cope with the demands of the  
11 environment (Kilby and Sherman, 2016). By contrast, a threat appraisal, is thought to be  
12 related to a stress-is-debilitating mindset (Kelley *et al.*, 2019; Blascovich *et al.*, 2004).  
13 However, research has found that a person can evaluate a situation as a threat but can still  
14 believe that positive outcomes are possible so hold a more stress is enhancing mindset  
15 (Copec *et al.*, 2022). Despite this, studies have found that individuals who hold a more  
16 stress-is-enhancing mindset are more likely to appraisal stressful situations as a challenge.  
17 For example, a recent study which involved 125 university students who all actively  
18 compete in sport found that stress-is-enhancing mindset was the strongest predictor of  
19 challenge appraisal tendencies (Copec *et al.*, 2022). Consequently, while individuals may  
20 be able to appraise a stressful situation as a challenge or threat despite possessing a stress-  
21 is-debilitating or stress-is-enhancing mindset, it appears that appraisal tendencies research  
22 demonstrates a more consistent pattern of challenge appraisal tendencies being associated  
23 with a stress-is-enhancing mindset, and threat appraisal tendencies being associated with a  
24 stress-is-debilitating mindset.

1           Stress appraisal tendencies have also been shown to correlate with certain  
2 indicators of positive wellbeing. For example, Maier *et al.* (2013) found that those who  
3 appraise situations as a challenge are more likely to elicit more positive affect (i.e.,  
4 pleasant emotions such as excitement and happiness; Khosla, 2006). And those who  
5 appraise situations as a threat are more likely to elicit more negative affect (unpleasant  
6 emotions such as anger and fear (Watson *et al.*, 1988). However, to date, limited research  
7 has been completed in terms of challenge and threat and affect within a competitive  
8 sporting situation. Wood *et al.*, (2018) completed the first study to investigate this whilst  
9 using a competitive cycling task. This study found that challenge and threat were linked to  
10 positive and negative affect, with those who appraised the situation as a challenge eliciting  
11 increase positive affect however, this study did not find any significant relationships. As  
12 there is limited research within this, future studies need to investigate this further and  
13 complete further studies to find whether there are any significant relationships between  
14 challenge and threat appraisals and positive and negative affect.

15           The way an individual appraises stress may impact the emotions they experience  
16 whilst stress is present (Neil *et al.*, 2011). The theory of challenge and threat states in  
17 athletes (TCTSA; Jones *et al.*, 2009) proposes that in a challenge state, emotions  
18 experienced are different to when in a threat state. Both positive and negative emotions can  
19 be experienced in a challenge state not all tend to be perceived as helpful to performance  
20 (Jones *et al.*, 2009). By contrast, only negative emotions are thought to be experienced in a  
21 threat state which are viewed as detrimental to performance (Jones *et al.*, 2009).  
22 Consequently, the TCTSA suggests that anxiety is likely to be present in both challenge  
23 and threat states, but the interpretation of this anxiety likely differs between the two states  
24 (Meijen *et al.*, 2020).

1           Research has shown that if you hold a more stress-is-enhancing mindset and  
2 appraise stress as more of a challenge you are more likely to elicit positive emotions  
3 (Karampas *et al.*, 2020; Crum *et al.*, 2017). For example, Cross sectional research has  
4 shown a more enhancing stress mindset is associated with more positive affect and less  
5 negative affect (Crum *et al.*, 2013). By contrast, holding a more stress-is-debilitating  
6 mindset will more likely lead to holding negative emotions (Horiuchi *et al.*, 2018). This is  
7 also the case if you appraise a stressful situation as a threat (Crum *et al.*, 2017). If an  
8 individual experiences positive emotion whilst faced with a stressful situation it is more  
9 likely to improve their performance compared to if they experience negative emotion  
10 (McCarthy, 2011). If an individual sees stress as negative, they are more likely to be  
11 susceptible to experience more serious negative emotions such as depression and anxiety  
12 (Jiang *et al.*, 2019). Whereas those who see stress as positive and experience positive  
13 emotions as a result are more likely to have an increased life satisfaction (Cohn *et al.*,  
14 2009; Sanchez *et al.*, 2014). Although, the majority of this research has been cross-  
15 sectional more recently experimental studies are starting to be conducted to see whether  
16 causation can be implied. For example, a recent study on disadvantaged incoming  
17 university freshman involved 2 workshops containing exercises, research evidence, and  
18 anecdotes about the positive effects of stress. Results found significant increases in  
19 positive affect with the mindset group eliciting more positive affect leading to significant  
20 differences compared to the control groups and a positive association between the  
21 intervention and positive affect (Goyer *et al.*, 2021). Although research demonstrates that  
22 stress mindset, challenge and threat appraisal tendencies, and positive and negative affect  
23 are related, research is yet to sufficiently investigate how these variables may relate to each  
24 other. This will be the focus of Chapter 2 of the present thesis.

1           Beyond negative affect, a negative emotion which individuals often experience  
2 during stress is anxiety. Anxiety can be categorised into two different types, somatic  
3 anxiety which is the perception of physical sensations such as an increased heartbeat and  
4 hyperventilating (Grossbard *et al.*, 2009) and cognitive anxiety which is the mental  
5 component to anxiety and refers to negative thoughts and concerns (Ree *et al.*, 2008). High  
6 levels of anxiety are believed to have a negative impact on an individual's health and  
7 performance (Fulton *et al.*, 2011; Maloney *et al.*, 2014). However, research shows that  
8 individuals can interpret anxiety as facilitative to outcomes such as health and performance  
9 or they could interpret anxiety as debilitating to these outcomes (Robazza *et al.*, 2007). If  
10 an individual interprets anxiety in a facilitative way, it has been shown to be beneficial to  
11 their performance (Hanin, 2010).

12           The TCTSA suggests that anxiety is often present during stress, however, if an  
13 athlete interprets the stress as a challenge state, they are more likely to perceive the anxiety  
14 as being facilitative as well as experience other more positive emotions, compared to a  
15 threat state eliciting more negative emotions and interpretation of anxiety (Meijen *et al.*,  
16 2020). Limited research has explored stress mindset and anxiety, the research that has been  
17 completed in this area suggests that there are relationships. However, further research  
18 needs to be done to examine exactly what this relationship is (Kilby *et al.*, 2016). Perhaps  
19 surprisingly there has been no research that has examined stress mindset and anxiety  
20 interpretation. It is important for research to investigate this as the effectiveness of stress  
21 mindset on regulating anxiety may be through altering the interpretation of it rather than  
22 reducing the intensity.

23           The aim of the present thesis was to address some of the identified gaps in the  
24 stress mindset literature by investigating the relationships between stress mindset,



1 challenge and threat appraisal tendencies and levels of positive and negative affect.  
2 Chapter 2 employed a cross-sectional questionnaire-based study design to investigate  
3 whether stress mindset was related to general levels of positive and negative affect via  
4 challenge and threat appraisal tendencies (i.e., examine whether challenge and threat  
5 appraisal tendencies mediated the relationship between stress mindset and positive and  
6 negative affect). Extending the findings of Chapter 2, Chapter 3 used an experimental  
7 design to investigate whether an online stress mindset video intervention was effective in  
8 manipulating stress mindset and whether this was also accompanied by changes in  
9 appraisal tendencies, and general affect. It also investigated whether any changes in stress  
10 mindset were accompanied by group differences in stress appraisals, affect, and anxiety  
11 reported in relation to two stressful scenarios. More specific aims and hypotheses of each  
12 study are addressed within each chapter.

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**Chapter 2. INVESTIGATING DISPOSITIONAL CHALLENGE AND THREAT**

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**APPRAISAL TENDENCIES AS MEDIATORS OF THE RELATIONSHIP**

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**BETWEEN STRESS MINDSET AND POSITIVE AND NEGATIVE AFFECT**

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1 **Investigating challenge and threat as mediators of the relationship between stress**  
2 **mindset and positive and negative affect**

3 **Introduction**

4 Stress can be defined as “a particular relationship between the person and the  
5 environment that is appraised by the person as taxing or exceeding his or her resources and  
6 endangering his or her wellbeing” (Lazarus and Folkman, 1984, p.19). Stress is inevitable  
7 in everyday life (Beiter *et al.*, 2015). It can be experienced by a variety of people and in a  
8 number of different settings including but not limited to work (Michie, 2002), when  
9 competing in major sporting competitions (Neil *et al.*, 2011), and when completing  
10 assessments (Putwain, 2009). Experiencing regular and/or very high levels of stress can  
11 have negative implications on an individual’s physical and mental health (Seegerstrom *et*  
12 *al.*, 2012). This can include high blood pressure (Thoits, 2010), heart problems (Miodrag  
13 *et al.*, 2010), as well as depression (Maercker *et al.*, 2013), anxiety (Garbarino *et al.*,  
14 2013), and burnout (Pines *et al.*, 2005). However, there has now been research that shows  
15 that stress doesn’t always have negative effects, for example athletes produce their best  
16 performances whilst under pressure (Swann *et al.*, 2017). Stress does relate to both  
17 positive and negative affect (Hamama *et al.*, 2013).

18 Negative affect can be described as unpleasant emotions you can feel such as  
19 nervousness, fear and anger (Watson *et al.*, 1988). Research has shown that these emotions  
20 can escalate into more serious emotions such as depression and anxiety (McGonagle *et al.*,  
21 1990). There has been research which shows that greater negative affect is associated with  
22 lower life satisfaction and more serious mental health issues (Wang *et al.*, 2018; Mandal *et*  
23 *al.*, 2012). Contrary to this, positive affect has been associated with higher life satisfaction  
24 (Gloria *et al.*, 2016). Positive affect can be described as the pleasant emotions you can feel

1 such as excitement, enthusiasm and alertness (Watson *et al.*, 1988). As well as a higher life  
2 satisfaction, positive affect is associated with lower morbidity and increased longevity  
3 (Pressman *et al.*, 2005). Stress is typically associated with higher levels of negative affect  
4 and lower levels of positive affect (Sève *et al.*, 2007).

5         Although experiencing stress relates to levels of positive and negative affect, more  
6 recent research suggests that rather than the intensity of stress experienced, outcomes  
7 associated with stress may be more heavily influenced by how we view stress (Crum *et al.*,  
8 2020). Stress is typically thought of as being a negative experience which is not only  
9 detrimental to our health and wellbeing (Dhabhar, 2014), but also how well we perform in  
10 a stressful situation (Bhadauriya *et al* 2018). However, some people benefit from stress  
11 and thrive under pressure (Linley & Joseph, 2004). There is yet to be a distinct answer as  
12 to why people react differently to stress (Kilby *et al.*, 2016). However, because stress is  
13 always going to happen, it is important for research to establish factors associated with  
14 more positive interpretations and responses to stress such as appraisals and mindsets and  
15 investigate how these constructs are related to positive and negative affect to facilitate  
16 better wellbeing.

17         A factor which can influence the emotions or affect one experiences is how stress  
18 is appraised. Appraisals are how individuals view a situation. There are two types of stress  
19 appraisals; primary appraisals which are where an individual makes an evaluation of the  
20 demands of the environment, and secondary appraisals where the individual makes the  
21 evaluation of the resources they have to cope with those demands (Kelley *et al.*, 2019). If  
22 one appraises a situation as a challenge, it is due to the individual believing that they have  
23 enough resources (or nearly sufficient resources) to cope with the demands of the situation  
24 (Blascovich *et al.*, 2000). A challenge appraisal is associated with more positive affect

1 during a stressful situation (Garland *et al.*, 2015). By contrast, an individual who appraises  
2 a situation as a threat perceives that the demands of the stress-evoking situation outweigh  
3 their available resources (Blascovich *et al.*, 2000). A threat appraisal is associated with  
4 more negative affect during a stressful situation (Garland *et al.*, 2015). The associations  
5 between challenge and threat appraisals and positive and negative affect are not just those  
6 experienced in response to stress-evoking situations, but also at a dispositional level. For  
7 example, challenge appraisal tendencies are associated with greater levels of positive  
8 affect and lower levels of negative affect (Houge, 2019). This suggests that dispositions  
9 associated with greater challenge and lower threat appraisal tendencies are likely to in turn  
10 be associated with greater positive affect and less negative affect.

11         One factor thought to be associated with how an individual's appraises stress is  
12 their stress mindset (Hagger *et al.*, 2020). Stress mindset is the belief an individual has  
13 about the outcomes of stress. Crum *et al.*, (2013) identified two types of stress mindset,  
14 stress-is-enhancing (when the individual holds the belief that the outcomes of stress are  
15 beneficial in regard to health, learning, performance, and growth) and stress-is-debilitating  
16 (when the individual holds the belief that the outcomes of stress have negative effects on  
17 their health, learning, performance and growth). A stress-is-enhancing mindset is  
18 associated with more positive outcomes such as better performance, more proactive  
19 approaches to coping, and greater psychological wellbeing (Casper *et al.*, 2017; Kilby *et*  
20 *al.*, 2016). A stress-is-debilitating mindset is associated with poorer performance, more  
21 avoidant approaches to coping, and poorer psychological wellbeing (Chen *et al.*, 2021).  
22 Specific to stress appraisals, research has shown that stress mindset is associated with  
23 challenge and threat appraisals. Specifically, a more stress-is-enhancing mindset has been  
24 related to higher challenge appraisal tendencies within an athlete sample (Mansell, 2021).  
25 It can be suggested that the same principles would likely apply to a non-athlete sample,

1 however, research is limited. By contrast, a more stress-is-debilitating mindset was related  
2 to higher threat appraisal tendencies within a non-athlete sample (Chen *et al.*, 2021).

3 As well as relating to stress appraisal tendencies, research has shown that stress  
4 mindset is also associated with emotions experienced during stress (SangWoo, 2016).  
5 Specifically, a more stress-is-enhancing mindset is related to greater positive affect (Crum  
6 *et al.*, 2017) whereas a more stress-is-debilitating mindset is related to greater negative  
7 affect (Huebschmann *et al.*, 2020). Research has shown that a more stress-is-enhancing  
8 mindset can elicit more positive emotions during a stressful situation leading to individuals  
9 coping with the situation better (Jiang *et al.*, 2019). Stress mindset is also associated with  
10 general feelings and emotions reflective of general wellbeing. For example, a more stress-  
11 is-debilitating mindset is associated with more negative emotions and can have a negative  
12 effect on an individual's mental health (Huebschmann *et al.*, 2020). Whilst a more stress-  
13 is-enhancing mindset is associated with positive emotions which can lead to an increase in  
14 life satisfaction (Marten, 2017).

15 As explained, research demonstrates that a more stress-is-enhancing mindset is  
16 related to greater challenge appraisal tendencies while a more stress-is-debilitating mindset  
17 is related to greater threat appraisal tendencies. It is suggested that if an individual holds a  
18 more stress-is-enhancing mindset they are more likely to believe that they have the  
19 resources to cope with the demands of the environment and therefore appraise a stressful  
20 situation as more of a challenge (Hammond *et al.*, 2020), while those holding a more  
21 stress-is-debilitating mindset are more likely to believe that the demands of the  
22 environment outweigh their individual resources thus appraising the situation as a threat  
23 (Kilby *et al.*, 2016).

1           However, contradictory to previous research, new research has now found that a  
2 person can evaluate a situation as a threat but can still believe that positive outcomes are  
3 possible so hold a more stress is enhancing mindset. However, studies have found that an  
4 individual who holds a more stress is enhancing mindset is more likely to appraisal  
5 stressful situations as a challenge (Copeck *et al.*, 2022). Although stress mindset and  
6 appraisal tendencies could be considered similar and relate to the same things, they are  
7 very different in terms that stress mindset is a set of beliefs and is very general which does  
8 not take the situation into account, whereas appraisal tendencies are situational and that  
9 appraisal can vary between situation (Kilby *et al.*, 2016). Additionally, a greater challenge  
10 appraisal tendency is related to higher levels of positive affect while a greater threat  
11 appraisal tendency is related to more negative affect. Therefore, it can be suggested that  
12 the relationship between stress mindset and positive and negative affect could be mediated  
13 through challenge and threat appraisal tendencies, however, research has yet to examine  
14 this.

## 15 **Aims and Hypothesis**

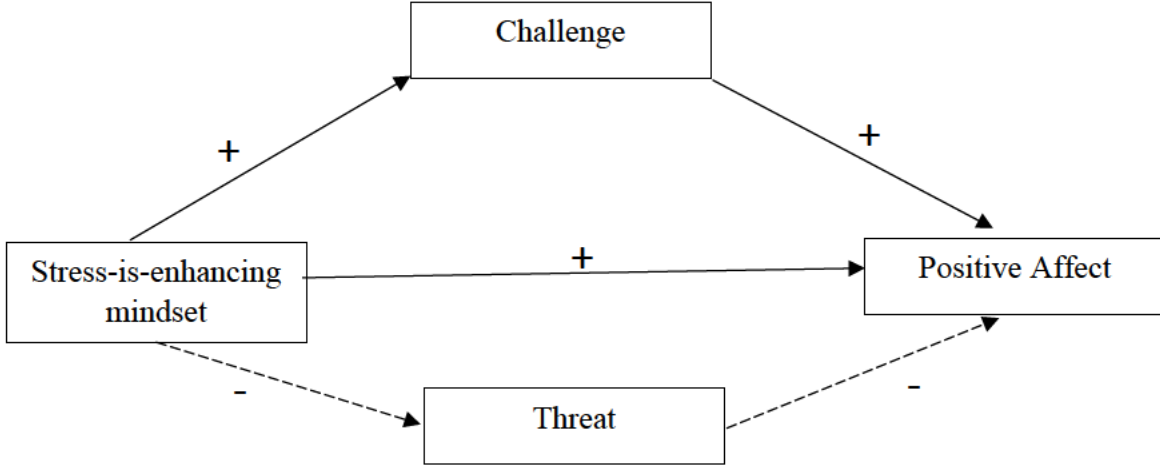
16           The aim of the present study was to examine the associations between stress  
17 mindset, challenge appraisal, threat appraisal, positive affect, and negative affect. More  
18 specifically, the study aimed to examine the extent to which challenge and threat appraisal  
19 tendencies mediated the relationship between stress mindset and general levels of positive  
20 and negative affect. Using mediation analysis, two separate models were tested, the first  
21 examined positive affect as the outcome variable and the second examined negative affect  
22 as the outcome variable.

23           It was hypothesized that a more stress-is-enhancing mindset would relate to higher  
24 levels of positive affect and lower levels of negative affect. However, it was hypothesized

1 that this relationship would be mediated through challenge and threat appraisal tendencies  
2 so that a more stress-is-enhancing mindset would be related to a greater challenge  
3 appraisal tendency and a lower threat appraisal tendency. A greater challenge appraisal  
4 tendency was then hypothesized to relate to higher levels of positive affect and lower  
5 levels of negative affect. Whereas higher threat appraisal tendencies were hypothesized to  
6 relate to higher levels of negative affect and lower levels of positive affect. The two  
7 hypothesized models to be tested are displayed in Figure 1a and 1b.

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18 *Figure 1a- Hypothesized mediation model for stress mindset, challenge and threat*  
19 *appraisal tendencies, and positive affect*

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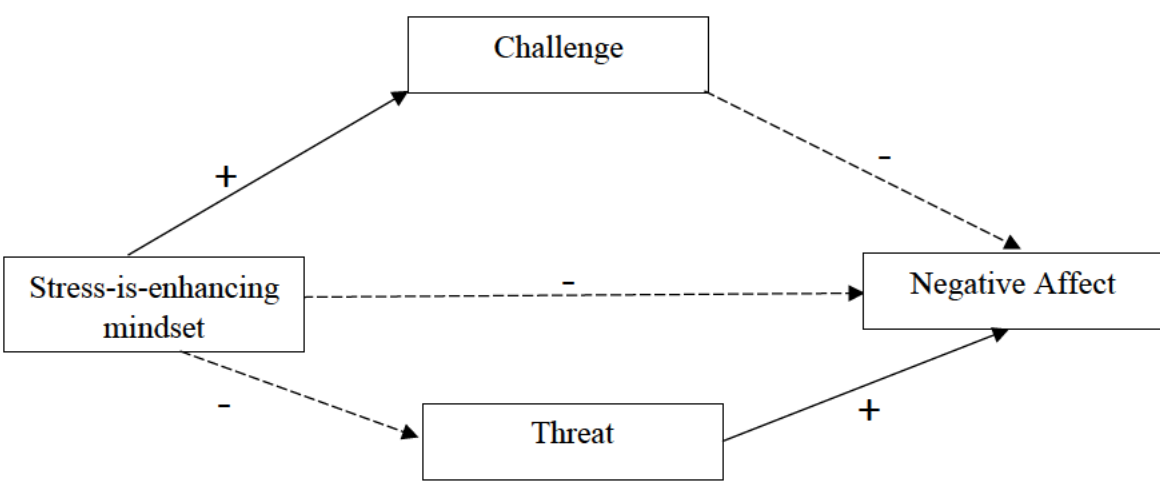
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4 *Figure 1b- Hypothesized mediation model for stress mindset, challenge and threat*  
5 *appraisal tendencies, and negative affect*

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## Methods

### 8 Participants

9 A power analysis was conducted to determine the appropriate sample size. Based  
10 on the number of predictors in the mediation model, with an alpha level at .05, a power of  
11 .80, and accounting for a small to medium effect size, a sample of 197 was needed. A total  
12 of 209 participants (54 male, 154 female, 1 genderfluid) between the ages of 18-35 (M =  
13 22.61; SD = 4.49) were recruited to account for any issues with missing data. Inclusion  
14 criteria were being aged 18-35 and proficient in reading English, as well as having access  
15 to the internet. Exclusion criteria included having a diagnosis of a mental health condition  
16 at the time of data collection. The sample included 109 athletes and 100 non-athletes. The  
17 athletes represented 30 different sports with the most popular sports being football (n =  
18 30), hockey (n = 14), cricket (n = 9) and golf (n = 8).

### 19 Questionnaires

20 **Stress Mindset Measure.** The Stress Mindset Measure (SMM; Crum *et al.*, 2013)  
21 was used to measure the participants' general stress mindset. This questionnaire consists of  
22 8 items, with 4 worded positively (e.g., "The effects of stress are positive and should be  
23 utilized") and 4 worded negatively (e.g., "Experiencing stress depletes my health and  
24 vitality"). Participants rate the extent to which they agree or disagree with each item on a  
25 5-point scale ranging from 0 (strongly disagree) to 4 (strongly agree). The 4 negatively

1 worded items are reversed scored and all 8 items averaged so that a higher score indicates  
2 a more stress-is-enhancing stress mindset. The SMM produces a valid and reliable measure  
3 of stress mindset and has been used in several previous studies (Ben-Avi *et al.*, 2018;  
4 Casper *et al.*, 2017). This questionnaire had good internal reliability for the present study  
5 with Cronbach alpha's coefficient being .81.

6 **Positive and Negative Affect Schedule.** Positive and negative affect was  
7 measured using the Positive and Negative Affect Schedule (PANAS; Watson *et al.*, 1988).  
8 This questionnaire consists of 20 items each referring to a particular feeling. Ten of the  
9 items refer to positive feelings such as "Inspired," and 10 refer to negative feelings such as  
10 "Afraid." Participants indicate the extent to which they have experienced each feeling over  
11 the past 2 weeks on a 5-point scale from 1 (very slightly or not at all) to 5 (extremely). The  
12 10 positive items are then added together to give a total positive affect score and the 10  
13 negative items added together to give a total negative affect score. Scores for each  
14 construct range between 10 and 50 with a higher score indicating higher positive or  
15 negative affect. The PANAS has been validated as a measure of positive and negative  
16 affect (Crawford *et al.*, 2004) and has been used in previous studies (Egloff *et al.*, 2003).  
17 The Cronbach alpha's coefficients of this questionnaire in this present study were .88 for  
18 positive affect and .86 for negative affect.

19 **Cognitive Appraisal Scale.** The Cognitive Appraisal Scale (CAS; Skinner &  
20 Brewer, 2002) measured the participants' challenge and threat appraisal tendencies. This  
21 questionnaire consists of 18 items, 8 of which measure challenge appraisal (e.g., "I tend to  
22 focus on the positive aspects of any situation") whilst the other 10 items measure a threat  
23 appraisal (e.g., "I am concerned that others will find fault with me"). Participants indicate  
24 the extent to which they agree/disagree with each item on a 6-point scale from 1 (strongly

1 disagree) to 6 (strongly agree). Mean scores are then calculated for each subscale to give a  
2 score for both challenge and threat appraisal tendencies ranging between 1 and 6 with a  
3 higher score indicating a greater challenge or threat appraisal tendency. The CAS has been  
4 identified as a valid and reliable questionnaire to produce an indication of someone's  
5 challenge and threat appraisal tendencies (Sarrasin *et al.*, 2014). This questionnaire  
6 demonstrated good internal reliability with Cronbach alpha's coefficients being .74 for  
7 challenge and .93 for threat.

## 8 **Procedures**

9 Ethical approval was first gained from the university's STEM ethics before  
10 participants were recruited. Recruitment for this study was then completed through emails  
11 and word of mouth. All data collection was conducted online via SmartSurvey. Pilot  
12 testing (N = 10) was first completed to ensure the questionnaire pack made sense and was  
13 easy to complete unsupervised by the researchers, and minor changes to the layout and  
14 wording of questions were made from this feedback. Potential participants were provided  
15 with an online information sheet which provided details of the study, and the inclusion and  
16 exclusion criteria. The participants were made aware that their participation in the study  
17 was voluntary and they had the right to withdraw at any time during the study and up to 2  
18 weeks after completing the questionnaire pack, and that they could contact the researchers  
19 if they had any questions regarding the study. A consent form was then provided to the  
20 participants willing to take part which was completed before they completed the  
21 questionnaire pack. The questionnaire pack consisted of demographic questions and the  
22 stress mindset measure, the positive and negative affect schedule, and the cognitive  
23 appraisal scale. Completion of the study took the participants roughly 15-20 minutes.

## 24 **Data Analysis**

1 All data analysis was completed using SPSS. Firstly, data were screened for  
2 missing data and outliers. There were missing data for positive affect (n = 3), negative  
3 affect (n = 2), challenge appraisal tendency (n = 4), and threat appraisal tendency (n = 3).  
4 These participants were excluded from analyses involving these specific variables. No  
5 outliers were found.

6 First, bivariate correlations were run to see how stress mindset, positive affect,  
7 negative affect, challenge appraisal tendency and threat appraisal tendency were related to  
8 each other. Prior to the main mediation analysis factorial ANOVAs were run to see  
9 whether there were any sport status differences (i.e., athletes compared with non-athletes),  
10 gender differences, or any gender by sport interactions for stress mindset, positive affect,  
11 negative affect, challenge appraisal tendency and threat appraisal tendency. This is because  
12 previous research has suggested that athletes may differ to non-athletes in their stress  
13 mindset (Mansell, 2021). Research has also found that athletes report more positive affect  
14 (i.e. happiness) and have a higher stress tolerance compared to non-athletes (Bostani *et al.*,  
15 2011) Moreover, females experience negative emotions more frequently and are more  
16 likely to appraise situations as a threat compared to males (Brebner, 2003; Mak *et al.*,  
17 2004). The genderfluid participant was excluded from this analysis due to only being one  
18 participant in this group and thus violating the assumptions of an ANOVA. As such, the  
19 analyses run were 2 gender (male, female) × 2 sport status (athlete, non-athlete) factorial  
20 ANOVAs. These findings were used to determine which variables to include as control  
21 variables in the mediation models.

22 Finally, to address the main aim of the study, mediation analysis was conducted via  
23 the SPSS add on PROCESS using model 4 (Hayes, 2018). Mediation is when there is a  
24 third variable which is associated between two other variables. Variable X will be

1 associated with variable Y. However, in mediation there is variable Z that relates to  
2 variable X, and then variable Z in turn is associated with variation on variable Y  
3 (Mackinnon, 2008). Variable Z would be known as the mediator. Mediation analysis in  
4 this study consisted of two mediation models, the first model consisted of stress mindset  
5 (predictor), challenge and threat appraisal tendencies (parallel mediators) and positive  
6 affect (outcome). The second model consisted of stress mindset (predictor), challenge and  
7 threat appraisal tendencies (parallel mediators) and negative affect (outcome).

8 For all analyses, the significance level was set as  $<.05$  and partial eta squared ( $\eta_p^2$ )  
9 was the reported effect size for ANOVAS. For the mediation analysis, standardized beta  
10 values were reported, and bias-corrected 95% confidence intervals were generated for all  
11 indirect effects from bootstrapping of 1000 samples. Due to significant findings when  
12 completing factorial ANOVAs to find any sport status or gender differences, both of these  
13 were controlled for throughout all mediation analysis.

## 14 **Results**

### 15 **Correlations**

16 Bivariate Correlations between stress mindset, challenge and threat appraisal  
17 tendencies, and positive and negative affect are reported in Table 1. Stress Mindset was  
18 positively correlated with challenge appraisal tendency with a small to medium effect size  
19 ( $p <.001$ ) and positive affect with small to medium effect size ( $p = .001$ ), and negatively  
20 correlated with threat appraisal tendency with a medium effect size ( $p <.001$ ) and negative  
21 affect with a small to medium effect size ( $p <.001$ ). Challenge appraisal tendency was  
22 negatively correlated to threat appraisal tendency with a medium effect size ( $p <.001$ ) and  
23 negative affect with a medium effect size ( $p <.001$ ), and positively correlated with positive  
24 affect with a medium effect size ( $p <.001$ ). Threat appraisal tendency was negatively

1 correlated to positive affect with a small effect size ( $p=.006$ ) and positively correlated to  
 2 negative affect with a medium to large effect size ( $p<.001$ ). Positive affect and negative  
 3 affect were also negatively correlated with a medium effect size ( $p<.001$ )<sup>1</sup>.

4 **Table 1.** Bivariate correlations between stress mindset, challenge and threat appraisal  
 5 tendencies, and positive and negative affect.

	Stress Mindset	Challenge Appraisal	Threat Appraisal	Positive Affect
<i>Challenge Appraisal</i>	.29**			
<i>Threat Appraisal</i>	-.31**	-.41**		
<i>Positive Affect</i>	.23*	.42**	-.19*	
<i>Negative Affect</i>	-.29**	-.41**	.45**	-.44**

6 *Note.* \*  $p<.01$  \*\*  $p<.001$

## 8 Sport Status and Gender Differences

9 Means and standard deviations of stress mindset, challenge and threat appraisal  
 10 tendencies, and positive and negative affect broken down by sport status and gender are  
 11 reported in Table 2.

12 **Stress mindset.** Factorial ANOVA results showed there was a significant sport  
 13 status effect with a small effect size  $F(1, 204) = 4.37, p = .038, \eta_p^2 = .021$ , with athletes  
 14 having a more stress-is-enhancing mindset than non-athletes. There was a non-significant  
 15 gender effect with a small effect size  $F(1, 204) = 1.56, p = .213, \eta_p^2 = .008$ , and a non-

<sup>1</sup> Sensitivity analyses was run on all the results using a bonferroni correction to account for a possible type 1 error. All the results remained significant apart from the bivariate correlation between threat appraisal tendency and positive affect.

1 significant gender by sport status interaction with a small effect size  $F(1, 204) = .581, p =$   
2  $.447, \eta_p^2 = .003$ .

3 **Positive and negative affect.** For positive affect there was a non-significant with  
4 small effect sizes sport status effect  $F(1, 204) = .727, p = .395, \eta_p^2 = .004$ , gender effect  $F$   
5  $(1, 201) = .614, p = .434, \eta_p^2 = .003$  and gender by sport interaction  $F(1, 204) = .116, p =$   
6  $.734, \eta_p^2 = .001$ . For negative affect there was a non-significant sport status effect with a  
7 small effect size  $F(1, 202) = .807, p = .370, \eta_p^2 = .004$ . However, there was a significant  
8 gender effect with a small effect size  $F(1, 202) = 5.60, p = .019, \eta_p^2 = .027$ , with females  
9 having a higher negative affect compared to males. There was a non-significant gender by  
10 sport status interaction with a small effect size  $F(1, 202) = .155, p = .694, \eta_p^2 = .001$ .

11 **Challenge and threat appraisal tendencies.** For challenge appraisal there was a  
12 non-significant sport status effect with a small effect size  $F(1, 200) = .004, p = .952, \eta_p^2 <$   
13  $.001$ . However, there was a significant gender effect with a medium effect sizes  $F(1, 200)$   
14  $= 10.67, p = .001, \eta_p^2 = .051$ , with males reporting a significantly higher challenge  
15 appraisal tendency compared to females. There was a non-significant gender by sport  
16 status interaction with a small effect size  $F(1, 200) = .062, p = .804, \eta_p^2 < .001$ . For threat  
17 there was a non-significant sport status effect with a small effect size  $F(1, 201) = .259, p =$   
18  $.611, \eta_p^2 = .001$ . However, there was a significant gender effect with a medium effect size  
19  $F(1, 204) = 12.89, p < .001, \eta_p^2 = .060$ , with females reporting significantly higher threat  
20 appraisal tendencies compared to males. There was also a non-significant gender by sport  
21 status interaction with a small effect size  $F(1, 201) = .119, p = .730, \eta_p^2 = .001$ .

22

**Table 2.** Means and standard deviations of stress mindset, challenge and threat appraisal tendencies, and positive and negative affect broken down by sport status and gender.

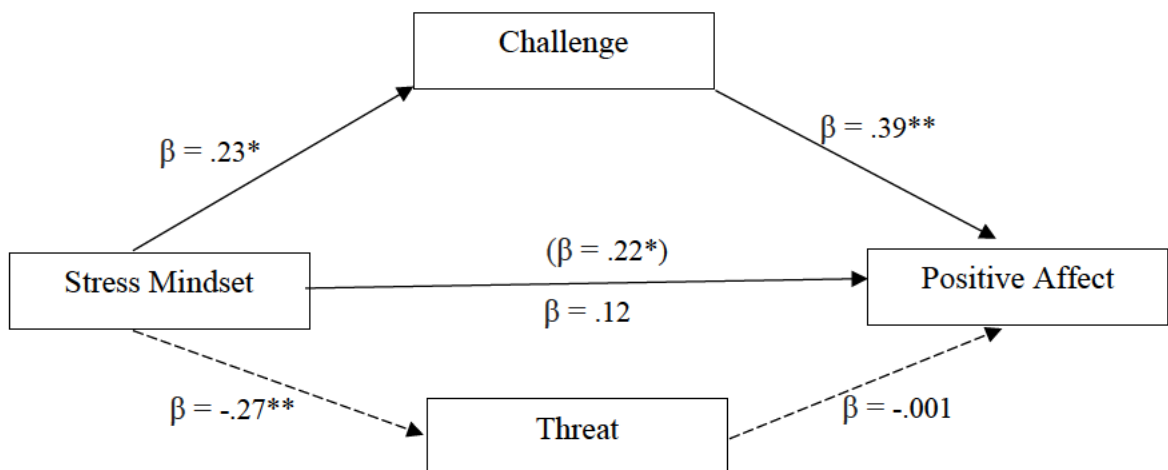
Variable	Males			Females			Total		
	Athlete	Non-Athlete	Total	Athlete	Non-Athlete	Total	Athlete	Non-Athlete	Total
Stress Mindset (0-4)	2.06 (0.68)	1.92 (0.75)	2.02 (0.70)	2.01 (0.52)	1.71 (0.62)	1.85 (0.59)	2.03 <sup>a*</sup> (0.58)	1.75 (0.64)	1.89 (0.62)
Challenge (1-7)	4.64 (0.60)	4.67 (0.52)	4.65 <sup>b*</sup> (0.57)	4.34 (0.64)	4.33 (0.53)	4.33 (0.58)	4.45 (0.64)	4.38 (0.54)	4.42 (0.59)
Threat (1-7)	3.48 (1.10)	3.51 (1.16)	3.49 (1.11)	4.04 (0.95)	4.19 (1.01)	4.12 <sup>c*</sup> (0.99)	3.85 (1.03)	4.08 (1.06)	3.96 (1.05)
Positive Affect (10-50)	31.39 (7.81)	30.69 (7.39)	31.19 (7.63)	30.78 (8.06)	29.13 (8.45)	29.89 (8.29)	31.00 (7.94)	29.39 (8.27)	30.23 (8.12)
Negative Affect (10-50)	19.92 (7.14)	20.56 (5.97)	20.11 (6.76)	22.44 (8.13)	24.09 (7.34)	23.32 <sup>c*</sup> (7.73)	21.57 (7.87)	23.51 (7.22)	22.50 (7.61)

Note. *a* = significantly higher than non-athletes, *b* = significantly higher than females, *c* = significantly higher than males. \**p*<0.05



1 **Mediation Analysis**

2 **Positive affect.** The results of the mediation analysis are presented in Table 3 and  
3 the direct effect estimates are also visually displayed in Figure 1. When controlling for  
4 gender and sport, stress mindset initially had a significant direct effect on positive affect  
5 such that a more stress-is-enhancing stress mindset was associated with greater positive  
6 affect. Stress mindset was also a significant direct positive predictor of challenge appraisal  
7 tendency and negative predictor of threat appraisal tendency. Thus, a more stress-is-  
8 enhancing mindset was associated with greater challenge appraisal tendency and lower  
9 threat appraisal tendency. When examining the effect of both mediators on positive affect,  
10 only challenge appraisal tendency was a significant predictor, with greater challenge  
11 appraisal tendency being associated with greater positive affect. Threat appraisal tendency  
12 and positive affect were not associated. The full mediation model showed that the  
13 relationship between stress mindset and positive affect became non-significant when  
14 accounting for the mediators, indicating that the relationship between stress mindset and  
15 positive affect was mediated through challenge appraisal tendency. The significant indirect  
16 effect of stress mindset on positive affect through challenge appraisal tendency confirmed  
17 this mediation effect ( $\beta = 1.15$ ; LLCI = .51, ULCI = 1.89), while the indirect effect  
18 through threat was non-significant ( $\beta < .001$ ; LLCI = -.55, ULCI = .59).



1 *Figure 1- Mediation model for stress mindset, challenge and threat appraisal tendencies,*  
 2 *and positive affect. For visual simplicity, gender and sport status are not displayed were*  
 3 *controlled for in the analyses. Beta weight in brackets denotes the original direct effect*  
 4 *before controlling for the mediators.*

5 *Note. \*  $p < .01$  \*\*  $p < .001$*

6 **Table 3.** Mediation analysis results for challenge and threat appraisal tendencies  
 7 meditating the relationship between stress mindset and positive affect.

Direct Effect of Stress Mindset on Positive Affect					
R <sup>2</sup> = .06, F (3,195) = 3.76, p =.012					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
Gender	-.02	-0.34	1.08	.756	<.001
Sport	-.04	-0.61	1.16	.600	.002
<b>Stress Mindset</b>	<b>.22</b>	<b>2.70</b>	<b>0.91</b>	<b>.003</b>	<b>.05</b>
Direct Effect of Stress Mindset on Challenge Appraisal					
R <sup>2</sup> = .11, F (3,195) = 7.94, p <.001					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
<b>Gender</b>	<b>-.20</b>	<b>-0.22</b>	<b>0.08</b>	<b>.004</b>	<b>.04</b>
Sport	.04	0.04	0.08	.624	<.001
<b>Stress Mindset</b>	<b>.23</b>	<b>0.21</b>	<b>0.06</b>	<b>.001</b>	<b>.05</b>
Direct Effect of Stress Mindset on Threat Appraisal					
R <sup>2</sup> = .14 F (3,195) = 10.45, p <.001					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
<b>Gender</b>	<b>.21</b>	<b>0.42</b>	<b>0.14</b>	<b>.002</b>	<b>.04</b>
Sport	-.01	-0.02	0.15	.870	<.001
<b>Stress Mindset</b>	<b>-.27</b>	<b>-0.45</b>	<b>0.11</b>	<b>&lt;.001</b>	<b>.07</b>
Mediation Model Predicting Positive Affect					
R <sup>2</sup> = .193, F (5,193) = 9.23, p <.001					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
Gender	.06	0.86	1.04	.405	.003
Sport	-.05	-0.83	1.08	.444	.002
<b>Challenge Appraisal</b>	<b>.39</b>	<b>5.50</b>	<b>1.02</b>	<b>&lt;.001</b>	<b>.15</b>
Threat Appraisal	-.001	-0.01	0.56	.989	<.001

Stress Mindset	.12	1.54	0.88	.083	.01
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1

2       **Negative Affect.** The results of the mediation analysis are presented in Table 4 and  
3 the direct effect estimates are also visually displayed in Figure 2. Whilst controlling for  
4 gender and sport, initially stress mindset had a significant direct relationship with negative  
5 affect, suggesting a more stress-is-enhancing mindset is related to a lower negative affect.  
6 Similar to model 1 Stress mindset was a significant direct positive predictor of challenge  
7 appraisal tendency and negative predictor of threat appraisal tendency. When examining  
8 the effect of both mediators on negative affect, both challenge and threat appraisal  
9 tendencies were significant predictors, with lower challenge appraisal and a greater threat  
10 appraisal being associated with greater negative affect. The full mediation model showed  
11 that the relationship between stress mindset and negative affect became non-significant  
12 when accounting for the mediators, indicating that the relationship between stress mindset  
13 and negative affect was mediated through both challenge and threat appraisal tendencies.  
14 The significant indirect effect of stress mindset on negative affect through challenge  
15 appraisal ( $\beta = -.62$ ; LLCI = -1.32, ULCI = -.14) and threat appraisal ( $\beta = -1.01$ ; LLCI = -  
16 1.74, ULCI = -.42) confirmed this mediation effect.

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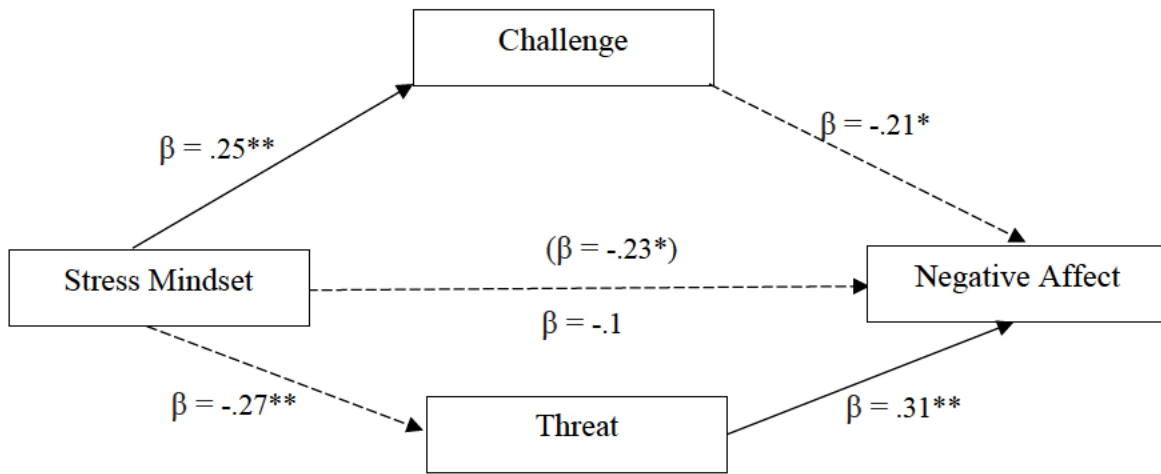
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25 *Figure 2. Mediation model for stress mindset, challenge and threat and negative affect*

1 Note. \*  $p < .01$  \*\*  $p < .001$ . For visual simplicity, gender and sport status are not displayed  
 2 were controlled for in the analyses. Beta weight in brackets denotes the original direct  
 3 effect before controlling for the mediators.

4 **Table 4.** Mediation analysis results for challenge and threat appraisal tendencies  
 5 meditating the relationship between stress mindset and negative affect.

Direct Effect of Stress Mindset on Negative Affect					
$R^2 = .14, F(3,196) = 10.18, p < .001$					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
<b>Gender</b>	<b>.23</b>	<b>3.42</b>	<b>1.00</b>	<b>.001</b>	<b>.05</b>
Sport	.03	0.43	1.07	.692	<.001
<b>Stress Mindset</b>	<b>-.23</b>	<b>-2.78</b>	<b>0.84</b>	<b>.001</b>	<b>.05</b>
Direct Effect of Stress Mindset on Challenge Appraisal					
$R^2 = .12, F(3,196) = 8.55, p < .001$					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
<b>Gender</b>	<b>-.20</b>	<b>-0.22</b>	<b>0.08</b>	<b>.004</b>	<b>.04</b>
Sport	.04	0.04	0.08	.624	<.001
<b>Stress Mindset</b>	<b>.25</b>	<b>0.23</b>	<b>0.06</b>	<b>&lt;.001</b>	<b>.06</b>
Direct Effect of Stress Mindset on Threat Appraisal					
$R^2 = .14, F(3,196) = 10.26, p < .001$					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
<b>Gender</b>	<b>.20</b>	<b>0.40</b>	<b>0.14</b>	<b>.004</b>	<b>.04</b>
Sport	-.002	-0.01	0.15	.973	<.001
<b>Stress Mindset</b>	<b>-.27</b>	<b>-0.45</b>	<b>0.11</b>	<b>&lt;.001</b>	<b>.08</b>
Mediation Model Predicting Negative Affect					
$R^2 = .29, F(5,194) = 15.87, p < .001$					
Predictors	Standardized coefficients	Unstandardized coefficients	Standard Error	p	Effect size
Gender	.13	1.91	0.94	.043	.02
Sport	.04	0.56	0.98	.569	<.001
<b>Challenge Appraisal</b>	<b>-.21</b>	<b>-2.74</b>	<b>0.91</b>	<b>.003</b>	<b>.04</b>
<b>Threat Appraisal</b>	<b>.31</b>	<b>2.25</b>	<b>0.51</b>	<b>&lt;.001</b>	<b>.1</b>
Stress Mindset	-.10	-1.15	0.80	.155	.01

6

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## Discussion

This study aimed to examine the extent to which challenge and threat appraisal tendencies mediated the relationship between stress mindset and positive affect and negative affect. Based on previous research it was hypothesized that a stress-is-enhancing mindset, challenge appraisal tendencies, and positive affect would all be positively associated with each other. It was also hypothesized that a stress-is-debilitating mindset, threat appraisal tendencies and negative affect would all be positively associated with each other. Thus, it was hypothesized that challenge and threat appraisal tendencies would mediate the relationship between stress mindset and positive and negative affect.

In support of the hypothesis, a more stress-is-enhancing mindset was associated with higher levels of positive affect and lower levels of negative affect. These results are aligned with previous research which suggests when an individual a more stress-is-enhancing mindset they are more likely to elicit positive emotions. However, previous research was completed in response to stress, whilst this study shows that stress mindset also relates to general positive affect (Jiang *et al.*, 2019; Crum *et al.*, 2017). Similar to the present study, research has found that when students hold a more stress-is-debilitating mindset at a general level they are more likely to elicit negative emotions and can have a negative effect on an individual's mental health (Huebschmann *et al.*, 2020).

As well as a more stress-is-enhancing mindset relating to higher levels of positive affect, the results show that a more stress-is-enhancing mindset also relates to a greater challenge appraisal tendency. This finding is in line with previous research suggesting that a more stress-is-enhancing mindset is related to an increased challenge appraisal tendency (Mansell, 2021). However, while Mansell (2021) identified the finding in an athlete only sample, the present study demonstrated the relationship in a mixed sample of athletes and

1 non-athletes suggesting that the relationship also exists in non-athlete populations. The  
2 results of this study also show that a more stress-is-debilitating mindset is related to a  
3 greater threat appraisal tendency. Previous research suggests that a more stress-is-  
4 debilitating mindset is associated with an increased threat appraisal in an adolescent  
5 population (Chen *et al.*, 2021). The present study extends this work by demonstrating a  
6 more stress-is-debilitative mindset is also associated with greater threat appraisal  
7 tendencies in an adult population.

8           Although stress mindset and challenge and threat appraisal tendencies are  
9 associated with each other, and can cause similar responses to stress, they are different to  
10 one another. Stress mindset refers to how someone typically views stress in general and the  
11 viewpoint is held no matter how someone appraises a certain situation. Appraisals on the  
12 other hand are situational dependent and could change depending on in the perceived  
13 demands and resources. An individual could hold an enhancing mindset but still appraise  
14 the situation as a threat or hold a debilitating mindset but appraise the situation as a  
15 challenge (Crum *et al.*, 2017). Although stress mindset and appraisal tendencies are  
16 different and can be experienced in isolation of each other, the results of this study suggest  
17 that those with a more enhancing mindset tend to appraise situations as more of a  
18 challenge and less of a threat.

19           Results of the present study also support previous research and the hypothesis of a  
20 greater challenge appraisal tendency relating to higher levels of positive affect and lower  
21 levels of negative affect. Whereas higher threat appraisal tendencies relate to higher levels  
22 of negative affect and lower levels of positive affect. When appraising stress as a  
23 challenge, research has shown that an individual is more likely to think about the situation  
24 positively and therefore experience more positive emotions such as happiness and pride

1 (Giacobbi *et al.*, 2007). Opposite to this, when one appraises a stressful situation as a  
2 threat, they are more likely to try and avoid the situation and think about it negatively  
3 which in turn will lead to experiencing more negative emotions (Giacobbi *et al.*, 2007).  
4 The results of the present study show that the relationship between appraisal tendencies  
5 and positive and negative affect does not only occur whilst in a stressful situation but also  
6 at a general level.

7         While the results of the present study supported the hypotheses for the direction  
8 with which the variables would be related to one another, the hypothesis of challenge and  
9 threat mediating the relationship between stress mindset and positive affect was only  
10 partially supported. The results show that challenge mediated the relationship so that a  
11 more stress-is-enhancing mindset was associated with a greater challenge appraisal  
12 tendency, which in turn was associated with more positive affect. However, threat  
13 appraisal tendencies did not mediate this same relationship. A reason as to why challenge  
14 may have mediated the relationship but not threat is because research shows it is challenge  
15 appraisals which relate more closely to positive affect (Garland *et al.*, 2015). Another  
16 reason as to why challenge may have mediated this relationship is because there is also  
17 research out there which suggests that challenge appraisals result in less stress which could  
18 in turn reduce negative affect (Tomaka *et al.*, 2021). Irrespective of why threat does not  
19 mediate the relationship, challenge being such a strong predictor of positive affect, suggest  
20 that any unique variance in positive affect accounted for by threat is non-significant.  
21 Consequently, results suggest that someone's challenge appraisal tendencies are the more  
22 important than their threat appraisal tendencies when trying to promote levels of positive  
23 affect.

1           Although threat did not mediate the relationship between stress mindset and  
2 positive affect, the hypothesis for the mediation analysis for negative affect was supported  
3 with both challenge and threat mediating the relationship. Furthermore, the results show  
4 that threat was the stronger predictor in this model compared to challenge. Specifically, a  
5 stress-is-enhancing mindset negatively predicted threat which in turn positively predicted  
6 negative affect, which a stress-is-enhancing mindset positively predicted challenge which  
7 in turn negatively predicted negative affect. Threat was the likely stronger predictor due to  
8 research demonstrating that threat appraisals are typically more strongly related to negative  
9 affect (Garland *et al.*, 2015).

10           Looking into the mediation models, the model predicting positive affect revealed a  
11 small to medium effect and the mediation model predicting negative affect was displayed a  
12 medium effect size, which shows that challenge and threat were not only significant  
13 mediators between stress mindset and positive and negative affect but that the relationships  
14 between the variables accounted for a substantial portion of the variance.

15           Collectively, the findings of the mediation models support the notion that a  
16 challenge appraisal appears to be the more important disposition for promoting positive  
17 affect while threat appraisals are the more important disposition related to negative affect.  
18 However, due to challenge appraisal also accounting for a significant proportion of the  
19 variance in negative affect, one could argue that challenge is the more important appraisal  
20 tendency overall. While the study was only cross-sectional in nature, the findings suggests  
21 that it may be more important to try and enhance someone's challenge appraisal tendency  
22 rather than try to decrease someone's threat appraisal tendency when trying to promote  
23 more positive and lower negative affect.



1           This current research supports previous challenge and threat literature, of negative  
2 emotions being more strongly associated with a threat appraisal and more positive  
3 emotions being more closely associated with a challenge appraisal (Meijen *et al.*, 2020).  
4 One of the main focus' of TCTSA-R is predispositions, this study adds to this previous  
5 literature suggesting that the stress mindset an individual holds may dictate whether  
6 someone tends to appraise a situation as a challenge or a threat (Turner *et al.*, 2020).  
7 However, as this study is does not show causation further experimental research would  
8 need to be completed to investigate this further.

9           From an applied implication perspective this study helps coaches and sports  
10 psychologists understand factors that may influence how their athletes may appraise  
11 situations, and more specifically the pre dispositions that may lead to the athletes  
12 appraising a stressful situation as a challenge or threat. Consequently, an important  
13 competition may be more positively appraised if the athlete possesses a more stress is  
14 enhancing mindset. This present study also has implications for psychologists and those  
15 working with people who are under a lot of constant pressure or stress as knowing that  
16 stress mindset is associated with a more adaptive stress appraisal can help them identify  
17 which individuals may be more likely to appraise these situation more positively and thrive  
18 compared with those who display more maladaptive appraisals and thus require more  
19 support.

20           The main strength of the present study was the inclusion of multiple mediators in  
21 the same model to allow us to examine which appraisal was the strongest mediator. The  
22 findings of this study provide a number of theoretical and applied implications. will allow  
23 future research to refine and develop these findings further and look further into mediation

1 of these variables to see whether the relationships stay consistent when looking into them  
2 even deeper.

3         The main limitation of this study is the cross-sectional nature of the work means  
4 that causation cannot be inferred. Consequently, it is unclear whether altering stress  
5 mindset would elicit changes in how stress is typically appraised and in turn whether this  
6 would alter general levels of positive and negative affect. To examine these findings  
7 further, future research should employ experimental or intervention designs to determine  
8 whether any of the identified relationships are causal in nature. Previous research has  
9 shown that stress mindset can be manipulated through brief interventions such as  
10 educational videos (Crum *et al.*, 2017). Therefore, an experiment to manipulate stress  
11 mindset would allow future research to investigate whether this increase in a stress-is-  
12 enhancing mindset is accompanied by an increase challenge appraisal and greater levels of  
13 positive affect and lower levels of negative affect.

14         Another limitation of the present study was makeup of the sample of participants.  
15 Firstly, there was a gender imbalance of the sample being predominantly female. Previous  
16 research has shown that females are more likely to assess a situation negatively and are  
17 more influenced by a stress-is-debilitating mindset compared to males (Jiang *et al.*, 2019).  
18 Although gender was controlled for in the models, future work should re-examine these  
19 relationships with a more equal gender split. Second is the fact that the population was  
20 healthy young adults. This limits the generalizability of the findings beyond this age range  
21 and into different populations. The age group for the present study was selected partly for  
22 convenience of data collection (due to the restrictions of COVID-19) but also partly  
23 because athletes are more likely to be between the ages of 18 and 25 and the study aimed  
24 for a mixture of athletes and non-athletes. However, it would be interesting to re-examine

1 these findings in other populations such as clinical populations (e.g., those with clinical  
2 anxiety) to see whether challenge appraisal continues to emerge as the more predominant  
3 mediator. Also completing a similar study with older adults to see whether there is any  
4 difference in these relationships due to age would be worthy of future work.

5           In conclusion the present study examined the extent to which challenge and threat  
6 appraisal tendencies mediated the relationship between stress mindset and general levels of  
7 positive and negative affect. The results showed that challenge appraisal tendencies (but  
8 not threat appraisal) mediated the relationship for positive affect such that a more stress-is-  
9 enhancing mindset was positively associated with greater challenge appraisal tendencies  
10 which in turn was associated with greater levels of positive affect. For predicting negative  
11 affect, although both challenge and threat appraisal tendencies mediated the relationship,  
12 threat appraisals was the stronger mediator. The results of this study suggest that challenge  
13 appraisals seem to be the more important disposition when trying to promote more positive  
14 affect. Therefore, if manipulating someone's stress mindset may be able to alter an  
15 individual's appraisals and their positive and negative affect. However, the results of this  
16 study are cross-sectional so future research must examine this with an experimental design.

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**Chapter 3. INVESTIGATING THE EFFECTIVENESS OF A BRIEF ONLINE**

8

**VIDEO INTERVENTION IN MANIPULATING STRESS MINDSET**

9

10

# **Investigating the effectiveness of a brief online video intervention in manipulating stress mindset**

## **Introduction**

Stress mindset is the belief an individual holds regarding the extent to which stress has enhancing or debilitating effects on outcomes such as performance and productivity, health and well-being, and learning and growth (Crum *et al.*, 2017). People are often described as having either a stress-is-enhancing mindset or a stress-is-debilitating mindset. As the names would suggest, a stress-is-enhancing mindset is when an individual views stress as facilitative for performance and productivity, health and well-being, and learning and growth, while a stress-is-debilitating mindset is when an individual views stress as debilitating for those outcomes (Crum *et al.*, 2013). Stress mindset is viewed on a continuum where there is not yet a cut off where you would class an individual as having an enhancing or debilitating mindset. In actual fact individuals can hold a mix of both debilitating and enhancing (Kilby *et al.*, 2016).

Importantly, stress mindset can have effects on health and wellbeing (Keech *et al.*, 2021). For example, a more stress-is-enhancing mindset is related to increased life satisfaction (Kim *et al.*, 2020), positive emotion (Horiuchi *et al.*, 2018), challenge appraisals (Kilby *et al.*, 2016), and approach focussed coping (Keech *et al.*, 2020). By comparison, a stress-is-debilitating mindset is related to negative emotions such as anxiety (Crum *et al.*, 2017), threat appraisals (Kilby *et al.*, 2016), and more avoidant coping (Crum *et al.*, 2013). Consequently, stress mindset appears to be an important determinant in how we view and respond to stressful situations as well as general psychological wellbeing.

One factor in particular that stress mindset appears to be closely associated with is stress appraisal (Wegmann *et al.*, 2020), which can be referred to how an individual views

1 a stressful situation (Folkman *et al.*, 1985). Challenge appraisals can be experienced when  
2 the individual believes that they have sufficient resources (or nearly sufficient resources)  
3 to cope with the demands of the stressful situation, while threat appraisals can arise when  
4 the individual believes that the demands of the situation outweigh the perceived resources  
5 to cope (Jones *et al.*, 2009). Research demonstrates that challenge and threat appraisal  
6 tendencies are associated with stress mindset (Mansell, 2021). As stress mindset is a set of  
7 beliefs it is thought that an individual uses these beliefs to gain the information needed to  
8 appraise the situation. If an individual holds a debilitating mindset, they are more likely to  
9 focus on the negative parts of the stress whereas if they hold an enhancing mindset, they  
10 are more likely to focus on the positives of that stressor (Kilby *et al.*, 2016). In support,  
11 Chapter 2 demonstrated that a more stress-is-enhancing mindset was associated with  
12 higher challenge appraisal tendencies. Even though stress mindset and appraisals are  
13 somewhat similar and appear to relate to each other and similar outcomes. They have one  
14 very distinct difference which is the fact that appraisals are situational whereas mindset are  
15 general and do not take into consideration the context/situation (Kilby *et al.*, 2016).  
16 Indeed, the extent to which individuals appraise situations as either a challenge or threat  
17 can vary between different stress evoking situations (Trotman *et al.*, 2018, Williams *et al.*,  
18 2012) while stress mindset is thought to be more stable.

19 Both stress mindset and stress appraisals are related to positive and negative affect  
20 with challenge appraisals and a stress-is-enhancing mindset being related to greater  
21 positive emotions (Tomaka *et al.*, 2021), and threat appraisals and stress is debilitating  
22 mindset being related to an increase in negative emotion (Côté-Arsenault, 2007). Positive  
23 affect refers to pleasant feelings and emotions such as happiness, alertness and feeling  
24 proud, while negative affect refers to unpleasant feelings and emotions such as anxiety,  
25 and feeling afraid and scared (Sauter, 2010; Folkman, 2008).

1 Chapter 2 extended the previous literature by examining in more depth how stress  
2 mindset, challenge and threat appraisal tendencies, and positive and negative affect were  
3 related to one another. The chapter demonstrated that both challenge and threat appraisals  
4 mediated the relationship between stress mindset and negative affect, while only challenge  
5 appraisal mediated the relationship between stress mindset and positive affect. Although  
6 this research suggests that stress mindset relates to positive and negative affect indirectly  
7 through stress appraisals, the study was cross-sectional meaning causation could not be  
8 implied. It is therefore important for research to examine these relationships in more depth  
9 and investigate whether alterations in stress mindset are accompanied by changes in stress  
10 appraisal and positive and negative affect.

11 Importantly, research has shown that stress mindset is adaptable and can be  
12 manipulated through intervention (Hammond *et al.*, 2020). Numerous techniques such as  
13 reading passages about the positives of stress (Watermann, 2019) and thinking back to  
14 positive experiences have been used (Ben-Avi *et al.*, 2018). However, the intervention  
15 used most widely and effectively has been the use of videos. Crum *et al.*, (2013) have  
16 found that videos showing the positive effects of stress on learning, growth, development  
17 and/or performance can elicit a more stress-is-enhancing mindset. These videos comprise  
18 of words and images that emphasise the enhancing sides of stress, accompanied by  
19 background music to make the content more powerful (Crum *et al.*, 2017). Several studies  
20 have found that these videos only need to be around 3 to 4 minutes to have an immediate  
21 impact on participants' stress mindset and have been effective in different populations  
22 including university students and employees of a large financial institution (Meyer, 2020;  
23 Crum *et al.*, 2017; Crum *et al.*, 2013). As these interventions are being developed there is  
24 a need for more interventions to help promote a growth mindset (i.e. the belief that

1 capabilities can change and develop over time as they are not fixed [Dweck *et al.*, 2019])  
2 which would in turn lead to a more enhancing stress mindset (Montagna *et al.*, 2021).

3           When examining the effectiveness of stress mindset interventions on the  
4 aforementioned outcome variables, it is important to consider its feasibility and  
5 application. Given the number of people who own portable electronic devices (e.g.,  
6 smartphones, tablets), delivering mindset interventions online could be an incredibly cost-  
7 and time-effective way to intervene. There has been limited research trying to manipulate  
8 stress mindset online, however, there has been some research that shows that these  
9 interventions can be effective (Crum *et al.* 2020). Some of these studies included the  
10 participants reading passages rather than watching videos (Watermann, 2019). As little  
11 research has been completed with stress mindset video interventions online, there are many  
12 gaps which need to be addressed in future research. One gap which research is yet to  
13 investigate is the effectiveness of online stress mindset interventions in changing stress  
14 mindset, appraisal tendencies, and affect.

15           Research also needs to continue to examine the effectiveness of mindset  
16 interventions within different populations. One such group in which stress mindset  
17 interventions may be effective is student athletes. Previous research has shown that  
18 athletes face a lot of stress and pressure within competitions and the expectations to meet  
19 the demands from people surround them to perform well (Cohn,1990; Greenleaf *et al.*,  
20 2001). Furthermore, student athletes are likely to be particularly stressed due to the  
21 demands of juggling their sporting commitments with in their degree programme at the  
22 same time (Cosh *et al.*, 2015). Mansell (2021) showed in an athlete population, a more  
23 enhancing stress mindset relates to challenge appraisal tendencies. Previous research has  
24 also shown that athletes tend to interpret emotions such as anxiety as more facilitative



1 compared to non-athletes (Jones et al., 2009). The majority are also likely of an age to  
2 possess a smartphone or portable device. Therefore, online stress mindset interventions  
3 may be an effective way to help them deal with stress. However, to date, there have been  
4 no stress mindset interventions conducted on student athletes.

5 Previous research has shown that after manipulating stress mindset, those with a  
6 more stress-is-enhancing mindset can view the situation as more of a challenge compared  
7 to those with a more stress-is-debilitating mindset (Kilby *et al.*, 2016). Furthermore,  
8 eliciting a more stress-is-enhancing mindset has been accompanied by greater positive  
9 affect compared to those who hold a more debilitating mindset (Crum *et al.*, 2017). Based  
10 on this previous research, and the relationships found in Chapter 2, it can be hypothesised  
11 that manipulating stress mindset to elicit a more stress-is-enhancing mindset, will, in turn,  
12 increase challenge appraisal tendencies and reduce threat appraisal tendencies, and  
13 increase positive affect and lower negative affect. However, research has yet to investigate  
14 whether manipulating stress mindset leads to changes in an individual's appraisal  
15 tendencies or positive and negative affect.

16 As well as altering appraisal tendencies, it can be similarly hypothesised that a  
17 stress mindset intervention to elicit a more stress-is-enhancing mindset would be able to  
18 change appraisals of a stress-evoking situation and well as the emotions experienced in  
19 response to the situation (e.g., anxiety). Research shows that a more stress-is-enhancing  
20 mindset can lead to a decrease in anxiety (Kim *et al.*, 2020). However, anxiety's multi-  
21 dimensional nature should be considered as symptoms can be classified as being cognitive  
22 (the mental component of anxiety including negative thoughts and worry; Ree *et al.*, 2008)  
23 or somatic (the perception of physical state characterised by symptoms such as increases in  
24 heart rate or muscle stiffness; Grossbard *et al.*, 2009).

1 Previous research has shown those with a more stress-is-enhancing mindset report  
2 lower levels of anxiety compared to those with a stress-is-debilitating mindset  
3 (Huebschmann *et al.*, 2020). However, anxiety can also vary in how it is interpreted (i.e.,  
4 extent it is seen as positive/facilitative or negative/debilitating; Williams *et al.*, 2017).  
5 Importantly, more facilitative interpretations of anxiety can greatly benefit performance  
6 (Hanton *et al.*, 2004; Jones *et al.*, 2009). It may be that stress mindset is able to anxiety's  
7 interpretation rather than its intensity. Particularly given the stress mindset and challenge  
8 appraisals association as challenge appraisals are typically accompanied by more positive  
9 interpretations of cognitive and somatic anxiety (Williams *et al.*, 2017). However, to date  
10 limited research has focused on stress mindset and anxiety interpretation (Kim *et al.*, 2020).

## 11 **Aims and Hypothesis**

12 The first aim of the present study was to investigate the effectiveness of a brief  
13 online video intervention in eliciting a more stress-is-enhancing mindset in university  
14 student athletes compared with a control group comparison. A second aim was to see  
15 whether any stress mindset change was accompanied by alterations in challenge and threat  
16 appraisal tendencies and levels of positive and negative affect. A final aim investigated  
17 whether any group differences in stress mindset after the intervention were accompanied  
18 by group differences in how an upcoming stressful situation (i.e., an assessment period for  
19 their degree programme) was viewed by examining any group differences in anticipated  
20 challenge and threat appraisal states, positive and negative affect, and cognitive and  
21 somatic anxiety intensity and interpretation in relation to the assessment period.

22 It was hypothesised that following the brief online video intervention, the stress  
23 mindset group would experience a greater stress-is-enhancing mindset compared to  
24 baseline, while the control group would experience no change in their stress mindset. It

1 was also hypothesised that the intervention group's increase in a stress-is-enhancing  
2 mindset would be accompanied by an increase in challenge appraisal tendency and  
3 positive affect and a decrease in threat appraisal tendency and negative affect, while the  
4 control group would experience no changes in these variables. Finally, in relation to the  
5 upcoming assessment period it was hypothesised that as a result of the stress mindset  
6 intervention, compared to the control group the experimental group would report greater  
7 challenge and lower threat appraisals, higher positive affect, lower negative affect, and  
8 more positive interpretations of cognitive and somatic anxiety symptoms.

## 9 **Method**

### 10 **Participants**

11 A power analysis was conducted to determine the appropriate sample size. Based  
12 on the number of groups and pre and post intervention measures of stress mindset, with an  
13 alpha level at .05, a power of .80, and accounting for a small to medium effect size, a  
14 sample of 104 was needed. In total 124 male (n = 66) and female (n = 58) student athletes  
15 between the ages of 18-27 (M = 19.90; SD = .970) were recruited. This was due to  
16 convenience of sampling but also allowed for any missing data. We focused on the  
17 younger adults, to ensure that this study followed on exactly from study 1, but also because  
18 research has found that younger adults are more likely to be open to change than older  
19 adults would be, meaning that they will be more open to the intervention (Kebernik, 2019).  
20 Participants were a convenient sample of 2nd year students from the School of Sport,  
21 Exercise, and Rehabilitations Sciences at the University of Birmingham enrolled on a sport  
22 psychology module. The sample obtained was partially due to the study being completed  
23 during the COVID-19 pandemic lockdown making recruitment of any participants was  
24 incredibly difficult. However, a student athlete population was deemed to be a worthy

1 population to focus on based on the aforementioned importance of these individuals being  
2 able to balance their athletic and university demands. Consequently, inclusion criteria was  
3 being aged 18-35 and proficient in reading English, playing a sport, and having access to  
4 the internet. Exclusion criteria included having a diagnosis of a mental health condition at  
5 the time of data collection. At the start of the study, participants were randomly allocated  
6 using computer software into one of two groups: 1) stress mindset group (n=65) or 2)  
7 control group (n=59). Within the sample, there were 31 sports represented, with football  
8 (n=38) and hockey (n=8) being the most popular ones. This sample had been playing their  
9 sport between 1 and 19 years (M = 9.82 years; SD= 4.56).

## 10 **Measures**

11 **Stress mindset.** Crum *et al.*'s (2013) Stress Mindset Measure (SMM) was used to  
12 measure the participants' general stress mindset. This scale consists of 8 items in total, 4  
13 items worded positively (e.g., The effects of stress are positive and should be utilized) and  
14 4 questions worded negatively (e.g., Experiencing stress depletes my health and vitality).  
15 Participants rate the extent to which they agree with each item on a 5-point scale ranging  
16 from 0 (strongly disagree) to 4 (strongly agree). The negatively worded questions are  
17 reverse scored, and an average stress mindset score calculated meaning that scores range  
18 from 0 to 4 with a higher score reflecting a more enhancing stress mindset. The SMM has  
19 been shown to provide reliable and valid scores of stress mindset (Crum *et al.*, 2017). In  
20 the present study, the SMM demonstrated good internal reliability with Cronbach alpha's  
21 coefficient being .82.

22 **Challenge and threat appraisal tendencies.** Skinner and Brewer's (2002)  
23 cognitive appraisal scale (CAS) was used to measure participants challenge and threat

1 appraisal tendencies. This questionnaire contains 18 items, with 8 measuring challenge  
2 appraisal tendency (e.g., I tend to focus on the positive aspects of any situation), and the  
3 other 10 measuring threat appraisal tendency (e.g., I worry that I will say or do the wrong  
4 things). Participants rated the extent to which they agree or disagree with each item on a 6-  
5 point scale ranging from 1 (strongly disagree) to 6 (strongly agree). The average scores  
6 were then calculated separately for challenge and threat appraisal tendencies with a higher  
7 score reflecting a greater challenge or threat appraisal tendency. The CAS is a valid and  
8 reliable questionnaire that has previously been used in other studies (Sarrasin *et al.*, 2014).  
9 This questionnaire provided good internal reliability for both challenge and threat  
10 subscales with the Cronbach alphas being .87 and .95.

11 **Positive and negative affect.** The positive and negative affect schedule (PANAS;  
12 Watson *et al.*, 1988) was used to measure participants positive and negative affect. In total  
13 10 items assess positive feelings (e.g., excited and proud) and 10 items assess negative  
14 feelings (i.e. afraid and scared). For the present study, participants rated the extent to  
15 which they felt each emotion that day on a 6-point scale from 1 (very slightly/not at all) to  
16 6 (extremely). The positive emotions were then averaged to create a score for positive  
17 affect, and the negative emotions were averaged to create a score for negative affect,  
18 meaning two separate scores were generated ranging between 10 and 50, with a higher  
19 score indicating higher positive or negative affect. The PANAS questionnaire has  
20 produced reliable and valid scores of positive and negative affect in several studies (Egloff  
21 *et al.*, 2003; DePaoli *et al.*, 2000). In the present study, the Cronbach alphas for positive  
22 and negative affect were .92 and .84, demonstrating good internal reliability for both  
23 subscales.

1           **Situational challenge and threat.** Situation challenge and threat appraisals were  
2 measured using 6 items developed by McGregor and Elliot (2002), which have previously  
3 been used to measure state challenge and threat appraisal (Williams et al., 2010). Three  
4 items assessed challenge appraisal (e.g. The situation presents itself as a challenge to me)  
5 and the other 3 items assessed threat appraisals (e.g. I view the situation as a threat).  
6 Participants rated the extent to which they agree with each statement on a 7-point scale  
7 from 1 (not at all true) to 7 (very true). The items for each subscale were then averaged  
8 creating separate scores for challenge and threat appraisal, with higher scores reflecting  
9 greater challenge or threat appraisal. In the present study, we reworded the questions  
10 slightly, so it was about how they expect to feel about their upcoming assessment period.  
11 The measure demonstrated good internal reliability, with Cronbach alpha coefficients  
12 being .90 for challenge subscale and .95 for threat.

13           **Cognitive and somatic anxiety.** The Immediate Anxiety Measurement Scale  
14 (IAMS; Thomas *et al.*, 2002) was used to measure participants' state cognitive and somatic  
15 anxiety. The IAMS consists of 3 items, with 2 parts to each item. The first item, "I expect  
16 to be cognitively anxious", assesses cognitive anxiety (i.e., the mental component of  
17 anxiety and may be characterised by thoughts such as concerns or worries). The next  
18 statement, "I expect to be somatically anxious", assesses somatic anxiety (i.e., the  
19 perception of physical state and may be characterised by symptoms such as increases in  
20 heart rate). The final statement "I expect to be self-confident", assesses how self-confident  
21 the participant was however, was not used within the present study. For each item,  
22 participants first indicate how anxious they are feeling (i.e., anxiety intensity). This is rated  
23 on a 7-point scale from 1 (not at all) to 7 (extremely). Then, in Part 2, participants indicate  
24 how facilitative or debilitating they perceive the anxiety to be towards their performance

1 (i.e., anxiety interpretation). Responses are also rated on a 7-point scale but from -3 (very  
2 debilitating) to 3 (very facilitative). Participants complete Part one and two for the first  
3 item (cognitive anxiety) before proceeding on to the second item (somatic anxiety). The  
4 IAMS questionnaire is reliable and has previously been validated in several other studies  
5 (Singley *et al.*, 2012; Neil *et al.*, 2012). In the current study, the instructions and stem was  
6 reworded slightly to focus on how the participants expected to feel during the upcoming  
7 assessment period.

8         **Perceived stress.** A single item ‘How stressed do you expect to feel?’ was  
9 employed to assess how stressful participants expected the assessment period to be.  
10 Responses for this question were made on a 7-point scale ranging from 1 (not at all  
11 stressed) to 7 (very stressed). A single item was also used to measure the interpretation of  
12 this perceived stress ‘Do you expect these feelings of stress to have a positive or negative  
13 impact on your exam/assignment performance?’. Responses to this question was also on a  
14 7-point scale from -3 (Debilitative) to 3 (Facilitative).

15         **Intervention engagement.** To assess how engaged participants were during the  
16 video interventions, a single item asked participants ‘How much of the time were you  
17 engaged in the content?’ Responses were made on a 7-point scale ranging from 1 (not at  
18 all) to 7 (very).

## 19 **Experimental Conditions**

20         **Rethinking Stress Video.** The rethinking stress video was the intervention  
21 condition and therefore designed to elicit a more ‘stress-is-enhancing’ mindset. The video  
22 was based on those videos developed and previously employed by Crum *et al.* (2013) with  
23 the aim of helping participants to see the benefits of stress. The video contained a series of

1 examples in which people have performed better during stress such as ‘Students excelling  
2 during an exam’ and ‘Elite athletes achieving success with the eyes of the world on them.’  
3 These statements were accompanied by pictures of males and females in these situations. It  
4 also contained statements describing responses typically experienced during stress such as  
5 ‘Your heart rate increases, you feel butterflies in your stomach, your palms begin to feel  
6 sweaty...’ but this was accompanied by positive statements such as ‘...all of these  
7 responses are your body’s way of preparing for the event’. The aim of the content in this  
8 video was to try and get the participants to associate the responses they may experience  
9 whilst they are stressed as being positive and beneficial for them. The video was made on  
10 PowerPoint with the slides being timed, then recorded, and uploaded to YouTube for the  
11 participants to obtain the link during the experiment to watch the video at the correct time.  
12 The video lasted for 5 minutes and 20 seconds, and included the instrumental version of  
13 ‘Therefore I Am’ by Billie Eilish in the background. The video was pilot tested (n=8) and  
14 amendments to wording and timing were made based on feedback provided. Two different  
15 versions of the video were pilot tested, with the only difference being the backing music,  
16 majority of feedback preferred ‘Therefore I Am’ by Billie Eilish, therefore this song was  
17 used for the study.

18       **Personality Video.** The personality video was the control condition. The content  
19 was based on Watermann’s (2019) work, and the aim of this video was to inform  
20 participants about personality types (an unrelated topic to stress mindset). It introduced the  
21 topic by relating personality to the Big 5 animals by including facts and pictures of these  
22 animals such as ‘The top 3 behaviours of a rhinoceros are: Solitary, Territorial and  
23 Aggressiveness’. It then went on to explain the different personality types including  
24 statements such as ‘Openness to experience: curious, broad range of interests, try new  
25 things’ and ‘People who are open to experience are intellectually curious, open to emotion,



1 sensitive to beauty and willing to try new things.’ This video was designed to not elicit  
2 thoughts about stress or stress mindset but lasted the same duration as the rethinking stress  
3 video (i.e., 5 minutes and 20 seconds) and also had the instrumental version of ‘Therefore I  
4 Am’ by Billie Eilish playing in the background. Everything in this video (i.e., backing  
5 music, timing, number of slides, slide colour) matched the rethinking stress video, so the  
6 only difference was the content on the slides. This video was also made on PowerPoint  
7 with the slides being timed, then recorded, and uploaded to YouTube for the participants to  
8 obtain the link during the experiment to watch the video at the correct time. This video was  
9 pilot tested (n=8) and amendments to wording and timing were made based on feedback  
10 provided. During pilot testing, no participants identified this as being a control condition  
11 video.

## 12 **Procedures**

13 Figure 1 below provides an overview of the study procedures. Ethical approval was  
14 gained for this study through the University of Birmingham. All participants were then  
15 recruited through the 2<sup>nd</sup> year sport and performance psychology module. This study was  
16 run as part of a lab practical. However, it was voluntary for participants to allow their data  
17 to be used for research purposes. At the start of the study, all participants were provided  
18 with an information sheet providing details of the study. They were made aware that their  
19 decision to provide their data for research purposes was entirely voluntary, their decision  
20 would not affect their final grade in the module, and that teaching staff on the module  
21 would be unaware of which students opted in or out for research purposes.

22 Once participants had provided consent, they were randomly allocated into either  
23 the stress mindset intervention group or the control group. The study was completed in two  
24 parts in which the participants were given a week to complete. Separate online links were

1 sent for each part to make sure part one was completed first. Part one consisted of a  
2 baseline questionnaire pack which took participants around 20 minutes to complete. This  
3 questionnaire pack included questions about demographic information, and the SMM, as  
4 well as the CAS and PANAS to assess baseline stress mindset, challenge and threat  
5 appraisal tendencies, positive and negative affect.

6 Part two consisted of three parts. Part A involved participants completing the brief  
7 intervention (i.e., watching either the rethinking stress video or the personality video  
8 depending on whether they were randomly assigned to the stress mindset group or the  
9 control group, respectively). A specific link was sent out to participants depending on  
10 which group they had been randomly assigned to. After the brief video intervention, in  
11 Part B participants completed the post-intervention SMM, they also indicated the extent to  
12 which they were engaged in the video intervention. For Part B Participants were asked to  
13 think about the upcoming assessment period that they were due to encounter in around 5  
14 weeks' time which would include a mixture of module exams and coursework deadlines.  
15 Upon thinking about this assessment period, participants were asked to complete the  
16 IAMS, situational challenge and threat measure, PANAS, and stress rating in relation to  
17 how they expect to feel during this time. For Part C participants completed a post study  
18 questionnaire which included the CAS and PANAS to get a post-intervention challenge  
19 and threat appraisal tendencies, and positive and negative affect.

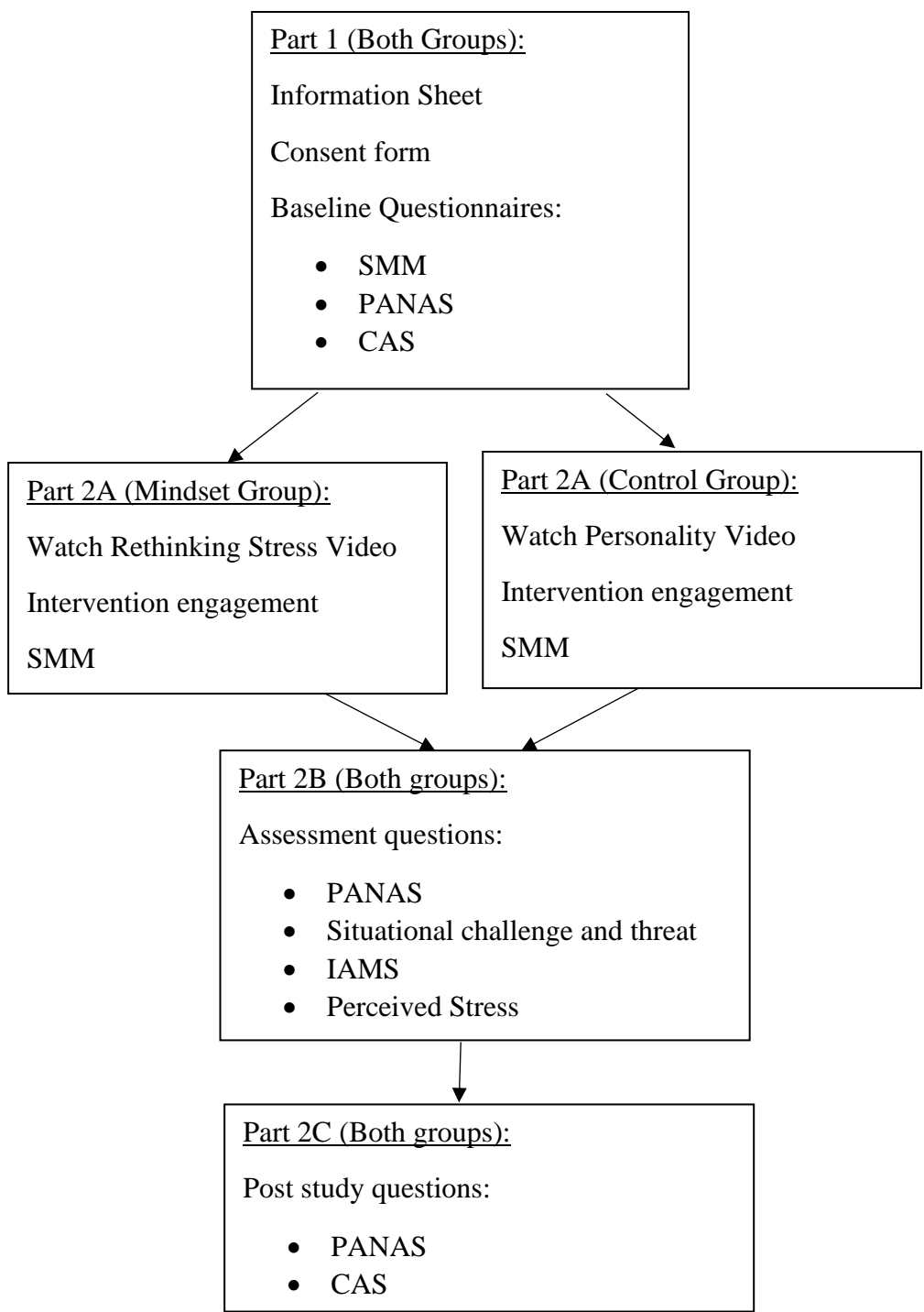
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18 *Figure 1. Procedures*

19 *Note:* SMM = Stress Mindset Measure; PANAS = Positive and Negative Affect Schedule;

20 CAS = Cognitive Appraisal Scale; IAMS = Immediate Anxiety Measurement Scale

21 **Data Analysis**

1 All data was analysed using SPSS statistics 26. Data were firstly screened for  
2 missing values. Three participants were removed due to not engaging with the study  
3 properly due to having multiple sets of missing data (two participants in the mindset  
4 group, and one in the control group). Finally, 2 participants rated a 1 on the video  
5 engagement scale (i.e., “not at all engaged”) and 1 participant did not answer this question  
6 making it impossible to know how engaged they were. All of these participants were  
7 therefore excluded from the analysis (all three of these participants were in the control  
8 group). Missing data of remaining participants were then identified from baseline  
9 challenge (n = 1), baseline threat (n = 2), post challenge (n = 2), post threat (n = 1). All  
10 missing data were from different participants, 3 participants were in the mindset group and  
11 3 were in the control group. These participants were excluded from any analysis for which  
12 they had missing data. Data was then inspected for outliers with 3 outliers identified as  
13 being 3 SDs removed from the mean in one or more variables. However, after examining  
14 this in more depth and running the data analysis with and without these outliers, the results  
15 did not change in terms of what was and was not significant, nor the magnitude of the  
16 effect sizes. Therefore, this data was retained in the analysis to increase the statistical  
17 power.

18 Preliminary analysis was first conducted to check that both groups were similar in  
19 terms of participant characteristics. Due to the differences in stress mindset, challenge and  
20 threat, and negative affect due to gender identified in Chapter 2, one-way ANOVAs were  
21 run to check if there were any gender differences in stress mindset, challenge and threat  
22 appraisal tendencies, and positive affect and negative affect. Two separate two-way chi-  
23 squared tests were run to check if the groups were similar in gender breakdown to  
24 determine whether data should be analysed separately or collapsed for gender. One-way  
25 ANOVAs were also run to examine any group differences in age due to the chance of

1 these relating to main study variables such as stress mindset (Huebschmann *et al.*, 2020).  
2 A one-way ANOVA was also run to make sure that both groups were similar in  
3 engagement of the video.

4 For the main analysis, separate 2 group (experimental, control) by 2 time (baseline,  
5 post intervention) ANOVAs with repeated measures on the second factor were run to  
6 examine any changes in stress mindset, challenge and threat appraisal tendencies, and  
7 positive and negative affect for the two groups as a result of the intervention. Specific to  
8 the assessment period, one-way ANOVAs were run to examine any differences in the  
9 groups' challenge and threat appraisals, positive and negative affect, the intensity and  
10 interpretation of cognitive and somatic anxiety, and the amount of stress they expect to feel  
11 along with the interpretation of this perceived stress. For all ANOVAs, the reported effect  
12 size was the partial eta squared ( $\eta_p^2$ ) and for all analysis the significance level was set at  
13  $<.05$ . Post Hoc pairwise bonferroni comparisons were run to follow up the significant  
14 ANOVAs.

## 15 Results

### 16 Gender Differences

17 One-way ANOVAs were run on baseline scores to determine whether there were  
18 any gender differences. Please see Table 1 for the means and standard deviations of stress  
19 mindset, positive and negative affect, and challenge and threat appraisal tendencies broken  
20 down by gender. One-way ANOVA results showed there was a non-significant gender  
21 effect with very small effect size for stress mindset,  $F(1,117) = .070$ ,  $p = .791$ ,  $\eta_p^2 = .001$ ,  
22 challenge appraisals,  $F(1,116) = .015$ ,  $p = .902$ ,  $\eta_p^2 < .001$ , negative affect  $F(1,117) =$   
23  $.007$ ,  $p = .933$ ,  $\eta_p^2 < .001$ , and positive affect,  $F(1,117) = .430$ ,  $p = .513$ ,  $\eta_p^2 = .004$ .  
24 However, there was a significant gender effect with a medium effect size for threat

1 appraisals  $F(1,115) = 7.65, p = .007, \eta_p^2 = .06$ , with females scoring significantly higher  
 2 than males.

3 **Table 1.** Baseline means and standard deviations of stress mindset, positive and negative  
 4 affect, and challenge and threat appraisal tendencies broken down by gender.

5

Variable	Male	Female	Total
Stress Mindset (0-4)	2.62 (0.49)	2.65 (0.71)	2.63 (0.61)
Challenge Appraisals (1-7)	4.64 (0.52)	4.63 (0.73)	4.64 (0.62)
Threat Appraisals (1-7)	3.54 (0.94)	4.05* (1.05)	3.79 (1.03)
Positive Affect (10-50)	29.20 (7.64)	30.24 (9.53)	29.71 (8.60)
Negative Affect (10-50)	17.38 (6.20)	17.48 (6.60)	17.43 (6.37)

6 *Note: \* significantly greater than males ( $p < .05$ )*

## 7 **Group Comparisons**

8 Please refer to Table 2 for group comparisons regarding the breakdown for gender  
 9 and mean age. The final sample size was 118 (mindset group = 63; control group =55).  
 10 Two-way chi-squared analyses showed no-significant differences between groups in the  
 11 breakdown of gender ( $\chi^2 = [1] = 3.43, p = .063$ ). Therefore, even though there was a  
 12 significant gender effect in threat appraisals, due to the similar distribution of males and  
 13 females in each group, gender was not controlled for in the main analysis.<sup>2</sup>

<sup>2</sup> Sensitivity analysis was completed to see whether any results change when controlling for gender. The only differences to the results were the time effect for stress mindset became non-significant  $F(1, 140) = .700, p = .404, \eta_p^2 = .005$ . Also the significant time effects for positive and negative affect turned non-significant (Positive affect:  $F(1, 138) = .974, p = .326, \eta_p^2 = .007$  and Negative affect:  $F(1, 138) = 1.02, p = .314, \eta_p^2 = .007$ ). There were no other differences in the results when completing this analysis

1 One-way ANOVA results showed there were no significant group differences in age  $F(1,$   
2  $117) = .039, p = .844, \eta_p^2 < .001.$

3

4 **Table 2.** Group comparisons for gender and age.

	Mindset Group	Control Group
Age (Mean [SD])	19.83 (0.78)	19.97 (1.14)
Males (n)	27	33
Females (n)	36	22

5

## 6 **Video Engagement**

7 There was no significant group difference in how engaged the participants were in  
8 their respective intervention video,  $F(1, 117) = 1.58, p = .211, \eta_p^2 = .013.$  The participants  
9 were in the middle of the scale with mean scores of the mindset group being 4.38 (SD =  
10 1.41) and control group being 4.05 (SD = 1.41).

## 11 **Group Differences in General Dispositions**

12 Please refer to Table 3 for the means and standard deviations of general stress  
13 mindset, positive and negative affect, and challenge and threat appraisals tendencies  
14 broken down by group at baseline and post intervention.

15 **Stress mindset.** A 2 time by 2 group ANOVA showed that there was a significant  
16 time effect with a medium to large effect size,  $F(1, 116) = 11.90, p < .001, \eta_p^2 = .093,$  and  
17 no significant group effect with a small effect size,  $F(1, 141) = .130, p = .719, \eta_p^2 = .001.$   
18 There was also a significant group by time interaction with a small effect size,  $F(1, 116) =$

1 .136,  $p = .004$ ,  $\eta_p^2 = .056$ . Post hoc analysis showed the stress mindset group experienced a  
2 significant increase in their stress mindset scores from baseline to post intervention (i.e.,  
3 following the intervention they displayed a more stress-is-enhancing mindset) while the  
4 control group's stress mindset did not change from baseline to post intervention. The  
5 interaction is displayed in Figure 1.

6 **Challenge and threat appraisal tendencies.** There was a significant time  
7 difference with medium effect sizes for both challenge appraisals,  $F(1, 113) = 10.11$ ,  $p =$   
8  $.002$ ,  $\eta_p^2 = .082$ , and threat appraisals,  $F(1, 113) = 8.99$ ,  $p = .003$ ,  $\eta_p^2 = .074$ , with  
9 participants, irrespective of group, reporting significantly lower challenge and threat  
10 appraisals at post intervention compared to baseline. There was no-significant group effect  
11 with a small effect size for challenge appraisals,  $F(1, 113) = .234$ ,  $p = .630$ ,  $\eta_p^2 = .002$ , or  
12 threat appraisals,  $F(1, 113) < .001$ ,  $p = .985$ ,  $\eta_p^2 < .001$ , and no-significant group by time  
13 interactions with small effect sizes (challenge:  $F[1, 113] = 3.08$ ,  $p = .082$ ,  $\eta_p^2 = .027$  or  
14 threat:  $F[1, 113] = .029$ ,  $p = .864$ ,  $\eta_p^2 < .001$ ).

15 **Positive and negative affect.** Two separate time by two group ANOVAs showed  
16 a significant time effect with medium effect sizes for both positive, ( $F[1, 116] = 9.09$ ,  $p =$   
17  $.002$ ,  $\eta_p^2 = .079$ ), and negative, ( $F[1, 116] = 8.98$ ,  $p = .003$ ,  $\eta_p^2 = .072$ ), affect such that  
18 irrespective of group, participants had significantly higher positive affect and higher  
19 negative affect post intervention compared to baseline. There was a significant main effect  
20 with a small to medium effect size for group for positive affect  $F(1, 116) = 5.32$ ,  $p = .023$ ,  
21  $\eta_p^2 = .044$ , with the mindset group scoring significantly higher in positive affect compared  
22 to the control group. There was no significant group effect with a small effect size for  
23 negative affect  $F(1, 116) = .430$ ,  $p = .513$ ,  $\eta_p^2 = .004$ , and no significant group by time



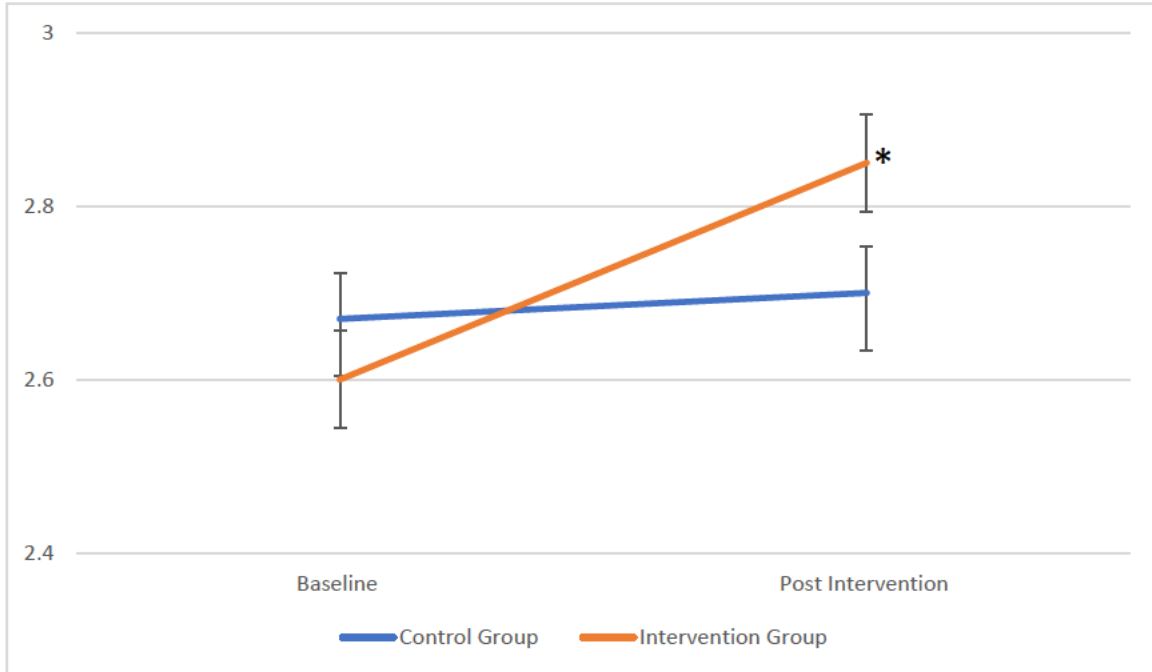
- 1 interactions with small effect sizes (positive affect:  $F[1, 116] = .629, p = .429, \eta_p^2 = .005,$
- 2 negative affect:  $F[1, 116] = .291, p = .591, \eta_p^2 = .003$ ).

**Table 3.** Means and standard deviations of stress mindset, challenge and threat appraisals, and positive and negative affect at baseline and post-intervention for both groups.

Variable	Baseline			Post-Intervention		
	Stress Mindset Intervention Group	Control Group	Total	Stress Mindset Intervention Group	Control Group	Total
Stress Mindset (0-4)	2.60 (0.63)	2.67 (0.59)	2.63 (0.61)	2.85 <sup>a**</sup> (0.63)	2.70 (0.74)	2.78 (0.68)
Challenge Appraisal (1-7)	4.63 (0.61)	4.65 (0.66)	4.64 (0.63)	4.56 (0.63)	4.43 (0.73)	4.50 <sup>b*</sup> (0.68)
Threat Appraisal (1-7)	3.78 (1.07)	3.81 (0.99)	3.79 (1.03)	3.65 (1.11)	3.68 (1.08)	3.66 <sup>b**</sup> (1.09)
Positive Affect (10-50)	31.46 (8.09)	27.71 (8.79)	29.71 (8.60)	32.70 (8.32)	29.78 (8.16)	31.34 <sup>a**</sup> (8.34)
Negative Affect (10-50)	17.21 (6.47)	17.69 (6.31)	17.43 (6.37)	18.44 (7.05)	19.47 (7.42)	18.92 <sup>a**</sup> (7.22)

Note. a = significantly higher than baseline, b = significantly lower than baseline. \*p<0.05 \*\*p<0.0

1 **Figure 2.** Means and standard errors of stress mindset for the intervention and control  
2 groups at baseline and post-intervention depicting the significant group by time  
3 interaction.



4 Note. \* = significantly greater than baseline ( $p < .05$ )

### 5 **Group Differences in Assessment Period**

6 Please refer to Table 4 for group means and standard deviations of positive affect, negative  
7 affect, challenge appraisal, threat appraisal, cognitive and somatic anxiety intensity and  
8 interpretation, in relation to how participants felt about the upcoming assessment period.

9 One way ANOVA results showed that there were no significant group differences in any  
10 of these variables.

**Table 4.** Group means and standard deviations for positive and negative affect, challenge and threat appraisals, cognitive and somatic anxiety intensity and interpretation, in relation to the assessment period.

Variable	Mindset Group	Control Group	Total	ANOVA statement
	Mean (SD)	Mean (SD)	Mean (SD)	
Challenge	5.15 (1.08)	5.02 (0.83)	5.09 (0.97)	$F(1, 117) = .530, p = .468, \eta_p^2 = .005$
Threat	3.80 (1.49)	4.01 (1.33)	3.90 (1.42)	$F(1, 117) = .594, p = .442, \eta_p^2 = .005$
Positive Affect	32.21 (7.44)	30.62 (7.69)	31.47 (7.57)	$F(1, 117) = 1.30, p = .257, \eta_p^2 = .011$
Negative Affect	24.76 (6.83)	23.84 (7.50)	24.33 (7.14)	$F(1, 117) = .429, p = .484, \eta_p^2 = .004$
Perceived Stress	5.46 (0.98)	5.35 (1.06)	5.41 (1.02)	$F(1, 117) = 0.374, p = .542, \eta_p^2 = .003$
Perceived Stress Interpretation	0.48 (1.22)	0.04 (1.44)	0.27 (1.34)	$F(1, 117) = 3.24, p = .075, \eta_p^2 = .027$
Cognitive Anxiety Intensity	5.27 (1.11)	5.09 (1.00)	5.19 (1.06)	$F(1, 117) = .833, p = .636, \eta_p^2 = .007$
Somatic Anxiety Intensity	4.30 (1.29)	4.51 (1.45)	4.40 (1.37)	$F(1, 117) = .676, p = .413, \eta_p^2 = .006$
Cognitive Anxiety Direction	0.10 (1.32)	-0.25 (1.34)	-0.07 (1.33)	$F(1, 117) = 2.04, p = .155, \eta_p^2 = .017$
Somatic Anxiety Direction	0.03 (1.16)	-0.11 (1.20)	-0.03 (1.18)	$F(1, 117) = .419, p = .519, \eta_p^2 = .004$

## Discussion

The aim of the present study was to investigate the effectiveness of a brief online video intervention in eliciting a more stress-is-enhancing mindset in university athletes. The second aim was to see whether an increase in a more stress-is-enhancing mindset was accompanied by an increase in general challenge appraisal and positive affect, and a decrease in general threat appraisal and negative affect. The third aim was to see whether there were any group differences in challenge and threat appraisals, positive and negative affect, and anxiety interpretation in relation to an upcoming assessment period. It was hypothesised that from baseline to post intervention the experimental group would have an increase in stress mindset, challenge appraisal tendency, and positive affect, and a reduction in threat appraisal tendency and negative affect, while the control group would experience no changes. In response to the assessment period, it was hypothesised that compared to the control group, the experimental group would report higher challenge appraisal, positive affect, lower threat appraisal and negative affect, and more positive interpretations of anxiety.

In support of the first hypothesis, after the brief video intervention, the experimental group experienced a significant increase in stress mindset scores reflecting a more stress-is-enhancing mindset. By comparison, the control group saw no change in their mindset scores from baseline to post intervention. This supports previous research showing that a brief video can have an immediate effect on an individual's stress mindset (Jamieson *et al.*, 2018). It also adds to previous research by demonstrating these sorts of videos can be effective in a student athlete population and in altering stress mindset when delivered online with no input from the researcher whilst completing the intervention.

1           Although the brief intervention was effective in altering stress mindset, these  
2 differences did not appear to translate to differences in general stress appraisals or positive  
3 and negative affect, thus the second hypothesis was not supported. Although general  
4 challenge and threat appraisal tendency scores were lower following the intervention  
5 compared to baseline, this occurred for both the experimental group and the control group  
6 irrespective of video content. Similarly, for positive and negative affect, regardless of  
7 group, participants experienced similar changes from baseline to post intervention  
8 (although in this instance scores increased for both positive and negative affect). One  
9 possible reason for this could have been the effect of completing the questionnaires again  
10 in such quick succession meant that the participants were familiar with the items, or simply  
11 taking part in the study and watching videos may have elicited changes in the way  
12 participants responded to the questionnaires. Hypothesis 3 was also not supported as there  
13 were no differences in any of the degree assessment period measures.

14           The findings have added to previous stress mindset literature as it shows that it can  
15 be manipulated solely online without any input from a researcher, this is very novel as no  
16 previous research has been done with this before. Although some previous research has  
17 been completed suggesting that multiple videos are needed to manipulate stress mindset  
18 (Crum *et al.*, 2013), this study supports previous research as it shows that stress mindset  
19 can be manipulated in as little as one three minute video (Crum *et al.*, 2017). The positive  
20 of this intervention being online and not needing any support to complete it is the fact that  
21 it would allow individuals to complete this on a portable device allowing them to do it  
22 anytime and anywhere they would need it, and as it is a quick online intervention it is not  
23 time consuming for individuals. Therefore, individuals such as athletes will be able to  
24 incorporate this into their plan when preparing for important competitions.

1

2           Despite the effectiveness of the brief intervention in altering stress mindset, it is  
3 important to consider that the video has a small effect on stress mindset suggesting that  
4 other factors likely account for a large portion of the variance. It is therefore important  
5 future research continue to examine this as brief interventions have been successful in  
6 previous research and as it is possible that they may be more meaningful with certain types  
7 of individuals (Kim *et al.*, 2020 ; Zhang *et al.*, 2022), or that the intervention needs to be a  
8 stronger dosage to have a more meaningful effect. Future research could therefore also  
9 look at the effects of the intervention after repeated exposure to see whether the content  
10 becomes more meaningful in altering stress mindset.

11           One possible reason for why changes in stress mindset did not translate to changes  
12 in stress appraisal tendencies or positive and negative affect could be that while research  
13 has shown that stress mindset can be manipulated straight away (Ben-Avi *et al.*, 2018), any  
14 changes that this has on other variables – particularly tendencies and general feelings  
15 rather than those in response to situations – may take longer to occur. Therefore, a longer  
16 lag time may be required between the intervention and assessing appraisal tendencies and  
17 positive and negative affect to observe any changes in stress appraisal tendencies and  
18 general levels of positive and negative affect as a result in the change to stress mindset.  
19 Because there was no follow up period in the present study, we could not see whether this  
20 intervention brought about changes at a later date.

21           A follow up period would also have allowed for examination into whether the  
22 intervention had a long-lasting effect on changes to stress mindset. There has been some  
23 research that shows that even though these videos can have an immediate effect, it is not a  
24 long-lasting effect and a week after watching a video, the impact it initially had on an

1 individual's stress mindset can decrease (Cholewa, 2020). This suggests that to create a  
2 long-lasting impact on an individual's stress mindset they may need to go through a more  
3 intense intervention with more videos involved. If this intervention did not have a long-  
4 lasting impact on an individual's stress mindset it probably would not translate into having  
5 an impact on the other variables such as stress appraisal tendencies and affect. Future  
6 research should include follow up periods to answer these questions.

7         Secondly, the intervention dosage may not have been sufficient enough to translate  
8 to measurable changes in general tendencies as well as those responses to the assessment  
9 period. This study was a brief intervention where the participants watched one video  
10 around 4 minutes in length, which some research has suggested is enough to manipulate  
11 stress mindset. Although the results supported this suggestion by demonstrating 4 minutes  
12 was sufficient to alter mindset, because there has been no previous research manipulating  
13 stress mindset to impact appraisal tendencies and affect, it is unknown how long the video  
14 (or number of exposures) needs to be for the intervention to be effective in elicited these  
15 changes. This study has shown that the likelihood is participants would need to have an  
16 increased dosage for changes in stress mindset to have any influence on appraisal  
17 tendencies and affect. Previous research which has been longer in length, i.e. 3 videos in  
18 the space of a week have been effective in manipulating participants to have a more  
19 enhancing mindset and accompanied changes in things like general anxiety (Crum et al.,  
20 2013). Therefore, future research should investigate repeated intervention exposure to see  
21 whether this is sufficient to also bring about alterations in appraisals and affect.

22         Another potential reason behind a number of the non-significant findings could  
23 have been due to the study being underpowered for all of the assessment period variables  
24 (power was below .294 for all one-way ANOVAs) as well as the power for the interaction



1 effects of the ANOVAs for trait dispositions being below .312 for all variables except for  
2 Stress Mindset (.734). Our a priori power calculation was run on identifying differences in  
3 stress mindset from a small study conducted by the research group prior to the beginning  
4 of my Master's thesis. However, it was unknown of the anticipated effect sizes for the  
5 other variables. Furthermore, due to the disruptions to the thesis brought about by COVID-  
6 19, a bigger sample could not be recruited in the timeframe of the Master's thesis.  
7 Recruitment had to be conducted solely online, and as discovered in Chapter 2, people  
8 seemed much more reluctant to take part in resaerch studies compared to typical  
9 recruitment numbers in previous years (likely due to what was happening with the  
10 pandemic Given that sample size is one of the biggest determinants of power (Wisz *et al.*,  
11 2008), future research should conduct a similar study to see whether the results are similar  
12 when the statistics are fully powered (using the effect sizes in the current study when  
13 conducting the a priori power analysis).

14 Non-significant group differences specifically regarding the assessment period  
15 variables could also have been due to the fact that the assessment period was a few months  
16 away when participants completed the intervention. Thus, it may have not been stress  
17 evoking enough for stress mindset to influence how they view it. Future research should  
18 examine whether a more stressful task or obtaining the measures closer to the assessment  
19 period is able to tease out any group differences regarding how the situation is viewed.

20 A limitation of the present study is that there were no baseline scores for the  
21 assessment period variables. Therefore, it is unknown whether the stress mindset  
22 intervention changed how they viewed the assessment period. The decision to not include  
23 baseline measures was done partly to prevent overloading the participants with a lot of  
24 questions but also because the study aimed to look at whether after manipulating stress

1 mindset it led to group differences in how people respond to stress exposure. However, in  
2 hindsight this could be considered as a limitation of this study – particularly as the stress  
3 mindset results suggest increases in stress mindset scores (from baseline) rather than group  
4 differences following the intervention. As such, a similar effect may have occurred  
5 regarding the assessment period variables without knowing it.

6         The results of the present study leave more questions to be answered by future  
7 research about whether changes in stress mindset brought about by an online video  
8 intervention can lead to changes in other dispositions and how stress is appraised.  
9 However, this study adds to previous research in showing that stress mindset interventions  
10 can also alter stress mindset in student athletes. Given that most previous interventions  
11 have been within workplaces (Crum *et al.*, 2013; Ben-Avi *et al.*, 2018), it has extending  
12 the literature demonstrating an additional population that stress mindset videos are  
13 effective in. It also shows that stress mindset can be manipulated in as little as 4-minutes  
14 following exposure to one online video.

15         As this study did not successfully manipulate challenge and threat appraisals or  
16 positive and negative affect, future research needs to find an effective way in doing this,  
17 and consider the previously mentioned suggestions (e.g., increased dosage, follow-up  
18 assessments, more stressful situations, larger sample size). Only once these factors are  
19 investigated will it be clearer regarding stress mindset interventions' true potential in  
20 bringing about changes in appraisals and responses to stress as a result of altering stress  
21 mindset in student athletes.

22         In conclusion, the present study examined the effects of a 3-4-minute online video  
23 intervention in altering the stress mindset of a sample of university student athletes.  
24 Results showed that compared to a control condition, the intervention was effective in

1 eliciting a greater stress-is-enhancing mindset. However, this change in stress mindset was  
2 not accompanied by changes in general challenge and threat appraisals nor alterations in  
3 positive affect and negative affect. It also did not appear to elicit any group differences in  
4 how an upcoming assessment period was viewed. This could be because any changes in  
5 appraisals and emotions may not be so immediate or because the intervention dosage was  
6 not strong enough. Future research needs to establish how stress mindset can be  
7 manipulated in ways that lead to changes in how stress is appraised as well as feelings and  
8 emotions, both at a general level and in responses to stress-evoking situations.

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## **Chapter 4. GENERAL DISCUSSION**

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## General Discussion

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4       The overall aim of the present thesis was to investigate how stress mindset relates  
5 to stress appraisal and affect. Chapter 2 set out to investigate the relationships between  
6 stress mindset, challenge appraisal tendencies, threat appraisal tendencies, and general  
7 positive and negative affect. Specifically, it examined whether challenge and threat  
8 appraisal tendencies mediated the relationship between stress mindset and general levels of  
9 positive and negative affect. Chapter 3 followed on from this to investigate whether an  
10 online stress mindset video intervention was effective in eliciting a more stress-is-  
11 enhancing mindset in student athletes compared with a control group. Chapter 3 also  
12 examined whether any changes in stress mindset were accompanied by changes in  
13 appraisal tendencies and general affect as well as group differences in how the student  
athletes' viewed stress in relation to an upcoming assessment period.

14

15       Chapter 2 hypothesised and found significant positive relationships between stress-  
16 is-enhancing mindset, challenge appraisal tendencies and positive affect, and a significant  
17 negative relationship between stress-is-enhancing mindset and threat appraisal tendencies,  
18 and threat appraisal tendencies were positively associated with negative affect. Chapter 2  
19 also hypothesised that both challenge and threat would mediate the relationships between  
20 stress mindset and positive and negative affect. The study found that while challenge and  
21 threat appraisals mediated the relationship between stress mindset and negative affect, only  
challenge appraisal mediated the relationship between stress mindset and positive affect.

22

23       Chapter 3 hypothesised that an online video intervention would be effective in  
24 making an individual's stress mindset more enhancing, it also hypothesised that this would  
lead to an increase in challenge appraisal tendencies and positive affect. Chapter 3 found

1 that an online video intervention was effective in manipulating an individual's stress  
2 mindset. However, despite the associations between stress mindset, appraisal tendencies,  
3 and general positive and negative affect evident in Chapter 2, this change in stress mindset  
4 was not accompanied by changes in appraisal tendencies or positive and negative affect.  
5 The intervention was also not effective in eliciting group differences in reported positive  
6 and negative affect and anxiety in relation to an upcoming assessment period suggesting  
7 that the changes elicited in stress mindset may not have changed the positive and negative  
8 feelings and emotions associated with an upcoming stressful scenario.

9 Previous research has found that a more stress-is-enhancing enhancing mindset  
10 elicits a greater challenge appraisal tendency (Mansell, 2021). It has also been found to  
11 elicit higher positive affect (Jiang *et al.*, 2019; Crum *et al.*, 2017). Whereas a stress-is  
12 debilitating mindset leads to an increase in threat appraisal tendencies (Chen *et al.*, 2021)  
13 and higher negative affect (Huebschmann *et al.*, 2020). Therefore, the relationships found  
14 in Chapter 2 support this previous research. By including non-athletes as well as athletes  
15 within the sample, Chapter 2 also added to previous research by completing it in different  
16 populations as previous research was completed either in athletes (Mansell, 2021) or  
17 adolescents (Chen *et al.*, 2021).

18 Chapter 3 supported previous research by showing that videos around 3 to 4  
19 minutes in length reinforcing the positive sides of stress is effective in manipulating an  
20 individual's stress mindset (Crum *et al.*, 2013). Chapter 3 also added to the stress mindset  
21 literature by being the first to demonstrate that these videos can also be effective when  
22 implemented online (the only previous online stress mindset interventions have used  
23 different methods to try and manipulate stress mindset such as reading a passage which  
24 reinforces the positives of stress; Watermann, 2019).

1 Previous research has shown that while manipulating stress mindset can be  
2 immediate (Crum *et al.*, 2013; Ben-Avi *et al.*, 2018), it is not clear how soon any effects of  
3 changing stress mindset might impact other dispositions. This may explain why the change  
4 in stress mindset in Chapter 3 was not accompanied by changes in challenge and threat  
5 appraisals and positive and negative affect despite the relationships between these  
6 variables identified in Chapter 2. Although, there has been some research suggesting a  
7 changes in stress mindset can have an immediate effect on appraisal tendencies and affect  
8 (Kilby *et al.*, 2016; Crum *et al.*, 2017). It is important research establish how soon changes  
9 in stress mindset likely bring about changes in other dispositions and whether there are any  
10 situational or individual characteristics that can impact this.

11 Previous research has shown that manipulating stress mindset the changes  
12 instigated from the manipulation can still be in place 3 days after the intervention (Crum *et*  
13 *al.*, 2013), however, there has not been any research as of yet to see whether changes  
14 instigated during the manipulation are still in place past this 3-day period (Keech, 2019).  
15 We did not include a follow up questionnaire in chapter 3 so we could not see whether  
16 there was a lag period for any effects to take place, therefore, future research should  
17 examine this through the inclusion of including follow up periods (e.g., including follow  
18 up periods 2 weeks and a month after the post-test). Including these follow up periods  
19 would also let us see whether the study had a long-lasting impact on manipulating an  
20 individual's stress mindset and if and when this might also bring about changes in stress  
21 appraisals and positive and negative affect.

22 The two studies in this thesis also provided more insight into the apparent  
23 differences in stress mindset between athletes and non-athletes. Chapter 2 showed that the  
24 stress mindset scores in athletes was on average 2.03 which was significantly higher than

1 non-athletes ( $M = 1.75$ ). The majority of stress mindset research has been conducted in  
2 non-athlete samples with a recent study by Mansell (2021) being the first examining stress  
3 mindset in athletes. Mansell suggested that athletes may possess a more stress-is-  
4 enhancing mindset compared to non-athletes based on his data showing an average stress  
5 mindset of 2.04 but he had no non-athlete comparison group. Results of the present thesis  
6 support Mansell's notion with the baseline stress mindset mean score in Chapter 3 being  
7 2.60 for the sample as a whole, and most importantly, the Chapter 2 findings being the first  
8 to show significant differences in stress mindset between athletes and non-athletes. Jones  
9 *et al.*, (2009) has suggested that athletes tend to interpret anxiety as more facilitative  
10 compared to non-athletes suggested that athletes may appraise and view stress and the  
11 subsequent responses as less debilitating. Based on the stress mindset scores from previous  
12 research, and stress mindset scores found within this study, the evidence is beginning to  
13 more clearly suggest that athletes are likely to hold a more stress is enhancing mindset  
14 compared to non-athletes (Mansell, 2021).

15         Throughout this thesis a predominantly athlete sample was used collectively across  
16 both chapters. As previously stated within this thesis, athletes – especially student athletes  
17 – are likely to face a lot of stress and pressures highlighting the importance of focussing on  
18 this sample group for the present thesis (Cohn,1990; Greenleaf *et al.*, 2001). However,  
19 because of this, the generalisability of the thesis findings study cannot extend more  
20 broadly meaning it could be considered a limitation of the work. It is therefore important  
21 that research examines whether the results of the present thesis are specific to the student  
22 athlete population or whether it would be universal across other types of population.  
23 Building on from this thesis and the limitation of such a specific sample, future research  
24 should examine the effectiveness of such interventions and relationships in different  
25 populations (e.g., non-athletes, clinical populations etc.).



1           Throughout both studies females were found to have significantly higher threat  
2 appraisal tendencies compared to males, and males had significantly higher challenge  
3 appraisal tendencies compared to females. Previous research has shown that females tend  
4 to hold more negative moods and beliefs compared to males (Holsen *et al.*, 2000).  
5 Research has also shown that males are more likely to appraise stressors as a challenge  
6 compared to females who are more likely to appraise the stress as a threat (Mak *et al.*,  
7 2004). This current study adds to this previous research by adding further evidence that  
8 there are differences in how stress tends to be appraised between males and females. Males  
9 being more likely to appraise situations as a challenge may be related from the fact that  
10 males tend to have a higher self-esteem and feel more confident compared to females  
11 (Vajapey *et al.*,2020). This a common finding amongst research within this area therefore,  
12 future research needs to take these likely gender differences into consideration with  
13 regards to challenge and threat appraisal research and when introducing interventions to  
14 help individuals see situations more as a challenge and less as a threat.

15           A second potential limitation of the present thesis is that the data collection for  
16 both studies were completed during lockdown due to the COVID-19 pandemic. While this  
17 in some ways could be considered a novelty, in that the work gained an understanding on  
18 the topic of stress mindset during the pandemic, it is important to consider that the  
19 situation may have influenced the findings. For example, the COVID-19 pandemic and the  
20 national lockdowns that occurred in 2020 and 2021 are known to have caused an increase  
21 in anxiety levels (Kowal *et al.*, 2020), an elevation in levels of depression (Gallagher *et al.*,  
22 2021), and an increase in fear (Lathabhavan *et al.*, 2021). Specific to the population of the  
23 thesis, recent research has also shown that one group which reported poorer mental health  
24 was students (Gurvich *et al.*, 2021). COVID-19 might have also altered people's views in  
25 terms of dealing with stress, as it was an ever-changing uncertain time for everyone

1 (Kontoangelos et al., 2020). Therefore, the pandemic may have influenced the ratings of  
2 the variables and how they relate in Chapter 2 and the effectiveness of the intervention in  
3 Chapter 3. In light of all of this, future research should conduct this research now there are  
4 no restrictions/lockdowns in place to see whether the results and trends are the same or  
5 whether they are any different.

6 One other factor that could be considered a limitation of the present thesis was the  
7 measure used to assess challenge and threat appraisal tendencies. There are a variety of  
8 objective and subjective measures of challenge and threat (Minkley *et al.*, 2021). The  
9 present thesis selected the Cognitive Appraisal Scale because at the time of devising the  
10 thesis it was one of the most commonly used measures to assess challenge and threat  
11 appraisal tendencies. However, more recently Tomaka et al., (2018) has developed the  
12 appraisal of challenge and threat scale (ACTS) which has been proposed to be a more  
13 accurate assessment of actual challenge and threat appraisal tendencies (i.e., the balance  
14 between how demanding or stressful a situation is and the extent to which he individual  
15 feels able to cope with these demands) rather than characteristics of challenge and threat  
16 (Tomaka et al., 2018). Given that the conceptualisation of challenge and threat in the  
17 present thesis revolves around the balance between demands and resources of stressful  
18 situations, it is important that future research examines whether the results of the present  
19 thesis are similar if using the ACTS to assess challenge and threat appraisal tendencies.

## 20 **Future research**

21 Although these studies had a lot of strength and added a lot including some novel  
22 ideas into current research, there are still areas where future research should investigate  
23 further. One of these being the population's used, as these studies were completed during  
24 the COVID-19 pandemic it limited us to the amount of people we could recruit and also

1 the type of people we could recruit as it all had to be done online. It would be important  
2 for future research to look into different populations especially non-athletes to add to these  
3 studies and see whether the results and relationships were the same or whether they differ.  
4 Also as the intervention in chapter 3 was brief it would be good for future research to do a  
5 more intensive intervention which was longer in duration and included more dosage of the  
6 intervention.

7 To conclude, the presented thesis aimed to more comprehensively investigate the  
8 relationships between stress mindset, challenge and threat appraisals, and positive and  
9 negative affect. It also aimed to see what impact an online video intervention had on stress  
10 mindset and what effect this had on altering stress appraisals and affect. Overall the  
11 findings of Chapter 2 showed that challenge and threat appraisals mediate the relationship  
12 between stress mindset and general affect. Results of Chapter 3 showed that using an  
13 online video intervention which does not have any input from the researcher was effective  
14 in having an immediate effect in eliciting a more stress-is-enhancing mindset in student  
15 athletes. However, this change in stress mindset did not seem to be accompanied by  
16 changes in stress appraisals or positive and negative affect. The use of an online  
17 intervention also did not appear to elicit any group differences in how student athletes  
18 viewed an upcoming assessment period. These lack of differences may have been due to a  
19 number of theoretical or methodological factors (e.g., assessment period not being stressful  
20 enough, dosage of the intervention, etc.). Collectively, results show that although stress  
21 mindset, appraisals, and affect are related, it might not be as simple as using a one-off  
22 video intervention to manipulate stress mindset to have an impact on the other variables.  
23 Future research should build on this thesis to establish how stress mindset interventions  
24 can be administered in an effective way to not only alter stress mindset, but also how

1 individuals appraise acute and general stress, as well as the positive and negative affect  
2 experienced.

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## **Appendices**

Appendix A – Information sheet for participants (study 1)

Appendix B – Consent form for participants (study 1)

Appendix C- Information sheet for participant (study 2)

Appendix D – Consent form for participants (study 2)

Appendix E – Example slides from control video

Appendix F – Example slides from stress mindset video

Appendix G - Positive and Negative affect schedule (PANAS)

Appendix H – Stress Mindset Measure (SMM)

Appendix I – Immediate Anxiety Measure Scale (IAMS)

Appendix J – Cognitive Appraisal Scale (CAS)

Appendix K – Challenge and Threat (CAT)

## Appendix A - Information Sheet for Participants (Study 1)

Study Title: Investigating Stress and Wellbeing

Dear Participant,

Thank you for considering taking part in this study, which has been approved by the University of Birmingham's Ethical Review Committee.

What is the study about?

This study seeks to investigate the relationship between stress and psychological wellbeing.

Can anyone take part?

Anyone aged 18-35 can take part if they are proficient in reading English, has access to the internet, and does not currently have a diagnosis of a mental health condition.

What will your participation involve?

If you are willing to participate, you will be asked to complete a questionnaire pack, which will take between 20-30 minutes. The questionnaires will assess various personality and dispositional factors as well as beliefs about stress and measures of psychological wellbeing. Although some people may consider some questions to be of a sensitive nature (e.g., assessing anxiety and depression), questionnaires completed are no more demanding than questions and activities experienced in daily living and you are free to not answer any question you find distressing or do not wish to answer. If you require any additional support with some of the issues linked to mental health in this study, appropriate contact details are provided at the bottom of this information sheet.

All your personal data will remain confidential and will be solely used for academic purposes. Consequently, we would be grateful if you were honest in your responses to the questionnaires. The data will not be anonymous but will only be identifiable using a unique ID number. This is to give you the option to withdraw your data from the study after you have completed the study. In accordance with the Data Protection Act (2018) raw and processed data from this investigation will be kept for a period of ten years following completion of the study or post-publication. Computer files containing processed data will be kept securely on a password protected computer and will only be accessed by the study investigators. After ten-year period has elapsed, all the data collected will be destroyed. You will not be individually identified in any publication.

Do I have to take part?

Please note, your participation in this study is voluntary and you may withdraw at any time up to two weeks after you complete the questionnaire pack, without having to give us an explanation or any negative consequences. If you choose to withdraw from the study, please contact Mr Paul Mansell (contact details at the end of this information sheet) to inform us of your decision. You do not need to give any reason for this, participation is not

compulsory. If you decide to withdraw, you may withdraw at any time up until 2 weeks after completion of the intervention. If you choose to withdraw before the two weeks have elapsed, your data will be destroyed and not included in the data analyses.

What are the benefits and risks?

By taking part in this study you will be helping with our understanding in how personality and dispositional factors as well as beliefs about stress are associated with psychological wellbeing. If you are a first year or second year student in the School of Sport, Exercise & Rehabilitation Sciences, you have the opportunity to indicate if you would like to be contacted about future research opportunities to receive research hours or an Amazon voucher. If you are a student in another school within The University of Birmingham that offers remuneration for taking part in research, you may also be able to claim 1 hour of research credits. Eligibility for this is dependent on schools so please email Paul Mansell to check whether your school qualifies for the research hour.

The risks of taking part in this study are no more than those of day to day stressors. However, if you find any questions distressing you do not need to answer and sources of support can be found at the bottom of this information sheet. All information that we collect will be strictly confidential. A brief summary presenting the results and findings will be available upon request at the end of the study.

Who else is taking part?

We will be recruiting other individuals who like you fit the inclusion criteria described previously.

Do I have to sign anything?

Yes, if you agree to participate we will ask you to electronically sign a Consent Form by typing your name. This is to show that you have understood what is involved and that you have read the Information Sheet. After signing the consent form you may still withdraw at any time up to 2 weeks after completing the questionnaire without having to give us an explanation.

On completion of the questionnaire pack, you will have the opportunity to leave your email address to be contacted about future studies. An expression of interest in being contacted does not mean you have to take part in any future studies, and you will receive information about these studies before deciding whether or not to take part. You can also opt out of being contacted at any time.

Contact details

Paul Mansell, lead researcher

Email: [REDACTED]

Henry Beevor, lead researcher

[REDACTED]

Emily Sutton, lead researcher

[REDACTED]

Dr Sarah Williams, research supervisor

Email: [s.e.williams@bham.ac.uk](mailto:s.e.williams@bham.ac.uk)

In the event that you wish to seek advice and/or information as a result of completing the questionnaires, here are some recommended sources: a) your GP, b) the Birmingham and Solihull Mental Health NHS Foundation Trust on 0121 301 0000, website: [www.bsmhft.nhs.uk](http://www.bsmhft.nhs.uk). If you are a student at the University of Birmingham, you can also access the Mental Health and Wellbeing Services. For information about their services and online resources, please have a look at this link: <https://intranet.birmingham.ac.uk/student/welfare/mental-health/index.aspx>. Or Tel 0121 4145130. Furthermore, this is an online self-referral process at <https://intranet.birmingham.ac.uk/student/welfare/mental-health/personalised-support/access.aspx>.

## Appendix B – Study Consent Form (Study 1)

**To be completed by the participant:**

	Initial to consent
I confirm that I have read and understand the information sheet and have had the opportunity to ask questions.	
All questions have been answered to my satisfaction.	
I confirm that I am aged 18-35, proficient in reading English, and do not currently have a diagnosis of a mental health condition.	
I understand that my participation is voluntary and that I am free to withdraw at any time <b>up to two weeks</b> after completing the questionnaire without giving any reason or my rights being affected.	
I consent to participating in the study.	
I give consent for the data that I provide to be used for research purposes.	

If you would like to receive a summary of the study findings please initial below and provide your email address (please note, this is a summary of all the study findings rather than your own individual results).

	Initial to consent
I would like to receive a summary of the results of the study.	
Email: _____	

If you have any more questions about the study, please feel free to contact us on the details on the information sheet.

Type name .....

Date .....

## Appendix C- Information Sheet for Participants (Study 2)

Study Title: Psychological skills and wellbeing

Dear Student,

Below provides you with more details about the online laboratory practical that you are due to complete as part of the Sport and Performance Psychology module. This lab practical is to show you some of the different psychological skills and techniques that are used by athletes to regulate their thoughts and feelings. It will also teach you about how this type of research is conducted in athlete and student populations. You should complete this lab practical during week [to be decided] of the module. The remainder of this information sheet is to provide you with some more information about the lab practical which will be referred to in the remainder of this document as the “study.” Information about what you should do and when will be provided via the module canvas course. This study has been approved by the University of Birmingham’s Ethical Review Committee.

What is the study about?

This study will help you to develop a knowledge of different types of psychological skills that athletes use and how this type of research is conducted by researchers and sport psychologists.

Can anyone take part?

Anyone aged 18 and over can take part as long they are proficient in reading English and a student on the Sport and Performance Psychology module, and does not currently have any medically-diagnosed mental health conditions.

What will your participation involve?

You will be asked to complete this study online which should take no longer than 2 hours. However, this can be broken up into different sections. You will be asked to complete some questionnaires that will assess various personality and dispositional factors such as anxiety, beliefs about stress and imagery ability. Although some people may consider some questions to be of a sensitive nature (e.g., assessing anxiety and depression), questionnaires completed are no more demanding than questions and activities experienced in daily living and you are free to not answer any question you do not wish to answer. You will then be asked to watch a short 3-minute video and imagine a sporting situation before answering some questions about how you would feel if you were in that situation. We will then ask you to complete some questionnaires about how you feel about the upcoming assessment period at the end of semester 2.

If you require any additional support with some of the issues linked to mental health in this study, appropriate contact details are provided at the bottom of this information sheet.

Prior to taking part in the study you will be asked to complete a consent form confirming you have read this information sheet and understand the purpose of the study.

Option to provide your data for research purposes



In taking part in this study for teaching purposes, you also have the option to provide your data for research purposes. It is important that you understand that this is completely optional and that whatever you decide will have no bearing on how you are treated by any staff or PGR demonstrators on the module. Your decision will also not influence your performance on the module in any way.

Do I have to provide my data for research purposes?

Please note, your decision to provide your data for research purposes is completely voluntary and you may withdraw at any time up to two weeks after you complete the study, without explanation or any negative consequences. Teaching staff on the module will not know who on the module have or have not consented to provide their data for research purposes.

What if I decide to provide my data for research purposes?

All your personal data will remain confidential and will be solely used for academic purposes. The data will not be anonymous but will only be identifiable using a unique ID number. This is to give you the option to withdraw your data from the study after you have completed the study. In accordance with the Data Protection Act (2018) raw and processed data from this investigation will be kept for a period of ten years following completion of the study or post-publication. Questionnaires and computer files containing processed data will be kept securely in a locked filing cabinet and will only be accessed by the study investigators. After this time period, all the data collected will be destroyed.

What are the benefits and risks of providing my data for research purposes?

The risks of taking part in this study are minimal to participants and providing your data for research purposes does not increase any risk beyond that experienced by taking part for teaching purposes. However, if you find any questions or situations distressing you do not need to answer and sources of support can be found at the bottom of this information sheet. All information that we collect will be strictly confidential. The benefits of providing your data for research purposes are that you would be helping us to understand how different constructs regarding appraisals and responses to stress relate to each other. You would not be individually identified in any publication.

Can I change my mind?

Absolutely. If, at any point before or during completion of the study, you wish to withdraw your data from being used for research purposes, then you may do so up to two weeks after completing the study. You do not need to give any reason for this as providing your data for research purposes is not compulsory. If you choose to withdraw from the study, please contact Miss Emily Sutton (contact details at the end of this information sheet) to inform us of your decision. If you choose to withdraw before the two weeks have elapsed, your data will be destroyed and not included in the data analyses.

Who else is providing their data for research purposes?

We will be asking all individuals on the module whether they would be interested in providing their data for research purposes. To provide your data you should be over 18 and not currently have any medically-diagnosed mental health conditions.

Do I have to sign anything?

Yes, if you agree to provide your data for research purposes we will ask you to complete an additional part of the Consent Form. This is to show that you have understood that it is completely voluntary and will not impact your treatment or performance on the module. After signing the consent form you may still withdraw your data for research purposes at any time up to 2 weeks after completing the study without having to give us an explanation.

What if I chose not to provide my data for research purposes?

That is fine, it is entirely your decision. You will complete the study for teaching purposes. All data for teaching purposes will be presented to students in the form of graphs and charts to facilitate class discussions in the module. Following this, your data will be destroyed.

Contact details

Emily Sutton, researcher

Tel: [REDACTED]

Email: [REDACTED]

Dr Sarah Williams, research supervisor and module lead

Email: [REDACTED]

In the event that you wish to seek advice and/or information as a result of completing the questionnaires, here are some recommended sources: a) your GP, b) the Birmingham and Solihull Mental Health NHS Foundation Trust on 0121 301 0000, website: [www.bsmhft.nhs.uk](http://www.bsmhft.nhs.uk). If you are a student at the University of Birmingham, you can also access the Mental Health and Wellbeing Services. For information about their services and online resources, please have a look at this link: <https://intranet.birmingham.ac.uk/student/welfare/mental-health/index.aspx>. Or Tel 0121 4145130. Furthermore, this is an online self-referral process at <https://intranet.birmingham.ac.uk/student/welfare/mental-health/personalised-support/access.aspx>, and University well-being drop in services, which are held Mon-Thurs 13:30-14:30 and Fri 11:30-12:30 at Aston Webb Student Hub (R7 on Edgbaston Campus map).

Please note that these services are not provided as part of the research study, hence we will not be responsible for any related fees or charges

**Appendix D – Study Consent Form (Study 2)**

	<b>Initial to consent</b>
I confirm that I have read and understand the information sheet and have had the opportunity to ask questions.	
All questions have been answered to my satisfaction.	
I understand that I am taking part in this online lab practical as part of my Sport and Performance Psychology module.	
I consent to taking part in this online lab practical.	
I confirm that I am aged 18 or over, and proficient in reading English.	

Please print your name to confirm you consent to taking part in the online lab practical.

Print name .....

Date .....

If you would like to allow the data you provide as part of this online lab practical to be used for research purposes, please also complete the consent below.

	<b>Initial to consent</b>
I give consent for the data that I provide to be used for research purposes.	
I understand that if I consent my data will be stored confidentially and no one apart from the PGR researcher will be able to identify me.	
I understand that my decision to provide my data for research purposes is voluntary and that I am free to withdraw at any time up to two weeks after completing the lab practical without giving any reason or my rights being affected.	
I understand that my performance on the module will have no bearing on whether or not I provide my data for research purposes.	
I confirm that I do not currently have a medically-diagnosed mental health condition.	

Please print your name to confirm you consent to your data being used for research purposes.

Print name .....

Date .....

## Appendix E – Example slides from Control Video

Psychologists use the term to describe the five core traits of your personality

2. Conscientiousness: thoughtfulness and planning, organized, attention to detail.

The big five animals in Africa refer to the five animals most difficult to hunt on foot - the lion, leopard, rhinoceros, elephant and cape buffalo



## Appendix F – Example slides from Stress Mindset video

Your heart rate increases, you feel  
butterflies in your stomach, your palms  
begin to feel sweaty...

Individuals can do amazing things when  
under pressure

Elite athletes achieving success with the  
eyes of the world on them



### Appendix G - Positive and Negative affect schedule (PANAS):

This questionnaire was included study one and in the baseline questionnaire pack, post intervention questionnaire pack and in relation to the upcoming assessment period of study two.

This scale consists of a number of words that describe different feelings and emotions. Read each item and then indicate to what extent you [felt this way during the past two weeks/ would feel this way in the imagined scenario]. Use the scale below to make your response.

	Very slightly/ not at all	A little	Moderately	Quite a bit	Extremely
Interested	1	2	3	4	5
Distressed	1	2	3	4	5
Excited	1	2	3	4	5
Upset	1	2	3	4	5
Strong	1	2	3	4	5
Guilty	1	2	3	4	5
Scared	1	2	3	4	5
Hostile	1	2	3	4	5
Enthusiastic	1	2	3	4	5
Proud	1	2	3	4	5
Irritable	1	2	3	4	5
Alert	1	2	3	4	5
Ashamed	1	2	3	4	5
Inspired	1	2	3	4	5
Nervous	1	2	3	4	5
Determined	1	2	3	4	5
Attentive	1	2	3	4	5
Jittery	1	2	3	4	5
Active	1	2	3	4	5
Afraid	1	2	3	4	5

**Appendix H - Stress Mindset Measure (SMM):**

This questionnaire was included study one and in the baseline questionnaire pack, post intervention questionnaire pack and in relation to the upcoming assessment period of study two.

Please rate the extent to which you agree or disagree with the following statements within your sport.

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
The effects of stress are negative and should be avoided.	0	1	2	3	4
Experiencing stress facilitates my learning and growth.	0	1	2	3	4
Experiencing stress depletes my health and vitality.	0	1	2	3	4
Experiencing stress enhances my performance and productivity.	0	1	2	3	4
Experiencing stress inhibits my learning and growth	0	1	2	3	4
Experiencing stress improves my health and vitality.	0	1	2	3	4
Experiencing stress debilitates my performance and productivity.	0	1	2	3	4
The effects of stress are positive and should be utilized.	0	1	2	3	4

## Appendix I - Immediate Anxiety Measure Scale (IAMS):

This questionnaire was included in the questionnaire pack in relation to the upcoming assessment period.

The following questionnaire asks you to rate how anxious you were feeling in the scenario. There are two main types of anxiety which are sometimes experienced. These are cognitive anxiety (the mental component) and somatic anxiety (the physical component). In order to answer as accurately as possible please bear the following definitions in mind:

**Cognitive Anxiety:** Is the mental component of anxiety and maybe characterised by thoughts such as concerns or worries about your performance of the task, for example about the way you may perform or the importance of the task.

**Somatic Anxiety:** Is your perception of your physical state and maybe characterised by symptoms such as physical nervousness, butterflies in the stomach, tense muscles, and increases in heart rate.

**Self Confidence:** Is how confident you are of performing well in the task and maybe characterised by factors such as achieving your goals and performing well under pressure.

Below are 3 statements reflecting the thoughts and feelings you may be experiencing at this moment in time. Each statement requires a response from each of the 2 sections. Section 1 asks you to respond to the level of cognitive anxiety, somatic anxiety, and self-confidence (see definitions); Section 2 then asks whether you regard these feelings are seen as positive or negative to your upcoming performance. Read each statement carefully and then circle the appropriate number in each of the 2 sections.

**Please answer the 3 questions with regards to how you feel about the upcoming assessment period**

	Section 1							Section 2								
	To what extent were you experiencing anxiety and confidence (i.e., what level)?							Did you regard these feelings as being positive or negative in relation to the scenario?								
Before the upcoming assessment period...	<i>Not at all</i>							<i>Extremely</i>		<i>Very debilitating (Negative)</i>			<i>Unimportant</i>		<i>Very facilitative (Positive)</i>	
1. I am cognitively anxious	1	2	3	4	5	6	7	-3	-2	-1	0	+1	+2	+3		
2. I am somatically anxious	1	2	3	4	5	6	7	-3	-2	-1	0	+1	+2	+3		
3. I am self-confident	1	2	3	4	5	6	7	-3	-2	-1	0	+1	+2	+3		



### Appendix J - Cognitive Appraisal Scale (CAS):

This questionnaire was included in study one and in the baseline questionnaire pack of study two.

The purpose of this questionnaire is to obtain information about how you generally perceive different situations. Please be as accurate as possible and take as long as you feel necessary to arrive at the proper rating for each statement. There are no right or wrong answers because we are simply interested in your response. In relation a meaningful situation, such as an examination, please indicate your level of agreement or disagreement with the following statements...

	1 Strongly disagree	2	3	4	5	6 Strongly agree
I tend to focus on the positive aspects of any situation	1	2	3	4	5	6
I worry that I will say or do the wrong things	1	2	3	4	5	6
I often think about what it would be like if I do very well	1	2	3	4	5	6
I believe that most stressful situations contain the potential for positive benefits	1	2	3	4	5	6
I worry about the kind of impression I make	1	2	3	4	5	6
I am concerned that others will find fault with me	1	2	3	4	5	6
Overall I expect that I will achieve success rather than experience failure	1	2	3	4	5	6
In general I look forward to the rewards and benefits of success	1	2	3	4	5	6
Sometimes I think that I am too concerned with what other people think of me	1	2	3	4	5	6

### Appendix K – Challenge and Threat (CAT)

This questionnaire was included in the post intervention questionnaire pack and in relation to the upcoming assessment period

Challenge and threat can be defined as two motivational states reflecting how individuals engage in meaningful stress evoking situations. A challenge state is experienced when an individual perceives they have sufficient, or nearly sufficient, resources to meet the demands of a task or situation, whereas a threat state is experienced when an individual perceives they have insufficient resources to meet the demands of a task or situation.

**Please answer the following questions in relation to how you feel about the upcoming assessment period by circling the appropriate response:**

	1. Not true at all	2	3	4 Somewhat true	5	6	7. Completely true
The situation presents itself as a challenge to me	1	2	3	4	5	6	7
I view the task as a threat	1	2	3	4	5	6	7
I feel threatened by the situation	1	2	3	4	5	6	7
I view the task as a challenge	1	2	3	4	5	6	7
The situation presents itself as a threat to me	1	2	3	4	5	6	7
I feel challenged by the situation	1	2	3	4	5	6	7