How personality moderates stress in needs thwarting environments

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Marianna Bottiglieri

Abstract

Individual stress responses have been addressed by multiple theorists; yet there remains uncertainty concerning how contextual and individual factors interact during the process. In this thesis, I formulate and test a transtheoretical model integrating basic psychological needs (Deci & Ryan, 2002) theory and challenge and threat states (Blascovich, 2008) to better understand when and why environments might differentially affect appraisals. In contrast to previous work theorising a deterministic relationship between thwarting environments and threat appraisals, I hypothesized that in presence of needs thwarting, specified personality factors exacerbate or attenuate sensitivity to stress, and subsequent formation of challenge and threat-based appraisals.

The model was tested across two experimental studies where needs thwarting was elicited: in Experiment 1 students (n=54) led an academic presentation. Psychometric and cardiovascular data confirmed some support for the moderating influence of personality: only extraversion significantly moderated the stress reaction, though perceived relatedness frustration was poorly affected by manipulation. Experiment 2 therefore replicated this protocol on athletes (n=18), separating the effects of competence and relatedness thwarting. Relatedness manipulation was enhanced using real friendship groups and providing fake feedback regarding group rejection. However, perceived relatedness frustration remained low, and the study was suspended due to manipulation failure. In response, I conducted a scoping review to critically assess protocols for acute manipulation of relatedness. This identified critical gaps regarding explicit testing of relatedness thwarting and concerns about protocol effectiveness. More promisingly, imagery/recall and ostracism-based protocols were effective and highlighted the utility of drawing from non-SDT based research. The review informed the generation of a set of recommendations for researchers seeking to manipulate relatedness in future work.

This doctoral thesis contributes to the understanding of the interplay between environment and individual differences in stressful environments and offers methodological evidence to improve the study of these dynamics, with a specific focus on relatedness-thwarting settings. I argue that these ideas and methods will enhance understanding of individual reactions to socially-challenging environments, and identify protective factors associated with resilience and growth.

Abstract (Italiano)

Sebbene diverse teorie si siano occupate di reazioni allo stress, il modo in cui queste siano determinate dall'interazione tra contesto e fattori individuali rimane incerto. Questa tesi ha formulato e testato un modello transteorico, integrando la teoria dell'autodeterminazione (Deci e Ryan, 2002) con il modello di sfida e minaccia (Blaschovic, 2008), allo scopo di comprendere quando e perché diversi contesti possano influenzare percezioni dello stress. Contrariamente a teorie sostenenti un legame diretto tra ostruzione dei bisogni psicologici e percezioni di minaccia, la tesi ipotizza che fattori di personalità moderino questa relazione, esacerbando o attenuando la sensibilità a fattori di stress.

Il modello è stato testato manipolando sperimentalmente l'ostruzione dei bisogni in due studi. Nel primo esperimento, durante una presentazione accademica condotta da 54 studenti. Dati fisiologici e psicometrici hanno parzialmente confermato la validità del modello: livelli di estroversione hanno determinato reazioni differenziate allo stress; tuttavia, i partecipanti presentavano bassi livelli di frustrazione dei bisogni conseguenti alla manipolazione. Il secondo esperimento ha replicato il protocollo su 18 atleti, separando manipolazione di competenza e relazione e manipolando quest'ultima attraverso l' esclusione dei partecipanti da parte di membri della stessa squadra. Tuttavia, i partecipanti presentavano ancora bassi livelli di frustrazione (specialmente del bisogno di relazione) e l'esperimento è stato interrotto. In risposta, una scoping review è stata condotta allo scopo di valutare criticamente protocolli per la manipolazione del bisogno di relazione. Quest'ultima ha evidenziato lacune nella misurazione della frustrazione e incertezza nell'efficacia delle procedure di manipolazione. Procedure basate sull'imagery/ricordo e sull'ostracismo, e ispirate ad altri modelli teorici, hanno mostrato risultati promettenti. La scoping review ha generato delle raccomandazioni metodologiche per la manipolazione dei bisogni.

Questa tesi di dottorato contribuisce allo studio dell'interazione tra individuo e ambiente in situazioni di stress, ed offre evidenza metodologica per lo studio di dinamiche di ostruzione dei bisogni, specialmente quello di relazione. I risultati evidenziati contribuiscono alla comprensione delle reazioni individuali in contesti di pressione sociale, e all'identificazione di fattori protettivi associati a processi di crescita e resilienza.

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List of abbreviations

BFM – Big-Five model

BNSG - S – Basic Psychological Needs Scale in General

BPNSFS – Basic Psychological Needs Satisfaction and Frustration Scale

BPNSS – Basic Psychological Needs Satisfaction scales

BPNT – Basic psychological needs theory

BPS – Biopsychosocial model of challenge and threat

CO – Cardiac output

COT – Causality orientation theory

CPU – Central processing unit

CTS – Challenge and threat states

DBP – Diastolic blood pressure

ECG – Electrocardiogram

e.g. – Exempli gratia (for example)

et al. – Et alia (and others)

etc. – Et cetera (and the rest)

fMRI – Functional magnetic resonance imaging

HR – Hearth rate

i.e. – Id est (that is)

ICG – Impedance cardiogram

MAP – Mean arterial pressure

MAS – Metamodel of adaptation in sport

MDT – Motive disposition theory

PEP – Pre-ejection period

PNTS – Psychological Needs Thwarting Scale

REBT – Rational emotive behavior therapy

RMT – Relationship motivation theory

SBP – Systolic blood pressure

SDT – Self-determination theory

SV – Stroke volume

TCTSA – Theory of challenge and threat states in athletes

TCTSA- R – Theory of challenge and threat states in athletes – revised

TPR – Peripheral resistance

Declaration

I confirm that the work in this thesis is my own and has not been submitted for any other degree or application. Except where stated otherwise by reference or acknowledgment, the work presented is entirely my own.

Statement of copyright

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Chapter 1

General Introduction

1.1 Introduction

The concept of mental health has been defined in several ways, depending on context and culture. Some recent approaches characterize it as a continuum between high levels of functioning, and low functioning/poor psychological states (Lardon & Fitzgerald, 2013). This interpretation has contributed to re-evaluate mental illness, conceived, in the past, as a condition of evident abnormality of thoughts and behaviours. However, there is evidence that mental health issues are more common than a concept based on abnormality could suggest: for instance, it is estimated that 1 on 6 people in the past week experienced a common mental health problem in the UK (McManus et al., 2016). Present definitions consider mental health disorders to be shaped by, and derived from emotional and situational challenges, such as distress and interference with personal functions (Anderson, 2004). For instance, anxiety and depression have been linked to how people react to acute stressors (e.g., Wright et al., 2002), determined not just by major life issues, but also by minor events, such as work deadlines and arguments (Lazarus, 1999). One striking example was provided by Charles et al. (2013), who demonstrated that experience of daily stressors and prevalence of negative affect during a period of eight consecutive days could predict self-reported symptoms of anxiety and depression ten years later.

The mentioned relationship between daily stressors and mental health highlights the importance of understanding mechanisms underpinning the experience of stress. This could be particularly relevant in contexts that are not just demanding, but where specific

organizational dynamics and cultural factors could impact resources to cope and prevent individuals from asking for help (e.g., stigma in sport; Moesch et al., 2018; Gulliver et al., 2012). Different theoretical contributions in literature were employed to explore acute stress dynamics (e.g., transactional model of stress and coping; Lazarus & Folkman, 1984; biopsychosocial model of challenge and threat; Blascovich, 2008), but few attempts of integration have been conducted. As such, this doctoral thesis aims to explore how and why stress is differentially perceived, experienced, and subsequently impacts on markers of mental health. First and foremost, the present chapter will introduce the concept of stress, outlining why it is deemed fundamental to integrate different theoretical contributions for a complete understanding of this process, and why the context of sport could be considered a breeding-ground for the study of stress-related dynamics.

1.2 An introduction to stress: from physiological to psychological perspectives

A pivotal framework for the study of stress and its consequences on living beings is Selye's (1956) work, that described stress as an adaptive biological process aimed at facing dangerous stimuli. In particular, Selye theorized the existence of a general adaptation syndrome of the organism in the presence of stressors, characterized by three stages: an alarm phase, a stage of awareness of the danger; a resistance phase, where the organism's resources are actively used to face the stressors; and an exhaustion phase, occurring when the exposure to stress is prolonged, enough to exceed the individual resources and expose systems to damage. It should be considered that, in the original sense of the term, stress is not a negative process itself; indeed, later work by Selye (1976) distinguished between eustress, a healthy process characterized by activation and the successful use of resources, and distress, a negative activation leading to exhaustion. However, research focusing on the functional process of eustress has been somewhat obscured by the more common use of the generic term stress in relation to its negative value, at the point that stress has become a synonym for distress.

Formulated in the field of physiology, Seyle's general theory has been reinforced by a substantive body of research evidencing biological processes associated to stress, which consist in temporary and cumulative modifications in the functioning of nervous, cardiovascular, endocrine, and immune systems (e.g., Dhabar & McEwen, 1997; Schneiderman et al., 2005). For prolonged stress, these systems are repeatedly activated, causing maladaptive responses (Selye, 1956). For instance, a continuous stimulation of the cardiovascular system can cause elevated resting blood pressure and a harder hearth workload, while elevated basal levels of stress hormones causes a suppression of the immune system in the long term (Schneiderman et al., 2005). Beyond the consequences on health, in humans these physiological changes are usually associated with neurocognitive responses, which can be positive in the short-term, but negative for a prolonged activation. Specifically, changes in hormone secretion and increases in the blood pressure are linked to an improvement in processes such as concentration, attention, and learning (Greenberg et al., 2002); while for prolonged or critical stress, cognitive functions can decrease or even be suppressed (Arnsten, 2000).

If physiological changes associated with stress are well known, and overall depend on the reaction of the organism to environmental demands in a stimulus-response process, psychological correlates are not uniquely predictable and individual differences occur on many levels (e.g., cognitive, emotional, behavioural; Weiner, 1992). As such, from a psychological perspective, research around stress did not theorise it as a linear process, but as a transaction between person and environment (Lazarus, 1991), incorporating two main factors elapsing between stressors and outcomes: appraisal and coping. Appraisal can be defined as the response to the relational meaning of an event, namely the sense of benefit or harm that individuals attribute to the event (Lazarus, 1991, 1993). In other terms, stressors have a different significance for individuals, and this significance determines psychological responses alongside the number, nature, and persistence of stressors. The chance to differently appraise the same circumstances implies not just that individuals could react positively or negatively to the same event; but also, different cognitions, behaviours, and emotions could occur following similar appraisals. For example, a negative stress-related activation could be linked to different emotions such as anger, sadness, shame, anxiety, etc., based on the significance of the stressors. On the other hand, stress-related outcomes do not automatically follow appraisals, but there is recognition that individuals put in place processes of adaptation to external circumstances

and to consequent emotional and cognitive responses (Monroe & Cummins, 2015). In psychological literature, the process of coping has been defined as a group of cognitive, affective, and behavioural efforts aimed at managing specific external and internal demands (Crocker, Kowalsky & Graham, 1998; Lazarus & Folkman, 1984). How people appraise and cope largely contributes to explanations of stress-related psychological outcomes.

1.3 Stress between appraisal and coping

In their transactional model of stress and coping, Lazarus and Folkman (1984) offered a perspective on psychological stress, outlining the impact of processes of appraisal and coping on the individual-environment transaction. Regarding the process of appraisal, the model outlined two cognitive mechanisms that individuals use to assess the significance of stressors encountered: primary and secondary appraisal. Primary appraisal represents the relevance and significance of stressors in relation to personal goals; in other terms, it is an evaluation of whether the situation is noxious or beneficial for individuals, either in the present or in the future. Lazarus and Folkman (1984) distinguished among four different types of primary appraisal, namely harm/loss, threat, challenge and benign: an event is appraised as harm/loss in case of an already occurred damage; a threat appraisal involves potential danger; a challenge appraisal occurs when the situation is seen as an occasion of improvement or growth; a benign appraisal is a positive evaluation in which no further action is needed. Alongside with primary appraisal, individuals compare the value of the event with their personal resources, evaluating whether they can cope; this is the process of secondary appraisal. Resources could be cognitive, emotional, social, or material, and allow individuals to re-establish a balance with the environment.

Therefore, interindividual variation also occurs in selecting and using resources to deal with stress, and another important assumption of the transactional model is that stress-related outcomes also depend on the more or less adaptive way that individuals cope. Lazarus and Folkman formulated a categorization of coping strategies, distinguishing between problem-focused and emotional-focused coping: the first, aimed at actively changing the circumstances and representing a way to deal with the problem itself; the second, a form of regulation aimed at reducing the

negative emotional impact of the problem, and involving strategies like cognitive re-framing and avoidance. The distinction between emotional-focused and problem-focused coping has been widely used in literature, however classifications based on different criteria have been proposed. For example, Roth & Cohen (1986) proposed the distinction between approach and avoidance coping, the former involving active attempts to deal with the problem or the emotion, the second including ways to escape the stressor, such as disengagement and denial. What determines the use of specific coping strategies has been widely debated. Some theorizations characterized effective or ineffective coping as an individual trait or resource, pinpointing the use of some strategies by specific groups of people (e.g., avoidance; Krohne & Hindel, 1988; Yoo, 2001) or personality traits (e.g., Allen et al., 2011); instead, other literature contributions, more common in the field of general psychology, characterized coping as situational, linking coping styles to gravity and intensity of the stressors experienced (Connor-Smith & Flachsbart, 2007; Moos & Holahan, 2003; Murberg et al., 2002).

In literature, appraisal and coping are proposed to be linked because, from the perspective of the transactional model (Lazarus and Folkman, 1984), negatively appraising a stressor also implies that less coping resources are available, and vice versa. Following this theorization, some categories of coping have been proposed as more effective than others. For instance, in the sport context threat appraisals have been linked to emotion-focused and avoidance coping (Anshel et al. 2001; Dias et al., 2012), while challenge appraisals have been linked to problem-focused and approach coping (Anshel and Wells, 2000; Dias et al., 2012). These studies propose that negative stress-related appraisals are associated with actions based on internal regulation (e.g., emotional-focused coping) or disengagement, while positively appraising a stressor could promote more adaptive forms of coping directly aimed at the resolution of the situation (e.g., problem-focused/approach).

Even so, this evidence would imply that there are “better” coping strategies, since the formulation of the transactional model there has been support for the argument that coping effectiveness could be not absolute, but could depend on specific environmental requests. For example, Folkman (1991, 1992) in his Goodness-of-fit approach, argued that effectiveness of coping could be associated to secondary appraisal: in particular, that problem-focused strategies could be more adaptive in the presence of stressors appraised as controllable, while emotion-focused strategies could be more appropriate when

stressors cannot be controlled. In some contexts, also the temporal dimension was demonstrated as relevant in influencing coping effectiveness: for example, Kim and Duda (2003) found that both approach and avoidance strategies were effective in improving short-term outcomes (e.g., performance) in a group of athletes, but avoidance and withdrawal coping negatively impacted dimensions like satisfaction and enjoyment in the long-term. Therefore, there is wide support that stress-related outcomes could depend on the complex interplay among characteristics of the situation, appraisals, and compatibility of the coping strategies used with these elements. As such, appraisals, and subsequent ways to cope, have a great individual and inter-individual variability. This variability, stemming from appraisals, is one of the fundamental points examined in the present doctoral research. Prior to this, I will make a case for the sport context.

1.4 Sport and mental health: a matter of prevalence?

Given the introduced link between stress and mental health and given that this work aims at examining and developing results and recommendations to apply to the sport context, one of the questions that might raise is whether athletes represent a vulnerable group for the development of mental health issues. There has been a growing interest for athletes' mental health in recent years, particularly in relation to elite athletes (Poucher et al., 2021). Indeed, though there is exhausting work demonstrating that participation in sport could be overall beneficial for mental health, psychological well-being, and social outcomes (as highlighted by the systematic review by Eather et al., 2023), there is also strong evidence supporting the presence of risk factors facilitating the development of mental disorders in athletes. First, the age of peak performance in sport (Allen & Opkins, 2015) matches the age of onset of the most common mental disorders (Solmi et al., 2022), with athletes recruited younger than in the past, and then supported by poorer psychological skills to deal with sport-related challenges (Bauman, 2016). Second, there is growing evidence that there are sport-specific risk factors that can lead to specific mental health disorders or negative outcomes: for example, elite athletes present more risk factors than the general population for the development of eating disorders, especially in aesthetics or endurance sports Bratland-Sanda & Sundgot-Borgen, 2013; Sundgot-Borgen &

Torstbveit, 2004); sport-related concussion can impact on mood, emotions, and mental health symptoms such as anxiety, depression, and impulsivity (Rice et al., 2018), leading to severe outcomes in specific sports characterised by the occurrence of multiple concussions (e.g., encephalopathy in boxers; Bär & Markser, 2013); non-functional overreaching (NFO) and overtraining could be related to symptoms overlapping with major depressive disorders (e.g., fatigue, insomnia, amotivation; Armstrong et al., 2002; Reardon et al., 2019); injury could induce or exacerbate mental health conditions (Daley et al., 2021; Wiese-Bjornstal, 2010). Third, sport-related cultural factors could influence the tendency to report mental health issues or reach out for help. Indeed, sport is characterised as an environment where ideas of strength and mental toughness are predominant, and in contrast with "weakness" and "vulnerability" (Castaldelli-Maia et al., 2019; Moesch et al., 2018). The issue of stigma has been reported as a primary reason in preventing elite athletes from consulting a professional for mental health problems, for the fear of being considered not able to perform by coaches, teammates, media (Gulliver et al., 2012), and the risk of loss of playing time, starting role, and contract (Bauman, 2016).

Due to the mentioned risk factors, a consistent number of cross-sectional studies assessed the presence of mental disorders in athletes, with anxiety and depression found as the most prevalent issues across different samples. For instance, symptoms of depression/anxiety were reported by the 26% of a sample of current European footballers (Gouttebarge et al., 2015); 34% of Canadian swimmers met diagnostic criteria for depression post competition (Hammond et al., 2013); in a sample of more than 200 mixed Australian athletes (Gulliver et al., 2015), many reported depression (27.2%), general psychological distress (16.5%), social anxiety (14.7%), generalized anxiety disorder (7.1%), and panic disorders (4.5%). A consensus paper by Reardon et al. (2019) provided evidence of reported depressive symptoms in from 4% to 68%, and generalised anxiety disorders ranging from 6% (for clinician's diagnosis) to 14.6% (for self-report measures) of elite athletes. Many reviews concluded that the prevalence of mental health disorders in athletes, particularly anxiety and depression, is considerable and comparable with the one in the general population (e.g., Gouttebarge et al., 2019; Rice et al., 2016). However, some recent approaches suggest caution in interpreting these results, due to the differences in the way mental health issues are described and measured across studies, which include both general symptoms and full psychological disorders, with the risk of

underestimating of overestimating their prevalence. Indeed, on one side anxiety, distress, or adverse emotional responses measured at one point in time could be temporarily part of any athlete's experience (Uphill et al., 2016), and could even promote resilience and learning when effectively faced (e.g., Collins & MacNamara, 2012; Sarkar et al., 2015). On the other side, symptoms could be detrimental for athletes' mental health, and there is growing agreement that research should be focused on these, expanding and making processes of screening more efficient (Reardon et al., 2019). Similar considerations led to the development of alternative models based on a double continuum where mental health and mental issues symptoms could coexist and not be mutually exclusive (Keyes, 2002; Lundqvist & Andersson, 2021).

Second, the importance of considering not just current mental health conditions, but the quality of the interactions between athletes' and the context is emphasised: there is evidence, for example, that the context of sport is a high-risk ground for episodes of harassment and abuse, particularly related to actual or perceived differences in power (non-accidental violence; Mountjoy et al., 2016). Physical and psychological violence are reported as a frequent risk occurring at any sport age and level, having long-term consequences on performance and mental health outcomes (Parent et al., 2017; Stafford et al., 2015). The effect of the context on athletes' mental health could also not be directly expressed through positive or negative actions, but conveyed through the creation of a culture that can support or be detrimental for athletes': pressure to win, financial rewards, requests to train when fatigued or injured, and the already mentioned stigma, are examples of negative cultural factors that can have a negative impact on athletes' experience and aspirations (Henriksen et al., 2020). Embracing the perspectives presented, I argue that to establish whether athletes are a vulnerable group from the perspective of mental health, the assessment of their current clinical symptoms alone could not be sufficient. A switch of perspective could include considering whether there are specific factors of risk in the context where athletes operate (sport) that could influence their ability to deal with the difficulties encountered. In the next paragraphs some of these risks are identified and presented in relation to stress, first introducing the organizational nature of stress in sport settings, and second focusing on the specific path which through daily stressors might impact on athletes' mental health over time.

1.5 Stress in sport: organizational risks

There is general agreement that sport is a risky environment for the daily experience of a wide range of stressors. Indeed, due to the complexity in pursuing and maintaining high standards, athletes can be considered an exemplar of performers in a dynamic stressful environment and many studies (Dugdale et al., 2002; Gould et al., 1999; Holt & Hogg, 2002; McKay et al., 2008; Nicholls et al., 2005) evidenced their vulnerability to several kinds of stressors: physical (e.g. fatigue, injury, illness), psychological (e.g. performance pressure and evaluation, game and pre-game anxiety, fear of being dropped), interpersonal (e.g. relationship with staff and teammates, coaches' communication) and structural (e.g. physical environment, efficiency of the sport facilities). However, it can be argued that the context of sport also presents some characteristics that make it a peculiar context for the study of stress-related dynamics, beyond the number and the intensity of the stressor experienced. One of these characteristics is that most of the stressors occurring are not limited to the individual experience, but are organizational in nature (Arnold & Fletcher, 2012), and linked to the specific athletes' work environment and interactions. This means on one side, that sport dynamics are really similar to the ones experienced in the workplace, particularly when sport is a job, as in the case of elite athletes. These dynamics may involve high job demands, low perceived control, low social support, organizational changes, job insecurity, atypical working hours, bullying and role stress, all factors that in the workplace have been linked to a high risk of developing anxiety and depression symptomatology (Harvey et al., 2017; Rugulies et al., 2017; Theorell et al., 2015).

In addition, and independently from the level of competition considered, stress occurs in an environment characterised by specific sociocultural norms, implying that not just some stressors related to individual psychological processes (e.g., performance-related anxiety) could involve a social component (e.g., external pressure to perform), but also that appraisal and coping are influenced by organizational and collective processes and rules. In this sense, it can be argued that stress dynamics in sport could resemble the ones occurring in people work, namely jobs involving frequent interactions with customers and/or interpersonal contacts. These jobs require workers to display appropriate emotions in order to be positively perceived by customers (Gopinath, 2011), and frequent interactions can involve the necessity of regulating emotional expression, reducing the

correspondence between employees' real and displayed emotions (Rafaeli & Sutton, 1989), a condition that was defined as emotional labour (Hochschild, 1983). Overall, there is evidence that emotional labour is not a positive or negative process itself and, in some cases, may help employees to successfully accomplish tasks, increasing workers' effectiveness, reducing interpersonal conflicts, and facilitating customers' satisfaction (Ashforth & Humphrey, 1993; Grandey et al., 2005). However, the experience of emotional dissonance, namely the discrepancy between perceived and displayed emotion, has been associated with detrimental effects on employees' well-being (Morris & Feldman, 1996). Consistently with this, work by Côté and Morgan (2002) showed that while the amplification of pleasant emotions increases job satisfaction, the suppression of unpleasant emotions could cause an intention to quit. These considerations about the suppression of emotions have been linked to two different strategies to manage emotional labour and display required emotions: surface acting and deep acting (Hochschild, 1983). Surface acting involves control and modification of the expression only, without regulating the underlying emotional state; deep acting involves the active regulation and modification of feelings to internally meet the emotional demands (Hochshild, 1983). While deep acting has been associated with higher personal accomplishment (Brotheridge & Grandey, 2002), surface acting showed links with noxious effects of stress and burnout, such as depersonalization and emotional exhaustion (Brotheridge & Grandey, 2002; Biron & van Veldoven, 2012).

There is evidence that the processes described in relation to workplaces could be particularly relevant in sport and then represent a factor of risk for the experience of stress. Indeed, similarly to service or interactive service work, sociocultural norms within sport organizations influence athletes' emotional regulation strategies (Wagstaff et al., 2012), and research on emotional labour has evidenced that the use of surface acting increases burnout and turnover intentions among athletes and other sport professionals (e.g., coaches, sport scientists, and medics; Larner et al., 2017).

The effect of the dynamics described could be stronger in contexts with a high number of relationships and interactions that also affect performance, such as team sports. In support of these observations, a few studies investigated emotional labour in athletic teams, and its effects on emotional regulation and adherence to social norms. For instance, research on college football players (Wong et al., 2010) showed

that perceiving an emotional display as appropriate could have an influence on the tendency to conform. In the mentioned study, two groups of football players were asked to judge the appropriateness of crying behaviours of different intensity (tearing up vs. sobbing) after a football game, indicating their conformity: as a result, exposure to the lower intensity crying behaviour (tearing up), was associated to higher levels of perceived appropriateness which, in turn, could predict higher levels of conformity. Furthermore, the perception of higher conformity to the more intense crying behaviour (sobbing), was linked to lower levels of self-esteem, interpreted as shame and fear of appearing weak in front of teammates. Another study by Tamminen et al. (2016) found that sport teams perceived a set of collective stressors, to which they responded with shared appraisals and coping that could also communicate information about team values and commitment. For instance, showing happiness or laughing after a poor performance could convey a lack of care or commitment, with athletes reporting the feeling of being constrained from emotional expression, to not being excluded by their teammates. These studies provide evidence that in teams environments there are silent "rules" of emotional display that influence both conformity and quality of social relationships. However, there is evidence that groups like sport teams may not just share overt emotional processes, but also experience similar emotional processes. For example, there is evidence of occurrence of collective stressors in teams during performance, as a form of "synchronization": examples are common concerns about a player's performance, external events commonly perceived as stressful, simultaneous concerns about opponents, and the level of a team's performance being perceived as below expectations (Doron & Bourbousson, 2017). Following the evidence provided, it is argued that sport could present peculiar relational and organizational dynamics that make it a high-risk environment for the experience of stressors impacting processes of appraisal and coping, also when occurring during short-term events (e.g., training, performance). How these stressors could have an influence on long-term well-being will be examined in the next paragraph.

1.6 Transitions and adaptation in sport

Having highlighted that organizational and relational factors could be risk factors for athletes who experience and deal with stress, the way daily stressors could impact adaptation and influence well-being will be examined. Some theoretical approaches investigated processes of adaptation in sport characterising athletes' career as a succession of objective stages and transitions related to peculiar demands (Alfermann & Stambulova, 2007). In literature, these transitions are classified based on predictability: normative transitions, usually predictable or related to necessary steps in the athletes' career (e.g., retirement); quasi-normative, predictable transitions just for some groups of athletes (e.g., cultural transitions for transnational athletes); non-normative, namely sudden or unexpected events (e.g., injury; Schinke et al., 2018; Stambulova, 2016). A successful transition is determined by effective coping and problem solving, while, when this process fails and there is a perceived need of support or assistance, athletes could face a crisis. Within the model described, three kinds of crises are possible: age-related, linked to the athletes' stage of life; sport-career related, linked to stages of the athletic career (e.g., transitions to high-achievement sports); situation-related, linked to specific sport dynamics (e.g., relationship with coaches and teammates, loss; Stambulova, 2000). The passage to a crisis transition is described as the effect of ineffective processes of coping, which could be due to a lack of personal and environmental resources, personality factors, or inappropriate coping strategies (Schinke et al., 2018).

Whilst this doctoral thesis embraces the evidence that athletes' experience cannot be reduced to sport transitions and can be also characterised by stages of non-transition or external factors impacting sport transitions (e.g., family commitments, parental pressure; Gordon & Lavallee, 2012), it is argued that Stambulova's model offers an insight on how single sport-related events can impact on the mental health of athletes in the long-term. In this sense, the characterisation of athletes' experience as a progressive path where each stage can be influenced by success or failure in coping with sport-related issues, may not explain every aspect of the lives of athletes, but could be fundamental in outlining the importance of dealing with specific sport-related stressors (e.g., performance), also when the risk of failure is linked to minor subclinical outcomes. Related to this, recent developments of the concept of

adaptation in sport brought to the theorisation of the meta-model of adaptation in sport (MAS; Samuel et al., 2023), that distinguishes between two tracks: fast and prolonged adaptation. The former occurs during acute events (e.g., competition) and involves immediate processing (e.g., perception, cognition, decision-making); while the latter occurs as a result of substantial changes or transitions (e.g., retirement), with athletes having periods of prolonged time to appraise and deal with events. Fast and prolonged tracks are not mutually exclusive, but there are events (e.g., injury) that need both immediate and prolonged action. Importantly, both paths influence the process of adaptation to the same extent, based on whether the perceived ability of athletes to deal with the events is higher than the demands of tasks/events (Tenenbaum et al., 2015).

It is worth highlighting that the characterization of the process of adaptation outlined above presents several similarities with the concept of stress appraisal, and, similarly to stress appraisals, it is reflected by a series of positive outcomes regarding feelings, performance, motivation, positive relationships, and self-efficacy, in both short-term and long-term tracks (Samuel et al., 2023). The role of mental health in the models mentioned above has been linked to these outcomes: for example, outlining that a crisis occurring in the context of a transition can be characterized by subclinical symptoms, such as decreases in self-esteem, low self-efficacy, and negative emotions (Schinke et al., 2018); on the other hand, these subclinical symptoms influence athletes' mental health over subsequent transitions, and can be resources or barriers, which facilitate or impede effective coping (e.g., Samuel & Tenenbaum, 2011). Importantly, in the sport research there is also evidence for the opposite mechanism, with Holt and Dunn (2004) demonstrating that initial coping could influence subsequent stress appraisals: for instance, the perception of a stressor as controllable could facilitate athletes' use of problem-focused strategies; however, in the presence of repetitive failures of these strategies, the problem was re-appraised as uncontrollable, causing the shifting to emotional-focused coping. That is, appraisals and coping are dynamic and interact in a circular way, and initial ineffective adaptation could contribute to the maintenance of the positive or negative "circle".

The characterization of athletes' experience as a succession of transitions, and the theorization of a fast track through which short term events could contribute to and maintain psychological disfunction, implies also that minor stressors affecting performance could impact mental health. It is argued that this process could represent

another factor of risk in the sport context, together with the organizational and relational dynamics discussed in the previous paragraphs. Furthermore, investigating stress dynamics occurring during short-term events, such as performance, could be informative about signals of ineffective stress processes that impact mental health outcomes in the long term.

1.7 Individual differences in appraisal: towards the construction of a model

If some contexts present more risks for the outcomes linked to stress-related processes, environmental factors alone cannot determine how people react to stress. Indeed, as already mentioned, individuals give different value to the same stressors, with stress defined as a transaction between person and environment (Lazarus, 1991). Research has recognised the importance of investigating personal contingencies, particularly in relation to stress appraisals, and a few individual differences have been linked to more positive or negative appraisals. For example, higher stress reactivity was associated with higher perceived stressor intensity and more detrimental forms of appraisal (e.g., threat; Britton et al., 2019; Schlotz et al., 2011); while specific types of goal orientations (e.g., a learning goal orientation) were associated with positive appraisals (e.g., challenge; Ma et al., 2019). The study of personal factors affecting appraisals has also been extended to the sport context. For example, perceived stress intensity has been related with gender (Kaiseler et al., 2012a), and trait-based factors like mental toughness (Kaiseler et al., 2009; Poulus et al., 2020), neuroticism, and agreeableness (Kaiseler et al., 2012b).

Therefore, there is evidence that stress-related outcomes depend both on environmental factors (e.g., stressors strength, relational and organizational dynamics) and individual characteristics (e.g., traits, personal resources). The interplay between these elements can actively influence the value of stressors (e.g., appraisals) with different implications for individual responses and coping strategies. Furthermore, some models outline that this dynamic could contribute to mental health outcomes also through short-term acute transactions, given also that provisory failures in coping could diminish individual resources and re-influence future appraisals of

the same events. This doctoral thesis reflects the position that an exhaustive study of stress as a person-environment transaction should consider four main elements: contextual determinants, individual characteristics, stress appraisals, and coping strategies. Here I argue that previous research failed to test at least one of these elements: for example, studies investigating individual variability in appraisal and coping (e.g., Anshel et al., 2001; Kaiseler et al., 2009; Kaiseler et al., 2012b) assessed the occurrence of appraisals, and the prevalent use of coping categories (e.g., emotional-focused, problem-focused) in presence of predetermined categories of stressors (e.g., injury, referee decisions), neglecting to investigate what aspects of the social context were challenged by these stressors (e.g., relationships) or assessing just specific aspects (e.g., perceptions of control). Studies considering appraisal and coping as a process, resulting of intensity and gravity offrom the specific stressors experienced (e.g., Nicholls & Pollman, 2008; Gould, Eklund, & Jackson, 1993) mostly neglected to assess differences linked to individual characteristics, similar to some research showing links between appraisals and coping (e.g., Hatzigeorgiadis & Chroni, 2007).

Therefore, an integration of different findings and approaches is deemed essential for understanding the athletes' between and within-person variability both in dealing with acute stress, and the long-term consequences of their responses. As such, the initial purpose for this doctoral thesis is to present and test a model of stress, integrating different theoretical frameworks aimed at covering each of the elements introduced in this chapter to understand stress-related processes. In the next chapter, these theoretical frameworks are presented and progressively integrated in the construction of the model.

Chapter 2

Literature review

2.1 Progressive steps for a model of stress: contextual stressors

To build an integrated model of stress, it is argued that the use of a contextual theory, describing situational aspects of the process, should be the starting point. For this purpose, the present work adopts self-determination theory (SDT, Deci & Ryan, 1985a, 2002), a framework developed in the field of motivation, which characterizes human beings as oriented to growth and development, pursued through autonomous and self-determined behaviours. A sub-theory within this framework, basic psychological needs theory (BPNT; Ryan, 1995), defined the presence of three innate needs that humans achieve to satisfy and to experience intrinsic forms of motivation and psychological growth: autonomy, competence, and relatedness. Autonomy is the tendency to experience a sense of choice and volition in pursuing actions; competence is the need to feel effective in interacting with the environment and in producing desired outcomes; relatedness is the need to be connected with and feel accepted by significant others (Vansteenkiste et al., 2020). The theorisation of these needs was inspired by Aristotle's view (1869) that wellness is realised through eudaimonia, namely flourishing and realising humans' best potential, in contrast to pursuing only subjective happiness, that can follow eudaimonic living, but does not fully define well-being (Ryan & Deci, 2017). As such, humans experience the greatest (eudaimonic and hedonic) well-being when they can flourish and grow through the satisfaction of these needs, while thwarting of the needs could result in ill-being and negative psychological states (Deci & Ryan, 2000).

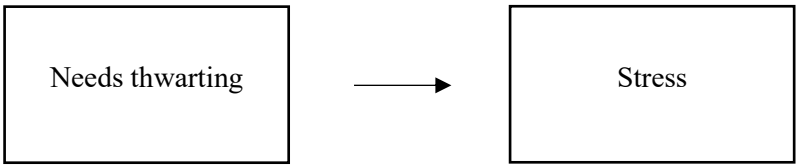
The use of basic psychological needs theory as a contextual framework in the model presented here is due to two main reasons. First, though the basic needs are theorized as inherent and natural individual tendencies, they are achieved through a process of internalization, requiring the social environment to be supportive of these inclinations (Deci & Ryan, 2000). In other terms, relevance is given to environmental conditions that facilitate or obstruct the basic needs: individuals can feel related when they have the chance to experience affection and caring from others; they can experience a sense of competence when the context is structured, predictable, contingent, and consistent; they can experience themselves as autonomous when they are allowed freedom of action, and can freely pursue their values and desires (Skinner & Egde, 2002). These contexts are associated with optimal well-being, internalised regulation, and personal development, evidence that is supported in several environments, such as parenting (e.g., Chirkov & Ryan, 2001), workplace (e.g., Baard, Deci, & Ryan, 2004; Gagné, 2003), and sport (e.g., Reinboth et al., 2004). In contrast, basic psychological needs can be thwarted by controlling, pressuring or coercive contexts (Deci and Ryan, 2000). Needs thwarting has been linked to reduced well-being, negative emotions, feelings, behaviours, and higher illness risk (Deci & Ryan, 2000; Gillet et al., 2012; Hein et al., 2015; Vansteenkiste & Ryan, 2013). Given the already highlighted organizational and environmental structure of stressors in sport, the mentioned differentiated outcomes between needs satisfaction and thwarting have been also extensively examined in the context of sport and exercise. For instance, maladaptive outcomes such as negative affect, burnout, and depression have been linked to sport environments characterised by social isolation, control, and pressuring coaches' behaviours (Bartholomew et al., 2010; Balaguer et al., 2012; Blanchard et al., 2009; Gunnel et al., 2013). Importantly, recent SDT developments separate between lack of needs support and needs thwarting, with the first related to low satisfaction and the feeling that needs are not met; the second, related to the feeling that needs are actively undermined, with subsequent experience of frustration (Bartholomew et al., 2011a). Though both circumstances can impact well-being, needs thwarting is deemed more likely to lead to negative outcomes and ill-being (Bartholomew et al., 2011a).

The second reason to adopt BPNT as a framework for the description of stressors that are contextual, is that given that the basic needs are theorised as innate, it is argued that contexts facilitating their obstruction or fulfilment could be universally relevant. This

relevance is here associated with stress in the case of needs thwarting from a conceptual perspective, for the argument that imbalances in the process of development and growth should induce regulation responses. This is supported by Skinner and Edge (2002), who characterise challenges or threats of three needs as prototypical situations triggering action tendencies, or coping responses; for example, coercive parenting is describing by Skinner and Edge as objectively stressful in the extent it undermines children's sense of autonomy. As such, BPNT is adopted as contextual framework, with the aim of characterising situations thwarting the basic needs, triggering stress-related responses, and subsequent processes of appraisals and coping (Figure 2.1).

Figure 2.1

A schematic representation of the link between needs thwarting and stress



As already discussed in the previous paragraphs, stressors have different interindividual significance (Lazarus & Folkman, 1984). For this reason, a second step in the construction of the model will be introducing a theory of appraisal, to differentiate interpretations of stressors related to needs thwarting.

2.2 A theory of appraisal: challenge and threat states

As discussed in the previous chapter, Lazarus and Folkman's transactional model (1984) emphasised the interindividual variability in stress responses, through theorising the occurrence of primary (relative to the situational value) and secondary (relative to personal resources to cope) appraisals. Offering a new development, the

biopsychosocial model (BPS) of challenge and threat (Blascovich, 2008) specifically focuses on the appraisals of challenge and threat, that in Lazarus and Folkman's model were two types of primary appraisals. In particular, the BPS posits that during the occurrence of a stressful event individuals compare the situational demands with their personal resources. When the demands exceed the resources, the situation is appraised as a threat; vice versa, when the resources balance or exceed the demands, the outcome is a challenge appraisal. Despite conceptual similarity, challenge and threat appraisals in BPS present a fundamental difference with the ones theorised by Lazarus and Folkman: they just occur in motivated contexts, namely situations already judged as self-relevant. As such, they can be placed between primary and secondary appraisal, that is, at the end of the situational appraisal process (Seery et al., 2010).

Furthermore, the BPS argues that challenge and threat are mainly automatic responses, and as such, they are associated with two distinct physiological patterns, determined by different hormonal and cardiovascular processes (Dienstbier, 1989; Seery, 2011). These physiological changes are, in turn, reflected by emotional, cognitive, and behavioural differences, that have been investigated in a variety of contexts, particularly related to performance (e.g., sport). In particular, challenge and threat have been linked to different emotional states (Skinner & Brewer, 2004), with a challenge state associated with positive emotions, and a threat state linked to negative emotions (Chadha, Turner, & Slater, 2019). Mixed findings have concerned levels of cognitive and somatic anxiety (e.g., Moore et al., 2012; Quested et al., 2011; Trotman et al., 2018), though threat seems to be associated with more debilitative interpretations of anxiety than challenge (Chadha, Turner, & Slater, 2019; Williams et al., 2010). In terms of functionality, there is also evidence regarding differences in performance, with challenge globally associated with better performance than threat (Hase et al., 2018), result explained by differences in optimal attention and decision-making (Moore et al., 2013; Vine et al., 2013, 2015).

The BPS is here adopted as a framework for describing stress appraisals following needs thwarting and is preferred to Lazarus and Folkman's transactional model for two main reasons: first, it is focused on appraisals of potential situations of stress, excluding the cases where damage has already occurred (harm/loss) or there is no reason to react to/cope with the problem (benign). Second, for its aforementioned reliance on physiological measures. Indeed, it is argued that the presence of objective measures could allow the measurement of online appraisals independently from the influence of coping

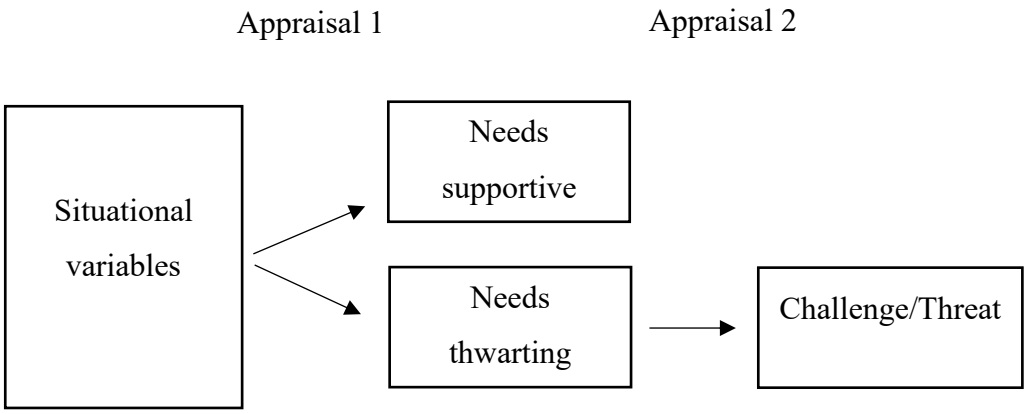
strategies that could cognitively re-structure the value of the stressors: for example, in the presence of intense anxiety, this could be reported as facilitative, in an attempt to regulate the negative emotion experienced (emotional-focused coping). Another reason for integrating this framework in the model, and specifically in relation to BPNT, is that there is partial conceptual alignment between the basic psychological needs and the challenge and threat predictors hypothesised in literature. These predictors were formulated by Jones et al. (2009) in a sport-specific implementation of the BPS: the theory of challenge and threat states in athletes (TCTSA). In particular, the TCTSA posited that challenge could be predicted by high self-efficacy, high perceptions of control, and a tendency to approach tasks; threat states could be predicted by low self-efficacy, low perception of control and an avoidance attitude. It is argued that perceptions of control and self-efficacy presents similarities with the needs for autonomy and competence in the BPNT. Indeed, perception of control relates to the amount of control subjectively perceived over a situation (Skinner et al., 1996; Jones et al., 2009), an aspect that, from an SDT perspective, is aligned with feelings of volition and causality attributed to the concept of autonomy (Ryan & Connell, 1989). Similarly, the need for competence links to perceived mastery, and effectiveness to produce desired outcomes (Deci & Ryan, 2002), elements that align with Bandura's conceptualization of self-efficacy (1977). However, an important difference between the two frameworks is that the TCTSA characterises antecedents of challenge and threat almost as dispositions: indeed, given that their occurrence is placed after the situational appraisal, they just relate to individual resources (Jones et al., 2009). However, here it is argued that this formulation omits specific links with the context, and basic psychological needs could enrich the descriptions of stress antecedents, given that it also helps to describe elements of the environment (supportive vs thwarting) that go beyond the only appraisal of self-relevance. Related to this, with the formulation of the need for relatedness, BPNT also emphasises the importance of having quality relationships for a healthy psychological functioning; it is argued that this is a fundamental element when examining stress, given that, as previously discussed, some stressors have a strong organizational and interpersonal nature. As such, in the model here presented, challenge and threat states will be assessed in relation to context-specific stressors consisting in basic psychological needs thwarting.

Other recent studies and theorisations have integrated satisfaction/thwarting of basic psychological needs and stress appraisals, linking needs satisfaction to challenge and needs thwarting to threat (Bartholomew et al., 2017; Ntoumanis et al., 2009). Instead, this thesis offers an alternative way of conceptualising the relationship between thwarting and appraisals, suggesting that needs thwarting can be appraised either as a challenge or as a threat (Figure 2.2). This challenges previous propositions on the basis of three core arguments. First, appraisal of a need thwarting experience as a stressor (i.e., that it is thwarting vs supportive) is best considered to occur prior to an appraisal of the balance between resources and demands resulting in a perception of challenge or threat. Second, alongside evidence that experiencing needs satisfaction may foster challenge states, particularly considering cognitive appraisals (Quested et al., 2011), need satisfaction is generally characterized by lower levels of stress compared to needs frustration (Li et al., 2019). This potentially makes need supportive contexts less salient, and therefore less appropriate, for exploring stress appraisals and their outcomes. Third, contrary to the hypothesis of Jones et al. (2009), there are cases in literature where challenge and threat states did not, or just partially differed in terms of perception of control, approach/avoidance orientation and self-efficacy, during competitions/sport tasks (e.g., Mejien et al., 2013; Turner et al., 2012; Turner et al., 2013). This could imply that needs thwarting, even with related feelings of lack of control or competence, could not be appraised as a threat by particular groups of athletes, if they perceive they have enough personal resources to deal with it.

Therefore, athletic contexts associated with needs thwarting are conceptualised as stressful conditions, which individuals could differently appraise. A further question could be why some individuals appraise need thwarting as a challenge or as a threat; this will be addressed in the next paragraph, in reference to individual differences, and specifically personality.

Figure 2.2

A schematic representation of the hypothesized relationship between needs thwarting and stress appraisal



2.3 Personality differences between stressors and appraisals

With stress consistently defined as a person-environment transaction (Lazarus, 1991), exploring contextual determinants could be insufficient for explaining the great individual variability observed in stress responses. As already mentioned in the previous chapter, several personal qualities and dispositions have been associated with the way people appraise and cope with stress, such as stress reactivity, goal orientation, and personality (Britton et al., 2019; Kaiseler et al., 2012b; Schlotz et al., 2011). This interindividual variability is also specifically supported in relation to challenge and threat states in competitive contexts, such as sport: for example, Fletcher and Sarkar (2016) have evidenced the importance of personal qualities, together with a facilitative environment, in promoting a challenge mindset in athletes. Among the relevant personal qualities, Fletcher and Sarkar also outlined the

importance of personality traits, such as extraversion, consciousness, and narcissism. Along with expanding previous results and theorisations, the focus on personality in the present thesis is due to the range of individual dimensions that this factor allows us to explore. Indeed, personality has been defined as a group of "characteristic patterns of behaviour, thoughts and feelings" (Allport, 1961, p. 11), incorporating factors associated with emotional, cognitive, and behavioural processes. Furthermore, there is general agreement about personality's long-term stability over time and situations (Costa & McCrae, 1986; McCrae & Costa, 2008; Pervin & Cervone, 2010), a factor that could minimise differences in the stress response across contexts from an experimental perspective.

Importantly, the assumption that personality can shape the appraisal of stressful contexts is supported both by BPNT and BPS. In the BPNT, personality has been shown to influence appraisals in two possible ways: first, determining sensitivity to specific aspects of the situation; second, influencing reactivity to needs thwarting and needs satisfaction exposure. According to the first mechanism, personality could determine whether an event is evaluated as needs satisfying or frustrating. This is derived from the conceptualization of Ryan and Deci (2000), who suggested that individual differences could influence the degree of experienced needs satisfaction, and finds support in theories of personality characterising traits as vulnerable to specific environmental stimuli (Zuckerman, 1999). Şimşek and Koydemir (2013) supported this mechanism, demonstrating that two personality traits called stability (high agreeableness, low neuroticism, and high conscientiousness) and plasticity (high extraversion and high openness to experience) were positively linked to needs satisfaction, which, in order, predicted life satisfaction. Instead, according to the second mechanism, personality could influence cognitive, emotional, and behavioural reaction to needs thwarting or needs support exposure. For example, in the presence of controlling parenting, children low in benevolence and conscientiousness have been shown to react with more externalized behaviours (e.g., aggressiveness), while children low in emotional stability and extraversion have presented internalized symptoms (e.g., social isolation, anxiety/depression; Van Leevwen et al., 2004). A recent study led by Thomas, Fadeeva and Oliver (2020) tested both mechanisms, asking participants to evaluate situations illustrated in vignettes and to indicate their subsequent behaviour. The first mechanism was supported, with covert narcissism and neuroticism positively predicting needs

frustration and negatively needs satisfaction, and extraversion positively linked to needs satisfaction. In contrast, the second mechanism was only partially supported, with some personality traits (e.g., covert narcissism and neuroticism) predicting the occurrence of reactive need-oriented behaviours (e.g., engaging in interesting activities [autonomy]; be alone [relatedness]), but just in the presence of high levels of needs frustration. The presence of a significant effect just for unfavourable environments in Thomas, Fadeeva, and Oliver's study, could be a good starting point to just test the mediator role of personality in situations of needs thwarting alone, compatible with the model discussed here.

The hypothesis of reactivity (i.e., that personality influences reactions to need thwarting) also mirrors ideas presented in the BPS, with personal dispositions theorised as affecting perceptions of environmental demands and personal resources, subsequently influencing challenge and threat predictors (Jones et al, 2009). However, few studies have tried to test this assumption specifically for personality. Within the context of education, Mak, Blewitt and Heaven (2004) have shown that extraverted students were more likely to appraise stressors as a challenge, while students with higher levels of neuroticism, experienced more threat states. Whereas one notable attempt in sport-related research made by Allen et al. (2012) was ineffective in inducing challenge and threat states through asking participants to image an important upcoming competition. However, some personality traits, such as extraversion and conscientiousness, were related to general physiological indices of challenge.

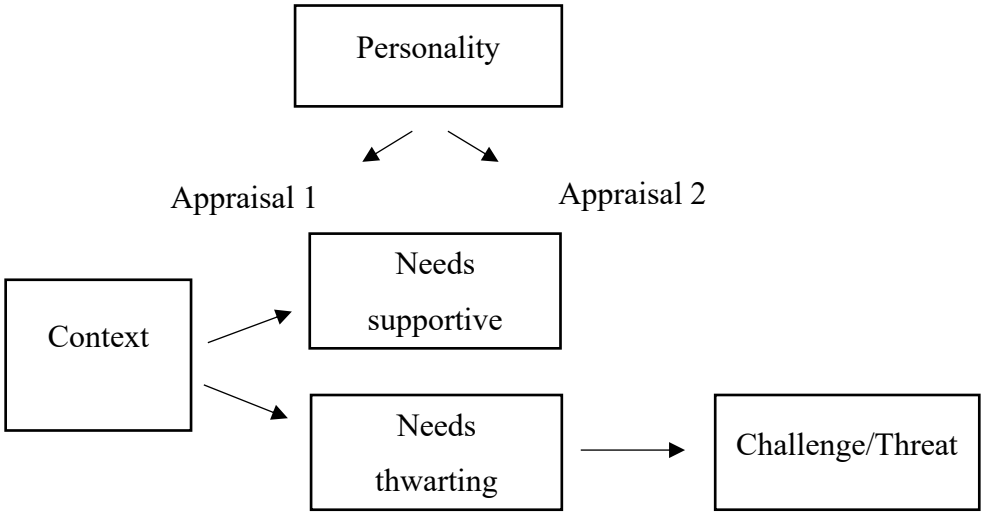
Therefore, in the model presented in this thesis, personality is hypothesized to influence both sensitivity and reactivity to thwarting environments, determining either challenge or threat states based on how thwarting interacts with individual characteristics (Figure 2.3). Among the variety of personality models available, this thesis employed the Big Five model (BFM; Digman, 1989; McCrae & John, 1992). BFM conceptualizes personality as composed of five assessable traits: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Neuroticism represents the individual tendency to emotional instability; extraversion is the positive disposition towards interactions with people and engagement in the external world; openness is the degree of curiosity and proneness to try new experiences;

agreeableness represents the propensity for cooperation and social harmony; conscientiousness is the individual tendency to organize, control and focus behaviour.

The model was also further developed in relation to its main traits, including a number of different facets for each of the five factors (Costa & McCrae, 1992). In addition to its widespread use, also involving all the previously mentioned studies, the use of the BFM for investigating personality is here supported due to the broad range of traits that are measurable with its dimensions. Regarding this, a mapping review by Laborde et al. (2019) examined the use of personality traits ascribable to different models and approaches over sport-based research. Laborde and colleagues demonstrated that most of the traits examined could be linked to traits or facets of the BFM. This is an important advantage given the intent of this thesis to produce recommendations that can be extended to the sport context.

Figure 2.3

Integrating personality in the relationship between needs thwarting and stress appraisals



2.4 Towards the completion of the model: the role of coping

In the previous paragraphs, a model of stress has been built, where the interaction between needs thwarting and individual differences could contribute to positive or negative stress appraisals. Therefore, the last step for the construction of the model will integrate coping, attempting to explain positive or negative stress-related psychological outcomes of the stress process. As already mentioned, though a part of literature examining stress attempted to identify the most effective group of coping strategies denoting approach and problem solving as more functional than emotional management and avoidance, there is support for the argument that coping effectiveness could depend on the compatibility between strategies employed and situational factors (Goodness-of-fit; Lazarus, 1991, 1992). Related to this, it should be noted that studies supporting the greater effectiveness of specific coping strategies mainly tested their use with cross-sectional designs, a factor that has been flagged as a limitation: indeed, high scores at scales assessing emotion-focused coping may be interpreted as more maladaptive for their overlapping with measures of distress and psychopathology (Stanton et al., 1994). When coping was investigated through experimental designs, some studies demonstrated that problem-focused and emotional-focused coping are both used depending on the specific person-environment transaction (Calmeiro et al., 2014; Folkman & Lazarus, 1980), and that avoidance and emotion-focused coping could be even adaptive or provide benefits in case of severe stressors (e.g., abusive relationships; Matheson et al., 2007). Furthermore, issues of classification were addressed, regarding both the distinction between problem-focused and emotional-focused coping, and the one between approach and avoidance strategies (Skinner et al., 2003). Indeed, these categories have been showed to be neither mutually exclusive nor exhaustive: for example, strategies such as “making a plan”, could be classified as problem-focused, but could also have the function to control and moderate emotions; likewise, seeking support or asking for help could be aimed at actively facing unpleasant emotions but, in fact, being directed away from the stressful stimulus.

Therefore, though there is evidence that stress appraisals influence the use of coping strategies, observing and evaluating coping actions may require a change of

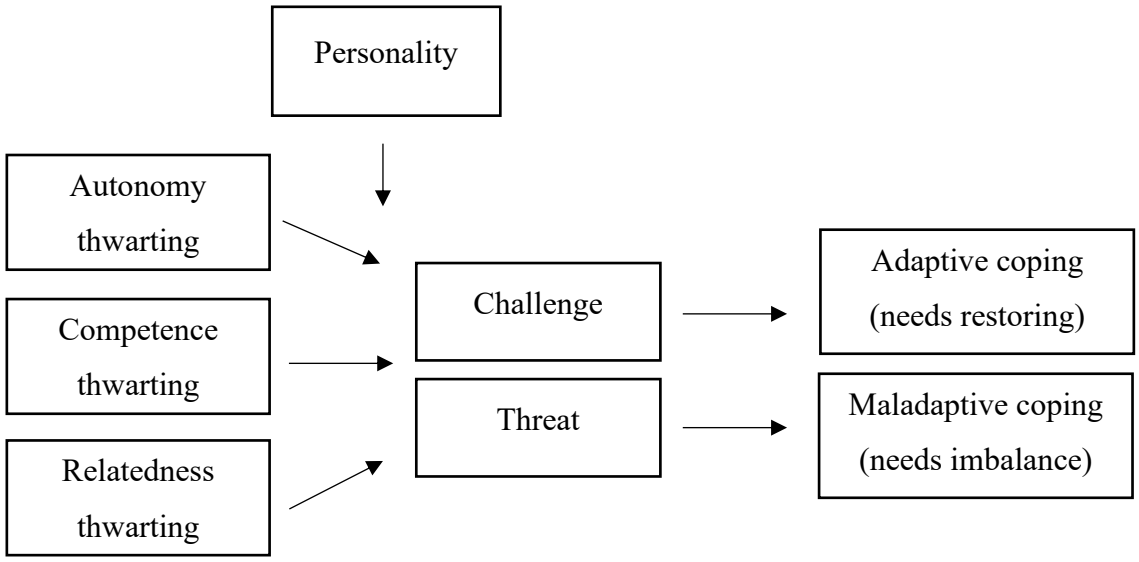
perspective, in relation to the most widespread criteria of classification. In attempting to address some of the aforementioned criticism, and simultaneously deepening understanding of when and why coping happens differently, Skinner and colleagues (2003) proposed a new classification of strategies, integrating coping with BPNT. More precisely, Skinner and colleagues organized coping strategies around three classes of concern, corresponding with the needs for autonomy, competence, and relatedness. From this perspective, and compatibly with the model I present in this Ph.D. work, stressors could cause imbalances in one of the three needs, being appraised as challenging or threatening, and determining the employment of coping actions aimed at re-balancing the needs. Strategies linked to challenge and threat were then classified by Skinner and colleagues based on their compatibility with the targeted needs, and they include a range of actions also attributable to various "classic" categories (e.g., problem-focused, emotional-focused, approach, and avoidance). For instance, when the stressor concerns the need of competence, challenge appraisals can lead to actions aimed to problem solving or information seeking, while threat appraisal can lead to actions linked to helplessness or escape. It should be pointed out that the mentioned classification does not draw conclusions about the outcome of the coping strategies used, which are considered all potentially adaptive. This is a point of contention in the present work because, as already discussed, there is evidence that challenge and threat appraisals are linked to different outcomes in several areas, such as performance, emotions, and visuo-motor processes (see paragraph 2.2).

I propose that, if coping strategies can be classified based on their compatibility with the three basic psychological needs, their adaptive or maladaptive outcomes could depend on the extent with which they allow individuals to re-balance the targeted need. In this regard, researchers introduced the concept of needs restoration, defined as a need-oriented behaviour which occurs when there is a deprivation of one of the basic psychological needs (Radel, et al., 2011; Veltkamp et al., 2009). Thomas et al. (2018) experimentally demonstrated that individuals engage in need restoration attempts, after experiencing needs thwarting. Here, therefore, I integrate the perspective of Skinner et al. (2003) with the concept of needs restoration to present a model in which coping strategies are described as actions compatible or incompatible with the imbalanced basic psychological needs. As such, coping effectiveness would depend on the degree to which strategies allow individuals to restore needs satisfaction. The model here presented adopts this

integrated perspective, hypothesizing that challenge states are linked to coping strategies compatible with the thwarted need(s) and enabling the restoration process; in contrast, threat states are associated with actions that are incompatible with the thwarted need(s), or unsuccessful in enabling the process of restoration (Figure 2.4).

Figure 2.4

Representation of the relationship between challenge/threat appraisal and coping strategies in the model of stress



2.5 Summary and overview of the studies

In the previous chapter, the importance of studying stress for understanding mental health outcomes was argued, identifying organizational and interpersonal factors that increase stress-related risks in specific environments. Related to this, the description of sport as a high-risk context for the development of stress-related subclinical symptoms was supported, due to the regular occurrence of the mentioned

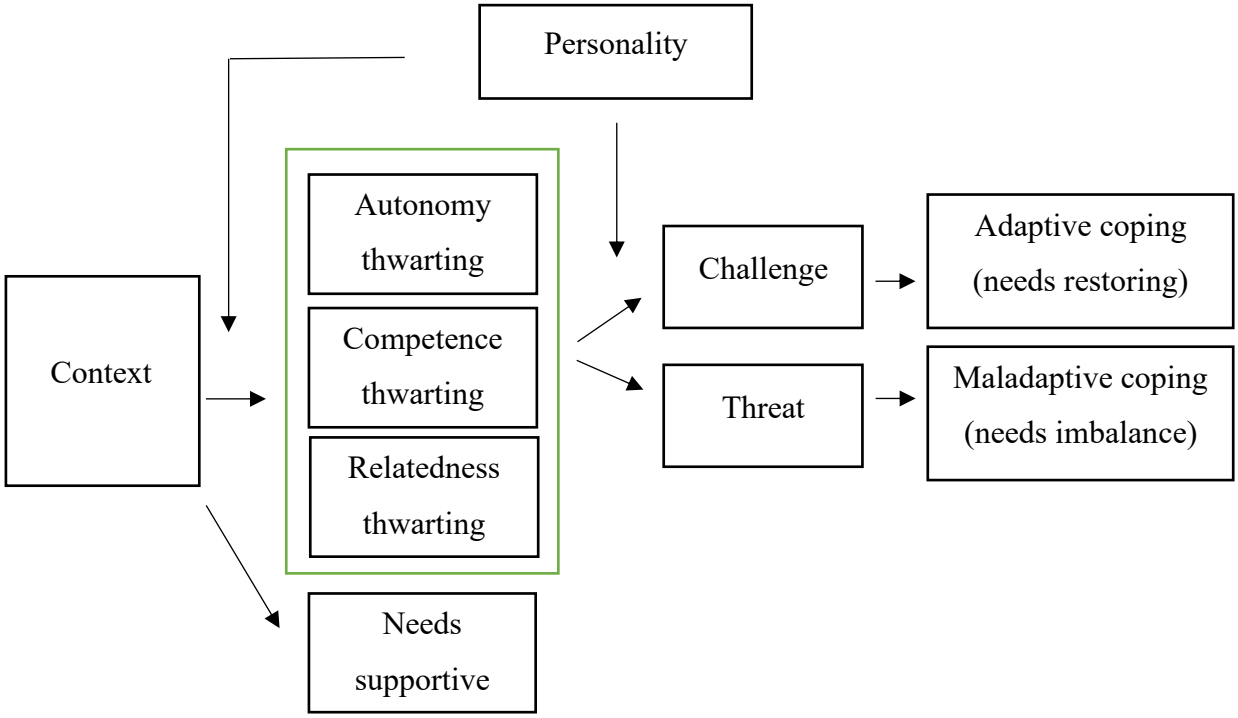
risk factors, and for the peculiar structure of the career and experience of athletes. In particular, theorisations have been presented that describe environments like sport as a succession of transitions or short-term events where individual resources and environmental barriers can impact processes of stress appraisal and subsequent coping, determining mental health-related problems in a circular relationship. Evidence was shown regarding appraisal as determined by the interplay between situational and individual factors, and the necessity of integrating different theoretical frameworks for the understanding of these elements was reinforced.

Following previous reflections, in the present chapter I attempted to build the theoretical basis for a complex model of stress in sport (Figure 2.5), integrating a contextual theory (BPNT; Ryan, 1995), a model for the description of stress appraisals (BPS; Blascovich, 2008), a theory outlining individual differences (BFM; McCrae & John, 1992), and a classification of coping strategies (Skinner et al., 2003). Compatibly with the main purpose of this thesis, the next chapters are aimed at testing the model presented here. However, it should be noted that hypotheses about coping were not tested, for two main reasons. First, the model built presents a series of assumptions that need to be demonstrated in order to test every other element, with the main being the relationship between needs thwarting and stress appraisals, that challenges other theorisations in literature. Second, following the evidence presented in the previous chapter, coping strategies are characterised as subsequent to stress appraisals, implying that understanding the process of appraisal is a pre-requisite for future research developments.

In addition to the reasons proposed, it is necessary to consider that the model of stress presented finds theoretical justification in theorisations that give relevance to acute events (e.g., MAS; Samuel et al., 2023). As such, this work aims at testing it through laboratory-based protocols that could re-create and simulate short-term stressors, a goal that, from an experimental perspective, has been translated in manipulating basic psychological needs thwarting. However, as evidenced in previous literature (e.g., Sheldon & Filak, 2008) and as discussed in the next chapters based on the results of this work, there is a lack of studies specifically manipulating competence and relatedness in laboratory-based procedures, a factor that entails the necessity of giving priority to methodological aspects, compared to advancing the model with coping strategies.

Figure 2.5

A graphic representation of the model of stress showing the relationship between stress appraisals and coping



Following these points of discussion, Study 1 (Chapter 3) utilised an experimental design to test the interaction between needs thwarting and personality factors in influencing appraisals of challenge and threat. The study was led on a sample of students, and manipulation techniques were used during an academic task to induce needs thwarting and cause environmental imbalance (Deci et al., 1994; Sheldon & Filak, 2008). Building on the findings of the first experiment, Study 2 (Chapter 4) attempted to replicate and improve the previous procedure on a sample of athletes, with a series of variations: it involved a sport-based task (dart throwing); it separately manipulated the need for competence and relatedness in two different conditions; it recruited groups of two/three participants competing in the same teams. However, Study 2 was interrupted due to the ineffectiveness of the manipulation procedures of the need for relatedness. For this

reason, in Study 3 (Chapter 5) a scoping review was undertaken that focused on protocols of relatedness manipulation in experimental settings.

In summary, the thesis had three main aims:

(1) to highlight the need for theoretical integration in studying and understanding psychological stress, and subsequently theorising a model of stress based on the contribution of different theoretical frameworks.

(2) to test some elements of the transtheoretical model presented and increase the understanding of the interplay between individual and situational factors in influencing acute stress appraisals.

(3) to revise experimental protocols employed in literature and provide recommendations related to the manipulation of contextual aspects of the model (specifically relatedness thwarting).

Given the intent to extend the findings of the thesis to the context of sport, the work adopted theories and methodologies widespread in literature about sport and exercise, considering specifically stress occurring during acute events (e.g., performance). In the next chapters the two experimental studies and the scoping review will be presented and discussed.

Chapter 3

Appraising frustration: how personality moderates experiences of motivationally-challenging environments

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This research was presented at: 1) 35th Annual PsyPAG Conference (virtual), University of Leeds, Leeds, United Kingdom, 2020; 2) Science Slam of the 23rd National Congress of AIPS (Italian Sport Psychology Association), Online, 2021; 3) BPS Conference "Positive adaptations: psychological strengths", Online, 2021; 4) FEPSAC 16th European Congress of Sport & Exercise Psychology, Padua, Italy, 2022

3.1 Introduction

As discussed in the previous chapters, performance contexts (e.g., workplace, sport) involve frequent and variable exposure to stressors, that can be also precipitated and influenced by organizational dynamics (e.g., Harvey et al., 2017; Wagstaff et al., 2012). Though stressors are typically framed negatively, it has long been recognised that they can result in either distress (i.e., negative) or eustress (i.e., positive) experiences (cf. Seyle, 1956; 1976). To determine the nature of the stress experience, psychological theorists (e.g., Lazarus, 1991) have focused on the role of 'relational meaning', highlighting the importance not just of the nature and intensity of stressors, but also of individual differences in appraising the psychological significance of stressors. This appraisal process, that is, how individuals perceive and evaluate stress, has well-evidenced effects on behaviour and on the chance to select functional strategies to cope (Lazarus & Folkman, 1984). In this study, contemporary theories of appraisals are drawn together to consider a relatively unexplored area: how the interaction between context and individual differences (in particular personality) influences stress appraisals. Though previous research has investigated links between appraisals and individual differences (e.g., Anshel et al., 2001; Kaiseler et al., 2009; Kaiseler et al., 2012b) there is limited evidence integrating biopsychosocial theories alongside cognitively-driven ideas. Here, a part of the transtheoretical model formulated in the previous chapter is tested, hypothesising that personality traits influence sensitivity and responsiveness to specified characteristics of stressful contexts, determining stress responses. At this purpose, theories concerning appraisals, context, and personality are integrated to create a conceptual framework for the study of stress dynamics.

Regarding appraisals, the biopsychosocial model of challenge and threat (BPS; Blascovich, 2008) has been adopted. According to this model, situational demands and personal resources are assessed explicitly (through cognitive processes) and implicitly (through physiological processes). A challenge appraisal occurs when resources are sufficient to match the demands; vice versa, a threat appraisal is the result of situational demands overcoming the resources. As previously mentioned, these two appraisals have been associated with differences in emotions (e.g., Chadha, Turner, & Slater, 2019; Williams et al., 2010), performance (e.g., Hase et al., 2018), and physiological processes (Dienstbier, 1989; Seery et al., 2011), all related with more positive outcomes for

challenge compared to threat appraisals. Concerning physiological differences, challenge and threat states have been linked to differentiated sympathetic adrenomedullary (SAM) and pituitary-adreno-cortical (PEP) activity, meaning that while both challenge and threat states are reflected by an increased cardiac activity (e.g., increased heart rate, attenuated pre-ejection period), during a challenge state the arteries dilate, while during a threat state arteries constrict and less blood circulates, with resultant negative consequences on the body's activation (Mejien et al., 2020). From a physiological perspective, this difference is reflected in a challenge state by a greater cardiac output (CO) and decreased peripheral resistance (TPR), while a threat state is associated with a smaller increase or a stabilization of CO and an increased TPR (Dienstbier, 1989; Seery et al., 2011).

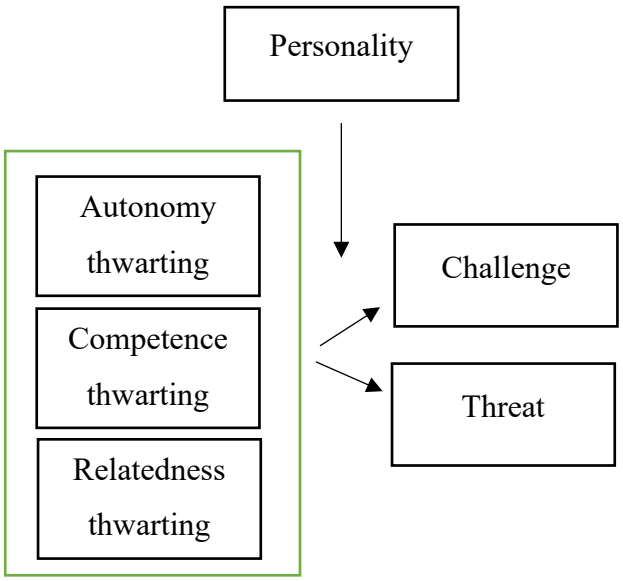
Though challenge and threat states are theorised as subsequent to the appraisal of a situation as self-relevant, and then concern particularly individual resources, it is argued that this formulation simplifies the role of the context. Indeed, resources may vary quantitively, but also qualitatively, meaning that some aspects of the situation (e.g., task mastery), but not others (e.g., ability to gain social support), could result in a challenge or a threat appraisal depending on the salience of each of these features for the individual. In this sense, basic psychological needs theory (BPNT; Deci & Ryan, 1985, 2002; Ryan et al., 2019) has been adopted as a contextual framework to give 'content' to the stressors encountered. The theory posits that environments supporting the basic needs for competence, autonomy, and relatedness promote forms of intrinsic motivation, psychological growth, and positive well-being outcomes; whereas contexts thwarting basic needs are linked to extrinsic forms of motivation and undermine well-being. Needs thwarting has been conceptualised as an imbalance leading to appraisals of stress, following other stress-related formulations (Skinner & Edge, 2002).

Finally, with stress consistently defined as a person-environment transaction (Lazarus, 1991), the contribution of individual differences has been incorporated, investigating the role of personality factors in the process of appraisal. Indeed, though little evidence explores the role of personality in relation to stress appraisals, contributions from BPNT and BPS have shown that personality could impact both behaviours subsequent to needs satisfaction/frustration (Thomas, Fadeeva, & Oliver, 2020) and challenge/threat states (Allen et al., 2012; Mak, Blewitt, & Heaven, 2004). As such, theorising explaining both why (interaction between environment and personality) and how (challenge or threat) people appraise have been integrated, and the first part of

the model of stress previously introduced has been tested in the present study (Figure 3.1).

Figure 3.1

Testing the model: interaction between needs thwarting and personality in influencing stress appraisals



Due to the integration of different theoretical contributions, it was also necessary to integrate respective methodologies. As already mentioned, BPNT was employed in relation to needs thwarting. Previous research investigated need thwarting or perceived frustration in a variety of contexts, mostly adopting cross-sectional (e.g., Bartholomew et al., 2011a; Gillet et al., 2015; Van den Berghe et al., 2013) or longitudinal perspectives (e.g., Cece et al., 2018; Haerens et al., 2015; Mageau et al., 2017; Quested & Duda, 2011). The use of cross-sectional designs was excluded in this study because, from a BPS perspective, it would allow the assessment of cognitive indices of challenge and threat, but not physiological measures, that, as discussed, are related to cardiovascular changes and then reactive to events. Longitudinal designs were also excluded: I argue that it was necessary to conduct a preliminary test of the model before observing its effects over

time. Indeed, given that it can be argued that appraisals and coping have a recursive effect (e.g., Holt & Dunn, 2004), it was deemed necessary to avoid the risk of observing modifications in needs thwarting perceptions or appraisals following successful or unsuccessful use of coping strategies. As such, and compatibly with previous BPNT-related approaches (e.g., Deci et al., 1994; Reeve et al., 2004), needs thwarting was induced during a lab-based task. Compatibly with studies conducted under the BPS framework, advocating that challenge and threat occur in self-relevant situations (Blascovich, 2008), the task selected was performance-based. Despite this work aims at generating results applicable to the sport setting, the performance assessed in Study 1 was not athletic, but involved an academic presentation. This was due, firstly, to limitations related to Covid-19 restrictions affecting the type of task that was possible to structure (e.g., maintaining a physical distance), and the sample that was possible to recruit (e.g., considering the temporary suspension of sport-related activities). Secondly, the use of an exercise-based task could limit the chance to assess cardiovascular indices *during* the performance, for the occurrence of movement artifacts. This issue has been already reported in many studies in the BPS framework that indeed have mostly assessed physiological indices of challenge and threat states *before* a task or a performance, by manipulating instructions for its execution (e.g., Moore et al., 2012; Turner et al., 2014).

As such, in this study needs thwarting was manipulated, and variations in physiological indices of challenge and threat were measured during an academic presentation, with the aim to test a model where stress appraisals are influenced by the interaction between needs thwarting and personality factors. Two main hypotheses were formulated:

first, that in presence of needs thwarting, the consequent stress appraisal could be either a challenge or a threat state, depending on interactions between situational and individual factors (H1);

second, that personality traits moderate the effect of needs thwarting on subsequent stress appraisals, influencing the experience of a challenge or a threat state (H2).

3.2 Methods

3.2.1 Participants

Due to a lack of studies integrating BPNT and CTS in experimental paradigms, and the related difficulty of estimating an effect size based on previous findings, the sample size was not determined through a power analysis. Instead, sample sizes of previously published work employing the assessment of physiological indices of CTS during experimental tasks (Allen et al., 2012; Meijen et al., 2014; Trotman et al., 2018; Turner et al., 2013; 2014) were examined, finding that their number of participants ranged from 32 to 78. Following this, an invite to participate in the study was sent to 96 students attending a first-year undergraduate module in Sport Psychology at Durham University. The final number of students that agreed to take part in the research was 60 (30 M, 30 F), in line with previous comparable literature. Self-reported ethnicity revealed that 98.8% of participants were Caucasian, while 1.2% were Asian. The experiment was part of the voluntary teaching activities of the module and took place between November and December 2020. Participants were normotensive, reported being in a good health via self-reported-screening items, and completed a Covid-19 self-certification before attending the study. Ethical approval was obtained from Durham University and informed consent was gained from participants prior to every stage of data collection.

3.2.2 Measures

Personality

Personality was assessed employing the IPIP-NEO-120 (Johnson, 2014). This 120-item self-report measure is an open-source instrument developed as part of the International Personality Item Pool (Goldberg, 1999), for the measurement of personality factors linked to the Big Five model (Digman, 1989; McCrae and John, 1992). The IPIP-NEO-120 assesses five main personality dimensions (extraversion, conscientiousness, neuroticism, agreeableness, and openness), each one including six facets. The instrument shows good general indices of reliability for each factor (Cronbach's alpha =.81 - .88) and coefficients of reliability or the five subscales were adequate for the current sample of participants, with Cronbach's alphas ranging from .78 (Openness) to .88 (Neuroticism).

Needs thwarting

To assess perceived needs thwarting, an adapted version of the Psychological Needs Thwarting Scale (PNTS; Bartholomew et al., 2011b) was employed. The PNTS includes 12 items divided into three subscales: competence, autonomy and relatedness. In the present study items were adapted for the experimental task. Examples for each subscale included: "I felt pushed to behave in certain ways" (autonomy thwarting), "There were times when I was told things that made me feel incompetent" (competence thwarting), and "I felt rejected" (relatedness thwarting). Items were evaluated on a Likert scale ranging from 1 ("not at all true") to 7 ("very true"); higher scores correspond with higher levels of needs thwarting. The PNTS has shown good predictive validity and reliability for each of the subscale (Bartholomew et al., 2011b). In the current study, good reliability is confirmed both for general scores of needs thwarting (Cronbach's alpha = .93), that for each of the subscales, with Cronbach's alphas ranging from .89 (autonomy thwarting) to .87 (competence and relatedness thwarting). One item of the relatedness thwarting scale ("I felt envied when I did well) presented a considerably weaker consistency with the respective subscale (r = .59), however this did not considerably impact the general reliability of the subscale when removed. As such, the original subscale was used in the study.

Cognitive appraisals

Items assessing cognitive appraisals of challenge and threat have been included and adapted from the original protocol developed by Tomaka et al. (1993) aimed at measuring the evaluation of demands and resources. This consists of two items assessing perceived task demands ("How demanding do you expect the upcoming task to be?") and personal resources ("How able are you to cope with the demands of the upcoming task), scored on a 6-point Likert scale from 1 (Not at all) to 6 (Extremely). A composite score was obtained (from −5 to +5), subtracting demands from resources following the instructions of Tomaka and colleagues. Positive scores reflected challenge appraisal, while negative scores were reflective of threat appraisals.

Cardiovascular measures

A cardiograph portable device (VU-AMS, Vrije Universiteit Amsterdam, de Geus et al., 1995) was used for measuring the electrocardiogram (ECG) and impedance cardiogram (ICG) during the experimental task following published guidelines (Sherwood et al., 1990). A blood pressure monitor (Omron M2) was used for measuring systolic (SBP) and diastolic blood pressure (DBP). Mean arterial pressure (MAP) was calculated as [(2xDBP)+SBP]/3. Once collected, ECG and ICG signals were manually inspected and corrected using the Data Analysis and Management Software (VU-DAMS, Vrije Universitiet Amsterdam, de Geus et al., 1995). Artefacts were removed from the ECG and three averaged ICG complexes were obtained for each of the stages of the experiment: pre-task, baseline, and task. For each of the complexes, the software automatically identified four points: the Q-point in the ECG, the B-point, the dz/dtmin, and the X-point in the ICG. These points were manually corrected where necessary; the process was repeated by two separate observers. Heart rate (HR), Pre-ejection period (PEP) and Stroke Volume (SV) were calculated for each of the average complexes. Then, for each stage (baseline and task), Cardiac output (CO) and Peripheral resistance (TPR) were calculated using the Kubicek et al.'s formula (1974): CO (l/min) was calculated as HR×SV, and TPR (dyne-s/cm^{-5}) using the formula TPR=(MAP/CO)×80. For obtaining indices of cardiovascular reactivity, average CO and TPR of the task were subtracted by average CO and TPR of the baseline. CO and TPR reactivity were used for deriving a unique index of challenge and threat (CTS index), converting them in Z scores and then subtracting the ZTPR from the ZCO (Blascovich et al., 2004). Positive scores were indicative of a challenge state, while negative scores were indicative of a threat state.

3.2.3 Task

Due to previously mentioned difficulties in monitoring cardiovascular reactivity during tasks involving physical exertion, a "speech-task" was created and adapted using previous methodological guidelines (e.g., Allen et al., 2012; Trotman et al., 2018). Participants were asked to deliver a 4-minutes academic presentation concerning anxiety in sport. The content of the presentation was part of the Sport Psychology module that the students were attending as a formal part of their undergraduate course, and the study took place before any formal / summative academic assessment related to the topic, to avoid

stress appraisals that could be influenced by any previous feedback received. For ethical reasons, participants were informed that the presentation was not assessed, and the activity was presented as a feedback opportunity. The task was completed in a laboratory setting, and due to the Covid-19 restrictions in place at the time of the experiment (December 2020), health and security measures were assured and approved by the University ethics commission.

3.2.4 Needs thwarting manipulation

Task instructions and behaviours of the experimenter were modified to undermine the basic psychological needs, compatibly with previous protocols (e.g., Deci et al., 1994; Thomas et al., 2018), and inverting guidelines for basic psychological needs support identified in a broad review led by Teixeira et al. (2020). In the present experiment, needs were actively thwarted at two main stages: during task instructions and during task execution. Examples for each need are illustrated below.

Autonomy thwarting

Relevant guidelines for autonomy support suggest the use of a non-controlling, informational language, to provide a meaningful rationale for engaging in the task, and to convey a sense of choice of kind and characteristics of the task (Teixeira et al., 2020). Conversely, in the study the topic of the discussion was chosen by the examiner, so that participants did not have a sense of choice in this process; task instructions did not provide a rationale to engage (e.g., informing participants that the task would be boring and uncomfortable); controlling language was employed, using verbs as “should” and “must”, as opposed to “might” or could”, the absence of words as “please” and “would” and the use of “will” to emphasize the absence of choice in the actions.

Competence thwarting

Techniques for the support of competence include clarifying expectations, offering constructive and relevant feedback and using a supportive language (Sheldon & Filak, 2008; Teixeira et al., 2020). In the present study, pre-task instructions

emphasized the difficulty of the task (e.g., "we do not expect you to deliver an excellent presentation and we will be monitoring and noting down your mistakes"). During the presentation verbal and non-verbal (e.g., shaking the head, yawning) negative feedback was expressed.

Relatedness thwarting

Relatedness-support techniques involve acknowledgement of individual perspective and feelings, encouragement to asking questions, expressing, or providing opportunities for positive support, demonstrating interest (Teixeira et al., 2020). Conversely, task instructions conveying thwarting were used, minimizing personal support (e.g., "please, keep your opinions to yourself during the experiment"). Questions were explicitly forbidden during the task, and the experimenter distanced themselves from the students, showing lack of interest, and addressing students with their participants' number instead of their name.

3.2.5 Procedure

Participants first compiled an online form including demographics and the IPIP-NEO-120, giving their consent for the use of the collected information for experimental purposes, then received information for attending the second part of the study. This included an information sheet, privacy notice, and instructions for attending the in-person experiment. Once accepted, a date for the experiment was assigned and participants were asked to avoid heavy exercise in the preceding 24h, and alcohol and caffeine consumption on the day of the experiment. Upon arrival at the laboratory, participants were given an introduction and signed another informed consent form. Electrodes for the measurement of cardiovascular indices were then placed following guidelines for measurement of cardiac impedance (Willemsen et al., 1996), cardiovascular parameters were checked, and a blood pressure monitor was attached to participants' non-dominant arm. Cardiovascular data were then collected for a 5-minutes baseline, during which participants were seated and still. The manipulation of needs thwarting then started via task instructions, after which participants completed items assessing their demands/resources appraisal and started the presentation. During the task, cardiovascular parameters were continuously measured and needs thwarting was further manipulated via the words and behaviours of

the experimenter. Finally, participants compiled the PNTS to assess needs frustration. Participants were then verbally debriefed, and a debriefing sheet was provided for them to keep, detailing the contact information of the experimenter.

3.2.6 Data analysis

Preliminary correlations among components of needs thwarting and personality factors were conducted using Pearson's coefficient, to explore and control multicollinearity in the subsequent regression analyses. Correlations were also calculated between physiological CTS indices and cognitive composite score, to assess the correspondence between implicit and explicit measures of challenge and threat.

To examine the link between needs thwarting, personality, and challenge and threat states, two main analyses were conducted. First, task engagement was calculated comparing average HR and PEP of the baseline with average HR and PEP of the task, through two paired *t*-tests. It was expected that from baseline to the task, HR would significantly increase, and PEP would significantly decrease, indicating a greater cardiac activity during the task, indicative of task engagement (Seery et al., 2011). Second, hierarchical regression analyses (Jaccard, Turrisi, & Wan, 1990) tested the moderation of personality on the relationship between needs thwarting and stress appraisals. Given the intention to test the hypotheses of personality as a moderator between thwarting and stress appraisals, needs thwarting was inserted as predictor at Step 1, with the CTS physiological index as a dependent variable. Personality factors were entered at Step 2, and the interaction effect at Step 3. Predictors and moderators were converted into *Z* scores. Analyses were repeated for every component of needs thwarting and for every main personality factor of the IPIP-NEO-120 (extraversion, neuroticism, conscientiousness, openness, and agreeableness).

Assumptions of normality and homoscedasticity of the residuals' distribution were tested to confirm the validity of a linear model. Furthermore, outliers were screened calculating Cook's Distances (Cook & Weisberg, 1982); in the presence of concerning outliers, analyses were repeated excluding those cases to explore the stability of the findings. Below, results are reported using the whole sample given that

this may improve replicability of research findings (Mejien et al., 2020), though the presence of outliers is being reported and discussed.

3.3 Results

3.3.1 Initial data screening

Six participants were excluded from the sample due to data quality issues: two participants were missing personality questionnaires and in four other cases the cardiovascular data were not valid for movement artifacts, or a great number of discarded beats were detected. The final sample comprised 54 participants. Normality and homoscedasticity checks met the assumptions for data analysis.

Correlations between personality and needs thwarting scales are shown in Table 3.1. These did not identify fundamental issues of multicollinearity with respect to personality traits. Weak correlations were reported among a few factors, the strongest being between conscientiousness and agreeableness ($r(52) = .56$, $p < .01$). This is unsurprising given that weak correlations among traits of the Big Five model are commonly reported (Digman, 1997). As it could be expected given that basic needs were manipulated together, positive correlations were observed between subscales of need thwarting, with the strongest being between competence and relatedness thwarting ($r(52) = .74$, $p < .01$); due to conceptual distinctiveness, needs were analysed separately in the regression analyses. Of note, the only significant correlation between personality and need thwarting was a small negative correlation between agreeableness and relatedness thwarting ($r(52) = -.26$, $p < .05$). The relative absence of direct relationships here further supports exploration of moderating relationships. Finally, no significant correlations were found between CTS physiological index and cognitive ratio ($r(52) = .01$, $p = .92$), indicating that challenge and threat physiological appraisals were not reflected by self-report.

Table 3.1

Correlations among IPIP personality factors and basic psychological needs thwarting

	1	2	3	4	5	6	7	8
1. Extraversion	-							
2. Neuroticism	-.37**							
3. Agreeableness	.16	-.26						
4. Conscientiousness	.20	-.43**	.56**					
5. Openness	.11	.09	.22	.04				
6. Needs thwarting	-.06	.065	-.24	-.02	.14			
7. Relatedness thwarting	-.10	.00	-.26*	.00	.16	.88**		
8. Autonomy thwarting	-.05	.02	-.22	.00	.14	.88**	.64**	
9. Competence thwarting	-.02	.13	-.16	-.07	.09	.91**	.74**	.72**

* Values were significant at $p<.05$

** Values were significant at $p<.05$

3.3.2 Manipulation checks: needs thwarting and task engagement

The average needs thwarting score was slightly below the scale mean (M = 38, SD = 15.3), indicating that moderate/low levels of needs thwarting were perceived. Small variations were found among the different components, with competence thwarting the most strongly perceived (M = 14.2, SD = 5.7), and relatedness thwarting the least (M =10.9, SD = 5.4).

To assess task engagement, two separate paired samples t-test compared HR and PEP at baseline and during the task. Significant differences were identified: HR significantly increased, $t(53) = 11.25$, $p<.01$, $d = 1.13$, from baseline (M = 77.3 bpm, SD = 13.2 bpm) to the task (M = 91.1 bpm, SD = 11.9 bpm); for PEP, there was a significant decrease, $t(53) = -2.54$, $p<.05$, $d = -.34$, from baseline (M = 97.3 ms, SD = 23.6 ms) to the task (M = 90.8 ms, SD = 27 ms). These results indicated an increase in task engagement from baseline to the academic presentation.

3.3.3 Challenge and threat appraisals: hypothesis 1

CTS index scores showed an exact split between challenge and threat appraisals, with 27 participants demonstrating a negative CTS index (indicative of a threat state), while 27 participants showed a positive CTS index (indicative of a challenge state). The cognitive scores just partially mirrored the physiological data, demonstrating a prevalence of challenge appraisals: 34 participants (63%) reported a cognitive challenge appraisal, and 20 participants (37%) reported a threat appraisal. As previously reported, this was also reflected by the absence of a significant correlation between CTS cardiovascular and cognitive measures. Given that cognitive CTS measures were collected pre- task, while the physiological indices were continuously measured during the task, this result will be further discussed. Due to the interest of this work in online or concurrent (i.e., during task) appraisals, subsequent analyses of moderation used the physiological index of challenge and threat (CTS index) as the dependent variable. Results of the moderated regressions are summarised in Table 3.2. For each of the analyses, no significant effects were observed at Step 1 and Step 2, indicating that needs thwarting and personality did not show any direct relationship with challenge and threat indices. This, together with the descriptive statistics, confirms the study's first hypothesis, namely that needs thwarting was not significantly associated with threat in this study.

3.3.4 Moderation of personality factors: hypothesis 2

Out of 20 interactions tested (Step 3), only 2 were significant. Specifically, significant effects on the CTS index were found in between extraversion and competence thwarting ($t(53) = 2.80$, $p<.01$, $R^2 = .14$), and between extraversion and relatedness thwarting ($t(53) = 2.20$, $p<.05$, $R^2 = .10$). The regression with extraversion and competence thwarting remained significant after three outliers were excluded, ($t(50) = 2.50$, $p<.05$, $R^2 = .13$). Using Dawson's procedure for plotting interaction effects (Aiken & West, 1991; Dawson, 2014; Dawson & Richter, 2006), it can be observed that when competence or relatedness thwarting were low, high extraversion was linked to a threat state and low extraversion to a challenge state; in contrast, when competence and relatedness thwarting was high, high extraversion was linked to a challenge state and low extraversion to a threat state (see Figure 3.2 and Figure 3.3). In summary, in the presence of competence or relatedness thwarting, high extraversion facilitated a challenge state and low extraversion predicted a threat state. Of note, four outliers were found in the regression with extraversion and relatedness thwarting as predictors. After the exclusion of those cases from a new multivariate regression, the interaction effect previously found became non-significant. However, a detailed analysis of the excluded outliers revealed that their scores of relatedness thwarting were at the lowest (in one case) or the highest (in three cases) extreme of the range. Considering that the average perception of relatedness thwarting was particularly low in the sample, it is argued that the influence of the outliers in this regression could be an important point of discussion.

Table 3.2

Summary of effects (F), significance (p), and variance explained (R^2) of the hierarchical analyses conducted for each step.

		Personality traits (moderators)													
Predictor variables		Extraversion			Neuroticism			Conscientiousness			Agreeableness			Openness		
		F	*p*	R^2	*F*	*p*	R^2	*F*	*p*	R^2	*F*	*p*	R^2	*F*	*p*	R^2
Needs thwarting																
	Step 1	.10	.75	.00	-	-	-	-	-	-	-	-	-	-	-	-
	Step 2	.51	.47	.01	1.5	.21	.03	.11	.73	.00	.01	.89	.00	.03	.86	.00
	Step 3	3.44	.06	.07	1.6	.21	.06	.65	.42	.01	.95	.33	.02	.73	.39	.01
Autonomy thwarting																
	Step 1	.41	.52	.00	-	-	-	-	-	-	-	-	-	-	-	-
	Step 2	.50	.48	.01	1.5	.21	.03	.12	.72	.01	.00	.95	.00	.05	.82	.00
	Step 3	.00	.93	.01	.77	.38	.05	.28	.59	.01	.46	.49	.01	.00	.98	.00
Competence thwarting																
	Step 1	.26	.60	.00	-	-	-	-	-	-	-	-	-	-	-	-
	Step 2	.53	.47	.01	1.4	.23	.03	.09	.75	.00	.01	.90	.00	.03	.86	.00
	Step 3	7.8	.00**	.14	2.2	.13	.07	1.2	.26	.03	2.2	.13	.04	1.3	.24	.03
Relatedness thwarting																
	Step 1	.11	.73	.00	-	-	-	-	-	-	-	-	-	-	-	-
	Step 2	.60	.44	.01	1.6	.20	.03	.12	.72	.00	.09	.76	.00	.00	.94	.00
	Step 3	4.8	.03*	.10	.99	.32	.05	.22	.63	.00	.22	.64	.00	1.1	.29	.02

** Values were significant at $p<.01$

* Values were significant at $p<.05$

Figure 3.2

Graphic representation of the interaction effect between competence thwarting and extraversion

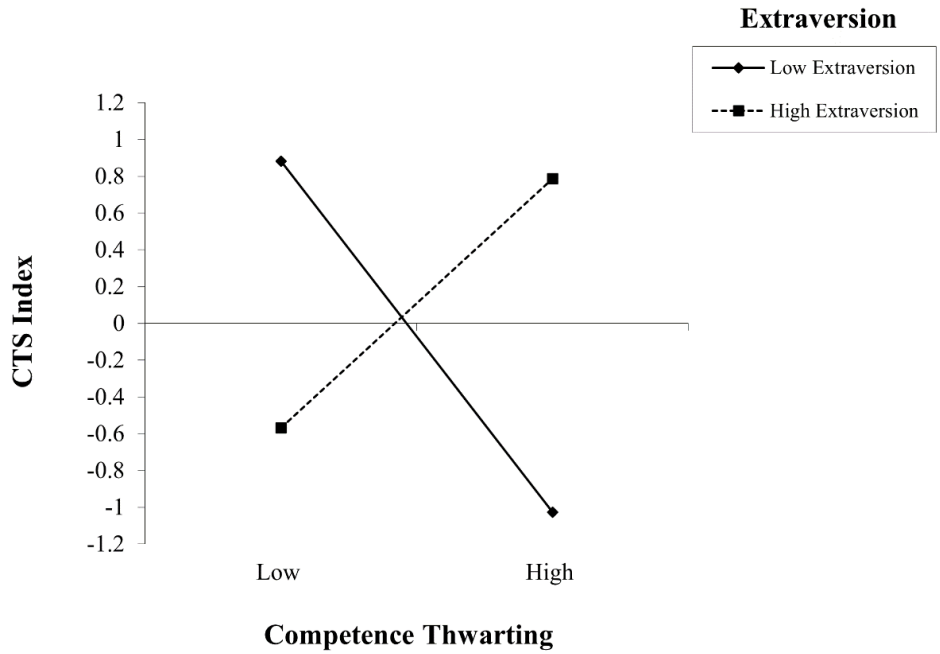
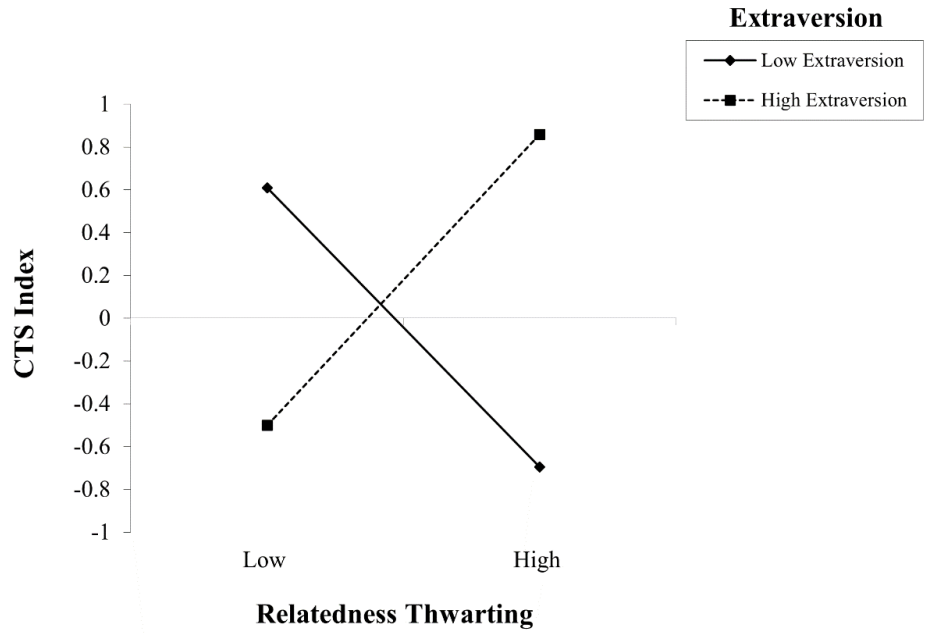


Figure 3.3

Graphic representation of the interaction effect between relatedness thwarting and extraversion



3.4 Discussion

The aim of this study was testing a model of stress, wherein personality traits moderate the effect of perceived needs thwarting on stress appraisals. In particular, it was hypothesized that in presence of situations undermining the needs for autonomy, competence, and relatedness, personality factors would differentially contribute to predict subsequent challenge or threat appraisals. The study aimed to induce needs frustration experimentally, manipulating environmental factors (experimenters' language and behaviours), in line with previous work (e.g., Deci et al., 1994; Thomas et al., 2018).

Regarding one of the main hypotheses formulated, no direct effect of needs frustration on physiological indices of CTS was found, demonstrating that needs thwarting was not consistently associated with either a challenge or a threat in the study, in contradiction with previous suggestions (e.g., Bartholomew et al., 2017; Ntoumanis et al., 2009). In the present study this result was also reflected by the absence of significant correlations between needs frustration and cognitive measures of challenge and threat, meaning that when perceiving the environment as thwarting, participants did not feel that the demands of the environment overcame their resources. This confirms the hypothesis formulated in the present work that experiences of needs frustration could be a momentary imbalance in which, in the long term, outcomes are understood as depending on how individuals appraise and cope. On the other hand, it should be considered that levels of needs frustration were low for each of the three subscales of the PNTS. This is an important aspect because, when needs thwarting was assessed in cross-sectional or longitudinal studies, it was related to negative stress outcomes such as burnout or emotional exhaustion (e.g., Olafsen et al., 2017; Teixeira et al., 2018). This may indicate that, as previously hypothesised and discussed, negative outcomes could depend on failure in coping with thwarting in the long term; on the other hand, there is still the possibility that for more intense stressors (e.g., undermining all the basic needs), needs thwarting could be perceived as overcoming personal resources (and then threatening). As such, while it cannot be excluded that, had needs frustration been stronger in the present study, threat appraisals would have increased, this result suggests that other factors are moderating the interpretation of needs thwarting stimuli as challenging or threatening in the short-term, as hypothesised. This perspective is at least somewhat aligned with early theorising of Deci and Ryan (1985a) concerning how the 'functional significance' of environments

may differ between individuals. However, while they focus on differences in the perception of need thwarting or support, here it is arguably showed that functional significance can vary later in the appraisal process; that is, need thwarting can be perceived but its interpretation still varies in its functional significance.

Overall, the second hypothesis, that personality factors would moderate the relationship between needs thwarting and stress appraisals, was just partially confirmed. Indeed, most regressions tested were not significant, indicating the possible salience of other factors in the interpretation of needs thwarting as a challenge or as a threat. However, this result presented an important exception, with extraversion moderating both the link between competence frustration and CTS, and relatedness frustration and CTS. In particular, when feeling incompetent or excluded, extraversion seemed to act as a protective factor facilitating a challenge appraisal, while being introverted seemed to determine a threat state. This is somewhat compatible with previous research that associated extraversion with appraisals of challenge (Allen et al., 2012; Mak, Blewitt, and Heaven, 2004). The reason why extraversion could have affected specifically competence and relatedness appraisals could be related to the perception of personal resources. For example, there is evidence that extraversion could be linked to higher general levels of self-efficacy (Barańczuk, 2021), a factor that could protect individuals from momentary frustration of the sense of competence, i.e., relying on other sources of efficacy (e.g., mastery/past experience, Bandura, 1986). Similarly, given that the trait of extraversion encompasses aspects of sociability (McCrae & John, 1992), extraverted participants could have perceived rejection occurring in the experimental setting as less threatening and less affecting of their personal resources. However, a part of the interaction effect that was found is harder to explain: when competence and relatedness thwarting were low, being extraverted was more likely to induce a threat state, while being introverted was linked to a challenge state. Here, I will attempt to give two tentative explanations for this part of the result. First, low levels of perceived needs thwarting could have been experienced as general low levels of social interaction with the experimenter, a condition more positive for introverted students, and that might have prevented extraverted students from relying on previously discussed compensation strategies. Second, the PNTS was compiled retrospectively by participants just after the task, and then after the measurement of cardiovascular

indices of challenge and threat. It may be possible that extraverted participants that were in a threat state did not generally report high levels of needs frustration for a form of social desirability. In literature, there is not a direct effect between extraversion and social desirability, however instruments linked to the BFM, such as the IPIP-NEO (Goldberg, 1999) were examined by Bäckström and Björklund (2013), demonstrating that people having high scores of extraversion and agreeableness also tend to have high scores of social desirability. Replication of the present results could help to better clarify the nature of the effect found.

A surprising result in this study was the absence of a direct relationship between personality factors and needs thwarting, except that for a small correlation between agreeableness and relatedness thwarting. Indeed, previous research (Şimşek & Koydemir, 2013; Thomas, Fadeeva & Oliver, 2020) reported that personality traits affect the likelihood of interpreting an environment as supportive or thwarting. This study did not confirm these results, given that traits usually related to the perception of needs frustration/satisfaction, such as extraversion and neuroticism, were unrelated to dimensions of needs thwarting. The only correlation found could indicate that participants high in agreeableness were less sensitive to relatedness manipulation, and less likely to feel rejected or excluded. This result seems to confirm previous conclusions about the protective role of agreeableness in situations of interpersonal conflict (Jessen-Campbell et al., 2003), suggesting an "early" effect of this personality trait in the model here proposed. However, the correlation found in the present study was small, and furthermore, the general levels of relatedness thwarting were generally low for the sample, indicating that further data are needed.

The main limitation of this work is the inability to engender conditions of moderate/high needs frustration. In the present research, this could be due to too much caution in exposing participants to needs thwarting, or to characteristics of the task and the procedure employed. For example, students were told that their academic performance was not assessed, and it was an opportunity for feedback. Related to this, higher frustration may have been perceived if students believed the task had a stronger extrinsic component (evaluation, reward) compatibly with SDT's theorisations on motivation (Ryan & Connell, 1989). The lack of familiarity of participants with the experimenter could be another factor impacting perceptions of needs frustration, particularly in the case of the need for relatedness, that indeed was the least affected need

in the present study. Indeed, frustration following thwarting is experienced when individuals value the goal being thwarted (e.g., Maslow & Murphy, 1954), and a non-significant relationship (e.g., between participant and experimenter) could be less valued and subsequently not sufficient to thwart relatedness. Previous studies have also demonstrated that manipulating relatedness thwarting in experimental settings can be difficult (e.g., Thomas et al., 2018), and I propose that future developments should seek to use existing significant relationships, if possible, in ways similar to studies on interpersonal insecurity (e.g., Lemay & Dudley, 2009).

The necessity of clarifying the effect of relatedness thwarting is also supported by the influence of outliers on the significant interaction between relatedness thwarting and extraversion. Outliers presented extreme scores of relatedness frustration, which on one side could support the possibility that the effect found could be stronger with a more effective manipulation of relatedness. On the other side, it flags the risk that the effect observed is mainly due to the presence of outliers, and I argue that future research should exclude this possibility. Related to this, it should be also considered that subscales of needs thwarting were strongly related, with competence and relatedness thwarting presenting the strongest correlation in the sample. Though needs were manipulated as a whole for methodological choices linked to testing a new model, one need could have affected the perception of the other; for example, there is evidence that in the presence of failure, feedback on the person is linked to a more negative perception of the student-teacher relationship than feedback focused on the process, or no feedback (Skipper & Douglas, 2015). Given that academic feedback was provided together with personal rejection, this could have impacted relational dynamics, producing similar effects on appraisals of each need. Though an argument against this is that perceptions of autonomy thwarting were not affected in the same way, I suggest that future developments of the study should assess the separate effects of competence and relatedness thwarting, to exclude the presence of such effects.

Finally, as in previous work (e.g., Dixon et al., 2019; Trotman et al., 2018), cognitive and physiological CTS measures of challenge and threat did not concur. Cardiovascular measures have been critiqued for being subject to delays in reactivity (Mejien et al., 2020), and likewise cognitive appraisals have been criticised for capturing an outcome rather than a process, much of which is subconscious

(Blascovich & Mendes, 2000). It is argued that these findings highlight the importance of considering the two measurements as capturing different, yet both important, parts of the appraisal process. In the present study, cognitive appraisals were measured after task instructions, and so just at the start of the needs thwarting manipulation. As such, there is the possibility that (as in previous research) they were more based on anticipation of the task, and consequently more linked to participants' general beliefs about their ability to cope; in contrast, cardiovascular indices were monitored continuously from baseline to the end of the task, reflecting perception of the situation (and related changes) over time. To further scrutinise these differences, future work could incorporate other physiological indices (e.g., oxytocin and neuropeptide Y; Mejien et al., 2020) and pre- and post-task cognitive appraisals (e.g., Trotman et al. 2018).

Despite the highlighted limitations, findings offer two alternatives to previous theorising exploring need thwarting, appraisal, and personality. First, there is clear evidence that thwarting could not always be linked to threat appraisals. By suggesting that individuals may vary in the 'functional significance' (Deci & Ryan, 1985a) they attribute to thwarting, there is support for the emergence of both threat and challenge appraisals depending on perceived resources and wider beliefs. Second, limited evidence is offered that some personality characteristics (such as extraversion) influence post-exposure appraisals, not just perception of, thwarting environments. These ideas begin to re-define the role of the event/environment in producing positive or negative consequences, as it is typically explored under an SDT framework. While this work agrees with the evidence that need- supportive contexts are beneficial and thwarting ones harmful, the important protective role that personalities can play in moderating acute exposure to thwarting is highlighted. This has important implications for practitioners (e.g., counsellors, psychologists, educators) in promoting and enhancing appraisal, coping, and subsequent mental health. Tailored forms of intervention considering individual sensitivity in contexts involving acute stressors (e.g., workplace, education, sport and physical activity settings) and that undermine basic needs, are recommended. However, caution is suggested in applying the model of stress here theorized, arguing that individual factors other than personality should be researched as moderators between the perception of needs frustration and appraisals of challenge and threat. Due to the previous considerations, the replication of these findings in more ecologically-valid contexts is advocated.

Chapter 4

Manipulating competence and relatedness thwarting: the moderation of personality factors on stress appraisals during athletic performance

4.1 Introduction

While study 1 has provided some evidence regarding individual differences influencing thwarting-related appraisals, it also showed the necessity of replicating and improving parts of the experimental protocol, in order to clarify the nature of the effects found. As such, study 2 represented an attempt to replicate the previous findings on athletes, refining the methodology, and subsequently increasing the validity of the results in the sport setting, compatibly with the general purpose of this thesis. Unfortunately, due to difficulties related to the repeated unsuccess of manipulation of the basic psychological needs (specifically relatedness) and to time-constraints caused by the Covid-19 pandemic outbreak, the study was interrupted. Despite this, data were collected on a small sample of participants, and some of the previously discussed limitations were addressed from a methodological perspective.

First, the need to strengthen the manipulation of basic psychological needs was considered. Given that in the previous study significant effects were found just for the needs of competence and relatedness, the experiment was focused on the replication of these effects. At this purpose, the two needs were manipulated in two separate conditions, not including a condition of autonomy manipulation, because the need did not evidence a significant effect in study 1. Furthermore, to increase the effect of the manipulation protocols, and to address the chance that low levels of frustration could depend on the lack of familiarity with the experimenter, competence and relatedness were thwarted manipulating elements of the broader social environment. Related to this, negative feedback related to competence thwarting was delivered on an actual (measured) performance and included elements of performance comparison with other groups of players. There is evidence, indeed, that upward comparison could impact motivational and emotional processes (e.g., Diel et al., 2021). Whereas to strengthen relatedness thwarting, an attempt to simulate rejection from a group of peers (athletes of the same team) was conducted with the aim of increasing the ecological validity of the manipulation.

Second, participants were current athletes and had to perform a sport task. Indeed, despite there is evidence that predictions related to challenge and threat states (CTS) are transversal to various performance contexts, like sport, workplace, and education (Hase et al., 2018), there is also work highlighting that predictions of the framework could not

be applicable to the academic context (Smith et al., 2022). As such, being the present work oriented to produce recommendations for athletes and sport-related professionals, it was deemed necessary to replicate the design including participants and task relevant for this purpose. Given that, as previously discussed, measuring cardiovascular indices of challenge and threat is challenging during tasks involving a great amount of movement, an aiming task, specifically a dart game, was structured. It was hypothesised that on one hand this type of task would not require effort, subsequently not impacting effort-related cardiovascular measures (e.g., heart rate). On the other hand, eventual movement artifacts related to the darts throwing could have a very brief duration, and as such, they could be easily cut from the ECG without affecting the quality of the whole signal, making it possible to measure CTS during the sport task. Furthermore, a component of extrinsic reward was added to the task, promising a voucher for the group with the best performance, with the aim of increasing the task's relevance for participants.

Third, the necessity of including both pre-task and post-task self-report measures was recognised. Concerning measures of needs thwarting, this was aimed at clarifying the nature of the effects found in study 1 and excluding that factors other than the manipulation could have affected perceived competence and relatedness frustration. Furthermore, given the low levels of frustration previously found, it was deemed fundamental to assess the difference between pre-task and post-task scores, in the eventuality that thwarting manipulation could affect the increase of frustration scores, more than general levels of frustration. Instead, regarding CTS cognitive self-reports, it was deemed important to test whether the previously showed discrepancy between cognitive and physiological measures was maintained also when cognitive measures where related to experiences occurring during and not just before the task; in other terms, the study attempted to compare cognitive and physiological measures occurring in the same timeframe. Furthermore, new developments of CTS theories, such as the theory of challenge and threat states in athletes revised (TCTSA-R; Meijen et al., 2020) theorised that cognitive appraisals are not static, but individuals can re-evaluate personal resources based on the evolution of their performance. As such, it could be important to assess both anticipatory cognitive appraisals and post-task cognitive appraisals.

Finally, study 2 was led with the intention of extending the exploration of moderation effects to facets of the trait of extraversion, in case of replication of the previous results. In the IPIP-NEO-120 (Johnson, 2014), mostly in line with the Big Five model (BFM), these facets are formulated as: friendliness, gregariousness, assertiveness, activity level, and excitement seeking. Investigating moderation effects at facet level could help clarifying the nature of the moderating effect of extraversion between thwarting and stress appraisals. However, given that the study was interrupted, these moderation effects were not tested.

Summarizing, study 2 attempted to test the stress model formulated in the first chapters of the present work, and to replicate results of study 1 using sport-related tasks and sample. A series of methodological changes and improvements were implemented to test the following hypotheses:

first, that in presence of needs thwarting, the consequent stress appraisal could be either a challenge or a threat state, depending on interactions between situational and individual factors (H1);

second, that specific personality traits could moderate the effect of needs thwarting on subsequent stress appraisals, influencing the experience of a challenge or a threat state (H2). In particular, the effect of extraversion on the link between competence thwarting and CTS was expected (H2a), while more caution was exercised regarding the link between relatedness thwarting and CTS, given the weakness of the previous relatedness manipulation attempts;

third, that using a group of peers for comparison (in the case of competence thwarting) or for conveying social exclusion (in the case of relatedness thwarting), would have strengthen the effect of the needs manipulation procedures, specifically inducing a significant increase of scores of competence and relatedness frustration from pre-task to post-task in the groups who received the respective manipulation (H3).

4.2 Methods

4.2.1 Participants

An a priori power analysis was conducted using G*Power version 3.1.9.7 (Faul et al., 2007) for sample size estimation. The effect size was calculated based on data from the first study of this work, linked to the significant interaction between relatedness thwarting and extraversion, and presenting the smallest effect size in the study, $F^2 = .12$. Considering a significance of $\alpha = .05$ and a power = .80, it was estimated that the smaller sample needed consisted in 53 participants. However, given that the sample recruitment was interrupted for methodological reasons, the final group of participants consisted in 18 students/athletes (Mage = 20.41, SD = 2.37; 16 F, 2 M) competing for different sport teams at Durham University. Self-reported ethnicity revealed that all participants but one identified as Caucasian, while one reported to be of mixed ethnicity. Participants were normotensive, in good health conditions assessed via the completion of screening self-reported items, and completed a Covid-19 self-certification before attending the study. Groups of two or three players competing for the same team and having previous friendly relationships were recruited, to facilitate manipulation of relatedness thwarting. Participants were assigned to two experimental conditions: competence thwarting (n= 9) and relatedness thwarting (n = 9). Recruitment was conducted by word of mouth and contacting respective sport teams. As a part of the experimental manipulation, groups were told that the best performing team at the task would have won a voucher of £20. A winning group was randomly picked after the end of the experiment. Ethical approval was obtained from Durham University and informed consent was gained from participants prior to every stage of data collection.

4.2.2 Measures

Personality

As in the previous study, personality was assessed with the IPIP-NEO-120 (see Chapter 3 for the complete description). Participants completed the questionnaire online before attending the experiment.

Needs thwarting

Needs thwarting was assessed with an adaptation of the Psychological Needs Thwarting Scale (PNTS) for the sport task (see Chapter 3 for description of scales and subscales). The instrument was compiled by participants both pre-task and post-task, to assess variations in levels of needs thwarting. In the current sample, excellent reliability for general scores of needs thwarting was observed both pre-task (Cronbach's alpha = .89) and post-task (Cronbach's alpha = .93). Subscales presented more variation, though internal consistency was mostly good, ranging from .77 (pre-task autonomy and competence thwarting) to .90 (post-task autonomy thwarting). As already observed in Study 1, one item of the relatedness thwarting subscale ("I feel/felt envied when I did well") presented a considerably weaker item-total correlation with the respective subscale both pre-task

(r = .38) and post-task (r = .10). In both cases reliability could considerably increase if the item was removed, though both subscales already presented good reliability in the range of .80 and as such, analyses were led maintaining all the items of the subscale.

Cognitive appraisals

Cognitive challenge and threat appraisals were assessed through items evaluating perception of stress-related demands and individual resources (Tomaka et al., 1993). In this study, these items were assessed both pre-task and post-task, in order to capture not just anticipatory cognitive appraisals, but also evaluations that participants gave in relation to the task. Pre-task items corresponded to the ones used in study 1 ("How demanding do you expect the upcoming task to be?"; "How able are you to cope with the demands of the upcoming task?"), while post-task items referred to how participants felt during the task ("How demanding did you find the task?"; "How able were you to cope with the task?"). Items were scored on the same 1-6 scale of study 1 and a composite score was obtained (from −5 to +5), subtracting demands from resources for both measurements. Positive scores reflected challenge appraisals, while negative scores were reflective of threat appraisals.

Cardiovascular measures

As in study 1, a portable cardiograph (VU-AMS) was employed to assess cardiovascular indices of challenge and threat through the measurement of electrocardiogram (ECG) and impedance cardiogram (ICG). Furthermore, a blood pressure monitor (Omron M2) measured systolic (SBP) and diastolic blood pressure (DBP), and mean arterial pressure (MAP) was manually calculated as [(2xDBP)+SBP]/3. The ECG signal was manually inspected using the VU-DAMS Data Management Software, to assess whether the number of artefacts detected was problematic, given that cardiovascular data were collected during the darts throwing task. The signals inspected did not present considerable issues attributed to movement and were deemed usable. However, given that the study was suspended due to the results of preliminary analyses, procedures for the inspection and correction of ECG and ICG signals were not completed, and indices of challenge and threat were not derived.

Manipulation items

Participants in the competence thwarting condition compiled a pre-task item assessing their perceived level at the sport task, ranging from 1 to 10. The item had the purpose of directing participants' attention to aspects of competence and provided an additional measure of self-efficacy. Participants in the relatedness thwarting condition were asked to write down the name of the teammates they wanted to compete with.

Performance

Performance data were collected during the sport task. In particular, circles of the dart board worthed a number of points ranging from 1 (most external circle) to 5 (bullseye). Scores for each throw were summed up and a general performance score was calculated for each participant. Group performance was calculated as the mean score of the members of the same group/team.

4.2.3 Task

The experimental task consisted in a sport activity based on darts throwing. The activity was presented as an individual and inter-team competition among sport teams of Durham University. As such, participants had the chance to compete for both the individual score and the team score, and were told that the members of the winning group would have won a 20£ voucher for a sport clothing retail. Participants were asked to throw three darts in three seconds for five times (for a total of 15 throws). To decrease participants' familiarity with the task and reinforce the manipulation of competence thwarting, the task presented a series of variations compared to a normal darts game. First, participants were asked to throw the darts with the non-dominant arm. Second, the darts board was placed at a distance of 4m from participants, compared to the 2.37m expected in dart games. Third, scores on the board were covered up, and a different scoring system was adopted: scored ranged from 1 to 5, increasingly higher from the most external circle of the board to the bullseye. This scoring system was adopted to decrease the chance that participants could have high scores casually hitting different parts of the board and reinforce the credibility of the experimenter's feedback. Finally, participants threw the darts while seated, to facilitate the measurement of cardiovascular indices through the portable ECG.

4.2.4 Needs thwarting manipulation

Needs for competence and relatedness were manipulated in two separate conditions, and procedures of social comparison (competence thwarting), and social exclusion (relatedness thwarting) were employed in addition to manipulation of experimenter's instructions and behaviours. Furthermore, though there was no attempt to manipulate the need for autonomy, the use of controlling language was employed during the task to strengthen both competence and relatedness thwarting. Needs were manipulated again through the modification of task instructions, and during task execution implementing sentences and comments after each block of throws. Examples of specific procedures for the manipulation of competence and relatedness are summarised below.

Competence thwarting

Participants in the competence thwarting condition compiled the assessment of their self-reported level at the darts game, before receiving specific task instructions. Adapting techniques from previous guidelines (e.g., Teixeira et al., 2020; Sheldon and Filak, 2008), pre-task instructions consisted in conveying negative feedback regarding ability shown during the trial (e.g., "I could see that you struggled in the practice trials"), setting negative expectations depending on stable factors (e.g., "we know that aiming tasks are difficult for people of your height"), and introducing an element of social comparison with scores of other teams (e.g., "everyone plays sport and other teams are putting a lot of effort in this") and the own team (e.g. "you could decrease the average score of your team"). Furthermore, specific negative feedback was given to participants by the experimenter in form of comments during the performance, after each block of throws (e.g., "do you usually find aiming tasks so difficult?", "You should hope that your group makes it better").

Relatedness thwarting

Participants in the relatedness thwarting condition were asked to indicate whether they wanted to compete alone or together with the members of their group. Following this, participants were informed that they were not picked by the other members of the team, and that they would have competed alone, emphasising aspects of social isolation (e.g., "there are not many participants that have not been selected by their own teammates, but unfortunately we cannot force anyone"). Furthermore, after each block of throws participants received comments about their exclusion (e.g., "good to be the first block of throws! Such a shame that nobody picked you") and the experimenter showed lack of attention and distraction (e.g., yawning).

4.2.5 Procedure

Participants compiled an online form including demographics and the IPIP-NEO-120, giving their consent for the use of the collected information for experimental purposes. A link was also provided where they could book a date and time to attend the laboratory session in groups of two/three. Before attendance, participants who

booked a session were provided via e-mail with information sheet, privacy notice, and instructions for the laboratory session, such as to avoid heavy exercise in the preceding 24h, and alcohol and caffeine consumption on the day of the experiment. Upon arrival at the laboratory, the groups of participants were given general instructions and compiled an informed consent form. Then, they performed a trial of two blocks of darts throwing (for a total of six throws); the trial was performed by each member of the group. After the trial, participants were asked to compile the questionnaires determining their experimental condition in separate laboratory spaces and were asked to not communicate with the other members of the team. One of the participants remained in the laboratory to perform the task, while the others were asked to wait in separate rooms. Then, the first participant had electrodes and the blood pressure monitor placed, cardiovascular parameters were checked and measured for a baseline of five minutes, during which the pre-task PNTS was compiled. Following this, specific task instructions for the manipulation of needs were delivered, and participants compiled the first CTS cognitive assessment before performing the dart throwing task, during which cardiovascular indices were continuously measured. After the task, participants compiled the second PNTS and CTS cognitive assessment, and were then debriefed. The procedure was repeated for each of the participants of the group, alternating the different needs thwarting conditions. The whole group was debriefed at the end of the experimental session, and each member of the team was given a debriefing sheet.

4.2.6 Data analysis

Due to the previously reported difficulties in manipulating basic psychological needs, preliminary analyses were led on the sample regarding levels of competence and relatedness thwarting pre and post task. The need for these analyses was reinforced by the fact that during the debriefing some participants in the relatedness thwarting condition (n = 3) reported to not have believed that their teammates could have excluded them. As such, means and standard deviations of post-task scores of PNTS were examined. Furthermore, two-way repeated measures ANOVAs were led to compare pre-task and post-task PNTS scores of both competence and relatedness thwarting, and to see whether the difference varied between different experimental conditions. Results are reported below; due to the low means found in the sample, particularly for relatedness thwarting, the study was interrupted, and no further analyses were led.

4.3 Results

An examination of post-task PNTS scores revealed that mean scores of needs frustration in the sample (Table 4.1) were below the scale average (M = 31.72, SD = 17.08). This could be expected given that basic needs were not manipulated all at once in the experiment. However, low average scores involved evenly all the subscales, including competence (M = 12.11, SD = 7.18) and relatedness frustration (M = 8.88, SD = 5.07). These average scores were lower than the ones assessed in study 1, particularly in the case of the relatedness subscale. However, needs were separately manipulated in different conditions, and also assessed pre-task. As such, to confirm that low scores of each need were not affected by participants that did not receive the manipulation (e.g., relatedness scores could have been lowered by participants that were in the competence thwarting condition and vice versa), means were also compared between pre- and post-task, and between needs thwarting conditions.

Table 4.1

Means and standard deviations for the post-task scores of scales of the PNTS

Scale/subscale	Mean	SD
Needs thwarting	31.7	17.0
Autonomy thwarting	10.7	6.4
Relatedness thwarting	8.8	5.0
Competence thwarting	12.1	7.1

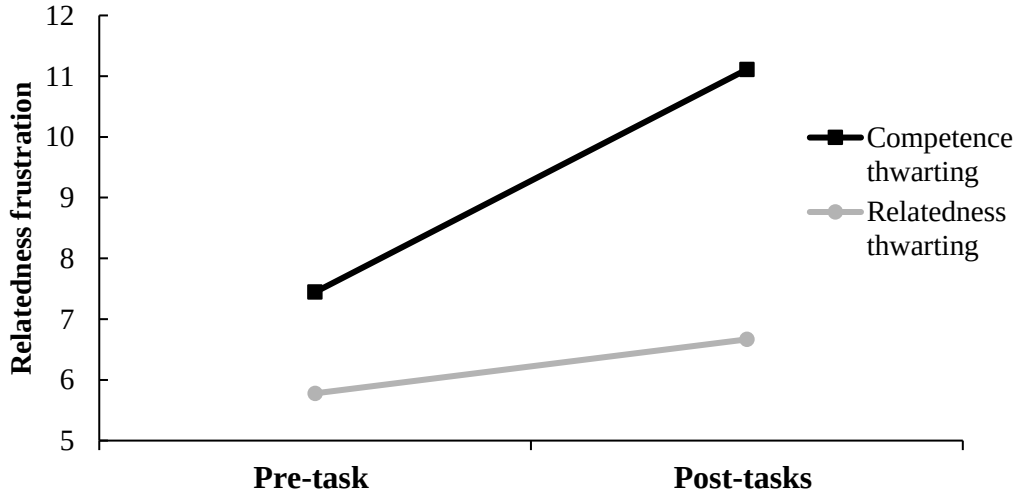
Results of the two-way repeated measures ANOVA showed a main effect of relatedness thwarting, but with a borderline significance ($F(1, 17) = 4.23$, $p = .05$). This indicates that levels of relatedness frustration varied in the whole sample from pre-task to post-task, though this variation was not fully significant. The ANOVA also showed that the interaction effect between relatedness frustration and group condition was not significant; in other terms, levels of relatedness frustration did not differently vary from pre-task to post-task between conditions. Given that the analyses were performed on a small sample,

with the risk that the level of significance was underestimated, this parameter was considered indicative, but not determinant to draw conclusions for the present results, and as such comparisons of the means and graphic representation of the results were led in addition. In particular, when levels of relatedness frustration between- and within-groups were graphically examined (Figure 4.1), they showed a weak increase in both competence and relatedness manipulation groups. Furthermore, the effect was more evident for the competence thwarting condition (pre-task: M = 7.4, SD = 4.3; post-task: M = 11.1, SD = 5.1) than for the relatedness thwarting condition (pre-task: M = 5.7, SD = 2.1; post-task: M = 6.6, SD = 4.1), that also presented particularly low scores. In conclusion, there is evidence that manipulation of relatedness was not successful in the preliminary analyses.

Instead, when considering the need of competence, the repeated measures ANOVA showed a significant main effect of competence frustration (F(1, 17) = 6.67, p = .02), indicating that there was a significant variation of competence frustration from pre-task to post-task occurring in the whole sample. Also in this case, the ANOVA showed that the interaction effect between competence frustration and group condition was not significant, and levels of competence frustration did not differently vary from pre-task to post-task between conditions.

Figure 4.1

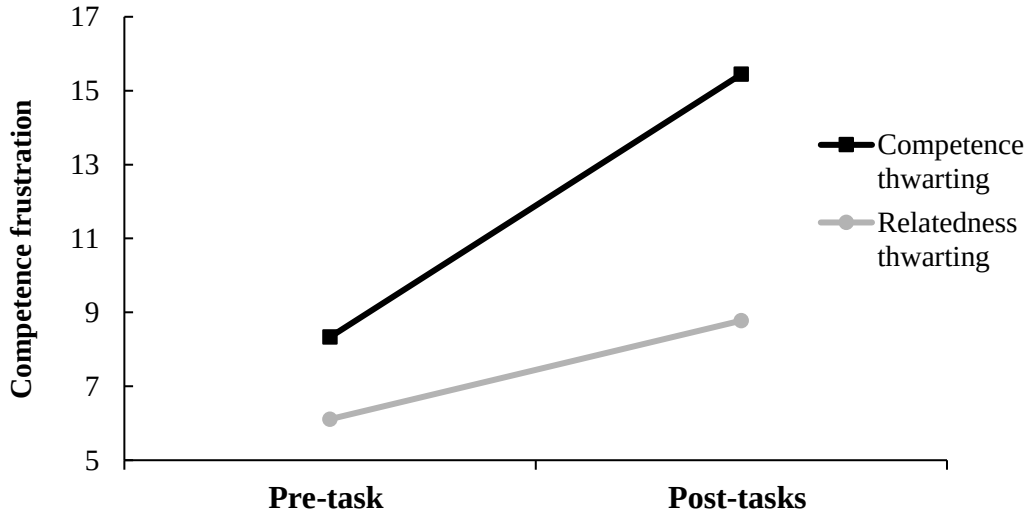
Mean scores of relatedness frustration from pre-task to post-task between manipulation conditions



Again, the significance of these results was interpreted with caution and means comparisons were integrated. When examining the result graphically (Figure 4.2), it can be noted that levels of competence frustration increased in both competence and relatedness manipulation groups. However, compatibly with what expected, competence frustration increased clearly to a greater extent in the competence thwarting condition (pre-task: M = 8.3, SD = 3.3; post-task: M = 15.4, SD = 7) than in the relatedness thwarting condition (pre-task: M = 6.1, SD = 3.5; post-task: M = 8.7, SD = 5.8). Summarizing, levels of competence frustration significantly increased in the whole sample after manipulation, and this increase was more evident for the competence thwarting condition. As such, in contrast with relatedness frustration, it can be concluded that manipulation of competence thwarting was successful, though just partially, given that scores of competence frustration were generally below average both pre-task and post-task. Results of the preliminary analyses will be discussed below.

Figure 4.2

Mean scores of competence frustration from pre-task to post-task between manipulation conditions



4.4 Discussion

The main aim of study 2 was examining the differentiated interaction of types of thwarting with personality variables during a sport-related performance consisting in a darts competition. However, the study was interrupted on the grounds of the inability to create two distinct successful conditions of manipulation of competence and relatedness. This conclusion was confirmed by different results of the preliminary analyses.

First, post-task levels of both competence and relatedness frustration were below the subscales' average not just in the general sample, but also in the specific group conditions. Though this provides a general indication that thwarting manipulation did not contribute to the perception of high levels of frustration, it is not sufficient, alone, to conclude that the protocol of manipulation was not successful. Indeed, the perception of low levels of frustration could also depend on the fact that a darts game could have low motivational relevance for participants. As previously mentioned, frustration could be experienced when relevant goals are thwarted (Maslow & Murphy, 1954) and then, though perceiving the environment as thwarting, participants could have judged their feelings of incompetence and rejection low to moderate, compared to other relevant situations in life. However, the comparison between pre-task and post-task needs frustration in different groups conditions provides elements in support of the ineffectiveness of the manipulation protocols, specifically regarding relatedness thwarting. Indeed, as seen, competence frustration showed an important increase in the group that received a competence-based manipulation, and a minimal increase in the group receiving a relatedness-based manipulation; though the opposite was expected for relatedness frustration, this slightly increased in both groups but more in the competence-thwarting condition. In other terms, manipulating competence thwarting increased both feelings of incompetence (as expected) and rejection (to a lesser extent), while manipulating relatedness had a general weaker effect and did not affect relatedness frustration as expected.

The evidence that competence could also impact feelings of rejection could be in line with the observations made regarding results of study 1 and it is not surprising. Specifically, given that feedback on performance was delivered by the only experimenter based on a (fake) comparison with other groups, this could have affected participants' relatedness frustration in two ways: first, feedback could have been interpreted as "personal", impacting the relational perception of the person who delivered it (in this case

the experimenter), point already discussed in study 1; second, given that components of intragroup and intergroup upward comparison were introduced to strengthen the manipulation, participants could have felt incompetent in relation to others, with subsequent feeling of exclusion (e.g., believing that their performance could negatively impact their teammates). Future research developments could include more objective forms of feedback, and less dependent from interaction (e.g., setting a very challenging target score) to better isolate the effects of competence thwarting. However, it is important to consider that conclusions on the significance of the effects cannot be drawn due to the small sample size, and as such, a small increase of relatedness frustration following competence thwarting manipulation could not represent a substantial issue, particularly because this is in line with BPNT assumptions regarding existing correlations among the basic psychological needs (Martela et al., 2022).

Instead, the evidence that the manipulation of relatedness thwarting could not impact relatedness, even in relation to competence thwarting, is more problematic from a methodological perspective. In study 1, it was hypothesised that one of the reasons for the low levels of frustration reported by participants was the lack of familiarity with the experimenter. In study 2, a more ecological form of manipulation was introduced, attempting to induce feelings of group rejection; as seen, this not just did not solve the problem, but participants experienced exclusion and rejection to a lesser extent than what observed in study 1. However, three participants reported issues with the credibility of the procedure, and as such, the ineffectiveness of relatedness manipulation could be explained again by limitations linked to interactions with experimenter/confederates. Another factor to consider is that participants received a communication of rejection without interacting with their teammates. The lack of direct interaction (e.g., being explicitly ignored or rejected) may have attenuated perceptions of exclusion and subsequent frustration. As previously mentioned, issues with manipulation of relatedness may not be specific for this thesis and also occurred in other studies (e.g., Thomas et al., 2018), indicating that in the context of SDT literature clearer guidelines for protocols aiming to experimentally test the effects of relatedness thwarting could be needed.

Summarizing, study 2 was not successful in generating differentiated conditions of competence and relatedness thwarting and assessing effects of moderation of

personality factors on the effect of needs thwarting on stress appraisals. Indeed, while it can be argued that manipulation of competence thwarting was partially successful, preliminary evidence showed that the manipulation of relatedness thwarting was particularly challenging and not effective. Given that, in order to test the theoretical model of stress here theorised it is deemed fundamental to experimentally create conditions of needs thwarting, the last study of this thesis addressed the issue of identifying factors relevant for the manipulation of relatedness.

Chapter 5

Simulating connection: a critical scoping review of relatedness manipulations in experimental paradigms

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This research was presented at the 8th International Self-Determination Theory Conference, Orlando, Florida, 2023

5.1 Introduction

The idea that interpersonal relationships are of fundamental importance for the experience of well-being is a fundamental and widespread theorization that finds support in several frameworks of psychological tradition. For example, in psychoanalytic formulations considering primary relationships as fundamental for children's (and then adults') emotional regulation (Freud, 1930), and in Bowlby's landmark theory of attachment (1969; 1973). The importance of interpersonal relationships also features strongly in the field of motivation, with love and belonging prioritised, by Maslow (1968) in his needs' hierarchy, right after physiological and safety necessities. In a more recent formulation, Baumeister and Leary (1995) defined the need for belonging as "a need to form and maintain at least a minimum quantity of interpersonal relationships" (pp. 499), outlining its positive impact on emotional and cognitive processes. Fundamentally then, interpersonal needs, how they are met, and their effects both in the short and long-term have long caught the interest of psychologists of varying backgrounds.

Therefore, the central importance of relatedness, characterised in self-determination theory (SDT; Deci & Ryan, 1985a) as the need to be connected with, and cared for by significant others, cannot be considered new. Still, in this framework the need acquires a renewed importance. The reason is that the interpersonal dimension, with the form of need of relatedness, seems to have both a "direct" and an "indirect" role in the SDT framework. This is due to the fact that relatedness is theorized as one of the three basic psychological needs (Deci & Ryan, 1991), which satisfaction, as previously discussed, is linked to several positive outcomes including growth, well-being, intrinsic motivation and functioning at a physiological, psychological, and social level (Deci et al., 2001; Reis et al., 2000; Ryan, 1995; Vansteenkiste, Niemiec, & Soenens, 2010). At the same time, as outlined by Sheldon & Prentice (2019), having quality relationships is essential not just for relatedness, but for the satisfaction of all the three basic needs (i.e., competence and autonomy in addition to relatedness). Indeed, for basic needs to be satisfied, the social environment should be supportive of these tendencies, to facilitate needs satisfaction through the process of internalization (Deci & Ryan, 2000). Related to this aspect, the concept of social support has been often integrated with self-determination theory in recent research developments, outlining the mediating role of basic psychological needs between social support and motivational factors (e.g., Graves & Luciano, 2013; Knight

et al., 2017; Tian et al., 2016; Vallerand, 2007). As such, being linked with positive outcomes both by itself and by facilitating the satisfaction of the other needs through the experience of a functional social environment, it could be expected for relatedness to be recognised a fundamental role in the SDT framework.

Despite this, relatedness has received less theoretical and empirical attention, compared to the needs of autonomy and competence. Sheldon and Prentice (2019) argued that this could be due to the need's similarity with relational constructs covered in other theories, factor that makes the concept "uncontroversial" (pp. 10). In addition, it should be considered that the first developments of SDT were specifically focused on the need for autonomy, first evidencing that external forms of reward (e.g., monetary) could decrease the frequency of a behaviour, fostering forms of controlled motivation (cognitive evaluation theory; Deci & Ryan, 1985a); then, characterizing autonomy not just as context-bound, but also as an individual disposition to seek out autonomous/controlled situations (causality orientation theory; Deci & Ryan, 1985b). I argue that the cited role of autonomy in SDT shaped theory and research around the basic needs, and this is also particularly valid for relatedness. An example is represented by the recent formulation of the relationship motivation theory (RMT; Deci & Ryan, 2014). Though this is the first mini-theory of the framework to focus specifically on the need for relatedness, it starts from the proposition that relationships that promote well-being are not limited to social contact, but they include perceiving autonomy in caring and being cared for. In this sense, relatedness and autonomy are described as positively interdependent in relationships, except that for the dysfunctional cases where being loved and cared depends on satisfying partner demands (conditional regard; Ryan & Deci, 2017).

Though the interdependency of relatedness and autonomy is widely demonstrated in the context of relationships (e.g., Blais et al., 1990; Hadden et al., 2015; Knee et al., 2005), I argue that considering relatedness solely in conjunction with autonomy has limited our understanding of its unique effects. This has particularly hampered empirical testing for cases, like the present work, where it is necessary to separately assess the effect of each need in broader contexts. In 2008 Sheldon and Filak claimed that the tendency to incorporate the basic psychological needs under the concept of autonomy produced, as a consequence, a lack of studies experimentally manipulating competence and relatedness, limiting the chance to test causal effects for these needs in the SDT framework. The present work argues that this issue has yet to be resolved, 15 years later. Indeed, though

as outlined by Ryan et al. (2019) the research based on SDT used a variety of experimental designs over the last decades, the majority of these rely on the manipulation of autonomy/extrinsic reward (e.g., Deci et al., 1994; Deci et al., 1999; Wuyts et al., 2017). Furthermore, also where the necessity of considering separate contribution of each of the needs was recognized (e.g., Sheldon & Filak, 2008), the experimental protocol employed was adapted from studies that originally manipulated autonomy, acting on task/experiment instructions delivered by the experimenter, and neglecting the necessity of considering a social environment that is significant for the individual. In the experiments of the present work, this has been identified as a possible limitation.

In sum, there is insufficient work isolating the motivational and affective outcomes of relatedness, a central component within the widely-used self-determination theory framework. Therefore, the aim of this scoping review was to identify and collate research paradigms that manipulate or have an effect on relatedness, then critically analyse their effectiveness to produce recommendations for future experiments. Though the review followed a systematic approach to identify relevant literature, a scoping review design was adopted and preferred to a systematic review. Indeed, scoping reviews are deemed more appropriate when the aim is identifying, mapping, and discussing relevant concepts that underpin a specific research area and implications for practice (Arksey & O' Malley, 2005; Munn et al., 2018). Here a gap in the literature concerning SDT has been identified, and also, as Sheldon and Prentice (2019) suggest, the concept of relatedness could present overlaps with other theories and methodological traditions. Given the breadth of contexts (e.g., work, education, sport) and paradigms (e.g., laboratory and field-based studies; inter- and intra- individual designs) where changes in relatedness could have been studied, it was anticipated that the rigorous inclusion criteria with respect to study quality of a systematic review may exclude relevant research in the first instance. Second, literature outside of published sources, that may have failed to progress through peer review parameters, has been purposively sought. This is due to well-established publication biases, and the desire to identify and learn from paradigms that have not worked, as much as those that have. Items of the scoping review are reported following guidelines from the PRISMA-ScR Checklist (Tricco et al., 2018).

5.2 Methods

5.2.1 Protocol

This scoping review adopted the protocol developed by Arksey and O'Malley (2005), which consists in five methodological stages: (i) identifying the research question, (ii) identifying relevant studies, (iii), study selection, (iv) charting the data, and (v) collating, summarizing, and reporting the results.

Though fundamental to develop clear rationale and eligibility criteria, identifying a research question was challenging given the broad nature of the topic, and the anticipation of the need to draw from a wide variety of methods and approaches. As such, guidelines from Arksey and O'Malley (2005) were followed of maintaining a wide focus before getting an understanding of the volume of the field. The risk for the question to lack focus or direction was identified in the initial stages of the review, and so, as suggested by Levac et al. (2010) in their revision of Arksey and O' Malley's protocol, some specifications related to the scope of inquiry, such as the target research designs or the outcome of interest, were clearly defined. The resulting research question was investigating how the need of relatedness was manipulated and/or impacted in acute experimental paradigms.

5.2.2 Eligibility and refining the theoretical lens

Following the formulation of the research question, relevant studies were identified using the following eligibility criteria:

(1) experiments, quasi-experiments or interventions. One of the goals of this review was producing recommendations based on previous experimental paradigms. As such, non-empirical sources (e.g., reviews, meta-analyses, theoretical chapters, questionnaires validations), and cross-sectional designs were excluded.

(2) involving manipulation of relatedness or other variables impacting relatedness. The nature of this criteria was widely discussed since the first stages of the review, in relation to two main issues, one theoretical, one methodological. From a theoretical perspective, it was recognized that several other frameworks have theorized the basic human need for relationships, providing slightly different definitions, such as belonging, attachment, social connectedness (e.g., Baumesteir & Leary, 1995; Bowlby, 1969; Lee &

Robbins, 1995). However, in the current review I adopted the perspective of Sheldon et al. (2011), who underlined the importance and unicity of the SDT framework in emphasizing the role of the context not just for the satisfaction of the basic psychological needs, but also for determining a detrimental effect when these needs are not met or are actively thwarted. So, at the stage of the literature search, the focus was restricted to the concepts of relatedness and basic psychological needs. I recognise that this choice could risk to exclude relevant experimental protocols that did not have the manipulation of relatedness as a primary aim, but that identified factors affecting this variable. During the process of selection, it was therefore decided to also include studies that, though starting from a different theoretical perspective or research aims, obtained changes in relatedness satisfaction and/or frustration following the experimental manipulation of other variables.

(3) producing acute changes in the manipulated variables. The first aim of this criterion was to exclude longitudinal and long-term interventions, reflecting the research aim (and informed by the challenges portrayed in earlier chapters of the thesis) to produce recommendations for empirical work focused on acute manipulations of relatedness. The focus on "acute changes" was preferred to a definition based on the duration of the experimental protocol, to discriminate between different types of what could be considered short-term interventions (e.g., days), that would not be easily replicable.

(4) being replicable without involving specific professional training. The experimental procedures considered were the ones controllable and replicable by researchers of any background. This aimed to exclude first, interventions based on trained techniques (e.g., psychotherapy, mindfulness) which are complex to deliver and aim for longer-term change; and second, interventions not directly delivered by the experimenters, but by third parties (e.g., coaches, personal trainers, educators) trained in SDT by experimenters as part of the intervention.

Finally, I included any articles where there was a (5) full-text available in English or Italian. This criterion reflected my linguistic competences.

5.2.3 Search strategy

A systematic search of four electronic databases was led from March to May 2022. Given that the review concerns a specific aspect of self-determination theory encompassing several domains (general, work, economics, developmental, sport), four

broad databases characterized by different specialisms were selected. In particular, three databases, SCOPUS, PUBMED, and PsycINFO, were chosen for their broad range of disciplines included and for their focus on social and health sciences, and a fourth database, Proquest Dissertation & Theses, was added with the intent to draw from unpublished work and include dissertations. Furthermore, attempting to identify unpublished work of relevance, a message was posted on SDT LISTSERV, an online network for the discussion of theoretical and applied aspects related to self-determination theory, and following this, relevant work was sent by other SDT researchers.

The database search was led on titles and abstracts, using the string "basic psychological needs" AND manipulat* [OR alter* OR experiment OR change]. The choice to not include 'relatedness' was due to the generalizability of this word, also attributable to other domains (e.g., skill relatedness, semantic relatedness). Following the exclusion of the duplicates, two researchers independently completed a screening of titles and abstracts applying inclusion and exclusion criteria. After completing the screening, the two researchers critically discussed the findings in order to reach agreement on excluded studies. At this stage, studies that did not clearly meet the eligibility criteria were excluded. Finally, the first researcher completed a full-text screening of the remaining studies, and the 10% of these was also independently screened full-text by the second researcher.

5.2.4 Data charting

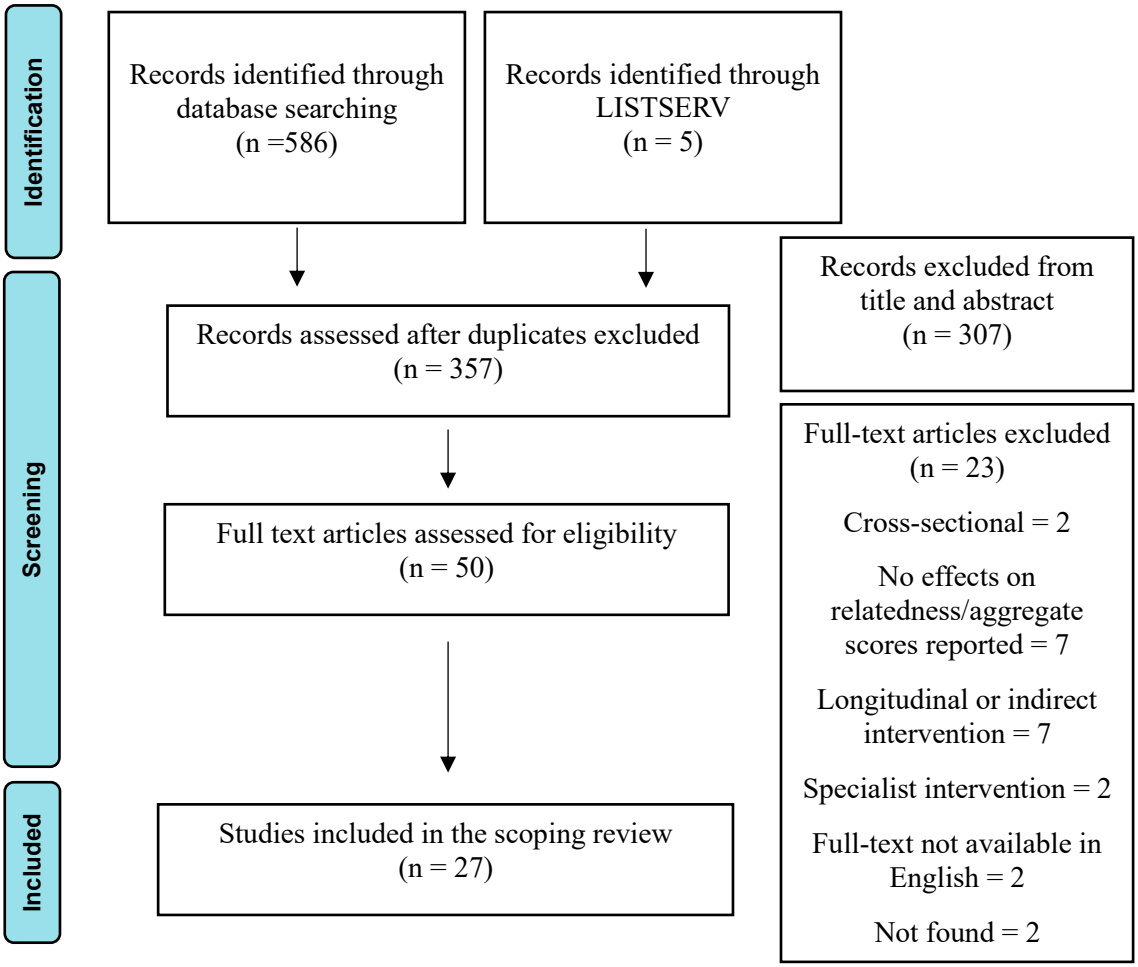
Data from each included study were extracted in a form created in Microsoft Word. Following guidelines from Arksey and O'Malley (2005), the form contained general information about the study (e.g., date of publication, citation, publication type) and specific information about aims of the study, characteristics of the study population (e.g., age, gender, ethnicity), intervention type/experimental procedure, instruments, relevant results.

5.3 Results

The search of electronic databases yielded 586 records, while five studies were found through LISTSERV. From the initial sample of 591 records, duplicates were excluded, and 357 records were screened by title and abstract. Of these, 307 were excluded and 50 studies were assessed full text for eligibility. Following this assessment, 27 records were retained and included in the scoping review. Results of the screening are summarized in Figure 5.1.

Figure 5.1

Flow diagram of the screening process



5.3.1 Study characteristics

Study characteristics are summarised in Table 5.1. Of the 27 records identified, 20 were journal articles, while seven were theses, including one master's degree thesis. Sixteen records (59.25%) included either two (40.74%), three (11.11%), or four (7.40%) different relevant experiments, for a total of 52 experiments examined. With regards to the geographic location of the studies, 10 records reported experiments conducted in United States (37.3%), two in Canada (7.4%) one in Italy (3.7%), one in Israel (3.7%), one in New Zealand (3.7%), two reported more than one location (e.g., United States and Britain; 7.4%). Furthermore, 13 studies were either led online, or did not specify a location (48.1%). The majority of the studies was led on students (74%), ranging from college/high school (n = 4) to university level (n = 20). Just four studies (14.8%) included a general sample of adults, and other three records reported mixed samples, between students and non-student adults (11.1%). This meant that most of the studies involved young participants, with 19 records reporting samples from 18 to 26 years old. When reported (77.7% of the records), participants' average age ranged from 14.8 (SD = 1.2) to 38.4 (SD = 13.5). With regards to participants' gender, 85% of the experiments comprised samples of men and women; just one of these also reported the presence of trans/non-binary participants. Three studies involved just women. Wider sample characteristics including disability status, socioeconomic status, religion, and ethnicity were infrequently reported.

5.3.2 Study design and instruments

The 27 records deemed eligible were all experiments taking place in one session, and all of them adopted quantitative measures. Twenty-two studies measured the need of relatedness as defined under the SDT framework. The remaining five studies (Brambilla & Riva, 2017; Daniels, 2012; Pesch et al., 2018; Pharo et al., 2011; Walasek et al., 2015) adopted Baumeister and Leary's framework (1995), using the concept of belonging. The inclusion of studies manipulating belonging will be discussed in next sections of this chapter, in relation to the conceptual similarity with relatedness in the SDT framework.

Table 5.1

Descriptive information on included studies

Research characteristics	Number of records
Type of publication	
Journal article	20(74%)
Thesis	7(26%)
Population sampled	
University students	20 (74%)
General adult population	7(26%)
College/High-school students	4(14.8%)
Sample Location	
United States	10(37%)
Canada	2(7.4%)
Britain	2(7.4%)
Other	3(11.1%)
Not reported (online/in person)	13(48.1%)
Age	
Adults	21(77.8%)
Youth (U18)	3(11.1%)
Not reported	4(14.8%)
Gender	
Mixed	24(88.8%)
Women	3(11.1%)
Not reported	1(3.7%)
Construct measured	
Relatedness	22(81.5%)
Belonging	5(18.5%)

Of the studies relying on SDT, just eight (Austin, 2019; Bagheri & Milyavskaya, 2020; Kaefer & Chiviacowsky, 2021; Kanat-Maymon et al., 2015; Pavey et al., 2011; Sheldon & Filak, 2008; Thomas, 2015; Valshtein et al., 2020) directly manipulated the need of relatedness. The remaining 19 were primarily focused on other constructs that were reported to have an effect on relatedness satisfaction/frustration. Relatedness was measured through assessing needs satisfaction in the majority of the records (n = 16), while one study assessed needs frustration (Legate et al., 2021), and three studies (Bagheri & Milyavskaya, 2020; Thomas, 2015; Zeng, 2020) reported the assessment of both relatedness satisfaction and frustration. In order to measure needs satisfaction/frustration,

nine different validated scales were reported across records, with variations in the same research occurring in the twenty records that included more than one experiment. For needs satisfaction, most of the studies (n = 11; 40.74%), reported the use of one of the Basic Psychological Needs Satisfaction scales (BPNSS). In particular, five studies used the Basic Psychological Needs Scale in General (BNSG-S; Deci & Ryan, 2000; Gagné, 2003), four studies focused on the relationship domain employing and adapting the Basic Psychological Needs in Relationships Scale (La Guardia, Ryan, Couchman, & Deci, 2000), and two studies reported the use of the Basic Need Satisfaction at Work Scale (Ilardi, et al., 1993; Kasser, Davey, & Ryan, 1992). In two records Sheldon et al.'s (2001) relatedness items were adopted.

Since just four records reported to assess needs frustration, there was less variation in the instruments employed at this purpose. Importantly, all the instruments that measured negative aspects of relatedness assessed individual perceptions of the needs, independently of the fact that they reported to assess thwarting or frustration. The Basic Psychological Needs Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) was the most frequently reported, being employed in three studies; though in the original form the instrument includes 24 items and subscales for both needs satisfaction and thwarting, in one of the studies (Legate et al., 2021) a version of 12 items was adapted to exclusively measure needs frustration (12-item Need Thwarting scale; Chen et al., 2015). Furthermore, the same instrument was also employed to measure needs satisfaction in two records (Austin, 2019; Lou & Noels, 2020), aggregating the scores of the two subscales (I assume reversing half of the items, though the authors did not clarify their method). One record (Thomas, 2015) reported the use of the Psychological Need Thwarting Scale (PNTS; Bartholomew et al., 2011b). Four records reported the use of manipulation checks when including conditions of negative manipulation of relational variables (e.g., relatedness thwarting, ostracism, social exclusion); however, these were used to assess compliance with the condition assigned or whether the experimental condition was believable. Just in one case (Legate et al., 2013) manipulation checks included one question about feelings of exclusion ("I felt excluded").

Of the five studies measuring the need of belonging, four included items on a Likert Scale ranging from 1 to 5, adapted from Williams' ostracism model (Williams & Zadro, 2001; Williams, 2007) and measuring both positive (e.g., "I feel I belong to

the group") and negative (e.g., I feel rejected") aspects of belonging. One article (Pesch et al., 2018) considered the sense of belonging in a broader sense of "feeling part" of a context, and subsequently adopted a measure of cohesion, the Sense of Belonging subscale of the Perceived Cohesion Scale (Bollen & Hoyle, 1990), instead of measures based on ostracism. Two studies of this group included the assessment of manipulation checks, with just one (Pharo et al., 2011) assessing perception of exclusion (e.g., "I was ignored").

It is important to notice that in two studies of the scoping review relatedness and belonging were not measured using validated scales. In one record (Pavey et al., 2011), one of the studies included a word stem task, and relatedness was operationalized as the number of need-related words found during the task; another study (Valshtein et al., 2020) involved a relatedness-recall procedure, and just a manipulation check was employed asking participants how easy it was to imagine relatedness-based situations.

5.3.3 Manipulation procedure

Considering the variety of studies included, results in this section were grouped by two factors relevant in the theoretical development of the present work: first, the study's reliance on direct or indirect manipulation of relatedness, and second, the proximity of the manipulated variables to the concept of relatedness, as formulated by BPNT. Studies were classified in four categories: (i) research where manipulation of relatedness was direct and under the SDT framework; research where manipulation of relatedness was either indirect under the SDT framework or involved concepts theoretically close to relatedness (e.g., belonging, ostracism, social exclusion): this category was divided in two parts, one for the need of relatedness (ii) and one for the need of belonging (iii); finally, (iv) research that obtained an effect on relatedness via manipulation of variables or constructs not normally aligned to relatedness (e.g., task difficulty).

5.3.3.1 Direct manipulation of relatedness

Of the 27 studies included in this scoping review, eight reported protocols aiming at the direct manipulation of the need of relatedness. Among these, the most commonly applied protocol (n = 5) was adaptation of experimenters' instructions pre- and during the

delivery of a task (Kaefer & Chiviacowsky, 2021; Kanat-Maymon et al., 2015; Pavey et al., 2011; Sheldon & Filak, 2008; Thomas, 2015). In the experiment reported by Sheldon and Filak (2008), for example, instructions for a game-learning setting were separately manipulated for supporting or thwarting each of the basic psychological needs, in a 2x2x2 factorial design. With regards to relatedness, in the support condition task instructions expressed a sense of caring and interest towards the individual (e.g., "we…are trying to understand each person's learning style. So, I hope you'll share your experiences with me after we're done", pp. 271); in the thwarting condition, instead, disinterest and lack of empathy were conveyed (e.g., "Remember, to us you're just one anonymous participant, the same as everybody else. We're focused on trying to understand the game, not you personally", pp. 272). The same protocol was employed, differentiating between relatedness thwarting and supporting conditions, by Kaefer and Chiviacowsky (2021), during a motor task, and by Pavey et al. (2011) and Thomas (2015), during the completion of cognitive tasks. Another record (Kanat-Maymon et al., 2015) similarly reported the manipulation of supportive or thwarting instructions during cognitive tasks, but not including separate conditions for the three basic needs. In four of these studies, relatedness was successfully manipulated, as assessed by self-reports, with the exception being in Thomas (2015) where the instruction protocol was not effective or just partially effective (e.g., not in comparison with the control group), and data about relatedness were excluded from one of the experiments reported. This was the only record of the group that used a specific measure and scores to assess needs frustration or dissatisfaction and as such, the result is in line with findings of the present work and will be discussed in relation to the effectiveness of manipulation protocols.

Four studies reported the use of procedures based on relatedness-related scenario imagery or recalling. For example, in one of the experiments led by Austin (2019), participants in one of the experimental conditions wrote about a time they felt included and connected with someone important ("relationship success"). A similar procedure was employed by Pavey et al. (2011), where participants were asked about times they had experienced various forms of relatedness, and then were asked to describe them. In contrast, in Bagheri and Milyavskaya (2020) the manipulation of the scenario was aimed at frustrating relatedness and was not based on previous memories, but on the prospective imagination of a fake event: participants imagined

a work (or life) situation where relatedness was thwarted due to lack of connection with other people. Not always relatedness thwarting was manipulated through a negative scenario description. For example, Valshtein et al. (2020) employed a paradigm of metacognitive threat: participants recalled situations where they felt loved, but while in the control group (neutral condition) the situations to recall were a small number, the experimental group (relatedness thwarting condition) had to recall and describe a considerable number of different situations (16). So, positive memory recalling has been employed for manipulating both needs support and needs thwarting. In all the records reporting the use of recall/imagery tasks, manipulation was effective, with levels of relatedness satisfaction being significantly affected in comparison with other recall/imagery conditions (e.g., competence-based). However, it is important to underline that, despite some of these studies manipulated needs thwarting, most of them measured just positive aspects of relatedness, such as satisfaction or connectedness (Pavey et al., 2011). In Bagheri and Milyavskaya (2020), supplementary data were also reported for needs thwarting, demonstrating that manipulations based on imagery could be effective also when relatedness frustration is measured.

Finally, two of the records already mentioned in this section (Pavey et al., 2011, Valshtein et al., 2020), included more than one experiment, and also reported procedures of relatedness manipulation less common in literature or drawing from other theoretical backgrounds. For example, Valshtein et al. (2020) reported the use of the game Cyberball (Williams 2002; Williams & Jarvis, 2006). Given that this procedure is more commonly implemented in studies manipulating ostracism, it will be more extensively described in the next section of this work. Conversely, in Pavey et al. (2011) the instructions manipulation was “reinforced” though the use of a priming task: before receiving instructions, participants were given lists of words to form a sentence, with the words associated either with competence, autonomy, or relatedness. This procedure increased the implicit value of the experiment, and the manipulation was successful, with participants selecting more words linked to relatedness at a word stem task.

5.3.3.2 Indirect manipulation: relational constructs

Ostracism/social exclusion: recall tasks, ball-tossing, and social descriptions

An example of indirect manipulation is manipulation of experienced or acted ostracism (Williams, 2007), and reported by two studies in relation to the need for relatedness (Legate et al., 2013; Legate, Weinstein, & Ryan, 2021). In particular, in Legate et al. (2013), ostracism was manipulated in two experiments through the game Cyberball, a computer ball-tossing game (Williams, Cheung, & Choi, 2000). In Cyberball, participants play with a central processing unit (CPU) but are deceived to believe that they are interacting with other real players located in different rooms. Legate et al. (2013) included experimental conditions where participants were ostracised (the ball was passed to them a considerably less amount of time), or ostracisers (they were instructed to not throwing the ball to a specific player). Both ostracizers and ostracized conditions were related to lower levels of relatedness satisfaction compared to control conditions ("inclusive" instructions or no instructions), demonstrating that detrimental effects on relatedness are caused not just by being ignored, but also by actively ignoring others. Similar results were obtained by Legate, Weinstein, and Ryan (2021), who instead manipulated ostracism with a recall task, asking participants to write about experiences where they excluded or were excluded by others. In this case, both participants writing about experienced and acted ostracism presented higher levels of relatedness frustration compared to control conditions. It is important to notice that while in Legate et al. (2013) ostracisers had lower levels of relatedness satisfaction compared to ostracised participants, in Legate, Weinstein, and Ryan (2021) also needs frustration was measured, and passive ostracism was linked to higher levels of relatedness frustration. This difference could depend on the manipulation procedure or on the theoretical difference between needs satisfaction and needs frustration and will be discussed in following sections of this work. One record (Ricard, 2014) obtained similar findings in relation to social exclusion. In contrast to the manipulation of ostracism, that often involved online tasks or recall of true experiences, in this study social exclusion was manipulated through fake personality descriptions: after completing a personality test, participants received fake descriptions of their profiles emphasising aspects of trait-related exclusion or inclusion from others (future life alone paradigm; Baumeister et al., 2005). Participants that received a negative social description had lower scores of

relatedness satisfaction compared to the other groups, demonstrating that social exclusion can have an impact on relatedness also through generating negative social self-beliefs.

Pro-social behaviour: recall tasks, manipulation of chance to help

Two studies manipulated aspects related to pro-social behaviour (Miles & Upenieks, 2021; Weinstein & Ryan, 2010), supporting the previous finding that acting socially can influence perceptions of relatedness. A recall task was employed in two experiments by Miles & Upenieks (2021), asking participants to write about an acted positive social action (e.g., donating money), whereas Weinstein and Ryan (2010) used online tasks across two experiments: a dictator game, and a cognitive task. In the dictator game, participants had a sum of money for five rounds and they were either told to donate a certain amount each round (no-choice condition) or could decide the amount to split (choice condition); the cognitive task was attended by dyads that could either complete the task separately (control condition), or one member was told that they could help the other to win a prize (help condition). In all the cited studies, prosocial behaviour showed a positive relationship with relatedness satisfaction (Miles & Upenieks, 2021), and recipients of help underpinned by autonomous motivation also reported higher relatedness than participants who worked alone, or recipients of controlled help (Weinstein & Ryan, 2010). These results confirm that socially-oriented behaviours increase relatedness satisfaction for both actors and recipients, with similar results for recall task and "online" tasks.

Listening: quality of feedback in "online" conversations

One record (Itzchakov & Weinstein, 2021) linked quality of being listened to during a conversation with levels of relatedness satisfaction. The result was demonstrated in two experiments, where participants were asked to write about and to discuss a bias with a listener or an audience of trained confederates: in one group listeners were attentive and involved (high listening), while in another group listeners appeared distracted and disengaged (moderate listeners). In both experiments manipulation of listening produced the expected result, with levels of relatedness being higher for groups of participants that interacted with attentive listeners. Though conversations about a bias are considered a very specific factor to manipulate and might not extend to all types of conversations, the

procedure used in these studies presented similarities with the instruction paradigms explored in relation to direct manipulation of relatedness: indeed, in both cases the key element is experimenters' involvement and interest in participants. However, it is important to notice that the same studies also found a less strong effect on relatedness when the need of autonomy was included in the model, with also a mediation effect of autonomy occurring between listening and relatedness. This result was attributed to the lack of familiarity of the speaker with the listeners in an experimental environment, and this point will be further discussed in relation to procedures involving confederates or experimenters.

Body acceptance: exposure to body-related messages

Despite directly linked to relatedness and formulated in the framework of SDT, body acceptance by others has been included in this section because it is a domain-specific concept. The concept was formulated in one record (Legault & Sago, 2022), that explored the effect of exposure to different messages concerning the body on basic psychological needs and self-perceptions. In a series of four experiments, participants were exposed to messages linked to body image corresponding to satisfaction/frustration of different needs: for example, messages could relate to autonomous body positivity, with an emphasis on personal freedom, or controlled body positivity, emphasizing that participants should or must accept themselves. As such, relatedness was manipulated through the creation of messages conveying a sense of acceptance and validation of women's bodies from others. Despite the studies including a manipulation check, and that relatedness messages were reported to increase feelings of acceptance compared to the other conditions, general levels of relatedness satisfaction or frustration were not assessed with validated instruments. General conclusions on the effectiveness of this manipulation are therefore difficult to draw.

5.3.3.3 Indirect manipulation: relational constructs and need of belonging

Ostracism/social exclusion: Cyberball, fake interviews, social acceptance

Four studies manipulated belonging through ostracism/social exclusion (Daniels, 2012; Pesch et al., 2018; Pharo et al., 2011; Walasek et al., 2015). These employed

procedures very similar to what observed for relatedness in the previous category. For example, one of the main procedures employed for this purpose was a ball-tossing paradigm, that however presented some variations compared to the classic Cyberball procedure: for example, in the study led by Pharo et al. (2011), participants were recruited in groups of four friends, and were asked to play together the game Cyberball from separate rooms, interacting with the CPU instead; as such, ostracized participants were deceived to believe that the exclusion came from people they had a previous social bond with. In contrast, in Walasek et al. (2015) participants were not deceived, and they were aware of playing with a CPU. Despite the differences in the type of relationship included, in both studies levels of belonging were compared between ostracized and non-ostracized participants and manipulation was reported as successful, with lower feelings of belonging for ostracized participants.

A variation of the ball tossing paradigm was employed by Daniels (2012), involving a fake computer-mediated interview: in a series of four experiments, participants were told to take part in a computerized interview involving an interviewer and other two interviewees, interacting with a CPU instead. Across the experiments there were conditions of acted ostracism, where participants were asked to not answer the interviewer's questions, and experienced ostracism, where participants were ignored and not asked as many questions as the other interviewees. As in previously mentioned studies, both experienced and acted ostracism were associated with lower levels of belongingness; however, in the studies led by Daniels this happened also in comparison with conditions of negative inclusion, where participants were asked all the questions of the interview, but the interviewer acted impolitely. This result is relevant because it shows that interacting with participants with negative manners (which is a widespread procedure in the instruction-based manipulations under the SDT framework), could have different outcomes for relatedness/belonging compared to paradigms of exclusion.

One study (Pesch et al., 2018) manipulated social exclusion without the use of explicit rejection during tasks, using, in contrast, perceived social acceptance. Participants were falsely told that other three persons were attending the experiment and were asked to write an essay about either their career paths or their personal interests. Then, the other fictional essays were circulated, and participants were asked to rank them based on how much they wanted to speak with the other people involved. With false feedback, participants were then informed to have been ranked first (inclusion condition) or last (exclusion condition)

by the others. Manipulation in this study was successful, with the excluded groups showing lower sense of belonging than the included participants, both for personal and career-based exclusion, demonstrating that the social evaluation of personal values and goals could be an effective form of inclusion/rejection.

Schadenfreude: imagery and computer games

Finally, one record (Brambilla & Riva, 2017) tested the effect of schadenfreude, defined as the positive feeling determined by another individual's misfortune during competitive situations (Smith et al., 2009), on psychological needs. The construct was manipulated in different experiments with two main methods: an imagery task, and a computer game. In the imagery task, participants were asked to imagine competing with a colleague for the same job interview, and then were informed that their colleague missed the interview due to an accident. In the computer game participants competed with a fake opponent (CPU) in a reaction time task, and after losing a round they were informed that the opponent could not log in anymore due to a technical issue. The experimental procedures included control groups where participants were informed of others' misfortunes in a non-competitive condition (e.g., different job interviews or games). In both experiments being in competition was linked to higher satisfaction of all needs, and this relationship was fully mediated by schadenfreude. The results show that sense of belonging could be increased in a competitive condition if people experience schadenfreude.

5.3.3.4 Indirect manipulation: non-relational constructs

The last seven studies included reported an indirect effect on relatedness through manipulation of variables and constructs either not associated with social aspects, or conceptually closer to other basic psychological needs (e.g., competence). Results are classified and summarized below, divided in three groups: the first category involved manipulation of other basic psychological needs, with competence-based procedures (three studies), and autonomy-based procedures (one study); the second group involved the use of more specific variables, which manipulation could not be significant per-se, but in association with procedures already described: construal level (one study), and internalization of social status (one study); finally the last

paragraphs described a work-specific study manipulating organizational relationships.

Competence and autonomy-based procedures

Three studies (Bechara, 2019; Kyeong et al., 2020; Lou & Noels, 2020) reported procedures considered closer to the need of competence than to relatedness, as they involved the manipulation of task difficulty or individual ability. This is in line with results highlighted in the previous chapters and was extended to experimental protocols where not just feedback, but objective aspects of the performance were controlled. For example, Bechara (2019) demonstrated that different levels of difficulties of a video game could have an impact on relatedness satisfaction; in particular, when participants played at lower difficulty, they reported higher levels of relatedness than when playing at high difficulty. Furthermore, this difference was greater for groups of participants receiving training, a result that Bechara and colleagues explained due to a training-related increased awareness and need to perform. The relational nature of performance was also explored by Lou and Noels (2020) in the form of feedback. Participants received false feedback regarding an English test, and the results showed that "ability-consoling" feedback, namely providing emotional support and emphasizing that every person has different talents, was linked to lower levels of relatedness, compared to improvement-oriented feedback or no feedback. The effect was fully mediated by beliefs of fixed ability (meta-lay theories), demonstrating that the way others' feedback is formulated could negatively impact individual growth mindset and also influence how receivers feel about their connectedness with the providers. This effect of type of feedback on relatedness has been demonstrated to be valid also in cases where feedback was self-provided. Related to this, Kyeong et al. (2020) showed participants some self-recorded visual-audio material during an fMRI; videos contained self-criticism based and self-respect based self-talk in a randomized order. It was found self-criticism could cause the activation of parts of the brain (e.g., posterior cingulate cortex; ventrolateral prefrontal cortex) that negatively predicted relatedness satisfaction; however, this happened only in the group of participants characterized by low levels of life satisfaction, and the manipulation involved also relational references (e.g., "Everyone else will all hate me"; "Everyone will be disappointed in me").

Though in the previous paragraphs autonomy showed mediation effects in procedures manipulating relational aspects, just one study on this scoping review (Young-Jones et

al., 2014) reported the specific use of procedures usually associated with the need of autonomy. As with instructions-based paradigms, the procedure reported by the study manipulated teachers' verbal and non-verbal communication during a lecture. Specifically, the lecture delivery could use an autonomy-supportive communication, for example, providing a rationale for attendance, and creating a "sense of partnership" (pp. 501) in the teacher body language, or a controlling communication, for example, conveying a sense of control for the attendance, and limiting the body movement in a sense of non-verbal "dominance" (pp. 501). The experiment showed that controlling language was associated with decreased levels of relatedness satisfaction. However, this effect depended on the lecture format: in particular, it occurred only when the lecture included audio or audio/video combined information, with video-only communication not associated with variations in relatedness levels. The result reported is here considered relevant, because it could integrate instruction-based paradigms already explored in the previous paragraphs, shedding light on the importance of the delivery format of this type of manipulation.

Variables strengthening other paradigms: construal level, internalization

One study (Zeng, 2020) expanded findings on pro-social behaviour, assessing the strength of behavioural intents linked to the abstract or concrete mindset of participants. In Zeng's series of experiments, a recall task was employed, where participants described a past pro-social or pro-environmental behaviour in two conditions: they were asked to recall either abstract aspects of the action, such as "why" (abstract construal), or concrete aspects, such as "what" (concrete construal). The abstract or concrete mindset impacted levels of relatedness: specifically, participants recalling abstract aspects of the action had higher relatedness satisfaction. This result could be relevant to demonstrate that details of the script or that the way an experimental task is led could increase or decrease the effectiveness of tasks normally associated with relatedness, such as manipulation of pro-social behaviour. However, it should be considered that the same procedure of manipulation was not effective on needs frustration, aspect that will be discussed.

One of the findings of the previous sections is that relatedness can be also impacted by manipulations acting through negative social self-beliefs (e.g., Ricard,

2014). Related to this, one record of this scoping review (Jackson et al., 2015) showed that relatedness could be impacted not just by general perceptions of subjective social status, but also by the internalization of it, namely how much people believe the social condition is their responsibility. Jackson and colleagues tested this assumption using two different methods: an imagery task, and an "online" group task. Specifically, in one experiment participants were asked to contemplate a picture of the social ladder in the United States of America, and then to write about an imaginary five-year college reunion, viewing themselves either at the top, at the middle, or at the bottom of the ladder. In the experiment manipulating social status with an "online" task, instead, participants attended the experiment in groups of four/six, and after answering questions about their lives, they were asked to select a leader (high social status), an assistant leader (middle social status), and simple members (low social status) of the group. Following this procedure, false feedback was provided on the assigned social status, to place participants in each of the categories. Though using different paradigms, both experiments demonstrated that internalization of social status was linked to lower levels of relatedness satisfaction; however, this effect was found just for conditions of low social status.

Organizational relationships: partner of choice

One record (Houde, 2004) examined organizational dynamics linked to basic psychological needs, studying the impact of three employer:employee relationships on needs satisfaction: spot contracting (focus on contract delivery only), authority ranking (respect for long-term working relationship and expertise) and partner of choice (free market, but interaction/feedback between partners). The methodology used was a scenario simulation in pairs, where participants could take either the role of employers or employees. Participants in each condition had to find an agreement on issues regarding design and delivery of an intervention, with the goal to maximize individual advantages. As a main result of the study, the spot contracting relationship was associated with lower levels of need satisfaction in all the subscales, relatedness included. Though related to a very specific applied setting, the result is here considered useful because it evidences the effectiveness of scenario-simulations on relatedness, when manipulating relational aspects.

5.3.4 Effect sizes

In the previous paragraphs, several manipulation procedures involving either the need for relatedness or belonging have been identified. These were reported always as effective by the studies' authors, except in two cases (Thomas, 2015; Zeng, 2020). All the studies where the experimental protocols were deemed effective reported either a significant difference between groups presenting different conditions of relatedness manipulation (e.g., positive vs negative; manipulation vs no-manipulation), or a statistically significant relationship between a manipulated variable (e.g., ostracism) and levels of relatedness satisfaction/frustration. Though this overview offers precious insight about procedures that can statistically work in an experimental setting, it does not provide any information about which of the manipulation protocols highlighted could be more or less effective. As such, in the present paragraph a brief summary of the effect sizes of the most widespread procedures of relatedness/belonging manipulation is offered. Since the protocols of manipulation examined were at times directed on relatedness/belonging, and at times on other primary variables (e.g., social exclusion, pro-social behaviour, etc.), and given that some procedures were transversal to the manipulation of different variables (e.g., instructional paradigms, recall methods, etc.), the effect sizes in this paragraph have been grouped based on the type of protocol and not just on the variable: for example, if a recall method was reported for both the direct manipulation of relatedness, and for the manipulation of pro-social behaviour, the effect sizes of recall methods have been considered here independently on the variable this was applied to. It is to be noted that not all the procedures described in the previous paragraphs are discussed in depth at this stage, due to two main reasons: first, just 19 records of the 27 included in this scoping review reported effect sizes; second, and related to the first point, some records described very specific procedures that no other records mentioned (e.g., body-related messages; Legault & Sago, 2022), making it difficult to discuss their effectiveness more broadly.

Concerning the type of data discussed, 63% of the records including effect sizes assessed the variance explained by the model or the predictors, either applied to a group difference (e.g., eta squared [η^2] or partial eta squared [ηp^2]) or to a regression/correlation (R squared [R^2]). Other studies (37%) assessed the "distance" in standard deviations between means of different groups, employing Cohen's *d* or

Hedges' *g* for the purpose. Finally, one study reported a structural equation modelling (SEM) standardised path coefficient. It should be noted that these effect sizes have very different meanings and given that in most records just one of those indices was reported, no reliable comparison across different studies was always possible. As such, indices are mainly generally discussed here in relation to the possible effectiveness of single procedures, and interpretations concerning the size of the effects found followed general statistical guidelines (Cohen, 1988; Richardson, 2011), with some additional considerations around means and scales (that these effects were applied to) when this was deemed relevant.

Instructional paradigms

Of the six studies manipulating basic psychological needs through experimenters' instructions/scripts, three reported specific effect sizes for effects on relatedness satisfaction (Kaefer & Chiviacowsky, 2021; Kanat-Maymon et al., 2015; Thomas, 2015). These studies all compared levels of relatedness satisfaction among groups receiving relatedness support, relatedness thwarting, and neutral (or just slightly positive) instructions. In all the studies, groups receiving relatedness support and/or neutral instructions before or during a task had significantly higher scores of relatedness satisfaction compared to groups receiving relatedness thwarting instructions. Two records (Kaefer & Chiviacowsky, 2021; Kanat-Maymon et al., 2015) reported the calculation of η^2or ηp^2 ranging from 0.19 to 0.27, indicating a high portion of variance explained by the group effect. The result was mirrored by one of the experiments of Thomas (2015), who found a large effect in both the comparison between support and thwarting conditions ($g = 1.44$) and neutral and thwarting conditions ($g = 1.40$). The effect sizes reported show the effectiveness of paradigms based on task instructions for the manipulation of relatedness satisfaction among different groups.

Exclusion/rejection in "online" tasks

Seven records (Daniels, 2012; Itzchakov & Weinstein, 2021; Legate et al., 2013; Ricard, 2014; Valshtein et al., 2020; Walasek et al., 2015; Weinstein & Ryan, 2010) reported effect sizes related to simulation of conditions of social exclusion/inclusion during online tasks. Among these studies, the most frequently employed procedure was

the manipulation of active or passive ostracism/social exclusion during games consisting in ball tossing (e.g., Cyberball) or similar tasks involving fake interactions with other participants (e.g., fake interview; Daniels, 2012). Studies employing these protocols all showed lower levels of relatedness satisfaction/belonging in groups that received ostracism manipulation (either active or passive) compared to groups receiving neutral and positive manipulations. This was also reflected by large effect sizes: when calculated, ηp^2 ranged from .16 (Legate et al., 2013) to .52 (Walasek et al., 2015), indicating a large/very large variance explained by the group effects found. Though not using validated instruments to assess relatedness, Valshtein et al. (2020) reported a similar result regarding manipulation checks assessing feelings of exclusion between groups (d = 1.88), offering some evidence that ball tossing paradigms could be effective also in manipulation of relatedness frustration. Evidence of large effect sizes was also found for the use of fake personality descriptions conveying social exclusion by Ricard (2014), between socially excluded and included groups (d = .92). However, when considering means and standard deviations of the two groups compared, it can be noted that these were very close (M = 5.10, SD = 0.80 for the excluded group; M = 5.82, SD = 0.78 for the included group) with relatedness satisfaction assessed on a Likert scale ranging from 1 to 7. This seems to suggest that despite a statistically significant difference, findings might not reflect an overall unstandardised difference in actual levels of relatedness, and this point will be further discussed in the next sections of this thesis. Furthermore, the same study also reported just a marginal difference (p<.10) between the excluded group and the group that received neutral manipulation, in contrast with similar studies reported above.

The large effect sizes found for exclusion/rejection during online tasks seem to be confirmed also in "positive" paradigms manipulating relatedness through inclusion or pro-social behaviour (Itzchakov & Weinstein, 2021; Weinstein & Ryan, 2010). These overall evidenced higher levels of relatedness satisfaction in agents or targets of inclusive behaviours (e.g., autonomous money donation, listening) compared to non-included/neutral groups, that were reflected by large effect sizes linked to group differences across studies (ds>1.00). When reported (Itzchakov & Weinstein, 2021), group means linked to the effect size seemed also to present slightly larger differences than was seen for other procedures (e.g., two points on a Likert scale ranging from 1 to 7).

Overall, effects sizes related to manipulation of social inclusion/exclusion during online tasks seem to suggest that procedures based on the simulation of the interactions with other players/CPU/confederates are effective on relatedness satisfaction/belonging levels, with also some evidence that this could be valid for relatedness frustration. Instead, alternative procedures that do not involve direct participants' rejection (e.g., personality descriptors) presented mixed evidence.

Recall/Imagery protocols

Four records reported effect sizes related to the use of recall methods (Austin, 2019; Legate et al., 2021; Valshtein, 2020; Zeng, 2020). These procedures consisted of asking participants to recall a positive (e.g., inclusion; altruistic behaviour) or a negative (e.g., ostracism) relatedness experience, comparing resulting levels of relatedness satisfaction and frustration in different group conditions. Findings for these studies mostly evidenced that groups asked to recall positive relatedness memories, and characterised by abstract construal approaches (Zeng, 2020), presented higher relatedness satisfaction than neutral conditions but also that groups that were asked to recall ostracism-related memories (active or passive) had higher levels of relatedness frustration than positive or neutral conditions. In contrast with the previous procedures examined, some of the effect sizes for these studies were small to moderate. For example, Austin (2019) reported an $\eta p^2 = .06$ related to the effect of memory group condition, indicating a low/moderate portion of variance explained. This was also reflected, in the same study, by a small Cohen's d related to the difference in relatedness satisfaction between the group that recalled a positive relatedness memory and the neutral group ($d = .42$). Similarly, the evidence that abstract recalling was linked to higher relatedness satisfaction than concrete recalling (Zeng, 2020), showed a very small variance related to the group effect (ηp^2 ranging from .01 to. 02). Small effects sizes were also shown by Valshtein et al. (2020) in their studies employing a paradigm of metacognitive threat, in relation to group differences in manipulation checks assessing feelings of being loved (ds < .50).

The only exception to the previous evidence is represented by Legate et al. (2021), who reported high effects sizes linked to recall methods, but for the manipulation of relatedness frustration. In particular, Legate and colleagues found that groups recalling experiences of active or passive ostracism ($M = 2.39$ [$SD = 0.82$] to 3.75 [$SD = 0.86$]) had

higher levels of relatedness frustration than groups recalling neutral memories (M = 1.38; SD = 0.82), with all the group differences presenting large effect sizes (ds > 1.00). Considering that in this last case relatedness frustration was assessed on a Likert scale ranging from 1 to 5, it can be noted again that some of the differences among groups' means and related standard deviations are small, and the large effect sizes reported might not always reflect a relevant difference in relatedness for all the groups, point that will be further discussed.

Overall, the effect sizes reported for recall methods seem to suggest that on one side this procedure could be weaker than others explored in the present chapter, at least for the manipulation of relatedness satisfaction. On the other side, this is the only procedure described that seems also to show large effects on relatedness frustration, despite these not always being reflected by relevant group differences.

5.3.5 Summary of the results

The results described in the previous sections demonstrate that all the manipulation protocols reported were effective in affecting levels of relatedness. However, this was valid only for relatedness satisfaction, whereas more evidence is needed that protocols effectively manipulate relatedness frustration, which was assessed just in four studies. For direct manipulation of relatedness, the procedures more frequently described were experimental instructions and recall/imagery tasks paradigms. While instruction-based paradigms did evidence successful manipulation of relatedness satisfaction, manipulation was not effective in the only case where relatedness frustration was assessed (Thomas, 2015). Imagery tasks were successful in inducing relatedness frustration in one study (Bagheri & Milyavskaya, 2020).

Twelve studies manipulated relatedness indirectly through relational constructs. Of these, five were not linked to relatedness under the framework of SDT but reported indirect manipulation of the need of belonging, most frequently via manipulation of ostracism. Procedures here mostly involved online tasks (e.g., ball tossing, fake interview) where participants could be ostracised or be the ostracisers. Ostracism consistently successfully impacted relatedness, irrespective of whether it was active or passive. In one case (Daniels, 2012), being ostracised was linked to lower relatedness satisfaction, also compared to conditions of negative interactions with

confederates. However, the majority of the studies manipulating ostracism evidenced effects on lower levels of relatedness satisfaction, with relatedness frustration measured only in one study involving a recall task (Legate, Weinstein, & Ryan, 2021). Two studies reported the manipulation of social exclusion through the induction of negative self-belief in participants (e.g., fake personality descriptions, fake career-based rankings), with social exclusion showing a negative impact on relatedness satisfaction; on the other hand, prosocial behaviour, acted or recalled, was reported as successful in increasing relatedness satisfaction. More domain-specific positive manipulations involved the exposition to messages of body-related acceptance, schadenfreude, and being listened to, all of which increased relatedness satisfaction.

The third group of studies manipulated non-relational constructs. These studies mostly involved manipulation of other basic psychological needs: paradigms based on competence involved the manipulation of feedback (positive or negative) or task difficulty; the need of autonomy was manipulated through controlling or autonomy-supportive language. Other records employed manipulation of factors unrelated to SDT (e.g., social status, and construal level). Finally, one study, specific to the organizational domain, assessed the impact of different kinds of employers/employee relationships, finding the "spot contracting" to have a negative effect on relatedness satisfaction. All the studies manipulating non-relational construct were effective in positively or negatively impacting relatedness satisfaction; however, no significant effects on relatedness frustration were identified (assessed in only one study that manipulated construal level: Zeng, 2020).

A general discussion of effect sizes of the mostly employed protocols evidenced that instructional paradigms could be particularly effective in the manipulation of relatedness satisfaction, along with online tasks based on deceptive interactions (e.g., Cyberball), that seem also promising for the manipulation of "negative" aspects of relatedness (e.g., frustration), though these were not assessed with validated instruments. In contrast, evidence on the effectiveness of recall methods seem to be less strong, though showing promising results for the effect of "negative" recalling on relatedness frustration.

5.4 Discussion

Overview

The purpose of this scoping review was to assess the effectiveness of experimental manipulations of relatedness. Four key findings were identified. Though a variety of procedures effectively affect relatedness satisfaction (Finding 1) there is limited evidence concerning how to impact relatedness frustration (Finding 2). First, because frustration was assessed in only four studies; and second, because when frustration was assessed, procedures of manipulation were not always effective. There is some promising evidence that manipulations based outwith self-determination theory protocols can effectively manipulate relatedness (Finding 3), and that relatedness can be influenced by altering non-relational elements of a protocol (Finding 4). Given that previous researchers (e.g., Chester & Lasko, 2021) have underlined the importance of ensuring that experimental manipulations causally affect the intended psychological construct, I argue that more evidence is needed about the construct validity of procedures directly manipulating relatedness frustration. Equally, given the focus of this thesis, I suggest researchers should consider more frequently checking manipulations using both perceived thwarting or support measures (e.g., through manipulation checks), as well as need satisfaction and frustration measures (e.g., through validated scales), to explore both the relative functional significance of manipulations (i.e., the extent to which they are perceived as thwarting or supportive) and the relative impact of these perceptions on participants' needs (i.e., the extent to which in turn this results in need satisfaction or frustration). Here, I discuss the key findings and my subsequent recommendations in turn.

Finding 1: There is strong evidence of successful manipulations of relatedness satisfaction.

Overall, the review identified multiple successful approaches to manipulating relatedness satisfaction using direct and indirect, and interactive and non-interactive, methods mostly presenting, when assessed, large effect sizes. These included the use of: instructions (e.g., Kaefer & Chiviachowsky, 2021; Kanat-Maymon et al., 2015; Sheldon & Filak, 2008; Thomas, 2015), actions promoting social contact and acceptance (e.g., pro-social behaviour and listening, both for recipients and actors;

Miles & Upenieks, 2021; Weinstein & Ryan, 2010), recall tasks (e.g., Austin, 2019), and scenario imagery (Bagheri & Milyavskaya, 2020).

There were some subtleties to the findings, furthering my claim that both environmental and individual-level variables can influence the potency of thwarting experiences. For example, evidence emerged that feelings of relatedness could be influenced not just by receiving or acting a pro-social behaviour (e.g., helping someone or donating money), but also by the underlying motivation. In particular, when choice to help (autonomous vs controlled) was manipulated as part of the procedure, both actors and recipients of autonomous help showed higher relatedness satisfaction than when help was controlled. However, this is also in line with previous studies with a focus on autonomy (Frey & Meyer, 2004; Gagnè, 2003) and could indicate that in some paradigms the interdependency between autonomy and relatedness is more evident, making more difficult to assess their separate contribution. Similarly, in one of the studies included (Itzchakov & Weinstein, 2021), relatedness satisfaction failed to mediate the relationship between being listened (by a confederate) and self-esteem when the need of autonomy was simultaneously modelled. Importantly, and in line with previous experiments of this doctoral thesis, the finding was explained with the need of relatedness being less relevant for dyads of strangers (participant-experimenter). The other procedures examined in the scoping review and involving interaction with an experimenter were all effective in producing differences in the levels of needs satisfaction.

Finding 2: There is little evidence concerning successful manipulations of relatedness frustration.

In contrast to relatedness satisfaction, effects of manipulations on need frustration were infrequently tested, were unsuccessful (e.g., for instructional paradigms) or had no or limited replications (e.g., scenario imagery; Bagheri, 2020). Compatibly with this, needs frustration and lack of needs satisfaction are theorised as two different conditions in the SDT framework: the first related to general feelings that needs are not met by a context; the second, related to contexts that actively undermine the needs (e.g., exclusion from a group, Bartholomew et al., 2011a). As such, the relationship between needs satisfaction and needs frustration is considered asymmetrical, with needs frustration always implying lack of needs satisfaction, but absence of needs satisfaction not

necessarily being linked with needs frustration (Olafsen et al., 2021; Vansteenkiste & Ryan, 2013). Being two separate constructs, I suggests that the manipulation of needs satisfaction and needs thwarting could require the employment of different procedures.

Focusing briefly on promising though isolated positive findings, there is support for the effectiveness of procedures based on imagery and recalling, both in the direct manipulation of relatedness frustration, and through other relational aspects like pro-social behaviour and ostracism. This is supported by research evidencing that imagery can support needs in the earlier stages of development, with types of active play imagery associated with fulfilment of different basic psychological needs in children, and specifically social imagery associated with relatedness (Tobin et al., 2017). More generally, experimental procedures involving guided scenarios (e.g., vignettes) have been shown to be effective in inducing belonging threat (Smith et al., 2017) and to elicit emotional arousal compatible with their valence, with positive vignettes linked to positive emotions and vice versa (Usée & Lüdtke, 2020). Furthermore, though there is debate on the comparability between effects of memories and online tasks, because in the first case processes of meaning and understanding could potentially alter the quality of the recall (Baumesteir et al., 2007), there is support in literature for the effectiveness of recall procedures in retaining the feelings linked to basic psychological needs satisfaction and frustration. For instance, Philippe et al. (2011) found that memories retain the degree of needs satisfaction experienced during past events. In addition, a study conducted on ex university students showed that participants referenced elements related to basic psychological needs when describing both pleasant and unpleasant memories concerning their previous university career (Janke et al., 2021).

The mentioned mixed evidence concerning recall methods is mirrored by the effect sizes of the studies reported in the present scoping review, that overall seem to suggest a weaker effect of the procedure on relatedness satisfaction and that, however, evidenced larger effect sizes when concerning manipulation of relatedness frustration. An interpretation of these mixed findings could consider the type of memory that the studies of the scoping review asked participants to recall: for example, Austin (2019) and Valshtein et al. (2020) asked participants to recall positive relatedness memories (e.g., occasions where participants felt included/loved), despite Valshtein and

colleagues increased the number of memories to recall in relatedness thwarting conditions. Instead, Legate et al. (2021) manipulated relatedness frustration directly asking participants to recall negative memories (e.g., occasions where participants felt rejected/excluded). There is evidence in literature that negative events are more accurately remembered than positive events (e.g., Kensinger, 2009; Ochsner, 2000), and this could help to retain the degree of relatedness satisfaction/frustration experienced. This could explain why Legate et al. (2021) found larger effect sizes that were applicable to relatedness frustration, compared to other studies based on the same procedure. However, caution in the interpretation of these data is suggested, for the evidence that overall large effect sizes were not always reflected by large group differences in mean scores, point that will be also considered among the limitations of the present scoping review. Overall, it is reasonable to conclude that procedures based on imagery and recalling show some promise for the effective manipulation of both relatedness satisfaction and frustration, though the evidence is less strong compared to other procedures and further evidence could be needed, that also considers content and valence of the recalling/imagery.

Overall, there may be multiple reasons why paradigms that effectively influenced need satisfaction (e.g., instructional paradigms) were mostly unable to do the same for frustration. First, from an SDT perspective, the need of relatedness is not merely linked to having social relationships, but it is also formulated in terms of quality of the relationship, including dimensions of closeness, connectedness, and caring (Martela & Riekki, 2018; Ryan, 1995). Therefore, as previously hypothesised, relationships with experimenters or confederates could lack depth and familiarity for participants to perceive that those relational dimensions are present, and subsequently actively thwarted. There is mixed evidence regarding this hypothesis, with some studies demonstrating that rejection from strangers could be less hurtful and cause less negative feelings than rejection from established relationships (Leary et al., 1998; Rajchert et al., 2019); in contrast, Snapp and Leary (2001) found that being familiar with a source of rejection could protect people from experiencing negative feelings, because the relationship could be perceived as more secure. Nevertheless, the scoping review also showed some evidence that perceptions of needs frustration might be influenced by factors related to social status (e.g., role assigned; Jackson et al., 2015). In this sense, familiarity is likely to not be the only factor to consider that could affect frustration in interactions occurring during an experimental

setting, but the difference in status with confederates or other participants taking part in the experiment might as well play a role. This is as well supported by studies assessing the impact of differences in power in relationships, with power defined as the feeling of influence or control over other people (Halevy, Chou, & Galinsky, 2011). In particular, there is evidence that people in condition of low power tend to experience more negative emotions (Keltner, et al., 2003) and are more sensitive to perceptions of threat in ambiguous social interactions (Schwartz et al., 1993), compared to people in higher positions of power. Furthermore, low power priming (through a recall method) has been linked to indices of stress, such as fear of negative evaluation and physiological arousal (Schmid & Mast, 2013). Similarly, but more in relation to the concept of autonomy and control, two studies of this scoping review (Lou & Noels, 2020; Weinstein & Ryan, 2010) included interactions with confederates that had power on participants (e.g., could decide the amount of money allocated, or could determine participants to fail an exam) showing good effects on relatedness satisfaction.

Following the evidence mentioned, it is argued that more studies should test the effect of the factors highlighted on relatedness frustration, comparing different levels of familiarity of the interactions occurring during the experiment, and/or including experimental tasks where confederates (or other players) interacting with participants are in a higher position of power (e.g., could decide whether participants receive a payment or not; could determine failure to a relevant task). The limited effectiveness of instructional paradigms on needs frustration could also be explained by the conceptual and empirical difference between active rejection and negative forms of relationships. The first case involves active forms of rejection (e.g., ostracism) or exclusion, where individuals are prevented to connect; in the second case, the relationship could have negative value, such as in cases of perceived de-evaluation and disregard, but individuals are not removed from the social bond (Daniels, 2012; Leary et al., 1998). I argue that while active rejection could be associated with increased relatedness frustration, negative social bonds could be more linked to lack of relatedness satisfaction, particularly in controlled experimental settings where the negative interaction does not involve aspects of abuse or violence that could be more intensely perceived as thwarting. This argument finds support in the scoping review, with Daniels (2012) finding that when compared, relationships characterised by

rejection (with participants being ostracised or ostracisers) were associated with lower levels of relatedness satisfaction than negative interactions with confederates. At this regard, methods to integrate the instructional paradigms emerged in the scoping review: for example, Pavey et al. (2011) added a relatedness priming task to the manipulation of task instructions. This procedure could strengthen the relatedness manipulation without involving interaction with the experimenters, though its effect should be tested (and measured) also for relatedness frustration.

Finding 3: Protocols based on non-SDT frameworks have promise for successful manipulation of relatedness and aligned concepts.

More evidence about the adoption of effective methods of relatedness manipulation came from studies manipulating other relational constructs. A relevant aspect to consider is that in these studies procedures of manipulation seemed to be similar, regardless of whether the variable considered was relatedness or belonging. Possibly due to their parallel development, there is lack of formal distinction between these two concepts in literature, and the preference for one or the other is mostly not theoretically justified in the studies included in the present scoping review. Both SDT (Deci & Ryan, 2000) and the belonging hypothesis (Baumeister & Leary, 1995) theorise relatedness/belonging as an innate and universal human need, with the need of belonging more characterized as evolutionary. Ricard (2014) highlighted that SDT, and subsequently the need for relatedness, are not just focused on the process of forming relationships, but also on the quality of the relationships and the motivational factors underlying these. Related to this, in Baumeister and Leary's work (1995) a sufficient number of positive relationships is theorised as reducing the chance for individuals to form new social bonds, and though long-term relationships are deemed to satisfy belonging to a greater extent, this is linked to the difficulty of replacing shared experience or intimacy and does not have motivational foundations. Despite this difference, both frameworks argue that lack of relatedness/belonging or thwarting of these needs has negative consequences on well-being (e.g., Bartholomew et al., 2011b; Baumeister et al, 2007; Baumeister et al., 2005; Gillet et al., 2012). However, in the SDT framework the distinction between unsupportive and thwarting environments, and subsequently between lack of needs satisfaction and needs frustration, is more clearly theorized, and this is also reflected by the findings of this scoping review, where a greater variety of psychometric instruments emerged to

separately assess the two constructs; whereas instruments of assessment of the need of belonging mostly use aggregate scores of satisfaction and frustration (e.g., Williams, 2007). However, despite relatedness and belonging present differences related to their theorization, these were negligible, when considering the similarity of procedure and factors impacting the two constructs in experimental settings, as shown in the scoping review here presented.

Among the protocols not based on SDT, effective experimental procedures included the manipulation of ostracism through rejection (being or doing) in the context of online tasks (e.g., ball-tossing/fake interview), or more general feelings of exclusion by inducing negative social self-belief in participants, with personality descriptions emphasising future loneliness in life, or negative evaluation of personal goals. Indeed, despite these procedures emerged in the present review only for the manipulation of relatedness or belonging satisfaction, they were overall consistently linked to large effect sizes in the studies that employed them. Furthermore, they could have greater promise than the previous approaches described also for application to the manipulation of relatedness frustration given that they do not rely on interactions with in-person confederates or experimenters only. For example, interacting with a CPU produces comparable effects to the interaction with real people (Zadro et al., 2004), as also evidenced by the scoping review, and it is easier to mimic the presence of a real friendship group/significant others using online methods than in-person, an element I argue could be particularly important for impacting relatedness frustration. Another important feature of the paradigms manipulating ostracism, is that they have shown effectiveness also in the case participants were the ostracisers. This aspect could be relevant because the action of ostracising could be implemented independently from the quality of the previous relationship with the ostracised individuals, meaning that experimental protocols may involve also groups of strangers. This would limit recruitment-related challenges.

Of note, paradigms inducing exclusion through negative self-belief have the advantage of not requiring an actual interaction at all. Indeed, compared to the more specific concept of rejection, people can experience social exclusion without making an attempt to connect (Blackhart et al., 2010). From an experimental perspective, these forms of manipulation work on decreasing levels of relatedness/belonging satisfaction, though, as already addressed in study 2, the absence of an explicit

rejection by a perpetrator could imply that these procedures might not work for manipulating relatedness frustration. This risk is partially supported by evidence of this scoping review, having found that despite presenting large effect sizes, procedures like providing fake personality descriptions (life-alone paradigm) could be linked to minimal differences in relatedness among groups (Ricard, 2014). However, cautiousness should be applied around these conclusions, concerning just one study utilising this procedure. There is evidence in literature that the life-alone paradigm could be effective in inducing negative affect in participants, such as feelings of dislike and aggression (DeWall et al., 2009), also in comparison with conditions where the prediction concerns a general bad news (e.g., the possibility to have a severe accident; Twenge et al., 2001). As such, procedures inducing exclusion through self-belief could be effective in manipulating relatedness, and specifically relatedness frustration, if the exclusion is perceived as an actual interpersonal interaction.

Finding 4: Relatedness is sensitive to change via non-relational mechanisms

Of particular interest, there were a number of procedures that affected relatedness satisfaction through the manipulation of non-relational constructs, including autonomous/controlling communication (autonomy), and feedback/task difficulty (competence). As previously discussed, the evidence that other needs could impact levels of relatedness is not surprising in the SDT framework. In particular, the interdependency between autonomy and relatedness has been already discussed in the previous paragraphs of the present doctoral work, evidencing how some aspects of relationships are more beneficial when characterized by autonomous choice and vice versa (e.g., pro-social behaviour). This can be applied to the only study of the scoping review finding a link between manipulation of autonomy and relatedness (Young-Jones et al., 2014): in the study, autonomous/controlling language was manipulated in an academic setting through interaction with a teacher. It could be possible that, when autonomy/control is delivered through an actual interaction in experimental settings, the quality of this interaction also impacts relatedness satisfaction. In addition, environments promoting autonomy alone have been demonstrated to have an important impact on self-determined motivation, that is linked to general need satisfaction (e.g., Black & Deci, 2000; Deci & Ryan, 1985a; Reeve et al., 2004; Sheldon & Krieger, 2007).

If the link between autonomy and relatedness is well established and expanded in recent SDT developments (e.g., motivation relationship theory; Deci & Ryan, 2014), the interdependency between competence and relatedness is less explored. In the current work, both task-related variables (e.g., task difficulty, level of training) and feedback impacted levels of relatedness satisfaction. In particular, playing a difficult level of a videogame had a more negative impact on relatedness satisfaction when participants had received training for the task (high competence); the result is challenging due to the absence of clear interactions during the reported experiment, and was explained with an increased task-related self-consciousness that may have affected participants' perception of their performance. However, an alternative explanation may be offered: though performance was objectively measured, it is not clear whether participants were provided with feedback, being reported that many participants asked for help, and this was provided through generic task clarification, or already known instructions. As such, the low relatedness satisfaction of the more competent participants could be due to a perceived low support in the task, or low-quality feedback. The effect of feedback type on relatedness, already hypothesised in the previous experimental studies, was also supported by other studies of this scoping review: in particular, ability-consoling feedback resulted in lower levels of relatedness than improvement-oriented feedback in an academic environment. The peculiarity of this result is that in both cases the feedback provided was negative, demonstrating that to impact the need for relatedness, the quality of the feedback provided may be more important than its valence. I argue that these could be important elements to consider, when structuring procedures of relatedness manipulation. On the other hand, relatedness satisfaction could be also affected by self-provided respect/criticism through the use of self-talk (Kyeong et al., 2020); however, this effect emerged for only for participants with low levels of life satisfaction, and the manipulation of self-respect/criticism was general, not task-specific, and also included relational aspects: here I argue that this may have influenced more mechanisms of rumination and social exclusion than competence itself.

It is worth highlighting that some included studies manipulated non-relational aspects that could potentially be integrated in procedures discussed in previous paragraphs. For example, evidence was identified that abstract construal mindset

positively impacts relatedness satisfaction when recalling pro-social actions. More generally, there is support for the influence of abstract priming (inducing participants to think about abstract aspects of a behaviour) in strengthening behavioural intent (Torelli & Kaikati, 2009). This offers interesting perspectives of implementing abstract priming not just in recall procedures (where it might show small effect sizes as evidenced by the present scoping review), but also in online tasks where participants act relatedness-related behaviours (e.g., pro-social behaviour, ostracism). I propose that, if abstract construal can benefit behaviours that are compatible with people's intentions, it could either increase satisfaction when the behaviour is pro-social and decrease satisfaction/increase frustration in case of negative social behaviour (e.g., being ostracisers). As such, manipulating construal level in "strong" experimental protocols, could increase the strength of the manipulation of relatedness satisfaction/frustration. However, this should be tested in future research, given that, when used in isolation, construal level regarding pro-social behaviour showed a small effect size, and did not directly affect relatedness frustration (Zeng, 2020).

Finally, social status was linked to lower needs, and relatedness, satisfaction, but the effect was significant just for participants perceiving responsibility for their condition (high internalization). This result showed that first, social status is not determined just by objective parameters (e.g., income), but also on subjective perception; this is supported by literature (e.g., Demakakos et al., 2008; Ghaed & Gallo, 2007; Jackman & Jackman, 1973). As such, manipulating social status could affect relatedness in a similar way and extent than inducing negative social self-belief, as previously discussed. Second, that experimentally inducing different perceptions of responsibility when participant perform or receive a social action (e.g., ostracism or pro-social behaviour), could strengthen the effects of the manipulation. I argue that this last point should be experimentally tested, given that internalization was just assessed and not manipulated in the evidence featured in this review.

Limitations and future directions

Along with the results provided, this scoping review presents some limitations to consider. First, due to the limited research available regarding manipulation of relatedness under the SDT framework, the scoping review has adopted an iterative approach for the identification of relevant papers falling outwith SDT. This is here considered a limitation

because this approach limited the use of relevant non-SDT search terms that could identify useful literature from the start, with alternative procedures for relatedness manipulation integrated and discussed a posteriori. I advocate that future research could explore concepts similar to relatedness, but linked to other theoretical backgrounds (e.g., ostracism, social exclusion), adding these to the search terms of the review.

Another limitation, related to the nature of the scoping review here presented, is that it mostly relies on the concept of significance to assess whether the procedures of manipulation identified were successful or not. As such, procedures were here reported as effective when they produced a statistical change or difference in relatedness/belonging, with effect sizes qualitatively reported and discussed just for a limited number of studies, but without statistical comparison. This is in line with the nature of scoping reviews, that are usually employed to provide a map of the evidence available around a specific issue (Munn et al., 2018) and do not include a meta-analysis as part of their results presentation (Sargeant & Connor, 2020). However, though a qualitative discussion of the effect sizes related to the most widespread procedures found here could help providing general guidelines for the manipulation of relatedness in future protocols, it presents a series of limitations that were also outlined in the previous paragraphs. First, records using similar procedures could rely on different types of effect size, related to different meanings (e.g., ηp^2 and d) and difficult to compare. Second, simply discussing the magnitude of an effect size might not provide exhaustive information about effectiveness when this applies to procedures of manipulation: Cohen (1988) developed his guidelines for the interpretation of effect sizes theorising that a medium effect size (e.g., $d = 0.5$) should reflect "an effect likely to be visible to the naked eye of a careful observer" (p. 25). The present scoping review evidenced studies where, though a large effect size was reported regarding group differences (e.g., $d > 1.00$), due to the presence of a small standard deviation, the real difference in means scores of the groups were below one point of the Likert scale of the relatedness measure employed. In other terms, a large effect size might not reflect actual tangible changes in feelings of relatedness experienced by participants following manipulation, despite the significance of the result. This issue, together with issues of reliability of the empirical basis of real population effects are widely discussed in literature, and recommendations of

interpreting effects considering the practical meanings of the psychological phenomena are provided (e.g., Baguley, 2009; Schäfer & Schwarz, 2019). Following those guidelines, and given that in the present work (e.g., study 2) the presence of low levels of relatedness before and after manipulation has represented one of the main limitations, I argue that future work could employ a systematic approach to assess effect sizes, providing more insight into paradigms' potency beyond the only evaluation of effective/ineffective, and including a statistical comparison among means/scores variations in relatedness levels.

Another limitation to consider is that, due to the established chosen criteria of selection, and particularly the decision to include just paradigms producing acute changes, the research that this scoping review examined was delimited to forms of laboratory-based manipulation. This is compatible with the interest of the work here presented, and in continuity with what experimentally attempted. However, this factor potentially decreased the ecological validity of the protocols examined, impacting the generalization of the factors here affecting relatedness to real-life environments. This issue is also increased by the demographics of the participants that the majority of the studies included. Indeed, as mentioned, 23 studies were led on students, with 19 reporting participants of age included between 18 and 26 years. As such, most of the procedures of manipulation of relatedness were led (and were effective) on participants that presented similar and peculiar demographic characteristics. I argue that developments of the present work could aim at including longer term protocols (e.g., days, weeks) that as such would take (at least partially) place outside the laboratory environment, and possibly including other categories of participants (e.g., athletes, teachers, military). Integrating these factors in the future could unearth some more ecologically valid paradigms and be useful where long-term outcomes, or the dynamics of behaviour over time are of interest. However, it is here noted that this development may work particularly for the manipulation of relatedness support, given that providing long-term thwarting presents ethical issues.

Despite these limitations, this scoping review provides with important evidence not just around successful and unsuccessful protocols, but also regarding the necessity of replicating experimental procedures in the extent which they are validated in previous work. I argue that future work implementing relatedness manipulation should ensure that experimental manipulations causally affect the intended psychological construct. Guidelines are provided by Chester and Lasko (2021) regarding the implementation of three main types of construct validity assessment that future work could implement: use

of previously validated manipulations, use of manipulation checks, use of pilot validity studies. The present review showed a lack of studies specifically assessing not just the validity of manipulation (through the use of manipulation checks), but also the impact that negative relatedness manipulations have on individual perceptions (needs frustration). This is considered an important issue specifically in the framework of SDT, mainly because, as already discussed in previous chapters, satisfaction or frustration of basic needs are theorised as a result of a process of internalization. This means that assessing whether an environment is thwarting, or the only compliance with the experimental conditions, could not be sufficient if not evidencing that the manipulation had an actual effect on individual feelings and perceptions. For this reason, I advocate that the use of manipulation checks could not be sufficient to test the success of manipulation protocols, and future experimental research should incorporate instruments assessing subsequent levels of frustration.

Chapter 6

General Discussion

6.1 Introduction

The aim of the present work was to increase understanding of the interplay between individual and situational factors determining functional or dysfunctional stress outcomes. The thesis theorized a new transtheoretical model of stress integrating basic psychological needs theory (Deci & Ryan, 2000), the biopsychosocial model of challenge and threat (Blascovich, 2008), and the five-factor model of personality (Digman, 1989; McCrae and John, 1992). It was proposed that personality factors could moderate challenge and threat appraisals in sub-optimal motivational environments, conceptualised here as situations of needs thwarting. This was tested in two experimental studies that measured cardiovascular stress indices while inducing needs frustration. Despite the differences in the procedures employed, both studies found procedures of manipulation of relatedness ineffective overall, and a scoping review was completed with the aim of revising and critically assessing previously employed procedures of relatedness manipulation.

The main findings of the thesis were: (1) frustrated basic psychological needs do not necessary lead to negative stress reactions (threat states) in the short term; (2) there is some initial evidence that some personality traits moderate the link between competence and relatedness thwarting, and challenge/threat states; (3) though procedures of manipulation of relatedness support are reported as effective in literature, there are important gaps in the construct validity of procedures manipulating relatedness thwarting;

(4) more evidence is needed regarding how to deliver effective protocols manipulating relatedness thwarting, though promising use of non-SDT based procedures (e.g., ostracism, social exclusion) is recommended.

6.2 Theoretical advancements

This thesis provides emerging evidence supporting my proposed model for understanding differential (i.e., different between individuals) outcomes of acute needs thwarting. The model contributes to theoretical advancements in the SDT framework, linking experiences of needs frustration to stress and testing this link in online tasks. Indeed, the relationship between basic psychological needs and stress has been already theorized and demonstrated in recent cross-sectional studies, particularly in educational and occupational contexts (e.g., Dirzyte et al., 2022; Rouse et al., 2020; Neufeld et al., 2020), providing evidence that needs frustration could be related to higher levels of stress and more negative forms of stress and emotional regulation. However, this doctoral thesis is one of the first works investigating needs thwarting as a series of stressful events that impact acute stress reactions, demonstrating that these outcomes could be differentiated.

This has two main implications from a theoretical perspective: first, that the long-term negative consequences of needs frustration observed in literature (Vansteenkiste & Ryan, 2013) may not always reflect the short-term outcomes; in other terms, individuals may be able to somewhat mitigate through positive appraisals and actions the negative effects of situations where they feel controlled, incompetent, or socially rejected. This supports the idea that short-term experiences of needs frustration could promote resilience and growth if effectively faced, an assumption that although present in the SDT framework has not been exhaustively tested and demonstrated (as highlighted by Ryan et al., 2019).

The second implication is that there are wider individual-level factors determining more positive or negative frustration-related outcomes for different individuals, at least in the short term. In the present work, these factors were related to specific aspects of personality; indeed, the complex effect of extraversion found in Chapter 3 suggests that some personality facets could influence frustration-related appraisals,

though there is insufficient evidence within this thesis to extend these conclusions to personality traits overall. These findings challenge existing theorizations on the link between basic psychological needs and stress (e.g., Bartholomew et al., 2017; Ntoumanis et al., 2009) that link needs satisfaction to positive stress appraisals (e.g., challenge states) and needs frustration to negative stress appraisals (e.g., threat states); the present work produced evidence that this relationship could be less deterministic than hypothesized in the past, and could also depend on the moderation of individual factors.

This change of perspective also somewhat redefines the concept of functional significance in the SDT framework (Deci & Ryan, 1985a): in Deci and Ryan's work there is recognition that motivation is determined by the psychological meaning associated to events, however pressure and tension are characterised as controlling and negatively affecting the psychological meaning. In contrast, the present thesis demonstrates that differences in the functional significance of an event can occur despite the presence of pressure and tension. This means that individual differences could not just influence whether the event is perceived as supporting or thwarting the basic psychological needs, as demonstrated by previous research (e.g., Thomas, Fadaeeva, Oliver, 2020), but also the emotional outcomes associated with subsequent needs satisfaction or frustration. Though these theoretical contributions are considered fundamental for the understanding of individual differences from an SDT perspective, it should be considered that the conclusions here drawn are tentative and the necessity for replication is advocated.

6.3 Methodological advancements

One of the main methodological advancements of the present thesis is expanding research regarding procedures that cause and capture relatedness satisfaction and frustration. This is particularly relevant for the manipulation of relatedness frustration, due to the evidenced inadequacy of existing protocols in the SDT research manipulating this aspect (Chapter 5). I suggest that this is a particularly important contribution because manipulating relatedness frustration could be challenging: first because, as already outlined in the previous chapters of this thesis (e.g., Chapter 3), it is based on social interactions that are difficult to experimentally simulate; and second, because there is lack of studies experimentally manipulating relatedness frustration under the SDT framework, and it is difficult to adapt or reverse procedures based on relatedness satisfaction. Indeed,

there is no scarcity of literature investigating or classifying techniques for the promotion of basic psychological needs satisfaction (relatedness included) in a variety of contexts, particularly in education and health settings (e.g., Gillison et al., 2019; Sparks et al., 2016; Sparks et al., 2017; Teixeira et al., 2020). However, the same techniques employed in the mentioned studies involve long-term interventions, while manipulating relatedness frustration in the long term, could undermine participants' psychological functioning (Vansteenkiste & Ryan, 2013). Related to the last point, this thesis reinforces the importance of measuring both needs satisfaction and frustration in experimental protocols manipulating basic psychological needs. This is due to the evidence (Chapter 5) that some procedures that work in reducing levels of needs satisfaction could not be sufficient in actively undermining the needs, and so could not work in inducing frustration.

Another, more context-specific, methodological advancement of this thesis is related to the adaptation of experimental paradigms to adhere to restrictions in place due to the Covid-19 pandemic. The work demonstrated that procedures involving human contact are still possible under pandemic restrictions. In particular, the use of screens, visors, time-limit in the physical contact (e.g., during placements of the electrodes) demonstrated that online designs are not the only alternative for research in challenging times. Future methodological research could assess the strength of the manipulation of social variables among restricted, non-restricted, and online procedures to compare their effectiveness.

Further advancements are related to the adaptation of procedures for the manipulation of basic psychological needs, and for the measurement of challenge and threat states, to more ecologically-valid contexts than is common in basic laboratory-based protocols. Regarding basic psychological needs, this thesis included one of the first studies attempting to induce relatedness and competence frustration manipulating the interaction with real-life teammates/friends, without using CPU-related deception (e.g., Cyberball; Williams & Jarvis, 2006). Despite the already mentioned limitations of the experimental protocol used for this purpose in this doctoral thesis (Chapter 4), the results of the scoping review here presented evidenced that making participants interact with significant people could increase the effectiveness of the manipulation. So, elements of the procedure of manipulation here described could be improved and used in future research.

With regards to the measurement of challenge and threat states, the experiment in Chapter 4 attempted to overcome difficulties in monitoring cardiovascular reactivity during tasks involving physical exertion. In previous studies, this issue led researchers to use either "speech-tasks" limiting participants' movements (e.g., Allen et al., 2012; Trotman et al., 2018) or to measure physiological indices before the task, assessing their anticipatory stress reactions (e.g., Turner et al., 2014). Instead, the second experiment of this thesis implemented the measurement of cardiovascular reactivity during a task of dart throwing, hypothesising that low levels of physical exertion could produce brief movement artifacts that could be cut from the original signal. This methodological expedient produced a usable cardiovascular signal, demonstrating that employing low exertion tasks could be a valid way to measure online stress indices in more ecological tasks, and exploring more in depth linked individual experience.

6.4 Strengths of the thesis

One of the major strengths of the present work is the level of theoretical integration. In particular, the integration between two broad theoretical frameworks, the BPNT and the BPS, allowed the study of a complex phenomenon like stress encompassing both individual and situational components. It is advocated that this integration has potential to overcome the limitations of the single theoretical frameworks employed: on one side, basic psychological needs theory recognizing the importance of elements of the environment conveying pressure, and increasing the understanding of why individuals react with challenge or threat states; on the other side, a theory of stress recognizing individual differences in appraising and reacting to situations of pressure, and increasing the understanding of how different individuals react to needs frustration. Therefore, the present thesis develops both these areas of study, and it is argued that future research could extend the work of theoretical integration, for a better understanding of individual differences in stress appraisals.

Another strength of the work is developing the study of areas that previous research has not extensively explored. One example is represented by the focus on the need for relatedness. As previously discussed (Chapter 5), in the SDT framework the study of relatedness was overlooked both from a theoretical and a methodological perspective, compared to the other basic psychological needs, particularly the need for autonomy (as

also highlighted by Sheldon & Prentice, 2019). The present thesis focused on relatedness both from a theoretical lens, attempting to explore the effect that relatedness frustration has on stress and how it interacts with individual differences, and from a methodological lens, providing an extensive study of the experimental methods aimed at manipulating and measuring the need. The same is argued for the decision to focus on needs frustration and not on needs satisfaction. Indeed, not just the conceptual separation between needs frustration and needs satisfaction is relatively recent in the context of SDT (e.g., Bartholomew et al., 2011a) and so less explored for this reason; the present work also demonstrated that a consistent number of studies tends to not separately assess frustration, also when including conditions of frustration manipulation. It is argued that both the theoretical and the methodological contributions here highlighted offer a base for future research to explore in depth and filling the evidenced gap in the SDT literature.

Finally, the thesis employed a wide range of methods and perspectives. In particular, the experiments included the measurement of both psychological and physiological aspects, collecting both explicit and implicit measures. Different procedures of deception were explored, either directly from the experimenter or attempting to induce it through group rejection. Furthermore, wide theoretical and methodological reflection was provided first with the formulation of a transtheoretical model, and second, with a scoping review that focused on methodological aspects. It is argued that the variety of procedures of investigation employed provides depth and valuable insights on multiple levels, subsequently offering a base to further explore issues related to stress, basic psychological needs, personality, and individual differences from several perspectives (e.g., theoretical, cognitive, physiological).

6.5 Limitations of the thesis

One of the main limitations of the present work is that, despite the model formulated offering an important contribution to the study of the interaction between individual and situational factors affecting stress, it focuses just on some of the elements that could affect this interaction. For example, it overlooks the influence of past experience. As already seen in the introduction chapter of this work, previous experience with stressors could determine subsequent positive or negative stress

appraisals (Holt & Dunn, 2004; Ntoumanis et al., 2009). In the present thesis previous participants' experience with the experimental tasks was not assessed nor its influence outlined in the model. Despite this, the importance of the factor was considered, and some measures were put in place to minimize its influence. Indeed, both the experimental tasks were structured as "new" for participants: the first experiment was led on first-year undergraduate students, that had a lack of familiarity with university-related assessments; while the darts task of the second experiment involved the use of the non-dominant arm, and an increased distance from the dartboard. Despite the use of unfamiliar situations, it should be considered that participants could still have familiarity with stressors related to needs frustration, such as exclusion and negative feedback, and could have developed strategies to cope. While familiarity with the task could be assessed and controlled, assessing previous experience with exclusion or negative feedback could be more problematic from an ethical perspective. It is argued that future research could incorporate past experience in the form of general levels of needs satisfaction/frustration or assessing aspects of competence and relatedness, such as self-efficacy.

Another limitation of the thesis is that due to the interruption of the second experiment, some assumptions of this work could not be experimentally proved. For example, in the first experiment basic psychological needs were not successfully manipulated in separate conditions and needs were all manipulated at once as part of the procedure. Furthermore, the second experiment should have extended the first also involving an experimental task and a type of relatedness manipulation with increased ecological validity. Despite the scoping review addressing issues of manipulation from a narrative perspective, the effect of the planned methodological improvements could not be observed from a positivistic lens. This implies that the results of the first experiment are difficult to extend to more ecological contexts without replication.

A further limitation of the thesis is in the limited demographic of the sample that took part in the research. Indeed, both experiments were led on university students (or students/athletes), and they were mostly Caucasian and based in the United Kingdom. Despite these demographic characteristics are very commonly found in samples used in similar studies (as evidenced in Chapter 5), the lack of diversity could be particularly relevant when considering the study of stress and individual differences. There is evidence, for example, that some demographic characteristics influence perception of stress and individual responses. For example, a higher percentage (60%) of British young

people (18-24) is reported to be affected by stress related to pressure to succeed, compared to other age ranges (Mental Health Foundation, 2018). Considering that the present work assessed stress in relation to academic and competitive tasks, and the young age of the sample (18-23), it is possible that participants were more sensitive to the kind of stressors assessed. On the other hand, there is evidence that groups that are underrepresented in this thesis, such as ethnic minorities, could be characterised by a higher stress exposure (Brown et al., 2018; Mental Health Foundation, 2018; Van Borthel et al., 2022), and face peculiar relational stressors (e.g., discrimination; Hackett et al., 2020). It is argued that these factors could influence the perception and coping strategies in place when facing needs thwarting, and as such, caution should be exercised with the generalizability of results and conclusions of the present work to the wider population.

Finally, a limitation of this thesis is that most of the experimental work was conducted during the Covid-19 global pandemic. This represents a limitation from different perspectives. First, it impacted availability of participants, and the ways the experimental design was adapted to the pandemic restrictions. Despite the last point, as addressed in the previous paragraphs, could also represent a methodological advancement, the use of masks, visors, and screens during the experiments could have impacted the social interaction, affecting the manipulation procedures in ways that could be difficult to predict, given the peculiarity of the circumstances. Second, it limited the chance to amend procedures or correct accidents occurring during the experiments: for example, given the reduced amount of direct contact with participants that was possible under ethical regulations, electrodes could not be replaced or re-attached in case of persistent issues, causing the exclusion of some participants' data from the study. Third, pandemic stress could impact participants' sensitivity to the experimental situation, influencing subsequent stress reactions. Despite the fact that the risk of global events or everyday stressors impacting participants mental status is considered universal, this last limitation is another reason to advocate for the necessity of replication.

6.6 Ethical considerations

All the studies in the thesis were conducted in line with the ethical guidelines of the Department of Sport and Exercise Sciences at Durham University. All the experiments obtained Durham University's ethical approval prior to data collection. The research conducted did not use vulnerable participants or participants under the age of 18, and full informed consent was obtained from participants before taking part in the experiments. There were two aspects of the ethics that were more challenging and required additional reflection. First, the use of deception as part of the experimental procedure, with subsequent exposure of participants to needs thwarting. Guidelines for psychological research in the U.K. (e.g., British Psychological Society ethics code; Oates et al., 2021) specify that consent should be provided after giving participants sufficient information to enable them to make a choice. In the experiments conducted, deception about the interaction with the experimenter was deliberate and necessary to capture spontaneous reactions to needs thwarting; however, participants were informed in advance of every activity to undertake and were also informed of the possibility of experiencing stress during the procedure, with the invitation to not take part in case of specific vulnerability. As previously discussed in this work, experiencing needs thwarting could impact individual well-being (Deci & Ryan, 2000; Sheldon & Bettencourt, 2002; Vansteekiste & Ryan, 2013). However, the exposure to needs thwarting was adapted from previous studies (e.g., Thomas et al., 2018) and aimed to induce short term, acute, and minor changes in well-being, consistent with daily experiences. Participants were also fully debriefed after completing the experiment and reminded of the chance to withdraw their data. No participants reported discomfort with the experiment or withdrew from the data collection.

A second aspect that was ethically challenging was related to the organization of in-person experiments during the Covid-19 pandemic. Indeed, both experiments took place at different stages of the Covid-19 outbreak, with the first starting in November 2020, and partially overlapping with the U.K. national lockdown, and the second starting in November 2021, at the start of the omicron-variant outbreak. This impacted the severity of the risks related to the research, and subsequently the number of measures and precautions needed to minimize potential harm to participants and researchers. In particular, during the first experiment a research protocol and a separate risk assessment

were developed compatibly with the national rules and the laboratory's health and safety regulations. Participants were requested to provide self-certification regarding health and absence of any Covid-19 symptoms in the previous 72 hours; participants, experimenter, and lab technicians wore face coverings and a visor for the entire duration of the experimental session; electrodes for collection of physiological measures were placed by either the experimenter or the laboratory technician with the use of gloves, and close frontal contact was restricted to a maximum of 2 minutes; all the equipment, surfaces and relevant areas of the laboratory were disinfected before and after each participant, and 30 minutes time passed between the end of a session and the start of the next. During the second experiment some of these measures were lessened compatibly with national regulations and the decreased severity of the emergency, but the use of masks, distancing, and frequent cleaning of the lab spaces were maintained. Despite from a reflective perspective there was a degree of uncertainty related to dealing with unprecedent times, the measures were rigidly applied, and were effective in minimizing the risks. Indeed, neither the participants, the experimenter or the laboratory technicians contracted Covid-19 over the duration of the experiment.

6.7 Applied recommendations

It is argued that the results presented in this work could produce a series of applied recommendations. In particular, evidencing that the relationship between needs frustration and subsequent adaptive or maladaptive appraisals could be influenced by individual differences could have important implications for the promotion of mental health in a variety of settings. For example, it could help identifying vulnerable individuals or individual characteristics in settings as education, workplace, or sport, for the purpose of providing targeted support when some stressors (e.g., relational) are predominant. This has important implications for psychological practice (e.g., counselling), and offers opportunities for integration with already existing techniques of intervention. For example, there is emerging evidence that irrational beliefs, theorised as dispositional dysfunctional cognitions (Turner, 2016), could be linked to more detrimental stress appraisals (Dixon et al., 2017; Evans et al., 2018). It is argued that knowing more about individual factors (e.g., personality) and characteristics of

the environment triggering irrational beliefs (e.g., needs thwarting) could inform mental health professionals about the content of dysfunctional thinking patterns (e.g., perceived needs frustration), helping the structuration of intervention (e.g., Rational emotive behavior therapy [REBT]; Ellis, 2005).

Furthermore, evidencing that some characteristics could be instead protective in the presence of acute experiences of needs thwarting, could also contribute to the identification of individual areas of strength, for the purpose of maximizing their impact in contexts of high stress exposure. Important implications of this involve the focus on the individuals and their functional characteristics in the context of psychological intervention, as already illustrated for factors of vulnerability; in addition, it could be informative on how to manipulate environmental demands for the purpose to deliver optimal challenge and facilitate positive stress responses. For example, training protocols could be structured with the aim of increasing demands of the environment and providing acute and short-term experiences of needs frustration in order to trigger challenge responses under pressure. Though not from an SDT perspective, this principle already guides the structuration of training programmes for stress desensitization in performance contexts (e.g., Driskell et al., 2014; Johnston & Cannon-Bowers, 1996; Fletcher & Sarkar, 2016). However, I advocate that training programmes should carefully consider the intensity and duration of needs frustration exposure, given the already discussed detrimental effects that this could have in the long term (Vansteenkiste & Ryan, 2013).

Applied recommendations of the present work also derive from the evidence of the scoping review about what factors facilitate relatedness satisfaction and what instead cause perception of relatedness frustration. Apart from the already discussed deliberate use of needs-based techniques for the purpose of intervention and training, the evidence that more subtle factors, not totally aligned with relational aspects, could have a significant impact on the perception of relatedness, opens to a series of applied reflections. On one hand, this evidence could help the study of organizational dynamics for the identification of factors facilitating well-being or ill-being in contexts like workplaces or sport. On the other hand, this could have wider implications on ways to promote relatedness in the general population, particularly when delivering or communicating guidelines and social messages. One example is represented by the evidence that compliance to Covid-19 guidelines was affected by levels of communication-related autonomy support (Martela et al., 2021). It is argued that the reflection could be extended

to the need for relatedness, taking into consideration some of the factors highlighted in this work.

6.8 Future directions

Separation of the effects of basic psychological needs. The thesis showed partial evidence that in presence of competence or relatedness frustration, some aspects of personality could moderate subsequent stress appraisals. The effect of each need on stress was separately assessed, but basic psychological needs were not separately manipulated, and the experiment attempting to create separate conditions was interrupted. I propose that future developments of this work should not just separately assess basic psychological needs frustration, but also separately manipulate the needs for autonomy, competence, and relatedness to assess their unique contribution. Indeed, there is evidence that each of the needs combines and has separate influence on levels of well-being (e.g., Reis et al., 2000; Sheldon et al., 2001); conversely, there is also evidence that needs are highly correlated (Martela et al., 2023). In the experiments of the thesis, general levels of needs frustration did not predict differences in perceived stress, a result that leads to the hypothesis that the contribution of competence and relatedness frustration could be somewhat separated. However, limitations have emerged about procedures of both needs manipulation across the studies, and it could be useful to take these into account, to develop guidelines for the improvement of future protocols. Considerations around the need of competence are provided here, specifically considering the necessity of separating its manipulation from relatedness. Instead, specific guidelines for the manipulation of relatedness frustration will be illustrated in the next paragraph.

Regarding the need for competence, the thesis has shown that a successful manipulation could be obtained through presenting the task as difficult for participants, and providing negative feedback, in line with previous manipulation attempts (e.g., Sheldon & Filak, 2008). However, the thesis has also shown that some improvements could be needed in increasing the magnitude of the effects observed (e.g., producing a greater difference between groups that received/not received the manipulation), and that there could be some issues in separating the effects on competence and relatedness when using the mentioned protocols. Linked to the first

problem, literature around the theorisation of competence emphasises that fulfilment of this need is based on the concepts of challenge and skill (Cerasoli et al., 2016): this means that to feel competent one should perceive both that a task is challenging enough, and that they possess the skills to deal with it. While difficulty and negative feedback could be linked to the aspect of skill, I argue that to increase the feelings of competence frustration, protocols should take into consideration also the aspect of challenge. Based on previous considerations (Chapter 4), this could involve manipulating difficulty and feedback of tasks that are self-relevant (e.g., related to personal goals) or which failure could determine a self-relevant consequence. The second problem, linked to the overlap between effects on competence and relatedness, could be addressed not providing negative feedback or information on task difficulty through an interaction, which could have consequences on the relationship (e.g., Skipper & Douglas, 2015), but manipulating "objective" aspects of the task: for example, asking participants to match a very high score, or to equal an unrealistic performance. In the sport context, these considerations could involve using a task related to the main sport played by participants, which failure might have negative consequences (e.g., exclusion from the starting team, financial loss), and manipulating task difficulty and related feedback through the use of fake scores/rankings to match.

Through the separation of the needs-related effects, future research could help to establish whether individual differences determine specific sensitivity to competence and relatedness, or whether there are interaction/mediation effects to consider.

Development of valid procedures for the manipulation of relatedness frustration. This work evidenced the lack of specific and valid protocols for the experimental manipulation of relatedness frustration. As reinforced in previous paragraphs of this chapter, developing procedures aimed at recreating challenging social circumstances from an experimental perspective, could help the understanding of individual strength and vulnerability that could inform techniques of support and intervention. As such, I suggest that future research should expand the present findings, elaborating SDT-based techniques for the manipulation of relatedness frustration through the validation of procedures that have been shown promising in this work. In particular, future work, including replication of the findings here outlined, should consider the following points:

1. Procedures based on “online tasks” (e.g., Cyberball) have overall presented good evidence of success for the negative manipulation of relatedness, also reflected by effect sizes. Applied to the sport context, this could involve the organization of a sport-based task, as already attempted in the second study of the present thesis, but possibly self-relevant for participants/athletes.

2. Findings across all studies seem to suggest that interacting with the experimenter might not be always sufficient to induce substantial changes in levels of relatedness frustration. As such, I suggest that future work should aim at inducing frustration through interactions with significant people; this can include (true or simulated) interactions with other participants/confederates/figures that are relevant for participants. On the other hand, based on the evidence that differences in social power can affect emotions and social evaluations (e.g., Schmid & Mast, 2013; Schwartz et al., 1993), the relevance of the interaction could also not be just “emotional” (e.g., familiarity) but also “practical”, impacting the task through imbalances in status or power. Examples of this could consist in deceiving participants to believe that the social interaction with confederates/significant people could determine a disadvantage (e.g., loss of a payment, impact on grades, etc.). In the sport context, interactions with significant people could involve simulating rejection from other players, or from other sources that hold power in the sport relationship (e.g., coaches). However, as already highlighted in Chapter 5, the concept of power could present some overlap with the concept of autonomy under the SDT framework; for example, in the sport context the use of rewards, personal control, and negative conditional regard by coaches are considered dimensions of controlling interpersonal style (Bartholomew et al., 2010): this was associated with frustration of all the basic psychological needs (e.g., Bartholomew et al., 2011a; González et al., 2017; Sevil-Serrano et al., 2021). As such, paradigms manipulating differences in status, power, or control, should consider issues in separating the effects of autonomy and relatedness thwarting.

3. Paradigms including explicit rejection (e.g., ostracism) seem to show stronger evidence of success compared to indirect exclusion (e.g., Ricard, 2014) and recall/imagery methods overall, as supported by both the greater number of replication attempts, and the consistent presence of large effect sizes, though this was not tested specifically on relatedness frustration. As such, it is recommended that

future work include tasks where the rejection comes directly from the source (e.g., through the use of deception or confederates) and not induced indirectly or communicated by third parties (e.g., Study 1 and 2). In the sport context, this could involve giving instructions to other players taking part in the research to exclude a participant from a task/team up with other players (in a similar way to the interview protocol developed by Daniels et al., 2012), or making the rejection coming from a third party, but relevant for the task (e.g., coach/confederate). In cases where it is necessary to use a recall/imagery method for ethical reasons, or for characteristics of the task (e.g., measurement of physiological indices), there is support that these procedures could be more effective in manipulating frustration when the event to recall/imagine has negative characteristics (e.g., an explicit rejection).

All the guidelines provided regarding future developments for the manipulation of relatedness frustration should consider the use of methods for assessing the construct validity of the procedures used, such as including manipulation checks and instruments for the specific measurement of relatedness frustration during the experiment (Chester & Lasko, 2021). Additional developments could come from expanding the breadth of the review included in this work, overcoming some of its limitations: on one side, drawing to a greater extent from non-SDT based protocols for the negative manipulation of relational variables; on the other hand, integrating the present narrative (and critical) approach and including a metanalysis of the effect sizes linked to procedures reported, at the purpose of strengthen the recommendations based on the effectiveness of the manipulation.

Expanding individual differences. Some evidence has emerged that aspects related to personality could moderate the relationship between needs thwarting and subsequent stress appraisals. In the present work the Big-Five personality model (BFM; Digman, 1989; McCrae & John, 1992) has been used as the framework of reference for the exploration of individual differences. This choice reflects the wide range of research and applied contexts (e.g., sport, workplace, education) where the model has been employed, with the chance to test or replicate results and assumptions of previous work (e.g., Allen et al., 2012; Thomas, Fadeeva, & Oliver, 2020). However, I argue that future research should expand on the individual factors considered or include the study of other individual dimensions. This is due to several reasons. First, in the present work just one personality factor showed an effect of moderation between needs frustration and stress appraisal:

though this is preliminary evidence, and the necessity of replication is advocated, this may indicate that some personality facets could be more relevant in moderating stress reactions than others. Linked to this, a useful research direction could be investigating more specifically the personality facets linked to the Big Five factors, specifically the factor of extraversion, as included in the NEO Personality Inventory-Revised (Costa & McCrae, 1992). Second, there are several other personality traits that could be more relevant for assessing the impact of stress-related processes in performance settings. For example, a review by Laborde et al. (2019) already mentioned in the previous chapters, evidenced that some personality dimensions, such as rumination, optimism, and narcissism, could be independent from the Big Five facets in the sport context. As such, the necessity of exploring other dimensions of personality, potentially more problematic for stress appraisals (e.g., rumination) is advocated. Third, other models related to individual differences could better reflect individual responses to situations affecting basic psychological needs as motivational processes. For example, theorizations of motives as personality orientations have emerged both in the SDT framework (causality orientation theory [COT]; Deci & Ryan, 1985b) and in other theoretical frameworks (e.g., motive disposition theory [MDT]; McClelland, Koestner, & Weinberger, 1989). It is argued that motivational orientations could be an alternative individual factor to explore in future research, given that the prevalence of specific motives (e.g., affiliation) could affect how individuals react to situation thwarting these motives (e.g., relatedness thwarting) from a motivational perspective.

Coping, needs restoration and well-being. An important result of this work is evidencing that needs frustration could be linked to different stress appraisals, and as such, there could be differences between short-term and long-term consequences of needs frustration on well-being. Future research could expand on this evidence, investigating how different appraisals impact well-being in the short and in the long term. A promising direction comes from SDT-related research, proposing that needs frustration could lead to restorative responses in the short term, such as increased attention towards stimuli related to the frustrated need (Radel et al., 2011), or increased motivation in following tasks (Fang et al., 2019; Radel et al., 2014). Radel and colleagues (2011) also proposed a temporal model where the long-term negative impact of needs thwarting on individuals could depend not on needs frustration per-se, but on the failure to restore the frustrated needs over time. As such, differentiated

outcomes following needs frustration could depend on individual differences in the effectiveness of coping or needs restoration strategies. It is argued that studying restoration processes related to individual differences could extend the results of the present thesis.

Replication in more ecological settings. As already discussed in previous paragraphs, one of the limitations of this thesis is that some of the theoretical assumptions could not be tested, and some of the results showed in the first study could not be replicated. As such, results about the moderation of personality factors on thwarting-related stress appraisals were demonstrated just in the setting of an academic performance led in a laboratory setting. Future research could expand these findings extending the protocols of needs manipulation to different types of performance, and in more ecological settings. Indeed, considering different kinds of performance could shed light on whether individuals steadily respond to needs frustration, or whether it could also depend on the relevance needs have in different environments. There is evidence, for instance, that individuals could develop compensatory behaviours (e.g., disengagement) or needs substitutes (e.g., focusing on extrinsic aspirations) when their basic psychological needs are frustrated (Vansteenkiste et al., 2020). I propose that some of these strategies could be more adaptive in environments where actual relevance is attributed to the results of these compensatory behaviours: for example, focusing on extrinsic aspirations could be more adaptive for managing negative emotional outcomes in contexts like sport, than in pure relational contexts, such as familiar environments, with linked variations in stress-related outcomes. Furthermore, the importance for future research of studying needs-related appraisals using tasks that simulate real-life levels of stress is advocated. In the sport context, this could involve the organization of existing competitions, or the use of specific tasks during training sessions.

6.9 Conclusive remarks

Though highlighting the necessity of replication, this thesis advances the literature from both a theoretical and a methodological perspective. Indeed, it provides a systematic integration of different theoretical frameworks at the purpose of explaining and testing the interaction between situational and individual variables (specifically personality) in

affecting stress reactions. Furthermore, it provides methodological insight in the context of each of the integrated theoretical contributions, specifically regarding measurements of CTS indices during a task, and procedures of basic psychological needs manipulation.

Advancing ways to manipulate the environment inducing satisfaction and frustration, and measuring psychophysiological outcomes associated to different values of the social context, could be an important contribution for the study of individual differences and their impact on appraisal and reaction to challenging circumstances. In this sense, though some of the findings outlined in this work have not been tested specifically in the sport context, both the theoretical and methodological insights here outlined could be employed in the sport setting to progress the testing of individual differences and be implemented in interventions aimed at identifying and support protective factors promoting functional stress reactions.

List of appendices

Appendix A. Information sheet (Online survey) - Study 1

You are invited to take part in a study that I am conducting as part of my Ph.D. at Durham University.

This study has received ethical approval from the ethics committee of the Department of Sport and Exercise Sciences of Durham University.

Before you decide whether to agree to take part it is important for you to understand the purpose of the research and what is involved as a participant. Please read the following information carefully. Please get in contact if there is anything that is not clear or if you would like more information.

The rights and responsibilities of anyone taking part in Durham University research are set out in our 'Participants Charter':

https://www.dur.ac.uk/research.innovation/governance/ethics/considerations/people/charter/

What is the purpose of the study?

The aim of this study is to investigate the link between personality factors and academic performance. The project is funded by Durham University with the Durham Doctoral Studentship scheme, and it is part of a three-year Ph.D. project ending in September 2022. The study will run from October to December 2020.

Why have I been invited to take part?

You have been invited because as a first-year student, the activities of this experiment will be part of your teaching experience within the module, and an opportunity for you to receive insight into stress and coping (a core topic of the module).

Do I have to take part?
Although all students will complete the teaching activity, you can choose whether or not your data is used for this research. Consenting for your data to be used for research is voluntary, and you do not have to agree to this. If you do agree, you can withdraw your data at any time, without giving a reason. Your rights in relation to withdrawing any data that is identifiable to you are explained in the accompanying Privacy Notice.

What will happen to me if I take part?
At this stage, you will be asked to complete a personality questionnaire and some items about your general health; this should take no more than 20 minutes to complete. You can choose to omit any questions that you do not wish to answer.

Then, as a part of your teaching activities, you will deliver **a non-assessed** academic discussion in the physiology lab at Maiden Castle. You will talk about your allocated topic for 4 minutes, receiving some feedback and advice. **You will be able to book a slot for this presentation at the end of the survey.**

The session will include the assessment of some cardiovascular measures before, during, and after your presentation. This will involve the placement of electrodes on your shoulders, chest, and back, and the measurement of your blood pressure with a blood pressure monitor. After the presentation you will receive feedback from the experimenter; in total, the session will last about 25 minutes.

A seminar will be also provided during the module about the topics of the research. You will be informed about the date and time of the seminar, during your attendance at the course "Introduction to Sport and Exercise Psychology".

Are there any potential risks involved?
There are no risks over and above what you might experience in normal daily life. We understand that the non-invasive measurement of cardiovascular indices, the use of questionnaires, and the presentations could cause anxiety and discomfort to some students – if this is the case please contact the experimenter to arrange an alternative form of engagement in the module teaching.

Information about the risks caused by COVID-19 and the departmental procedures in use to minimize it will be provided to all the participants in the next stages.

Will my data be kept confidential?
All information obtained during the study will be kept confidential. If the data is published it will be entirely anonymous and will not be identifiable as yours. Full details are included in the accompanying Privacy Notice

What will happen to the results of the project?

The study will be part of the final Ph.D. dissertation of the main researcher. Results could be published and/or publicly presented at conferences and seminars.

No personal data will be shared; however, anonymised data may be used in publications, reports, presentations, web pages, and other research outputs. At the end of the project, anonymised data may be archived and shared with others for legitimate research purposes.

All research data and records needed to validate the research findings will be stored for 10 years after the end of the project.

Durham University is committed to sharing the results of its world-class research for public benefit. As part of this commitment, the University has established an online repository for all Durham University Higher Degree theses which provides access to the full text of freely available theses. The study in which you are invited to participate will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be published open access.

Appendix B. Consent form (Online surveys)

Consent

This form is to confirm that you understand and are happy with the treatment and the storage of the data collected in the present survey:

- ☐ I confirm that I have read and understood the information sheet dated and the privacy notice for the above project.
- ☐ I have had sufficient time to consider the information and ask any questions I might have, and I am satisfied with the answers I have been given.
- ☐ I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.

This is to confirm your understanding of the purposes of the research project, what is involved, and that you are happy to take part. Please initial each box to indicate your agreement:

- ☐ I agree to take part in the research project, consenting the use of my data for the research purposes.
- ☐ I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason.

Appendix C. Demographics and health self-report items (Online survey) – Study 1

In this section, some general information will be collected, to be able to link your data among the different stages of the experiment.

Please, remind that all the information obtained during the study will be kept confidential. If the data is published, it will be entirely anonymous and will not be identifiable as yours.

Full Name

……

Race/ethnicity

……

Gender

F ☐ M ☐ Other ☐ Prefer not to say ☐

Do you suffer from cardiovascular disease/high blood pressure/any heart condition that could influence the collection of cardiovascular data?

Yes ☐ No ☐

If yes, please, specify which condition you suffer from:

……

Have you taken prescribed medications over the last 2 weeks?

Yes ☐ No ☐

Durham University e-mail contact:

……

Appendix D. COVID-19 Declaration Form

Durham University

Research Participant COVID-19 Exposure Declaration

Dear Participant

To prevent the spread of COVID-19 in our community and reduce the risk of exposure to our staff and research participants, we are conducting a simple questionnaire. Your participation is important to help us take precautionary measures to protect you and everyone else involved.

This form covers you for seven days. If your circumstances change during this period (for example if you start to feel unwell or have been in contact with a confirmed case of COVID-19), you must inform the researcher.

Thank you for your time and co-operation.

Participant's name:

Contact number (mobile):

Researcher's name:

Meeting venue:

Self-declaration by participant

1. Have you knowingly been exposed to anyone with Corona Virus or displaying Covid-19 symptoms in the past 14 days?

2. Do you have any underlying health conditions which could put you at increased risk if you should contract Covid-19? A list of these conditions can be found here: https://www.nhs.uk/conditions/coronavirus-covid-19/people-at-higher-risk-from-coronavirus/whos-at-higher-risk-from-coronavirus/#

3. Have you now, or in the past 14 days, had any of the following flu-like symptoms?

   Fever (37.3°C or higher)

   Breathlessness

   Cough

   Sore throat

   Loss of sense of smell or taste

Participant Signature (type name):

Date of signature:

The completed form must be emailed to the researcher 24 hours before taking part in the research. Confirmation whether the activity can proceed will be sent following receipt of this form.

Appendix E. IPIP-NEO-120

This questionnaire contains 120 statements. Please read each item carefully and circle the one answer that best corresponds to your agreement or disagreement:

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

There are no right or wrong answers, and you need not to be an “expert” to complete this questionnaire. Describe yourself honestly and state your opinions as accurately as possible.

I…

Am afraid to draw attention to myself	1	2	3	4	5
Take charge	1	2	3	4	5
Am attached to conventional ways	1	2	3	4	5
Make rash decisions	1	2	3	4	5
Leave my belongings around	1	2	3	4	5
Yell at people	1	2	3	4	5
Prefer variety to routine	1	2	3	4	5
Love life	1	2	3	4	5
Like to take it easy	1	2	3	4	5
Keep my promises	1	2	3	4	5

Talk to a lot of different people at parties	1	2	3	4	5
Distrust people	1	2	3	4	5
Am always prepared	1	2	3	4	5
Keep others at a distance	1	2	3	4	5
Jump into things without thinking	1	2	3	4	5
Obstruct others' plans	1	2	3	4	5
Don't understand people who get emotional	1	2	3	4	5
Believe that there is no absolute right and wrong	1	2	3	4	5
Am often down in the dumps	1	2	3	4	5
Only feel comfortable with friends	1	2	3	4	5
Love to daydream	1	2	3	4	5
Cheat to get ahead	1	2	3	4	5
Wait for others to lead the way	1	2	3	4	5
Am not interested in other people's problems	1	2	3	4	5
Am always busy	1	2	3	4	5
Get stressed out easily	1	2	3	4	5

Panic easily	1	2	3	4	5
Sympathize with the homeless	1	2	3	4	5
Believe that I am better than others	1	2	3	4	5
Take advantage of others	1	2	3	4	5
Avoid contacts with others	1	2	3	4	5
Have a high opinion of myself	1	2	3	4	5
Avoid crowds	1	2	3	4	5
Leave a mess in my room	1	2	3	4	5
Know how to get things done	1	2	3	4	5
Love to help others	1	2	3	4	5
Am afraid of many things	1	2	3	4	5
Enjoy being reckless	1	2	3	4	5
Go on binges	1	2	3	4	5
Act wild and crazy	1	2	3	4	5
Make friends easily	1	2	3	4	5
Use others for my own ends	1	2	3	4	5

Feel sympathy for those who are worse off than myself	1	2	3	4	5
Do more than what's expected of me	1	2	3	4	5
Find it difficult to approach others	1	2	3	4	5
Take control of things	1	2	3	4	5
Believe in the importance of art	1	2	3	4	5
Rush into things	1	2	3	4	5
Prefer to stick with things that I know	1	2	3	4	5
Carry out my plans	1	2	3	4	5
Get angry easily	1	2	3	4	5
Have difficulty starting tasks	1	2	3	4	5
Have difficulty understanding abstract ideas	1	2	3	4	5
Complete tasks successfully	1	2	3	4	5
Try to lead others	1	2	3	4	5
Easily resist temptations	1	2	3	4	5
Often feel blue	1	2	3	4	5
Am able to control my cravings	1	2	3	4	5

Worry about things	1	2	3	4	5
Get back at others	1	2	3	4	5
Fear for the worst	1	2	3	4	5
Rarely notice my emotional reactions	1	2	3	4	5
Act without thinking	1	2	3	4	5
Trust others	1	2	3	4	5
Love large parties	1	2	3	4	5
Radiate joy	1	2	3	4	5
Am always on the go	1	2	3	4	5
Think highly of myself	1	2	3	4	5
Do a lot in my spare time	1	2	3	4	5
Am indifferent to the feelings of others	1	2	3	4	5
Feel others' emotions	1	2	3	4	5
Waste my time	1	2	3	4	5
Am not bothered by difficult social situations	1	2	3	4	5
Am not interested in theoretical discussions	1	2	3	4	5

Break my promises	1	2	3	4	5
Try not to think about the needy	1	2	3	4	5
Feel comfortable around people	1	2	3	4	5
Tend to vote for conservative political candidates	1	2	3	4	5
Am not easily annoyed	1	2	3	4	5
Believe that we should be tough on crime	1	2	3	4	5
Get irritated easily	1	2	3	4	5
Lose my temper	1	2	3	4	5
Insult people	1	2	3	4	5
Experience my emotions intensely	1	2	3	4	5
Tend to vote for liberal political candidates	1	2	3	4	5
Like to tidy up	1	2	3	4	5
Have a lot of fun	1	2	3	4	5
Take no time for others	1	2	3	4	5
Like to get lost in thought	1	2	3	4	5
Look at the bright side of life	1	2	3	4	5

Put little time and effort into my work	1	2	3	4	5
Feel that I'm unable to deal with things	1	2	3	4	5
Dislike changes	1	2	3	4	5
Boast about my virtues	1	2	3	4	5
Love a good fight	1	2	3	4	5
Trust what people say	1	2	3	4	5
Seek adventure	1	2	3	4	5
Feel comfortable with myself	1	2	3	4	5
Avoid philosophical discussions	1	2	3	4	5
Break rules	1	2	3	4	5
Remain calm under pressure	1	2	3	4	5
See beauty in things that others might not notice	1	2	3	4	5
Love excitement	1	2	3	4	5
Do just enough work to get by	1	2	3	4	5
Often forget to put things back in their proper place	1	2	3	4	5
Rarely overindulge	1	2	3	4	5

Have a vivid imagination	1	2	3	4	5
Enjoy wild flights of fantasy	1	2	3	4	5
Handle tasks smoothly	1	2	3	4	5
Love to read challenging material	1	2	3	4	5
Excel in what I do	1	2	3	4	5
Tell the truth	1	2	3	4	5
Work hard	1	2	3	4	5
Am concerned about others	1	2	3	4	5
Do not like poetry	1	2	3	4	5
Prefer to be alone	1	2	3	4	5
Dislike myself	1	2	3	4	5
Believe that others have good intentions	1	2	3	4	5
Do not enjoy going to art museums	1	2	3	4	5
Become overwhelmed by events	1	2	3	4	5

Appendix F. Participant Information Sheet (Experiment) – Study 1

Project title: Investigating links between personality and academic performance

Researcher(s): Marianna Bottiglieri
Department: Sport and Exercise Sciences
Contact details: marianna.bottiglieri@durham.ac.uk

Supervisor names: Dr Emily Oliver and Dr Martin Roderick

Supervisor contact details:
emily.oliver@durham.ac.uk
m.j.roderick@durham.ac.uk

You are invited to take part in a study that I am conducting as part of my PhD at Durham University.

This study has received ethical approval from the ethics committee of the Department of Sport and Exercise Sciences of Durham University.

Before you decide whether to agree to take part it is important for you to understand the purpose of the research and what is involved as a participant. Please read the following information carefully. Please get in contact if there is anything that is not clear or if you would like more information.

The rights and responsibilities of anyone taking part in Durham University research are set out in our 'Participants Charter':

https://www.dur.ac.uk/research.innovation/governance/ethics/considerations/people/charter/

What is the purpose of the study?

The aim of this study is investigating the link between personality factors and academic performance. The project is funded by Durham University with the Durham Doctoral Studentship scheme and it is part of a three-year Ph.D. project ending in September 2022. The study will run from October to December 2020*.

Why have I been invited to take part?

You have been invited because as first year student, the activities of this experiment will be part of your teaching experience within the module, and an opportunity for you to receive insight into stress and coping (a core topic of the module).

Do I have to take part?

Although all students will complete the teaching activity, you can choose whether or not your data is used for this research. Consenting for your data to be used for research is voluntary, and you do not have to agree to this. If you do agree, you can withdraw your data at any time, without giving a reason. Your rights in relation to withdrawing any data that is identifiable to you are explained in the accompanying Privacy Notice.

What will happen to me if I take part?

You will deliver **a non-assessed** academic presentation in the physiology lab at Maiden Castle. You will talk about your allocated topic for 5 minutes, receiving some feedback and advice.

The session will include the assessment of some self-report and cardiovascular measures before, during and after your presentation. This will involve the placement of an armband on your left arm and electrodes on your shoulders, chest, and back. Please, note that the equipment (ECG and blood pressure monitor), will be employed solely for research purposes and not for any clinical assessment/feedback. In case of concerns or symptoms, please report them to the experimenter and consult a healthcare professional.

After the presentation you will receive feedback from the experimenter; in total the session will last about 25 minutes. A seminar will be also provided during the module about the topics of the research.

Are there any potential risks involved?

There are no risks over and above what you might experience in normal daily life. We understand that presentations can cause anxiety and discomfort for some students – if this is the case please contact the experimenter to arrange an alternative form of engagement in the module teaching.

Will my data be kept confidential?

All information obtained during the study will be kept confidential. If the data is published it will be entirely anonymous and will not be identifiable as yours. Full details are included in the accompanying Privacy Notice.

What will happen to the results of the project?

The study will be part of the final Ph.D. dissertation of the main researcher. Results could be published and/or publicly presented at conferences and seminars.

No personal data will be shared, however anonymised data may be used in publications, reports, presentations, web pages and other research outputs. At the end of the project, anonymised data may be archived and shared with others for legitimate research purposes.

All research data and records needed to validate the research findings will be stored for 10 years after the end of the project.

Durham University is committed to sharing the results of its world-class research for public benefit. As part of this commitment the University has established an online repository for all Durham University Higher Degree theses which provides access to the full text of freely available theses. The study in which you are invited to participate will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be published open access.

<u>Considerations about Covid-19 standard operating procedures</u>

In order to minimize the risk linked to the Covid-19 outbreak, this research will follow the departmental Standard Operating Procedure, with the implementation of the following security measures:

- Staff, researchers, and students that are part of this research should not come to the lab/retire their participation in case of Covid-19 symptoms. To ensure this is respected, an exposure declaration form will be completed by all participants and e-mailed to the researcher 24 hours before the experimental session;

- The number of people in the research lab will be kept to an absolute minimum, with a maximum occupancy of 6 people at any one time. For this reason, a booking system will be used for assigning laboratory slots to participants;

- Staff, researchers, and participants must follow social distancing and Laboratory hygiene protocols: hand hygiene with regular and thorough handwashing; when coughing or sneezing, they should cover their mouth and nose with a tissue or their elbow;

- Any space, surface, equipment, and any other touch points will be disinfected before and after use;

Who do I contact if I have any questions or concerns about this study?

If you have any further questions or concerns about this study, please speak to the researcher (marianna.bottiglieri@durham.ac.uk) or their supervisor (emily.oliver@durham.ac.uk). If you remain unhappy or wish to make a formal complaint, please submit a complaint via the University's Complaints Process.

Thank you for reading this information and considering taking part in this study.

Appendix G. Privacy Notice

PART 1 – GENERIC PRIVACY NOTICE

Durham University has a responsibility under data protection legislation to provide individuals with information about how we process their personal data. We do this in a number of ways, one of which is the publication of privacy notices. Organisations variously call them a privacy statement, a fair processing notice or a privacy policy.

To ensure that we process your personal data fairly and lawfully we are required to inform you:

- Why we collect your data
- How it will be used
- Who it will be shared with

We will also explain what rights you have to control how we use your information and how to inform us about your wishes. Durham University will make the Privacy Notice available via the website and at the point we request personal data.

Our privacy notices comprise two parts – a generic part (ie common to all of our privacy notices) and a part tailored to the specific processing activity being undertaken.

Data Controller

The Data Controller is Durham University. If you would like more information about how the University uses your personal data, please see the University's Information Governance webpages or contact Information Governance Unit:

Telephone: (0191 33) 46246 or 46103

E-mail: information.governance@durham.ac.uk

Information Governance Unit also coordinate response to individuals asserting their rights under the legislation. Please contact the Unit in the first instance.

Data Protection Officer

The Data Protection Officer is responsible for advising the University on compliance with Data Protection legislation and monitoring its performance against it. If you have any concerns regarding the way in which the University is processing your personal data, please contact the Data Protection Officer:

Jennifer Sewel

University Secretary

Telephone: (0191 33) 46144

E-mail: university.secretary@durham.ac.uk

Your rights in relation to your personal data

Privacy notices and/or consent

You have the right to be provided with information about how and why we process your personal data. Where you have the choice to determine how your personal data will be used, we will ask you for consent. Where you do not have a choice (for example, where we have a legal obligation to process the personal data), we will provide you with a privacy notice. A privacy notice is a verbal or written statement that explains how we use personal data.

Whenever you give your consent for the processing of your personal data, you receive the right to withdraw that consent at any time. Where withdrawal of consent will have an impact on the services we are able to provide, this will be explained to you, so that you can determine whether it is the right decision for you.

Accessing your personal data

You have the right to be told whether we are processing your personal data and, if so, to be given a copy of it. This is known as the right of subject access. You can find out more about this right on the University's Subject Access Requests webpage.

Right to rectification

If you believe that personal data we hold about you is inaccurate, please contact us and we will investigate. You can also request that we complete any incomplete data.

Once we have determined what we are going to do, we will contact you to let you know.

Right to erasure

You can ask us to erase your personal data in any of the following circumstances:

- We no longer need the personal data for the purpose it was originally collected
- You withdraw your consent and there is no other legal basis for the processing
- You object to the processing and there are no overriding legitimate grounds for the processing
- The personal data have been unlawfully processed
- The personal data have to be erased for compliance with a legal obligation
- The personal data have been collected in relation to the offer of information society services (information society services are online services such as banking or social media sites).

Once we have determined whether we will erase the personal data, we will contact you to let you know.

Right to restriction of processing

You can ask us to restrict the processing of your personal data in the following circumstances:

- You believe that the data is inaccurate, and you want us to restrict processing until we determine whether it is indeed inaccurate
- The processing is unlawful, and you want us to restrict processing rather than erase it
- We no longer need the data for the purpose we originally collected it, but you need it in order to establish, exercise or defend a legal claim and
- You have objected to the processing and you want us to restrict processing until we determine whether our legitimate interests in processing the data override your objection.

Once we have determined how we propose to restrict processing of the data, we will contact you to discuss and, where possible, agree this with you.

Retention

The University keeps personal data for as long as it is needed for the purpose for which it was originally collected. Most of these time periods are set out in the University Records Retention Schedule.

Making a complaint

If you are unsatisfied with the way in which we process your personal data, we ask that you let us know so that we can try and put things right. If we are not able to resolve issues to your satisfaction, you can refer the matter to the Information Commissioner's Office (ICO). The ICO can be contacted at:

Information Commissioner's Office Wycliffe House Water Lane Wilmslow Cheshire SK9 5AF

Telephone: 0303 123 1113

Website: Information Commissioner's Office

PART 2 – TAILORED PRIVACY NOTICE

This section of the Privacy Notice provides you with the privacy information that you need to know before you provide personal data to the University for the particular purpose(s) stated below.

Project Title: Investigating links between personality and academic performance

Type(s) of personal data collected and held by the researcher and method of collection:

Personal data will be collected through questionnaires and the informed consent. This will include name and age. Furthermore, information about your general personality and some health indices (i.e., cardiovascular markers; anxiety) will be retained.

Lawful Basis

Under data protection legislation, we need to tell you the lawful basis we are relying on to process your data. The lawful basis we are relying on is public task: the processing is necessary for an activity being carried out as part of the University's public task, which is defined as teaching, learning and research. For further information see: *https://durham.ac.uk/research.innovation/governance/ethics/governance/dp/legalbasis/*

How personal data is stored:

Personal data will be stored on locked online databases, such as SharePoint and retained for 10 years after the end of the project, compatibly with the research data management policy of Durham University. All personal data will be held securely and strictly confidential to the research team. You will be allocated an anonymous number for data collection which will not be connected to your name or identity. Signed consent forms will be stored separately to project data.

How personal data is processed:

Information will be entered into a database and analysed to examine predictors of responses during the presentation task. After six months the data will be completely anonymised and the original records, including any information which can identify you personally, will be destroyed.

Withdrawal of data

You can request withdrawal of your data until it has been fully anonymised. Once this has happened it will not be possible to identify you from any of the data we hold.

Who the researcher shares personal data with:

Personal data will be deposited on a protected data storage and access will be allowed just to the main researcher and the supervisors of this project. No personal data will be included in publications or other project outputs.

Please be aware that if you disclose information which indicates the potential for serious and immediate harm to yourself or others, the research team may be obliged to breach confidentiality and report this to relevant authorities. This includes disclosure of child protection offences such as the physical or sexual abuse of minors, the physical abuse of vulnerable adults, money laundering, or other crimes covered by prevention of terrorism legislation. Where you disclose behaviour (by yourself or others) that is potentially illegal but does not present serious and immediate danger to others, the researcher will, where appropriate, signpost you to relevant services, but the information you provide will be kept confidential (unless you explicitly request otherwise).

How long personal data is held by the researcher:

The research group will hold personal data for six months, after which it will be anonymised.

How to object to the processing of your personal data for this project:

If you have any concerns regarding the processing of your personal data, or you wish to withdraw your data from the project, contact the lead researcher.

Further information:

Marianna Bottiglieri: marianna.bottiglieri@durham.ac.uk

Appendix H. Consent form (experiments)

Researcher(s): Marianna Bottiglieri
Department: Sport and Exercise Sciences
Contact details: marianna.bottiglieri@durham.ac.uk

Supervisor name: Dr Emily Oliver and Prof Martin Roderick
Supervisor contact details: emily.oliver@durham.ac.uk
m.j.roderick@durham.ac.uk

This form is to confirm that you understand what the purposes of the project, what is involved and that you are happy to take part. Please tick each box to indicate your agreement:

I confirm that I have read and understand the information sheet dated [ ] and the privacy notice for the above project.	
I have had sufficient time to consider the information and ask any questions I might have, and I am satisfied with the answers I have been given.	
I understand who will have access to personal data provided, how the data will be stored and what will happen to the data at the end of the project.	
I agree to take part in the above project, consenting the use of my data for the research purposes.	
I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason.	
I am conscious of the current health emergency and I declare to understand the process in place to mitigate the risk of Covid-19	

Participant's Signature_____

Date_____

NAME IN BLOCK LETTERS_____

Appendix I. Psychological Needs Thwarting Scale (PNTS) – Post-Task

This is a questionnaire assessing your experience during this experiment. Please, indicate how much you agree or disagree with each of the statements below:

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree

During the experimental task:

I felt prevented from making choices with regard to the way I discussed	1 2 3 4 5 6 7
I felt pushed to behave in certain ways	1 2 3 4 5 6 7
I felt forced to follow decisions made for me	1 2 3 4 5 6 7
I felt under pressure to agree with the procedure I was provided	1 2 3 4 5 6 7
I was made to feel incapable	1 2 3 4 5 6 7
There were times when I was told things that made me feel incompetent	1 2 3 4 5 6 7
There were situations where I was made to feel inadequate	1 2 3 4 5 6 7
I felt inadequate because I was not given opportunities to fulfil my potential	1 2 3 4 5 6 7
I felt rejected	1 2 3 4 5 6 7
I felt dismissed	1 2 3 4 5 6 7
I felt disliked	1 2 3 4 5 6 7
I felt envied when I did well	1 2 3 4 5 6 7

Appendix J. Challenge and Threat States cognitive appraisals – Pre-task

Now you should respond to these questions about the upcoming academic discussion:

How demanding do you expect the upcoming task to be?

1	2	3	4	5	6
Not at all					Extremely

How able are you to cope with the demands of the upcoming task?

1	2	3	4	5	6
Not at all					Extremely

Appendix K. Experiment instructions and manipulation cues – Study 1

Experiment Instructions

You are participant number _ . To make things easier for me I will call you "participant _" throughout the experiment.

For the purpose of this experiment, you must present to me what you have learnt so far about anxiety and confidence so I can judge/evaluate your learning so far.

You must talk through the different ideas you have read and learnt about so far, and **it must last no less than 4 minutes**. I will control how much time you are allowed and will interrupt you if you are talking for too long.

You will deliver your presentation seated at this table; I will be sat in front of you.

During your presentation, cardiovascular indices will be measured with this non-invasive device and blood pressure will be monitored at some points.

For this reason, **you should limit your movements**. This is necessary, though it will make the task boring and uncomfortable. Accurate data is more important than your comfort.

We do not expect you to deliver an excellent presentation and we will be monitoring and noting down your mistakes to feed back to you.

Please keep your opinions/observations regarding the experiment to yourself during the discussion.

Before and after the presentation, you will compile a questionnaire. Your cardiovascular indices will be collected throughout this procedure. I will tell you when to take off the electrodes.

Now you should compile the first questionnaire and start your presentation.

Manipulation cues

30sec – Do not look participants while they are presenting

1.30min – Head shaking

2.30min – "That's not correct! Tell me a different idea that you read about"

After 3 min – Lose attention until the end of the presentation

Appendix L. Debriefing sheet – Study 1

Project title: "*Personality and stress response: a transtheoretical approach"*

Thank you for taking part in this study, we hope you were able to learn a little bit about how you perform under pressure!

Our research is exploring the link between personality traits and physiological and emotional reactions to specific stressors, such as negative feedback, absence of control, and feeling distant from other people. Due to this, you might have experienced stress induced by verbal instructions or experimenter's behaviour, before and during the academic presentation. If any feelings of stress persist after this session, we would signpost you towards the following resources regarding stress and coping:

Durham University Counselling Services: counsel.service@dur.ac.uk
MIND: https://www.mind.org.uk/

Please do also contact the experimenter and/or their supervisor to let them know.

What happens next?

We wanted to remind you that your presentation is not assessed and does not contribute to your grade. As part of this module, we will explore stress and coping, using data from this experiment, later in the course.

In writing up the study all data will be anonymized, and your individual data will not be available to anyone outside research team. You can request withdrawal of your data, until they will be completely anonymized, after 6 months. For further information about data policy and withdrawal, please check the Privacy Notice.

Any further questions?

If you have any concerns, would like further information about the study or would like to know about what my findings are when all the data have been collected and analysed, then please contact me on the e-mail address marianna.bottiglieri@durham.ac.uk. I cannot however provide you with your individual results.

Appendix M. Information sheet (Online survey) - Study 2

Research project – Investigating the link between personality and sport performance

You are invited to take part in a study that I am conducting as part of my PhD at Durham University.

This study has received ethical approval from the ethics committee of the Department of Sport and Exercise Sciences of Durham University.

Before you decide whether to agree to take part it is important for you to understand the purpose of the research and what is involved as a participant. Please read the following information carefully. Please get in contact if there is anything that is not clear or if you would like more information.

The rights and responsibilities of anyone taking part in Durham University research are set out in our 'Participants' Charter':

https://www.dur.ac.uk/research.innovation/governance/ethics/considerations/people/charter/

What is the purpose of the research?
The aim of this study is investigating the link between personality factors and sport performance. The project is funded by Durham University with the Durham Doctoral Studentship scheme and it is part of a three-year Ph.D. project ending in September 2022. The study will run from October to Spring 2021.

Why have I been invited to take part?
You have been invited because you are aged over 18 years old and you are a sport team athlete, frequently taking part in team sport performances.

Do I have to take part?
No, participation is completely voluntary. If you do agree to participate, you can withdraw your participation or your data at any time, without giving a reason. Your rights in relation to withdrawing any data that is identifiable to you are explained in the accompanying Privacy Notice.

What will be involved if I decide to take part in the research?
At this point, you will be asked to complete a personality questionnaire and some items about your general health.

Then, you are asked to **form a group of three athletes with your team members** and to **book together a spot at the Human Performance Laboratory in Maiden Castle**. Your group of three will compete in a team

performance, that consists in a darts game. The session will include the assessment of some self-report and cardiovascular measures before, and during the sport task. This will involve the placement of an armband on your left arm and electrodes on your shoulders, chest, and back. Please, note that the equipment (ECG and blood pressure monitor), will be employed solely for research purposes and not for any clinical assessment/feedback. In case of concerns or symptoms, please report them to the experimenter and consult a healthcare professional. The darts game will last 5 minutes; the entire laboratory session will last approximately one hour.
The winners of the darts competition among all the groups of participants will receive £20 vouchers at the end of the experiment.

Are there any potential risks involved?
There are no risks over and above what you might experience in normal sport performance. We understand that sport performances can cause anxiety for some athletes – and you can report to the experimenter and withdraw from the study at any time in case of excessive discomfort.

How will confidentiality be assured?

All information obtained during the study will be kept confidential. If the data is published it will be entirely anonymous and will not be identifiable as yours. Full details are included in the accompanying Privacy Notice.

What will happen to the results of the project?

The study will be part of the final Ph.D. dissertation of the main researcher. Results could be published and/or publicly presented at conferences and seminars.

No personal data will be shared, however anonymised data may be used in publications, reports, presentations, web pages and other research outputs. At the end of the project, anonymised data may be archived and shared with others for legitimate research purposes.

All research data and records needed to validate the research findings will be stored for 10 years after the end of the project.

Durham University is committed to sharing the results of its world-class research for public benefit. As part of this commitment the University has established an online repository for all Durham University Higher Degree theses which provides access to the full text of freely available theses. The study in which you are invited to participate will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be published open access.

Who do I contact if I have any questions or concerns about this study?

If you have any further questions or concerns about this study, please speak to the researcher (marianna.bottiglieri@durham.ac.uk) or their supervisor (emily.oliver@durham.ac.uk). If you remain unhappy or wish to make a formal complaint, please submit a complaint via the University's Complaints Process.

Thank you for reading this information and considering taking part in this study.

Appendix N. Demographics and health self-report (Online survey) – Study 2

In this section, some general information will be collected, to be able to link your data among the different stages of the experiment.

Please, remind that all the information obtained during the study will be kept confidential. If the data is published, it will be entirely anonymous and will not be identifiable as yours.

Full Name

……

Date of birth

……

Race/ethnicity

……

Gender

F ☐ M ☐ Other ☐ Prefer not to say ☐

Do you suffer from cardiovascular disease/high blood pressure/any heart condition that could influence the collection of cardiovascular data?

Yes ☐ No ☐

If yes, please, specify which condition you suffer from (optional question):

……

Do you usually take prescribed medications that could alter your cardiovascular data?

Yes ☐ No ☐

Have you completed a full program of Covid-19 vaccination (optional)?

……

Please, report who are the provisory members of your group for this research study (you can flag any change when your lab slot is confirmed):

……

Durham University e-mail contact:

……

Appendix O. Information Sheet (experiment) - Study 2

Project title: Investigating links between personality and teams sport performance

Researcher(s): Marianna Bottiglieri
Department: Sport and Exercise Sciences
Contact details: marianna.bottiglieri@durham.ac.uk

Supervisor names: Dr Emily Oliver and Dr Martin Roderick

Supervisor contact details:
emily.oliver@durham.ac.uk
m.j.roderick@durham.ac.uk

You are invited to take part in a study that I am conducting as part of my PhD at Durham University.

This study has received ethical approval from the ethics committee of the Department of Sport and Exercise Sciences of Durham University.

Before you decide whether to agree to take part it is important for you to understand the purpose of the research and what is involved as a participant. Please read the following information carefully. Please get in contact if there is anything that is not clear or if you would like more information.

The rights and responsibilities of anyone taking part in Durham University research are set out in our 'Participants Charter':

https://www.dur.ac.uk/research.innovation/governance/ethics/considerations/people/charter/

What is the purpose of the research?

The aim of this study is investigating the link between personality factors and sport performance. The project is funded by Durham University with the Durham Doctoral Studentship scheme and it is part of a three-year Ph.D. project ending in September 2022. The study will run from October to Spring 2021.

Why have I been invited to take part?

You have been invited because you are aged over 18 years old and you are a sport team athlete, frequently taking part in team sport performances.

Do I have to take part?

No, participation is completely voluntary. If you do agree to participate, you can withdraw your participation or your data at any time, without giving a reason. Your rights in relation to withdrawing any data that is identifiable to you are explained in the accompanying Privacy Notice.

What will be involved if I decide to take part in the research?

You will be asked to complete a team performance in a group of three athletes at the Human Performance Laboratory at Maiden Castle. The performance will involve a darts game. Furthermore, you will be asked to complete a personality questionnaire and some items about your general health. The session will include the assessment of some self-report and cardiovascular measures before, and during the sport task. This will involve the placement of an armband on your left arm and electrodes on your shoulders, chest, and back. Please, note that the equipment (ECG and blood pressure monitor), will be employed solely for research purposes and not for any clinical assessment/feedback. In case of concerns or symptoms, please report them to the experimenter and consult a healthcare professional.

The sport performance will last 5 minutes, however it will be necessary that every member of the group completes the activities, and so the entire experimental session will last about an hour.

Are there any potential risks involved?

There are no risks over and above what you might experience in normal sport performance. We understand that sport performances can cause anxiety for some athletes – and you can report to the experimenter and withdraw from the study at any time in case of excessive discomfort.

How will confidentiality be assured?

All information obtained during the study will be kept confidential. If the data is published it will be entirely anonymous and will not be identifiable as yours. Full details are included in the accompanying Privacy Notice.

What will happen to the results of the project?

The study will be part of the final Ph.D. dissertation of the main researcher. Results could be published and/or publicly presented at conferences and seminars.

No personal data will be shared, however anonymised data may be used in publications, reports, presentations, web pages and other research outputs. At the end of the project, anonymised data may be archived and shared with others for legitimate research purposes.

All research data and records needed to validate the research findings will be stored for 10 years after the end of the project.

Durham University is committed to sharing the results of its world-class research for public benefit. As part of this commitment the University has established an online repository for all Durham University Higher Degree theses which provides access to the full text of freely available theses. The study in which you are invited to participate will be written up as a thesis. On successful submission of the thesis, it will be deposited both in print and online in the University archives, to facilitate its use in future research. The thesis will be published open access.

Considerations about Covid-19 standard operating procedures

In order to minimize the risk linked to the Covid-19 outbreak, this research will follow the departmental Standard Operating Procedure, with the implementation of the following security measures:

. Staff, researchers, and students that are part of this research should not come to the lab/should retire their participation in case of Covid-19 symptoms. To ensure this is respected, an exposure declaration form will be completed by all participants and e-mailed to the researcher 24 hours before the experimental session. Participants will be also asked about their vaccination status, and a lateral flow test the days before accessing the laboratory is recommended;

. The number of people in the research lab will be kept to an absolute minimum, with a maximum occupancy of 15 people at any one time. For this reason, a booking system will be used for assigning laboratory slots to participants;

. Staff, researchers, and participants must follow social distancing and Laboratory hygiene protocols: hand hygiene with regular and thorough handwashing; when coughing or sneezing, they should cover their mouth and nose with a tissue or their elbow;

. Any space, surface, equipment, and any other touch points will be disinfected before and after use;

Who do I contact if I have any questions or concerns about this study?

If you have any further questions or concerns about this study, please speak to the researcher (marianna.bottiglieri@durham.ac.uk) or their supervisor (emily.oliver@durham.ac.uk). If you remain unhappy or wish to make a formal complaint, please submit a complaint via the University's Complaints Process

Appendix P. Psychological needs thwarting scale (PNTS) – Pre-task

This is a questionnaire assessing your experience during this experiment. Please, indicate how much you agree or disagree with each of the statements below:

1	2	3	4	5	6	7
Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree

I feel prevented from making choices	1	2	3	4	5	6	7
I feel pushed to behave in certain ways	1	2	3	4	5	6	7
I feel forced to follow decisions made for me	1	2	3	4	5	6	7
I feel under pressure to agree with the procedure I was provided	1	2	3	4	5	6	7
I am made to feel incapable	1	2	3	4	5	6	7
There were times when I was told things that made me feel incompetent	1	2	3	4	5	6	7
There were situations where I was made to feel inadequate	1	2	3	4	5	6	7
I feel inadequate because I was not given opportunities to fulfill my potential	1	2	3	4	5	6	7
I feel rejected	1	2	3	4	5	6	7
I feel dismissed	1	2	3	4	5	6	7
I feel disliked	1	2	3	4	5	6	7
I feel envied when I do well	1	2	3	4	5	6	7

Appendix Q. CTS cognitive appraisals (Post-task)

How demanding did you find the task?

_____

1	2	3	4	5	6
Not at all					Extremely

How able were you to cope with the task?

_____

1	2	3	4	5	6
Not at all					Extremely

Appendix R. Manipulation items and instructions – Study 2

Competence thwarting - Item

Please, assess your level at the present task on a scale from 1 to 10:

__|_____|_____|_____|_____|_____|_____|_____|_____|_____|__

1 2 3 4 5 6 7 8 9 10

Competence thwarting - Instructions

I could see that you struggled in the practice trials. The average score so far has been (unrealistic total). We know that it is difficult for people of your height to do well in aiming tasks.

You are decreasing the average score of your team and, together with being unable to compete for the individual best score, I think that a performance like the one in the trial will ruin the chances of your team to win the vouchers as the best group.

Now I will measure your pressure and ask you to compile this questionnaire (CTS), then I will tell you when to start with the first throw.

Competence thwarting – Performance comments examples

1st block: “Mmm…Not so different from the trial”

2nd block: laughing

3rd block: “Do you usually find aiming tasks so difficult?”

4th block: “No way”

Relatedness thwarting - Item

Please identify whether you would like to compete with one, or both, of your group in the performance task. Please write down the name(s) of who you would like to compete with. Remember, there is a prize for all members of the winning team. Team choices will be kept confidential.

……
…

Please, do not communicate your choices to the other team members.

Relatedness thwarting – Instructions

You were not been picked by anybody in your team/your teammate. For this reason, you will have to compete alone. This is unusual, there are not many participants that are not selected by their own teammates, but unfortunately, we can't force anyone to pick you.

Now I will measure your pressure and ask you to compile this questionnaire (CTS), then I will tell you when to start with the first throw.

Relatedness thwarting – Comments examples

1st block: "Good throws, such a shame nobody selected you

2nd block: "Yeah, definitely in line with other performances, maybe it is a personal reason"

3rd block: Showing lack of attention, forgetting to count the three seconds

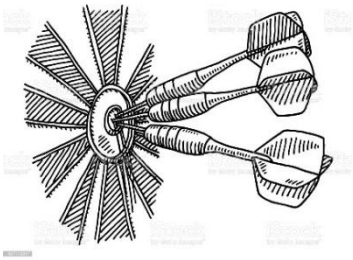
4th block: "Do you usually have issues with your teammates

Appendix S. Task instructions – Study 2

Now the performance will start. For the purposes of this experiment, you will be asked to perform a darts throwing task.
The task will consist in throwing **three darts in three seconds** for **five times**, one time a minute. You will use your **non-dominant arm** for the throw. After each throw of three darts, **your cardiovascular indices will be measured for one minute** and then you will perform the next throw.

Summary

. You will throw three darts in three seconds
. You will repeat this for 5 times
. After each throw, we will monitor your ECG for one minute
. You will use your non-dominant arm



I will tell you when to start the throws and I will measure the three seconds. Please, before and after the throws **limit your movements** to make sure we get the measurement correct.

Appendix T. Debriefing sheet – Study 2

Thank you for taking part in this study, we hope you were able to learn a little about how you perform under pressure!

What was the research about?

Our research is exploring links between personality traits and physiological and emotional reactions to specific stressors occurring during performance, such as negative feedback and feelings of personal exclusion. Due to this, you might have experienced stress induced by verbal instructions, experimental procedures, or experimenter's behaviour, before and during the sport task. If any feelings of stress persist after this session, we would signpost you towards the following resources regarding stress and coping:

Durham University Counselling Services: counsel.service@dur.ac.uk
MIND: https://www.mind.org.uk/

Please do also contact the experimenter and/or supervisor to let them know.

What happens next?

We wanted to remind you that your performance will be not published or considered for rankings, and we will randomly pick the group that won the voucher. We will analyse your data among the data of other athletes.

In writing up the study all data will be anonymized, and your individual data will not be available to anyone outside research team. You can request withdrawal of your data, until they will be completely anonymized, after 6 months. For further information about data policy and withdrawal, please check the Privacy Notice.

Any further questions?

If you have any concerns, would like further information about the study or would like to know about what my findings are when all the data have been collected and analysed, then please contact me via email: marianna.bottiglieri@durham.ac.uk. I cannot however provide you with your individual results.

Appendix U. Scoping review extraction summary table

Study	Theory (REL./ BELONG.)	Manipulation (SUPPORT/ THWARTING/ OTHER)	Measure (SATISFACTION/ FRUSTRATION)	Protocol	Rel. manip. success	Result
Austin, 2019	Relatedness	Relatedness support (focus on competence)	Satisfaction	Memory recall after a task (difficulty)	Yes	Relatedness recall was associated to higher scores of relatedness
Bagheri, 2020	Relatedness	Relatedness thwarting	Satisfaction and frustration (just in study 2)	Scenario imagery	Yes	Relatedness thwarting increased and was independent from other needs
Bechara, 2019	Relatedness	Task difficulty and Training	Satisfaction	Video-game	N/A	Higher relatedness satisf for lower difficulty
Brambilla, 2017	Belonging	Schadenfreude	1. Belonging 2. Mixed but reversed for the negative	1. Scenario imagery 2. Fake game with opponent	N/A	Shadenfreude associated with higher belonging
Daniels, 2012	Belonging	Ostracism (victim/agent)	Belonging	Fake interview (all 3 studies)	N/A	Lower belonging for ostracizer and ostracised
Houde, 2004	Relatedness	Organizational relationship	Satisfaction	Script simulation: negotiation	N/A	Spot contracting perspective related to lower needs satisfaction
Itzchakov, 2021	Relatedness	Listening	Satisfaction	Fake conversation about a bias (all three studies)	N/A	Perceived listening associated with higher relatedness satisf.
Jackson, 2015	Relatedness	Social status	Satisfaction	1. Scenario imagery 2. Fake role assignment (leader,	N/A	Lower social status linked to lower relatedness for higher internalization

				assistant, member)		
Kaefer, 2021	Relatedness	Relatedness (both support and frustration)	Satisfaction (reversed for thwarting)	Instructions to a sport task	Yes	Higher scores of relatedness satisfaction in supported group; lower scores in thwarted groups
Kanat-Maymon, 2015	Relatedness	Relatedness (both support and frustration)	Satisfaction	Instructions before cognitive tasks	Yes	Higher chance of dishonesty for lower satisfaction
Kyeong, 2020	Relatedness	Self-criticism/respect	Satisfaction	Pre-recorded videos during an fMRI scan	N/A	Lower relatedness scores in low life satisfaction group after self-criticism
Legate, 2013	Relatedness	Ostracism (active and passive)	Satisfaction (frustration items reversed)	Playing "Cyberball" with fake participants (CPU) – two studies	N/A	Lower relatedness for both ostracizer and ostracised
Legate, 2021	Relatedness	Ostracism (active, justified, passive)	Frustration	Recall	N/A	Higher levels of frustration for both ostracisers and ostracised
Legault, 2022	Body acceptance from the others (link with relatedness)	Body-related messages (based on SDT – aut and rel)	Satisfaction (perception of "acceptance")	Exposure to different messages	Yes	Body acceptance linked to higher body empowerment, self-, and body appreciation
Lou, 2020	Relatedness	Feedback (ability consoling/improvement oriented)	Satisfaction	Task (English test) false feedback	N/A	Consoling feedback predicted meta-lay theories which in turn predicted lower levels of relatedness (and vice versa)
Miles, 2021	Relatedness	Pro-social behaviour	"Fulfilment" (connection to others)	1. Recall task 2. Cognitive task with money donations	N/A	Pro-social behaviour linked to higher levels of relatedness

Pavey, 2011	Relatedness	Relatedness support	Needs "associations" (word-stem and recall)	1. Priming task 2. Recall	Yes	Relatedness linked to various measures of pro-social intentions and behaviours
Pesch, 2018	Belonging	Social exclusion (career, personal)	Belonging (more as "perceived cohesion")	Fake ranking (based on essays written)	N/A	Exclusion (personal or career based) was linked to lower scores of belonging
Pharo, 2011	Belonging	Ostracism (x age)	Belonging	Playing Cyberball with fake friends (groups of 4 recruited)	N/A	Ostracised had lower scores of needs (also belonging)
Ricard, 2014	Relatedness	Social exclusion	Satisfaction	1. Fake feedback on personality description + (2.) puzzle	N/A	Excluded participants had lower scores of relatedness compared with included ones
Sheldon, 2008	Relatedness	Relatedness (both support and thwarting)	Satisfaction	Task instructions and hints	Yes	Relatedness levels changed for effect of condition (both for competence and relatedness). The comparison was valid just for thwarting vs neural
Thomas, 2015	Relatedness	Relatedness (both support and thwarting)	Satisfaction and frustration	Task instructions, hints, and feedback	No	Less (general) BPN satisfaction and more thwarting for thwarting conditions
Valshtein, 2020	Relatedness	Relatedness and fantasy valence (link with obsessive thinking)	1. Satisfaction 2. Frustration (2 items) Not precisely frustration, but degree of exclusion	1. Metacognitive threat 2. Cyberball	Yes	Relatedness threat linked to feel less loved, difficulties in recalling, feelings of exclusion
Weinstein, 2010	Relatedness	Choice to help	Satisfaction	1. Dictator game	N/A	Choice conditions (or

				2. Task completion for a prize (themselves; chance to help someone else)		autonomous help) linked to higher relatedness satisfaction (all needs): 1. For more money donated (and vice versa) 2. In general
Young-Jones, 2014	Relatedness	1. Autonomy (supportive/controlling) 2. Script delivery (video/audio/both)	Satisfaction	Lecture instructions and script	N/A	Higher relatedness satisfaction for autonomous (and vice versa), just for deliveries including audio
Walasek, 2015	Belonging	1. Sense of ownership 2. Ostracism	Belonging	1. Perspective taking (owner/non-owner or buyer) 2. Cyberball (explicit CPU)	N/A	Ostracised participants had lower sense of belonging compared to non-ostracised participants
Zeng, 2020	Relatedness	Construal level	Satisfaction and frustration (in one of the studies)	Recalling (charitable or pro-environmental behaviour)	N/A	Abstract construal related to higher needs satisfaction

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