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Why do people procrastinate? The role of prospective memory, negative affect and time perspective

By:

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Declaration

I, Jiawei Xie, declare that this work was conducted by myself under the supervision of Dr Claudia von Bastian, Professor Fuschia Sirois, and Dr Christopher Martin. It has not been submitted for an award at this, or any other, university.

Conference Presentation Arising from Thesis

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Abstract

The aim of this thesis was to explore the cognitive underpinnings of procrastination. In particular, the main objective was to examine how prospective memory links to the tendency to procrastinate. For this purpose, this PhD project consists of three studies (total *N* = 551) that investigated 1) procrastination-related memory with a qualitative–quantitative mixed-methods approach; 2) the role of prospective memory in explaining the relationship between procrastination and negative affect; 3) the role of time perspective in explaining the relationship between prospective memory and self-report as well as behavioural procrastination. In Study 1 (Chapter 2), an online survey was conducted to characterise procrastination-related memory in the procrastination population. The results demonstrated that procrastinators are more likely to perceive external memory aids negatively, implying that procrastinators may be less likely to get reminders and may fail to keep the intended tasks in mind. Consequently, tasks are put off. Following this, an online survey was conducted in Study 2 (Chapter 3) to assess self-report procrastination, prospective memory and negative affect. The correlational findings showed that people who procrastinate more have worse prospective memory. In Study 3 (Chapter 4), we further assessed prospective memory and procrastination in both self-report and behavioural measures. The findings suggested that an individual's future time perspective mediates the relationship between prospective memory and procrastination. Taken together, the findings from this thesis suggest that procrastinators may be less likely to be future-oriented which makes it less possible to remember future tasks, thereby leading people to be more likely to procrastinate when they only consider negative aspects and forget the positives about intended tasks. This thesis provided valuable insight into the cognitive underpinnings of procrastination, highlighting the role of prospective memory. It concludes that a lack of ability to remember to do something

on time may contribute to procrastination, and that interventions that help people keep their intentions and future tasks in mind may be important in reducing procrastination.

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I feel very honoured to be able to study and conduct research work at the University of Sheffield. I hope that the findings of my tiny research can make some contribution to the relevant research area and improve people's daily lives.

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Chapter 1 Literature Review

Most individuals have probably experienced the following situation: we had decided to see a dentist to discuss our dental plan within a month. When the end of the month approached, we postponed it to next month. But when next month arrived, we delayed taking action again despite knowing that it will cost more if we do not have the dental plan in advance. Over time, when the dental problems arise, we notice that we have not had the dental plan in place. Consequently, we have to pay more for our dilatory behaviour. These types of events are associated with procrastination.

Procrastination is a common dilatory behaviour, and it brings serious consequences to people's life in different domains. Basically, procrastination is most often considered a voluntary delay of an intended course of actions, despite expecting to be worse off for doing so (Lay, 1986; Steel, 2007). It also refers to a common self-regulatory problem involving the unnecessary and voluntary delay of important intended tasks despite the recognition that this delay may have negative consequences (Ferrari, 2001; Sirois & Pychyl, 2013). Besides constructing the definition of procrastination, researchers have paid extraordinary attention to investigate how and why procrastination happens. Interventions have been developed to reduce this dilatory tendency, such as time management. Going back to the original example, to see a dentist, we need to keep in mind about when to make an appointment with the dentist and where to see him or her. This ability to remember to perform intended action at the appropriate moment in the future is defined as prospective memory (Einstein & McDaniel, 1990). Although prospective memory is associated with future-oriented behaviour, which is associated with procrastination, the potential link between these two domains remains unclear. This chapter provides an overview of the wider context and background that frames

the association between procrastination and prospective memory. First, I focus on the definitions of procrastination, and the types of procrastination involved in different contexts. Next, the correlates and causes of procrastination, and the critical role of negative affect in procrastination are discussed. Finally, prospective memory and its potential role in explaining the relationship between procrastination and negative affect is introduced. The chapter concludes by synthesising the findings of each section, reflecting on the potential role of prospective memory in procrastination and the dynamic relationship between procrastination, negative affect and prospective memory.

1.1 Procrastination

There are varied definitions to conceptualise procrastination from different aspects. Procrastination has been described as a form of self-regulation failure that involves prioritising short-term mood repair over the long-term pursuit of intended actions (Ferrari, 1991; Sirois & Pychyl, 2013; Solomon & Rothblum, 1984). Even though different attempts by researchers to refine the understanding of procrastination vary in different contexts and not all researchers draw the same lines when it comes to procrastination definition, from the origin of procrastination identification, it was argued that all procrastination conceptualizations must include a key factor: postponing, delaying, or putting off a task or decision (Steel, 2007), which reflects the behavioural and temporal nature of procrastination.

The prevailing view in the literature of procrastination concept is that procrastination is a self-regulatory problem involving the unnecessary and voluntary delay of important intended tasks despite the negative consequences (Lay, 1986; Sirois & Pychyl, 2013) and it is often accompanied by psychological discomfort and negative affect (Blunt & Pychyl, 2005; see also Ellis & Knaus, 1977; Haghbin et al., 2012; Sirois & Giguère, 2018). The definition could be interpreted to suggest that self-regulation is the process by which the concern about

negative consequences and negative affect could be regulated. From this perspective, procrastination is in some sense emotion regulation (Sirois, 2014).

Emotion regulation is involved in certain approaches that are applied to change certain aspects of behaviour or cognitive function to get a more satisfactory emotion response level (Bosse, 2017; Gross, 2010). Accordingly, emotion regulation could be a way to change negative moods to a positive one and increase happiness, and this positive strategy could be used to increase happiness when individuals experience negative affect. A number of studies have shown that emotion regulation is a sort of beneficial approach to temporal mental health (Gross, 2007; Quoidbach et al., 2015), but it is not always positive. For example, even when individuals regulate their emotions, their regulatory efforts sometimes backfire and make things worse (Gross, 2013). Such instances of emotion dysregulation could also occur when people are faced with unpleasant tasks.

In line with the proposed definition that procrastination is an irrational delay of behaviour (Silver & Sabini, 1981), it was argued that procrastination should be distinguished from intentional delay. People might delay tasks in a productive way, or because the tasks are out of their control. Steel (2007) proposed that these types of delay cannot be considered procrastination, as procrastination requires expectation of negative consequences.

Given the largely overlapped definitions and there is no formal coherent system for constructing procrastination, to better understand the nature of procrastination, it might be reasonable to describe and classify procrastination in a diverse way. For example, besides the traditional defined procrastination which emphasises the irrational delay and the awareness of negative consequences, an adaptive type of procrastination is proposed as active procrastination (Chu & Choi, 2005). In contrast to the traditional passive procrastination which leads to negative outcomes, active procrastination refers to the intended delay which is considered a way to enhance motivation in order to have better performance (Chu & Choi,

2005). This view of procrastination is interesting because it highlights the positive side of procrastination which is controversial to the traditional procrastination definition. According to Chu and Choi (2005), individuals who are classified as active procrastinators tend to delay tasks as they prefer to work under the deadline pressure. By working at the last minute, they could generate more creative ideas and tend to work better and faster. Meanwhile, in their review, Lay and Silverman (1996) argue that procrastination should be considered situational-specific, and the negative affect (anxiety for example) should not be considered a strong correlate of trait procrastination. This could be indirect evidence to support the positive perspective of procrastination. However, this purposeful delay has been criticised by other researchers from theoretical grounds, as it neglects the crucial element of negative consequences that is integral to procrastination and it cannot basically contribute to behavioural delay (Hensley, 2014; Steel, 2010; Wessel et al., 2019).

More generally, as a chronic and dilatory behaviour, procrastination is featured with affect and cognition. A useful resource for understanding procrastination is procrastination definition Venn diagram (Wessel, 2021) which constructs the main structure of procrastination. In particular, there are four features required to define procrastination: (1) intent to complete the task, (2) delay, (3) volition, and (4) an expectation for harm if delayed. According to the diagram, if procrastination requires these four features, then phenomena can only be considered procrastination when it falls into the centre of a four-circle Venn diagram, otherwise the rest of phenomena surrounded are the segments of procrastination. Once committed to completing a task, procrastinators are more likely to postpone taking action, which reflects the behavioural nature of procrastination. Besides, the feature of volition reflects that procrastination behaviour is based on plan. According to Haggard and Clark (2003), voluntary behaviour relies on individuals' internal beliefs of effects about their behaviour over the actual consequences of the behaviour. In the case of procrastination, the

voluntary delay likely reflects prior beliefs regarding the intended tasks and predicted consequences, as well as current behaviour planning for what to do next. It implies a potential cognitive process underlying procrastination. Last but not least, the feature of procrastination is that procrastinators could expect that the delay will be harmful. This proposition could be consistent with Steel's (2007) suggestion that the core feature of procrastination is that procrastinators are aware that they will be worse off because of the delay. Indeed, these features in the diagram might vary in any observed procrastination behaviour. The diagram systematically lays out the main features of procrastination and distinguishes procrastination from other types of delays.

1.2 Procrastination Relevant Factors

A wide range of affective and cognitive factors have been identified as contributing to procrastination. In this section, I will review the literature that highlights the relevant factors of procrastination.

1.2.1 Negative Affect

One of the relevant factors that contributes to procrastination is negative affect. Generally, negative affect has a large impact in a variety of cognitive domains, and it could either enhance or hinder cognitive performance (Robinson & Harmon-Jones, 2013). In definition, negative affect reflects the extent to which individuals experience a variety of unpleasurable and aversive mood states (Russell, 1980, 2003). In terms of how negative affect influence procrastination, mood regulation models of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000) suggest that when individuals are faced with aversive tasks, choosing to delay and disengage from unpleasant tasks are ways to reduce immediate negative affect. This theory highlights the prioritisation of short-term mood regulation over long-term goals pursuit. In other words, choosing to engage in enjoyable activities rather than intended tasks can help to regulate negative affect. Research supports

this proposition, as research indicates that procrastinators would voluntarily switch themselves to other on-going activities which are more pleasant or just quit on the purpose to avoid negative affect which are caused by intended tasks (Sirois & Giguère, 2018). Furthermore, a meta-analysis of procrastination and negative affect suggest that procrastinators are more likely to distract themselves with less negative affect-triggering activities (Haghbin et al., 2012). Therefore, when people are stressed and anxious about tasks, they are likely to tend to postpone what they had planned to do. In short, the cognitive processes of procrastination could be considered a mechanism to cope with negative affect.

One approach to examine the role of negative affect in procrastination is cluster analysis. According to Rebetez's study (2015), participants were asked to complete a measure of procrastination and four questionnaires assessing impulsivity, cognitive emotion regulation, self-esteem, and global motivation. Four of those variables were selected for cluster analysis and emotion was identified as one of the clusters characterised by higher urgency, higher inappropriate cognitive emotion regulation strategies, and lower self-esteem. These findings are consistent with the mood-regulation account that considers emotion regulation to be central to procrastination (Sirois & Pychyl, 2013). More specifically, people in this cluster could thus be more likely to be engaged in more enjoyable activities instead of aversive tasks when they are faced with negative affect.

Similarly, Sirois and Giguère (2018) considered the relation between trait procrastination and situational procrastination in a recent study, and negative affect was also assessed for moderated mediation analyses. In the research, participants were asked to recall the most recent time they delayed working on a task (situational procrastination), and an online survey was then conducted to assess trait procrastination, positive and negative affect. The findings revealed that low positive affect mediated the relation between trait procrastination and time spent procrastinating, indicating the effects of trait procrastination

on situational procrastination through positive affect instead of negative affect (Sirois & Giguère, 2018).

However, little research has examined how negative affect is aroused. It could not be inferred that general affect is an emotion triggered by recalling tasks. If affect is a mediator between two kinds of procrastination (trait procrastination and situational procrastination), then the cause of this affect should be defined, so that the effects could be more clarified. But the overall effects of affect on procrastination were not assessed specifically. Clarification of the source of that affect is necessary and valuable for future research when it is referred to the relationship between affect and procrastination, general affect or affect triggered by procrastination-related thinking for example.

Specifically, previous research shows that fear of failure is positively related to procrastination (Haghbin et al., 2012). Other research also demonstrated that people procrastinate more when the task itself is more aversive (Steel, 2007). Furthermore, Krause and Freund (2016) applied Academic scenarios to access procrastination and considered fear of failure and task aversiveness as moderators, which suggested that higher focus on the task process is related to lower procrastination. These studies indicate that there are three points in the circle of procrastination: task, emotional response and action. After being exposed to a task, people are more likely to be involved in negative affect which could then contribute to procrastination. Hence, what individuals feel about the task should be a crucial factor of procrastination and the primacy of immediate mood over longer-term goals and rewards could then cause the delay (attention action), especially for a chronic procrastinator. Meanwhile, the negative affect is associated with how individuals feel about past procrastination. For example, chronic procrastination is related to the affective experiences of shame and guilt (Fee & Tangney, 2000). Anxiety could be aroused when people recall past procrastination experiences (Lay, 1994).

However, even though the negative affect is highlighted in the investigation of procrastination, there is still some empirical evidence which is inconsistent and sometimes confounded with this proposed idea. Taking the link between procrastination and anxiety for example, it is investigated that trait anxiety is not related to trait procrastination and the proposed strong association between trait procrastination and negative affect is questionable (Lay & Silverman, 1996). Besides, recent findings from Yang (2021), which suggested that the association between trait procrastination and wellbeing might vary under different cultural backgrounds, also indirectly cast doubt on the wider role of negative affect in trait procrastination. These preliminary findings demonstrate some of the complexities of the association between procrastination and negative affect, as procrastination's proposed relationships with negative affect vary in different studies. In line with this view, it is notable that the effectiveness regarding procrastination is generally based on post-recollection data which could lead to biassed attitudes. Thus, reexamining the affect of recollection of past procrastination and the anticipation of intended task engagement would be necessary for future research to better understand the role of negative affect in procrastination.

Taken together, if it is true that negative affect is critical in procrastination, then both the intended tasks and past procrastination experiences could be considered the representational events which link to negative affect. As Steel suggested, negative affect may not only result from procrastination but also create it (2007). It seems plausible to propose that negative affect can play a crucial role in coping with procrastination and both intended tasks and past procrastination experience could trigger negative affect and contribute to procrastination in return. Otherwise, it would be necessary to examine the procrastinators' initial perspective of the intended task and past procrastination experience. While no consistent evidence from empirical study alone explains how these events are involved in procrastination.

1.2.2 Motivation

It has been theoretically noted that there are two main motives which could serve as attribution to procrastination: one is reducing negative mood (Ferrari, 2001; Ferrari & Johnson, 1995; Sirois & Pychyl, 2013; Steel, 2007); the other is maintaining feelings of self-worth. The former one has been discussed thoroughly in previous sections regarding the relationships between procrastination and negative affect. As for the latter one, maintaining a sense of self-worth is considered a way to prevent oneself from potential performance consequences, which is considered an explanation for the procrastinator's claimed fear of failure(Ferrari & Johnson, 1995). For example, by avoiding aversive tasks, people could use it as an excuse that they could have done better if they had started earlier, and performing worse is not because of their own ability (Foster, 2007; Rice et al., 2012; Sirois et al., 2017; Van Eerde, 2003).

1.2.3 Self-regulation

The motivation that people prefer to rather regulate current negative affect than pursuing their intended goal is characteristic of the self-regulation processes. Basically, self-regulation is broadly used to refer to any effort made by people to alter their own responses, which includes actions, thoughts, feeling, desires and actual performances (Baumeister et al., 1994). In terms of the association between procrastination and self-regulation, a majority of studies consider procrastination as a form of self-regulation failure (Steel, 2007). To understand why people procrastinate and how motivation is attributed to procrastination, it is necessary to have a grasp of the processes of self-regulation.

According to Baumeister et al. (1994), there are three important features in the processes of self-regulation. Firstly, people have multiple processes, and self-regulation is a prioritisation of one process over another. For instance, a person may plan to call his dentist to make an appointment. While he is looking at the contact list, he may realise that it has been

a long time that he doesn't call and communicate with his parents. Normally thinking about parents would prompt him to call their phone number. However, he will have to confront the risk of not being able to see a dentist and put his dental plan in place. The urgency of his dental situation may prompt him to override this response and call the dentist first. Secondly, to successfully regulate themselves, people should pay attention to and keep track of what they are doing. Thirdly, individuals are supposed to monitor and alter their responses to reach the desired changes. Self-regulation failure could occur with any of these features. In the procrastination context, procrastinators do make efforts to alter their own responses to the negative affect, but, as it is noted, this response is at the expense of goal pursuit (Ferrari, 1991; Solomon & Rothblum, 1984). When people are unable to regulate themselves effectively, they may be more likely to procrastinate. For instance, high level of procrastination has been investigated to be associated with low self-regulation (Wijaya & Tori, 2018). Specifically, in the temporal frame of the task, one may be tempted to be involved in other pleasure activities because the intended task is perceived as difficult or aversive.

Furthermore, given the robust evidence that both self-control and self-efficacy contribute to the results of self-regulation (Baumeister et al., 1994; Klassen et al., 2008; Mamta Sharma & Gagandeep Kaur, 2013), indicating that low levels of self-efficacy and losing self-control might explain the failure of self-regulation, namely, procrastination. Self-control refers to the process of regulating or inhibiting automatic, habitual, emotions, or desires that would otherwise interfere with long-term goals (Barkley, 1997; Baumeister et al., 1994; Englert, 2019; Kanfer & Karoly, 1972). For instance, individuals have to resist the immediate temptation to relax and have to work on the intended tasks instead in order to achieve the long-term goal. Meanwhile, while exerting self-control, individuals whose autonomy was supported performed better on a subsequent test of self-control (Muraven et

al., 2008). Basically, autonomy refers to a desire to self-organise behaviour and to have action be consistent with one's integrated sense of self (Deci & Ryan, 1980; 2000; Sheldon & Elliot, 1999). Lack of autonomy has been found in previous research to be positively associated with procrastinatory behaviour (Kljajic et al., 2022; Lay, 1992). According to Kuhl's (1992) action control theory, individuals who can efficiently use self-control processes to achieve the intended goal are action oriented, while individuals who are bad at self-control processes are considered state oriented. Accordingly, action orientation is connected with an action-promoting mode of control, whereas state orientation is referred as action-preventing (Ruigendijk & Koole, 2014; Wolff et al., 2016). Self-control and self-efficacy are suggested to be linked to procrastination (Katz et al., 2013; Wäschle et al., 2014; Zuffianò et al., 2013). Thus, individuals who lack self-control are more likely to procrastinate, as they are more likely to be disturbed and sensitive to external distracting stimuli (Sirois & Giguère, 2018).

Furthermore, it is suggested that emotion regulation plays a critical role in self-control (Tice & Bratslavsky, 2000). Emotion regulation is defined as a construct of cognitive processes to monitor, evaluate, and modify emotional reactions to accomplish one's goals (Gross, 2007). As it is stated in previous research, procrastinators prioritise the immediate short-term mood repair over long-term goal pursuit (Sirois & Pychyl, 2013). When people's focus is on feeling positive now, the emotion regulation strategy is to avoid the negative affect. Thus, it is more likely for them to delay the aversive tasks. Accordingly, emotional regulation training is viewed as an intervention to reduce procrastination and its associated adverse effects (Schuenemann et al., 2022).

1.2.4 Task Characteristics

When it comes to the reasons why people procrastinate, most research focuses on procrastinators' characteristics, less attention has been devoted to identifying the characteristics of the tasks. Most of procrastination research have investigated that

procrastination links to the lack of motivation, deficient self-regulation, external locus of control, perfectionism, trait and state anxiety, fear of failure (Janssen & Carton, 1999; Lay & Silverman, 1996; Rice et al., 2012; Steel et al., 2001; Steel & Klingsieck, 2016). Besides these procrastinator characteristics, as a possible environmental cause, task characteristics are suggested to be a predictable factor of procrastination. For example, people are more likely to procrastinate when they find tasks boring or difficult (Blunt, 2000; Blunt & Pychyl, 2005; Lay, 1992).

In procrastination research, task aversiveness refers to how unpleasant or difficult a task is (Lay, 1990; Milgram et al., 1995; Solomon & Rothblum, 1984). Although most researchers note that individuals tend to delay task completion and typically procrastinate more often on tasks which are perceived to be more unpleasant or unenjoyable than others (Blunt, 2000; Rice et al., 2012; Sirois & Pychyl, 2013), the relationship between procrastination and task aversiveness has been still unclear so far due to the varied research methods. For example, Janssen and Carton (1999) manipulate the task difficulty levels to examine the relation between procrastination and task aversiveness, which suggested that task difficulty does not have an effect on procrastination. In contrast, results from Blunt and Pychyl (2005) have suggested that procrastination may arise when tasks are perceived aversive and the task aversiveness could be a causal factor in procrastination. This discrepancy might result from using different research methods. Specifically, Janssen and Carton (1999) focussed on objective task difficulty, whereas Blunt and Pychyl (2005) focussed on the participants' appraisal of the task. According to appraisal theories of emotion (Scherer et al., 2001), different individuals interpret and evaluate similar events in different ways, which could explain why two people feel differently when confronted with similar events? Given that task appraisal is linked to negative affect (Fisher et al., 2013), it seems

plausible that the effects of task aversiveness on procrastination may be mixed with the effect of negative affect.

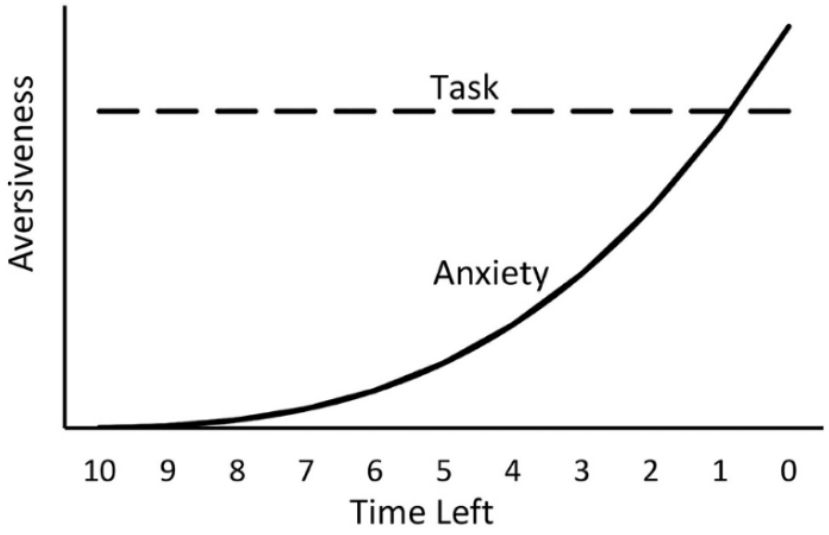
As procrastinators often choose to delay an aversive task to engage in a pleasant or less aversive activity, Zentall (2021) proposed that procrastination can be considered a behavioural process in which the aversive tasks are delayed. First of all, one might be engaged in anxiety when an intended task is formed, and this negative affect could contribute to the possibility of procrastination. As time approaches, the anxiety about the intended task then might be increased in the process underlying procrastination. Accordingly, the task aversiveness could serve as a reasonable source of reinforcement of negative affect in this procedure.

To better clarify and explain the relation between tasks aversiveness, negative affect and procrastination, Zentall (2021) introduces a conceptual model of procrastination (see Figure 1.1). This model is based on the assumption that procrastination follows a time course. The aversive task is the source of negative affect (anxiety). As it is presented, the task aversiveness is relatively constant, whereas the anxiety keeps building up slowly at beginning and then increasingly faster. The closer to the deadline the individuals approach, the greater negative affect they are engaged in. This view is consistent with Sirois and Giguère's (2018) suggestion that the negative affect may be particularly detrimental for procrastinators in long-term tasks completion. Furthermore, what is interesting is that Zentall (2021) also suggested that the beliefs of avoiding the aversive task might be reinforced when the deadline is becoming closer. As individuals approach closer to the deadline, the beliefs of reducing the greater negative affect would be stronger which, however, actually maintain procrastination in return. This could support the defined feature of irrational belief and intention-action gap in procrastination (Klingsieck, 2013). Zentall's (2021) research has brought the task characteristics into consideration and examined the roles of task characteristics and negative

affect in the behavioural process underlying procrastination. Although some researchers have noted that procrastination is trait-like which is mentioned previously, the proposed behavioural process is a novel research approach which could contribute to the understanding of procrastination in both theoretical and practical ways.

Figure 1.1

The Conceptual Model of Procrastination



Note. The anxiety of not completing the task prior to the deadline increases as the time left approaches the deadline. The numbers along the x-axis represent the time left before the final deadline. Y-axis implies the level of task aversiveness people perceive. From "Basic Behavioural Processes Involved in Procrastination," by T. R. Zentall, 2021, *Frontiers in Psychology, 12*, p. 769928–769928 (https://doi.org/10.3389/fpsyg.2021.769928).

1.3 The Behavioural Nature of Procrastination

Although negative affect is critical in procrastination, one of the nature of procrastination is behaviour delay. As it is particularly prevalent in people's everyday life, procrastination is viewed as a personality trait that is associated with repeated episodes of dilatory behaviour. In respect to the relation between trait procrastination and dilatory

behaviour, Lay and Silverman (1996) have suggested that trait procrastination is a summary of tendency to engage in dilatory behaviour. Schouwenburg and Groenewoud (2001) examined the role of personality traits and motivation in procrastination. The findings suggested that different levels of procrastination were detected from actual behaviour instead of personality trait nor motivation, implying that the behaviour, rather than intention, may be an important distinction between procrastinator and non-procrastinator. Furthermore, recent studies have suggested that behavioural delay is the core characteristic of procrastination (Steel et al., 2018; Svartdal et al., 2018). This view is highly consistent with the general definition of procrastination.

Even though it seems that active procrastination is defined positively, it is still not convincing enough to distinguish procrastination and dilatory behaviour with the emphasis on the negative side of procrastination. There is a preliminary limitation from previous arguments, as the underlying behavioural processes of procrastination seem to be completely neglected when the emphasis is on the proposed negative aspects of procrastination. For example, negative consequences and negative affect of the poor performance are highlighted in Chowdhury and Pychyl's argument (2018), as active procrastination only focuses on the positive side of the dilatory behaviour and the behavioural process underlying procrastination. Clearly, these arguments focus on the behavioural consequences after the procrastination. Namely, the negative side of procrastination is most likely a post behaviour reflection. As it is noted above, active procrastination refers to an intended delay to work closer to the deadline to seek pressure and motivation (Chu & Choi, 2005). From this perspective, it indicates that people intend to delay the task to the last minute in order to experience high arousal and excitement as a motivation to enforce task completion. According to the self-regulation characteristic of procrastination, it is reasonable to consider that the concept of active procrastination describes the self-regulation and the subjective

beliefs during the behavioural process underlying procrastination. Consequently, this positive strategic delay could end up as procrastination with negative outcomes. This could be in line with the empirical evidence that chronic procrastinators are more likely to ineffectively regulate their performance when they are under pressure (Ferrari, 2001).

Given the behavioural nature of procrastination, we argue that delay could be considered the critical domain of procrastination, which combines with various affect and cognition. However, researchers from different viewpoints highlight the different domains of procrastination. To reach a consensus regarding the definition of procrastination and better understand procrastination, it is necessary to study procrastination not only take account of its behavioural pattern and associated affect, but also assess the underlying cognition.

1.4 The Temporal Nature of Procrastination

According to the well-established procrastination theories, procrastination is conceptually associated with a temporal frame, and there is a temporal disjunction between present and future selves among procrastinators (Sirois & Pychyl, 2013). In other words, the consideration of the future self is neglected. In particular, people could experience an immediate reward for their negative moods by procrastinating. Initial studies concentrated on determining how procrastination occurs in the temporal frame. It is proposed that the present self could escape the unpleasant feelings associated with the task and feel good now by delaying a task when they are stressed and anxious. This immediate reward is at the expense of future self and, therefore, procrastination can be viewed as an emotion-regulation failure (Sirois & Kitner, 2015). Support for this is that procrastinators usually had a low level of future time perspective (Ferrari & Díaz-Morales, 2007; Sirois, 2014). Similarly, Altgassen et al. (2019) described a study of individuals with ADHD and stated that procrastination is linked to prospective memory performance.

The temporal view of procrastination highlights the procrastinator's present bias, which reflects the subjective value of present in the temporal frame. For example, procrastinators are suggested to be more likely absorbed in the moment (Sirois, 2014) which is consistent with Ferrari's research (2007), indicating that procrastination is positively correlated with present orientation. However, the literature is not specific and clear about how the present and future work in the temporal frame, and the explanation of the findings are somewhat mixed. For example, previous research suggested that trait procrastination is linked to higher levels of absorption (Sirois, 2014), which indicates a temporal bias towards the present and away from the future. Following the temporal view of procrastination, it seems that this investigation is based on the assumption that pleasant activities are preferred in the current time point and avoided intended actions are in a time point of future. This is debatable, as the investigations seem to mix two effects from temporal factor and affect factor. Extending from the temporal nature of procrastination, plenty of studies have investigated that time perspective is related to procrastination. Basically, time perspective is considered a trait-like tendency that focuses on the temporal frames: past, present or future (Zimbardo & Boyd, 1999). For example, procrastinators may fail to have a long-term vision of their life and only focus on the present (Specter & Ferrari, 2000). From the perspective of the cognitive escape hypothesis (Sirois, 2014), procrastinators tend to be engaged in pleasant activities in order to escape from intended tasks. It is likely that procrastinators prefer escaping from the current negative affect caused by intended tasks, and being engaged in the current positive affect. Meanwhile, chronic procrastinators tend to underestimate the time when they estimate how long it will take them to complete a task (Burt & Kemp, 1994). Both of these time preferences and time estimation reflect individuals' subjective time conception, and are present based. From this perspective, procrastination is typically the decision-making between current pleasant activity and avoidance of intended tasks. Thus, the indication of

future perspective may be over investigated without direct evidence. Further evidence is needed regarding the association between procrastination and future time perspective.

1.5 Procrastination Measures

Basically, procrastination is assessed through both subjective and objective measurements. Given the obvious distinction between trait procrastination and dilatory behaviour, it is particularly important to consider different features at the same time when it comes to the measure of procrastination.

Measures for procrastination assessment vary greatly. The General Behavioral Procrastination Scale (GPS; Lay, 1986) and the Pure Procrastination Scale (PPS; Steel, 2010) are two of the classic and typical measures which are broadly used as subjective measures in procrastination research. Taking the GPS for example, it is a well-documented measure developed by Lay (1986) and consists of 20 items (e.g., “I often find myself performing tasks that I had intended to do days before”), with higher scores indicating a greater degree of procrastination. According to Svartdal and Steel (2017), GPS and PPS are strongly correlated with each other (correlation > 0.80), and the strong correlations were also found between other procrastination scales. Based on this evidence, it seems that these procrastination scales are preferable measures. Generally, subjective measures are faster to administer and obtained at no cost. However, despite the strong internal reliability, subjective self-report measures are shown to have inconsistent validity (Vangsness et al., 2022). The problem with subjective performance has been raised as it is prone to be biassed. For instance, some people might be much more likely to answer that they did not have any procrastination experiences listed in the subjective measures, but they do procrastinate a lot in other life domains. Conversely, others may judge themselves harshly when they respond to the self-report measures, but in fact they postpone tasks slightly. Thus, the self-report procrastination measures may not reflect individuals’ actual procrastination behaviour.

Objective measures of procrastination typically assess task engagement which are based on how long it takes participants to do a task, irrespective of what they experience while performing the task. Taking academic measurement for example, procrastination behavioural tasks are designed to assess students' academic procrastination, in which students were instructed to submit assignments or send back documents within a fixed duration (McCrea et al., 2008; Vangsness et al., 2022; Voss & Vangsness, 2020; Zuber et al., 2020). Specifically, the number of days that elapses since the start of the task is considered the level of students' procrastination.

Compared with objective measures, even though the self-reported procrastination is suggested to better reflect the construct of affect than objective behaviour (Krause & Freund, 2014), a common limitation is that the predictive validity of subjective procrastination measures is substantially lower. For example, it has been investigated that subjective self-reported and objective behavioural procrastination correlated only moderately (Krause & Freund, 2014; Vangsness et al., 2022), and less than 15% variability of procrastination behaviour can be explained by subjective self-report measures (Kim & Seo, 2015). Hence, the findings from subjective procrastination measures may fail to precisely reflect the actual procrastination behaviour.

It should be pointed out that the vast majority of literature considered in this section relies almost exclusively on findings from self-reported measures. Interpretations of data from this method are limited in a number of ways. For instance, instead of procrastinating behaviour, the perspective of procrastination is tested. This method cannot capture the specific behavioural process underlying procrastination, and what procrastinators exactly do and think in the duration of procrastination are unclear. Although there is a branch of research which examines procrastination with academic performances (Krause & Freund, 2014; Krause & Freund, 2016), the investigations on the behavioural process underlying these

performances are neglected. Clearly, the behavioural process underlying procrastination has not been paid enough attention from previous research. But these approaches are important because they can help to understand the complex behavioural pattern of procrastination. For example, Gustavson and his colleagues (2015) use behavioural genetics methodology to investigate the cognitive underpinnings of procrastination which highlight the important cognitive and genetic influences that underlie procrastination. Unfortunately, there is little research that examines the specific cognitive mechanisms that might be involved in the behaviour process underlying procrastination by examining the role of memory, such as prospective memory.

Despite the influential and powerful findings from self-report procrastination measures, more and more researchers have questioned the construct validity of these subjective measures (Vangsness et al., 2022). One possible explanation is that self-report measures of procrastination can-not reflect the actual behavioural pattern. Despite the limitations of traditional self-report procrastination measures, however, it is still premature to conclude that objective behavioural measure is superior to subjective self-report. A general notion which could be drawn is that it is necessary to combine both subjective and objective measures in the future research. By doing so, a better conclusive conclusion could be drawn.

1.6 Procrastination and Memory

Remembering what we intend to do is critical for our daily life. In the following sections, the potential role of memory in procrastination will be discussed, with a particular focus on links between prospective memory and procrastination.

Although the research regarding the role of memory in procrastination has merely been studied in recent years, a number of pieces of evidence from previous research appear to link memory to procrastination, and this association may reveal the potential mechanism underlying procrastination. One of the fundamental nature of procrastination is to delay

beginning or completing an intended course of action (Ferrari, 1993; Lay & Silverman, 1996), in which an temporal frame could be formed from the moment when the decision is made to the final deadline. Regarding the procedure of task completion in a temporal frame, one would need to memorise the intended task in case of missing the deadline. This temporal frame is not only for the possible procrastination, but also could be considered a possibility of forgetting which would then contribute to procrastination, as forgetting is a ubiquitous phenomenon in the temporal frame. Given this foundation, it is reasonable to think that the procrastination in the procedure of task completion may be due to temporal decay of memory. In other words, memory may link to the behavioural process underlying procrastination.

To support the assumption that memory may link to the behavioural process underlying procrastination, some evidence may be found in repeated demonstration about the association between task delay and forgetting. For example, forgetting is more likely to occur when the intended task is delayed (Einstein et al., 2000; Eysenck & Groome, 2020; Zuber et al., 2021). A number of studies have also indicated that the task-related memory (memory of intended tasks) may diminish over time when attention is diverted by concurrent activities (Barrouillet et al., 2011; deBettencourt et al., 2017; Rosenberg et al., 2013). If individuals are more likely to forget when they are delaying the intended task, then it seems that this forgetting becomes an additional contribution to the poorer performance in the task completion procedure.

1.6.1 Prospective Memory

The known influence of memory on the intention completion and its interaction with emotion has yet to be considered in the context of procrastination. Whether individuals remember the intended task throughout the temporal frame and the links between memory and relevant behaviour may be an interesting topic regarding procrastination. The use of the term remembering often carries the meaning of what we have done in the past and what we

will do in the future, namely the retrospective memory and prospective memory. Prospective memory involves remembering to carry out intended tasks in the future or execute the intentions at a certain time (time-based tasks) or when an event occurs (event-based tasks) (Brandimonte et al., 1996). In contrast, retrospective memory involves the encoding and retrieval of the content of the past (Kopp & Thöne-Otto, 2003). Accordingly, the past procrastination experiences, intended tasks and aimed goals are contents of retrospective memory and prospective memory respectively. For example, when asked to give a presentation at the end of term, students planned to work on slides every day to achieve their goal. As time approaches, they need to remember that they have made the specific plan (retrospective memory) and remember to give the presentation (prospective memory).

Prospective memory plays a critical role in people's cognitive function, and it is involved in making plans, retaining them, and bringing them back to one's consciousness at the right time and place (Brandimonte, 1996; Kliegel & Martin, 2003). Basically, there are robust correlations between prospective memory and cognitive ability. In detail, main possible cognitive resources are demonstrated in Kliegel et al. 's process model of prospective memory (2002). In the model, a prospective memory task consists of four phases: intention formation, intention retention, intention initiation and intention execution. It is proposed that executive function is mainly involved in the intention formation, intention initiation and execution, and intention retention rely on the capacity of retrospective memory. Moreover, task characteristics are highlighted in the proposition which may account for the variations of prospective memory performance. Based on Kliegel et al. 's modelling works (Kliegel et al., 2002; Kliegel et al., 2011), Zogg et al. (2011) further introduce a broad conceptual model describing five stages of prospective memory. The first stage involves the intention formation, in which the action plan is generated. The second stage is the intention delay, which can range from hours to days and during which people engage in the strategic

behavioural monitoring for time and events cues. The third stage involves the intention retrieval and cue detection which is associated with the intention. Following the process of intention retrieval, the content of the intention is recalled from retrospective memory, and it is considered a fundamental aspect of successful prospective memory (Kliegel et al., 2008). After that, the final two stages are the intention recollection and execution. Although Zogg et al. 's (2011) five-stage model is consistent with Kliegel et al.'s (2002) theoretical model, the second stage features the temporal delay.

Examining both theoretical models, a potential link between prospective memory and procrastination may emerge. First, prospective memory and procrastination are both associated with performing intended tasks, and tasks-related characteristics may affect the cognitive processes underlying both domains (Kliegel et al., 2002; Zentall, 2021). Second, as noted in the models, there is a temporal delay in prospective memory tasks (Zogg et al., 2011), and this is similar to procrastination regarding its temporal nature. That is, both of the domains are related to a time frame.

From the potential cognitive process of prospective memory and procrastination, it appears that the procedures of both domains are closely related. According to Einstein et al. (1998), prospective memory is divided into three parts: episodic prospective memory, vigilance/monitoring and habitual prospective memory. Episodic prospective memory is to remember previously formed intentions in response to appropriate cues. For example, people would remember to buy groceries when they come across the supermarket sign. In contrast, vigilance/monitoring maintains the plan in consciousness from the formation of the plan until the right time or place for its performance. Habitual prospective memory is similar to episodic prospective memory, but the time and place for undergoing the tasks repeats regularly with a long time for the plan to stay consciousness (Graf & Uttl, 2001). It implies

that the actions in habitual prospective memory tasks are performed repeatedly in a temporal frame. For instance, patients need to take medicine three times a day within two month.

The temporal frame in prospective memory could also be applied to the situation when people voluntarily delay their intended task (for example, making appointments with GP) despite the negative consequences in the future. In the context of procrastination, the behavioural process could be that procrastinators do not act today to call their GP because they plan to act tomorrow, but when tomorrow arrives, they may delay again. Accordingly, a basic notion here is that procrastination occurs in a temporal frame. This is consistent with Lay's (1986) argument that procrastination occurs in a time span. Although the actual delay behaviours are different, since the delay in prospective memory tasks is a part of design, and the underlying cognitive mechanisms may differ as well, it is still reasonable to assume that there is a link between prospective memory and procrastination when it comes to the underlying behavioural process in a temporal frame.

Furthermore, it states that consideration of future consequences and episodic future thinking are associated with procrastination (Rebetez et al., 2016). Researchers have also stated that there are links between everyday prospective memory performance and reported procrastination behaviour in ADHD samples (Altgassen et al., 2019). Diaz-Morales et al. (2008) investigate that procrastinators focus more on the present than the future, and it is more difficult for procrastinators to think about the future items. It should be inferred that prospective memory may be associated with procrastination.

Heathcote et al. (2015) have suggested that event-based prospective memory requires a delay to allow more time for PM response selection when a target event is encountered in the future. It indicates that poor prospective memory about intention might be a reason for delay, because it requires more time for response selection. This research provides a new approach to take event-based memory into consideration. The findings from general literature

of emotion and prospective memory suggest that positive emotion is likely to improve prospective memory (Hostler et al., 2018). As the content of intention is recalled from retrospective memory in the intention execution process (Zogg et al., 2011) and there is a positive relation between prospective memory and retrospective memory (Wang, 2008), retrospective memory should be concerned as well to investigate the relation between prospective memory and procrastination.

1.6.2 Procrastination and Task Reminder

Tasks are more likely to be delayed when individuals forget their intended tasks and limited memory could explain why poor task performance happens consistently (Ericson, 2017). However, the use of memory technologies, digital assistants and planners for example, could improve individuals' memory efficiently. Why then does memory still matter? According to Landsiedel (2015), there was a dissociable influence of reminders on delayed intentions. Researchers applied an intention-offloading task in the study. There were three conditions: 1) participants were required to set an external reminder; 2) participants took the task without any external memory aid; 3) a control task with no delayed intention. Functional images were acquired by MRI scanner in interested brain areas. Compared with the control task, the reduction in task-negative deactivation was significantly high when an external memory aid (reminder) was applied. From this result, it could be implied that memory aid could contribute to better goal-directed behaviour. Given that procrastination refers to a voluntary delay of an intended task, which could be related to goal-directed behaviour, it is reasonable to expect that procrastination might be associated with memory.

Furthermore, one study indicates that intention retrieval plays a critical role in intention execution (Rummel, 2017). When individuals get tasks to finish in the future, memory is relevant - people need to retrieve tasks and put them into action. In Rummel's study (2017), researchers applied a standard prospective memory paradigm, in which

participants are asked to take two tasks: an on-going task and a prospective memory task. As it is expected, participants perform better in the prospective memory task if there is a prospective cue than that in the non-cue and irrelevant cue trials. This result indicates that remembering what to do would help individuals complete their intention, suggesting that intention completion is partly dependent on memory. Similarly, Gilbert (2015) describes a study about strategic use of reminders and stated that participants were significantly more likely to set reminders in poor memory ability and use of reminders improves performance.

In contrast, one computational modelling study investigated this issue and indicated that anticipated reminders may induce additional procrastination (Ericson, 2017). Researchers set up a model (Completing Task) to investigate how memory affects the probability of action. Reminders are designed as memory aids to help participants remember what they are going to do. Ericson's computational model distinguishes two types of reminders: anticipated and unanticipated reminders. For example, weekly reminders will be provided in the anticipated group, so that individuals can rely on future reminders. Whereas individuals who are not told that they will receive reminders face more urgency to take action since they cannot be assured that they will remember to act in the future. Ericson's findings (2017) indicated that individuals may delay tasks when there are regular reminders in the future. But it is worthy to note that this result is not stable since present-biassed individuals may not use available reminders.

The studies discussed above that have investigated the relationship between memory aids and procrastination have arrived at opposite conclusions. The conclusion made by Rummel (2017) is focused on retrieval of tasks without concern about emotional state which may be affected by the process of retrieval. Ericson (2017) concluded that individuals are more likely to take action when they are supposed to get unanticipated reminders, because they do not know when they will be reminded in an unanticipated context in which they

would have to keep the tasks in mind by themself and take action more urgently before they forget. Oppositely, individuals who get anticipated reminders tend to rely on future reminders and delay intended tasks. It indicated that the type of task reminder would affect procrastination. Similarly, a study on reminder type and task performance suggested that task performance was improved with target-action reminder, but neither target reminder nor action reminder did (Peper et al., 2022).

However, a recent study suggested that a pure reminder intervention does not change behaviour and procrastinators benefit most from the commitment reminder (Himmler et al., 2019). In the experiment, participants were randomly assigned to three treatments: commitment reminder group, pure reminder group and control group. Participants in the commitment reminder group were instructed to sign an agreement to complete scheduled exams. Besides the signed commitment, participants got reminders during the target period. In a pure reminder group, participants did not need to sign any exam commitment, but they only received exams reminders. For the control group, there were no reminders provided. Performance was evaluated by how well they scored in scheduled exams. Although the findings of Ericsson (2017) and Landsiedel (2015) suggest that task reminder is associated with procrastination, the experiments of Himmler et al. (2019) imply that participants' performance may not be driven by pure reminders, but rather by the commitment they make at the beginning of the experiment. According to Himmler et al. (2019), commitment may increase the willingness to complete the intended tasks. Being reminded, people may recall the memory of the tasks or their procrastination experiences. But the reminder could not be a pure one. There is very little consistent and powerful evidence for the influence of memory on procrastination. Either benefits or impairment of memory to procrastination should be explored more.

In addition to the objective memory capacity, other evidence that seems to support the assumed links between procrastination and memory relates to the subjective perspective of memory. Previous research have revealed interactions between present bias and limited memory and have suggested that present-biassed individuals may have incorrect beliefs about their memory ability (Ericson, 2011; Ericson, 2017). Besides, the valence of the memory information could affect how individuals perceive their memory (Blaney, 1986; Bowen et al., 2020; Grider, 2008; Libkuman et al., 2004). From this perspective, individuals might have biassed beliefs about their memory, and overconfident individuals may fail to prepare optimally for the future. Given that procrastinators are considered to be present-biased (Ferrari, 2007; Sirois, 2014), they might be more likely to have incorrect beliefs about their memory.

Furthermore, according to Zentall's conceptual model of procrastination (2021; see Figure 1.1), the task-related negative affect arises as the time approaches the deadline which then contributes to procrastination. Alternatively, the intended tasks may consistently affect people's procrastination through negative affect. In line with this, the task-related memory may serve as a reason to explain why people experience negative affect, which in turn may result in procrastination. According to the temporal view of procrastination, procrastinators protect the present self from unpleasant feelings when they are engaged in such negative affect (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000). The negative affect may be aroused by appraisal of the task-related memory and then reduce the motivation for task engagement, implying the potential role of task-related memory in the relationship between procrastination and negative affect.Taken together, either forgetting or task remembering may relate to procrastination

1.6.3 Emotional Memory

As an emotionally evocative event, the aversive task should be maintained in memory until the deadline.Whereas little is known about the effects of emotional memory on procrastination. Emotional memory refers to the memory for events that evoke an emotional response (Heuer, 1992; Kensinger, 2003; Kensinger, 2004; Reisberg & Hertel, 2004). In addition to the intended tasks, the emotion about the tasks would be also encoded. Previous research has shown that retrieval of emotional experience would cause reexperience of the same emotion (Buchanan, 2007; Lalla & Sheldon, 2021). It could be inferred that: after encoding, the retrieval of emotional experience would cause reexperience of the same emotion. Engaging in previous emotional memory, individuals' behaviour may be affected by the aroused emotion when there are new tasks at the same time. However, it is yet unclear what emotions individuals experience when they remember their past procrastination and how these emotions affect procrastination.

The role of emotional memory may explain the findings of studies investigating procrastination and negative affect. People need to remember the emotionally evocative tasks in a delayed interval. As time approaches the deadline, some people remember these emotional tasks quite completely and consistently, whereas other people may temporarily forget their intended actions. How people perceive task-related memory may reflect the underlying cognitive process that may explain why people end up with procrastination.

The retrieval of past events is linked to emotion (D'Argembeau et al., 2011). Specifically, recallinging emotional events is often associated with greater accuracy and vividness than events lacking emotional arousal (Reisberg & Hertel, 2005). For chronic procrastinators, the emotional memory of past procrastination experience should be formed after procrastination, and the associated emotion may be aroused in a particular situation. Taking rumination for example, which relates to excessive, repetitive thoughts (Flett et al.,

2016; Nolen-Hoeksema et al., 1994; Treynor, 2003), Stainton (2000) demonstrated that rumination mediated the relation between procrastination and negative affect. The authors present that the ruminative thought of procrastination reflects that people would procrastinate when they are engaged in thinking procrastination, and emotion should be also aroused during rumination.

Thus, both intended tasks and procrastination experiences may serve as cues to emotional memory. According to the theory of emotional enhancement of memory (EEM), emotionally arousing events are more likely to be remembered than neutral events (Dolcos et al., 2005). Due to the enhanced memory for emotional events, emotional memory could remain longer than neutral memory. Furthermore, the onset of a stressful experience would involve the experience of negative affect (Lovallo, 1997). It would be more possible for an individual to re-experience the previous emotion when there is a similar situation, the stressful condition for example. This could be also applied for delay experience. In terms of procrastination, there should be negative affect (Sirois & Pychyl, 2013) which may be associated with this behaviour problem when people recall procrastination experiences. But little is known about how this recalling would affect the future procrastination.

Previous study has suggested that the retrieval of emotional memory about previous experience would contribute to current cognition and behaviour (Battaglini, 2018), which may be evidence that previous emotional memory can affect present behaviour. This result underlines Stainton's (2000) argument that people are more likely to procrastinate when they are involved in thinking about procrastination.

In summary, research on procrastination has usually focussed either on the related factors or on the impacts of affect. By reviewing previous research, it appears that the basic cognition and specific behavioural process underlying procrastination are neglected by previous researchers. In line with the theoretical and empirical background, there is a

growing body of evidence supporting the hypothesis that prospective memory plays an important role in procrastination. Both the temporal view of procrastination and the behavioural process underlying procrastination reflect the cognitive components including one's attitudes toward future intended tasks, ability to maintain the intention and regulation strategies to achieve the final goal. Given the proposed critical role of negative affect, the valence or arousal of task-related memory might be concerned in procrastination research. It would introduce a new perspective to investigate the reason why people procrastinate. Meanwhile, it could be expected that prospective memory may link to procrastination through negative affect. On the one hand, the prospective memory of intended tasks may make individuals experience negative affect, and how people deal with the relevant memory would affect the upcoming behaviour. On the other hand, procrastinators may be more likely to temporarily forget the intended tasks (task-related memory failure) when they experience negative affect. This assumption would be evidence to support the argument that prospective memory decreases procrastination.

1.7 Present Thesis

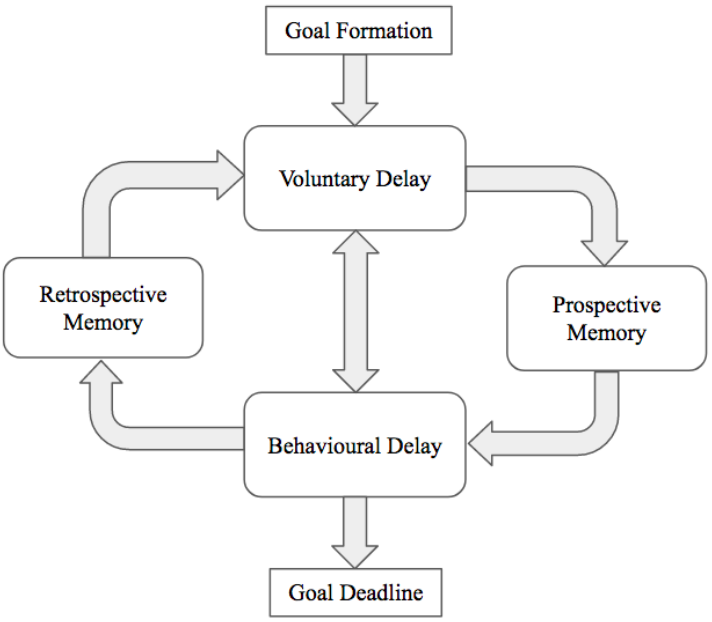
While the existing literature has provided different perspectives on procrastination, it is still unclear how it happens due to the lack of direct evidence. The broad integration of the above perspectives on procrastination provides insights into different factors from observed behaviour to its underlying cognitive mechanism. We argue that procrastination is more likely the dynamic behaviour between intention formation and goal accomplishment which end up with irrational delay or task overrun. Although there is no study that directly examines this proposition, there is reason to propose that task-related memory plays a role in procrastination, as keeping the intention fresh in mind and remembering the planned actions are critical in order to complete the intended tasks. As individuals get distracted from focusing tasks, the intended tasks will be more likely to be forgotten and put off. Task-related

memory should contribute to current behaviour in the context of procrastination. If task-related memory provides an account, we would expect that the prospective memory would not only be related to procrastination but result in distinct behavioural patterns in the duration between intention formation and goal accomplishment.

Accounting for the potential links between prospective memory and procrastination, a conceptual framework is depicted in Figure 1.2 that illustrates how retrospective and prospective memory may be related to procrastination. As it is presented, the vertical line represents the time frame from goal formation to goal deadline. That is a period of task completion during which people not only pursue and strive for the intended goal, but also possibly procrastinate. In the time frame, there are two phases involving voluntary delay and behavioural delay that are linked to the task performance. As for the link between voluntary delay and prospective memory, higher levels of voluntary delay can lead to task forgetting (Zuber et al., 2021). Relative to voluntary delay, I propose that forgetting to perform the intended tasks (prospective memory phase) may result in unconscious delay of the task, which then in turn contributes to voluntary delay. Namely, prospective memory may be a component underlying processes of procrastination. In terms of the link between behavioural delay, retrospective memory and voluntary delay, based on the mood regulation account of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000), we assume that procrastinators may experience negative affect when procrastinators think about past dilatory behaviours (behavioural delay phase) or when recalling their planned intention (retrospective memory), which in turn evokes mood regulation and results in further voluntary delay. The model highlights the important role of prospective memory and retrospective memory which might be the explanation about why people chronically procrastinate.

Figure 1.2

The Conceptual Model of the Relationships between Prospective memory and Procrastination



1.7.1 Research Questions

There are questions over whether and how prospective memory plays a role in procrastination, what exactly makes it connected, and whether it links to the relationship between procrastination and negative affect. These questions are closely linked, and thus to better understand procrastination we must understand the very beginnings of its relation to memory. Along with the rationale, the research questions of this thesis are formulated as follows:

(a) Whether task-related memory links to procrastination?

(b) Whether prospective memory links to procrastination through negative affect?

(c) Whether time perspective could explain the association between prospective memory and procrastination?

1.7.2 Thesis Overview

The current chapter provides an overview of the research reported in this thesis. The remaining chapters are outlined below.

In Chapter 1, a comprehensive literature review was conducted of published theoretical and empirical studies which could link procrastination to prospective memory. The aim of the review was to illustrate how task-related memory relates to negative affect in respect to procrastination and to understand how prospective memory might be associated with procrastination.

Chapter 2 presents Study 1, which explored the features of procrastination-related memory with a qualitative–quantitative mixed-methods approach.

Chapter 3 presents Study 2, which investigated the relationships between self-reported procrastination, negative affect, and prospective memory.

Chapter 4 presents Study 3. Complementing Study 1 and 2, Study 3 verified the relationships between procrastination and prospective memory and further explored whether time perspective could explain this association.

Chapter 5 summarises and discusses the principal findings of the thesis and provides implications on how these findings contribute to the existing theoretical literature and practical applications.

Chapter 2 Study 1: Is Task-related Memory Related to Procrastination? A Qualitative–Quantitative Mixed-Methods Approach

2.1 Abstract

Previous studies have demonstrated that negative affect is task-related in respect to procrastination, but the cognitive variables underlying procrastination have mostly gone unexplored. To complete the intended task, people need to memorise and maintain the task in a temporal frame, which leads us to assume that the role of task-related memory may explain the link between negative affect and intended task which jointly account for procrastination. In this study, we aim to provide an exploratory approach to the links between procrastination and task-related memory with qualitative–quantitative mixed-methods. An online survey was conducted to identify the features of task remembering and recall of past procrastination experience. Overall, participants reported complex and mixed procrastination experience and varied perspectives of task remembering in free-text survey responses. Thematic analysis identified multiple affect domains that appear to link to task remembering and recall of procrastination experiences. Quantitative analysis found that there was a significant positive correlation between self-reported procrastination and procrastination-related emotional memory. These findings build on previous theories regarding the association between procrastination and negative affect and demonstrate the link between task-related memory and negative affect which might contribute to chronic procrastination. Moreover, these findings suggest a new avenue of consideration of memory for future procrastination research.

Keywords: procrastination; task-related memory; emotional memory; qualitative–quantitative mixed-methods approach; negative affect

2.2 Introduction

Procrastination is considered a common self-regulatory problem involving the unnecessary and voluntary delay of important intended tasks despite the recognition that this delay may have negative consequences (Lay, 1986; Sirois & Pychyl, 2013). The mood regulation model of procrastination proposes that procrastination is a form of self-regulation failure that involves prioritising short-term mood repair over the long-term pursuit of intended actions, and the focus on regulating immediate affect could be the underpinning of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000). Specifically, when individuals are faced with aversive tasks, choosing to delay and disengaging from these unpleasant tasks are ways to reduce immediate task-related negative affect, as they could experience more positive affect by engaging in other pleasant activities (Sirois & Giguère, 2018). Given that the highlighted role of negative affect in procrastination is task-related (Blunt & Pychyl, 2000; Pychyl et al., 2000), we assume that a contributing factor to procrastination is the task itself.

Researchers studying procrastination have suggested that memory of the task may link to procrastination. For example, recent estimates suggest that task recalling might decrease individuals' welfare and promote more procrastination (Ericson, 2017). According to Ericson, when individuals anticipate that they will get reminded about the intended tasks, they are more likely to rely on the reminder and hold the beliefs that they can remember to take action in the future. However, it has been investigated that forgetting may arise when people rely on external task reminders (Benoit & Anderson, 2012; Wimber et al., 2015). In this case, it could be less likely for individuals to complete the tasks. Thus, it could imply that individuals may have incorrect beliefs on their memory, and the failure of retrieving intended tasks may be interpreted as a factor linking to procrastination. Meanwhile, procrastinators are reported to be careless and bad task planners (Gustavson et al., 2014). It could be interpreted

as planning for the future task entails immediate costs for future benefit. This is consistent with the notion that procrastinators are present-biased (Ferrari & Díaz-Morales, 2007), which suggests a disconnection between present and future. Poor task planning could reflect less detailed information about what the individuals are expected to do in the duration between intention formation and goal accomplishment. In this case, it is possible that individuals may forget the intended tasks. Accordingly, it is reasonable to assume that procrastinators may be more forgetful about their intended tasks due to incorrect beliefs of memory and poor planning. Thus, it is important to study the role of task-related memory in procrastination.

2.2.1 Mood Regulation and Memory

Regarding the critical role of negative affect, it is important to investigate the causes underlying the negative affect. According to previous research, even the source of the negative affect could vary (Sirois & Giguère, 2018), the most relevant works highlight that aversive tasks are one of the sources of negative affect (Flett et al., 2016; Pychyl & Sirois, 2016). In respect to the intended tasks, aversiveness of tasks is a critical dimension of procrastination (Lay, 1992). Specifically, it has been suggested that individuals tend to procrastinate on tasks which are perceived to be aversive (Blunt & Pychyl, 2000; Watson, 2001). In line with this, it has been theoretically and empirically explained that task aversiveness is a main predictable factor of procrastination (Sirois & Pychyl, 2013; Steel, 2007; Tice & Bratslavsky, 2000). Hence, as the context that causes the subjective emotional state, the memory of the intended tasks may play a role underlying negative affect. For chronic procrastinators, better task-related memory (memory of intended tasks) may predict greater procrastination, because it means task aversion is amplified.

Given the close association between negative affect and intended task in procrastination, the task-related memory might be a potential interpretation for the link between negative affect and intended task. Generally, memories about both past and future

events are imbued with emotional value (D'Argembeau et al., 2011) and emotional memories that are triggered by certain contexts could contribute to present emotional response (Philippe et al., 2011). It could be less likely for individuals to start and complete intended tasks when they must remember their intended tasks, as they might experience negative affect. In fact, individuals' beliefs and behaviour could be affected by memories of significant past experiences and by the anticipated meaningful events in the future (Çili & Stopa, 2015; Demblon & D'Argembeau, 2017). Given the highlighted role of task-related negative affect in procrastination (Blunt& Pychyl, 2000; Sirois & Giguère, 2018), we assume that procrastinators may tend to postpone starting and completing tasks as they experience negative affect when they remember their intended tasks. However, there is little knowledge as to whether the task-related memory relates to negative affect regarding procrastination.

Moreover, the mood regulation model of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000) is potentially consistent with the studies showing that when engaging in the aversive tasks individuals experience negative affect. For example, several studies have shown that when memories about future intended events are retrieved, they are characterised with intense emotions (Ernst et al., 2018) and recall of these intended events could be associated with delayed behaviours (Palombo et al., 2015; Rosch et al., 2021). For chronic procrastinators, remembering the aversive tasks may make them experience negative affect again which could be associated with negative emotional responses and further procrastination. Given that recalling stressful experiences would expose individuals to negative affect (Lovallo, 1997), it could be reasonable to consider that procrastinators might re-experience the negative affect when procrastination-related memories were retrieved. Experiencing the negative affect caused by task-related memory, procrastination would be a better choice to regulate the negative affect. However, few

researchers have investigated the potential mechanism by which task-related memory may be associated with negative affect, which may underlie procrastination.

With regard to chronic procrastinators, the memories of procrastination experiences and intended tasks may be associated with emotion and these memories may be in turn correlated with future procrastination. For instance, the negative affect could be aroused when people recall or think about past procrastinating behaviour (Lay, 1994; Ferrari, 1991; Solomon & Rothblum, 1984) and intended tasks in the future (Sirois & Pychyl, 2013). The authors present a view that procrastination relevant events (i.e., procrastination experience, intended tasks) could be associated with negative affect, and remembering these events could get individuals to experience negative affect again. Thus, with respect to the relationship between memory and emotion, the memory about past experiences and intended tasks may be the sources of negative affect which should be related to procrastination. Under the negative affect context, people might seek to avoid aversive stimuli, aversive intended tasks for example. Consequently, the more aversive the task when it is remembered, the more likely individuals are to avoid it. Thus, it could be acceptable to consider procrastination as an emotional response to the task-related memory underlying negative affect. Given that negative affect may lead to procrastination, it could also be indicated that the negative affect itself may not only result from procrastinated tasks but also create procrastination.

2.2.2 The Role of Memory in the Relationship between Negative Affect and Intended Task

Evidence on whether memory capacity is related to procrastination is limited. Ericson (2017) made a first step to suggest the connection in the literature between memory capacity and procrastination, and the role that task reminders play in procrastination. This research highlights the importance of reminders in task completion even in people who perform well in memory tasks. According to Ericson (2017), task reminders could be distinguished between anticipated and unanticipated reminders. For instance, individuals were aware that

there are regular reminders during the task completion period (e.g., receiving task reminders once a week). In contrast, unanticipated reminders refer to surprise reminders, in which context individuals cannot assure that they will remember to act in the future. The results based on Ericson's model showed that individuals with anticipated reminders were more likely to complete the task later than those who were not told that they will receive reminders, which suggested that anticipated reminders could induce more procrastination. It was concluded that individuals with anticipated reminders were more likely to rely on future reminders when deciding when to complete the tasks, but individuals who do not know when the reminders will be provided would tend to complete tasks urgently as they cannot be assured that they will remember the tasks in the future. Namely, with an expectation that there is a task reminder in the future, individuals are more likely to procrastinate. As reminders are often used to bring a task back to mind, Ericson (2017) also discussed that the individual is more likely to have forgotten the intended tasks as time goes on. Namely, the failure of task-related memory may account for procrastination. This is new to procrastination research because most of the studies on procrastination did not consider the potential role of task-related memory which may underlie procrastination.

However, the investigation of the relation between procrastination and memory is unclear and there are two main issues to be considered. Firstly, it was not clear whether procrastination was measured appropriately. Ericson's definition of procrastination was different to (broader) the original definition from Lay (1986), because any additional delays were included in Ericson's data analysis without the consideration of voluntariness. The findings may confuse procrastination and other types of delays. Thus, the effects of memory in Ericson's conclusion might be misinterpreted. Secondly, Ericson (2017) has neglected the role of negative affect in procrastination. As procrastination is related to negative affect, task aversiveness (Blunt, 2000; Blunt & Pychyl, 2005; Lay, 1992), it is possible that remembering

the tasks may evoke the negative affect. This is of interest in determining whether the task-related memory might relate to procrastination through negative affect. For example, given that bringing the task back to mind may evoke negative affect, do individuals procrastinate more when it is easy for them to maintain the task in mind? Taking account of the negative affect may lead to a better understanding of potential cognitive mechanisms underlying procrastination. One approach to resolve these issues is to test procrastination with more basic measures and examine whether memory links to procrastination with the consideration of negative affect.

Considering the assumption that task-related memory might be linked to the association between procrastination and negative affect, the basic question is whether negative affect is aroused by the retrieval of the task-related memories and then contributes to procrastination? Or is memory capacity is impaired by negative affect which then results in worse task performance? To carry out intended aversive tasks in a temporal frame, individuals must maintain the task in memory and constantly cycle through them to ensure that the tasks are active. When the intended aversive tasks are refreshed, there is an additional possibility for individuals experiencing negative affect. Researchers studying the interactions between memory and emotion have suggested that emotions can modulate memory formation and retrieval with both enhancements and impairments possible (Allen et al., 2005; Cahill & McGaugh, 1998; Dixon-Melvin et al., 2022; Legrand et al., 2021; Raeder et al., 2019). For example, emotion is investigated to be a necessary condition for attentional selectivity which affects memory performance (Mather & Sutherland, 2011; Van Damme & Smets, 2014; van Steenbergen et al., 2011). Given the limited attention, the emotional events may be selected or be discarded, which will enhance or impair the memory of relevant events. On the one hand, memory performance for arousal tasks are better than the performance in neutral tasks, as the memory is enhanced by the emotional arousal (Libkuman et al., 2004; MacKay et al.,

2004; MacKay & Ahmetzanov, 2005). On the other hand, however, other studies have investigated that the memory performance is poorer in the emotional condition than in the neutral condition, as emotional arousal leads to a narrowing of attention (Christianson & Engelberg, 1999; Kern et al., 2005; Waring & Kensinger, 2009). In particular, when an emotional and a neutral stimuli are simultaneously presented, participants' attention is more likely to first fixate on the emotional stimuli and then fixate more frequently on it (Knight et al., 2007). In contrast, recent evidence has supported the notion that emotion could impair memory, which implied the negative affect could disrupt the memory for future locations and result in worse performance (Brown et al., 2020). Similarly, procrastinators may be more likely to be disrupted when they experience negative affect. Although the findings in the literature are inconsistent, this could be one reason why some people procrastinate chronically but others not, as people would implement different strategies to regulate the negative affect when they are faced with aversive tasks. Previous studies have not usually distinguished whether the task-related memory links to the relation between procrastination and negative affect.

The literature regarding the relationship between negative affect and intended tasks in procrastination and the interaction between memory and emotion could lead us to consider whether task-related memory could link to procrastination through emotion. Hence, we propose that task-related memory is associated with procrastination. To start with, it is important to explore whether the task-related memory can invoke affective experience, as this would determine whether procrastination could be affected by the negative affect when the relevant memories are retrieved.

To explore the possibility of the relation between procrastination and task-related memory and whether the task-related memory links to the relationship between procrastination and negative affect, it is necessary to understand procrastinators' beliefs about

task-related memory. However, when it comes to procrastination, instead of the aversive task itself, few studies focused on the task-related memory, and there are limited empirical studies reporting on the association between task-related memory and negative affect. For instance, Blunt and Pychyl (2000) suggested that the task aversiveness was related to procrastination. However, even though it has been inferred on the basis of studies of such things that people experience negative affect when they think about the aversive tasks (Blunt & Pychyl, 2000; Flett et al., 2016; Nolen-Hoeksema et al., 1994), task-related memory has not been studied explicitly in relation to procrastination. Instead, most of the research on procrastination has focused on the characteristics of the task (Ferrari & Scher, 2000; Sirois & Giguère, 2018; Steel, 2007; Zhang et al., 2021). Clearly, these research have merely focused on task-related memory with the quantitative method approach.

So far, along with the growing number of quantitative studies on procrastination, very few qualitative studies on procrastination are available. According to Schraw et al. (2007), the intended task was identified as one of antecedents to academic procrastination. In line with this, Grunschel et al. (2013) conducted qualitative content analysis to explore the reasons for academic procrastination, which highlighted the importance of task characteristics. However, it is not clear whether and how the task contributes to procrastination, and the potential cognition has not been investigated as of yet. Since previous researchers rarely pay attention to the task-related memory, they may have neglected essential antecedents of procrastination that may be underlying negative affect. To address these gaps, besides the quantitative method, the present research adopted a qualitative approach to ensure a thorough exploration of the potential role of task-related memory and the actual perspective and experiences of procrastinators.

2.3 Research Aims and Objectives

Overall, in the context of procrastination, memory could reflect the past procrastination experiences and future intended tasks, and these procrastination-related memories may contribute to individuals' daily procrastinatory behaviours. From this point of view, the primary goal of the current study is to explore individuals' perspective on procrastination-related memory. Our research question is (1) how do individuals feel about procrastination-related memory? Therefore, it was hypothesised that procrastinators were more likely to report negative affect when they were instructed to retrieve past procrastination experience and intended tasks. Given the suggested interaction between memory and emotion (D'Argembeau et al., 2011) which might affect current responses (Philippe et al., 2009, 2011), the secondary goal of the current study was to examine (2) whether procrastination-related emotional memories are associated with procrastination? We hypothesise that procrastination-related emotional memory is positively associated with procrastination. This could provide new insights for the understanding of procrastination.

2.4 Method

2.4.1 Participants

In total, 153 participants were recruited in this study. This was an anonymous online survey of individuals who reported having had procrastinated in the previous three months. The participants were recruited by sending email announcements through the Sheffield University Volunteer Email List or postings in social media. A hyperlink was attached in the advertisement which directed potential participants to a Qualtrics online survey. Participants who clicked the research link were presented with a consent document that provided details about the inclusion criteria. Eligible participants had to endorse being at least 18 years old, being able to read, write and speak fluent English, and that they had procrastination experiences in the last three months. This study was approved by the University of Sheffield

Research Ethics Committee and consent was obtained from all participants. A qualitative review process identified 7 participants to be excluded from analyses (participants revealed they had procrastinated in the last three months but did not report any experiences when asked via the open-ended questions in the survey). The final sample consisted of 146 respondents (mean age = 30.95; *SD* = 11.75; range = 18-68 years; 58.90% female, 2.74% non-binary).

2.4.2 Procedure

Eligible participants were directed to the online survey. The first two pages of this provided information regarding the purpose of the study, describing that responses were anonymous. Following the demographic information, participants were asked to complete the questionnaires, which included the measure that assessed self-report procrastination After that, participants were asked to recall and describe the task that they procrastinated on recently in an open-ended format. In addition to the procrastination description, respondents were asked to indicate whether they have experienced various aspects of the procrastination-related events and rate their affect on relevant events. Additionally, to gain an in-depth understanding of the emotional memory in procrastination, participants were asked to rate to what extent they remember how they have felt regarding procrastination-related memory. Detailed questions were provided in the measures section.

2.4.3 Measures

2.4.3.1 Procrastination

Self-report procrastination was assessed using the 9-item General Procrastination Scale (GPS-9; Sirois et al., 2019). This 9-item scale scored on the 5-point Likert scale (1 = false; 5 = true of me), and participants were asked to indicate agreement with each statement. Items such as “I often find myself performing tasks that I had intended to do days before” are

scored on the scale. The scale includes 3 reverse-scored items (5, 7 and 9), and all the items are summed, with higher scores reflecting a greater tendency to procrastinate. It has previously been demonstrated that the GPS-9 (test-retest reliability $r = 0.89$; Sirois et al., 2019) is a reliable (Cronbach's $\alpha = 0.87$ in current study) short version of the original longer 20-item measure.

2.4.3.2 Affect about Remembering Procrastination Experience

To measure the affect associated with recalling a past procrastination experience and investigate whether participants experienced emotion when recalling past procrastination experiences, participants were asked to recall their recent procrastination experiences and type them in one or more sentences in an open-ended text box. After that, participants were asked to rate their affect on the recalling (e.g., How does it make you feel to recall this time you procrastinated?), which is assessed by five smiley face pictures (coded from 1 to 5; see Figure 2.1). The higher the score, the more negative the affect.

Figure 2.1

Face Pictures for Affect Rating

2.4.3.3 Affect about Task-related Memory

To explore whether task-related memory is linked to procrastination and negative affect, there were three independent sets of questions designed to assess the affect toward task-related memory. Based on the initial results in respect to the association between procrastination and reminder (Ericson, 2017), task-related memory was distinguished as

general-expected reminder, specific-received reminder and specific-expected reminder. Participants were required to ask “YES” or “NO” to the questions. Each question was followed by a subset of questions with an affect rating scale and an open-ended text box. Participants who responded “YES” could then access the correspondent subset of questions, or they skipped the affect rating and continued to the open-ended text box. The affect rating question in the subset was “How did this make you feel?”. The emotional face pictures, which were applied in negative affect rating about procrastination experience recall, were also applied in these questions. To understand participants’ direct perspective about task remembering, the emotional face pictures were categorised in the statistical analyses section which reflected three types of the affect (positive, neutral and negative). After that, to explore the key features of task remembering from participants’ perspective, questions asked participants to provide a brief written description of the corresponding remembering in the open-ended text box to describe and explain why they feel that way. For example: why is that? Please tell us why you feel that way (see Table 2.1 for the structure).

Table 2.1

Questions Toward Task Remembering

Focus experience	Questions	Response
General-expected reminder	When you are procrastinating, do you expect that someone will be checking up on the task that you are delaying?	YES/NO
	"How did this make you feel?"	Affect rating
	Why is that? Please tell us why you feel that way.	Open-ended text
Specific-received reminder	Thinking about the time when you procrastinated recently, did you get reminders from others that you were late or delayed with your task?	YES/NO
	"How did this make you feel?"	Affect rating
	Why is that? Please tell us why you feel that way.	Open-ended text
Specific-expected reminder	Thinking about the time when you recently procrastinated, did you expect to get reminders from others that you were late or delayed with your task?	YES/NO
	"How did this make you feel?"	Affect rating
	Why is that? Please tell us why you feel that way.	Open-ended text

2.4.3.4 Emotional Memory about Procrastination Experience

There were two questions designed to assess procrastination-related emotional memory.

(1) Remembering the most recent time that you procrastinated, to what extent do you remember how you felt while procrastinating?

(2) Remembering the most recent time that you procrastinated, to what extent does remembering this event makes you relive how you felt?

These questions scored on a 10-point scale (1 = Not at all to 10 = Very). The score for item 1 and 2 separately reflected to what extent participants could remember how they felt

about the procrastination-related events and to what extent participants could re-experience the negative affect at the moment when they remember the events, which jointly reflect the level of emotional arousal when the procrastination-related events were remembered, namely procrastination-related emotional memory. To further explore the participants' perspective about remembering procrastination experiences, participants were asked to rate how much they think this remembering would be beneficial for them to improve procrastination. The score reflected how much the participants think remembering procrastination experiences could improve their procrastination.

(3) Remembering the most recent time that you procrastinated, to what extent does remembering this event make you think about how to do better in the future?

2.5 Results

2.5.1 Analytical Approaches

A qualitative analysis was conducted for the open-ended text box responses to the questions about participants' perspective toward procrastination experiences. To gain a basic understanding about the relationship between procrastination and relevant memory and thoughts across the collected data, thematic analysis was applied in the current study (see Table 2.2). Thematic analysis is a powerful and flexible method to identify, analyse, and report repeated patterns with qualitative data (Braun, 2006; Braun & Clarke, 2022). The basic framework for conducting thematic analysis involves a six-step process: data familiarisation, code generation, theme search, theme review, theme definition, and theme report (Braun, 2006; Braun & Clarke, 2006). In the current study, by examining the recurring themes in the open-ended text regarding participants' perspective toward task reminders in procrastination, it could provide an insight of key features of task remembering in respect to procrastination. Besides describing data, thematic analysis also involves interpretation in the processes of selecting codes and constructing themes which could reflect deeper and underlying meanings

(Braun & Clarke, 2006; Kiger & Varpio, 2020). The specific steps of thematic analysis followed the guidance from Braun and Clarke (2022).

Table 2.2

Six-step Thematic Analysis Process Used in Current Research

Step	Description of the process
1. Data familiarisation	154 statements were copied into Excel. The data were read and reread for potential ideas identification.
2. Codes generation	Data of interest were highlighted with tagged codes.
3. Theme search	Based on the proposed research questions, the generated codes were collated into possible themes with close reference to research questions. Macro-level thematic maps were generated in this step.
4. Theme review	Cross-check if the themes worked in relation to previous codes. The themes were modified in this step.
5. Theme definition	The levels of themes were checked, definition and narrative description of each theme were generated.
6. Theme report	The representative data extracts themes are presented in the results section.

Quantitative analyses included frequency counts, descriptive calculations and correlation results for all questionnaire responses. Data were analysed in SPSS version 26. Descriptive statistics were calculated for basic information. To investigate the relationship between self-reported procrastination, negative affect and emotional memory regarding procrastination, correlation analyses were conducted.

2.5.2 Qualitative Results

Following the thematic analysis process, the data analysis started with the first step of data familiarisation (step 1). As the specific question of interest in the current study was the

affect about task remembering, the thematic analysis was conducted based on the 154 brief statements from participants who reported that they have relevant experiences. The themes development was guided by the theoretical framework of the mood regulation theory of procrastination which highlights the critical role of negative affect (Blunt & Pychyl, 2005; Ellis & Knaus, 1977; Haghbin et al., 2012; Pychyl & Sirois, 2016). In the present study, the textual responses from the raw data were copied into Excel. Each brief statement occupied one cell in a row and initial notes were made. Example cases are illustrated in Table 2.3.

Table 2.3

Sample Textual Data Regarding Task Remembering

No.	Gender	Qualitative data	Main theme: affect toward general-expected reminder
			Subtheme: negative/neutral/positive
9	male	"I know I should do it,but it is hard for me to do it on time,so I need a person to realize me."	positive
11	male	"I hope someone helps me stop procrastinating, but I would feel anxious if they really did."	negative
56	female	"I feel bad for procrastinating when I'm meant to be doing something, especially when I'm paid to do something and I've procrastinate. I feel when I procrastinate on something will be of detriment to someone else I am less likely to do it."	negative
129	female	"I did not feel particularly positive or negative to have someone check on my progress as I was also doing the same."	neutral

Note. The cases selected for this table represent the "YES" responses to general-expected reminder, which perceived either positive, negative affect or neutral.

After the initial process of getting familiarised with the data, we then moved on to the development of codes (step 2). Based on previous initial notes, code words were constructed based on the described content in the textual responses. By doing so, this step was made toward finding common patterns, words, or ideas, which is the ultimate goal in thematic analysis.

Following the process of coding, the specific codes were grouped into clusters. In this step, each cluster of codes is a prospective theme (step 3), and the clustered codes were named by terms that are clearly anchored in the data. To systematically construct the potential themes, thematic maps were applied to demonstrate cross-connections between concepts and

among main themes and subthemes (examples of thematic maps were illustrated in Figure 2.2 and Figure 2.3).

Figure 2.2

Macro-level Thematic Map for Procrastinator's Perspective on Task Reminder

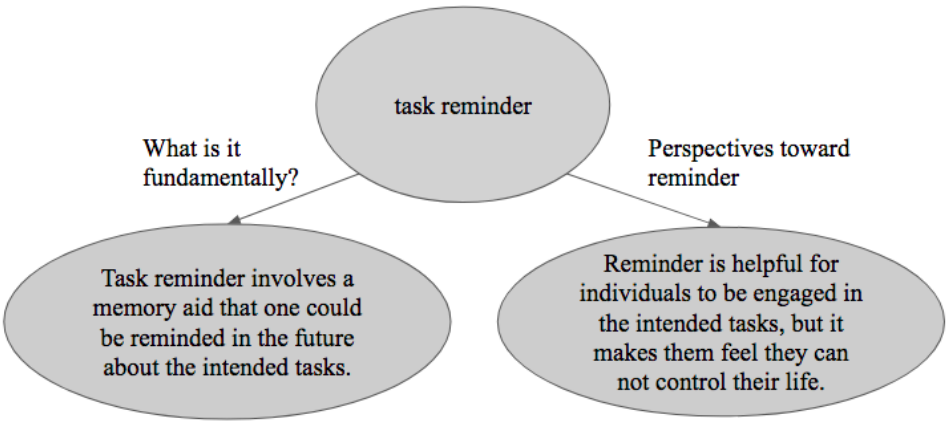
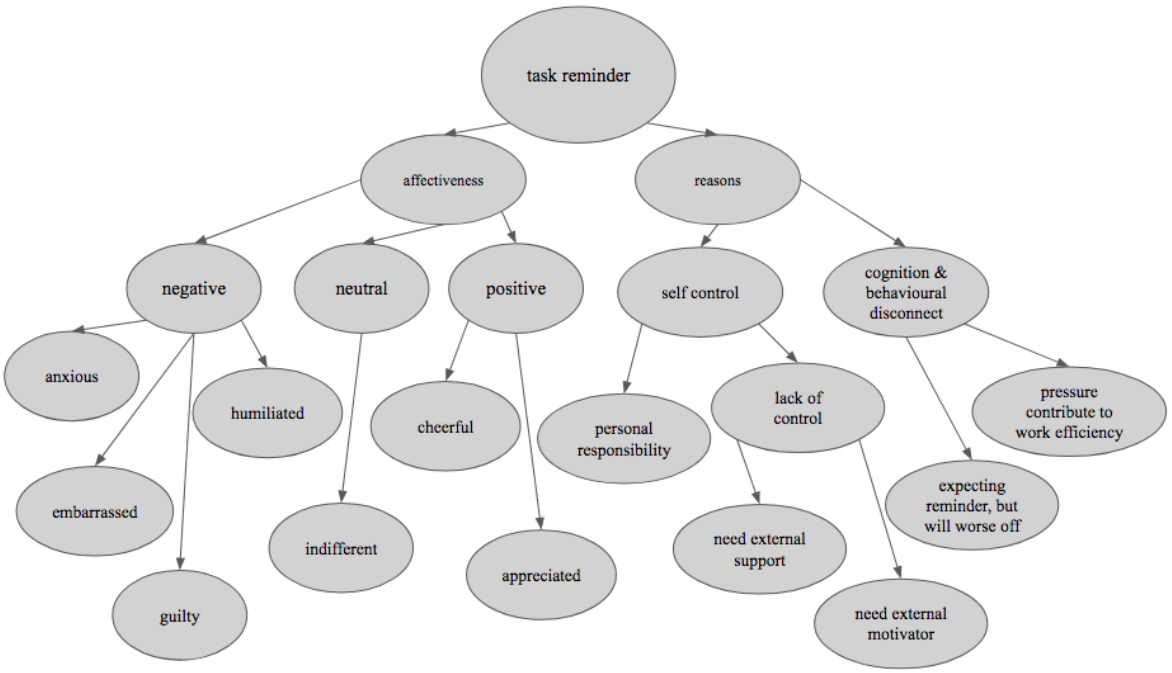


Figure 2.3

Macro-level Thematic Map Focus on Affect and Reasons about Procrastinators' Perspective on Task Reminder



After that, we moved to the theme review (step 4). By conducting theme review, the

modified themes could better reflect and capture the coded data in a more consistent, coherent and clear manner. Following the suggestion from Robinson (2021), to gain additional quality of analytical parsimony, an additional layer of order was created in the themes (examples were presented in Table 2.3). Thus, there were two levels of themes: main themes which are manifest in the surface meanings of the content, and subthemes which could be implicit beyond or below the surface meanings. Besides, the initial thematic maps were broad as they covered a lot of information from the data in step 3, and some of which might be less important regarding the research question in the current study. Less important information was reduced in this step. As for step 5, theme definition involves the process of checking the level of themes, creating definition and narrative description of each theme (Braun & Clarke, 2006). The final names of themes were reviewed to ensure they were brief and adequately descriptive. In the final step (step 6), the specific narrative descriptions and representative data extracts which were most representative for the selected themes were presented in the results section.

The thematic analysis procedure was used to organise and interpret the data about the participants' perspective toward task remembering (focused procrastination-related experiences: general-expected reminder/specific-received reminder/specific-expected reminder). Less than half of participants reported experiences about task remembering within each focused experience, with more than half reporting no relevant experiences when they are procrastinating. In total, we were able to analyse 438 brief statements with 154 statements from participants who reported that they have relevant experiences, while 284 brief statements were from participants who reported that they do not have these experiences.

The narrative descriptions and representative data extracts of each main theme (affect, self-control, cognition & behavioural disconnect) and subthemes are provided below.

2.5.2.1 Affect

The affect theme comprised statements related to the experiences of affect about the task remembering. The perspective expressed by participants in this theme was related to how participants feel about task remembering, which were divided into three subthemes: negative, neutral and positive. The single most prominent emotion appeared to be anxiety. For example: *"It reminds me that I have something left to do but I really don't want to do it, which makes me feel more anxious.",* and task reminder *"Contributes to anxiety around the task"*. As a subtheme, the statements related to negative were expressed with the greatest frequency (see Table 2.7). Meanwhile, there were a few statements which make up the subthemes of neutral and positive. For example: *"I did not feel particularly positive or negative to have someone check on my progress as I was also doing the same"* was identified as neutral, and *"The reason why is that someone can remind me to remember important tasks. I feel cheerful and think one person can accompany me"* was identified as positive. Overall, the statements expressed in this main theme were considered to be indicative of the emotional arousal of task remembering. These results were roughly consistent with the results from quantitative data about affect rating toward task remembering (see Figure 2.4). Although the main theme of affect comprised negative, neutral and positive affect, the majority of statements on negative affect could indicate that procrastinators are more likely to experience negative affect towards task remembering.

2.5.2.2 Self-control

The statements about self-control were frequently expressed when it came to the experiences about being reminded about the tasks. For example: *"It makes me upset because I do not feel in control of my life".* To classify the main theme of self-control, the subthemes of autonomy and renegade attention were generated. On the one hand, there were a group of participants noting that they are the person who should be responsible for the intended task

and they preferred to be supervised by themselves. This tendency was identified as autonomy. Autonomy refers to a desire to self-organise behaviour and to have action be consistent with one's integrated sense of self (Deci & Ryan, 1980, 2000; Sheldon & Elliot, 1999), namely, the capacity to run one's own life (Sneddon, 2013). For example: "*I do not like being 'told' to do something*". On the other hand, lack of self-control was discussed frequently, with several participants noting that while being reminded was strongly stressful, external support was still needed for them. These statements reflected that participants were more likely to rely on external support. For instance, "*Because I want to be supervised in some way, nometter (correction: no matter) by anyone or even myself. I think through the supervision, I would be more aware of the importance of daily tasks"*, "*I need someone to activate me*". The results from thematic analysis in this group showed that procrastinators thought that the reminder could motivate them to complete the intended tasks. This tendency was identified as renegade attention. According to self-control theory by Baumeister et al. (1994), renegade attention refers to the failure of attention management. For example: *"As it will motivate me to start the work", "I prefer to let someone remind me, it makes me do projects more efficiently"*.

2.5.2.3 Disconnect between Cognition and Behaviour

Several participants provided brief descriptions about the disconnect between cognition and behaviour. For instance, participants frequently characterised being reminded as negative, but this group of participants also believed that this negative situation would contribute to their successful behaviour, as they believed that "*what doesn't kill me makes me stronger*". Although they held overall negative beliefs about task reminders, they believed that task reminders could promote completing the task. However, it was also noted that the task reminder reflected external support and these participants were happy with that. With the concern that they might feel disappointed, these participants also stated that they would avoid getting task reminders. For example: *"I was pleased to be offered help but disappointed at my*

reaction, which was to ignore it".

2.5.3 Quantitative Results

2.5.3.1 Descriptive Results

Overall, the demographic information was presented in Table 2.4, and the means and standard deviations of the study variables were presented in Table 2.5.

Table 2.4

Participant Demographics

Characteristics	Number	Percentage
Gender		
Male	56	38.36%
Female	86	58.90%
Prefer not to say	4	2.74%
Profession		
Student	83	56.80%
Non-student	61	41.80%
Prefer not to say	2	1.40%
Highest level of education		
Some high school	1	0.70%
High school graduate	8	5.50%
Some college or university	25	17.10%
College/university graduate	40	27.40%
Some postgraduate school	10	6.80%
Postgraduate degree	62	42.50%

Table 2.5

Summary of the Study Variables (N = 146)

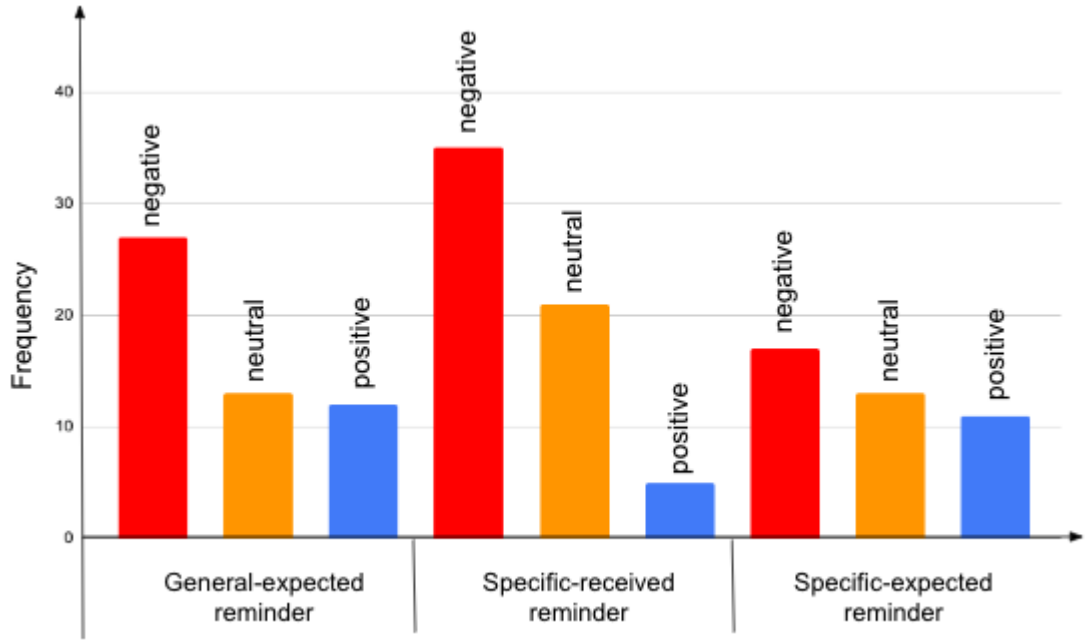
	M	*SD*	Range
GPS-9	3.34	0.77	1-5
Negative affect	3.75	1.00	1-5
Emotional memory	6.16	2.46	1-10
Perceived improvement	5.66	2.75	1-10

Note. Negative affect represents the level of negative affect for remembering procrastination experience. Emotional memory represents to what extent participants can remember the negative affect of their procrastination experiences; perceived improvement represents how much participants think the remembering of past procrastination experience would be beneficial for them to improve procrastination.

As it was noted above, face pictures for subjective affect rating for each task remembering experience were categorised into three types: positive, neutral and negative. Figure 2.2 presents the results as a set of frequencies of each type of affect for having relevant experiences. The most commonly endorsed information was that individuals have mixed perspectives regarding task reminders. But more importantly, procrastinators were more likely to perceive task remembering as negative.

Figure 2.4

Frequencies of Affect Rating for Task Remembering Experiences



As shown in Table 2.6, 52 meaningful statements (35.60%) were identified within the participants who reported that they intend to be checked up on their tasks, with 94 statements (64.40%) reporting that they do not expect to be checked up. 41.80% of participants went into the agreement that they have been reminded before for their tasks, with 58.20% reporting they do not have relevant experiences. Less than 30% indicated that they have expected to be reminded about their procrastination, with 71.92% reporting that they do not have relevant experiences.

Table 2.6

Frequencies of Experiences about Task Reminder

Questions	Response	Frequency	Percentage
General-expected reminder: When you are procrastinating, do you expect that someone will be checking up on the task that you are delaying?	YES	52	35.60%
	NO	94	64.40%
Specific-received reminder: Thinking about the time when you procrastinated recently, did you get reminders from others that you were late or delayed with your task?	YSE	61	41.80%
	NO	85	58.20%
Specific-expected reminder: Thinking about the time when you recently procrastinated, did you expect to get reminders from others that you were late or delayed with your task?	YES	41	28.08%
	NO	105	71.92%

In terms of the results of the specific thematic analysis. Table 2.7 shows the frequencies of the two-level themes from the groups who have relevant experiences.

Table 2.7

Frequencies of the Global Themes

Main theme	Subtheme	Frequency	Percentage (154)
affect	negative	77	50.00%
	neutral	11	7.14%
	positive	14	9.10%
self-control	autonomy	15	9.74%
	renegade attention	17	11.04%
cognition & behavioural disconnect	task avoidance	20	13.00%
	action promotor	10	6.50%

2.5.3.2 Correlation Analysis Results

To address the second research question whether the emotional memory of the

procrastination experience is associated with procrastination, a correlation analysis was conducted.

Table 2.8

Correlations Coefficients between Variables (N =146)

	1	2	3	4
1.Procrastination	-			
2.Negative affect	.42**	-		
3.Emotional memory	.24**	.34**	-	
4.Perceived improvement	.02	.16*	.29**	-

Note. Emotional memory represents the level of negative affect for recalling procrastination experiences; perceived improvement represents how much participants think the remembering of past procrastination experience would be beneficial for them to improve procrastination.

* $p < .05$; ** $p < .01$.

Based on Cohen's suggestion (1977), higher level of self-reported procrastination was moderately positively related to the negative affect when procrastination experiences were recalled ($r = .42$, $p < .01$; $N = 146$). Hence, people who chronically procrastinate were more likely to experience negative affect when they remember their procrastination experiences. Besides, there was a weak significant positive correlation between emotional memory and perceived improvement ($r = .29$, $p < .01$, $N = 146$), which suggests that procrastinators believe that the negative affect of remembering past procrastination experiences could be beneficial for procrastination (see Table 2.8).

2.6 Discussion

The present study provides an exploration of the association between procrastination and memory with a qualitative–quantitative mixed-methods approach. The aims of the research were to identify procrastinators' perspective on task remembering and recall of

procrastination experiences, and examine whether these procrastination-related memories are associated with procrastination.

2.6.1 Task Remembering and Negative Affect

Analysis of procrastinators' perspective about task remembering identified multiple domains that appear to link to procrastinators' behaviour. Multiple levels of affect were found to be relevant to task remembering: negative, neutral and positive. In addition, two main domains were identified which could explain why participants feel that way when they were engaged in task remembering: self-control, cognition and behavioural disconnection.

Basically, more than half of participants reported that they do not have the experiences of being reminded. This finding drew attention to the likelihood that participants avoided the task reminder when they were engaged in intended tasks. In regard to avoidance, procrastination is often viewed as a task-avoidant behaviour (Ferrari & Johnson, 1995). In line with this, it seems plausible to consider that procrastinators might also tend to avoid task-related information, task reminding for example. In other words, not only the tasks, but also the task-related information could be avoided by procrastinators. The theme of affect identified within the full set of statements about having relevant task reminder experiences was divided into three subthemes: negative, neutral and positive. With the majority of statements reflecting negative affect, it suggested that the task remembering could be associated with more negative affect when participants were reminded. In support of this proposition, Maslow (1963) viewed information avoidance as a way to reduce anxiety, as it would avoid potentially negative threats. This is consistent with the mood-regulation theories of procrastination. In contrast, less than half of participants expressed that they had relevant task reminding experiences, and the affect was rated for each experience. However, from participants' perspective, being reminded was more likely for them to experience negative affect. The provided reasons for why they felt in that way highlighted the importance of

self-control and cognitive and behavioural disconnection.

According to the notion that people voluntarily delay important intended tasks despite knowing they will be worse off for doing so in the future (Steel, 2007), it implies could provide an expanded temporal context of procrastination behaviour which starts from the time point when the task intention is formed to the time point when the task is completed. However, this context was obversely neglected by previous research. As procrastination happens in a timeframe, we argue the critical cognitive mechanism underlying procrastination might be missed by mistakenly assuming individuals decide to procrastinate from the time point when the intentions were formed to the final deadline, as task completion entails hiding role of task remembering.

Basically, to complete the intended task in a timeframe, people must remember the task constantly. When individuals make plans to complete in the future, memory is relevant, as they may fail if they forget the task. However, having accurate memory for the intended task does not guarantee the task completion, as the task-related memory might be associated with negative affect which has already been investigated to contribute to procrastination. This could be potentially consistent with Kuhl's (1984) Action Control Theory that the negative mood could make it difficult for people to maintain intention memory and take action to fulfil the intention.

2.6.2 The Procrastination and Irrational Thought

The influence of negative affect induced a greater divergence between cognition and behaviour from procrastinators' perspective. The findings of this study suggest that in the context of task reminding, the more negative affect individuals feel, the less likely their behaviour would be aligned with their cognition. On the one hand, one group of participants held negative beliefs on task reminders. Instead of avoiding it, they would rather believe that the task reminder could promote their behaviour to complete the intended tasks. On the other

hand, another group of participants were happy with the task reminder, as they considered it as external support. However, these participants also stated that they would avoid getting task reminders. There appears a high potential of divergence between cognition and behaviour, which might highlight the irrational thought from procrastinators. Crucially, either the former or the latter group, they hardly complete the intended task. This divergence between cognition and behaviour could be explained by cognitive-behavioural theory (CBT; Dryden, 2009). CBT states that people procrastinate because of established ways of thinking, and within this framework, the rational beliefs are highlighted for the improvement of procrastination. In other words, this group of participants think that they could perform better under the negative affect. However, what is true is that they are more likely to delay the tasks, which is contrary to their beliefs. This funding could be supported by the suggestion that procrastinators actually work worse under pressure than non-procrastinators (Tice & Baumeister, 1997).

2.6.3 Emotional Memory Regarding Procrastination Experiences

The finding that the self-report procrastination was positively related to negative affect on procrastination experiences supports the mood-regulation theory (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013) proposing that the negative affect is a common focus of procrastination. However, the correlation analysis about self-reported procrastination and emotional memory for procrastination had also revealed that participants reported better emotional memory regarding procrastination experiences. This association perhaps indicated the modulation effect between emotion and memory (Mikels & Reuter-Lorenz, 2019). Previous research indicated that the retrieval of emotional experience would cause reexperience of the same emotion (Buchanan, 2007). It could be reasonable to posit that individuals would be affected by the aroused negative affect when they were engaged in previous emotional memory. Accordingly, the interaction between emotion and memory may

occur in two ways: After the procrastination experience stored as emotional memory, the negative feelings may modulate the memory, and the feelings could be the emotional representations maintained and triggered by relevant memory. Thus, when procrastinators were engaged in procrastination context, remembering procrastination experiences for example, the relevant memory could trigger the negative emotion they had felt before. Experiencing negative affect maintained by emotional memory, individuals would chronically procrastinate.

As this research is the first attempt to explore the role of memory on self-report procrastination, the current results suggested multiple approaches to understand procrastination, which could contribute to the design of the conceptual model of the relationships between procrastination and memory. Firstly, the findings expand on the growing body of research highlighting that the negative affect is related to procrastination, which suggested that the role of memory might be a role to understand procrastination.

Theoretically, the relationships of procrastination and memory about task remembering and procrastination-related experience recalling could be usefully applied to existing procrastination theories. The mood regulation models of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000) have proposed that the procrastination involves the temporal domain that reflects the prioritisation of short-term mood repair over long-term goal achievement. Specifically, the present self would benefit from immediate mood rewarding, but the future self bears the negative consequence of task delay. In the current study the task-related memory and past procrastination memory could be linked to what is considered the temporal view in previous research and provide a broader view towards the procrastination theories. Accordingly, these theories highlighted the critical role of negative mood on procrastination. Due to the modulation effects of emotion and memory (Mikels & Reuter-Lorenz, 2019), the findings in this study could suggest a deeper

understanding of the subjective and negative affect regarding procrastination. Building on previous theories and research (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000), researchers could not only know more about the relationships between procrastination and negative affect, but also the role of memory underlying the relationship between procrastination and negative affect. Within this framework, the negative affect could maintain the core role in procrastination, whereas the memory (task-related memory, procrastination experience memory and emotional memory) might apply the conceptual knowledge about the relationships between procrastination and affect.

Although the current study is correlational and the direction of these relationships remains unclear, the findings nonetheless provided some support to build the model of relationships between procrastination and memory. The current results do not allow us to conclude that procrastination is related to the memory of past procrastination experience or intended tasks, and this is clearly an important issue that deserves more experimental methods to test specific aspects of memory in future studies. Meanwhile, given that the current study used cross-sectional data, the directionality of the relationships among the variables cannot be concluded from present findings.

Our findings represent a diversity of links to theoretical and applied backgrounds of procrastination research. We also come from a diversity of social and economic backgrounds, ranging from economic and social privilege to economic and social disenfranchisement. However, what we aimed to bring to this topic is a belief that the memory, especially the task-related memory and past experience memory which might serve as the emotional arousal, could play a role in the cognitive process underlying procrastination. In the results, although our findings do not perfectly align with the hypothesis included in this study, they allow us a unique entry point from which to try to understand individuals' perspective on their procrastination behaviour.

2.7 Conclusion

From procrastinators' perspective, current study has set up an overview of the potential links between procrastination and memory. Besides, the findings also demonstrate that self-reported procrastination is related to emotional memory with regard to procrastination experience. By exploring the role of memory on procrastination, this research provides new insights into how this relationship might be associated with affect, especially negative affect.

Chapter 3 Study 2: Is Prospective Memory a Missing Link Between Procrastination and Negative Affect?

3.1 Abstract

Chronic procrastinators often delay starting or completing their intended actions when they experience negative affect. Research suggests that the negative affect is related to task aversiveness and procrastination experiences. When these specific procrastination-related events are recalled, procrastinators could experience negative affect. This study aims to explore the relationships between procrastination, negative affect, and prospective memory. It was hypothesised that procrastination would be negatively related to prospective memory, and would have an indirect effect on negative affect through prospective memory. Participants (N = 256) completed an online survey assessing procrastination, prospective memory, affect (affect related to completing the task, being reminded of the task, and procrastinating on the task). Analyses revealed that there were significant negative correlations between procrastination and prospective memory. Also, better prospective memory was correlated with lower levels of negative affect from remembering procrastination experiences. Moreover, mediation analysis found a significant indirect effect of procrastination on negative affect through the memory of past events. Taken together, findings support the hypothesis that procrastination is negatively related to prospective memory. Procrastinators are more likely to experience negative affect when they recall procrastination experiences.

Keywords: Procrastination, negative affect, prospective memory, retrospective memory.

3.2 Introduction

Procrastination is considered as a common self-regulatory problem involving the unnecessary and voluntary delay of important intended tasks despite the recognition that this delay may have negative consequences (Lay, 1986; Sirois & Pychyl, 2013). It is also described as a form of self-regulation failure that involves prioritising short-term mood repair over the long-term pursuit of intended actions (Sirois & Pychyl, 2013). More generally, when individuals are faced with aversive tasks, choosing to delay the intention and disengaging from unpleasant tasks are ways to reduce immediate negative moods, and this current emotion prioritising is at the expense of future self (Sirois & Pychyl, 2013). In a temporal view, the brief process is that we feel negative when we are faced with aversive tasks, and then delay the tasks to feel better; But with lack of future concern, this prioritisation could result in worse consequences to future self.

Although negative emotion is investigated to be an essential factor in relation to procrastination, there is little research investigating the arousal of negative emotion which is a temporal construct in the process underlying procrastination. Previous theories and research showed that procrastination is negatively related to future time perspective (Sirois, 2014; Liu & Feng, 2019), and anticipation could lead to more procrastination (Blouin-Hudon & Psychyl, 2015; Ericson, 2017). Negative emotions were shown to be positively associated with task anticipation (Blunt & Pychyl, 2000). To regulate the negative emotions, procrastinators voluntarily prefer to be disengaged from intended tasks. Accordingly, it could be reasonable to consider that procrastinators may be less likely to perform their prospective memory (PM). With regard to prospective memory, it refers to the ability to remember to perform an intended action at an appropriate time in the future (Einstein & McDaniel, 1990; Kvavilashvili & Ellis, 1996). To be disengaged from intended tasks, individuals may avoid remembering this intention. For example, a patient remembers to book an appointment to

visit a doctor. To regulate the anxiety of seeing a doctor, the patient may prefer to be disengaged from remembering to book the appointment. In this example, the memories about seeing a doctor could be considered unwanted memories as it is anxiety associated. According to Benoit and Anderson (2012), people voluntarily exclude unwanted memory from awareness when they get reminded about the content of memory, which is referred to as voluntary forgetting. However, there is no research investigating whether voluntary exclusion of unwanted memory from awareness is linked to procrastination. With the perspective on procrastination and memory only limited evidence exists that links the procrastination to prospective memory. A study from ADHD samples revealed that higher reports of procrastination is related to less prospective memory performance (Altgassen et al., 2019). Nevertheless, the nature of associations between procrastination and prospective memory from these results remains largely unclear, as the lack of consideration of the crucial role of negative affect. From a temporal view, examining the potential mediating mechanisms which may explain the linkage between procrastination, negative affect and prospective memory.

For chronic procrastinators, the retrospective memory of previous procrastination experiences could represent a factor contributing to the arousal of negative affect. Being able to retrieve information about our past is at least as important as remembering to do things at the right time in the future. The literature on the relationship between trait procrastination and negative affect has provided support for the notion that procrastination is the source of stress, and it would be more possible for the relapse of stress when people recall their procrastination experience (Rice, 2012). However, there have been few attempts to quantify this systematically, or to explore the possible associations with procrastination. Opposite to prospective memory, retrospective memory has received little attention within the scientific literature when it comes to procrastination.

The current study is aimed at extending previous research on the temporal view of

procrastination by examining the association between procrastination, negative affect, prospective memory and retrospective memory. Exploring the roles of general prospective and retrospective memory and procrastination-related memory in relation to procrastination with regard to mediating effects may help to better understand the process underlying procrastination and how procrastinators delay intended actions chronically.

3.2.1 Procrastination and Emotion

The prevailing view in the literature of procrastination and emotion (Blunt & Pychyl, 2005; Ellis & Knaus, 1977; Haghbin et al., 2012; Sirois & Giguère, 2018; Sirois & Pychyl, 2013) describes how procrastination happens: individuals are more likely to delay tasks when they experience negative affect related to aversive tasks. To regulate their current negative emotional states, procrastinators prefer to be engaged in pleasant activities rather than the intended actions which can serve as a way to protect them from negative emotions. Thus, it is proposed that negative emotions play a crucial role in procrastination (Tice et al., 2001).

According to Sirois and Pychyl (2013), the processes of mood regulation are essential to understand procrastination. Considering individuals typically use emotion regulation to feel better when experiencing negative affect, and how procrastination occurs in the context of negative affect, it is reasonable to link procrastination to mood regulation. So far, the literature provides the argument for this essential link. In line with the conceptualization of mood regulation models of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000), procrastinators would voluntarily switch themselves to other on-going activities which are more pleasant or just quit on the purpose to avoid negative moods which are caused by intended tasks (Sirois & Giguère, 2018; Sirois & Pychyl, 2013; Steel, 2007; Tice & Bratslavsky, 2000). Moreover, by delaying a task, people may experience an immediate reward for their negative affect and benefit from this mood repair (Sirois & Kitner, 2015), but this short-term mood regulation could have negative consequences in the

future. Therefore, Sirois and Pychyl (2013) proposed that “the processes underlying procrastination are driven by a need to regulate the mood of the present self at the expense of the future self”. Such a viewpoint highlights a temporal view of mood regulation processes underlying procrastination. Meanwhile, investigating associations between procrastination and negative affect with the use of the temporal view of processes underlying procrastination may shed new light on cognitive processes of procrastination.

Given the literature about the crucial role of negative affect in procrastination, it is important to know the causality of the negative affect with regard to the processes of mood regulation underlying procrastination. Firstly, the intended tasks could be a cause of negative affect. On the purpose of avoiding negative affect, we may focus on feeling better and avoid the aversive tasks, which then lead to procrastination. For example, Tice and Bratslavsky (2000) argue that task avoidance is a strategy to avoid the negative affect associated with aversive tasks. In line with this proposal, a majority of research has considerably advanced our understanding of how negative affect link to intended tasks regarding procrastination. Such task avoidance mainly reflects the breakdown of the link between current self and future oriented intended actions, which entails negative affect. Secondly, as a chronic procrastinator, the continuous delay behaviours mean a consistent engagement of negative affect. Besides the task-related negative affect, we argue that the procrastination experience would be linked to the negative affect. Given that negative consequences are borne by future self, the result is that we may reexperience the negative affect after a short-term positive emotion. Apart from the current temporal view of procrastination, how individuals feel may be associated with their procrastination experience. For example, past studies indicated that chronic procrastination is related to the affective experiences of shame and guilt (Fee & Tangney, 2000), and anxiety could be aroused when people recall the past procrastination experiences (Lay, 1994). These past oriented events could refer to a retrospective perspective on

procrastination. Taken together, both intended tasks and past procrastination experience could trigger the negative affect. For chronic procrastinators, if what we currently experience is linked to what we did in the past and what we intended to do in the future, it is therefore important to investigate how these events (past experience and future tasks) relate to procrastination. In deciding whether chronic procrastination relates to past experience and future intention, it seems reasonable that we reflect on the negative affect associated with our memory of past experience and future intention, before moving forward to start or complete the intended actions. However, this assumption has received little attention.

3.2.2 Prospective Memory and Retrospective Memory

In line with the temporal view of procrastination and the potential association between past and future oriented memory and procrastination, it could be reasonable to consider the role of prospective memory (PM) and retrospective memory (RM) in procrastination. Prospective memory (PM) involves remembering to carry out intended tasks in the future. In contrast, retrospective memory (RM) involves the encoding and retrieval of the content of the past (Kopp & Thöne-Otto, 2003). Prospective memory plays a critical role in people's cognitive function, and it is involved in making plans, retaining them, and bringing them back to one's consciousness at the right time and place (Brandimonte, 1996). Robey and colleagues (2014) have demonstrated that there are robust correlations between prospective memory and cognitive ability, which particularly involves executive functions. Furthermore, it states that consideration of future consequences and episodic future thinking are associated with procrastination (Rebetez et al., 2016). It should also be inferred that prospective memory may be associated with procrastination. On the basis of this hypothesis, the present study set out to explore the potential link between prospective memory and procrastination.

With regard to chronic procrastinators, the memories of procrastination experiences and intended tasks may be associated with emotion and these memories may be correlated

with future procrastination in turn. For instance, the negative affect could be aroused when people recall or think about past procrastinating behaviour (Ferrari, 1991; Lay, 1994; Solomon & Rothblum, 1984) and intended tasks in the future (Sirois & Pychyl, 2013). Both memories about past events and future events are imbued with emotional value (D'Argembeau et al., 2011). Thus, with respect to the relationship between procrastination and emotion, the memories about past experiences and intended tasks should be related to procrastination. We further aimed to investigate the relationship between retrospective memory and procrastination.

3.2.3 Procrastination and Memory

Although largely unexplored to date, the literature provides many suggestions for a possible relationship between procrastination and memory. Previous studies confirmed that the negative affect would be triggered by recalling procrastination experiences. Basically, recalling stressful experiences would make individuals exposed to negative affect (Lovallo, 1997). Accordingly, both memories about past events and future events are imbued with emotional value (D'Argembeau et al., 2011) and emotional memories that are triggered by certain contexts could contribute to present response (Philippe et al., 2011). Expanding on these findings, both procrastination experiences and intended tasks could be considered as emotional events and recalling these events would make individuals experience relative affect which would be associated with future response. In other words, the memory of procrastination-related events may be linked to negative affect, and this association may contribute to procrastination. Yet, research revealed that anticipated reminders could induce additional procrastination (Ericson, 2017). Opposite to this, a research from Rummel (2017) states that intention retrieval could help individuals with their intention execution. It indicates that procrastination may be related to the absence of memory. However, there is still a lack of research investigating the relation between procrastination and memory, basically, the

memory capacity. Exploring this possible relation and the reason why reminder is associated with procrastination is therefore important for elucidating why procrastination happens consistently even with memory aids. The present research aims to explore the possible role of memory to establish for the first time what the relation between procrastination and memory is.

In accordance with the research trend aimed at investigating the cognitive process underlying procrastination, the possible linkage between memory and procrastination has been indicated from recent research. People may procrastinate when they forget their intended tasks and limited memory can explain why it happens consistently (Ericson, 2017). Generally, individuals with lower levels of memory may be more likely to postpone their intended tasks (Altgassen et al., 2019), and the use of memory technologies, digital assistants and planners for example, could efficiently improve individuals' memory and improve the completion of complex tasks (Himmler et al., 2019). From this perspective of the results, it is reasonable to expect that procrastination may be associated with poorer memory. However, even though there was some recent research investigating the association of two domains, it is important to note that the varied results were based on different measures with different research samples.

3.2.4 Procrastination, Prospective Memory and Retrospective Memory

Given the established view that memory may be related to procrastination, the emotion triggered by recalling procrastination experience may be an important factor that affects future procrastination in turn. Sirois and her colleagues (2018) suggested that emotion may mediate the relation between procrastination and time spent procrastinating. However, instead of testing emotion about procrastination, the roles of general emotion state were assessed in this study. It could not be inferred that general emotion is the emotion triggered by procrastination experience. Given the highlighted role of negative affect in

procrastination, if negative affect is a mediation between two kinds of procrastination (trait procrastination and situational procrastination), then the cause of the negative affect should be defined, so that the effects between procrastination and negative affect could be more clarified. But the overall effects of negative affect on procrastination are not assessed specifically. It would be necessary and valuable to clarify the origin of negative affect for future research when it is referred to the relationship between procrastination and negative affect, for example, trait-like negative affect or negative affect triggered by intended tasks.

Understanding the relationship among procrastination, negative affect, and task-related memory could lead us to wonder whether and how prospective memory is linked to the association between procrastination and negative affect. The findings from Study 1 have provided primary evidence that the retrieval of previous procrastination experiences and future intended tasks can invoke negative affect, which was consistent with previous proposition about the relationship between procrastination and negative affect. Existing empirical data generally support the notion that the prospective memory (PM) and retrospective memory (RM) may play roles in the procrastination (Gustavson & Miyake, 2017; Himmler et al., 2019). On the one hand, the PM may link to the relationship between procrastination and negative affect. For example, several studies had proposed that both PM and procrastination share similar cognitive processes (Svartdal et al., 2018), and PM failure could be predicted by procrastination (Zuber et al., 2021). Meanwhile, in line with the mood regulation models of procrastination, which highlights that procrastinators prioritise the immediate short-term mood repair over long-term goal pursuit (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000), the future intended tasks could be forgotten by procrastinators when they pay attention to their present-self and focus on regulating current negative affect. In other words, the intended tasks and previously planned goals may be forgotten as more attention was paid to negative affect. This interpretation could reflect the

roles of PM and negative affect in procrastination, and individuals may be more likely to forget their intended actions when they focus on current mood regulation. The more negative affect individuals feel about the intended tasks, the more likely they are to avoid it, and the more likely the tasks are forgotten at the same time. On the other hand, the RM about past procrastination experiences may account. Generally, research on the relation of memory and emotion showed that the retrieval of past events is linked to emotion (D'Argembeau et al., 2011). Recalling emotional events is often associated with greater accuracy and vividness than events lacking emotional arousal (Reisberg & Hertel, 2005). For chronic procrastinators, the emotional memory of procrastination experience could be formed after procrastination. Accordingly, this enhanced connection between memory about past procrastination experiences and negative affect may contribute to current procrastination. In this case, it is reasonable to consider the role of retrospective memory in the relationship between procrastination and negative affect.

Thus, we argue that, once relapsed, the memories about past procrastination experiences and future intended tasks appear to affect current responses through negative affect. For example, emotional memories, which are triggered by related situations, influence appraisal processes and contribute to current emotional response (Philippe et al., 2009, 2011). Moreover, Stainton and colleagues (2000) proposed that ruminative thought of procrastination reflects that people would procrastinate when they are engaged in thinking procrastination, and emotion should be also aroused during rumination. The mediating effects of rumination on the relation between procrastination and negative affect may indicate the potential association among procrastination, negative affect and memory about past procrastination experiences. Meanwhile, the theory of emotional enhancement of memory (EEM) suggests that emotionally arousing events are more likely to be remembered than neutral events (Dolcos et al., 2005). Due to the enhanced memory for emotional events,

emotional memory could remain longer than neutral memory. This effect may also apply to the cognitive process underlying procrastination, and retrospective memory about procrastination experiences may be enhanced by negative affect. In other words, how people feel about their procrastination experience may contribute to relevant memory. From the perspective of RM, the onset of a stressful past experience would involve the experience of negative affect (Lovallo, 1997), and it would be more possible for the relapse of previous emotion when there is a similar situation (Philippe et al., 2011), the stressful condition for example. For chronic procrastinators, remembering of past procrastination experiences (RM) may contribute to their negative emotional states. To regulate the present negative affect, we may voluntarily delay to start or complete the intended tasks. Although it seems plausible that these specific PM and RM (memories about future intended tasks and past procrastination experiences) could link to the association between procrastination and negative affect, it is unclear whether this connection varies when it comes to one's general PM and RM capacity.

Overall, the roles of PM and RM remain unclear with respect to procrastination. Given procrastination is treated as a trait-like tendency by most researchers (van Eerde, 2003), the objectives of this study were to investigate whether self-report procrastination was related to PM and RM. In accordance with the literature, if procrastinators' focus is current mood regulation, it would be more likely that the intended tasks and previously planned goals may be forgotten as more attention was paid to regulating negative affect. We hypothesised that the self-reported PM will be negatively associated with self-report procrastination (H_1). Based on the theory of emotional enhancement of memory (EEM), which suggests the enhanced connection between memory and emotion (Dolcos et al., 2005), the retrospective memory about past procrastination experiences may contribute to the link between procrastination and negative affect. Opposite to PM, we hypothesised that the self-reported RM will be positively associated with self-report procrastination (H_2). Furthermore, to

uncover whether PM and RM contribute to the association between self-report procrastination and negative affect, it is also hypothesised that self-report procrastination will have an indirect effect on negative affect through prospective memory and retrospective memory (H_3).

3.3 Methods

3.3.1 Participants

In total, 256 individuals participated in the current study, there were 17 participants who were excluded from the statistical analyses, as 8 of their completion duration was under five minutes, 3 provided the same response to every sub-scale, and 3 failed to recall. The final sample consisted of 239 participants (mean age = 25.09, *SD* = 6.47; range = 18-66; 71.5% female).

3.3.2 Procedures

The current study was an online cross-sectional survey. Participants were recruited via social media. All participants gave informed consent prior to taking part in the study. Participants were asked to click on a hyperlink to the Qualtrics survey web address, which provided information about the study including the purpose of the study, the procedures participants need to follow during the study, and what to do in case of problems or queries. After providing consent, participants were asked to click the "I agree" button if they consent to participate.

After linking to the online study via Qualtrics, all participants were asked to complete a demographics questionnaire (age, gender, educational level and ethnicity) and baseline questions. Following the baseline questions, participants were asked to recall and describe the task that they procrastinated on recently in an open-ended question. After that, participants were asked to complete the questionnaires, which included the measures assessing

procrastination, prospective and retrospective memory, emotion rating, emotion of procrastination experiences. At the end of the online survey the participants will click "submit survey" and be redirected to a page with an explanation of the study.

Ethical approval was granted by the Department of Psychology Research Ethics Committee at the University of Sheffield.

3.3.3 Measures

3.3.3.1 Procrastination

Self-report procrastination was assessed using the 9-item version of the General Procrastination Scale (GPS-9; Sirois et al., 2019). This 9-item scale scored on the 5-point Likert scale. Items such as, "I often find myself performing tasks that I had intended to do days before" were scored on the scale ranging from 1 (*False*) to 5 (*True of me*). The scale included 3 reverse-scored items, and all the items were summed with higher scores reflecting a greater tendency to procrastinate. It has previously demonstrated that the GPS-9 (test-retest reliability $r = 0.89$; Sirois et al., 2019) is a reliable short version of the original, longer 20-item measure (Lay, 1986).

3.3.3.2 Prospective Memory and Retrospective Memory

The Prospective-Retrospective Memory Questionnaire was a 16-item questionnaire which was divided into two sections to assess prospective memory and retrospective memory. Participants were asked to rate how often each type of memory failure occurred, and the respondents indicated the frequency that people make particular types of memory errors. This version (split half reliability $r = 0.84$; Smith et al., 2000) was applied in the current study as it also had been shown to be worded appropriately for a wide range of participant groups. e.g., "Do you decide to do something in a few minutes' time and then forget to do it?" on a 5-point Likert scale (1 = very often; 5 = never), and the higher averaged scores indicate better

prospective and retrospective memory.

3.3.3.3 Affect about Procrastination-related Events

To assess participants' attitudes toward procrastination, we designed three individual items which related to three types of procrastination-related events (general-expected reminder, specific-received reminder, specific-expected reminder), and participants were asked to rate their feeling in the PANAS 10-items scales regarding each event. The PANAS 10-items scales which is one of the most widely used affect scales developed by Watson (1988) was applied for affect rating.

(1) How does it make you feel when others check up on you when you are procrastinating?

(2) How does it make you feel when others remind you about your delayed task?

(3) Procrastination experience recall task: participants were asked to recall a recent instance where they had procrastinated and described it in as much detail as possible.

In case there were participants who did not have any experience about specific events, participants were presented with a question before each affect rating questions:

(1)Thinking about when you are procrastinating, to what extent do you expect that someone will be checking up on you?

(2)Thinking about when you are procrastinating, to what extent do other people remind you that you were late or delayed with your task?

There were four levels of the questions: Not at all, Rarely, Sometimes, Always. The samples with the reply "Not at all" would skip the relevant affect rating.

To assess the memory about procrastination, we designed two questions:

(1) Remembering the most recent time that you procrastinated, to what extent do you remember how you felt while procrastinating?

(2) Remembering the most recent time that you procrastinated, to what extent does remembering this event make you relive how you felt?

These questions scored on the 10-point scale (1 = Not at all to 10 = Very).

3.4 Results

All statistical analyses were completed using SPSS version 26. 9. To test the hypotheses, first, we conducted correlation analysis among all the variables to determine the association between self-report procrastination, negative affect (NA), prospective memory (PM) and retrospective memory (RM). Second, we used SPSS macro PROCESS (Hayes, 2013) to clarify the mediating effects of PM and RM in the association between self-report procrastination and negative affect.

As for the required sample size to achieve statistical power, according to Schönbrodt & Perugini (2013) the sample size should approach 250 for stable estimates for the correlation analysis. For mediation analysis, as it was conducted in SPSS Version 26.9 through PROCESS Version 3, the percentile bootstrap test of mediation requires sample size 126 to achieve 0.8 statistical power in the condition with $\alpha = .26$ and $\beta = .39$ (Matthew, 2007). Therefore, the sample size of 256 participants in the current study was appropriate.

Means, standard deviations, Pearson's correlations for self-report procrastination, three types of procrastination-related negative affect (NA), and two types of procrastination-related memory are reported in Table 3.1.

As predicted in Hypothesis 1, self-report procrastination was negatively associated with the self-reported prospective memory ($N = 239$, $r = -.42^{**}$, $p < .01$). However, opposite to what was hypothesised, the better retrospective memory was found to be negatively related to higher self-report procrastination ($N = 239$, $r = -.23^{**}$, $p < .01$). The negative affect (NA) of reminder and procrastination experience were positively related to self-report procrastination. These findings could indicate that prospective memory (e.g., remembering

intended task) and retrospective memory (e.g., remembering procrastination experience) may be identified as possible mediators with regard to the association between self-report procrastination and negative affect.

Table 3.1

Pearson Correlations among Self-report Procrastination, Negative Affect, and Procrastination-related Memory (N = 239)

	1	2	3	4	5	6	7	8
1. GPS-9	-							
2. Prospective memory	-.42**	-						
3. Retrospective memory	-.23**	.73**	-					
4. NA reminder1	.12	-.10	-.10	-				
5. NA reminder2	.22**	-.16*	-.17*	.33**	-			
6. NA reminder3	.29**	-.23**	-.27**	.33**	.59**	-		
7. Memory factual	.41**	-.17*	.01	.10	.20**	.36**	-	
8. Memory reliving	.19**	-.06	.01	.06	.28**	.42**	.55**	-
M	3.39	2.74	2.44	3.26	2.82	2.53	7.13	5.85
SD	.71	.67	.64	.82	.97	1.15	2.27	2.67

Note. NA = negative affect; Reminder1 = general-expected reminder; reminder2 = specific-received reminder, reminder3 = specific-expected reminder.

*$p < .05$; **$p < .01$.

In accordance with Hypothesis 3, SPSS macro PROCESS was used (Hayes, 2013) to test the mediating effects. The bias-corrected bootstrapping method involving 95% confidence intervals of 5000 resamples was used. Table 3.2 presents the summary statistics for the calculated mediation models.

The mediation role of PM in the relationship between self-report procrastination and negative affect was tested within the first model. When negative affect (NA) of general-expected reminder was tested as dependent variable, the bootstrap results indicated that indirect path for prospective memory (indirect effect = .02, bootstrapped SE = .05, 95%,

CI = -.04, .11) was not significant. However, as expected, the obtained data partially confirmed Hypothesis 3: the mediating effect of RM on the relation between self-report procrastination and negative affect about specific-expected reminder was investigated to be statistically significant (indirect effect = .07, bootstrapped SE = .05, 95%, *CI* = .02, .15). The total indirect effect for the overall model including mediator RM was significant. It indicated that the mediating effect occurred (Figure 3.1). Furthermore, in the mediation model, the direct effect remained significant. It suggested that RM partially mediates the relationship between self-report procrastination and negative affect about procrastination experiences.

Table 3.2

Mediation Analyses Based on 5,000 Bootstrapping Samples (N = 239)

Independent variable (IV)	Mediating variable (M)	Dependent variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Direct effect (c')	Indirect effect (a×b)	Total effect (c)
Self-report procrastination	Prospective memory	NA reminder1	-.34***	-.07	.12	.02 (-.04, .11)	.15
		NA reminder2	-.38***	-.13	.25*	.05 (-.03, .14)	.30**
		NA reminder3	-.40***	-.22	.38***	.09 (-.02, .20)	.47***
	Retrospective memory	NA reminder1	-.19**	-.10	.13	.02 (-.02, .08)	.15
		NA reminder2	-.19**	-.19	.27**	.04 (-.01, .10)	.30**
		NA reminder3	-.20***	-.38***	.40***	.07 (.02, .15)	.47***
	Memory reliving	NA reminder1	.61*	.01	.14	.01 (-.04, .32)	.15
		NA reminder2	.60*	.09***	.25*	.06 (.00, .13)	.30**
		NA reminder3	.74**	.16***	.35***	.12 (.03, .22)	.47***

Note. NA = negative affect; Reminder1 = general-expected reminder; reminder2 = specific-received reminder, reminder3 = specific-expected reminder.

Bias-corrected 95% confidence intervals.

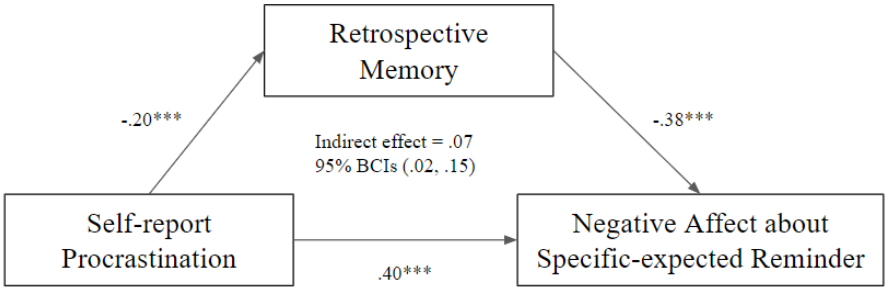
* $p < .05$; ** $p < .01$; *** $p < .001$.

To further examine the mediating effects of memory on the linkage of self-report

procrastination and negative affect, the mediation role of procrastination-related memory was tested. The bootstrap results indicated that indirect paths for procrastination memory reliving on the links between self-report procrastination and negative affect of reminder (indirect effect = .06, bootstrapped *SE* = .05, 95%, *CI* = .00, .13; Figure 3.2) and procrastination experience (indirect effect = .12, bootstrapped SE = .05, 95%, *CI* = .03, .22; Figure 3.2).

Figure 3.1

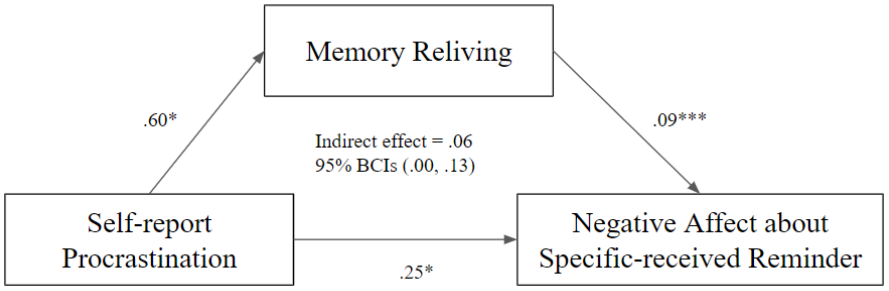
Statistical Mediation Model of the Relationship among Self-report Procrastination, Negative Affect about Specific-expected Reminder and Retrospective Memory



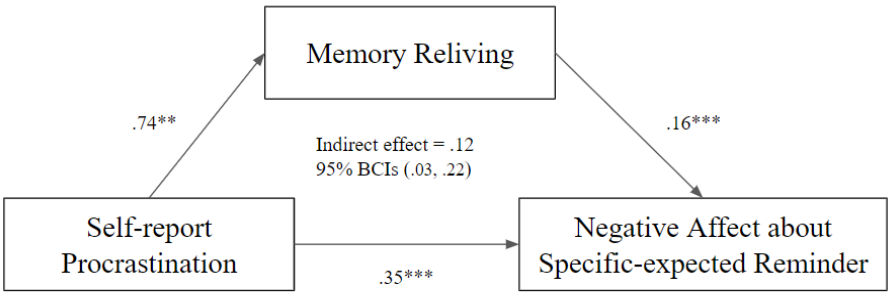
Note. *** $p < .001$.

Figure 3.2

Statistical Mediation Models of the Relationship among Self-report Procrastination, Negative Affect about Specific-received Reminder (a), Negative Affect about Specific-expected Reminder (b) and Memory Reliving



(a)



(b)

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

3.5 Discussion

Based on the temporal view of procrastination, the present study examines whether self-report procrastination is associated with prospective memory (PM) and retrospective memory (RM). In addition, as most studies regarding procrastination focus on the crucial role of negative affect (Blunt & Pychyl, 2005; Haghbin et al., 2012; Sirois & Giguère, 2018; Sirois & Pychyl, 2013), the causality of negative affect is of particular relevant, and both past procrastination experiences and future intended actions may be associated with the negative affect. Based on the mood-regulation theory of procrastination, another aim of this study was to investigate the role of prospective memory and retrospective memory in the association between self-report procrastination and negative affect.

When examining the relationship between self-reported procrastination, prospective memory (PM) and retrospective memory (RM), we found that self-reported procrastination was negatively correlated with PM and RM. Regarding prospective memory, the negative association between self-report procrastination and prospective memory could support the suggestions from previous work of Sirois (2014) and Liu (2018) that procrastination is negatively related to the future time perspective, which indicates that individuals who have a

good perspective on future time are less likely to procrastinate very often. Although the future time perspective was not equal to prospective memory, people with better future time perspective show better prospective memory (Nigro et al., 2014). Our finding could be evidence to support that the future-related memory capacity could be negatively associated with procrastination, which could support the notion that more procrastination behaviour is associated with lower prospective memory performance (Altgassen et al., 2019; Zuber et al., 2021). In the presence of limited memory to remember what to do in the future, it is more probable that people may procrastinate.

Moreover, this finding is in line with the prospective memory (PM) theory, suggesting that prospective memory (PM) requires a delay to allow more time for PM response selection when a target event is encountered in the future (Heathcote et al., 2015). Accordingly, prior research from a clinical sample study proposes that individuals who procrastinate more show reduced prospective memory due to less good intention formation (Altgassen et al., 2019). Thus, our findings seem to support the assumption that poor prospective memory could result in less detailed intentions and make it more difficult to maintain the intentions. Therefore individuals with poor prospective memory might be a reason for procrastination, because poor intention formation could contribute to intention delay (Martin et al., 2011).

Contrary to what was hypothesised, our findings revealed a negative link between self-report procrastination and RM, which was the first to consider the past oriented memory in procrastination. This negative relation may suggest that the poorer RM individuals have, the more they procrastinate. Our findings do not show a possible link between individuals' tendency to delay and their memory of past procrastination experiences. However, looking at the correlation between PM and RM could help to understand this result. As it is coherent with the results of the negative relationship between self-report procrastination and PM, it is possible that the negative correlation occurs between self-report procrastination and RM. This

could be supported by the fact that these cognitive functions (prospective memory & retrospective memory) have a consistent contribution to intention fulfilment (McDaniel & Einstein, 2000; Robey et al., 2014).

To address the second goal in present study, mediator models were constructed. In the first mediation analysis, the mediating effects of PM on the association between self-report procrastination and negative affect about three types of procrastination-related events were not significant. Interestingly, the link between self-report procrastination and negative affect about specific-expected reminder was partially mediated by RM. This finding could provide support for the notion that past oriented memory may explain the underlying mechanism through which individuals with poor capacity of RM are more likely to be engaged in negative affect. Meanwhile, the observed mediating effect of memory reliving might also indicate that the memory of past procrastination leads to an increased tendency to engage in negative affect. Alternatively, considering that in several previous research the past and future oriented thoughts were suggested to mediate the link between procrastination and negative affect (Flett et al., 2012; Stainton et al., 2000), the results reported in the present study suggest discrepant results between PM and RM. Dispide the insignificant mediating effects of PM, it seems to be important to investigate why RM links to the association between self-report procrastination and negative affect. The current findings are in line with previous research on the mechanisms of how memory links to behaviour. Building on Buchanan's research (2007), it could be inferred that: after encoding, the retrieval of emotional experience would cause reexperience of the same emotion. Engaging in previous emotional memory (retrospective perspective), individuals' behaviour may be affected by the aroused emotion when there are new tasks at the same time. Gaven the result that procrastinators reported that they can remember the negative affect about procrastination experiences, it suggested that the memory of negative affect formed during procrastination could be aroused

when people remember their procrastination experience. Thus, the results obtained in the present study seem to also support the assumption that chronic procrastinators, who might even have poor RM, are more likely to experience negative affect as the impact of the memory of past procrastination experience. Such procrastination-related RM is probably attached with the negative affect of past experience and induce more procrastination. However, further research on the direction of the relation is warranted to confirm this assumption.

It should be acknowledged that the present study has some limitations. Firstly, the current research is a cross-sectional study. I assessed self-report procrastination, PM and RM by the self-report questionnaires. However, these subjective measures are susceptible to potential biases, which can often be seen in self-reports: overestimating or underestimating (Krause & Freund, 2014; Rotenstein et al., 2009). Particularly, the association between memory and metamemory is not clear (Beaudoin, 2011) and some authors have suggested that there were no significant relationships between PM performance and self-reported PM (Zeintl et al., 2006). Future studies (i.e., longitudinal or experimental) will have to explore the possible causality. For example, studies will have to explore whether current findings would be applied with objective measures and whether PM has effects on procrastination. By combining the subjective and objective research, it will allow us to examine whether procrastination may be predicted by PM and RM.

3.6 Conclusion

The present study investigated whether prospective memory is related to procrastination, and what underlying mediation mechanisms may explain these associations. The current findings not only revealed that prospective memory is negatively related to procrastination (Altgassen et al., 2019; Zuber et al., 2021), but is the first time to demonstrate the significant links between retrospective memory and procrastination. Further mediation

analyses revealed that the linkage between procrastination and negative affect is partially mediated by retrospective memory and memory reliving of past procrastination experiences. Notwithstanding the limitations of the current study, this research could have important implications for understanding the role of prospective memory and retrospective memory on the cognitive process underlying procrastination.

Chapter 4 Study 3: Can Time Perspective Explain the Relationship Between Procrastination and Prospective Memory?

4.1 Abstract

Procrastination has been linked to prospective memory, and both of the domains relate to performance within a time frame. It is critical to examine the role of time in the association between procrastination and prospective memory. The current study set out to investigate how prospective memory relates to procrastination, and test whether time perspective could explain the relationships between prospective memory and procrastination. We assessed prospective memory, and procrastination in both self-reports and behavioural measures. Overall, correlations revealed that prospective memory and procrastination were significantly related to self-reported and behavioural measures respectively, and both prospective memory and procrastination were significantly related to future time perspective. Simple mediation analysis showed that future time perspective mediated the relationship between prospective memory and procrastination, suggesting that chronic procrastinators might find it difficult to retrieve their intended tasks and forget what to do in the future as they are less likely to be future oriented. In conclusion, the present study allowed for a deeper insight into the underlying mechanisms that might explain the links between prospective memory and procrastination.

Keywords: procrastination, prospective memory, time perspective, cognitive mechanism

4.2 Introduction

Procrastination refers to a form of self-regulation failure that involves prioritising short-term mood repair over the long-term pursuit of intended actions (Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000). Generally, self-regulation could be defined as the ability to regulate one's thoughts, emotions, behaviour (Baumeister et al., 1994). Taking procrastination for instance, when individuals are faced with aversive tasks, choosing to delay the intention and disengaging from unpleasant tasks are ways to reduce immediate negative affect, and this current emotion prioritising is at the expense of future self (Sirois & Pychyl, 2013). A brief explanation is that we feel negative when we are faced with aversive tasks, and then delay the tasks to feel better. But with lack of future concern, this prioritisation could result in worse consequences for the future self.

Given the highlighted disconnection between present and future, it is important to understand how procrastination happens in a time frame. Many studies have laid out the broad time frame of the behavioural process underlying procrastination. According to Lay (1986), procrastination occurs when there is a blank period between planning the action and the action actually being conducted. Instead of taking significant time and effort to consistently make progress to complete tasks, it is very common for procrastinators to take action at the end of the period, or miss the deadline. Blunt and Pychyl (2000) constructed four stages of task completion: inception, planning, action and termination, which reflects that procrastination may occur in different stages. Furthermore, the negative affect may vary in the time frame. According to Zentall (2021), procrastination is assumed to follow a time course, and the passage of time could increase negative affect. This could explain why procrastinators experience more negative affect when time approaches the deadline (Pierro et al., 2011). A common assumption of almost all current theoretical perspectives on

procrastination is that procrastination occurs in a time frame. However, the role of time in procrastination still lacks enough empirical integration.

From a temporal perspective, an individual's behaviour occurs in time and runs a temporal course. As a problematic behaviour, even procrastination has a lot to do with negative affect, its concepts still closely related to meeting a deadline within a specific time (Burt & Kemp, 1994; Ferrari & Díaz-Morales, 2007; 2000; Pychyl et al., 2000). In line with the temporal view of procrastination, recent research revealed that when the interval between what is planned to do and the final responses becomes longer the procrastinators have worse prospective memory performance (Zuber et al., 2021). It indicated the possible role of time in the relationships between procrastination and prospective memory. But there is no direct empirical assessment on the role of time in this association. As one aspect of psychological time (Zimbardo & Boyd, 1999), time perspective seems to be a particularly important variable to consider when understanding and examining the association between procrastination and prospective memory. Thus the overall goal of the current study was to build on previous research, and to examine the role of time perspective in the association between procrastination and prospective memory.

4.2.1 Time Perspective and Procrastination

Generally, time perspective is considered as a trait-like tendency that focuses on the temporal frames (Zimbardo & Boyd, 1999). Specifically, three distinct dimensions of time perspective were identified: past oriented (a tendency to focus on long-term perspective, avoid risks, and emphasise stability), present oriented (focusing on short-term perspectives and live for now), future oriented (a tendency that individuals tend to strive for future goals and consider future consequences) (Zimbardo & Boyd, 1999). Considering the valence, Zimbardo and Boyd (1999) distinguished five types of time perspective: past positive (a positive view of the past time), past negative (a negative and pessimistic attitude towards the

past), present fatalism (a helpless and hopeless attitude towards current time), present hedonism (a focus on present pleasure), future (striving for future goals and consideration of future consequences). To better understand this time perspective model, Carelli et al. (2011) divided the future time perspective into future positive (positive attitude towards future events) and future negative (negative attitude towards future events). As discussed below, time may have an important role in procrastination and so this multidimensional conception of time perspective could help us to understand different tendencies that individuals have when they are engaged in intended tasks.

Plenty of studies have investigated whether time perspective is associated with procrastination. Generally, individuals' belief in how well they control their time, namely time management, is positively related to their task performance (Häfner & Stock, 2010). Given the obvious association between time management and task performance, it seems that time might play an important role in procrastination. For example, chronic procrastinators tend to underestimate the time when they estimate how long it will take them to complete a task (Burt & Kemp, 1994). As both time estimation and time perspective are conceptualised as subjective time (Zimbardo & Boyd, 1999) and relate to each other (Witowska et al., 2020), this could indirectly reflect that one's time perspective is related to procrastination.

Furthermore, the tendency of procrastination could be associated with poor time perspective balance. Time perspective balance refers to a pattern of time perspective which enables individuals to efficiently switch between time orientations (Boniwell & Zimbardo, 2015). For an operational definition of time perspective balance, it refers to a high level of past positive, moderately high level of present hedonism and future positive, and low level of past negative, present fatalism, and future negative (Rönnlund et al., 2017). Previous findings have shown that procrastination is positively related to present-oriented perspective, and negatively related to future-oriented (Ferrari & Díaz-Morales, 2007; Kim et al., 2017).

Accordingly, research indicates that individuals with a less balanced time perspective were less likely to make an accurate time estimation and the reported subjective time duration is shorter than the control group (Witowska et al., 2020). The temporal bias towards the present and away from the future could be thought as an unbalanced time perspective which may explain why procrastinators underestimate time.

4.2.2 Procrastination and Prospective Memory

Considering the theoretical proposed temporal view of procrastination, it was expected that prospective memory might be related to procrastination (Altgassen et al., 2019; Zuber et al., 2021). Prospective memory (PM) involves remembering to carry out intended tasks in the future. (Kopp & Thöne-Otto, 2003). Prospective memory plays a critical role in people's cognitive function, and it is involved in making plans, retaining them, and bringing them back to one's consciousness at the right time and place (Brandimonte et al., 1996). Because procrastination happens in a timeline, there may be a gap between the time points when individuals decide to procrastinate and the planned deadline. In this timeline, procrastinators could spontaneously remember the intention but then decide to do it later. However, such a decision may often result in forgetting what they planned to do in the future. To be more specific, as intention execution relies on the retention of task-related memory, the longer the time lasts, the more likely individuals are distracted, the worse the prospective memory (PM) performance (McDaniel et al., 2003; Schaper & Grundgeiger, 2018). Following this assumption, it is still unknown whether the potential forgetting is related to procrastination.

So far, there are two relevant studies, which examine the mechanisms of procrastination, and have indicated that procrastination is negatively related to prospective memory (Altgassen et al., 2019; Zuber et al., 2021). In one of the first studies examining the relationships between procrastination and prospective memory, Altgassen et al. (2019)

conducted a study based on a sample with clinical diagnosis of ADHD. Besides the subjective self-report measures which are prone to potential bias, objective measures were applied as well to assess participants' prospective memory performance. In terms of the standard PM paradigm, there are a variety of experimental paradigms. In most studies, participants are instructed to make a special response at a specific target time or to a particular cue while they are engaged in an unrelated ongoing task (McDaniel & Einstein, 2007). For instance, participants may be instructed to press the spacebar (i.e., the PM action) every two minutes or any time the cue word (i.e., the PM cue) is encountered while deciding whether a string of letters form a word or a non-word (i.e., the ongoing task). This paradigm was applied in Altgassen, Scheres and Edel's study (2019) for laboratory-based PM tasks. Their results show that higher self-reported procrastination is related to lower PM performance. This could be the first evidence to support the proposed association. However, considering that ADHD is associated with a range of cognitive deficits and social cognition impairments (Nijmeijer et al., 2008; Uekermann et al., 2010), the results may vary when it is applied to the general population. This limitation exists in the questions whether the results apply for the general population, and whether there is a directional association between procrastination and PM?

One study that was set up to address these questions in the general population used both subjective and objective measures to assess PM performance and behavioural procrastination respectively (Zuber et al., 2021). Besides the subjective measures which are prone to potential bias for the results (Beaudoin & Desrichard, 2011; Krause & Freund, 2014; Vangsness et al., 2022), two naturalistic tasks were introduced. In terms of naturalistic tasks for PM performance, after participants finished laboratory-based tasks and left the laboratory, they were asked to execute a series of "send-back" tasks at self-defined target time. As for naturalistic task for assessment of behavioural procrastination, participants were asked to

accomplish a specific task before a certain deadline, namely asking participants to send back the participation sheet with signature before a specific date). The results showed that prospective memory could be predicted by self-report and behavioural procrastination. However, as it has been illustrated in other research (Dewitte & Schouwenburg, 2002; Krause & Freund, 2014), discrepancies were found between subjective and objective measures, which could highlight the importance of assessing procrastination with both subjective and objective measures.

4.2.3 Time Perspective in the Relationship between Procrastination and PM

Even though there is evidence to support the association between procrastination and prospective memory, the role of prospective memory in procrastination has still not been systematically investigated. For example, why might procrastination relate to prospective memory? The literature provides multiple indications that time perspective might explain the relationship between procrastination and PM.

First of all, despite the defined "voluntary delay", procrastination still comprises the notion of not being able to complete intended tasks in time (Ferrari & Díaz-Morales, 2007; Zuber et al., 2020), and this could be also indicated from the variety measurements of procrastination (Svartdal & Steel, 2017). Basically, it is proposed that time is one of the variables which affects the tendency of procrastination (Rozental & Carlbring, 2014; Steel, 2007; Steel, 2012). In line with this, individuals voluntarily delay a task, but they may then happen to forget the task eventually, because so much time has passed which makes forgetting become more likely (Beaman & Morton, 2000; Bjork & Whitten, 1974). A possible explanation for this delay is that under the effect of the temporal factors (Oberauer & Lewandowsky, 2014), intended tasks may be forgotten with individuals' voluntary delay, which may be linked to procrastination.

Secondly, the proposed temporal bias regarding the temporal view of procrastination could be associated with memory bias. As recalling a memory is not simply recalling a previous event but a constructive process in which information from different sources are combined to produce the details of the event, memory bias refers to preferential recall of a certain kind of information over another (D'Argembeau & Van der Linden, 2008). It is also indicated that the tendency which individuals have might shape the memory. As individuals are more likely to remember tasks as taking less time than they actually did (Roy et al., 2005), this could be a possible explanation about why procrastinators always miss their deadline. Time perspective relies closely on memory systems because past experience serves as the foundation on which alternative perspectives and conceived futures are built (Buckner & Carroll, 2007). Kroese and de Ridder (2016) argue that instead of fully abandoning the intentions, procrastinators may sometimes temporarily put them aside. These studies have considerably advanced our understanding of the potential predictors of procrastination. Following up on this hypothesis, the current study set out to examine the overlap of procrastination, PM and time perspective, and explore the potential role of time perspective in the relationship between procrastination and PM.

Taken together, it is yet unclear why procrastination and prospective memory are related which lead us to conduct the current study. In this study, we aimed to examine the relationship between procrastination and prospective memory in more detail by including the concept of time perspective. As procrastination, prospective memory and time perspective have been shown to be related to each other, the first goal of the current study is to examine whether the time perspective and its different dimensions mediate the relationship between procrastination and PM. In addition, the second goal of the current study is to investigate whether procrastination relates to prospective memory performance. On the basis of previously established associations between procrastination, time perspective, and

prospective memory (Altgassen et al., 2019; Ferrari & Díaz-Morales, 2007; McDaniel et al., 2003; Schaper & Grundgeiger, 2018; Zuber et al., 2021), we hypothesised that (1) higher level of procrastination would be negatively related to prospective memory; and (2) individuals with higher level of procrastination would be positively related to present time perspective and negatively related to future time perspective. It is also hypothesised that (3) individuals who demonstrate better prospective memory are more likely to focus on the future (future time perspective), which in turn would be related to procrastination; and (4) individuals with poorer prospective memory would be more likely present focused (present time perspective), which in turn would be related to procrastination.

4.3 Methods

4.3.1 Sample Size and Power

The sample size was determined a priori using G*Power 3 (Faul et al., 2007; Fritz & MacKinnon, 2007) in order to achieve 0.95 power. Examination of prior relevant studies (Altgassen et al., 2018; Ferrari & Díaz-Morales, 2007; Hang Choy & Cheung, 2018; Kim et al., 2017; Mioni et al., 2017; Mioni et al., 2020; Mioni & Stablum, 2014; Zuber et al., 2021) reveals generally medium sized correlations between three target variables. Considering an alpha error of 0.05 and a medium effect size for the proposed correlation analysis, the required total sample size was 134 participants. For mediation analysis, the percentile bootstrap test of mediation requires sample size of 126 to achieve 0.8 statistical power in the condition with $\alpha = .26$ and $\beta = .39$ (Fritz & MacKinnon, 2007). Therefore, the sample size of 142 participants in the current study is appropriate.

4.3.2 Participants

Accounting for invalid responses, optimal target sample size was N = 150. The final data set consisted of 142 participants (Mean age = 22.34, *SD* = 3.92, age range = 18–33, 79 females, 4 non-binary participants) after 8 participants were excluded because of a)

questionnaires that were incomplete; b) participants failed to follow the instruction; c) participants did not participate in the naturalistic tasks**.** All the recruited participants are fluent English speakers with normal hearing and normal or corrected-to-normal vision. Participants who did not complete all outcome measures were excluded from subsequent analyses. We used Qualtrics to implement the questionnaires and tasks. All participants were given informed consent prior to taking part in the research.

4.3.3 Materials

4.3.3.1 Self-report Procrastination

Self-report procrastination was assessed using the 9-item version of the General Procrastination Scale (GPS-9; Sirois et al., 2019). This 9-item scale scored on the 5-point Likert scale. Items such as, " I often find myself performing tasks that I had intended to do days before" are scored on the scale ranging from 1 (False) to 5 (True of me). The scale includes 3 reverse-scored items, and all the items are summed with higher scores reflecting a greater tendency to procrastinate. It has been previously demonstrated that the GPS-9 (test-retest reliability $r = 0.89$; Sirois et al., 2019) is a reliable short version of the original, longer 20-item measure (Lay, 1986).

4.3.3.2 Time Perspective

The 56-item (5-point rating scale) Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999), which is one of the most well-known and widely used measures of time perspective, was applied in present research. ZTPI assesses five time-related constructs–past negative (PN; e.g., "I often think of what I should have done differently in my life"), past positive (PP; e.g., "It gives me pleasure to think about my past"), present fatalistic (PF; e.g., "Since whatever will be will be, it doesn't really matter what I do"), present hedonistic (PF; e.g., "Fate determines much in my life"), and future (Ft; e.g., "When I want to achieve something, I set goals and consider specific means for reaching those goals").

Participants were asked to rate the degree to which each statement referred to him/her. The response scale is a five-point Likert scale (from 1 = very untrue, to 5 = very true). A composite score for each subscale was computed by averaging the responses for each frame, with higher scores for each scale reflecting a higher level of a specific time perspective.

4.3.3.3 The Prospective Memory and Retrospective Memory

The Prospective-Retrospective Memory Questionnaire is a 16-item questionnaire which is divided into two sections to assess prospective memory and retrospective memory. Participants were asked to rate how often each type of memory failure occurred (e.g., "Do you forget to buy something you planned to buy, like a birthday card, even when you see the shop?") on a 5-point Likert scale (1 = very often; 5 = never), and the higher averaged scores indicate better prospective and retrospective memory. This version (split half reliability r = 0.84; Smith et al., 2000) was applied in the current study as it also has been shown to be worded appropriately for a wide range of participant groups.

4.3.3.4 Naturalistic Prospective Memory Task

The modified "send-back" task is a well documented task to assess PM abilities in a naturalistic setting (Aberle & Kliegel, 2010; Zuber et al., 2021). The paradigm used in this study is modified from the one appeared in Zuber's research (2021). Specifically, participants were asked to remember to send predefined words via text messages, the total number of correctly sending messages at target-time was considered as PM score. Following the questionnaires, an electronic learning table was displayed, which presented a table with three columns and eight rows. The first column contained a half-day time slot (morning/afternoon) of eight slots over 4 days, starting in the next morning of the initial online survey session. The second column was empty on which participants were asked to define and write down a specific target-time when they wanted to perform the PM task (more restriction: any time they want except for full-hours and half-hours; e.g., 11:00 or 11:30), each target-time could

be only chosen once). As for the third column, each row contained a target-word, and participants were instructed to memorise it in association with the target-time of that row. After that, participants were instructed that they have to send a text message containing the target-word at the target-time throughout the next four days. After verifying that participants had understood the instructions, they had 5 minutes to memorise the eight time-word pairs. Finally, they finished the online survey session and the PM task started. Messages received 6 minutes before or after the defined target-times were classified as correct PM answers. The target window (± 6 minutes) is the same as the time reported in previous relevant research (Aberle & Kliegel, 2010; Zuber et al., 2021). The PM scores were calculated by summing up the correct PM responses (sending the message at corresponding target-time).

4.3.3.5 Naturalistic Procrastination Behaviour

So far, there was no clearly established measure for reliably assessing behavioural procrastination. To address this problem, Zuber et al. (2020) introduced a naturalistic task which is designed to evaluate individuals' actual behaviour with a real-life procrastination task. For instance, researchers assigned a specific task for participants, and instructed them to accomplish the task before a certain deadline. Similar to the naturalistic situation applied by Zuber et al. (2021), participants were instructed to return a signed participation sheet via email before a specific date (by 23:59 within three weeks after their participation) to validate their participation. The outcome variable is the number of days that elapsed before handing in the participation sheet.

4.3.4 Procedure

The study consisted of two parts: an online test session and a follow-up session. The online test session was conducted through Qualtrics. In the online test session, the order of questionnaires was counterbalanced. After participants finish the questionnaires (GPS-9, ZTPI, PMRM), the instructions of the PM tasks were displayed, and the learning table was

then provided, during which participants were asked to define target time when they would like to send back specific words. Finally, participants had five minutes to memorise the time-word pairs before they finished the whole online session. The PM tasks started from the next morning following the online test session and lasted for four days. There were two naturalistic tasks in the follow-up session: PM tasks and behavioural procrastination task. Once the PM tasks were finished, participation sheets were emailed to participants and they were instructed to sign the sheet and send it back to researchers to validate their participation within three weeks. The three weeks deadline was set to allow participants to perform the procrastination task, and it was also for the possible procrastination.

Ethical approval was granted by the Department of Psychology Research Ethics Committee at the University of Sheffield.

4.3.5 Statistical analysis

Statistical analyses were carried out using SPSS 26.9. First, Pearson's correlations were computed to measure the associations between the target variables (procrastination, time perspective and prospective memory).

Second, in order to examine whether the associations between procrastination and prospective memory were mediated by time perspective, mediation models were constructed using a bootstrapping procedure via SPSS Version 26.9 macro PROCESS Version 3 (Hayes, 2013) and the PROCESS model 4 was used for simple mediation analysis. The bias-corrected bootstrapping method involving 95% confidence intervals of 5000 resamples was used in the current study. The bootstrap is a nonparametric resampling technique which is a powerful method to test for indirect effects (Efron & Tibshirani, 1993; Preacher & Hayes, 2008). This procedure, which involves the estimation of the indirect effect in thousands of resampled observations within the data set (5,000 iterations in this study), provides an approximation of the distribution of the indirect effect. Besides, it can also provide the confidence intervals

around the effect, which are used to test whether the distribution of the indirect effect is significantly different from zero, namely, the mediation effect is statistically significant when zero does not fall in the 95% bias-corrected confidence intervals. This method has been considered better than the widely used Sobel test and the Baron and Kenny approach (Baron & Kenny, 1986), as it has been investigated not to inflate two error rates (false-positive & false-negative) and to have higher power (Fritz & MacKinnon, 2007). Moreover, as the bootstrap approach does not assume multivariate normality, it avoids some of the issues of traditional statistical significance testing (Carpenter, 2002; Thompson, 1993).

4.4 Results

4.4.1 Descriptive Statistics

With the current sample, Cronbach's α of all the measures ranged from 0.61 to 0.85 (see Table 4.1). Specifically, coefficients α of the subscales for ZTPI were 0.74 for past-negative time perspective (PN), 0.74 for present-hedonistic time perspective (PH), 0.75 for future time perspective (Ft), 0.72 for past-positive time perspective (PP), and 0.61 for present-fatalistic time perspective (PF). The mean score of PM failures (not sending the message at corresponding target-time) was $M = 5.13$ ($SD = 2.41$). The mean score of procrastination behaviour (the number of days that elapsed before handing in the participation sheet) was $M = 8.65$ ($SD = 8.18$).

Table 4.1

Descriptive Statistics of Means, Standard Deviations, Internal Consistency Reliability Coefficients and Range for Self-reported Measures (N = 142)

	M	*SD*	α	Range
1. P	3.25	.68	.78	1-5

2.PN	3.22	.59	.74	1-5
3.PH	3.54	.44	.74	1-5
4.Ft	3.31	.52	.75	1-5
5.PP	3.54	.55	.72	1-5
6.PF	2.84	.52	.61	1-5
7.PM	3.15	.67	.85	1-5
8.RM	3.36	.65	.80	1-5

Note. P = procrastination; PN = past-negative time perspective; PH = present-hedonistic time perspective; Ft = future time perspective; PP = past-positive time perspective; PF = present-fatalistic time perspective; PM = prospective memory; RM = retrospective memory.

4.4.2 Correlation Analyses

To address the correlation hypotheses, Pearson's correlations were conducted to assess the associations between the variables (procrastination, time perspective, prospective and retrospective memory, behavioural prospective memory). According to Cohen's suggestion (1977), self-reported procrastination was weakly related to past-negative time perspective, present-hedonistic time perspective and present-fatalistic time perspective. Interestingly, self-reported procrastination was found to be strongly related to poor future time perspective, whereas future time perspective was weakly related to better self-reported prospective memory. Meanwhile, self-reported procrastination was found to be weakly positively related to present-fatalistic time perspective, whereas present-fatalistic time perspective was weakly related to lack of self-reported prospective memory. As for the relationships between procrastination and prospective memory, self-reported prospective

memory was strongly negatively related to self-reported procrastination. Regarding the results of behavioural measures, there was no significant correlation found between behavioural prospective memory and self-reported procrastination. However, the prospective memory was found to be moderately negatively related to behavioural procrastination, namely, the prospective memory and procrastination from self-reported and behavioural measures were associated with each other respectively (see Table 4.2).

Table 4.2

Correlations Coefficients between Variables (N = 142)

	1	2	3	4	5	6	7	8	9	10
1. P	-									
2. PN	.18*	-								
3. PH	.25**	.13	-							
4. Ft	-.63**	.09	-.31**	-						
5. PP	-.02	-.45**	.00	-.11	-					
6. PF	.27**	.26**	.38**	-.34**	-.06	-				
7. PM	-.55**	-.22**	-.26**	.27**	.01	-.19*	-			
8. RM	-.44**	-.15	-.26**	.20*	-.08	-.25**	.83**	-		
9. BP	.34**	.00	.08	-.35**	.06	.10	-.30**	-.26**	-	
10.BPM	.13	.07	.10	-.20*	-.07	.08	.24**	.19*	-.46**	-

Note. P = procrastination; PN = past-negative time perspective; PH = present-hedonistic time perspective; Ft = future time perspective; PP = past-positive time perspective; PF = present-fatalistic time perspective; PM = prospective memory; RM = retrospective memory; BP = behavioural procrastination; BPM = behavioural prospective memory.

*$p < .05$; **$p < .01$ (2-tailed).

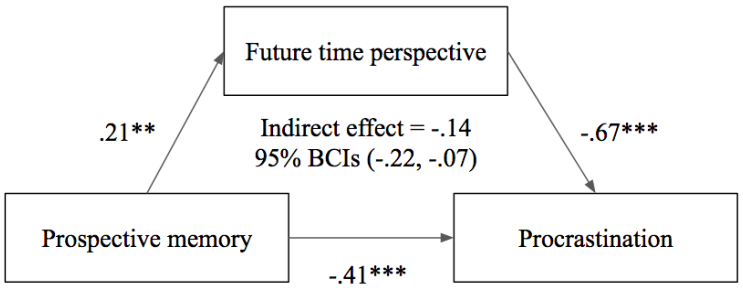
4.4.3 Mediation Analyses

Based on the correlations between the variables, the first overall mediation analysis tested the role of future time perspective in the relationship between prospective memory and

procrastination (see Figure 4.1). When self-reported procrastination was tested as a dependent variable, the bootstrap results indicated that the indirect path for future time perspective (indirect effect = -.14, bootstrapped *SE* = .05, 95%, *CI* = -.22, -.07) was significant. As the direct effect remains significant, it suggested that future time perspective partially mediated the relationship between prospective memory and procrastination. This model explained 25.45% of the variance of procrastination. However, the mediation effect of present-fatalistic time perspective (indirect effect = -.03, bootstrapped *SE* = .05, 95%, *CI* = -.11, .00) were not significant (see Table 4.3).

Figure 4.1

Mediation Model of the Relationship between Prospective Memory, Future Time Perspective and Procrastination Regarding Self-reported Measures



Note. ** $p < .01$; *** $p < .001$.

BCIs: bias-corrected confidence interval.

Table 4.3

Simple Mediation Analyses with Self-reported Measures Based on 5,000 Bootstrapping Samples (N =142)

Independent Variable (IV)	Mediating Variables (M)	Dependent Variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Direct effect (c')	Indirect Effect (a×b)	Total effect (c)
Prospective memory	Future time perspective	Procrastination	.21**	-.67***	-.41***	-.14 (-.22, -.07)	-.55***
	Present-fatalistic time perspective		-.15	.23	-.52***	-.03 (-.10, .00)	-.55***

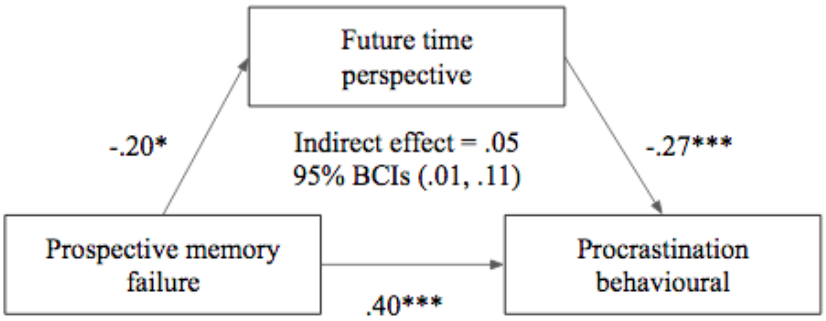
Note. Bias-corrected 95% confidence intervals.

** $p < .01$; *** $p < .001$.

As for the behavioural measures, the further mediation models performed with prospective memory failure showed that future time perspective acted as mediator of their relationship with behavioural procrastination, which revealed a significant indirect effect (indirect effect = .05, bootstrapped SE = .05, 95%, CI = .01, .11). This model explained 11.11% of the variance of behavioural procrastination (see Figure 4.2). However, no indirect effect of present-fatalistic time perspective was found, but only a direct effect (indirect effect = .02, bootstrapped SE = .05, 95%, CI = -.04, .11) (see Table 4.4).

Figure 4.2

Mediation Model of the Relationship between Prospective Memory, Future Time Perspective and Procrastination Regarding Behavioural Measures



Note. * $p < .05$; *** $p < .001$.

BCIs: bias-corrected confidence interval.

Table 4.4

Simple Mediation Analyses with Behavioural Measures Based on 5,000 Bootstrapping Samples (N =142)

Independent Variable (IV)	Mediating Variables (M)	Dependent Variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Direct effect (c')	Indirect Effect (a×b)	Total effect (c)
Prospective memory failure	Future time perspective	Behavioural procrastination	-.20*	-.27***	.40***	.05 (.01, .11)	.45***
	Present-fatalistic time perspective		.08	.06	.45***	.01 (-.01, .03)	.46***

Note. Bias-corrected 95% confidence intervals.

* $p < .05$; *** $p < .001$.

In addition, to further explore the data and examine Zuber et al. findings (2021) regarding the predictor role of procrastination on prospective memory, we tested reverse mediation models with future time perspective entered as a proposed mediator of the relationship between procrastination and prospective memory. Neither the indirect effects of future time perspective nor present-fatalistic time perspective were significant, but only direct effects (95% bias-corrected CIs containing zero) (see Table 4.5).

Table 4.5

Simple Mediation analyses based on 5,000 bootstrapping samples (N = 142)

Independent Variable (IV)	Mediating Variables (M)	Dependent Variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Direct effect (c')	Indirect Effect (a×b)	Total effect (c)
Procrastination	Future time perspective	Prospective memory	-.48***	-.15	-.61***	.07 (-.03, .19)	-.54***
	Present-fatalistic time perspective		.21**	-.05	-.53***	-.01 (-.06, .03)	-.54***
Behavioural procrastination	Future time perspective	Behavioural PM failure	-.35***	-.04	.44***	.01 (-.01, .02)	.45***
	Present-fatalistic time perspective		.10	.03	.45***	.00 (-.02, .03)	.45***

Note. ** $p < .01$; *** $p < .001$.

Bias-corrected 95% confidence intervals.

4.5 Discussion

The aim of this study was to investigate whether time perspective (past-negative time perspective, present-hedonistic time perspective, future time perspective, past-positive time perspective and present-fatalistic time perspective) mediates the relationships between prospective memory and procrastination. Based on the theories of procrastination and earlier literature that had investigated these relationships independently of each other, we specifically focused on the mediation role of future and present time perspective. The main findings of this study were as follows. First, results show that higher levels of procrastination were related to poorer future time perspective. Higher levels of procrastination were related to poorer prospective memory. Second, the association between prospective memory and procrastination was mediated by future time perspective. These findings are applied in both self-reported and behavioural measures. However, even though there was a significant link between self-reported procrastination and present-fatalistic time perspective, it revealed no significant association between behavioural procrastination and present-fatalistic time perspective. The mediation effect of present-fatalistic time perspective was not significant in the association between prospective memory and procrastination.

The overall results of the correlation analyses demonstrated significant association between procrastination and time perspective. Specifically, as it was previously mentioned, we replicated the expected patterns of results that both self-reported and behavioural procrastination were negatively correlated with future time perspective. In the case of overall time perspective, these could be regarded as voluntary avoidance to think about the future (Zimbardo & Boyd, 1999). In contrast, only self-reported procrastination was found to be associated with past-negative time perspective, present-hedonistic time perspective and present-fatalistic time perspective. It indicated that chronic procrastinators are more likely to be past and present oriented. In other words, the past and present time perspective may be

more sufficient for the trait procrastination but not for behavioural delay. This is consistent with the suggestion that there is still some degree of discrepancy regarding the differences between self-reported and behavioural measures of procrastination (Krause & Freund, 2014; Vangsness et al., 2022; Zuber et al., 2020).

With respect to correlation between procrastination and prospective memory, the current study provided further evidence that procrastination is negatively related to prospective memory, which meant that individuals who are more likely to procrastinate might be at more risk to forget what they are going to do in the future. This result was consistent across self-reported and naturalistic behavioural performance, and it was in accord with previous research (Altgassen et al., 2019; Zuber et al., 2021). Although there was no significant correlation found between the self-reported measure of procrastination and behavioural measure of PM failures in the current study, our finding could partially support the notion that self-reported and behavioural measures of procrastination can predict PM performance. In addition, results of significantly positive correlations between self-reported procrastination and behavioural PM failure indicated that individuals who tend to procrastinate are less likely to perform prospective tasks. This finding is coherent with the indication that self-reported procrastination is a positive predictor of behavioural PM failures (Zuber et al., 2021). Considering the possible discrepancy of self-reported and behavioural measures, it may be, for example, explained by the different focuses of the procrastination measures (Krause & Freund, 2014; Vangsness et al., 2022; Zuber et al., 2020). Similarly, further evidence comes from the discrepancy between memory self-efficacy and memory performance. For example, it was argued that the measures of self-reported prospective memory have poor validity even though they have been elaborated to have adequate reliability (Beaudoin & Desrichard, 2011; Uttl & Kibreab, 2011). This could explain the weak correlation between self-reported procrastination and behavioural PM failure. However, the

current study revealed strong correlation within self-reported measures and moderate correlation within naturalistic behavioural measures between procrastination and prospective memory. To illustrate, the correlations between procrastination and prospective memory were comparable in self-reported and behavioural measures.

Supporting the temporal mood repair in procrastination, research has primarily focused on the evaluation of current mood repair and future goal pursuit. Specifically, the evaluation between mood repair and goal pursuit induces a final decision-making process about whether to execute the intended action (Shafiei et al., 2012). Procrastinators in negative affective states are more likely to repair their negative affective states, and hence are unwilling to start or complete the intended tasks (Sirois & Pychyl, 2013; Steel, 2007). However, it is questionable that people in negative mood states may be unable to exert self-control and perform the mood repair. One supportive evidence is that depletion due to mood regulation attempts, rather than mood repair, is the underlying process of final decision (Bruyneel et al., 2009; Heatherton & Wagner, 2010). Extended from this, one interpretation is that the intended task might be forgotten while individuals are engaged in pleasant activities. For instance, in research investigating why people forget, Norby (2015) suggested that forgetting could serve as a purpose to help people be happy. This could be consistent with the mood regulation theory of procrastination, which makes it plausible that procrastination is memory-related.

Furthermore, the present findings not only complement past research by providing further support for the relations between procrastination and prospective memory, but also extend previous conclusions by highlighting the role of time perspective that mediates the association. The mediation results broaden prior research by showing how prospective memory is related to procrastination which highlight the role of future time perspective. Our mediation results suggested that the relationship between prospective memory and

procrastination regarding self-reported and behavioural measures were mediated by future time perspective respectively. This means that individuals with a higher level of prospective memory have a higher tendency to focus on the future. This, in turn, relates to less procrastination.

These mediation results highlight the temporal view of procrastination, corroborating the previous evidence that procrastinators reported it is difficult for them to think about the future (Ferrari & Díaz-Morales, 2007; Kim et al., 2017) and the negative association between procrastination and prospective memory (Altgassen et al., 2019; Zuber et al., 2021). On the one hand, the results fit well with and extend the theoretical assumptions of procrastination. Procrastinators might find it difficult to remember their intended tasks, as they are less likely to focus on the future (Diaz-Morales et al., 2008; Rebetez et al., 2016). On the other hand, our findings reflect the proposition about mood regulation models of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013). As it is proposed, people choose to engage in pleasurable activities rather than the intended task to regulate task-related negative mood. It is reasonable to consider procrastination as a reward-based decision. Accordingly, people feel negative when they think about the future intended task, and then decide to postpone the intended action. From a temporal view, the expectation of coming tasks and consequences of not completing tasks are future-oriented. Although lots of research always classify these future-oriented thinking as negative (Klingsieck, 2013; Zimbardo & Boyd, 1999) and procrastination is suggested to be associated with task-related negative mood (Sirois & Pychyl, 2013), research from motivational psychology implies that consideration of the future could be rewarding to present and motivate people to perform better (Lin & Epstein, 2014). Based on the mediation results in the current study, it is thus more reasonable to consider the valence of task-related affect at the first step. Researchers should be very careful when we conclude that task-related affect could explain procrastination, as the task-related affect could

be either positive or negative. Taking positive future thinking for example, future oriented individuals tend to be more organised about their future intentions and keep engaged in planned actions to achieve the final goals (Díaz-Morales & Ferrari, 2015). However, as the subscale of future time perspective focuses on the measurement of goal orientation and expectations of a positive future, it seems as likely that the negative valence which is related to the future is neglected in this association.

In contrast to our expectation of the mediation role of the present-fatalistic time perspective in the relationship between prospective memory and procrastination, there are no indirect effects observed in current study. This may reflect either a real disassociation of present-fatalistic time perspective with the relation between prospective memory and procrastination, or it is possible because of the lack of validity of the subscale of present-fatalistic time perspective (Cronbach's α = .61) in current study.

Combined with self-reports, this allows us to examine whether there are differences between subjective and objective evaluations of procrastination and PM performance. According to previous research, some investigators attribute the discrepancies between subjective and objective measures in the different focuses of the measures (Beaudoin & Desrichard, 2011; Krause & Freund, 2014; Vangsness et al., 2022; Zuber et al., 2020). Taking the measures of procrastination for instance, previous research have investigated that behavioural procrastination was not associated with affect, and only self-reported but not behavioural procrastination predicted affective well-being (Brownlow & Reasinger, 2000; Krause & Freund, 2014), which indicates the distinctions between two types of measures. This may be because behavioural measures of procrastination focus only on delay behaviour and neglect the affective component. Besides, as GPS-9 in the current study is designed for assessing trait procrastination, one of another explanation regarding these discrepancies could be that self-reported measures of procrastination focuses on trait level, but behavioural

measures of procrastination focuses on state level. Furthermore, it seems as likely that the time discrepancy could explain these differences between self-reported and behavioural measures as self-reported measures are based on the evaluation of past procrastination experiences, but behavioural measures focus on assessing the current delay behaviour.

4.5.1 Limitations and Implications

Although this study presents several strengths, such as the naturalistic design, several limitations should be acknowledged. First, the detected relationship between procrastination, prospective memory and time perspective provide no direct evidence regarding underlying mechanisms. Second, since the differences between self-reported and naturalistic measures with respect to procrastination performance and prospective memory performance, the results of the study have to be treated cautiously. Nevertheless, self-report measures are criticised due to the biassed report (Krause & Freund, 2014; Vangsness et al., 2022; Zuber et al., 2020). Even though some of the self-reported measures have been broadly applied with adequate reliability, they are still criticised by the poor validity (Uttl & Kibreab, 2011). That makes our research necessary to develop new laboratory-based or naturalistic designs to assess the relationships between procrastination and prospective memory. We therefore are certain that the results of this study are valuable.

Though the temporal view of procrastination has been fruitful in increasing our understanding of cognitive processes underlying procrastination, it does not completely cover the mechanism during the whole procrastination time frame. According to previous theories and empirical findings, it is reasonable to consider that procrastination could be an ongoing problematic behaviour after the intention is formed. That means it does not only occur at one specific time point but during a time frame. Following the indication of the temporal view of procrastination (Sirois & Pychyl, 2013), the cognitive processing could reflect prioritising short-term mood repair over long-term goal pursuit only. However, this emphasised

"short-term" does not reflect the potential complexity of cognitive processes that may be involved in the whole time frame. Considering the procrastination behaviour in a timeline of naturalistic context, there could be a huge gap between the time points when individuals decide to procrastinate and the planned deadline. After short-term mood repair and decision of delay, it is still difficult to understand the cognitive underpinning of procrastination. A primary question is: what is the cognitive process underlying procrastinatory behaviour during that time frame? Given the correlation between prospective memory and procrastination, and the detected mediation role of future time perspective, future research will be needed to further explore in more detail whether people postpone the intention and miss their deadline because of forgetting, or forget the intention because of voluntary delay.

4.6 Conclusion

In conclusion, the current study is one of the first to explore the role of time perspective in the relationship between prospective memory and procrastination. The findings in the current study show that poorer prospective memory is related to higher levels of procrastination, and the association between prospective memory and procrastination is mediated by future time perspective, which imply that prospective memory may constitute an important cognitive factor potentially impacting the behavioural process underlying procrastination. Theoretically, it could provide novel insights on the temporal view of procrastination and further understanding about the mechanisms underlying procrastination. Practically, it may provide helpful insight and suggest new directions for clinicians, mental health workers and individuals who are suffering with procrastination by illustrating whether these relevant concepts should be targeted when assessing procrastination or when developing future practice to reduce procrastination.

Chapter 5 General Discussion

5.1 Introduction

The overarching aim of this PhD project was to contribute to the knowledge relating to procrastination and explore how prospective memory relates to this problematic phenomenon. For this purpose, the main research question was whether and how procrastination links to prospective memory? Across literature review and three prospective studies exploring the links between procrastination and prospective memory, we obtained the hypothesised results. As part of this research project, the review of the literature established the potential links between procrastination and memory and highlighted the behavioural and temporal nature of procrastination. This chapter first presents a summary of the principal findings in relation to the research question. Three specific research questions were generated: 1) What do procrastinators think about task-related memory? 2) Whether procrastination links to negative affect through prospective memory? 3) Whether time perspective could explain the association between prospective memory and procrastination?

To address the above three research questions, three studies were conducted. Chapter 2/Study 1 addresses research question 1, which is aimed at investigating procrastinators' perspective about task-related memory with a qualitative and quantitative mixed-methods approach. Chapter 3/Study 2 addresses research question 2 by investigating the relationship between procrastination, prospective memory and negative affect, which has directly confirmed that higher level of self-reported procrastination is negatively related to prospective memory. Besides, Study 2 addresses research question 2 by investigating the potential mediating effect of prospective memory in the relationship between self-reported procrastination and negative affect. Chapter 4/Study 3 addresses research question 3 by exploring the role of time perspective which may explain the relationship between procrastination and prospective memory. Then Chapter 5 discusses the theoretical

implications of current findings. This is followed by the discussion on practical implications and what needs to be addressed in future. Finally, the recommendations for future work and conclusions were drawn at the end of the chapter.

5.2 Principal Findings

5.2.1 Study 1: Is Task-related Memory Related to Procrastination? A Qualitative–Quantitative Mixed-Methods Approach

Qualitative analysis of procrastinators' perspective in brief open text responses identified the affect that appeared to result from task remembering and recall of procrastination experiences, and the main reason why procrastinators perceive these task-related memories in that way. Correspondingly, quantitative analysis examined whether these task-related memories are associated with procrastination.

A mix of affective responses regarding procrastination relevant memory were identified from qualitative data. While the task reminder appears to be most frequently associated with negative affect, positive affect and neutral responses were also linked to task reminder. Accordingly, it could be confirmed that the intended task is characterised with mixed affect, indicating that procrastination may even occur without experiencing negative affect. Given that the affect is associated with task difficulties, these results are also consistent with Lay's (1986) proposition that procrastinators could even delay a simple task. On the one hand, procrastinators may be sensitive to affect and tend to postpone intended tasks when they experience negative affect, but on the other hand, it is questionable to what extent is this due to the negative affect? Under the pressure of task aversiveness and limited time to deadline, individuals are more likely to experience negative affect, which could be applied to both procrastinators and non-procrastinators. However, procrastinators appeared to differ in their affect rating towards task-related memories, implying that affect may vary across procrastinators. Even if negative affect is common in procrastination, relevant

individual differences need to be considered. Whether negative affect is unique and directly related to procrastination and the level of task aversiveness regarding procrastination still require further consideration.

Analysis also identified several themes about self-control and cognition/behaviour disconnection. The theme of self-control brings us to the statement of motivation about procrastination. As a motivational factor, self-control is suggested to be linked to procrastination (Katz et al., 2013; Wäschle et al., 2014; Zuffianò et al., 2013). From the qualitative data, it was suggested that a group of procrastinators tend to rely on the task reminder as they hold the beliefs that they cannot control their behaviour by themselves, and the external task reminding could motivate them to take action. It could be indicated that procrastinators who lack self-control are more likely to rely on memory aid.

But it is questionable that memory aid strategies really help procrastinators to perform better in the future. Even if task reminding is beneficial, it was proposed that procrastinators may procrastinate on setting up reminders (Ericson, 2017). This leads to the theme of cognition/behaviour disconnection, which could be considered a part of irrationality of procrastinators. As for the irrationality, it is presented in different forms among procrastinators. According to previous research, part of irrationality is considered the failure of prioritising intended tasks over ongoing activities (Lay, 1986; Sirois & Pychyl, 2013), and another part of it refers to the situation that procrastinators may tend to underestimate the duration of time to complete specific tasks (Lay, 1986). In current findings, the identified theme of cognition/behaviour disconnection indicated that procrastinators are irrational about the memory aid. Procrastinators believed that task reminders put them under intense pressure. However, procrastinators still believe that they can work more effectively under pressure. Similarly, procrastinators believe that task reminders could help them keep on track of

intended tasks and perform better in the future. But, dramatically, they would be more inclined to give up under the pressure of being reminded.

Furthermore, the quantitative approach revealed that higher levels of procrastination were positively related to negative affect when they remember their procrastination-related events (e.g., tasks, procrastination experiences). Besides, there was a weakly significant positive correlation found between the emotional memory and metacognition of procrastination decrease, which could suggest that procrastinators believed that the negative affect of remembering past procrastination experiences could help them reduce procrastination. This is irrational, as procrastinators are less likely to complete the tasks when they experience negative affect.

It could be suggested that both the task remembering and recall of procrastination experiences are expected to link to negative affect, and the experience of negative affect could contribute to further procrastination. It could be speculated that a mediator variable may indeed be altering the strength and direction of the relationship between procrastination and negative affect.

5.2.2 Study 2: Is Prospective Memory a Missing Link Between Procrastination and Negative Affect?

Findings from Study 1 recognised that, in line with the literature, task remembering is characterised by valence, and the majority of participants tend to avoid external task reminders. A consideration is whether the task remembering would link to negative affect and in turn relates to procrastination. The role of prospective memory could be implied in these results, as task reminder is considered a memory aid to remind people what they have planned to do in the future. Therefore, Study 2 focussed on the role of prospective memory to examine whether prospective memory links to the relationship between procrastination and negative affect.

A central finding of this research was the significant negative correlation between the self-reported procrastination and prospective memory. Participants who scored higher in procrastination were more likely to experience prospective memory failures in their daily life. Although not the focus of this thesis, retrospective memory was also measured, which suggested that self-reported procrastination is negatively related to retrospective memory. Since the retrospective memory is considered a component of prospective memory (Einstein et al., 1998), the role of prospective memory in the procrastination could be highlighted.

Importantly, mediation results suggested that the association between self-reported procrastination and negative affect was mediated by retrospective memory when focusing on the negative affect of procrastination experiences. For prospective memory, however, despite the detected association with self-reported procrastination, the mediating effect of prospective memory was not significant in the relationship between self-reported procrastination and negative affect. Thus, memory should be a significant factor in procrastination. Specifically, the mediation results suggested the possibility that the relationship between procrastination and negative affect may be explained by the ability to remember past things (such as procrastination experiences) rather than ability to remember future things. Supporting this conclusion is research showing that higher levels of procrastination are positively related to past-negative orientation (Ferrari & Díaz-Morales, 2007). Although the detected relationship between self-reported procrastination and negative affect did not provide direct evidence regarding the mediating role of prospective memory, the correlation findings about the relation between procrastination and prospective memory are consistent with previous research (Altgassen et al., 2019; Zuber et al., 2021).

5.2.3 Study 3: Can Time Perspective Explain the Relationship Between Procrastination and Prospective Memory?

Given the evidence from Study 2 supporting the link between procrastination and prospective memory, Study 3 aimed to include time perspective as an explanatory variable that might explain the link. To our knowledge, this is the first research that has considered the time perspective as a potential explanation to the relationship between procrastination and prospective memory. Prospective memory may indeed influence whether individuals could complete intended tasks in time and individuals who perform better in prospective memory tasks may be less likely to miss their deadline. Whilst, according to the main findings in Study 1 and Study 2, it could be implied that procrastinators might not only have irrational beliefs on their memory abilities since they are more likely to trust themselves and avoid task reminders, but also characterise limited memory to remember what to do in the future. The relationship between procrastination and prospective memory seems to be complicated when it accounts for negative affect about tasks remembering.

The overall results of the correlation analyses are in line with previous studies (Altgassen et al., 2019; Ferrari, 2001; Zuber et al., 2021). Firstly, it was highlighted that self-reported procrastination was found to be strongly related to poor future time perspective, whereas future time perspective was weakly related to better self-reported prospective memory. This is consistent with our hypothesis. Despite future time perspective, the correlation results show that self-reported procrastination was weakly related to past-negative time perspective, present-hedonistic time perspective and present-fatalistic time perspective. Thus, correlation analysis replicated the positive correlation between self-reported procrastination and present time perspective which is consistent with the classic view that procrastinators are present-biassed (Ferrari, 2001; Sirois, 2014). When people report that they tend to delay tasks despite expecting to be worse off, they often focus on the present. And yet

we also detected a significant negative correlation between procrastination and future time perspective. Both of these correlation findings are in line with the temporal view of procrastination.

Secondly, as for the relationships between procrastination and prospective memory, self-reported prospective memory was strongly negatively related to self-reported procrastination. Besides, behavioural measures showed that prospective memory failure was moderately positively related to behavioural procrastination. But there was no significant correlation found between behavioural prospective memory failure and self-reported procrastination. Thus, prospective memory and procrastination from self-reported and behavioural measures were associated with each other respectively (see Study 3), suggesting that individuals who make more prospective memory failures demonstrate higher levels of procrastination, or conversely, those with higher levels of procrastination make more prospective memory failures. According to the proposed cognitive processes of prospective memory (Kliegel et al., 2002), successful task performance in the latter stage relied on whether intentions were stored in retrospective memory in the previous stage. In this case, it is possible that prospective memory failure leads to task delay and tasks are more likely to be delayed due to the failure to retrieve and act on the intended task in a timely manner. This is consistent with the revealed negative association between prospective memory and procrastination. However, given the distinction between procrastination and general task delay, it is uncertain whether and how prospective memory contributes to procrastination. Future studies will have to consider the distinction between voluntary delay and general task delay when designing studies to examine the causality between prospective memory and procrastination.

The mediating effect of future time perspective was highlighted in Study 3. Both self-reported and behavioural data suggest that individuals who perform worse in prospective

memory are less likely to be future oriented, or conversely those who are less likely future-oriented make more prospective memory failures, which in turn link to a higher level of procrastination. The mediating effect of future time perspective could extend our understanding about the temporal view of procrastination and its potential cognitive underpinnings. A possible explanation for these results might be that people with poorer prospective memory are less likely to be future oriented which makes it more possible for delayed performance. Prospective memory should be used by the individual to maintain the intended action and final goal during the whole procrastination time frame. As such, individuals who lack prospective memory (e.g., they may temporarily forget the intention and cannot retrieve it) may be less likely to focus on their future and then voluntarily shift their attention to other activities. This could support Altgassen et al. 's (2019) claim that people's prospective memory ability contributes to procrastination behaviour. However, unlike task delays that could simply result from forgetting a prospective task, procrastination represents a voluntary behaviour. In other words, procrastinators consciously delay tasks. In this context, we cannot conclude that people procrastinate because of forgetting.

An alternative interpretation of the finding that procrastination is predicted by prospective memory in the mediation models might be that there are mixed components of simple delay caused by prospective memory failure and voluntary delays since almost procrastination measures are focused on procrastinators' metacognition about their procrastination experiences and final tasks performance (Lay, 1986; Sirois et al., 2019; Zuber et al., 2021). Given that there is a theoretical distinction between procrastination and simple delayed behaviour (Lay & Silverman, 1996; Steel et al., 2018; Svartdal et al., 2018), a common consensus is that procrastination is a specific voluntary delay which is extracted from general task delay. Meanwhile, task performance can be predicted by memory capacity (McBride et al., 2011; McVay & Kane, 2012) and successful task performance requires

prospective memory (Kliegel et al., 2011; McDaniel & Einstein, 2007), providing plausible evidence that memory capacity may link to task delay. Thus, a key to understanding the observed mediation models is related to an explanation of whether voluntary delay is confounded with general task delay in procrastination measures. I propose that procrastinators may unconsciously delay tasks when they fail to remember to do something during a time frame. According to Svartdal et al. (2018), procrastinators are more likely to voluntarily delay tasks in the early stage. This proposition is consistent with the findings of Tice and Baumeister (1997) that students tend to procrastinate early in the semester. Such voluntary delay may have negative consequences over time. For instance, procrastination may lead to forgetting what to do in the future (Zuber et al., 2021). It is possible that the tasks might then be unconsciously delayed for longer periods in the situation when procrastinators can not remember the intended action. At the final stage, task performance could be resulted from a combination of voluntary delay and unconscious delay. In this case, it is likely that both types of delay could be confounded when measuring procrastination. On the one hand, as the items in General Procrastination Scale focus on factors that address habitual or problematic behavioural delay (Lay, 1986; Sirois et al., 2019; Svartdal & Steel, 2017), this subjective measure focuses on the evaluation of post-procrastination behaviour. On the other hand, the final task performance or the number of days an individual delayed on a task is measured as an index of procrastination in the objective behavioural procrastination tasks. As the research methods stand, neither subjective procrastination scales nor objective procrastination tasks can separate the contribution of voluntary delay from the follow through of behavioural process when there is a possibility that behavioural delay could be caused by forgetting during the period. In research context, it is possible that both the results of voluntary delay and behavioural delay caused by prospective memory failure contribute to the final procrastination score. Given that only a longitudinal study could make causal

inferences, we cannot make any statement of direction of the relations based on current methods and results. Our mediation models provide insights on the mechanisms underlie the association between prospective memory and procrastination behaviour. A bidirectional relation between prospective memory and procrastination may be a promising explanation for how procrastination happens in a time frame.

Furthermore, given the measure of the future time perspective is focused on positive aspect (e.g., “Meeting tomorrow's deadlines and doing other necessary work comes before tonight's play”; Zimbardo & Boyd, 1999), such results are important considering the important role of affect in procrastination (Ferrari, 2001; Sirois & Pychyl, 2013; Steel, 2007). In terms of mediating effect of future time perspective in the relationship between prospective memory and procrastination, a possible interpretation is that poor prospective memory may lead to procrastinators forgetting about the goals (positive outcomes) from doing the task and putting off the intended tasks, because they only consider negative aspects and forget the positives. According to Ferrari (2001), procrastinators may dismiss future intended goals to reduce current anxiety. In line with this, reducing current tension could be viewed as the goal of procrastination, which could be supported by the proposed mood regulation model of procrastination (Pychyl & Sirois, 2016; Sirois & Pychyl, 2013; Tice & Bratslavsky, 2000). Our results about the positive correlation between self-reported procrastination and present time perspective could also be evidence to support this view. Following the explanation, the future time perspective seems to fit better in understanding the proposed behavioural process underlying procrastination. In the context of procrastination, it is possible that under the impact of task anxiety, procrastinators may be more likely to forget the positive side of their intended task. This point could be supported by the idea that forgetting of negative memories may be part of emotion regulation, which indicates that people tend to forget negative memories in favour of optimism (Norby, 2018).

5.3 Initial Theoretical Framework

Following the interpretation of the main findings about the association between procrastination and prospective memory, several theoretical perspectives were considered which could account for the current findings.

5.3.1 Emotional Arousal and Memory Binding

One possible explanation for the detected affect towards task remembering is memory binding. With respect to affect of task remembering, our findings are in accord with the framework of emotional arousal and memory binding (Mather, 2007). Specifically, in order to remember an event accurately, not only the event itself, but also various elements of the event are bound together and maintained in memory. Thus, it seems that memory with emotional arousal could be enhanced and is more likely to be remembered than non-emotional memory. Many studies have confirmed that emotional arousal increases the likelihood that items will be remembered (Dev et al., 2022; Easterbrook, 1959; Grider & Malmberg, 2008; Kensinger, 2007), and this account could be applied to both positive and negative emotions (Madan et al., 2019). For example, it has been suggested that positive and negative emotions can lead to greater cognitive processing and contribute to better memory (Dev et al., 2022; Fredrickson & Branigan, 2005). Our qualitative data in Study 1 showed that mixed valence (positive/negative) reported from procrastinators is associated with task remembering. It is possible that the intended task may be less likely to be forgotten as its valence feature may enhance the memory of the task. This could be opposite with the detected negative association between prospective memory and the negative affect of task remembering (see correlation results in Study 2). In a temporal frame, if the emotional memory about the tasks could be better maintained, then the task should be more likely to be executed instead of being forgotten. However, this is in opposition to the proposed negative association between prospective memory and procrastination.

There is an alternate possibility, however, which could be more promising. Previous research has suggested that arousal may impair associative memory binding (Bisby & Burgess, 2017). For instance, it is demonstrated that arousal level can narrow one's attentional focus (Moulds & Bryant, 2006). Besides, Zimmerman and Kelley (2010) argued that emotionality does not globally enhance memory, but rather has specific effects depending on the valence and task. Specifically, it demonstrates that emotional enhancement is only applied in positive emotion, but not negative emotion (Zimmerman & Kelley, 2010). This is in line with Grider and Malmberg's assumption that emotion plays an essential role in the allocation of attentional resources (2008). In this regard, procrastinators may be more likely to forget the intended task due to the bound negative affect. Our results showed that negative affect is related to task remembering. This association may be particularly problematic for procrastinators, because their task-related memory may be impaired when they experience negative affect.

With respect to the relationship between procrastination and prospective memory, our findings support the notion that the ability of remembering to do something in the future may link to procrastination. Within the time frame of the task, procrastinators may focus more on the task-related affect instead of the intended task. As correlation analysis confirmed, higher negative affect is associated with poorer prospective memory in procrastination context, meaning that procrastinators may be more likely to forget planned tasks when they experience increasing negative affect. Considering the impact of negative affect, it is plausible to assume that experiencing negative affect might shift individuals' attention allocation from task to task-related negative affect, which in turn results in worse task-related memory. In other words, procrastination can increase prospective memory failure as the negative affect associated with procrastination experiences may distract from the planned

tasks and lead to forgetting to perform planned tasks. This could be an explanation for Zuber's (2021) findings that prospective memory failures can be predicted by procrastination.

In line with the framework of emotional arousal and memory binding, there could be a trade-off between memory for emotional components of an event and memory for perceptual components of an event, and this trade-off depends on which components receive more attention (Hashtroudi et al., 1994; Subramaniam et al., 2000). Specifically, the trade-offs in memory relies on whether individuals pay more attention to the events or to the valence among the events (Hockley & Cristi, 1996). In other words, cognitive emotional processing could direct attention toward either events or their associations. Accordingly, negative affect may swamp attention and lead procrastinators to pay more attention to the negative affect instead of the aversive tasks, presumably because less source-specifying information was bound to the tasks. This could be consistent with the argument that arousal may shift attention and lead individuals to pay less attention to important information (Mandler, 1975). A related piece of evidence is that procrastinators are observed to lack perseverance (Dewitte & Schouwenburg, 2002), the ability to maintain focus on difficult tasks (Whiteside & Lynam, 2001), implying that it is difficult for procrastinators to focus on the intended tasks. Similarly, Rebetez et al. (2016) suggest that procrastinators may have difficulty resisting the entry of task-irrelevant positive information into memory. Thus, procrastinators may be more likely to forget intended tasks when they focus more on affect than on intended tasks. This may explain why procrastinators tend to make more prospective memory failures.

Taken together, even though the role of prospective memory showed consistency across all three studies, notable differences may emerge in the emphasis placed on the various effects of affect in the relationship between prospective memory and procrastination (e.g., task focused or negative affect focused). As most intended tasks require sustained attention to

the tasks over time, completing them depends on a series of cognitive mechanisms that may underlie procrastination. Specifically, the task-related memory could be enhanced due to its valence feature, which seems to ensure that tasks could be executed instead of being forgotten. Our research expands on the investigated critical role of negative affect by highlighting the potential links between negative affect and memory ability in procrastination context. The findings that procrastination is negatively related to prospective memory in current studies indicate that individuals, who have poorer ability to remember to perform planned actions after a certain delay, may be more likely to procrastinate. A possibility is that prospective memory is weakened as less attention is paid to the intended tasks. Paying attention to the negative affect of the tasks, rather than tasks, may be important to understand the negative association between procrastination and prospective memory. For example, experiencing negative affect may impair individuals' ability to engage in prospection, in which context they are more inclined to make irrational decisions (Worthy et al., 2014). Negative affect and memory ability may act as part of a potential system that regulates the cognitive process underlying procrastination. However, no significant mediating effect between procrastination, negative affect and prospective memory was detected from the current data. It is promising and interesting for future research that aims to investigate how prospective memory relates to procrastination, and how negative affect links to procrastination and the cognition underlying dilatory behaviour.

5.3.2 Delay Discounting Theory

One view that can explain the finding of the mediating effect of future time perspective in the relationship between prospective memory and procrastination is the delay discounting theory. According to the theory, delay discounting refers to the process of devaluing a future larger reward in favour of a smaller, immediate reward (Kirby & MarakoviĆ, 1996), which implies the cognitive processes underlying the decision-making

and its conceptual association with time perspective. Steel (2007) has demonstrated that delay discounting may play a role in procrastination. According to this theory, completing the future intended task could represent a larger reward, and engaging in other pleasant activities could represent a smaller, immediate reward. In the context of delay discounting, procrastination could be considered the priority of an immediate competing alternative activity over the delay to work on an intended task. In other words, the rewards associated with the final task completion may seem less attractive than the more immediate benefits of task delay. This view has been suggested in previous studies in terms of the temporal discounting in procrastination (Grund & Fries, 2018; Sutcliffe et al., 2019; Wypych et al., 2018). Our results showed that future time perspective was positively related to prospective memory, but negatively related to procrastination, which suggested that procrastinators may be less likely to remember what to do in the future when the devalued future intended task due to the delay discounting.

According to the framework of delay discounting theory (Frederick et al., 2002; Kirby & Herrnstein, 1995; Kirby & MarakoviĆ, 1996; Odum, 2011), one possible interpretation to the detected relationship between procrastination and prospective memory is that the future intended task may be more likely to be forgotten as it may be devalued, which then contributes to worse task performance. Specifically, in the potential behavioural process underlying procrastination, the positive reward of completing future tasks could be devalued depending on how long the duration of the task is. Although the duration of the tasks varies from hours to months in daily life, this could still indirectly support the proposed task forgetting within the temporal frame of the task. From this perspective, the devalued distant future intended tasks may make it less necessary for procrastinators to maintain them in mind, and thus are more likely to be irrationally delayed.

Combining the proposition that negative affect may link to the relationship between prospective memory and procrastination leads us to take affect into account to interpret how delay discounting theory explains the association between prospective memory and procrastination. Our results suggest that the relationship between more prospective memory failure and higher procrastination was mediated via a less tendency of future time perspective. Despite the interpretation that prospective memory may be impaired by delay discounting which may result in forgetting within the temporal frame of the task, another possibility is that when most attention is paid to the associated affect, rather than the future tasks, individuals' future time perspective may be weaken, which makes them less likely to pay attention to the future intended tasks. Namely, the delay discounting effect may be enhanced by less future time perspective. This assumption could be supported by Peters and Büchel's suggestion (2010) that future thinking could reduce delay discounting effect.

Accordingly, it is possible that prospective memory may link to procrastination in different situations, where procrastinators may be more likely to forget the devalued intended tasks, while the delay discounting effect is enhanced by less future time perspective. On the one hand, intended tasks could be devalued depending on how long the temporal period is, and prospective memory failures may be more likely to happen to the devalued tasks. For example, it has been suggested that individuals tend to remember more important information and forget less important one (Castel et al., 2012; Murphy & Castel, 2021). Accordingly, when individuals fail to remember future tasks, the task could be further delayed. That is, given the delay discounting effect within the temporal frame of the task, poorer prospective memory is associated with higher procrastination, which is what we found in current research. On the other hand, the delay discounting effect may be enhanced by reduced positive perspective towards the future. According to Worthy et al. (2014), negative affect may impair individuals' prospection about long-term future reward, which implies that higher

level of negative affect may enhance delay discounting. Furthermore, previous research suggest that positive future thinking or positive memory retrieval could also reduce delay discounting (Lempert et al., 2017; Peters & Büchel, 2010). Thus, the delay discounting theory could strongly support our interpretation about the potential role of future time perspective in the relationship between prospective memory and procrastination.

5.4 Implications

Though the temporal view of procrastination has been fruitful in increasing our understanding of cognitive processes underlying procrastination, it does not completely cover the mechanism during the whole procrastination time frame. According to previous theories and empirical findings, it is reasonable to consider that procrastination could be an ongoing problematic behaviour after the intention is formed. That means it does not only occur at one specific time point but during a time frame. Following the indication of the temporal view of procrastination (Sirois & Pychyl, 2013), the cognitive processing could reflect prioritising short-term mood repair over long-term goal pursuit only. However, this emphasised "short-term" does not reflect the potential complexity of cognitive processes that may be involved in the whole time frame. Considering the temporal nature of procrastination, there could be a huge gap between the intention and the actual action. Our findings could help to better understand how procrastination happens in this time frame.

The present research identifies the role of prospective memory in procrastination that could have many implications. There are two major implications of the present findings. First, research and theory that better integrate the role of prospective memory needs greater attention when it comes to the behavioural process underlying procrastination, because increasing evidence suggests that prospective memory is related to procrastination (e.g., Altgassen et al., 2019; Zuber et al., 2021). Although there is no direct evidence from previous research that prospective memory is linked to the relationship between procrastination and

negative affect, it is possible that instead of serving as a negative affect arousal, prospective memory, up to a point, is positively correlated with increases in motivation to achieve future goals which would then help to regulate the negative impacts of affect (self-regulation).

Secondly, the findings in present studies are consistent with the idea that procrastination might undergo an independent behavioural process in which prospective memory is involved. According to Steel et al. (2018), procrastinators are susceptible to the temporal disconnection between the intention and the actual planned action, which could be consistent with the proposed temporal frame of procrastination. In line with this, it is suggested that behavioural delays occur in early phases of action implementation (Svartdal et al., 2018). Extended from this idea, our findings of the association between procrastination and prospective memory suggest that prospective memory might contribute to procrastination following the early phases of action implementation, which bring new insights to understand procrastination through a whole dynamic approach and its potential underlying cognitive processes.

Furthermore, discussions of the findings about the relationships between procrastination and prospective memory must also consider the notions of self-report measures in current research. Taking the measure of prospective memory for example, the method is used to assess the frequency of various kinds of prospective memory failure, and make inferences about prospective memory ability (Uttl & Kibreab, 2011). The measurement is the evaluation participants make of their prospective memory abilities. In other words, it can be described as memory self-efficacy (MSE) about participants' usual ability to carry out prospective memory tasks (e.g., I often forget to buy something I planned to buy). According to a meta-analysis study conducted by Beaudoin and Desrichard (2011), there is likely some variability in the correlation between self-report prospective memory score and objective prospective memory task performance, and this inconsistency may be due to the different task

features. Hence, it is uncertain whether the score reflects general prospective memory ability, or metacognition about how people perceive their prospective memory ability in specific memory tasks. The measurements of procrastination (self-report vs. naturalistic behavioural task) could be similar (Svartdal & Steel, 2017; Zuber et al., 2020).

Considering the collected metacognitive information through the self-report measures, a possible explanation is that individuals' procrastinatory behaviours link to their general perceptions of prospective memory abilities, and their general ability to carry out prospective memory tasks may contribute to procrastination. This is consistent with Bandura's self-efficacy theory (1977), which suggests that people who have lower efficacy for their capacities perform worse on tasks. As it is mentioned above, the differences between the self-report measures and objective behavioural measures could contribute to the inconsistencies in the relation between procrastination and prospective memory. Thus, one possible explanation for the obtained negative correlations between procrastination and prospective memory is that individuals who believe that they are not capable of successfully remembering and completing future intended tasks would be more likely to procrastinate. This finding provides a new angle to look into how procrastination happens.

5.5 Research Limitations

Although this project presents several strengths, the overarching limitations of the three studies within this thesis, such as limitations of cross-sectional design, potential biassed reports on subjective measures and potential confounders in naturalistic design, should be acknowledged.

First, it is notable that the three studies in the present thesis use cross-sectional designs. The detected relationship between procrastination, prospective memory and time perspective provide no direct evidence regarding underlying mechanisms. Such a finding would not demonstrate that the capacity of prospective memory impacts on procrastinators

performance. Our results, especially the results about the mediating effect of future time perspective, could suggest a basic role for prospective memory, namely that procrastination behaviour may be predicted by prospective memory. It is worthy noting, however, that such demonstration does not guarantee the accuracy of this predicting role for out-of-sample data. Even though the detected mediating effect is not very strong, it helps to understand the potential process that prospective memory might be weakened by less future time perspective and then result in worse procrastination. This is an interesting idea but it is not sufficient according to current findings. To better advance the understanding about this relationship, the path directed from prospective memory to procrastination in our model requires further investigation with longitudinal studies.

Second, most of the variables in the three studies were assessed with self-report measures, it is possible that the responses may be biassed. Even some of the self-reported measures have been broadly applied with adequate reliability, they are still criticised by the poor validity (Uttl & Kibreab, 2011). In other words, what participants reported about their behaviour may not always reflect the real behaviour and relevant underlying cognitive mechanism, as they may not know why they voluntarily delay or forget the task nor how they feel about their behaviour afterwards. Thus, the results of the study have to be treated cautiously.

In addition, one of the limitations, which is worthy to mention in current research, is the analytical consequences of carrying out multiple testing. The problem of multiple testing may cause chance finding, which means that the findings may be more likely results of chance and the significance from current research may not be applied to the whole population. In other words, the more tests you run on a sample, the more likely there is a chance finding. Taking mediation analysis for example, there are multiple testing conducted through different mediation models. Theoretically, when we tested different variables (IV, DV

and M) within the proposed mediation model, there were multiple predictors. Due to multiple testing, the probability of false positives could arise. However, according to the findings in current research, most of the *P* values presented are < .001, which could account for the multiple testing, indicating that it is less likely to be a chance finding. Besides, bootstrapping is nonparametric resampling technique, which has been found not to inflate type I and type II error rates (Fritz & MacKinnon, 2007), and it avoids some of the issues of traditional statistical significance testing as its approach does not assume multivariate normality (Carpenter, 2002; Thompson, 1993). These can ensure that the associations detected in current research are more likely real rather than chance. Even so, future researchers should be cautious when attempting to interpret these conclusions drawn in current research.

Furthermore, despite the fact that controlled processes on naturalistic tasks, there are still a few confounders that lack appropriate control, which could be another limitation in current research. Taking naturalistic prospective memory tasks for example, it is possible that participants' send-back responses may be influenced by their different daily workloads. Particularly, since Study 2 and Study 3 took place during the COVID-19 pandemic, the external activities may impact the task engagement. That makes our research necessary to develop new laboratory-based or naturalistic designs to assess the relationships between prospective memory and procrastination. Focus on the procrastinators' behaviour could allow us to observe the behaviour in the absence of subjective biases and explore the underlying cognitive mechanism of procrastination.

5.6 Directions for Future Research and Procrastination Interventions

5.6.1 Directions for Future Research

Even though there is plenty of procrastination research that bear fruitful findings, the procrastination may be oversimplified in practical research work from some perspectives, the neglected cognitive mechanisms and the underlying behavioural process, for example.

Expanding from the investigated role of prospective memory in this thesis, the procrastination research would be greatly improved through addressing specific questions regarding its potential cognitive and behavioural process. For example, given the behavioural and temporal nature of procrastination, how does procrastination happen in a time frame? What cognitive mechanisms are involved in these behavioural processes?

Extended from the findings about the role of subjective time perspective regarding the relationship between prospective memory and procrastination, another important avenue for future research is whether objective time recognition(i.e., time perception) explains the relationships between these two domains. Time perception refers to the ability to accurately perceive the passage of time (Block & Zakay, 2008). In order to complete an intended task within a duration, one may not only need to remember the task-related information (e.g., when does he/she plan to take action) but also the duration of the task (e.g., how much time rest for completing the task). Basically, the time perception does not simply reflect the actual duration of an event, but relies on other factors. Research reveals that the remembered duration of an event is impacted by the process-context, for example, individuals tend to overestimate the duration under emotional-context (Brunot, 2004; Droit-Volet, 2013). Given the highlighted role of negative affect in procrastination and the detected mediating effect of future time orientation between prospective memory and procrastination, the time perception seems to be a particularly important variable to consider with regard to the problem of procrastination. Steel (2007) has firstly proposed the potential role of time perception in procrastination in his systematic review work. But, so far, there is no evidence to support this view. Research shows that procrastination was associated negatively with future time orientation (Ferrari & Díaz-Morales, 2007), and our results have replicated this finding. It is urgent for the future researchers to consider time perception in order to better understand the

cognitive underpinnings of procrastination. Building on this, the temporal view of procrastination could be further developed.

Given the continuing arguments on the procrastination definition and its related concepts, it is premature to conclude that procrastination performance assessment is better than self-report measure. However, the existing literature on behavioural procrastination and behavioural procedures (as well as other cognitive domains, including cognitive process, prospective memory) generally supports this contention. An over-reliance on self-report measures of procrastination, which reflect more general and habitual information, and a lack of attention to potentially cognitive underpinnings has raised questions about whether the results from self-report measures could directly reflect the links of potential factors to procrastination and exert the influence on procrastination.

Besides, the variation in secondary outcome from self-reported measures made it more and more necessary for researchers to consider the objective measures in order to aggregate the research results. Fortunately, there are groups of researchers who have set up designs with behavioural measures to test procrastination which have been tested with good validity compared with self-report measures. Introducing the multiple approach to procrastination research will help us to better understand and better explain procrastination. For instance, it permits more scope for understanding individual differences in behavioural processes (e.g., under task anxiety, why someone is prone to procrastinate while others could take actions and complete tasks in time), because peoples' behaviours may differ in the degree to which they perceive their ability or are influenced by objective cognitive capacity. So it would be interesting for future research to consider this point and conduct studies to address this.

5.6.2 Directions for Procrastination Interventions

Based on overall findings about the role of prospective memory in procrastination, it could be implied that interventions focusing on improving people's awareness of what they planned to do in the future and paying more attention to the positive side of intended tasks may have effects on reducing procrastination. The episodic future thinking, for example, seems to be promising as a procrastination intervention. Basically, episodic future thinking refers to the ability to travel forward in time and pre-experience prospective events (Atance & O'Neill, 2001). One might be tempted to be engaged in more pleasant activities and irrational delay the intended task when there is a disconnection between present and future. Alternatively, one might be motivated and take action to reach the future goal when they prospectively think about tasks. This proposition could be consistent with the suggestion that the episodic future thinking could help people to make more rational decisions, as people tend to neglect current motivations when previewing distant events and relevant outcomes (Boyer, 2008; Sasse et al., 2015). Besides, our studies highlighted the role of the positive future time perspective. As present-future disconnection is often the case in procrastination (Sirois & Pychyl, 2013; Steel, 2007), targeted attempts to foster such tendency may particularly benefit individuals who are likely to forget the intended task and tend to procrastinate.

There are several reasons why episodic future thinking could be a potential intervention for reducing procrastination. One consideration is that there are potential boundary conditions under which task forgetting may contribute to procrastination. It was noted during the current research that procrastination is negatively associated with prospective memory. Episodic future thinking may enable individuals to recognise their future intention and and get them familiar with when they plan to take action, which may help procrastinators to remember to take action on their own, and thus, reduce

procrastination. This interpretation could be supported by Krause and Freund's (2016) finding that focusing on the process of the intended task is linked to lower levels of procrastination, and this is consistent with the previous notion that lacking attention to the intended task may count for procrastination. Another reason to propose the episodic future thinking in reducing procrastination is that episodic future thinking is a reliable interference to reduce the effects of delay discounting (Rung & Madden, 2018). It is possible that episodic future thinking applies to situations in which people could be motivated by thinking about future tasks and taking action. Furthermore, it has also been investigated that guided episodic thinking could increase anticipated pleasure for positive future events and evoke behavioural intention (Hallford et al., 2020), which provides evidence to support our argument. However, it should be noted that the content of episodic future thinking is not future task specialised and there is not enough evidence existing yet to indicate whether remembering future tasks is the case, so it is possible that the episodic future thinking focused on intended tasks and positive sides of the tasks are more effective than others.

5.7 General Conclusion

Throughout the thesis, the results point to the importance of the relevant cognitive factors featured in procrastination. The findings offer persuasive evidence for the role of prospective memory in procrastination, implying that individuals who believe that they are not capable of successfully remembering and completing intended tasks would be more likely to procrastinate, and lack of ability of prospective memory may contribute to dilatory behaviour. But no cause–effect can be established from current data due to the cross-sectional designs. Even though the mediation models support the assumption that prospective memory may contribute to procrastination, longitudinal designs are required in future research to better investigate whether prospective memory has effects on procrastination. This thesis also features in investigating the role of prospective memory in the relationship between

procrastination and negative affect, which suggests that people may be more likely to procrastinate as they only consider negative aspects and forget the positives about intended tasks. The mediation models in this thesis suggest that negative affect and time perspective could be the potential concepts to explain the association between prospective memory and procrastination. This could be a novel approach to explore the potential cognitive mechanisms of procrastination and contribute to a better understanding of this problematic behaviour. Hence, interventions that help people remember what they planned to do and pay more attention to the positives of intended tasks could be important to reduce and prevent procrastination. However, these findings call into question the validity of current procrastination measures which may confound voluntary delay and other types of delay. Ultimately, it might be a problem of theoretical argumentation on the distinctions between procrastination and behavioural delay. Given the behavioural and temporal nature of procrastination, it may be promising and important for future research to consider other types of delays in addition to voluntary delay to explain how procrastination happens. By doing so, it could broaden how we think about the mechanisms underlying procrastination.

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Appendix A: General Procrastination Scale (9-items version)

Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

1. I often find myself performing tasks that I had intended to do days before.

False (1)

Not usually true for me (2)

Sometimes false/true for me (3)

Mostly true for me (4)

True of me (5)

2. Even with jobs that require little else except sitting down and doing them, I find they seldom get done for days.

False 1 2 3 4 5 True of me

3. I generally delay before starting work I have to do.

False 1 2 3 4 5 True of me

4. In preparing for some deadlines, I often waste time by doing other things.

False 1 2 3 4 5 True of me

5. I often have a task finished sooner than necessary.

False 1 2 3 4 5 True of me

6. I usually buy even an essential item at the last minute.

False 1 2 3 4 5 True of me

7. I usually accomplish all the things I plan to do in a day.

False 1 2 3 4 5 True of me

8. I am continually saying I'll do it tomorrow.

False 1 2 3 4 5 True of me

9. I usually take care of all the tasks I have to do before I settle down and relax for the evening.

False 1 2 3 4 5 True of me

Appendix B: Prospective and Retrospective Memory Questionnaire

In order to understand why people make memory mistakes, we need to find out about the kinds of mistakes people make, and how often they are made in normal everyday life. We would like you to tell us how often these kinds of things happen to you. Please indicate by ticking the appropriate box.

1. Do you decide to do something in a few minutes' time and then forget to do it?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

2. Do you fail to recognize a place you have visited before?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

3. Do you fail to do something you were supposed to do a few minutes later even though it's there in front of you, like taking a pill or turning off the kettle?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

4. Do you forget something that you were told a few minutes before?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

5. Do you forget appointments if you are not prompted by someone else or by a reminder such as a calendar or dairy?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

6. Do you fail to recognize a character in a radio or television show from scene to scene?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

7. Do you forget to buy something you planned to buy, like a birthday card, even when you see the shop?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

8. Do you fail to recall things that have happened to you in the last few days?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

9. Do you repeat the same story to the same person on different occasions?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

10. Do you intend to take something with you, before leaving a room or going out, but minutes later leave it behind, even though it's there in front of you?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

11. Do you mislay something that you have just put down, like magazine or glasses?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

12. Do you fail to mention or give something to a visitor that you were asked to pass on?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

13. Do you look at something without realizing you have seen it moments before?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

14. If you tried to contact a friend or relative who was out, would you forget to again later?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

15. Do you forget what you watched on television the previous day?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

16. Do you forget to tell someone something you had meant to mention a few minutes ago?

Never (5) Rarely (4) Sometimes (3) Quite Often (2) Very Often (1)

Appendix C: Zimbardo Time Perspective Inventory

Please read each item and, as honestly as you can, answer the following question: "How characteristic or true is this of you?"

1. I believe that getting together with one' friends to party is one of life's important pleasures.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

2. Familiar childhood sights, sounds, smells often bring back a flood of wonderful memories.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

3. Fate determines much in my life.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

4. I often think of what I should have done differently in my life.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

5. My decisions are mostly influenced by people and things around me.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

6. I believe that a person's day should be planned ahead each morning.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

7. It gives me pleasure to think about my past.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

8. I do things impulsively.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

9. If things don't get done on time, I don't worry about it.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

10. When I want to achieve something, I set goals and consider specific means for reaching those goals.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

11. On balance, there is much more good to recall than bad in my past.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

12. When listening to my favourite music, I often lose all track of time.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

13. Meeting tomorrow's deadlines and doing other necessary work comes before tonight's play.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

14. Since whatever will be will be, it doesn't really matter what I do.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

15. I enjoy stories about how things used to be in the "good old time."

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

16. Painful past experiences keep being replayed in my mind.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

17. I try to live my life as fully as possible, one day at a time.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

18. It upsets me to be late for appointments.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

19. Ideally, I would live each day as if it were my last.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

20. Happy memories of good times spring readily to mind.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

21. I meet my obligations to friends and authorities on time.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

22. I've taken my share of abuse and rejection in the past.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

23. I make decisions on the spur of the moment.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

24. I take each day as it is rather than try to plan it out.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

25. The past has too many unpleasant memories that I prefer not to think about.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

26. It is important to put excitement in my life.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

27. I've made mistakes in the past that I wish I could undo.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

28. I feel that it's more important to enjoy what you're doing than to get work done on time.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

29. I get nostalgic about my childhood.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

30. Before making a decision, I weigh the costs against the benefits.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

31. Taking risks keeps my life from becoming boring.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

32. It is more important for me to enjoy life's journey than to focus only on the destination.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

33. Things rarely work out as I expected.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

34. It's hard for me to forget unpleasant images of my youth.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

35. It takes joy out of the process and flow of my activities, if I have to think about goals, outcomes, and products.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

36. Even when I am enjoying the present, I am drawn back to comparison with similar past experiences.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

37. You can't really plan for the future because things change so much.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

38. My life path is controlled by forces I cannot influence.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

39. It doesn't make sense to worry about the future, since there is nothing that I can do about it anyway.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

40. I complete projects on time by making steady progress.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

41. I find myself tuning out when family members talk about the way things used to be.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

42. I take risks to put excitement in my life.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

43. I make lists of things to do.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

44. I often follow my heart more than my head.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

45. I am able to resist temptations when I know that there is work to be done.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

46. I find myself getting swept up in the excitement of the moment.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

47. Life today is too complicated; I would prefer the simpler life of the past.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

48. I prefer friends who are spontaneous rather than predictable.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

49. I like family rituals and traditions that are regularly repeated.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

50. I think about the bad things that have happened to me in the past.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

51. I keep working at difficult, uninteresting tasks if they will help me get ahead.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

52. Spending what I earn on pleasures today is better than saving for tomorrow's security.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

53. Often luck pays off better than hard work.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

54. I think about the good things that I have missed out on in my life.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

55. I like my close relationships to be passionate.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)

56. There will always be time to catch up on my work.

very untrue (1) untrue (2) neutral (3) true (4) very true (5)