School of Population Health

A Longitudinal Study of Motivation and Goal Difficulty on Goal Progress and Mental Contrasting with Implementation Intentions (MCII).

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Abstract

Overall Goal. This research was conducted in two parts, and aimed to determine the role of goal motives and the metacognitive strategy of Mental Contrasting with Implementation Intentions (MCII) during goal regulation.

Overal Objectives. This research investigated the role of MCII, autonomous and controlled goal motives on goal regulation and outcomes across two studies. Study 1 examined the effects of MCII and goal motives on the perception of obstacles to goal pursuit, specifically assessing whether controlled goal motives positively predict the number of perceived obstacles, whether MCII training reduces obstacle count, and if obstacle count negatively correlates with objective performance. Study 2 explored the longitudinal effects of autonomous and controlled motivation and MCII on goal progress and time spent pursuing a goal at both between- and within-person levels. It assessed whether MCII moderates the relationship between controlled motivation and goal-related outcomes and examined the association between goal motives and within-person variability in goal-related outcomes.

Study 1. Participants (N = 117) were recruited through Curtin University, and social networks, ages ranged from 18 to 73 years (M = 29.6, SD = 13.85), reported a mean of 1.3 hours of exercise a day (SD = 0.8), 60 identified as a woman, 39 as a man, one nonconforming. Participants were randomly assigned to receive MCII training, or a control condition, then asked to complete two cycling trials in a virtual environment in which we measured objective performance (time to complete the trial), interspersed by self-report measures including goal motives and obstacle count. MCII training was found to reduce the perceived number of obstacles in individuals, regardless of goal motives (B = -.22, t(94) = -2.22, 95% CI [-.41, -.02], p = .029). Autonomous or controlled goal motives did not significantly predict the number of obstacles. The number of obstacles did not predict objective performance. MCII is an effective tool for reducing the number of perceived obstacles during goal pursuit, regardless of their goal motives. It is effective without rehearsal, for externally specified novel goals, that must be attempted shortly after training, and when delivered electronically.

Study 2. Participants were recruited through an online platform from a diverse demographic in the United Kingdom. The final sample included 84 participants (43 females and 39 males, ages 20-70 years). Participants were randomly assigned to either an MCII intervention or control group and were surveyed every second day over four weeks. Self-reported measures of motivation, goal progress, and time spent on goal pursuit were collected each measurement. Neither autonomous nor controlled motivation predicted mean levels of time spent pursuing a goal or goal progress at any level. However, individuals reported more within-person variability in goal progress and less variability in time spent on goal pursuit when they had stronger controlled motivation. Conversely autonomous motivation predicted greater variability in time spent on goal pursuit. Participants in the MCII intervention did not spend more time pursuing their goal, or make more goal progress. MCII did not moderate the effects of controlled motivation. While autonomous motivation may influence goal-striving in the long term, its impact on day-to-day goal progress is not evident over a short period for a novel goal. Controlled motivation showed no significant detrimental effects on goal pursuit when considering mean levels of goal-related outcomes, but did influence the consistency with which people pursue their goals. The non-significant findings of MCII suggest that benefits are contingent upon detrimental effects typically experienced by those with high levels of controlled motivation.

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General Introduction

In 2020, 45-year-old David Goggins completed a 387km desert marathon in just over 62 hours. David finished in second place, 90 minutes behind a man nearly a decade his junior. David's achievements include over 70 endurance races, with records for endurance swimming and pull-ups. David once wrote, “I was the sum total of the obstacles I’d overcome" (Goggins, 2018). So how did a self-proclaimed obese, anaemic quitter overcome enough obstacles to become known as the toughest man alive? Why do some people struggle to engage in physical activity, meet their academic goals, or maintain a healthy diet? Setting, pursuing and achieving goals is an important part of being human and is influenced by many factors, including motivation, perceived obstacles, and goal progress, which can fluctuate substantially from one instance of goal pursuit to the next. Motivation, which is broadly defined here as an internal psychological state that drives people to engage in behaviours aimed at achieving goals (Ryan & Deci, 2000b), is key to our understanding of goal pursuit. In both academic literature and popular culture, motivation is often talked about in terms of quantity (e.g., how much motivation does a person have for a goal?); however, over four decades of research (Deci & Ryan, 2000) tells us that the quality of motivation (e.g., why is a person striving for a goal?) is at least an equally important consideration. Although an extensive body of literature has been dedicated to the understanding how the quality of motivation influences goal striving success, most of this work considers total goal progress over extended periods of time rather than looking at how motives predict goal striving from one instance of pursuit to the next. Studies that do examine single instances of goal pursuit typically only do so in laboratory settings or by using cross-sectional designs. Furthermore, few studies have investigated ways to counteract the negative influences of maladaptive forms of motivation during goal striving. The purpose of this thesis is twofold. First, I explore how the quality of goal motivation predicts goal-related outcomes in during instances of goal pursuit both in the laboratory and in the real world. Second, I test whether a simple metacognitive strategy (Mental Contrasting with Implementation Intentions; MCII) can moderate the effects of certain maladaptive forms of motivation.

Self-Determination Theory

Self-Determination Theory (SDT; Deci & Ryan, 1985, 2000) provides a comprehensive framework for conceptualising and understanding human motivation. SDT states that when the basic psychological needs of autonomy (having agency over actions), competence (efficacy and mastery over actions), and relatedness (feeling connected to others) are met, optimal functioning, growth, and well-being follow (Deci & Ryan, 1985, 2000). The theory further posits that motivation is defined not just by its quantity but also by its quality. In SDT, it is posited that all reasons for behaviour can be classified as existing on a continuum (Howard et al., 2017) between autonomous motives, 'want to' motives, which stem from internally held personal values and interests, including activities pursued for their inherent enjoyment, value, or significance; to controlled motives, 'have-to', motives, which stem from increasingly external pressures to avoid negative outcomes or seek approval, and align less with personal values (Deci & Ryan, 2000; see Figure 1.1).

Autonomous motives can be further broken down into three sub-types: intrinsic motivation, integrated regulation, and identified regulation. Intrinsic motives are driven by inherent pleasure or challenge and are most strongly associated with personal growth and positive psychological outcomes (Howard et al., 2017; Van den Broeck et al., 2019). Integrated regulation motives align with personal identity and, although conceptually different, can merge with adjacent motives, often rendering them indistinguishable (Gagné et al., 2015; Howard et al., 2017). Despite being on the lower end of autonomous motivation, identified regulation motives are pursued for their valued outcomes and have been associated with positive outcomes such as vitality and mood (Howard et al., 2020; Ng et al., 2012).

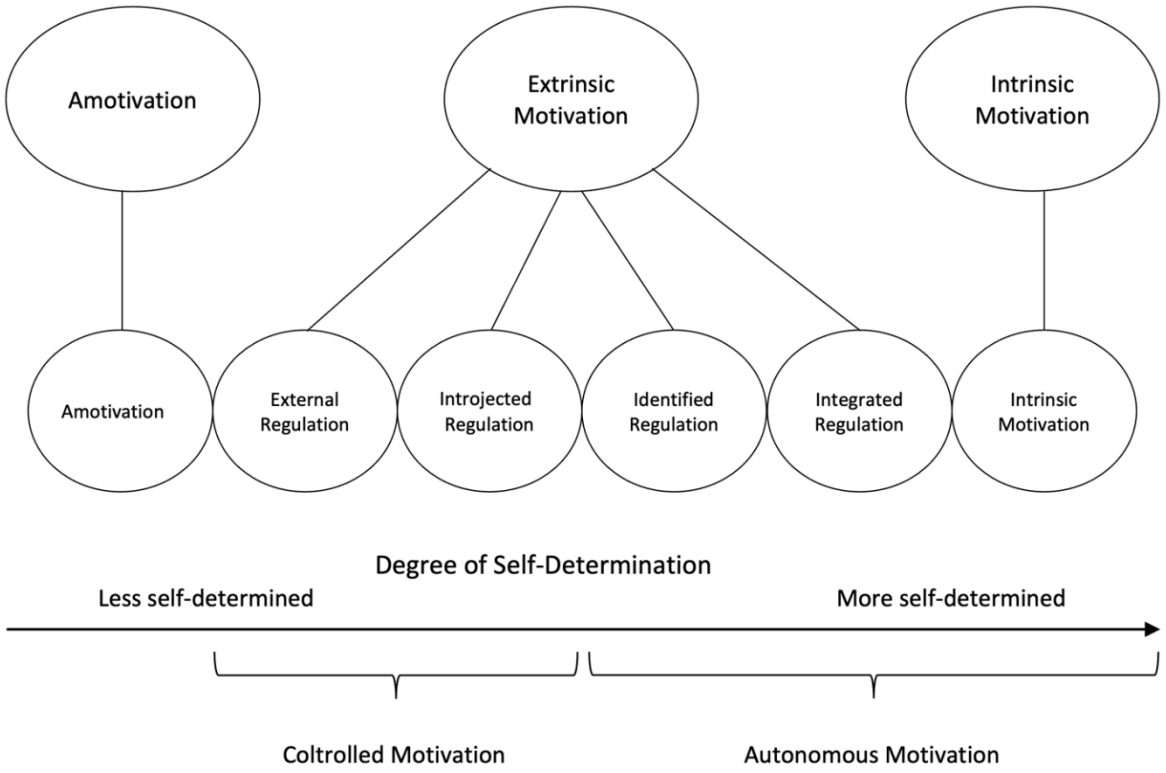
Controlled motives can similarly be broken down into external and introjected regulation. Introjected motives are influenced by internal factors such as guilt, shame or the pursuit of self-worth and are often associated with mixed outcomes ranging from anxiety to improved physical health (Ng et al., 2012; Assor et al., 2009). External motives are primarily influenced by external rewards or punishments, often lacking in inherent interest or enjoyment, and are associated with lower goal attainment and well-being (Howard et

al., 2020; Ng et al., 2012; Smith et al., 2007). Since individuals with high levels of controlled motivation do not generally experience positive outcomes, their goal-directed behaviour and even goal attainment can be associated with negative experiences (Gillet et al., 2017). As a result, even if goals are achieved, these individuals may experience increasingly adverse reactions, making future goal-directed behaviour less likely (Ntoumanis et al., 2014a). Even small differences in goal-directed behaviour between people with controlled and autonomous motivation can result in significantly divergent outcomes over time.

Whether a person is motivated primarily through autonomous or controlled motives plays an important role in the fulfilment or thwarting of basic psychological needs of autonomy, competence, and relatedness, which in turn are crucial for predicting ongoing well-being, psychological health, and goal attainment (Howard et al., 2020; Ng et al., 2012). Autonomous motives align with personal values and interests and directly foster the satisfaction of these needs. Research (Ryan & Deci, 2000a; Tang et al., 2020) has demonstrated that when individuals engage in activities that they have personally endorsed, they experience enhanced autonomy, competence, and a sense of relatedness, which are essential for optimal functioning and well-being. In contrast, pursuing goals through controlled motives contributes to the frustration of these needs, which can result in diminished well-being, increased stress, and other negative psychological outcomes (Vansteenkiste et al., 2013). Empirical literature supports SDT's framework, showing that autonomy-supporting environments significantly enhance need satisfaction, which in turn promotes well-being. Autonomous motivation can also foster autonomy-supportive environments, which in turn promotes further autonomous motivation. This interaction can result in an upward spiral where both autonomous motivation and autonomy-supporting environments are enhanced, further supporting well-being and goal attainment (Levine et al., 2021).

Figure 1.1

Conceptual map of motivation as outlined in Self-Determination Theory



Note: Adapted from Howard et al., (2017). Copyright 2017 by American Psychological Association.

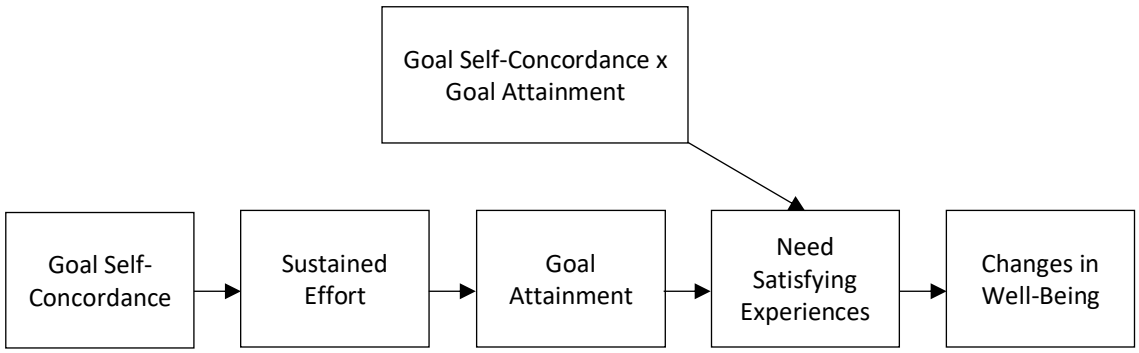
Self-Concordance Model

Building on SDT, the Self-Concordance Model (SCM; Figure 1.2; Sheldon & Elliot, 1999) bridges the gap between motivation and individual goal pursuit. According to the SCM autonomous and controlled motives can exist simultaneously for a single goal (Gillet et al., 2017) and explain why goal pursuit is more successful for some goals than others. Goals that are driven by more autonomous than controlled motivation are considered self-concordant because they are inherently interesting or enjoyable and resonate deeply with an individual's core values and identity. Pursuing these goals leads to greater goal attainment and personal well-being because self-concordant goals more likely to be pursued with effective goal regulatory strategies (e.g., use of implementation intention planning; Milyavskaya & Werner, 2018; e, Koestner et al., 2008; Riddell et al., 2023a), leading to higher rates of goal attainment or progress. This positive feedback loop reinforces the pursuit of self-concordant goals, promoting a sustainable cycle of motivation and fulfilment (Voigt et al., 2024).

In contrast, non-concordant goals, that is, those underpinned by more controlled than autonomous motives are less likely to be sustained over time (Sheldon & Houser-Marko, 2001). Further, the pursuit of non-concordant goals can lead to the development of ineffective goal regulation strategies, the frustration of psychological needs, and ultimately the perpetuation of psychological ill-being (Vansteenkiste et al., 2020). Recent meta-analytic structural equation modelling by Sezer (2023) examined the collective evidence for all pathways proposed in the SCM, finding moderate to strong associations between the constituent processes put forth in Sheldon and Elliot's (1999) original model. The authors also meta-analysed evidence for associations between controlled motives, maladaptive goal regulation, and ill-being, finding small-to-moderate-sized relationships between these processes.

Figure 1.2

The Self-Concordance Model.



Note: Adapted from Sheldon and Elliot, (1999).

Combatting Controlled Motives: Mental Contrasting with Implementation Intentions

The finding that motives can differentially influence how people pursue goals invites the question as to what can be done for people who are driven by controlled motives? One suggestion put forth by Ntoumanis and Sedikides (2018) in their Tripartite Model of Goal Striving is to train people to consciously use strategies that are observed in people pursuing goals for autonomous motives. In particular, these authors advocated training people to use MCII (Oettingen & Gollwitzer, 2010). MCII is a metacognitive strategy in which the individual first imagines attaining the most positive outcome they associate with their goal, then contrasting this with reality to identify obstacles to goal pursuit (mental contrasting). In the next step of the process, the individual forms “if-then” implementation intention to help them overcome

foreseeable obstacles in the future. Autonomously motived individuals form implementation intentions during goal pursuit (Chatzisarantis et al., 2010; Koestner et al., 2008) and that spontaneously formed patterns of cognition similar to MCII can help combat the maladaptive influence of controlled motivation (Riddell 2023b). Studies have shown that training people to use MCII can moderate the use of maladaptive forms of coping during goal striving associated with controlled motives both for individual instances of goal striving in the lab (Riddell et al., 2022) and longitudinally in the real world (Riddell et al., 2024). However, two questions remain outstanding: A) does MCII help people overcome obstacles, and B) does MCII help people in real world instances of engaging in goal-directed behaviour.

Research Aims and Overview

The two studies presented here aimed to examine how autonomous and controlled goal motives in combination with trained MCII influences the act of goal striving. We attempted investigate goal pursuit with a high degree of granularity by examining a single instance of goal pursuit in the lab (Study 1) as well as multiple instances of real-world goal pursuit over a month (Study 2). Study 1 in this paper measured motivation and goal-striving over a single instance in a lab-based experiment. MCII was provided as an intervention to determine the effects on the perceived disruptiveness of obstacles, motivation, and goal attainment. Findings from study 1 have been published as part of a larger piece of research (Riddell et al., 2023a). Study 2 expanded on this by measuring participants repeatedly over a four-week period in real-world setting, where people had recently engaged in a novel goal of their own choosing. This aimed to test not only the effects of the metacognitive strategy over a longer period, but also the assumption that motivation is stable, with little day-to-day fluctuation.

Study 1: The Effects of Mental Contrasting with Implementation Intentions (MCII) and Goal Motives on Obstacle Perception, and Objective Performance

In 2007, a 48-year-old Wim Hof climbed Mt Everest to an altitude of 6,700m wearing shorts and sandals. He then switched to boots with crampons, reaching 7,400m. Why are some people able to set lofty goals and achieve almost impossible accomplishments, while others struggle with seemingly simple goals such as exercising, getting to work on time, or eating a healthy diet? It has been proposed that factors that motivate an individual to strive for goals may influence how people perceive obstacles to goal attainment, and consequently the effort they apply to pursuing them (Leduc-Cummings et al., 2017; Milyavskaya et al., 2015). If this is the case, what can be done for individuals who lack motivation to overcome obstacles to achieving their goals? This research measured how goal motives and the metacognitive technique known as Mental Contrasting with Implementation Intentions (MCII; Oettingen & Gollwitzer, 2010) influence how individuals perceive obstacles, and whether this is related to objective performance.

This paper briefly reviews two key theories of motivation, Self-Determination Theory (SDT) and the Self-Concordance Model (SCM), and how they relate to goal progress and overcoming obstacles. It will then describe MCII and the Tripartite model of goal striving, which makes predictions about how MCII and goal motives may complement each other to promote effective goal striving. The remainder will outline an experimental research study that investigates how MCII and goal motives influence obstacle perception during goal striving.

Goal Motives

Motivation is a significant part of setting, pursuing, and achieving goals. It can vary between people and differ among their individual goals. Self-Determination Theory (Deci & Ryan, 1985, 2000) proposes that motivation occurs on a continuum ranging from autonomous to controlled, along with a state of amotivation (the absence of motivation). Autonomous motives are described as those which people 'want-to' pursue, because they are aligned with their inherent values and interests, and are often seen as interesting, enjoyable, or meaningful.

On the other end of the continuum, controlled, or 'have-to' motives (comprised of external or introjected regulation) are where internal or external influences drive motivation for reasons such as avoiding punishment, guilt, shame, anxiety, or for approval from others. They align to a lesser extent with an individual's inherent values or interests (Deci & Ryan, 2000), such as to avoid feelings of guilt or shame (introjected motives) or to avoid punishments or gain rewards that are external to an individual (external motives). People with controlled motives do not generally find goal pursuit interesting or enjoyable, and they are unlikely to continue pursuit without threat of punishment or promise of reward (Howard et al., 2020; Ng et al., 2012). Thus, they are associated with lower rates of goal attainment and wellbeing (Smith et al., 2007).

SDT further proposes that psychologically important needs of autonomy, competence, and relatedness underlie much of an individual's goal-directed behaviour (Deci & Ryan, 1985, 1991; Sheldon & Elliot, 1999). Autonomy refers to an individual's belief that their behaviour is self-directed and meaningful, competence is the feeling that a person is effective in their behaviour, and relatedness is connection to other people (Sheldon & Elliot, 1999). Goals pursued via autonomous motives are more likely to support these psychological needs, and in doing so, motivation is likely to become yet more autonomous (Howard et al., 2017). The extent to which a person is controlled or autonomously motivated has little relation to the importance of the goal outcome, such as physical health (Sheldon, 2014). Accordingly, some people may fail to exercise despite potential negative health outcomes, while others may spend hours each day mastering a beloved video game, despite the limited benefits from an outside perspective.

Self-Concordance Model

Grounded in SDT, the Self-Concordance Model (see Figure 1.3; Sheldon & Elliot, 1999) adds to the understanding of motivation, stating that goal motives can either be self-concordant, or not. Autonomously motivated goals are considered to be self-concordant because they align with an individual's self-conceptualisation or internally held values and interests. Individuals are more likely to sustain goal-directed behaviour over time towards self-concordant goals and are thus more likely to reap the benefits of their

attainment (Sheldon & Elliot, 1999). Goals pursued for controlled reasons do not align with an individual's sense of self and are thus not self-concordant.

The SCM further posits that individuals apply more effective behavioural regulation when goals are self-concordant (Sheldon & Elliot, 1999). For example, sustained effort is more likely to be applied to overcome obstacles and result in goal attainment , and self-concordant goals that are attained lead to internally satisfying experiences (Sheldon & Elliot, 1999). This ultimately drives positive changes in well-being (Sheldon, 2014; Sheldon & Elliot, 1999). Individuals pursuing self-concordant goals are more likely to persist in the face of adversity (Ntoumanis et al., 2014a), and use task-oriented coping strategies (Howard et al., 2020; Gaudreau et al., 2012). Task-oriented coping (e.g., directly managing stress and the emotional and cognitive effects through increasing effort, positive reappraisals, and relaxation) and effective self-regulation (e.g., planning and life management strategies) promote goal directed behaviour, rather than goal-thwarting behaviour such as disengagement (Howard et al., 2020; Gaudreau et al., 2012). Attainment of self-concordant goals is more likely to result in the satisfaction of psychological needs, including those of autonomy, relatedness, and competence, described in SDT (Sheldon & Elliot, 1999). Consequently, positive outcomes associated with goal attainment also reward and reinforce the pursuit of goals in people with autonomous motives, leading to further goal-directed behaviour, and ultimately goal attainment (Deci & Ryan, 2008; Gaudreau et al., 2012; Howard et al., 2020; Koestner, 2008; Sheldon & Elliot, 1999; Smith et al., 2007).

In contrast, behavioural regulation towards goals that are not self-concordant is diminished and even if they are achieved, important psychological outcomes such as positive changes in well-being are less likely to occur (Gaudreau et al., 2012; Ntoumanis et al., 2014b). For example, individuals with controlled motives are more likely to disengage from goal pursuit as a coping strategy (Gaudreau et al., 2012; Ntoumanis et al., 2014a; Ntoumanis & Sedikides, 2018). Those with controlled motives are often less committed to their goals, and demonstrate less persistent striving, and are less likely to attain their goals (Koestner et al., 2008; Ng et al., 2012).

Motivation and Obstacles Encountered During Goal Pursuit

In contrast to the idea that autonomously motivated individuals exert more effort towards their goals, it has been proposed that individuals with autonomous motives may have more access to effortless self-control, and self-regulation resources (Werner et al., 2016; Werner & Milyavskaya, 2019). Effortless self-regulation mechanisms might potentially be used to automatically or habitually engage in goal directed behaviour and overcome goal thwarting behaviour such as temptations and obstacles. Temptations that disrupt goal pursuit can occur in the form of impulsive attractions (Milyavskaya & Inzlicht, 2015), and when faced by those with controlled motives are perceived as more appealing. They can compete with goal-directed behaviour, and must be resisted with increased effortful self-control (Leduc-Cummings et al., 2017). Doing so can place greater demands on psychological resources to maintain goal pursuit, leading to goals and associated obstacles being perceived as more difficult (Werner et al., 2016; Werner & Milyavskaya, 2019). In contrast, people with autonomous motives can experience high levels of self-control in their goal pursuits as a function of habit rather than effortful self-control, and thus expend less psychological energy resisting temptations, making goal engagement easier (Gillebaart & de Ridder, 2015).

The potential implication of this research is that autonomous motivation may lead to goal attainment not because it initiates effortful persistence, as the SCM suggests (Sheldon & Elliot, 1999; Gaudreau et al., 2012), but because it results in effortless self-regulation, the perception of obstacles as less difficult, and fewer temptations (Leduc-Cummings et al., 2017; Werner et al., 2016; Werner & Milyavskaya, 2019). Resisting temptations relies on the ability to exert effort, and when people are tired, stressed, or otherwise overwhelmed, self-control may fail and the individual can give in, disrupting goal pursuit and compromising future goal attainment (Milyavskaya et al., 2015). People with autonomous motives may also find goal-thwarting temptations implicitly less appealing, and as such, may not have to rely on effortful self-control, but instead make psychologically congruent and efficient decisions to avoid temptations, and continue goal directed behaviour (Milyavskaya et al., 2015).

Obstacles to goal pursuit can be classified according to how numerous they are, how often they are encountered, as well as by the level of difficulty experienced. People with autonomous motives perceive obstacles that are fewer in number, and/or less difficult, compared to those with controlled motives (Milyavskaya et al., 2015). Experimental research has also demonstrated that future obstacles to goal pursuit are perceived as less difficult, and occur less frequently in people with autonomous motives (Leduc-Cummings et al., 2017). Given that controlled motives can negatively influence the perception of obstacles to goal pursuit, there is a need to empirically validate potential strategies to assist individuals with controlled motivation to persist with and overcome obstacles.

Enhancing Goal Striving: Mental Contrasting with Implementation Intentions

There are effective techniques to enhance goal striving through reducing influence of obstacles, and thus facilitate more effective goal-directed behaviour, while also reducing perceived effort (Werner & Milyavskaya, 2019). One technique that provides automated responses to obstacles and my thus facilitate goal striving that is less effortful is the metacognitive strategy of MCII (Oettingen & Gollwitzer, 2010). MCII involves first specifying a goal, imagining success and positive outcomes, and identifying obstacles that might be faced (e.g., Adriaanse et al., 2010). The initial mental contrasting component is argued to enhance goal commitment to match the individual's expectation of success (Kappes et al., 2012; Oettingen et al., 2009). Although it does not offer any solution to overcome obstacles. The implementation intentions component addresses this by developing contingency plans where 'if-then' statements are applied to obstacles identified during mental contrasting (e.g., Oettingen & Gollwitzer, 2010). By adding clearly and formally defined implementation intention, goal-directed responses can become automatic when an identified obstacle arises (e.g., Gollwitzer, 1999; Oettingen, 2012). This has been shown to facilitate goal engagement by reducing cognitive demands of overcoming obstacles (Brandstätter et al., 2001). Similarly, MCII can produce changes in the perceived quantity, or disruptiveness of obstacles (e.g., Kappes et al., 2012; Wittleder at al., 2020). MCII has also been shown to be an effective tool for improving goal commitment and attainment in a number of contexts, including health (Cross & Sheffield, 2019), education (Duckworth et al.,

2013), well-being (Howard et al., 2020) and relationships (Houssais et al., 2013). A recent meta-analysis of *N* = 21 studies found that MCII had small to moderate effects (*g* = 0.336) on goal attainment (Wang et al., 2021).

MCII may represent a time and cost effective, content-free practical tool for facilitating goal striving, especially for individuals with controlled motives. Such people experience less commitment to their goals (Ntoumanis et al., 2014a), and perceive more numerous and more difficult obstacles (Leduc-Cummings et al., 2017). MCII may prove effective since it can increase goal commitment by providing automated strategies for overcoming difficult obstacles (Chatzisarantis et al., 2008). Conversely, MCII might provide little additional benefit for autonomously motivated individuals, given that they already harbour strong goal commitments and motivational resources to overcome obstacles and are more likely to spontaneously use automated goal striving strategies, such as those promoted by MCII (Chatzisarantis et al., 2010; Koestner et al., 2008). Thus, it may be that MCII is differentially effective for individuals with different goal motivates.

The Tripartite Model of Goal Striving

Indeed, in their Tripartite Model of goal striving, Ntoumanis & Sedikides (2018) predict various ways in which goal motives and MCII might interact. It is proposed that self-regulation behaviours during goal striving (e.g., the exertion of effort to overcome obstacles) can be influenced by both MCII and autonomous or controlled motivation. When pursuing goals with controlled motives, it is proposed that MCII will improve commitment and effort towards the goal (Ntoumanis & Sedikides, 2018). It may also have the additional benefit of providing automated strategies to overcome obstacles, thus facilitating the perception of effortless goals striving (Gollwitzer, 1999). This in turn, will facilitate outcomes such as goal progress and attainment (Ntoumanis & Sedikides, 2018). Conversely, MCII should be of little additional benefit to individuals who are autonomously motivated to attain their goal, because these individuals already have a high degree of goal commitment and are more likely to spontaneously generate strategies that are associated with automated or habitual goal directed behaviour (Werner & Milyavskaya, 2019).

Research Aims

This research investigates the influence of MCII on the perceived number of obstacles when people have autonomous or controlled goal motives. It is proposed that people with controlled motives will perceive more numerous obstacles to overcome while in pursuit of their goals, and that MCII will moderate the effects of controlled motives by providing a strategy for reducing the number obstacles. Therefore, this research will test one of the key predictions of the Tripartite Model of goal striving (Ntoumanis & Sedikides, 2018) by examining the interactive effects of MCII and goal motives on obstacle perception. Additionally, we will investigate whether the number of obstacles predicts goal performance. To test our hypotheses we invited participants to complete two cycling time trials. In the first trial the participant was instructed to set a personal best (to encourage maximal effort), in the second trial they raced against a computerised opponent that cycled at a pace relative to their personal best. Half of participants were given MCII training. We measured goal motives for beating the computerised opponent for all participants. Given the effectiveness of MCII may be dependent on the perceived attainability of a goal (Kappes et al., 2012) we controlled for goal difficulty, goal importance, and attainment expectancy.

It is hypothesised that:

H1: Individuals with controlled goal motives perceive obstacles as more numerous than those with autonomous motives.

H2: Individuals who receive MCII training perceive obstacles as less numerous than individuals in a control condition.

H3: MCII training will interact differentially with autonomous and controlled goal motives, such that MCII will reduce the perceived number of obstacles for individuals with controlled motives, but will not influence the perceived number of obstacles in individuals with autonomous motives.

H4: Accounting for the effects of MCII training and goal motives, and controlling for baseline cycling performance, the perceived number of obstacles will negatively predict objective cycling performance in task two.

Method

This research contributed to findings published by Riddell and colleagues (2023a). Data were collected by two additional student-researchers measuring additional variables which are not included in the study presented here.

Participants

Participants were recruited from Curtin University's psychology participation pool, via posters on campus, and social media. Eligible psychology students received course credit for participation, no payments or incentives were offered to individuals recruited from outside the participant pool. Ethics approval was obtained for the larger project from the Curtin University Human Research Ethics Committee (HRE2018-0631). There was no upper age limit for participation, and mature minors were eligible. Competitive cyclists and triathletes were excluded as they are not representative of the wider population, as was anyone who failed the Adult Pre-exercise Screening System measure (APSS; Fitness Australia, 2019) for health and safety reasons.

An a priori power analysis using GPower (Faul et al., 2009) indicated a minimum sample of 98 participants would be needed to determine a medium effect (f^2 = .15, p < .05) with 80% power. The choice of medium sized effects was based on a recent meta-analysis indicating that MCII and goal attainment research generally produced small to medium effect sizes (Wang et al., 2021). A total of 117 participants were recruited. Participants' ages ranged from 18 to 73 years (M = 29.6, SD = 13.85), reported a mean of 1.3 hours of exercise a day (SD = 0.8), 60 identified as a woman, 39 as a man, and one as non-conforming.

Measures

Adult Pre-exercise Screening System

To manage potential health risk of strenuous physical activity, all participants were screened using the APSS (Fitness Australia, 2019). Questions included "Do you ever feel faint, dizzy or lose balance during physical activity/exercise?" Participants who answered *yes* to any questions were excluded from participating.

Goal Motives

Goal motives were measured using a self-report measure that assessed participants' agreement (1 - *Not at all*, 7 - *Very much so*) with 10 statements reflecting the following goal motives: intrinsic (e.g., I find pursuing the goal interesting), identified (e.g., The goal will give me personally important information), positive introjected (e.g., I want to feel proud of myself), negative introjected (e.g., I would feel ashamed if I didn't do well at the task), and external regulation (e.g., I feel that it is what I am supposed to do so). Each motivational construct was assessed by two items. This measure was adapted from Sheldon and colleagues (2017) and has been used previously in similar studies (Ntoumanis et al., 2014a). An autonomous motives score was calculated by averaging the intrinsic and identified items. A controlled motives score was calculated by averaging introjected, and external items.

Attainment Expectancy, Goal Difficulty, and Goal Importance

Given that the effectiveness of MCII may be dependent on the perceived attainability of a goal (Kappes et al., 2012), goal difficulty, goal importance, and attainment expectancy were included as control variables. These measures were adapted from Ntoumanis and colleagues (2014a, 2014b) and contain three items for each of the three constructs: attainment expectancy (e.g., "How confident are you that you will achieve your goal?"); goal difficulty (e.g., "How difficult is your goal?"); and goal importance (e.g., "How much do you value achieving you goal?"). Responses were rated on a seven-point scale (1 - *Not at all*, 7 - *Very*). Scores for the three items for each construct were averaged to obtain a construct score.

Obstacle Count

To determine obstacle perception, participants listed the obstacles they faced when striving for the goal of beating the AI opponent in the second cycling task. Participants wrote as many obstacles as they think they might face. Responses included "fatigue, muscle soreness, and negative thoughts". Obstacle count was scored by summing the number of obstacles listed by participants. On average participants reported 3.55 obstacles (*SD* = 1.38).

Performance

Objective performance for the cycling tasks was operationalised as the time taken to complete the 500 metres distance. Participants with lower race times were considered to have performed better on the task.

Other

Demographic information was collected including age, gender, and the average number of hours the participant spent doing physical activity each day.

Apparatus

The cycling task was conducted on a stationary cycling ergometer with an electromagnetic brake, programmed with a standardised resistance level. The cycling ergometer was placed in front of a 180-degree immersive screen, measuring 3 metres high by 8 metres wide. Participants viewed a computer-generated road, cyclist, and scenery. This provided an immersive, interactive environment, whereby the participants' pedalling effort dictated their cycling speed.

Procedure

Participants completed the study in a single session, lasting around 20-minutes. The study consisted of two cycling trials interspersed by self-report measures. On arrival, participants completed the APSS (Fitness Australia, 2019), and were informed the research was exploring goal motives. They were provided with a participant information sheet and completed a consent form. Prior to beginning the first cycling trial participants completed a survey that included demographics, and number hours of physical exercise per day. Participants were then shown the virtual cycling setup and were told that the aim of the first trial was to set a personal best. Participants were asked to pedal as fast as they could to a visible finish line. After the first trial, participants completed measures of goal motives, attainment expectancy, difficulty, and importance, and were provided the goal of beating an artificial intelligence (AI) opponent in the second trial. The AI opponent was 10% faster than the speed the participant had cycled at in their first trial, though they were not aware of this. Instead, participants were told that the AI was designed to be difficult but beatable.

Participants were randomly assigned by the survey software used to deliver the measures, and to receive either MCII training or the control condition. Researchers were aware of condition assignment, participants were not. In the MCII training condition participants viewed five short videos (around 40 seconds each) on MCII training, where they are asked to write their goal, a positive outcome of attaining their goal, and what significant obstacles they might face. They were then asked to think of an 'if-then' plan to overcome the obstacles. This procedure was developed based on MCII training described in other studies (e.g., Adriaanse et al., 2010), and examples developed by experts in the field (Oettingen, n.d.). Video delivery was used to standardise presentation. The control exercise was a creative writing task on an imaginary bicycle race that took approximately the same amount of time as the MCII training. After the second cycling task, participants had the opportunity to rest before completing final measures on obstacle perception. Debriefing information was provided on completion.

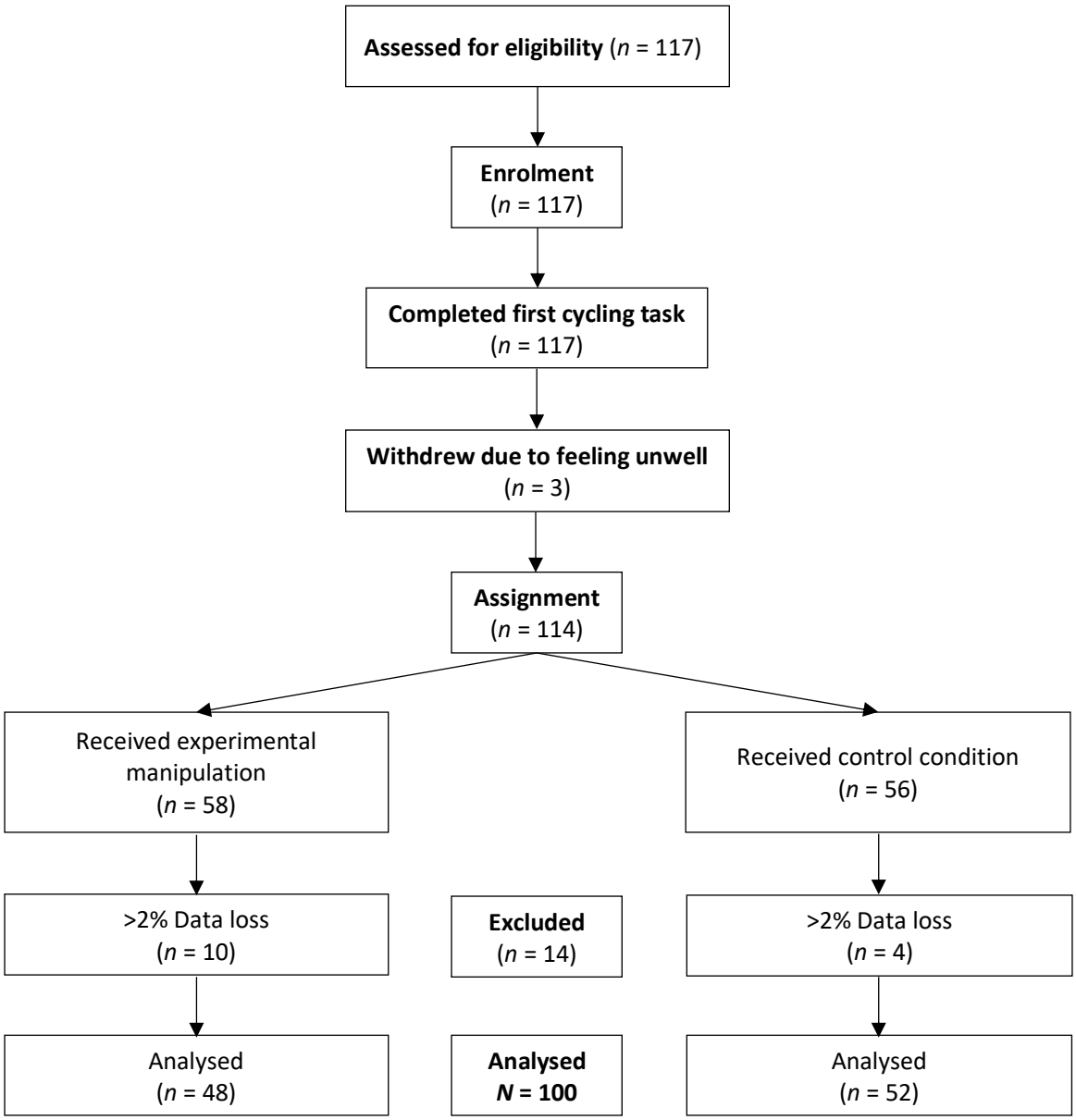
Results

Participant Flow

Figure 1.3 depicts the flow of participants through the experiment, showing points of data loss and participant withdrawal.

Figure 1.3

Participant flow through stages of the experiment



Note. Adapted from the CONSORT Group (Schulz, Altman, Moher, & the CONSORT Group, 2010).

Missing Data

Software errors resulted in data missing not at random, where 23 (19.7%) participant's second cycling time and distance were not recorded completely. Recorded distances for these participants ranged from 401 to 499 metres ($M_{missing}$ = 28.23 metres, $SD_{missing}$ = 28.58 metres), with one trial failing to record entirely. Data for 14 participants that had more than 10 metres (>2% of the total distance) missing were excluded from the sample. For the remaining nine data files where less than 2% of data was missing ($M_{missing}$

= 4.10 metres, *SD* = 2.82 metres), linear least squares regression ($y=\beta_1 x+\beta_0$) was fit to the last 25% of the available data for each participant (to avoid artefacts associated with rapid acceleration at the beginning of the trial). The resulting regression equations provided an excellent fit on average to the data (mean R^2 = .999). Individual regression equations were used to estimate missing data points for each participant. The mean estimated elapsed time for participants with missing data was 44.82 seconds (*SD* = 6.30), while the mean for those with complete data was 45.51 seconds (*SD* = 8.60). Welch t-test revealed no statistically significant difference between the race times for the two groups ($t(98) = .041$, $p = .491$).

Descriptive Statistics

Table 1.1 illustrates the descriptive statistics, internal consistency and intercorrelations between study variables. Results indicated several variables had weak to strong correlations, and all Cronbach's alpha reliabilities were above .70.

Table 1.1

Descriptive Statistics, Internal Reliabilities (Cronbach's alpha) and Pearson Bivariate Correlations Between Study Variables

	M	*SD*	2	3	4	5	6	7	8	9
1.Obstacle Count	3.55	1.38	**.24**	.19	**.24**	.11	**.26**	**-.22**	.01	.07
2.Controlled	4.19	1.26	-	.14	.16	.05	**.36**	.11	.19	**.22**
3.Autonomous	5.08	0.94		-	.06	**.45**	**.56**	.08	-.01	-.10
4.Goal Difficulty	5.14	0.95			-	-.05	**.28**	**-.22**	.01	.02
5.Attainment	4.70	1.27				-	**.56**	.03	-.20*	**-.30**
6.Goal Importance	4.77	1.13					-	-.01	.08	.03
7.Condition	-	-						-	-.07	-.16
8.Elapsed Time 1	47.26	8.43							-	**.92**
9.Elapsed Time 2	45.45	4.41								-
Cronbach's α			.82	.70	.88	.91	.88	-	-	-

Note. Condition: Control = 0; MCII = 1.

Goal Motives, Mental Contrasting with Implementation Intentions, and Obstacle Perception

Hypotheses one, two, and three were tested with a hierarchical multiple regression analysis (MRA; SPSS 26) to estimate the variance in obstacle count that could be accounted for by goal motives, and whether this was moderated by MCII training or the control condition.

Data were checked for relevant assumptions of Pearson's correlation, independent samples t-test, moderated regression, and hierarchical regression. Variables were normally distributed, with skewness and kurtosis ratios below the acceptable limits of 3 and 7 respectively (Tabachnick & Fidell, 2014). Goal difficultly displayed a moderate negative skew, and objective performance in task two displayed a moderate positive skew, these were not large enough to be considered non-normal and did not require transformation considering the sample size (Tabachnick & Fidell, 2014). Scatterplots between goal motives and obstacle count indicated that the assumption of linearity was met.

Homogeneity of variance was met between the two groups in the condition variable, with Levene's significance above 0.05. Assumption of independence of errors was met, with Durbin-Watson values within the required range for hypothesis three (*DW* = 2.07) of 1.5 to 2.5 (Tabachnick & Fidell, 2014). There were no issues of multicollinearity with all tolerance levels above 0.20 and VIF values less than 5. There were no influential cases with Cook's distance values less than 1.00 in hypothesis three (max = 0.12). There were no residual outliers outside +/-3.29, and no multivariate outliers with hypothesis three displaying none with the maximum Mahalanobis' distance value of 20.89, lower than the X^2 critical value of 22.46 for a model with six predictors at an alpha of .001 An inspection of the residual histogram and normal P-P plot indicated that the assumption of normality of residuals was met. Inspection of the standardised residual by standardised predicted value scatterplot indicated no obvious fanning, indicating that the assumption of homoscedasticity and linearity of residuals was met.

At step one of the hierarchical MRA we included the covariates of goal difficulty, attainment expectancy, and goal importance. They predicted a significant 10% portion of the variance of obstacle count (R^2 = .100, $R^2_{ADJUSTED}$ = .071, $F(3, 96) = 3.54$, p = .018).

Hypotheses one and two were tested at the second step, where we entered controlled goal motives and the condition. Together they explained a significant 6.4% change (ΔR^2 = .064, $\Delta F(2, 94) = 3.609$, p = .031), and a significant 16% portion of the variance in obstacle count (R^2 = .164, $R^2_{ADJUSTED}$ = .119, $F(5, 94)$ = 3.682, p = .004). Controlled goal motives did not significantly account for variance in the number of

obstacles (B = .19, t(94) = 1.83, p = .071), and as such hypothesis one was not supported. MCII training significantly predicted the number of obstacles (B = -.22, t(94) = -2.22, [-.41, -.02], p = .029), providing support for hypothesis two, with a small effect size (f^2 = 0.196), with those who received MCII predicted to perceive fewer obstacles than those in the control group.

In the third step we entered the interaction terms of MCII and controlled motivation, testing hypothesis three. This addition explained 16% variance (R^2 = .164, $R^2_{ADJUSTED}$ = .111, F(6, 93) = 3.05, p = .009) of obstacle count, although the change from step two was nonsignificant (ΔR^2 = .001, ΔF(1, 93) = .070, p = .791). As such, hypothesis three was not supported (see Table 1.2).

Table 1.2

Correlation Coefficients (B), 95% CIs, Standard Errors, t-values and Squared Semi-partial Correlations for a Hierarchical Regression in which Goal Motives Predict Number of Obstacles, Moderated by MCII Training

Variable	*B*	95% CI for *B*		*SE B*	*t*	*p*	*F*	ΔR^2	sr^2
		LL	*UL*						
Step 1						**.018**	3.539	.100	
Goal Difficulty	.18	-.03	.39	.10	1.73	.087			.03
Attainment	.003	-.24	.24	.12	0.02	.982			<.001
Goal Importance	.21	-.04	.46	.13	1.68	.097			.03
Step 2						**.004**	3.682	.064	
Goal Difficulty	.12	-.08	.33	.11	1.19	.238			.12
Attainment	.04	-.20	.28	.12	0.33	.742			< .001
Goal Importance	.14	-.13	.40	.13	1.03	.306			.01
Controlled	.19	-.02	.40	.10	1.82	.071			.03
Step 3						**.009**	3.050	.001	
Goal Difficulty	.13	-.08	.34	.11	1.21	.229			.01
Attainment	.05	-.20	.29	.12	0.37	.716			.001
Goal Importance	.14	-.13	.40	.13	1.03	.304			.01
Condition	**-.22**	-.41	-.02	.10	**-2.19**	**.031**			.04
Controlled	.19	-.02	.40	.11	1.79	.077			.03
Condition*Controlled	-.03	-.23	.17	.10	-0.27	.791			<.001

Note. CI = Confidence interval; *LL* = lower limit; *UL* = upper limit.

Obstacle Perception and Objective Performance

Hypotheses four was tested with a hierarchical MRA (SPSS 26) to estimate the variance in objective performance that could be accounted for by obstacle count.

Assumptions were met including Pearson's correlation, independent samples t-test, moderated regression, and hierarchical regression. All variables were normally distributed, although objective cycling performance in task one displayed a moderate positive skew, it did not require transformation (Tabachnick & Fidell, 2014). Assumption of independence of errors was met, with Durbin-Watson values within the required range of 1.5 to 2.5 (*DW* = 1.56; Tabachnick & Fidell, 2014). There was no multicollinearity with all tolerance levels above 0.20 and VIF values less than 5, and no influential cases with Cook's Distance values less than 1.00 (max = 0.20). There was a single outlier in elapsed time for cycling task one (z = 3.60; Mahalanobis' distance value of 19.81, larger than the maximum value of 16.27 for a model with three predictors). There was no justification to delete or transform this outlier. The residual histogram and normal P-P plot indicated the assumption of normality was met, and the standardised residual by standardised predicted value scatterplot indicated assumptions of homoscedasticity and linearity of residuals were met.

Results did not support the hypothesis that accounting for the influence of MCII training, and cycling performance in task one, the number of obstacles will negatively predict objective cycling performance in task two. The overall model accounted for 85.1% of variance in objective cycling performance in task two, R^2 = .85, $F(3, 94) = 179.19$, $p < .001$. While the addition of condition at step 2, contributed an additional 0.7% of variance to the model, $\Delta R^2 = .01$, $\Delta F(1, 95) = 4.13$, $p = .045$, the addition of obstacle count did not contribute additional significant variance at step three, $\Delta R^2 = .003$, $\Delta F(1, 94) = 1.88$, $p = .173$.

Inspection of the regression coefficients in Table 1.3 indicated that that performance in task one significantly predicted performance in task 2 at all three steps of the regression. The condition significantly predicted task two performance at step two, with those receiving MCII training predicted to have a faster time, however it did not predict performance at step three. Finally, at step three, obstacle count was not a significant predictor of task two performance.

Table 1.3

Hierarchical Regression Predicting Objective Cycling Performance in Task Two

Variable	*B*	95% CI for *B*		*SE B*	*t*	*p*	*F*	ΔR^2	sr^2
		LL	*UL*						
Step 1						**.000**	509.97	.842	
Elapsed Time(1)	**0.92**	0.84	1.00	0.04	**23.83**	**.000**			.85
Step 2						**.000**	265.37	.007	
Elapsed Time(1)	**0.92**	0.84	0.99	0.04	**24.16**	**.000**			.84
Condition	**-1.51**	-2.77	-0.25	0.64	**-2.37**	**.045**			.01
Step 3						**.000**	179.19	.003	
Elapsed Time(1)	**0.92**	-0.84	0.99	.04	**24.18**	**.000**			.84
Condition	-1.35	-2.65	-.06	0.65	-2.07	.096			.01
Obstacle Count	0.25	-0.22	0.72	0.24	1.06	.173			.002

Note. CI = Confidence interval; *LL* = lower limit; *UL* = upper limit.

Discussion

This experiment measured the effects of goal motives on the perceived number of obstacles during goal attainment, and whether this was moderated by MCII training. Participants completed the experiment in a single session, where they received MCII training or a control condition. They were provided with a goal of beating an AI cyclist, which they attempted shortly after the condition. An additional post-hoc analysis measured whether the number of obstacles predicted objective performance.

Hypothesis One: Controlled Goal Motives and the Number of Obstacles

Controlled goal motives were not able to predict the number of obstacles, as the *p* value fell just outside statistically significant norms and the confidence intervals crossed zero (Olsson-Collentine et al., 2019). Prior research exploring the role of goal motives in predicting the number of obstacles found that individuals with autonomous motives perceived fewer obstacles (e.g., Werner et al., 2016). This relation may be moderated by time, whereby the number of obstacles to future goals is reduced, but perceptions of past obstacles remain unchanged (Leduc-Cummings et al., 2017). This time-mediated relation suggests that our nonsignificant results may be partly due to measuring obstacles shortly after participants attempt a novel goal. Where prior research found a significant relation, participants either self-selected a goal, or there was temporal separation between providing participants with a goal, and measuring their obstacles (e.g., Leduc-Cummings et al., 2017; Milyavskaya et al., 2015). Additional research further links the effects of time to

physical activity, finding that athletes with autonomous goal motives demonstrated higher mid-season effort, which then predicted end-of-season goal attainment (Smith et al., 2011). The effect of autonomous motivation in reducing the number of obstacles may require temporal separation. It is proposed that time provides autonomously motivated individuals with the opportunity to engage in spontaneous, self-created techniques that enhance motivation by reducing the number of obstacles, and that individuals with controlled motives do not generally engage in such cognitions, regardless of time. The Tripartite Model of goal striving partially predicts this, where autonomously motivated individuals engage more persistently in goal-directed behaviour, which ultimately leads to a greater likelihood of goal attainment (Ntoumanis & Sedikides, 2018). Prior research also provides some support for the existence of self-created motivation strategies in finding that individuals with autonomous motives are more likely to approach their goals, while those with controlled motives are more likely to avoid them (Elliot et al., 1997). This approach-centric behaviour may facilitate the self-creation of cognitions that reduce the perceived number of obstacles, and in doing so enhance goal-directed behaviour, especially since people with autonomous goal motives are sensitive to feedback regarding their progress, and change their behaviours as a consequence (Deci & Ryan, 2000). Additional support is partly provided from research demonstrating that individuals with autonomous motives find goal-thwarting temptations less appealing, and as such, are more likely to engage in goal-directed behaviour (Milyavskaya et al., 2015).

An implication for this time-mediated relation may be that regardless of goal motives, individuals will initially perceive obstacles to a novel goal as equally numerous, while those with autonomous motives will perceive fewer obstacles over time, even without MCII. Accordingly, strategies to reduce the number of obstacles to goal-directed behaviour would be valuable for people who have recently undertaken a new goal, or for those who plan to, regardless of their motives. For those pursuing already established goals, MCII may prove more effective for those with controlled motives.

Hypothesis Two: Mental Contrasting with Implementation Intentions and the Number of Obstacles

This experiment provided evidence to support the hypothesis that individuals who received MCII training would perceive fewer obstacles while in pursuit of their goal. This is in line with existing research which finds that MCII is effective in reducing the number of obstacles across a variety of domains (e.g., Kappes et al., 2012; Wittleder at al., 2020). Our research delivered MCII training under conditions that may reduce the effectiveness, including: video delivery; providing a novel goal to participants; and measuring the obstacles soon after MCII training was provided.

Face-to-face delivery of MCII training has been shown produce larger effects than other modalities, including video delivery (Wang et al., 2021). Video was partly used in this experiment to standardise training and eliminate effects different researchers may have introduced. The results demonstrate that MCII can be effectively delivered electronically, which is supported by prior research (e.g., Gollwitzer et al., 2018). This is especially important given the increased reliance on non-personal communication, and the suitability of MCII training for electronic delivery.

Our research provides support for the effectiveness of MCII with externally specified goals, with existing research demonstrating that MCII is effective regardless of whether people self-select goals, or one specified for them (Abbott et al., 2020; Abdulla & Woods 2021). Our results also provide support for the generalisability of MCII as an effective tool to enhance motivation across a wide range of domains, and circumstance, where previous research has shown MCII to be effective in domains including health behaviour, academic achievement, relationships, and other personal goals (Cross & Sheffield, 2019; Duckworth et al., 2013; Houssais et al., 2013; Howard et al., 2020).

In conjunction with previous research, our findings demonstrate that MCII may be useful for reducing people's perceptions of goal-related obstacles and can be generalised across a wide range of domains and circumstances. It remains effective even when delivered under sub-optimal conditions such as electronic delivery, an externally specified, novel goal, that must be attempted shortly after training.

Additionally, MCII compares favourably to other meta-cognitive motivation techniques, such as solution-focussed coaching (Martenstyn & Grant, 2021).

Hypothesis Three: The Mediating Effect of Mental Contrasting with Implementation Intentions

Although our model did predict the number of obstacles, only MCII was statistically significant. As such, evidence to support the hypothesis of the mediating role of MCII differentially reducing the number of obstacles for individuals with controlled goal motives was not found. This is in line with results of our previous hypotheses, where goal motives are not a significant predictor of obstacles, and where it is proposed that time mediates the relation between autonomous motives and the number of obstacles to a novel goal. Conversely, if individuals provide their own self-selected goals, we might expect both goal motives and MCII to predict the number of obstacles, as supported by prior research (Ntoumanis & Sedikides, 2018).

Hypothesis Four: Number of Obstacles Predicting Objective Performance

The model tested was able to predict objective performance, however, only elapsed time in the first cycling trial was statistically significant. As such, our results did not support the hypothesis that the number of obstacles would predict objective cycling performance.

Existing research on obstacles and objective performance is still emerging, leaving little to compare our findings to. Given these results, it is proposed that the number of obstacles does not directly predict objective performance when an individual has already made the decision to engage in goal-directed behaviour. Rather, the relation may be mediated by goal engagement, where people who engage with their goal more frequently achieve better performance over time (e.g., Ntoumanis & Sedikides, 2018; Smith et al., 2011). As such, an individual who perceives more obstacles may choose to engage in exercise behaviour less frequently (giving in to temptations more often; Milyavskaya et al., 2015), but when they do engage, our research suggests they produce the same performance as those who perceive fewer obstacles. This may only apply to novel goals, since the performance of individuals may diverge over time, depending on how many obstacles they perceive. Given the infancy of this research, caution should be taken in generalising

these findings, as they may only apply to situations similar to our experiment, where people are presented with a novel goal that must be attempted in the immediate future.

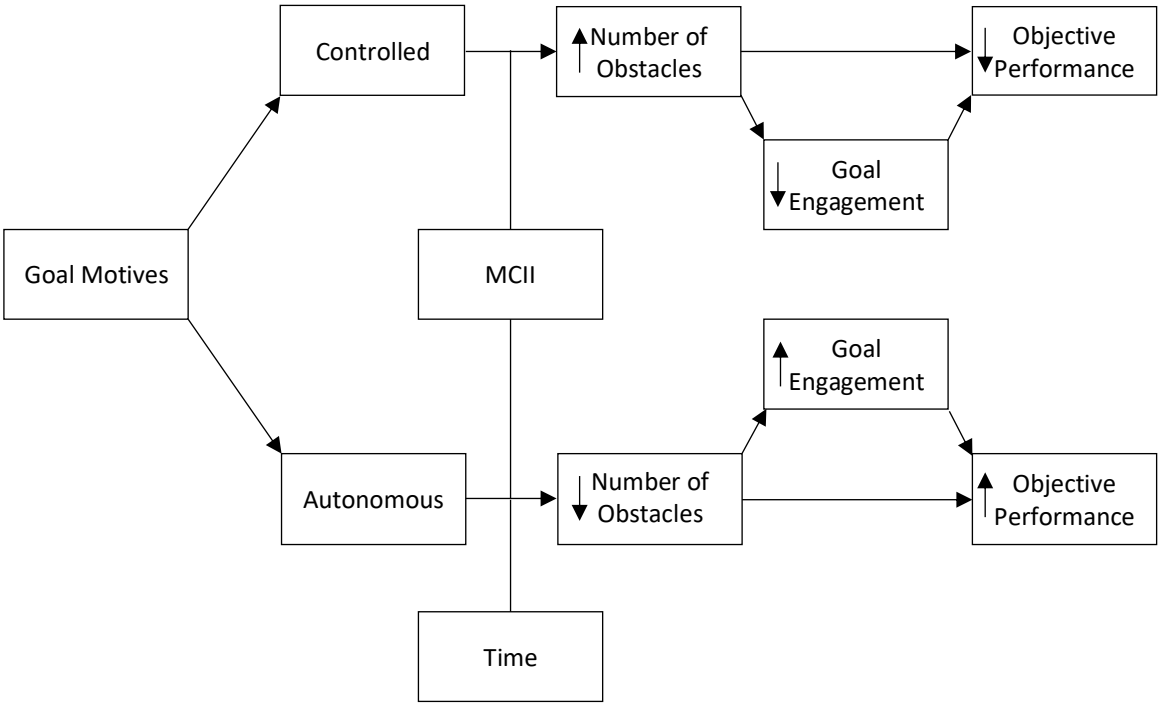
A Proposed Model of Goal Motives, Obstacles, and Performance

To aid in understanding of how goal motives, MCII, obstacles, and objective performance may interact, we propose a simplified conceptual model, which also accounts for the effects of time (see Figure 1.4). Components of this model are supported by our results, and from existing research.

The bottom half of the model proposes that autonomous goal motives are associated with fewer obstacles (Werner & Milyavskaya, 2019), but this may be largely mediated by time, a hypothesis that has yet to be formally tested. Once an autonomously motivated individual has defined a goal, the passing of time should result in fewer perceived obstacles, since the individual may create their own metacognitive strategies. MCII training provided at this point should still result in some additional reduction of obstacle count (as supported by our research and; Oettingen, 2012), as it is unlikely the self-created strategy is optimal. With a reduction in the number of obstacles, individuals are more likely to engage in goal-directed behaviour, rather than give-in to temptations (Milyavskaya et al., 2015).

Figure 1.4

Conceptual model of novel goal motives, MCII, obstacles, goal engagement and objective performance



Further testing is required to determine the extent to which the relation between obstacles and objective performance is mediated by goal engagement. Regardless, reducing the number of obstacles should facilitate increased objective performance over time for those with autonomous motives.

In contrast, the top half of the model largely proposes the opposite, although it is not believed that time will change the perceived number of obstacles for those with controlled motives. Here, more numerous obstacles can reduce goal-directed behaviour (Ntoumanis et al., 2014a), and increase the attractiveness of incompatible temptations (Milyavskaya et al., 2015), ultimately resulting in reduced performance (Werner et al., 2016). MCII training may be differentially more effective in reducing the number of obstacles in people with controlled motives (Ntoumanis & Sedikides, 2018), since they may be less likely to have formed their own metacognitive strategies. From this model it is proposed that changes to the number of obstacles lead to changes in goal-directed behaviour, which result in diverging performance over time, and that MCII can facilitate such helpful change.

Goal Disengagement

Research has shown that MCII can aid in producing more accurate assessments of whether a specified goal is attainable, and where goals are deemed unattainable, promote disengagement (Ntoumanis & Sedikides, 2018). This is an adaptive response which allows individuals to reengage with an attainable goal, and protects autonomously motivated individuals from negative outcomes associated with failure to attain their goals (Carver & Scheier, 2005). Participants in our experiment were provided a goal of beating an AI opponent that was difficult but beatable, however only around 15% (n = 18) of participants beat the opponent. We suggest that given the difficulty, participants who received MCII training may have been more likely to disengage, and stop or slow pedalling before the finish.

Directions for Future Research, Strengths and Limitations

Future research might consider formally testing the effects of time on the number of obstacles among individuals with different goal motives, and the interaction effect of MCII. By providing a novel goal to participants and measuring their goal motives and number of obstacles at two points in time, we could

test the hypothesis that autonomously motivated individuals who accept a novel goal will experience a reduction in the number of obstacles over time without MCII.

Additional research on the relation between MCII and the number of obstacles may consider a longitudinal or diary study, where MCII is delivered online, and participants can practise the technique over time. This will provide an opportunity to test the hypothesis that MCII is more effective for people with controlled goal motives, which our results did not support. There is also a practical need to test the effectiveness of electronic delivery of MCII training delivered over time. Additionally, the effectiveness of MCII strategies on different cultures should be considered, since most MCII intervention studies focused on Western cultures (e.g., Oettingen, 1997; Oettingen et al., 2008). Where research has explored the differences between cultures, it has been found that MCII has been effective for individuals in individualistic cultures, but not for people in collectivist cultures (Kizilcec & Cohen, 2017).

Unexpected data loss to participants' second cycling trial presented a technical limitation that could not be solved or adequately explained. While data could be extrapolated for some participants, too much data was missing from others that would have otherwise been included. Even though the minimum sample size was achieved, future research using this equipment might prioritise addressing this.

Conclusion

This research provides evidence for the effectiveness of MCII training to reduce the number of obstacles to goal pursuit. MCII training was delivered electronically, eliminating replicability and inseparability issues of face-to-face delivery. It was effective for a novel goal occurring in the immediate future, without the need for prolonged rehearsal. While previous literature proposes MCII is effective in reducing the perceived number of obstacles by the creation of 'if-then' plans which become automated, our research suggests it is also effective if that plan has not yet become automated. Our results did not support the hypotheses that goal motives would predict the perceived number of obstacles. MCII training was not differentially effective for people with autonomous or controlled goal motives. The perceived number of obstacles did not predict objective performance. A conceptual model of novel goal motives has been

proposed to further test areas of motivation and objective performance. A key initial step to evaluating this model lies in developing a nuanced understanding of the relationship between motives, MCII, goal engagement and goal progress change between instances of goal striving.

Study 2: A Longitudinal Study of Motivation and Goal Difficulty on Goal Progress and Mental Contrasting with Implementation Intentions (MCII).

People typically employ more effective self-regulatory strategies when pursuing autonomous or self-concordant goals and thus experience greater success in their goal striving (Gaudreau, 2012, Koestner et al., 2008; Sezer et al., 2024). However, inherent in the SCM is the idea that goals are not always entirely self-concordant and, in actuality, people are more likely to endorse some mixture of autonomous and controlled reasons for goal pursuit. Indeed, autonomous and controlled motives can exist simultaneously for the same goal (Ratelle et al., 2007). Anecdotally, motivation appears to fluctuate from goal-striving occasion to occasion – even activities we generally enjoy can occasionally feel burdensome. For instance, attending sports training when we are tired can feel like a chore, despite usually enjoying the activity (Shen et al., 2020). It stands to reason that in instances when people are more autonomously motivated, their goal regulation should be more effective, and progress and engagement with the goal should be greater than in instances when they feel they are pursuing the goal for controlled reasons.

Goal Motives and Behaviour Over Time

There is evidence that motivation can differ over time. For example, pursuing goals in autonomy-supportive environments that enhance personal choice supports autonomous forms of motivation and can facilitate an internalisation process, whereby externally imposed goals with controlled motives can become integrated into one's own value system over time through experiences of competence and success (Koestner et al., 2015; Ryan & Deci, 2000b). This creates a positive feedback loop that transforms motivation from controlled to autonomous (Sheldon & Houser-Marko, 2001). Research suggests that when people enjoy goal pursuit and experience success, it fosters the growth of autonomous motivation and increased engagement in goal-directed behaviour, which in turn creates more enjoyable and successful goal-striving

experiences. Success in pursuing goals and feelings of competence reinforce the personal value and satisfaction derived from activities, making the motivation to engage in these tasks more autonomous over time, ultimately resulting in stable, autonomously motivated goal pursuit (Koestner et al., 2008; Levine et al., 2021). It should be noted, however, that the aforementioned studies measure changes in motivation over extensive periods of time, such as months or years, assuming a slow transition from more controlled to more autonomous motivation. There is the inherent yet untested assumption that, over time, day-to-day experiences of goal pursuit must become more autonomous.

Contrasting with this assumption, autonomous motivation is often conceptualised as a stable trait-like characteristic (Koestner et al., 2015). Controlled motivation, by comparison, is thought to be subject to greater fluctuations day-to-day, and while external rewards or punishments can initially promote goal-directed behaviour, its impact on sustained goal-directed behaviour may depend on the continued presence of external influences. As such, controlled motivation can be a less reliable predictor of goal-directed behaviour (Koestner et al., 2015). In combination with findings discussed in the previous paragraph showing that motivation can change over time based on the environment in which a person pursues their goals, there is considerable research to suggest that motivation should be considered transient and subject to contextual influences rather than fixed.

Although longitudinal research has measured how goal-directed behaviour develops over time as a function of motivation; however, again this work typically treats motivation as a stable (Koestner et al., 2014), thus overlooking potential variability in the motivation that individuals experience from day-to-day during goal striving. For example, previous research has considered within-person associations between autonomous and controlled goal motives and various goal-related outcomes (e.g., progress, facilitation, interference) and observed substantial fluctuations in these outcomes from day-to-day (Riddell et al., 2023b). However, this work did not consider that motivation itself might also fluctuate and that these fluctuations might account for differences in goal striving effectiveness. On the other side of the equation, lab-based studies considering single, isolated instances of goal striving consistently find associations

between autonomous motivation, effective self-regulation, and consequently, goal progress (e.g., Ntoumanis et al., 2014; Riddell et al., 2023a, 2024). Open questions remain as to whether, in real-world settings, motivation changes substantially between instances of goal striving, and whether the predictions of the SCM hold at the within-person level. In other words, on days when an individual feels more autonomously motivated, do they engage more with goals and experience more goal progress? This area remains critically under-explored and could provide crucial insights into how people regulate their pursuit of goals in response to daily circumstances, obstacles, or difficulties (Neal et al., 2017).

Mental Contrasting with Implementation Intentions

Obstacles are frequently faced during goal pursuit and present barriers to goal-directed behaviour. People with high levels of autonomous motivation perceive obstacles as less numerous and less disruptive compared to those with high levels of controlled motivation (Milyavskaya et al., 2015). Additionally, high levels of controlled motivation are associated with a dyad of increased number of perceived obstacles (Riddell et al., 2023a) and less effective strategies for goal pursuit, which ultimately contribute to increased levels of failure for such goals (Koestner et al., 2008). Nonetheless, there are occasions when we must achieve goals, even when we feel driven by controlled motives (e.g., doing house chores or exercising when feeling tired). One way of helping people progress goals in instances when they feel driven by controlled motivation may be training them to use strategies frequently employed by autonomously motivated people (Ntoumains & Sedikides, 2018). For example, evidence that people with autonomous motivation spontaneously (i.e., without prior instruction) use metacognitive strategies like implementation plans and mental contrasting to enhance self-regulation of goal-directed behaviour (Koestner, 2008; Riddell et al., 2023a; Sevicner et al., 2013). Ntoumanis and Sedikides (2018) have suggested that training to use techniques that combine mental contrasting and implementation intentions (MCII; Oettingen & Gollwitzer, 2010) may be an effective way to help people effectively regulate-goal directed behaviour when they feel driven by controlled motives.

MCII is a metacognitive strategy that combines two techniques of mental contrasting and implementation intentions (Oettingen & Gollwitzer, 2010). The mental contrasting component asks individuals to define a goal, imagine successful outcomes, and identify potential obstacles (Adriaanse et al., 2010). Mental contrasting is believed to bolster commitment to goals by aligning them with the individual's expectations of success (Kappes et al., 2012; Oettingen et al., 2009), although it does not provide direct methods for overcoming obstacles. The implementation intentions phase addresses this by creating specific 'if-then' plans for anticipated obstacles (Oettingen & Gollwitzer, 2010). Formally structured implementation intentions can transform effortful goal-directed responses into automatic goal-directed actions upon encountering obstacles (Gollwitzer, 2014; Oettingen, 2012), thus easing goal engagement by reducing the cognitive load involved in navigating challenges (Brandstätter et al., 2001). MCII can also alter perceptions regarding the number and disruptiveness of obstacles (Kappes et al., 2012; Wittleder et al., 2020) and can improve the perceived ease of goal striving, as demonstrated in Study 1 of this thesis. Research suggests that MCII may enhance goal commitment by providing automated strategies for overcoming difficult obstacles (Chatzisarantis et al., 2008). MCII is beneficial for enhancing goal commitment and achievement across various domains such as health (Cross & Sheffield, 2019), education (Duckworth et al., 2013), well-being (Howard et al., 2020), and interpersonal relationships (Houssais et al., 2013). A recent meta-analysis of 21 studies indicated that MCII has small to moderate effects (g = 0.336) on goal attainment (Wang et al., 2021).

MCII represents a time-efficient, cost-effective, content-neutral tool that could be particularly beneficial when individuals experience controlled motivation for a goal and may be susceptible to weaker goal commitment or perceive obstacles as more numerous and disruptive (Leduc-Cummings et al., 2017; Riddell et al., 2023a). Individuals with autonomous motives may already be using MCII-like strategies spontaneously (Koestner, 2008; Riddell et al., 2023b; Werner & Milyavskaya, 2018). Consequently, Ntoumanis and Sedikides (2018) suggest that MCII should be less effective at fostering adaptive regulation in individuals with autonomous motivation; however, for individuals with controlled motivation, MCII could

help to foster goal commitment, engagement, and ultimately progress in the face of difficulty. This proposal has been supported longitudinally (Riddell et al., 2024) as well as for isolated instances of goal striving in laboratory conditions (Riddell et al., 2022; 2023a), but no studies have investigated whether such techniques may be effective for counteracting the maladaptive effects of controlled motivation during day-to-day goal pursuit in real-world settings.

Research Aims

Existing research has largely overlooked within-person changes, that is, how fluctuations in motivation relate to fluctuations in progress from one occurrence of goal striving to the next for a given individual. Instead, researchers have assumed that motivation is stable over time. Measuring within-person effects of motivation is crucial for understanding the dynamic nature of goal pursuit, especially in the early stages of goal striving, when stable patterns of motivation may not yet be established, or when internalisation processes are in their infancy (Koestner et al., 2008). MCII provides a trainable strategy for enhancing goal pursuit, particularly when individuals feel driven by controlled motives. By training people with effective self-regulation techniques characteristic of autonomous motivation, this study aims to test the effectiveness of MCII in mitigating the negative impacts of controlled motivation on goal progress.

This research aims to longitudinally measure the impact of autonomous and controlled motivation on goal progress and time spent on goal pursuit at both the between- and within-person level. Participants who had recently started pursuing a novel goal were surveyed every second day over four weeks to measure their motivation, goal progress, and time spent pursuing their goal. Additionally, half of our participants were randomly assigned to complete a brief MCII intervention, with the other half treated as controls, to explore the moderating role of MCII on the relation between controlled motivation and goal outcomes, examining whether MCII enhances goal progress and time spent on goal striving for individuals with high controlled motivation compared to controls.

Firstly, we hypothesised that, autonomous motivation will predict greater goal progress and more time pursuing a goal, whereas controlled motivation will predict less goal progress and less time pursuing a

goal both within and between individuals across the month. Specifically, individuals with higher-than-average autonomous motivation (i.e., between-person) will experience more goal progress and spend more time pursuing a goal (H1a). Further, on days when individuals report autonomous motivation that is higher than their personal average (i.e., within-person), they will experience more goal progress and spend more time pursuing their goal (H1b). Conversely, individuals who have higher than average controlled motivation (i.e., between-person) will report less goal progress and less time spent pursuing their goal (H1c). Additionally, on days when individuals experience controlled motivation as higher than their personal average (i.e., within-person), they will experience less goal progress and spend less time pursuing their goal (H1d). Secondly, we hypothesised that goal progress and time spent pursuing goals will be higher in the MCII condition compared to controls (H2). Finally, we hypothesised that MCII would moderate both within- and between-person associations between controlled motives and goal progress/time spent on goal pursuit. Specifically, goal progress and time spent pursuing a goal will be greater for individuals with high levels of controlled motivation in the MCII condition compared to controls (H3).

Method

Participants

An a priori power analysis using Monte Carlo simulations of the proposed multilevel model (n = 10,000) established that a sample size of 80 participants completing at least five surveys each would achieve >80% power to detect an effect size of $\beta = 0.4$ at a significance level of $\alpha < .05$. This effect size was selected based on a meta-analysis (Wang et al., 2021), which indicated that interventions like MCII typically yield small to medium effects on goal attainment. Ethics approval was secured from the Curtin University Human Research Ethics Committee (HRE2022-0462). Eligibility criteria required participants to have set a new goal within the past month, intending to pursue it for at least an additional month, and possess fluency in English.

Participants were recruited through an online platform (prolific.com) between November and December 2022. We recruited n = 99 participants through the Prolific online research platform, targeting a

diverse demographic across the United Kingdom. The final sample was *n* = 84. Participants comprised of 43 females (52.44%) and 39 males (47.56%). Ages ranged from 20 to 70 years (*M* = 39.09, *SD* = 11.53), and participants self-reported as White/Caucasian (78.05%), Asian/Indian (14.63%), Black/African/Caribbean (4.88%), Arab (1.22%), or other (1.22%). Two participants did not provide demographic data. Participants received monetary compensation (£0.418) for completing each survey. Because we were interested in fluctuations in variables over time, we excluded from our analysis participants who completed less than five of the 14 possible surveys, or who selected a new goal more than once.

Measures

Screening Survey

Initial screening posed eleven questions with *Yes/No* responses; all were prefaced with "*In the past month have you:*". Example questions included "*Left the country*", "*Smoked cigarettes or vaped*", and "*Used a ridesharing service*". To be eligible, participants needed to answer '*Yes*' to the questions "*In the past month, have you started a new goal?*" and "*Are you fluent in English?*". All other questions were included to obscure the precise aims of the research. We then asked eligible participants about their goals, using the prompt: "*In a few words, please describe your new or novel goal that you started pursuing within the past month*". Two members of the research team manually checked responses to ensure a valid response (i.e., written in English, reflected a goal). We then asked participants whether they estimated their goal would take 1 month or longer to achieve. Finally, we asked participants to rate the following single items: "*How difficult will it be to achieve your goal?*" and "*How important is it to you that you achieve your goal?*" both on an 11-point scale (0-10).

Goal Motives

Goal motives were measured through a self-administered questionnaire adapted from Riddell et al., (2023a), wherein participants rated their level of agreement with five statements regarding their goal across a 7-point Likert scale (1 = Not at all, 7 = Very much so). The statements represented different goal motives of: intrinsic ("*Pursuing my goal is enjoyable or challenging to me*"), identified ("*This goal is personally*

important to me"), positive introjected ("*I want to feel proud of myself*"), negative introjected ("*I would feel ashamed if I didn't do well*"), and external regulation ("*I may receive praise or other rewards for achieving my goal*"). These five statements formed two broader dimensions of autonomous motivation (calculated as the average of intrinsic and identified motives items) and controlled motivation (calculated as the average of positive introjected, negative introjected, and external regulation motives items).

Goal Obstacles, Difficulty, and Progress

Obstacles to goal pursuit were measured by a single item that asked participants, "*What is the one main obstacle stopping you from achieving your goal?*" for which a written response was required. Responses included "time, being tired, and motivation". Goal difficulty was measured by a single self-report item, "*How difficult was it to overcome this obstacle over the past two days?*" using a 7-point Likert scale (1 = Not at all, 7 = Very). Similarly, goal progress used a single item, "*Over the past two days, how much progress have you made toward achieving your goal?*", also using a 7-point Likert scale (1 = Not at all, 7 = Very much).

MCII training

Participants assigned to the MCII intervention were presented with MCII training on each of their 14 surveys. Training consisted of both text and video components. During the first survey only, several questions were posed as part of the goal-setting process, including: "*What is your goal?*", "*What is the best outcome you can imagine of achieving this goal?*" and "*What is the one main obstacle stopping you from achieving your goal?*". A final task included creating an 'if-then' response to overcoming their obstacle. Subsequent training used these responses from the first round of training. MCII training required participants to complete four steps: think about the novel goal they would like to accomplish, imagine achieving the goal, identify the greatest potential obstacle, and consider how that obstacle may be overcome.

Goal Engagement, Disengagement, and Reengagement

Goal engagement, as well as disengagement, and reengagement were also measured using items adapted from Wrosch and colleagues (2013) as potential exploratory items but were not analysed in the current study (see Supplementary Materials).

Procedure

This study was conducted online with participants responding to a battery of questions via any internet-connected device (i.e., mobile phone, computer). We first conducted an initial screening survey (n = 203) to assess eligibility to take part in the study; participants who did not meet our eligibility criteria were not invited to take part in the rest of the study (see *Screening Survey*). At the beginning of the study, participants were directed to screening questions to determine eligibility and assess the goal they planned to pursue over the next month. Participants then completed demographic information and were randomly assigned by survey software (Qualtrics) to either the MCII intervention or control group (see *MCII Training*). Both researchers and participants were blinded to the conditional assignment. Over the next 28 days, participants in both groups were given a survey every second day, which measured goal motives, goal difficulty/progress/obstacles, and goal engagement/disengagement/re-engagement. In total, participants completed up to 14 surveys.

Statistical Analysis

As participants provided repeated measures of motivation and goal striving over the length of the study, individual data points cannot be considered independent. As such, we used a multilevel modelling approach to analyse the data. In contexts where observations are clustered or hierarchically organised, such as multiple measurement days nested within individuals, multilevel modelling accommodates non-independence by explicitly modelling variance at different levels of the hierarchy. By capturing the structure inherent in the data, the multilevel analysis also enables researchers to disentangle between-person (i.e., how people differ from one another) from within-person (i.e., how measurement instances differ from one another for an individual) variations. Thus, not only does a multilevel approach provide more accurate

estimates of coefficients and standard errors, but it also enables researchers to investigate how individual differences influence outcomes across measurement instances, thereby providing a more comprehensive understanding of the complexities inherent within individuals. This is critical for the current study, where we are interested in how moment-to-moment motivation affects goal striving.

To test our hypotheses, we initially constructed a multilevel model that included autonomous and controlled motives (partitioned into within-person and between-person components using group mean and grand mean centring respectively), MCII condition, the interaction between MCII condition and controlled motives (at both the within-person and between-person levels), and the covariate daily goal striving difficulty as predictors of self-reported daily goal progress. We included random slopes and intercepts for goal motives.

Koestner and colleagues (2008) suggested that motivation should influence not only mean levels of goal progress but also variability in progress. Specifically, they suggested that goal striving should be more variable for individuals with controlled motivation. This suggests that the assumption that all participants have homogeneous within-person variation in goal progress may not be plausible. Thus, we also constructed an exploratory series of models in which we relaxed the assumption of homogeneity of variances and allowed autonomous and controlled motives, to predict both mean levels (location effects) and variance (scale effects) of goal progress. To justify the additional complexity introduced by modelling additional variance components, we used likelihood ratio tests to compare heterogeneous variance models against our initial homogeneous-variances-assumed model to determine the best-fitting model. Heterogeneous variance components significantly improved the model fit were determined to be statistically meaningful and were retained to produce a best fitting model (Lange et al., 2018).

Results

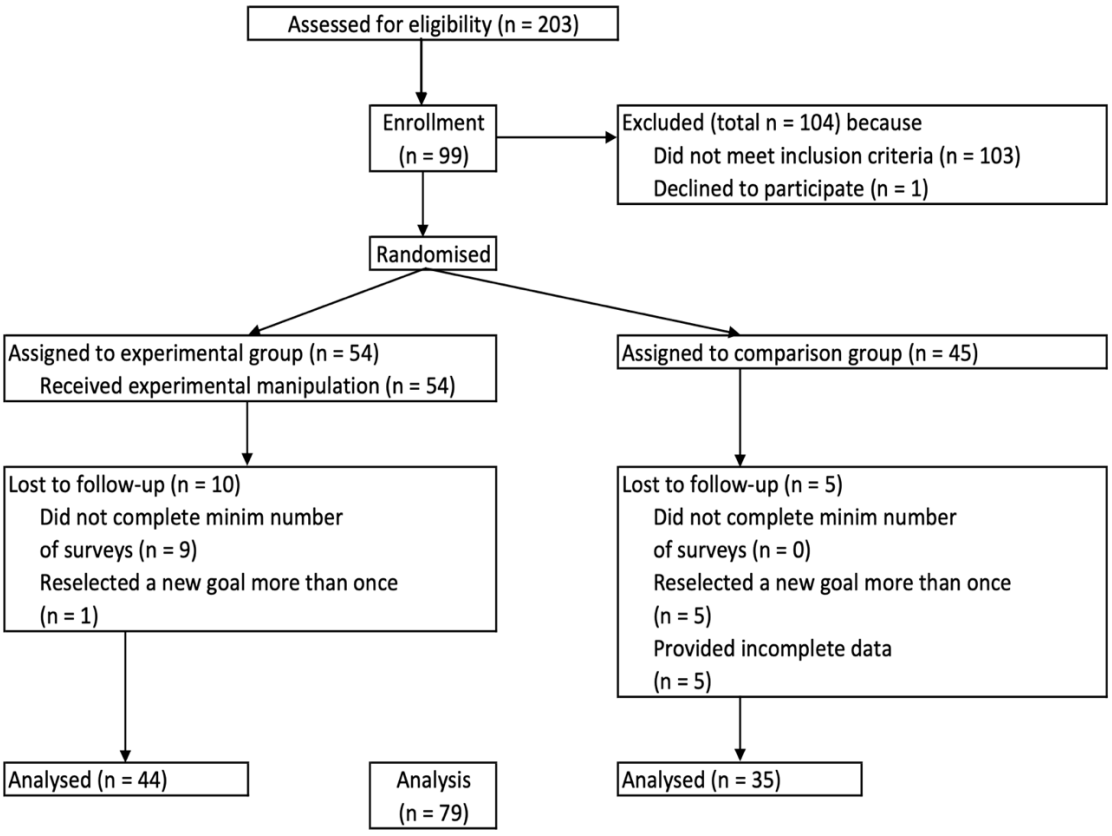
Participant Flow, Attrition and Adherence

The flow of participants through the stages of the experiment, including participant eligibility, withdrawal, and missing data, is depicted in Figure 2.1. A total of 203 people participated in an initial

screening survey, of which 104 were excluded due to not meeting the inclusion criterion of engaging in a new or novel goal within the past month (n = 103) and not providing consent (n = 1). Eligible participants (n = 99) were randomly assigned to either the MCII treatment (n = 54) or the control condition (n = 45). Participants were excluded from the analysis if they completed fewer than five of the 14 surveys or disengaged and re-selected a new goal more than once (n = 6). All participants in the control group completed the minimum number of surveys (M = 10.93, SD = 2.34), while n = 9 participants in the MCII group failed to complete the minimum number of surveys (M = 9.94, SD = 2.47). An additional n = 5 participants were removed because they provided incomplete data for between-person level variables in the survey. Several (n = 5) participants in the control group were excluded from the analysis as they disengaged from and reselected a new goal more than once. A single participant (n = 1) from the MCII group was excluded for reselecting a new goal more than once. A total of 79 participants were included in the final analysis (MCII: n = 44; control: n = 35).

Figure 2.1

Participant flow through stages of the experiment



Effects of Motivation at the Between-Person and Within-Person Level on Self-Reported Goal Progress

We present between-person level descriptive statistics, as well as within-person and between-person correlations between study variables in Table 2.1. Regarding our original planned analysis, there was a significant effect of daily goal-striving difficulty (b = -.363, SE = .026, p < .001); however, no other predictors had a significant effect on self-reported goal progress. However, upon conducting our exploratory analysis we found that the homogeneity of variances assumption did not hold for the current dataset and thus these results may not be reliable.

Exploratory models including either controlled or autonomous motives as independent predictors of variability provided a substantial improvement in model fit over the homogenous variance model. However, a model that jointly includes autonomous and controlled motives as predictors of variability did not provide an improvement in model fit over the controlled motives-only model (Table 2.2). This suggests that after accounting for the significant effects of controlled motives on variance in self-reported goal progress, the effect of autonomous motives on variability is negligible. We therefore conclude that the model including controlled motives only as a predictor of variance in goal progress provides the best fit to the data. Further, because this model represents a meaningful improvement over the model that does not include controlled motives as a predictor of variance, it indicates that the effect of controlled motives on variance (scale fixed effect) is significant (Lange et al., 2018).

Table 2.1

Between-person means and standard deviations for study variables and bivariate correlations at the between-person (upper triangle) and within-person (lower triangle) levels

	M	*SD*	*1*	*2*	*3*	*4*	*5*
1.Goal progress	3.35	1.08		**-.30**	**.32**	.35	**.23**
2.Difficulty	4.87	.99	**-.43**		**.28**	**.27**	-.20
3.Autonomous Motivation	5.19	1.28	.02	**.08**		**.89**	-.03
4.Controlled motivation	4.65	1.41	.03	.01	**.68**		-.08
5. Minutes Spent on Goal	43.82	62.43	**.38**	**-.27**	.02	.05	

Note: Statistically significant correlations at α = 0.05 are bolded

Table 2.2

Comparisons of multilevel models that assume homogenous within-person variation in goal progress against heterogeneous variance models that include autonomous and controlled goal motives as predictors of within-person variation

Models				Comparisons		
	DF	AIC	BIC		Likelihood Ratio	p-value
1. Homogenous Variance Model	16	3236.492	3314.296	1 vs 2	29.02063	<.001
2. Controlled Motives Predicting Scale Effects	17	3209.471	3292.138	1 vs 3	21.63911	<.001
3. Autonomous Motives Predicting Scale Effects	17	3216.853	3299.519	2 vs 4	.053	.818
4. Autonomous + Controlled Motives Predicting Scale Effects	18	3211.418	3298.948	3 vs 4	7.434429	.006

We present the coefficients of this best-fitting model in Table 2.3. Relaxing the homogeneity of variance assumption did not produce a substantive change in the effects of study variables on mean levels of goal progress (location-fixed effects). The effects of controlled motives on the variability of goal progress are depicted in Figure 2.2. As can be seen, goal progress was more variable at higher levels of controlled motivation, with goal progress ratings becoming more distributed as controlled motivation increases. The intraclass correlation coefficient (ICC = .417) indicates that a moderate proportion of variance in goal progress was due to moment-to-moment fluctuations at the within-person level.

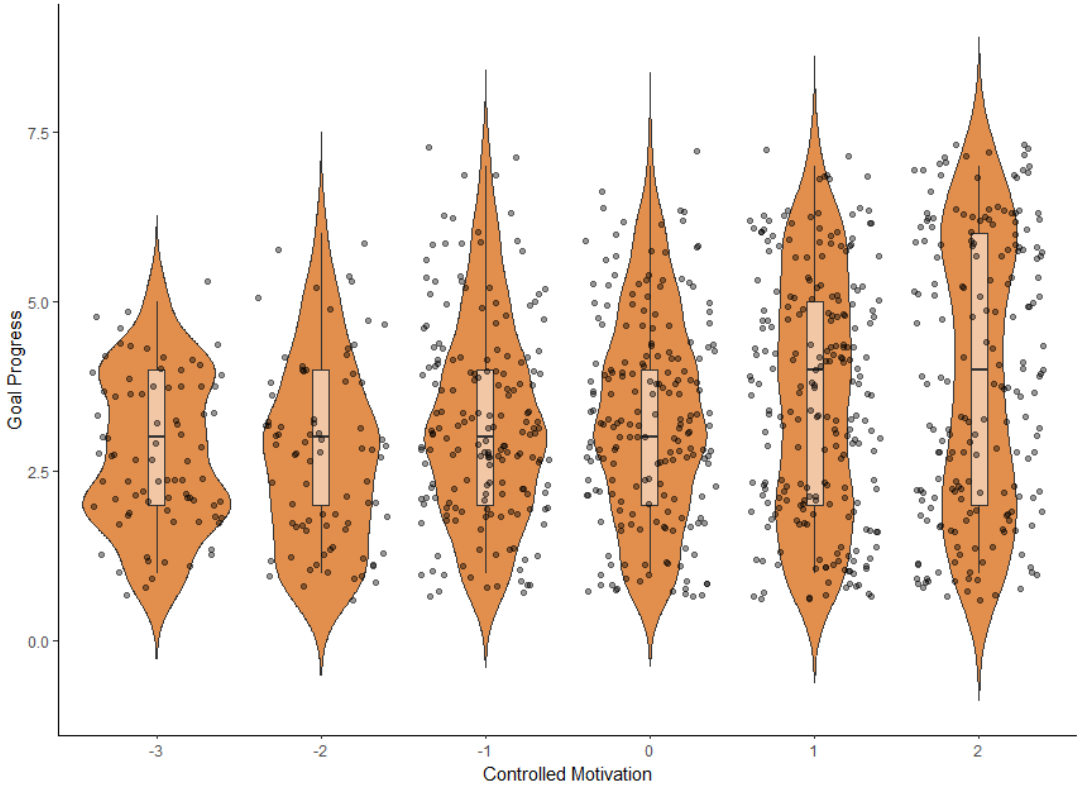
Table 2.3

Unstandardised model coefficients, standard errors, and p-values for a heterogeneous variance multilevel model that included within- and between-person goal motives, MCII condition, and Goal Difficulty as predictors of mean levels (location fixed effects) of self-reported goal progress and controlled motives as a predictor of variability in goal progress (scale fixed effects)

	b	*SE*	p-value
Location Fixed Effects			
Intercept	**3.282**	**.181**	**<.001**
Autonomous (within)	.055	.239	.819
Controlled (within)	-.215	.253	.396
Autonomous (between)	.064	.200	.749
Controlled (between)	.189	.195	.333
MCII Condition	.125	.239	.604
Difficulty	**-.363**	**.026**	**<.001**
Controlled (within) x Condition	-.026	.253	.917
Controlled (between) x Condition	.111	.177	.529
Scale Fixed Effects			
Controlled Motives	**.087**		
Random Effects (σ^2)			
Intercept	1.045		
Autonomous	.658		
Controlled	.572		
Residual	1.104		

Figure 2.2

Violin plots represent the predicted distribution of self-reported goal progress for different levels of controlled motivation (grand mean-centred). Boxplots show upper and lower quartiles, and points show individual participant data



Effects of Motivation at the Between-Person and Within-Person Level on Self-Reported Minutes Spent on Goal Pursuit

We replicated the analysis process used for goal progress to assess the effects of motivation on self-reported minutes spent on goal pursuit. We first constructed a model that assumed homogeneous within-person variance in the minutes spent on goal pursuit. We then relaxed the homogeneity of variance assumption and systematically tested autonomous and controlled goal motives as predictors of within-person variation. We compared models using likelihood ratio tests. Results of this analysis (see Table 2.4) indicate that a heterogeneous variance model including both autonomous and controlled motives as predictors of within-person variability in time spent on goal pursuit provided the best fit to the data. This suggests that both autonomous and controlled motives are significant predictors of variability in the amount of time spent on goal pursuit.

Table 2.4

Comparisons of multilevel models that assume homogenous within-person variation in time spent on goal striving against heterogeneous variance models that include autonomous and controlled goal motives as predictors of within-person variation

Models				Comparisons		
	DF	AIC	BIC		Likelihood Ratio	p-value
1. Homogenous Variance Model	16	10774.49	10852.300	1 vs 2	76.905	<.001
2. Controlled Motives Predicting Scale Effects	17	10699.59	10782.25	1 vs 3	20.102	<.001
3. Autonomous Motives Predicting Scale Effects	17	10756.39	10839.06	2 vs 4	33.259	<.001
4. Autonomous + Controlled Motives Predicting Scale Effects	18	10668.330	10755.86	3 vs 4	90.06269	<.001

We present the coefficients of the best-fitting model in Table 2.5. Daily goal difficulty was negatively related to time spent pursuing the goal; however, no other variables were significantly related to mean levels of time spent on goal pursuit (location-fixed effects). Scale-fixed effects indicate that variability in time spent pursuing the goal increased with autonomous motivation. As individuals reported higher autonomous motivation, time spent pursuing their goal dispersed upwards away from zero, this relationship is depicted in Figure 2.3 A. The opposite pattern of results was observed for individuals with high controlled motives. As controlled motivation increased, the reported time spent pursuing the goal tended to condense towards zero minutes (Figure 2.3 B). These findings are also reflected in the respective signs of the scale fixed effect coefficients presented in Table 2.5. The intraclass correlation coefficient (ICC = .522) again indicated that a moderate proportion of variance in time spent on goal pursuit was due to moment-to-moment fluctuations at the within-person level.

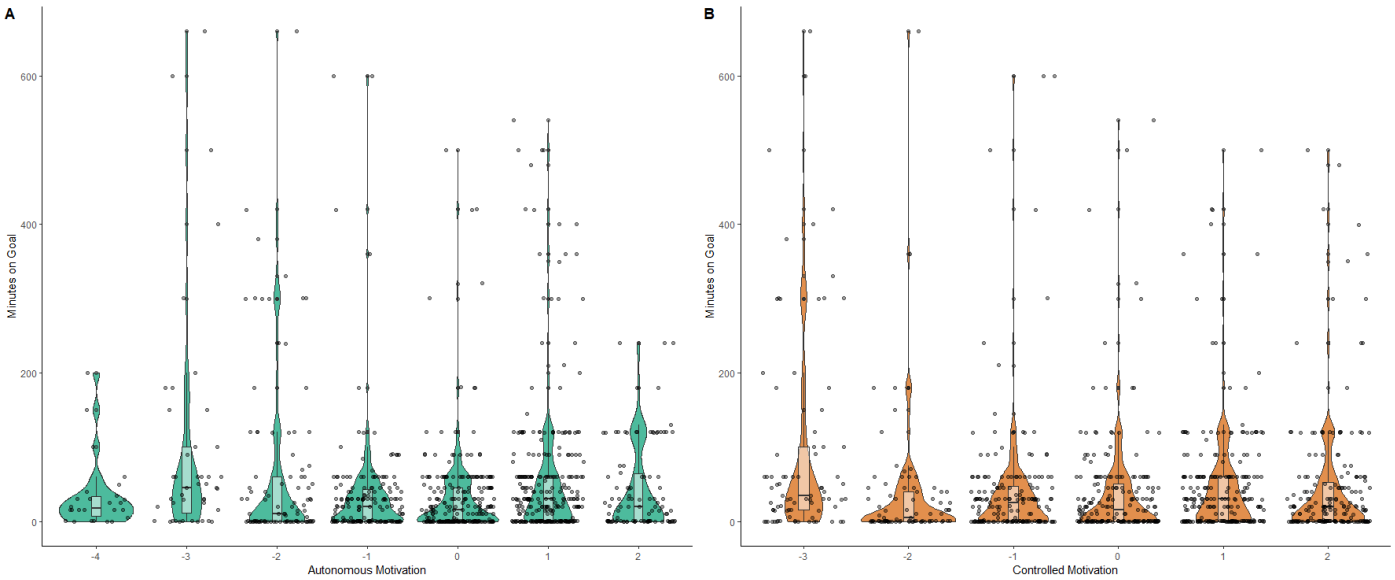
Table 2.5

Unstandardised model coefficients, standard errors, and p-values for a heterogeneous variance multilevel model that included within- and between-person goal motives, MCII condition, and Goal Difficulty as predictors of mean levels (location fixed effects) of self-reported time spent pursuing the goal and controlled and autonomous motives as predictors of variability (scale fixed effects)

	b	SE	p-value
Location Fixed Effects			
Intercept	**52.832**	**11.180**	**.000**
Autonomous (within)	-4.925	13.391	.713
Controlled (within)	16.170	13.501	.231
Autonomous (between)	7.779	12.107	.521
Controlled (between)	-17.562	11.797	.137
MCII Condition	-8.717	15.039	.564
Difficulty	**-10.580**	**1.158**	**.000**
Controlled (within) x Condition	-4.838	13.142	.713
Controlled (between) x Condition	17.142	10.700	.110
Scale Fixed Effects			
Controlled Motives	**-.299**		
Autonomous Motives	**.184**		
Random Effects (σ^2)			
Intercept	63.752		
Autonomous	2.651		
Controlled	12.997		
Residual	54.662		

Figure 2.3

Violin plots represent the distribution of self-reported time spent on goal pursuit for different levels of autonomous (A) and controlled (B) motivation (grand mean centred). Boxplots show upper and lower quartiles, and points show individual participant data



Discussion

The current study aimed to investigate the nature of motivation and goal pursuit by examining the within- and between-person effects of autonomous and controlled motivation on time spent on goal pursuit and goal progress, while controlling for difficulties encountered during goal striving. Our primary focus was to understand how different types of motivation influence the amount of time people spend pursuing a self-selected goal (i.e., regulation of goal-directed behaviour) and their progress. Unlike previous research in this area, we investigated motivation and goal striving variables repeatedly every two days over four weeks to obtain a picture of the within-person fluctuations in both motivation and goal pursuit from instance-to-instance of goal pursuit. We predicted that differences between individuals with autonomous and controlled motives would be apparent, even within the first month after people start pursuing a new or novel goal. We expected that people with autonomous motivation would spend more time pursuing their goals and make more progress compared to people with controlled motivation. Specifically, our first set of hypotheses (H1a-d) predicted that autonomous motivation would be positively associated with time spent pursuing a goal and goal progress, while controlled motivation would be associated with lower goal engagement and

progress. Our secondary focus was to investigate whether explicitly training people to use an MCII, a technique commonly observed in people with autonomous motivation (Riddell et al., 2023b), would improve goal outcomes (H2), particularly when motivation is controlled (H3). Although our results failed to support these hypotheses, exploratory analyses revealed that goal motives were related to day-to-day variability in time spent on striving and goal progress. Further, the surprising contrast between this research and previous work, most of which focuses on differences in motivation between people, encourages several questions about how goal striving might differ across timeframes and levels of measurement.

Hypothesis 1a: Autonomous motivation is positively associated with time spent pursuing a goal, and goal progress at the between-person level.

We hypothesised that individuals with higher than average levels of autonomous motivation would, on average, report greater goal progress and spend more time pursuing their goal. Our results did not support this hypothesis, with autonomous motivation failing to significantly predict time spent pursuing a goal or goal progress at the between-person level over the course of the study. These findings suggest that people with higher than average levels of autonomous motivation typically do not experience a positive impact on goal attainment, at least over a four-week period with a novel goal.

These results are surprising given that past research has repeatedly observed associations between autonomous motivation and goal progress. While research (e.g., Cerasoli et al., 2014) has demonstrated positive and negative goal-related outcomes associated with autonomous and controlled motivation respectively, there are few studies exploring how the relation between motivation and goal striving develops. Differences in goal regulation between individuals with more autonomous versus controlled motivation have been observed within periods as short as two weeks in longitudinal studies (e.g., Sheldon & Houser-Marko, 2001). However, even such studies typically do not measure fluctuations in both motivation and progress over the studied period. The quantity of an individual's motivation may vary greatly, even over the course of a single day (Stults-Kolehmainen et al., 2021), as does goal regulation (Neal et al., 2017). Whether motivation quality (i.e., from autonomous to controlled) also varies at this timescale is rarely

considered. Thus, despite running contrary to our hypothesis and postulates of the SCM, our null results are interesting. We show that the quality of goal motivation fluctuates over instances of goal-striving. When considering repeated measurements of motivation and daily goal progress over the course of a month, our data indicated that it is not always the case that autonomous motivation predicts goal progress. We suggest that while, on average, individuals with stronger autonomous motivation may experience greater total goal progress over months or years, this association may not be evident when observing incremental progress (e.g., average daily progress over the course of a month).

Another consideration that may have contributed to our null finding is the diversity of goals participants pursued. In our study, participants specified a wide range of goals, including mild exercise, saving for a holiday, training a dog, and producing a piece of music. It is likely that individuals have different yardsticks against which performance and/or achievement are evaluated (Chang et al., 2017). Furthermore, some goals may be amenable to observing incremental progress (e.g., saving, losing weight), whereas for others, progress may occur in spontaneous leaps (e.g., getting a job or promotion, home renovations). For the latter class of goals, we would expect individuals to report one or two days of substantial progress but also many days in which they remain autonomously motivated but experience little or no progress, which, on aggregate, would look like high autonomous motivation with low progress. Finally, given that our study required participants to have recently started pursuing a new goal, it is possible that self-regulation strategies have not yet sufficiently developed to produce a change in goal-directed behaviour. With evidence that people with autonomous motives employ self-regulation strategies that enhance goal striving (Werner and Milyavskaya, 2016), the question remains as to how long these take to develop and how long before they become effective.

H1b: On days when autonomous motivation is higher than average, time spent pursuing a goal, and goal progress will be higher (within-person).

Hypothesis H1b stated that on days when participants reported higher than average levels of autonomous motivation, they would spend more time pursuing their goal, and experience more goal

progress. We did not find a significant effect at the within-person level, suggesting that on days when a person experienced higher than average autonomous motivation, they did not spend more time on their goal, and did not make more progress. Our findings align with some previous research indicating that while autonomous motivation is a key driver of long-term goal attainment, daily fluctuations may not have an immediate or straightforward effect on day-to-day goal progress. For example, research by Koestner and colleagues (2002) emphasised the role of consistent and sustained motivation over time rather than short-term variations in predicting successful goal pursuit. Additionally, previous studies have shown that the impact of motivation on goal progress can be context dependent. Milyavskaya and Inzlicht (2017) found that the effectiveness of autonomous motivation might depend on the type of goals and the specific contexts in which they are pursued, contextual factors that our study may not have captured. Goals involving enjoyable activities, like hobbies or passion-driven careers, had fewer negative effects and led to greater persistence and success. However, for effortful and less enjoyable goals, like dieting or quitting smoking, context was crucial. In tempting or stressful environments, autonomous motivation was less effective, indicating the need for effortful self-control to overcome obstacles and resist temptations. Prior research has also largely measured motivation at a single point in time (e.g., Riddell et al., 2023a) or, conversely, measured over several years (e.g., Brunet et al., 2015; Gaudreau et al., 2012; Koestner et al., 2012). These studies involved less frequent intervals and provided a lower resolution of the effects of instance-to-instance motivation on goal progress. Although diary studies with a similar temporal resolution to the current study have been conducted to examine whether autonomous motivation predicts goal progress (Riddell et al., 2024), this work did not examine variations in goal motivation. Conversely, studies that measure single instances of goal striving and motivation in lab settings (e.g., Ntoumanis et al., 2014) often use goals that are highly amenable to measuring incremental progress (e.g., progress is a direct function of the amount of activity performed). Our results suggest that daily changes in motivation quality occur but are not related to the mean level of progress on a given day of real-world goal striving. Together, findings from this study suggest that the association between autonomous motivation and goal progress may be an emergent phenomenon that is

evident at the macro (i.e., total progress over months or years) but not as clear at the micro (i.e., progress during individual instances of goal striving) scale.

H1c & H1d: Controlled motivation is negatively associated with time spent pursuing a goal, and goal progress (between-person & within-person levels)

We hypothesised that individuals with higher than average levels of controlled motivation would report less goal progress and spend less time pursuing their goals at both the between-person (H1c) and within-person (H1d) levels. Contrary to our hypotheses, our analysis did not reveal a significant effect at either level, suggesting that individuals with a higher average level of controlled motivation over the study period did not have significantly lower than average goal progress or time spent pursuing their goal. Similarly, at the within-person level, on days when controlled motivation was higher than the person's average, there was no relation to goal progress or the time dedicated to goal pursuit. Similar explanations to those given for autonomous motivation in the above paragraphs could be applied to interpret the null findings for controlled motivation. In addition, it should be noted that there is some debate in the literature as to whether controlled motivation is actively harmful to goal progress or simply is not beneficial. While controlled motivation can undermine intrinsic interest and psychological need satisfaction (Vansteenkiste & Ryan, 2013), it might still drive individuals to pursue certain goals due to external pressures or expectations (Assor et al., 2002). People driven by controlled motivation might still allocate substantial time to their goals, however, over time the effects of external influences might diminish or become less effective, giving way for negative outcomes to arise and ultimately resulting in less time on goal pursuit and lower goal progress (Smith et al., 2007). This may not be observable in the initial month of the pursuit of a new goal. Another alternative is that controlled motivation is not actively harmful to goal progress (though it may result in other negative outcomes such as reduced need satisfaction and well-being; Deci & Ryan, 2000). For example, several meta-analyses (Gaudreau et al., 2012; Koestner et al., 2008a; Sezer et al., 2024) all failed to find support for a significant negative association between controlled motives and goal progress. Despite strong theoretical grounds for a negative relationship between controlled motives and goal progress

(Gaudreau et al., 2012), empirical evidence is mixed, and our findings align with those of several other authors.

Variability

One of the key findings of the current study was substantial day-to-day variation in the quality of motivation and goal progress over the course of a month. To examine these findings in more detail, we ran several exploratory analyses to determine whether autonomous and controlled goal motivation predicts not only mean levels but also within-person variability in goal progress and time spent on goal pursuit over the course of the study. Much of the existing research makes the implicit assumption that within-person variance in goal progress is homogenous (i.e., does not differ substantially or systematically from participant to participant). Contrasting with this assumption, we found that heterogeneous variance models, which allows within-person variance to differ for each participant (Lang et al., 2018), provided a significantly better fit to daily goal-striving data over a month. Moreover, we found that autonomous and controlled goal motives are predictive of this within-person variation. As controlled motivation increased variability declined, with time spent on goal pursuit tending to condense toward zero. Controlled motivation was also related to increased variability in goal progress. That is, individuals with stronger controlled motivation tended to exhibit greater fluctuations in their reported progress. Autonomous motivation, on the other hand, predicted increased variability in time spent on goal pursuit, with time spent dispersing upward from zero as autonomous motivation increased, but did not predict changes in the variability of goal progress.

Our findings provide empirical evidence for several assertions that have been made in the literature but have not been formally tested. The idea that consistency leads to better progress is well documented through several domains, including exercise, where multiple sets of sequential repetitions followed by short breaks will produce better results than completing the same total number of repetitions at sporadic intervals throughout the day (Haff et al., 2016), or psychological interventions for trauma, which are most efficacious under frequent, predictable, and repeated treatment (Perry & Szalavitz, 2017). Several authors have made the argument that autonomous motivation facilitates goal progress because individuals

consistently dedicate resources to goal striving (Koestner, 2008; Werner et al., 2016). Our results could be seen as supporting the assertion that autonomously motivated individuals habitually or automatically regulate their goals more effectively (Milyavskaya et al., 2015), in this case, by being more likely to have instances of protracted goal pursuit and stable progress. Conversely, controlled motivation should be related to less stable goal striving over time (Koestner et al., 2008), which we again demonstrate by showing that individuals with stronger controlled motives tend to have fewer instances of protracted goal pursuit and report larger variations day-to-day in progress. It may be the case that when external pressures associated with controlled motives are present, people may engage in goal-directed behaviour and make more progress on their goal but also may avoid negative consequences in other ways, resulting in a variable pattern of pursuit. However, when these influences are not present, people are not incentivised to engage with their goal.

H2 & H3: Time spent pursuing a goal and goal progress and will be higher in the MCII condition

The second aim of this study was to experimentally test whether individuals with controlled motivation, when trained to use mental contrasting with implementation intentions techniques, would improve their goal regulation. We hypothesised that MCII training would lead to more time spent pursuing goals and higher goal progress compared to the control condition (H2). However, our results did not find significant effects of MCII on either goal progress or time spent on goal pursuit. We also hypothesised that MCII would moderate the relationship between controlled motivation and goal progress, such that individuals with high controlled motivation in the MCII condition would show greater goal progress and spend more time pursuing their goals compared to the control group (H3). Findings also failed to support this hypothesis, as the interaction terms between MCII condition and controlled motivation (both within- and between-person) were not significant for either goal progress or time spent on goal pursuit.

The lack of significant effects suggests that MCII, as implemented in this study, did not provide additional benefits. Our findings differ from previous research that has demonstrated the efficacy of MCII in enhancing goal achievement and increasing the time spent on goal-related activities. Previous research

(Gollwitzer, 1999; Oettingen et al., 2001) has provided robust evidence for the effectiveness of MCII in various contexts, showing significant improvements in goal attainment and effort allocation. However, these studies often involve rigorous training and high levels of participant engagement with the MCII process, which might explain the discrepancy in results and highlight the need for a manualised, validated procedure for the administration of MCII, as well as studies investigating the boundary conditions for its effectiveness. The lack of effectiveness of MCII in this current study may also be in part due to the absence of measurable negative effects of controlled motivation. Individuals with autonomous motives may spontaneously use strategies similar to MCII (Koestner et al., 2008; Riddell et al., 2023b), and it has been suggested that MCII should be more effective for people with controlled motivation because it should negate some of the maladaptive self-regulatory tendencies associated with controlled motivation (Ntoumanis & Sedikides, 2018). As high levels of controlled motivation did not produce any decrements in goal attainment or time pursuing a goal, there may have been no maladaptive self-regulatory behaviours for MCII to negate.

Limitations

This study was conducted over a four-week period, which may have been insufficient to detect divergent changes in motivation, time pursuing a goal, and goal progress for participants had recently started a novel goal. However, we found indicators of variability in day-to-day motivation and goal-directed behaviour, which previous research has largely failed to measure. Future research aimed at replicating or building on this study might consider measuring participants over a longer period of time, and possibly a larger sample to detect early, smaller changes. There was a disproportionate rate of attrition between participants assigned to different conditions. While nine participants assigned to MCII training did not complete the minimum number of surveys, all participants in the control condition completed their minimum. Conversely, while only one participant in the MCII condition disengaged with their initial goal and reselected a new one more than once, five participants in the control condition reselected a new goal more than once. Whether the MCII training itself contributed to this result is unclear. Ultimately, future research will need to balance comprehensive and effective MCII training with the potential burden to participants.

This study also used self-reported data, which, while widely used in motivation research, introduces a degree of subjectivity that may affect the accuracy and reliability of the findings. A key issue with self-report data in the current study is the challenge of operationally defining goal progress. For example, if the goal is to 'make new friends', or 'get fit' how is progress defined and quantified and how natural is it for participants to think about their goals in this way? Similarly, some goals are about maintaining, rather than improving. While a participant might be successfully maintaining a level of fitness in the face of declining health, they may not technically be making goal progress, even if they are satisfied with their performance. Participants in this current research pursued a wide range of goals that varied in nature that was not accounted for in the analysis. Different goals may require different strategies and levels of effort, making it challenging to apply the findings to specific types of goals. The strength of our study lies in its novel approach to goal striving by examining a range of goals that are new or novel to participants, and how motivation and goal-striving change in the early stages of pursuit. This diversity, while possibly diluting specific effects, enhances the generalisability of our findings to a wider context. Unlike lab studies, this broad perspective captures a wide array of goal-related behaviours and motivations, suggesting our findings apply to many personal and professional objectives. Despite the wide range of goals, findings indicated the absence of early negative effects from high levels of controlled motivation, but also early signs of inconsistent goal pursuit. Measuring these changes over a longer period will likely reveal that inconsistent goal pursuit is associated with lower goal attainment.

Conclusion

The current study found autonomous and controlled motivation did not significantly predict differences in time spent pursuing a goal or goal progress when measured over a four-week period for participants with a new or novel goal. Although effects of autonomous and controlled motivation are commonly observed for long-term goal pursuit, this study did not find significant short-term effects on mean levels of time spent pursuing a goal or goal progress. We conclude that the effects of both forms of motivation may not be immediately observable on a day-to-day basis in the early stages of pursuing a novel

goal. Numerous explanations exist for why this might be; however, it raises the question of what an adequate timeframe for measuring the effects of motives on goal progress should be. We know from lab-based studies that in one-off instances of goal pursuit, autonomous and controlled motives can have observable influences on goal striving. Notably, these studies often focus on goals that have easily quantifiable indicators of progress. Thus, the question of an appropriate duration for measuring goal pursuit may hinge on the type of goal being examined – highly specific, measurable goals may be more amenable to observing short-term progress, while this may be difficult to judge for more nebulous goals. This aligns with tenets of goal setting theory (Locke & Latham, 2019) and practices of goal setting commonly used to promote progress in various real-world settings (e.g., SMART goals; Bjerke & Renger, 2017). Critically, the present work provides some of the first empirical evidence for a long-held assumption in the motivation literature – namely, that autonomous and controlled motives differentially influence the consistency of goal pursuit. We argue that this should be a key focus going forward. We suggest not the amount of progress one makes on their goal each day, but rather the consistent dedication of resources towards goal pursuit may explain why people with autonomous motives tend to be better at goal striving in the long term.

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Supplementary Materials

Ethics approval

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18-Aug-2022

Name: Hugh Riddell
Department/School: Curtin University
Email: Hugh.Riddell@curtin.edu.au

Dear Hugh Riddell

RE: Ethics Office approval
Approval number: HRE2022-0462

Thank you for submitting your application to the Human Research Ethics Office for the project **A Longitudinal Study of the Effects of Time and MCII (Mental Contrasting with Implementation Intentions) on Goal Motives and Perceived Obstacles.**.

Your application was reviewed through the Curtin University Low risk review process.

The review outcome is: **Approved**.

Your proposal meets the requirements described in the National Health and Medical Research Council's (NHMRC) *National Statement on Ethical Conduct in Human Research (2007)*.

Approval is granted for a period of one year from **18-Aug-2022** to **17-Aug-2023**. Continuation of approval will be granted on an annual basis following submission of an annual report.

Personnel authorised to work on this project:

Name	Role
Lombard, Merrill	Student
Quested, Eleanor	Supervisor
Riddell, Hugh	CI

Approved documents:

Document

Standard conditions of approval

1. Research must be conducted according to the approved proposal
2. Report in a timely manner anything that might warrant review of ethical approval of the project including:
   - proposed changes to the approved proposal or conduct of the study
   - unanticipated problems that might affect continued ethical acceptability of the project
   - major deviations from the approved proposal and/or regulatory guidelines
   - serious adverse events
3. Amendments to the proposal must be approved by the Human Research Ethics Office before they are implemented (except where an amendment is undertaken to eliminate an immediate risk to participants)
4. An annual progress report must be submitted to the Human Research Ethics Office on or before the anniversary of approval and a

Consent form

HREC Project Number:	HRE2022-0462
Project Title:	*A Longitudinal Study of the Effects of Time and MCII (Mental Contrasting with Implementation Intentions) on Goal Motives and Perceived Obstacles.*
Chief Investigator:	Eleanor Quested
Supervisors:	*Hugh Riddell*
Version Number:	*14/08/2022*
Version Date:	*14/AUG/2022*

- I have read the information statement version listed above and I understand its contents.
- I believe I understand the purpose, extent and possible risks of my involvement in this project.
- I voluntarily consent to take part in this research project.
- I have had an opportunity to ask questions and I am satisfied with the answers I have received.
- I understand that this project has been approved by Curtin University Human Research Ethics Committee and will be carried out in line with the National Statement on Ethical Conduct in Human Research (2007).
- I understand I can request a copy of the Information Statement and Consent Form.
- I agree that my data may be used in future research, given that it cannot be re-identified.

Participant information statement

HREC Project Number:	HRE2022-0462
Project Title:	*A Longitudinal Study of the Effects of Time and MCII (Mental Contrasting with Implementation Intentions) on Goal Motives and Perceived Obstacles.*
Chief Investigator:	Eleanor Quested
Supervisors:	*Hugh Riddell*
Version Number:	*14/08/2022*
Version Date:	*14/AUG/2022*

What is this research about?

• Motivation is an important part of setting, pursuing, and achieving goals. However, we find that some goals are easier to pursue than others. Some motivation can be described as 'want-to', while others are 'have-to'. Want-to goals can seem fun, meaningful, and often align with core values. Putting effort into the pursuit of these goals just seems easier. As a consequence, people can perceive the obstacles to these goals as lower, which can lead them put in more effort, and pursue them more often. This can lead to goal success, which can make people more likely to pursue further goals. The opposite is true for have-to goals.
• This research will examine the difference between people with want-to goals (autonomous), and have-to goals (controlled), and how they perceive the obstacles to a goal. Further to this, a meta-cognitive strategy that can reduce obstacle perception will randomly assigned to some participants, allowing us to determine if motivation can be enhanced, and under what conditions.
• Research between goal motives and obstacle perception has only recently emerged. Contributing to this will add to the body of evidence that suggests people with controlled motives can enhance their motivation with a simple meta-cognitive strategy that can be learned and applied by individuals.
• This research requires 80 participants, which includes adults and mature minors. A mature minor in this instance is someone under the age of 18 years, who is currently undertaking higher education such as university or TAFE, or who is currently employed.

Who is doing the Research?

• The project is being conducted by Merrill Lombard and will contribute toward a Master of Research degree in psychology.
• This research is not funded, and there will be no costs to you.

Why am I being asked to take part and what will I have to do?

• Participation involves answering a short survey every second day for 28 days.
• Questions relate to motivation and the perceived difficulty of obstacles. Items include statements such as "My goal is personally important to me", and questions such as "Over the past two days, how difficult was it to pursue your goal?". You will need to respond on a 7-point scale, ranging from 1 (not at all), to 7 (very much so).
• This study is done via a smartphone app, and does not require you to attend a specific location.
• Your participation is expected to take no more than 3 minutes every second day, for 28 days. There will be no cost to you for taking part in this research.
• You will be randomly assigned to one of two groups. Neither you nor the researcher can choose which group you go in. The difference and purpose of the groups will be explained to you after the research has concluded. You will have the chance to experience the conditions in the group you were not in.

Are there any benefits to being in the research project?

• We hope the results of this research will allow us to specify under which conditions the meta-cognitive technique is most effective, and whether there is a link between obstacle perception and objective performance. This may be used in health promotion, exercise, academic, and occupational contexts.

Are there any risks, side-effects, discomforts or inconveniences from being in the research project?

• Participants may be inconvenienced by the time taken to answer the survey. There is no additional compensation offered.

Who will have access to my information?

• The information collected in this research will be re-identifiable (coded). This means that we will collect data that may identify you from your email address, but we will then remove identifying information on any data or sample and replace it with a code when we analyse the data. Only the research team have access to the code to match your email address. Any information we collect will be treated as confidential and used on this, as well as future projects. The following people will have access to the information we collect in this research: the research team and, in the event of an audit or investigation, staff from the Curtin University Office of Research and Development.

• If you would like a summary of this research, you may provide your name and email address when we collect the data.

• Electronic data will be password-protected and hard copy data (including video or audio tapes) will be in locked storage.

• The information we collect in this study will be kept under secure conditions at Curtin University indefinitely after the research is published.

• The results of this research are primarily for a masters dissertation, and will be published in a professional journal, and may be presented at conferences.

• Electronic data will be password-protected and hard copy data will be in locked storage. The information we collect in this study will be kept under secure conditions at Curtin University for 7 years after date of publication or completion of project, or subjects have reached 25 years of age whichever is later and then it will be destroyed.

Do I have to take part in the research project?

• Taking part in a research project is voluntary. It is your choice. If you decide to take part and then change your mind, that is okay, you can withdraw from the project. If you choose to take part and then stop, it will not affect your relationship with the University, staff or colleagues. You have the right to stop participating during the study at any time, without consequence. You do not have to give us a reason, you can stop responding and delete the app. You also have to right to request your data be withdrawn, however, once analysis has begun, removing your data will no longer be possible. If you chose to leave the study we will use any information collected unless you tell us not to. Do I have to take part in the research project? • Taking part in a research project is voluntary. It is your choice. If you decide to take part and then change your mind, that is okay, you can withdraw from the project. If you

What happens next and who can I contact about the research?

• Please contact us through Prolific

Curtin University Human Research Ethics Committee (HREC) has approved this study (HREC number HRE2022-0462). Should you wish to discuss the study with someone not directly involved, in particular, any matters concerning the conduct of the study or your rights as a participant, or you wish to make a confidential complaint, you may contact the Ethics Officer on (08) 9266 9223 or the Manager, Research Integrity on (08) 9266 7093 or email hrec@curtin.edu.au.

Questionnaires

Screening and Eligibility

Please answer the following:

In the past month, have you...

Smoked or vaped?	Yes / No
Started a new goal?	Yes / No
Left the country?	Yes / No
Tested positive for COVID-19?	Yes / No
Used a ridesharing service?	Yes / No
Participated in any exercise?	Yes / No
Owned and used a smart watch?	Yes / No
Attended a football game?	Yes / No
Posted to social media?	Yes / No
Consumed alcohol?	Yes / No
Are you fluent in English.	Yes / No

Introduction

In a few words, please describe your new or novel goal that you started pursuing within the past month.
(Text response)

How difficult will it be to achieve your goal?

0 1 2 3 4 5 6 7 8 9 10

(0 = Not at all difficult) (10 = Extremely difficult)

How important is it to you that you achieve your goal?

0 1 2 3 4 5 6 7 8 9 10

(0 = Not important at all) (10 = Extremely important)

How long do you think it will take to achieve your goal? Please specify number of days, weeks, months, or years.
(Text response)

Goal engagement

Please think about the new or novel goal you previously selected. The following questions are about this goal, and only over the past two days.

Did you pursue your goal today? Yes / No

How many minutes did you spend engaging in your goal today?
(Text response)

In the past two days, did you decide to stop pursuing your goal? Yes / No

Goal disengagement

Please rate how accurately the following statement reflected your thoughts and feelings when deciding to pursue a new goal.

It was easy for me to stop thinking about the goal and let it go

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

I Stayed committed to the goal for a long time, I as unable to let it go.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

It was easy for me to reduce my effort towards the goal.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

I found it difficult to stop trying to achieve the goal.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

If you can, please select a new goal and continue responding to the surveys.

What is your new goal?

(Text response)

Please rate how accurately the following statement reflected your thoughts and feelings when deciding to pursue a new goal.

I thought about new goals to pursue

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

I sought other meaningful goals.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

I convinced myself that I have other meaningful goals to pursue.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

I told myself that I have a number of other new goals to draw on.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

Motivation

The following questions are about your goal. Drag the slider to indicate the extent to which you agree, or disagree.

Pursuing my goal is enjoyable or challenging to me.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much so)

My goal is personally important to me.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much so)

I want to feel proud of myself.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much so)

I would feel ashamed if I didn't do well.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much so)

I may receive praise or other rewards for achieving my goal.

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much so)

Obstacles and Progress

Over the past two days, what was the one obstacle that most prevented you from pursuing your goal? (Text response)

How difficult was it to overcome this obstacle over the past two days?

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very)

Over the past two days, how much progress have you made toward achieving your goal?

1 2 3 4 5 6 7

(1 = Not at all) (7 = Very much)

MCII Training

As part of this research, we will teach you a simple technique to increase motivation. It's called WOOP (Wish, Outcome, Obstacle, Plan) and it's easy to learn. We're going to ask you to use WOOP daily for your novel goal.

You'll have 2 minutes on this page before you can proceed.

Please keep reading to learn about this technique, or watch the video instead.
It may help you achieve your goal!
(Video option embedded)

What is WOOP?
WOOP involves thoughts and images rather than rational or effortful thinking. It involves creating time and space for thinking and imagining. It is critical that no interruptions occur during the exercise. Start the WOOP session when you feel calm and comfortable. This is your time now. Clear your mind and create space to imagine.

Wish:
Think about your novel goal over the next four weeks. What would you like to accomplish that you also think you could make progress toward? Your goal should be challenging, but also possible.
Summarise your novel goal in 3 to 6 words, and keep it in the front of your mind.

Outcome:
Now, what is the best outcome that you associate with fulfilling your goal? How would fulfilling your goal make you feel? What would be the best thing about achieving your goal? Summarise the best outcome in 3 to 6 words, and keep it in the front of your mind.
Now, imagine this best outcome as vividly as possible. Give your thoughts and images free reign. Let your mind go. Close your eyes if you like. Imagine and feel it as fully as you can.

Obstacle:
What holds you back from realising your goal? What is it in you that stands in the way of you making your goal come true? What is the obstacle in you that stands in the way of you fulfilling your goal? What behaviour of yours or what emotion could hinder you from fulfilling your goal?
Summarise this obstacle in 3 to 6 words, and keep it in the front of your mind.
Imagine this main obstacle as vividly as possible. Give your thoughts and images free reign. Let your mind go. Close your eyes if you like. Imagine and feel it as fully as you can.

Plan:
What can you do to overcome your obstacle? Identify one action you can take or one thought you can think to overcome your obstacle. What can you do?
Summarise it in 3 to 6 words, and keep it in the front of your mind.
Now make an 'if-then' plan: If I encounter my obstacle, then I will implement my plan to overcome it.
Every second day when you respond to the survey, we'll give you a quick reminder.
Try and practise WOOP every day, it might help you achieve your goal.

Demographics
What is your age in years?
(Text response)

To which gender do you most identify?

- Male
- Female
- Non-binary
- Non-conforming
- Prefer not to say
- Not listed

Ethnicity

- Aboriginal/Torres Strait Islander
- Arab
- Indian/Asian
- Black/African/Caribbean
- Hispanic/Latino
- White/Caucasian
- Prefer not to say
- Other (please describe)

Goal Engagement, Disengagement, and Reengagement

Goal engagement was measured using three items: "*Did you pursue your goal today*", with a *Yes/No* response; "*How many minutes did you spend engaging in your goal today?*"; and "*In the past two days, did you decide to stop pursuing your goal?*", with a *Yes/No* response.

Participants who had disengaged with their goal were presented with an additional branch of four statements, adapted from Wrosch and colleagues (2013), which measured the cognitive ease of disengaging from the goal. Example items included: "*It was easy for me to stop thinking about the goal and let it go.*", and "*I found it difficult to stop trying to achieve the goal*". Responses were provided on a 7-point Likert scale (1 = Strongly disagree, 7 = Strongly agree).

Participants who disengaged were also asked if they had reselected a new goal and, if so, what it was (reported via text entry). An additional four statements, which measured cognitive ease of reengaging in a new goal, were provided (also adapted from Wrosch et al., 2013). Example items included: "*I thought about new goals to pursue*.", and "*I convinced myself that I have other meaningful goals to pursue*." Responses were provided on a 7-point Likert scale (1 = Not at all, 7 = Very much).