Cognitive and Affective Aspects of Personality and Academic Procrastination: The Role of Personal Agency, Flow, and Executive Function

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‘COGNITIVE AND AFFECTIVE ASPECTS OF PERSONALITY AND ACADEMIC PROCRASTINATION: THE ROLE OF PERSONAL AGENCY, FLOW, & EXECUTIVE FUNCTION’

by

Marc Graff

A dissertation submitted to the Graduate Faculty in Educational Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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ACADEMIC PROCRASTINATION

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Marc Graff

This manuscript has been read and accepted for the Graduate Faculty in Educational Psychology in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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THE CITY UNIVERSITY OF NEW YORK
Abstract

‘Cognitive and Affective Aspects of Personality and Academic Procrastination: The Role of Personal Agency, Flow, & Executive Function’

by

Marc Graff

Advisor: Jay Verkuilen

Academic procrastination is a prevalent issue that affects school-related and other experiences of many students, with some studies identifying as many as a third of college students sampled as ‘severe’ procrastinators. This study investigated some of the factors previous studies have identified as potential contributors to procrastinating in the academic arena. In defining procrastination as a self-regulation issue, it is proposed that distinct executive function processes play a role in one’s efforts at academic task engagement and completion and resisting the tendency to procrastinate on these tasks. It is also proposed that the frequency with which one experiences ‘flow’, a state of total concentration and absorption, when working on academic tasks (e.g. writing a paper, studying for exams) would act as a motivator and enabler of staying on-task, and therefore be negatively related to the tendency to procrastinate on academic tasks. It is further proposed that one’s belief in their general self-efficacy, a measure thought to reflect one’s sense of personal agency, will predict the frequency with which one experiences negative or positive affect and thereby proneness to entering flow states. Lastly, it is proposed that the frequency with which one experiences flow in learning will interact with the relationship of EF processes to academic procrastination, shielding one’s efforts at task completion from the influence of EF deficits. This study investigated the role of gender as a possible moderator of the relationships mentioned above.
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One of the EF measures of inhibitory control was found to predict higher rates of procrastination on a subjective report of academic procrastination (self-report of the extent of one’s procrastination behaviors) for those identified as low in their frequency of flow-experience on academic tasks, although this relationship was not observed for two other measures of inhibitory control. This same EF measure predicted higher rates of procrastination as measured by the discrepancy between participants’ report of their intended and actual time spent on specifically stated academic tasks. Flow-frequency and positive affect predicted higher -- and negative affect lower -- levels of procrastination on the subjective measure, but lost their predictive power when a measure of self-regulatory self-efficacy was included as a predictor. General self-efficacy predicted higher levels of procrastination on the measures mentioned above (though for one this relationship only approached statistical significance), as well as on a measure of the discrepancy between a report of the intended and actual amount of specifically stated academic tasks participants reported doing, a relationship that was contrary to expectations. Self-regulatory self-efficacy (predicting lower levels of procrastination) emerged as the predictor having the strongest effect on academic procrastination; it and general self-efficacy were the most reliable predictors, in terms of the number of procrastination measures they were found to predict. The suggestion of the link between general self-efficacy, affect, and flow-frequency was confirmed with regard to positive but not negative affect. Gender differences were observed for the relationship of the EF measure of inhibitory control mentioned above and negative affect and procrastination measured by the discrepancy between participants’ report of their intended and actual time spent on specifically stated academic tasks: these relationships were found to be significantly stronger for males than for females.
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Introduction

Writing on the topic of procrastination is something like the experience of having a conversation with another while facing a mirror: it’s difficult not to feel self-conscious. In the process of working toward a goal (such as writing a thesis), one is confronted with a great many opportunities to procrastinate. The frequency with which the subject arises when it relates to an individual’s goal-related efforts is matched by its pervasiveness in the general public (e.g. Harriot & Ferrai, 1996; Klassen et al., 2010).

One encounters a variety of definitions of procrastination in the research literature. Some of these are more general, and define procrastination solely in terms of its behavioral properties, as in ‘postponing tasks’ (e.g. Schouwenberg, 1995). Others include affective aspects associated with procrastination, as in a needless delay that causes its agent stress and discomfort (e.g. Solomon & Rothblum, 1984). Still other definitions incorporate the psychological context, as in a delay in which an intention to act is not carried out (e.g. Lay 1994). Being that the primary focus of this study is to investigate the possible role of specific cognitive functions and affective states in facilitating the actualization of intended behavior, the working definition of procrastination I will use is in line with the last of those mentioned above: ‘Procrastination’ is any delayed activity that entails a discrepancy between an intention to act and actual behavior.

For as long as there have been people attempting to accomplish (and putting off) tasks, procrastination has probably been a topic of discussion. One of the earliest known written allusions of negative outcomes associated with delaying tasks is Ecclesiastes (about 3000 years ago): ‘With laziness the ceiling will weaken’. In about 800 BC, the Greek poet Hesiod wrote: ‘Do not put your work off till to-morrow and the day after; for a sluggish worker does not fill his barn, nor one who puts off his work etc.’ (p.405-413). Samuel Johnson (1751) gives a description of the challenges associated with procrastination, and its pervasiveness, in an article of the same title: ‘The folly of allowing ourselves to delay what we know cannot be finally
escaped is one of the general weaknesses which, in spite of the instruction of moralists, and the remonstrances of reason, prevail to a greater or lesser degree in every mind; even they who most steadily withstand it find it, if not the most violent, the most pertinacious of their passions, always renewing its attacks, and, though often vanquished, never destroyed.’

A good deal of research has been devoted to procrastination in more recent years, investigating topics that include its prevalence in the general population (e.g. Harriott & Ferrari, 1996), its invasiveness in daily routines (e.g. Pychyl, 2000), and its consequences in terms of both performance (e.g. Steel et al., 2001) and psychological and physical well-being (e.g. Tice and Baumeister, 1997). A brief review of the findings of these and other related studies follows in order to provide an illustration of the pervasiveness of and negative effects associated with procrastination.

**Literature Review**

Harriott and Ferrari (1996) had a sample of 211 adults complete survey measures of procrastination. The results of the study indicated that 20% of this sample reported falling under the label ‘chronic procrastinators’. Pychyl et al. (2000) utilized the ‘beeper paradigm’ (Czikszentmihalyi & Larson, 1987) to study the habits of undergraduate students. The students were signaled several times a day and asked to report on their current behavior for 5 days preceding an academic deadline. According to sample responses, on average the students spent one-third of their day procrastinating. Steel et al. (2001) observed the performance of undergraduate students at six points during an introductory psychology course, concluding that procrastination was found to be an ‘excellent’ (negative) predictor of performance, and that this was related to procrastinators’ larger than average gap between their intentions and actual behaviors. Tice and Baumeister (1997) found that procrastinators, as identified by a self-report measure and dilatory behavior on an academic task, reported more stress and illness symptoms by the end of the semester. Using a large sample, the majority of which were undergraduates,
Sirios (2014) found that procrastination was linked to high levels of stress and had a moderate inverse relationship with self-compassion.

Procrastination might be assumed to occur at a high rate when the intended goal is an academic task, and this assumption is backed by several studies. The results of various studies convey that the prevalence of engaging in procrastinating behavior is extremely high among college students, ranging from 50 to 95 percent (Paulitski, 2010). Day et al. (2000) administered the ‘Academic Procrastination Questionnaire’ to 248 college students, and found that 32% of the college students sampled exhibited procrastination behavior that could be categorized as ‘severe’. As mentioned above, Pychyl et al. (2000) found that the college students they sampled spent a third of their time engaged in procrastinating behavior. Illustrating that the high-prevalence of academic procrastination is consistent across cultures, Klassen et al. (2010) reported that in large samples of Canadian (389) and Singaporean (337) college students, 57% and 59%, respectively, said that they spent over three hours a day on average procrastinating. Procrastination has been shown to have a detrimental effect on academic performance, as alluded to above in Steel (2001). In his meta-analysis, Steel (2007) found that research study reveals a weak but consistently negative relationship ($r=-.19$) between academic procrastination and performance. In a study involving 670 undergraduate students, Kennedy and Tuckman (2013) found that in addition to the negative relationship of procrastination, as measured by self-report questionnaires, to end of semester GPA, a negative relationship was also observed between procrastination and academic task and grade goals, and that it also predicted higher stress, lower self-efficacy, and a lesser sense of school-belongingness 6 weeks later. Duru and Balkis (2014) report that in a sample of 260 college students in Turkey, the relationship between the self-belief of self-doubt, as measured by a questionnaire, and academic performance was completely mediated by procrastination, such that the negative relationship between the prior variables was significant only when procrastination was included in the model. Aside from its
observed deleterious effects on performance and academics-related affective and motivational experience, procrastination predicts various forms of academic misconduct, the highest relationship being between it and, perhaps unsurprisingly, giving falsified excuses for missed assignments (Patrzek et al., 2014).

The above mentioned studies serve to underscore the ubiquity and pervasiveness in daily activity of procrastination among college students, as well as its potential adverse effects on performance and affect. Trends cited in research seem to indicate that procrastination is on the rise. In a large scale survey of over 350,000 first year college students, Astin et al. (1997) reported that respondents claimed they spent fewer hours per week on homework and studying than freshman students surveyed a year before (cited in Kachgal et al., 2001). It is also an issue that may be more relevant than ever, as the number of distracting technologies we have ‘at hand’ at any given moment is constantly growing.

Explanations of Procrastination

A number of explanatory models of procrastination have been posited in the literature. Some theorists have viewed procrastination as a product of indecision. According to Janis and Mann (1977) delaying involvement in a task is often used as a coping mechanism for dealing with difficult decisions. These theorists propose a ‘conflict theory’ of procrastination which suggests that people delay taking action because they experience severe conflict about a relevant decision, along with pessimism that they will resolve the conflict satisfactorily. Although there is a substantial amount of literature on procrastination that is specific to decision making (e.g. Mann, 1982 cited in Steel, 2010; Ferrari, 1992; Ferrari & Dovidio, 2000; Tenne, 2000), not many have investigated the role of indecision as a cause of general procrastination. In one such study, Beswick et al. (1988) reported finding a significant although relatively small correlation between decisional conflict and self-report and observed procrastination.

Others have suggested that procrastination is a tactic used to protect a shaky sense of self-
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worth (Ellis and Knaus, 1977; Burka and Yuen, 1983). According to Ellis and Knaus, procrastinating behaviors stem from irrational beliefs about the connection between one’s performance on a given task and their self-worth. People with these beliefs may avoid tasks that involve a moderate risk of failure, which would ultimately negatively impact their self-esteem. Students might delay working on academic tasks they perceive as challenging out of fear of failing, which would have negative implications for their self-worth and feelings of self-esteem (Ellis & Knaus, 1977). Burka and Yuen note that a trait often exhibited by chronic procrastinators is a fragile sense of self-esteem. People might purposefully delay working on tasks as a tactic for protecting their self-esteem, for example, by allowing them to attribute anticipated failure to something other than lack of ability, a strategy sometimes referred to as ‘self-handicapping’ (Burka & Yuen, 1983). Research studies have largely supported the notion that some relationship exists between self-esteem and procrastination tendencies (e.g. Beswick et al., 1988; Ferrari, 1994; Farran, 2004). The argument that procrastination is sometimes used as a self-handicapping strategy has also been supported, e.g. Ferrari and Tice (2000) found that participants who indicated they engaged in higher rates of procrastinating behavior on a self-report measure were more likely to delay practicing problem solving in a condition where the latter was described as an evaluative task, but not when it was described as simply an ‘activity’.

A number of theorists have suggested that an antecedent of procrastination is anxiety, which has been proposed to contribute to a variety of self-defeating behaviors, including dilatory behavior (Curtis, 1989). When faced with a challenging task, anxiety can be brought about either by a fear of failure or by the features of a particular task, such as its perceived aversive qualities. Procrastinators may choose to avoid the negative feelings they experience when engaging in a task that is anxiety provoking by engaging in a less anxiety-filled task (McCown & Johnson, 1991). Similarly, in Milgram et al.’s (1998) appraisal-anxiety-avoidance model, procrastination is seen as an avoidant response to heightened levels of anxiety when a task is
perceived as having aversive qualities (Milgram et al., 1998). Research study on the proposed anxiety-procrastination connection has yielded mixed results. Beswick et al. (1988) found that anxiety was significantly related to both self-report and an observed measure of procrastination ($r = .4$ & .16, respectively). Lay and Silverman (1996) investigated the relationship between trait and state measures of anxiety and self-report and observed measures of procrastination. These researchers did not find a correlation between either measure of anxiety and observed procrastination behavior, or between measures of trait anxiety and self-reported procrastination. Haycock et al. (1998) report finding a significant correlation between anxiety and procrastination; however, this relationship was negated when the effects of both anxiety and self-efficacy strength on procrastination were included in a regression model.

Another construct that it has been suggested is tied to the tendency to procrastinate is negative affect/depressed mood. When planning on engaging in a task that is perceived as arduous or monotonous, some people may experience negative thought patterns about failure or disinterest, which induce a negative affective state. People may try to escape the negative mood brought about by these tasks by focusing their attention on an alternative task (Baumeister et al., 1994). Chronic procrastinators might also be more inclined to recall negative experiences, and also regard the present in more resigned and fatalistic terms (Jackson et al., 2003). Thought patterns such as these can lead to hopelessness and the negative mood associated with it, having a deleterious effect on motivation to achieve or perform. The link between negative affect and procrastination has not been consistently supported in research study. Beswick et al. (1988) found that self-reported procrastination was significantly related to a measure of depression. Similarly, Lay (1992) found that participants who were identified as ‘trait procrastinators’ also reported higher levels of negative affect. Pychyl et al. (2000), however, found that when students were signaled to report on their behavior and mood several times a day, reports of procrastination did not correlate with negative mood. Steel (2001) found that this relationship depended on the
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measure used: self-reported procrastination behavior was related to negative affect, whereas observed procrastination behavior was not.

Several researchers have proposed that self-efficacy, the personal beliefs one holds about their abilities on a specific task, would predict one’s tendency to procrastinate. According to Bandura (1986), in situations where individuals possess adequate levels of ability and sufficient motivation, their efficacy beliefs will facilitate task initiation and persistence. It follows that if individuals have low self-efficacy regarding a particular task, their initiation of that task as well as their persistence may be compromised, resulting in procrastination. Haycock et al. (1998) found that cumulative efficacy strength scores, a measure of the confidence individuals have that they can succeed at a given task, predicted 25% of the variance of their procrastination behaviors. Klassan et al. (2008) found that self-efficacy for academic tasks, as well as self-efficacy for the self-regulation of these tasks, were significant predictors of procrastination. Waschle et al. (2014) report finding that the self-efficacy beliefs of university students mediated the effect of perceived goal attainment on procrastination, such that lower self-efficacy negatively affected perception of goal attainment which led to higher rates of procrastination. It is important to note that the studies cited are investigations of the relationship of procrastination with domain-specific self-efficacy, such as one’s beliefs about one’s ability on academic tasks, or task-specific self-efficacy, such as beliefs about one’s ability to complete a particular project. Other studies have examined the relationship between procrastination and an overarching category of self-beliefs referred to as ‘general self-efficacy’, which is a measure of one’s beliefs about their personal agency, or, that their actions will enable them to succeed in a variety of situations they may encounter during their lives (Schwarzer & Jerusalem, 1995). These studies have indicated general self-efficacy to be a reliable predictor of lower levels of self-reported procrastination behavior (Tuckman, 1991; Ferrari et al., 1992; Schwarzer & Jerusalem, 1999).
Many theorists regard the tendency to procrastinate as an indicator of deficits in self-regulatory capacity (e.g. Baumeister et al., 1994; Tice & Baumeister, 1997; Wolters, 2003). In this view, a tendency to procrastinate is the result of difficulty in foregoing a present and immediate reward in favor of actions that will facilitate future goal attainment. Pychyl et al. (2000) point out that this type of behavior is self-reinforcing: choosing an immediate reward that results in instant gratification in favor of goal pursuit might condition one to habitually choose these more proximal rewards when they are pitted against rewards related to goal attainment, which are often only realized in the distant future.

Broadly construed, one may think of procrastination as one of two all-inclusive categories of self-regulatory challenge, one being events in which an actor must withhold the temptation to act on impulse in order to achieve an intended goal that requires remaining inactive, as in Mischel’s experiments (Mischel, 1974; Mischel et al., 1989), the other being events in which one must overcome the inclination to not act in accordance with fulfilling an intended goal, which describes the phenomenon of what is generally referred to as procrastination. It is for this reason that procrastination has been referred to as ‘the quintessential self-regulatory breakdown’ (Steel, 2007). In line with this notion of procrastination, it has been found to have a high, positive correlation with impulsivity (e.g. Steel, 2007). It has also been shown that the importance of self-regulation in one’s culture plays a role: In a large epidemiological survey involving over 16,000 online participants from multiple nationalities, Steel & Ferrari (2013) found that procrastinators tended to be young males with lower levels of education who resided in countries whose populations had been characterized as low in self-discipline. Klassen et al. (2008) have argued that labeling procrastination as a self-regulatory issue is limiting, based on research that revealed students’ self-efficacy for self-regulating was a stronger predictor of procrastination than the ability to self-regulate. Regardless of what is the most prominent enabler of the phenomenon, it would certainly appear accurate to refer to the
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behaviors associated with procrastination as reflective of a self-regulatory deficit.

Research has supported this view of procrastination as self-regulatory deficit. Klassen et al. (2008) found that responses on a self-report measure of academic self-regulation significantly predicted procrastination in a sample of undergraduate students (r = -.40, p < .01). Rakes and Dunn (2010) found procrastination was inversely related to the self-regulatory skill of effort regulation, or the ability to maintain one’s focus in distracting situations (r = -.38, p < .01), among a sample of graduate students. Research evidence also seems to suggest that self-regulatory difficulties are a common trait among chronic procrastinators. The results of Ferrari’s (2001) comparative study of the performance of high and low procrastinators in demanding task situations imply that chronic procrastinators have difficulty regulating their accuracy and performance speed in high-demand situations, such as on tasks that involve high levels of cognitive load or time restraints.

A situational feature commonly associated with procrastination is the perception of a task as having aversive qualities. A task may be regarded as unpleasant if one sees it as boring, frustrating, lacking personal meaning, controlling, or stressful (Blunt & Pychyl, 2000). Aversive tasks may influence the likelihood of procrastinating in a variety of ways, such as by affecting one’s motivational capacity, mood, or efforts at self-regulation. Studies have consistently and conclusively supported this association: Milgram et al. (1988) measured the aversiveness of particular tasks by taking the inverse of these task’s ratings as pleasurable, finding that across tasks, aversiveness accounted for 33% of the variance in procrastination. Using a similar approach, Lay (1990) found that task aversiveness was related to procrastination on short-term projects with deadlines and on projects without specific deadlines. Milgram et al. (1995) asked students to report the degree to which they delayed working on tasks that were described to them as being either pleasant, unpleasant, or neutral, and found that students were more likely to report delaying on tasks categorized as unpleasant. Blunt and Pychyl (2000) asked participants to list and report on the features of a number of projects they planned to undertake in the near future.
The researchers found that participants reported procrastinating more on projects that had components of task aversiveness (such as being frustrating or boring) at different points of project development (Blunt & Pychyl, 2000).

Researchers have also studied the relationship of broader personality traits with procrastination. Of the traits included in the ‘five-factor’ model of personality, conscientiousness and neuroticism have often been assumed to involve processes that may lead to procrastination. Both of these traits contain components that have been linked to procrastinating in theory and in research study: Conscientiousness includes the facets organization, self-discipline, dutifulness, and achievement motivation. Neuroticism includes the facets anxiety, depression, self-consciousness and impulsiveness. Research findings have been fairly consistent with regard to the relationship strength of these traits to procrastination. Johnson and Bloom (1995) found that conscientiousness predicted procrastination, the strongest association being with the facet of self-discipline. Neuroticism was found to have a much weaker association with procrastination.

Schouwenberg and Lay (1995) reported similar results in their study of ‘five-factor’ traits and procrastination. Watson (2001) found that both conscientiousness and neuroticism predicted a total procrastination score, with conscientiousness accounting for a substantially larger proportion of the variance (about 25%, as opposed to about 10% for neuroticism). Steel et al. (2001), however, found neuroticism was not correlated with either self-report or observed measures of procrastination.

Other explanations that have been offered for the reasons people procrastinate include perfectionism (e.g. Frost et al., 1990; Flett et al., 1992; Saddler & Sacks, 1993) and rebelliousness (e.g. Burka & Yuen, 1983; Schouwenberg, 1992). A controversial idea proposed by some theorists (e.g. Ferrari, 1992) is that people often delay on tasks in order to derive the sense of arousal that is anticipated with an approaching deadline. Similarly, Schraw et al. (2007) conducted interviews with undergraduate students concerning the reasons they procrastinated on
academic tasks, and reported that students most often said they procrastinated for adaptive reasons, such as to reduce the total amount of time they spent on academic tasks, or to generate arousal that enables them to enter flow states. Some more recently proposed models of procrastination include elements similar to the idea of arousal motivated task delay. Strunk et al. (2013) conceived a 2 x 2 model of procrastination that includes dimensions of timely engagement—procrastination and approach—avoidance. The authors suggest that some who delay in engaging or completing tasks fall into the category of approach—procrastination, where procrastinating is intended to bring about a sense of urgency and enable an individual to enter ‘flow’ states (Strunk et al., 2013). In a qualitative study of the antecedents of procrastination, Klingseick et al. (2013) conducted interviews with undergraduate students and report that a distinct category of content emerged from the transcripts that was consistent with the notion of delaying a task for ‘pressurization’, a concept similar to seeking arousal. As the researchers themselves note, though, the subjective theories to which students attribute their procrastination may not reflect the actual causes of their procrastinating behaviors. In a large-scale meta-analytic study that examined responses on three scales which purportedly measured three distinct forms of procrastination: avoidant, arousal, and decisional procrastination, Steele (2010) found that the results did not support the notion of different forms of procrastination. The measures in question were moderately to highly correlated with one another, though it was found that the decisional procrastination scale could ‘potentially’ be considered a different construct. The data implied that a single factor explained most of the variance in the scales studied, and that this factor is consistent with the view of procrastination as a dysfunctional delay brought about by irrational behavior (Steele, 2010)—in other words, a failure to actualize an intention.

Meta-analytical research has been conducted to investigate many of the foregoing proposals regarding the relationship of personality, emotional, and task-related variables on procrastination. Two meta-analyses, by van Eerde (2003) and Steel (2007), summarized the
findings of a number of studies that examined the relationship between procrastination and personality, emotion, and task variables. Both of these analyses revealed a consistently strong negative relationship between procrastination and both conscientiousness and self-efficacy. Both studies reported finding moderate positive correlations between procrastination and depression. In addition, Steel (2007) found that impulsivity and the aversiveness of a task were strong predictors of procrastination, and that an ‘intention-action gap’, self-esteem, and rebelliousness were more moderate predictors. Neuroticism was found to moderately predict procrastination as well; however, analyses revealed that this relationship was not due to the facet of anxiety, indicating that anxiety may not be a significant predictor of procrastination. Perfectionism was not found to be related to procrastination at a statistically significant level.

More comprehensive models of procrastination have been proposed in recent years. ‘Temporal Self-Regulation Theory’ (Hall & Fong, 2007), as its name suggests, holds that key elements of the tendency to procrastinate are the valuations individuals give to short vs. long-term benefits and their self-regulatory capacities, as well as the strength of intention for a given task and the belief that one’s actions are connected to desired outcomes. ‘Temporal Motivation Theory’ (Steel, 2007) is based on an expectancy-value theory of motivation, and includes the mitigating effect of time considerations such that ‘hyperbolic discounting’, or the tendency to exert minimal activity toward attaining a distant goal and then increase activity when the goal is closer to being realized, would limit one’s motivation for engaging in a task whose rewards are only realizable in the future. Steel provided the following equation as the simplest representation of this theory:

$$\text{Utility} = \frac{E \times V}{\Gamma \times D},$$

where ‘utility’, which refers to how desirable a task is for a given individual, is equal to the product of expectancy and value, divided by the product of the delay of time for the benefits of the task to be realized (D) and an individual’s sensitivity to the delay (Γ).
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Research study in more recent years has revealed potential contributors to procrastination that have not received as much attention previously. In Kliegseick et al.’s (2013) study mentioned above, transcript content analysis indicated that common themes among those interviewed included the statements that procrastination occurred because of the misperception that they simply had more time to complete an assignment, or ‘time-misperceptions’ (see also Kelly, 2003), or because they did not have sufficient knowledge about how to carry out a task. Other theorists have focused on the mediating effects of the cognitive processes that occur in instances of procrastination. Krauss and Freund’s (2014) proposed model suggests that one’s fear of failure will result in procrastinating when one’s focus is on the outcome of a given task, and that task aversiveness will result in procrastinating when one’s focus is on the task process.

These proposed explanations implicat a number of possible reasons for students’ procrastination in academic settings. Students may delay beginning or following through with a task because they are conflicted about which topic to concentrate on, or how to best plan and organize their thoughts (Janis & Mann, 1977; Beswick et al., 1988). Some students may delay studying for exams or devoting sufficient time to working on a task they perceive as demanding as a way of protecting their self-esteem or self-worth (Ellis & Knaus, 1977; Burka & Yuen, 1983). They might delay working on an academic task in order to avoid an anxiety provoking situation (Milgram, 1988), to avoid the negative feelings they associate with many academic tasks, or because of the influence of negative mood on their motivation (Baumeister et al., 1994). They might avoid working on tasks for which they lack confidence that they will be successful (Bandura, 1986), or with which they associate negative experiences and consider ‘aversive’ (Lay, 1990). Or, as has been suggested, students may procrastinate on academic tasks because they experience difficulty with self-regulating their behavior (Tice & Baumeister, 1997, Steel, 2007). Academic tasks would present an especially difficult challenge for people who experience difficulty with self-regulation as these tasks are not often perceived to be immediately rewarding,
and other, more readily gratifying courses of action are usually available.

Measurement of Procrastination

Procrastination has been measured via a variety of self-report behavioral scales, semi-objective questionnaires (some of which are indicators of the task intention-completion relationship), and objective observations of task engagement. Some of the more commonly used self-report scales for procrastination among the general public include the ‘General Procrastination Scale’ (Lay, 1986) (sample item: ‘I generally delay before starting on work I have to do’), the ‘Adult Inventory of Procrastination’ (McCown & Johnson, 1989) (sample item: ‘I am not very good at meeting deadlines), and the ‘Pure Procrastination Scale’ (Steel, 2010), a 12 item scale derived from the above and other measures of procrastination through factor analysis. Other self-report scales have been designed to measure procrastination among college students. Of these, often used measures include the ‘Academic Procrastination Inventory’ (Aitken, 1982) (sample item: ‘I am often frantically rushing to meet deadlines’), the ‘Procrastination Assessment Scale—Students’ (Solomon & Rothblum, 1984), and Tuckman’s ‘Procrastination Scale’ (Tuckman, 1991) (sample item: ‘I often wait till the last minute when I have a deadline’). Recently, a new measure of academic procrastination, the ‘Academic Procrastination Scale’ (McCloskey & Scielzo, 2015), has been introduced, which its authors claim is a more valid scale of procrastination-related behavior, beside its being the only ‘current’ measure that is specific to procrastination in the academic realm.

A number of studies have employed measures I have termed ‘semi-objective’, since these do not rely on participant’s retroactive self-judgments, but do require that participants report on their own intentions and behavior regarding a given task. Some studies have used participants’ responses on an inventory of ‘personal projects’, which involves choosing a number of projects one intends to engage in in the near future and rating each project’s importance. Lay (1990) observed procrastination by having participants compose a list of personal projects and assign
times for which they planned to engage in each project. Participants then reported on their adherence to their planned schedule at 3, 6, and 12 week intervals (Lay, 1990). Similarly, Scher and Ferrari (2000) had college students write ‘Future Intended Action Reports’ by choosing a number of academic tasks, and rating their importance as well as the strength of their intention to complete them. The participants were later asked to report on the percentage of each task they completed as well as estimate the amount of time spent on each task (‘Past Intended Action Reports’). Ackerman and Gross (2005) had students recall the point in the previous semester at which they were given an assignment, and report on the point in the semester at which they actually began the assignment. Still other studies have examined procrastination by objective observation of participants’ behavior. For example, Lay (1986) asked participants to accomplish a given task (mailing a letter) at a designated time and noted whether it was done accordingly. Moon and Illingworth (2005) noted the amount of time it took college students to take online quizzes, and used the difference in time between the moment the quizzes became available and when they were completed as a measure of procrastination.

Executive Function & Procrastination

The term ‘executive function’ refers to a set of cognitive abilities that help regulate overt and covert behaviors related to the learning process. These functions include the manipulation and coordination of auditory and visual information in working memory, switching from the use of an ineffective to a more appropriate strategy (i.e. the flexible use of different operations or mental sets in problem solving), and the inhibition of responses to intrusive external or internal stimuli that are irrelevant to the current task. Miyake et al. (2000) demonstrated that these three functions, which we will refer to as updating working memory, cognitive flexibility (or ‘set-switching’, and inhibitory control (or ‘response inhibition’), though clearly related to one another, are separable constructs, each one testable via distinct measures.

Although executive function (EF) was initially conceived of and studied as a unitary
construct, in more recent years specific executive function processes have been differentially implicated in a number of learning and cognitive processes. Bull and Scerif (2001) used measures associated with each of the above mentioned executive function abilities to measure the relationship of EF and mathematics ability in a sample of 93 young elementary-aged children (mean= 7.4 years). The researchers found that each of these areas of EF were significant predictors of children’s mathematical ability (e.g. as measured by performance on single and multi-digit addition and subtraction problems), and that they individually contributed to a unique amount of variance in math performance. St. Clair-Thompson and Gathercole (2006) reported that measures comprising factors of working memory and inhibitory control significantly predicted English and mathematics attainment (as measured by standardized tests) in a sample of 51 middle school students (mean= 11.9 years), while inhibitory control additionally predicted attainment of science knowledge. Clark et al. (2012) found that among older patients with Alzheimer’s disease, those who exhibited a significant decline in episodic memory also performed worse on EF tasks that were indicators of inhibitory control and set-switching one year earlier. These distinct EF components have also been studied in terms of their relationship to learning disabilities. A current theoretical model of ADHD holds that this learning disorder has its basis in deficits of inhibitory control (Barkley, 1997). This relationship has been borne out in several research studies. In a meta-analysis of research study examining the link between EF and ADHD, Willcutt et al. (2005) report that the highest correlation between ADHD and EF was with the component of inhibitory control, and that working memory was also found to be significantly related to the incidence of ADHD.

As noted, the influence of distinct properties of executive function on various areas of cognitive functioning has been the subject of a great deal of study over the past 15 years. The relationship between executive function and task-related behavioral manifestations of self-regulatory deficits, such as procrastination, has surprisingly received scant attention. Rabin et al.
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(2011) allude to this gap in the research literature: “Given the role of executive functioning in the initiation and completion of complex behaviors, it is surprising that little research examines the relationship between executive functioning and academic procrastination”. In addition, there are theoretical reasons to suggest that distinct EF processes would be related to the tendency to procrastinate: Inhibitory control, which allows one to inhibit responses to irrelevant stimuli, may understandably be implicated in one’s efforts to stay on task and complete a given project. There is also a cognitive basis for this proposed relationship, founded in the writing of William James (1904), who suggested that the accomplishment of one’s goals necessitates maintaining an image of the desired goal in one’s mind while working toward it. It is therefore theoretically plausible that the completion of intended tasks will be related to the degree to which one maintains the end-goal in mind, and is not distracted by interference from irrelevant thoughts. The ability to switch between strategies, operations, or mental sets may also exhibit a relationship with procrastination. It is plausible that the ability to effectively switch between tasks or operations would be related to the ease with which one commences working on a task, or regains focus and directs attention toward a task after a period of distraction. This theoretical relationship is supported by research study findings that disabilities of which a typical feature is perseveration on a single activity, such as autism spectrum disorders and OCD, have been associated with deficits in the executive function of cognitive flexibility, or ‘set-switching’ (e.g Ozonoff et al., 1994; Chamberlain et al., 2007).

In an effort to address this unexplored relationship, Rabin et al. (2011) studied the responses of 212 college students on the ‘Behavior Rating Inventory of Executive Function–Adult Version’ (BRIEF-A) which is a self-report questionnaire that includes items reflective of behavior related to various areas of executive function, such as inhibitory control/impulsivity, shifting between tasks, self-monitoring, organization skills, and task-initiation, and their correlation with the participants’ responses on the Lay General Procrastination (GP) Scale,
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Student Version, a measure of trait procrastination comprised of items that reflect behavioral tendencies to delay the initiation or completion of everyday tasks. Several of the item clusters relevant to self-regulatory behavior were found to be significant predictors of procrastination in a regression model that included demographic, psychological, and personality information: Planning, organization, initiation, task-monitoring and self-monitoring were all significant predictors of college students’ procrastinating behaviors. Regression analyses also revealed that clusters of items more related to cognitive aspects of executive function (and which have been measured using objective tasks, as in Miyake et al. (2000)), namely, inhibitory control and working memory, were significant predictors of procrastination. Interestingly, switching between tasks (the construct equivalent to what I have referred to as cognitive flexibility or ‘set-switching’) was found to significantly predict procrastination tendencies in a model that included only demographic information; however, when psychological and personality characteristics (such as conscientiousness) were included in the analysis, ‘switching’ was no longer observed to be a significant predictor (Rabin et al., 2011).

Rabin et al.’s results clearly indicate that self-report indices of distinct EF properties are related to the tendency to procrastinate, and echo the findings of the above mentioned studies as they pertain to the specific role of inhibitory control and working memory processes in other areas that are linked with self-regulatory deficits, such as in predicting academic ability and attentional disorders. This study did not examine whether objective, cognitive measures of these EF processes (e.g. Miyake et al., 2000) are predictive of the tendency to procrastinate, however, leaving open the question of whether behaviors typical of procrastination have a cognitive basis. Paulitzki (2010, in an unpublished dissertation) studied the relationship of a number of factors with responses on a series of self-report measures, as well as one semi-objective measure, of procrastination. In one study, Paulitzki examined the relationship between performance on three tasks intended to measure inhibitory control (the Go/No Go, Stroop, and Anti-Saccade tasks) and
three self-report procrastination scales (the AIP, GP, and API) as well as participants responses on the FIAR (‘future intended activity report’) and PIAR (‘past intended activity report’), on which they indicated tasks they considered important to complete, the time frame in which they intended to complete them, and the percentage of the task they actually did complete (the ‘semi-objective’ measure of procrastination, being that the variable of interest was reported by the participant but was not the result of reflective judgment). A number of interesting results emerged from this study. Inhibitory control was found to be related to trait procrastination, as observed in form of a latent variable factored from responses on the three self-report questionnaires mentioned above, for men, but not for women. Similarly, inhibitory control was found to be related to responses on self-report measures of other personality traits (impulsivity and self-efficacy) only for men and not for women. Inhibitory control was not found to significantly predict either task completion or the number of hours spent on a task in this study. However, a significant effect was found for the interaction of inhibitory control and intention strength on these dependent variables, such that higher scores on inhibition tasks increased the effect of intention strength on task completion and hours spent on the task.

Flow and Procrastination

Csikszentmihalyi (1975) described the optimal experience of engagement in an activity as the achievement of a ‘state of flow’. Characteristics of flow include total absorption in an activity, a loss of self-consciousness, and a lack of awareness of the passage of time. The construct of flow, initially used in relation to the cognitive and affective experiences of people engaged in some form of kinetic activity, such as athletes or musicians, was later extended to describe optimal experiences of engagement in cognitive activities as well, such as in learning. ‘Learning flow’ is described as the experience of becoming fully engaged in an activity, a state made possible when a learning task is neither too easy to be perceived as boring, or too difficult to be frustrating (Csikszentmihalyi, 1996). In addition, Csikszentmihalyi (1993) described
individuals who are more likely to experience flow in their daily lives, referring to these as having ‘autotelic’ personalities. Individual differences in the predisposition to achieve flow experience have been measured via self-report scales (e.g. the ‘Flow Questionnaire’, (Csikszentmihalyi, 1986), and the ‘Dispositional Flow Scale’, (Jackson & Ecklund, 2002), as well as indirectly via thematic tests such as the ‘Operant Motives Test’ (OMT) (Kuhl & Scheffer, 1999), which is a measure of ‘intrinsic achievement motivation’, a motivational construct thought to facilitate the development of an achievement flow motive and an autotelic personality (Busch et al., 2013). Martin & Jackson (2008) later modified the Dispositional Flow Scale, which was originally conceived for physical activity, to measure experience in other areas, such as in work or school settings.

A fair amount of research has been conducted investigating the relationship between learning flow and procrastination, yielding mixed results (e.g. Lee, 2005; Seo, 2011; Kim & Seo, 2013). These studies, however, observed only the relationship between procrastination and flow experience related to a single event (i.e. writing a paper or studying for an exam); or, put another way, they examined the relationship between procrastinating and ‘state flow’. Personality differences in the frequency of experiencing flow, or ‘trait flow’, as they relate to procrastination have not been studied directly, although some studies have yielded telling results. Busch et al. (2013) found that in a sample of participants recruited from three different cultures (Germany, Cameroon, and Costa Rica), responses on the Operant Motives Test (OMT) that were consistent with an achievement flow motive predicted educational attainment. Ross and Keiser (2014) found that trait flow, as measured by the second version of the Dispositional Flow Scale (DFS-2), was most highly correlated with the ‘Five Factor’ personality domains of neuroticism (negative) and conscientiousness (positive), both domains other studies have found are correlated (in reverse fashion) with procrastination (e.g. Steel, 2007; van Eerde, 2003).
General Self-efficacy, Affect, and Flow

General self-efficacy is a measure of one’s self-perception of efficacy across an array of different demands and situations, and is thus considered a ‘trait’ measure (as opposed to domain-specific self-efficacy, which relates to one’s perceptions of efficacy in a specific area) (Luszczynska et al., 2005; Choi, 2005). Self-efficacy measures at differing levels of generality/specificity have been found to correlate with one another (Choi, 2005; Roddenberry & Renk, 2010; Tamura, 2014), the strength of the relationship depending on the measures’ proximity in an efficacy-level hierarchy: General self-efficacy is more highly correlated with domain-specific self-efficacy than it is with task-specific self-efficacy (Choi, 2005; however, see Feldman & Kubota, 2014, for a contrary finding). Although different forms of self-efficacy are related, they differ with regard to their predictive power for given behaviors. For example, although more domain-specific academic self-efficacy is a reliable predictor of academic achievement (e.g. Zimmerman et al., 1992; cf. Pajares, 1996 for review), it has usually been shown that general self-efficacy is not a direct predictor of academic achievement (e.g. Ferrari & Parker, 1992; Lindley & Borgen, 2002; Choi, 2005, but see Luszczynska et al., 2005).

Perceptions of one’s efficacy can influence affective states. According to Bandura (1997), low self-efficacy is associated with negative emotions. People with low self-efficacy may appraise the challenges they encounter as more difficult than they are, which may lead to feelings of stress and depression (Pajares, 1996). Although this relationship was proposed with respect to local, task specific self-efficacy and affect, a similar relationship could be expected when considering more global measures of self-efficacy and stable affective experiences. Research has supported this link, indicating a significant low to moderate negative correlation between general self-efficacy and negative affect (Chen et al., 2004; Luszczynska et al., 2005; Lightsey et al. 2006). In turn, one’s affective state may influence their likelihood of initiating action toward a goal. Schwarz and Bohner (1996) suggest that positive affect plays an important
role in facilitating motivational processes in an action sequence. In a similar vein, Kuhl’s ‘Personality Systems Interaction’ theory (Kuhl & Kazen, 1999) predicts that implementing a difficult intention (which describes many academic tasks) is facilitated by positive affect. Positive affect is also thought to play an important role in work engagement (Bledow et al., 2011). These suggested causal relationships have been supported by research study (Kazen et al., 2008, Bledow et al., 2011). Interestingly, the results of Bledow et al. (2011) imply that positive affect-inducing events were positively correlated with work engagement only for participants that reported lower frequency of positive mood states in the hours before the study, suggesting that for participants that experienced generally positive affect before the study, their overall positive mood was sufficient to facilitate work engagement. Because of the role of affect in action initiation and engagement, affective states would also be expected to influence the attainment of flow states, which entail becoming absorbed in an activity. This relationship is a connotation of the connection of positive affect to work engagement, of which an important feature is absorption (Schaufeli et al., 2002; Bledow et al., 2011). The role of positive affect in flow attainment has also been illustrated in a study that examined the effect of manipulating positive mood on formal measures of the frequency of flow experience. In this study, participants who took part in an activity that had been shown to increase positive affect prior to their work day reported higher levels of flow experience in their work (Layous et al., 2013).

Study Rationale and Hypotheses

The focus of this study follows in the recent research tradition of investigation into the cognitive and affective processes that occur prior to or during engagement with a task, and their role as antecedents of procrastination. It also seeks to examine processes that have not received any, or at least much, attention in the past. Importantly, the specific focus of this study is on an explanatory model of academic procrastination, an important distinction since academic-specific procrastination may be a significant predictor of academic success (such as GPA), whereas
general procrastination does not appear to predict success in the academic realm (Steel, 2007).

The primary goal of this study is to investigate cognitive and affective phenomena associated with individuals’ tendency to procrastinate on academic-related tasks. It is suggested that specific abilities associated with executive functioning, namely, the ability to control one’s responses to irrelevant stimuli or intrusive thoughts, or ‘inhibitory control’, and the ability to switch between modes of thought and regain one’s focus, ‘cognitive flexibility’, or alternatively ‘set-switching’, support the cognitive mechanisms necessary for timely and consistent engagement when working on academic tasks, and that as a result, deficits in these areas of EF will result in higher rates of procrastination. It is also suggested that features of one’s personality enable subjective affective and cognitive experiences that motivate the timely engagement and completion of academic tasks. In line with research that implies that fear of failure, negative self-appraisal, and low self-efficacy contribute to procrastinating behavior (e.g. Ellis & Knaus, 1977; Burka & Yuen, 1983; Beswick et al., 1988; Ferrari et al., 1992), individuals who report lower levels of general self-efficacy should procrastinate to a greater extent than individuals with higher self-efficacy. Similarly, based on studies that imply negative affect and depressed mood are linked to procrastination (Baumeister et al., 1994; Jackson et al., 2003), individuals who report higher frequencies of experiencing negative mood should be more susceptible to procrastinating. A disposition to experience flow should also be related to the tendency to procrastinate, because of its motivational capacity and as an enabler of on-task behavior. With regard to motivation, the ability to derive enjoyment from and become absorbed in one’s work should reduce the role of sensitivity to delay of reward and time considerations in inducing procrastination by minimizing the denominator in the TMT model: \( E \times V / \Gamma \times D \) (Steel, 2007), described above. With regard to enabling task-related behavior, the focused attention that is characteristic of ‘flow’ experience should support an individual’s efforts to resist distraction. The study also proposes a causal model of the mechanisms that contribute to procrastination, such
that low general self-efficacy will have a negative influence on one’s overall affective state, which will in turn hinder the ability to experience flow in learning situations by inhibiting the actualization of goal-related intentions. An additional goal is to evaluate the relative explanatory value of this model next to two variables studies have revealed to be highly related to procrastination, namely, specific self-efficacy and task –aversiveness, as well as the more moderately related variable negative affect. In line with the recommendation of theorists that the most predictive form of self-efficacy for a given task is that which is most related to that task (Bandura, 1997; Pajares, 1996), controlling for the effects of task-specific self-efficacy would prescribe the inclusion of a scale for self-efficacy of self-regulation on academic tasks. The model also predicts an interactive effect of the relationship between executive function and procrastination, such that higher levels of the tendency to experience flow (‘trait flow’), which is an indicator of the frequency with which one enters states of focused attention and absorption in an activity (Csikszentmihalyi, 1975), will shield goal oriented activity from self-regulatory breakdown due to EF deficits that make one susceptible to becoming distracted during an academic task (inhibitory control) and experience difficulty in regaining focus (cognitive flexibility). Another goal of this study is to examine the above proposals in terms of their interaction with gender. Notably, Paulitzki (2010) found that performance on cognitive inhibitory control tasks was related to self-reported procrastination for males (r= -.40, p<.10) but not for females. This study may serve to reveal gender differences in the functioning of mechanisms that contribute to procrastination. An additional goal of this study is to investigate the relationship of the above mentioned variables with procrastination using a new set of instruments: One of these, the ‘Academic Procrastination Scale’ or ‘APS’, is a self-report measure of items that reflect one’s level of academic procrastination, similar to the measures and items referred to earlier. The authors report that the APS has a high level of internal reliability (α = .95) and has a number of advantages over other often used scales (e.g. Tuckman’s
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Procrastination Scale, Lay’s General Procrastination Scale), including its consistency across ethnic groups and gender, that it is differentiable and therefore distinct from measures of conscientiousness, and that the categorization of a ‘high procrastinator’ based on this scale was predictive of lower GPA among students (and vice versa), suggesting that it may be a more valid measure of this construct (McCloskey & Scielzo, 2015). The other measure of procrastination is a modified version of the Future and Past Intended Action Report (FIAR and PIAR) (Scher & Ferrari, 2000), described above. An objective measure of procrastination, amounting to the number of days participants’ take to complete and return the PIAR, is employed as well. A more detailed description of these instruments will be provided in the study ‘method’ section, below.

The hypotheses/questions guiding this study are:

1) Observed performance on the measures of EF processes ‘inhibitory control’ and ‘cognitive flexibility’ will be negatively correlated with procrastination for those participants identified as being lower in flow frequency on academic tasks, but will not be significantly correlated with these EF processes for those identified as higher in flow frequency.

2) Each of the variables general self-efficacy, negative affect, and tendency to experience flow in learning and academic work will be correlated (general self-efficacy and flow frequency negatively, negative affect positively) with procrastination.

3) A causal model will emerge such that the frequency of experiencing flow in learning will be influenced by frequency of negative affect, which will in turn be influenced by general self-efficacy.

4) Flow frequency will independently predict additional variance in procrastination behavior when the predictive power of self-regulatory self-efficacy, task-aversiveness, and negative affect for procrastination is accounted for.
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5) Will the aforementioned hypotheses be consistent for both males and females, or will diverse gender-related patterns emerge with regard to the mechanisms that predict high and low levels of academic procrastination (as suggested in previous research)?

**Method**

One-hundred and five undergraduate students enrolled in either of two urban-area universities were recruited for this study. Eighty-one of the participants were female, twenty-four were male. The sample included both graduates and undergraduates (53 and 52, respectively), with sixty-five participants from one university and forty from the other. Students were informed that they would receive credit toward their course research-participation requirement in exchange for their participation. The procedure was carried out on site at the participants’ universities, although it did involve one short survey that participants were asked to complete and return via email. If this survey was not returned by a participant within 30 days, a follow-up email was sent as a reminder. The in-person research component was conducted with each participant individually, and varied in length between 50 and 79 minutes. Participants first completed all surveys and the FIAR, followed by the cognitive executive function tasks. All surveys and the FIAR generally took between 15 and 20 minutes to complete. The remainder of the session was spent on EF tasks; of these, general times spent on each task were: ‘plus-minus’ task, 3-5 minutes; ‘go no-go’ task, 6-8 minutes; ‘letter memory’ task, 8-10 minutes; ‘anti-saccade’ task, 8-14 minutes; ‘number-letter’ task, 20-25 minutes. The executive function tasks were administered in random order. Data collection was completed within 3 to 4 months.

**Procrastination Measures**

All participants were asked to respond on the 25-item APS (‘Academic Procrastination Scale’), a questionnaire with responses based on a 5 point Likert scale which includes items such as ‘I put off work until the last minute’ and ‘When working on schoolwork, I usually get distracted by other things’. The dependent variable derived from the APS was the total score of
participants’ ratings (1-5) on the items, including 5 items that were reverse-scored.

Participants were also asked to give responses on a modified version of the FIAR (‘Future Intended Action Report’). The FIAR form asked participants to list 3 academic tasks they intended to work on within the coming week (7-day span). They were then asked to indicate, using a 9 or 10-point Likert scale (depending on the item), how much of each task they intended to complete within that week (1-very little, 10- all of it), how much time they intended to spend on the task (1-very little, 9- a lot), and how much they disliked the prospect of doing each task (1-a little, 9-very much). One week after submitting their completed FIARs, the participants were sent an email that included the description of the 3 academic tasks they had written on FIARs, and the PIAR (‘Past Intended Action Report’), which used the same point-value Likert scales and corresponding values as the FIAR, and prompted their responses to the questions: ‘How much of the task did you complete?’, and ‘How much time did you spend on the task?’ 10 participants were either unable to provide 3 academic tasks or included a task that was not considered ‘academic’, and data for these cases was therefore derived from the 2 academic tasks listed. Two dependent measures of procrastination were derived from these forms: Ratings on PIAR items relating to how much of a given task was actually completed were subtracted from the FIAR items relating to how much of that task was intended to be completed. The average of the discrepancies between intended and actual amounts completed on the academic tasks listed was used as one measure of procrastination: an intention-action difference in the amount of task completion (AMTDIF). Similarly, ratings on PIAR items for how much time was actually spent on a given task were subtracted from ratings on FIAR items for how much time was intended to be spent on that task. For tasks on which the intention-action difference in amount completed (AMTDIF) = 0, the difference between the intended and actual amount of time spent on that task was given a value of 0, since any time discrepancy could be attributed to the intended task having been completed. For tasks on which the intention-action
difference in amount completed > 0, differences between the time intended and actually spent on a task was computed as described above, and the average of the discrepancies was used as another measure of procrastination: intention-action difference in time spent (TIMDIF).

The number of days participants took to return the PIAR was used as a measure of procrastination as well. On the PIAR, participants were asked to indicate the day they noticed that they had received the PIAR in their email boxes, if this was later than the day it was sent to them. After the day following the day the PIAR was received, each additional day that participants delayed in returning the form was counted toward the total number of days of procrastinating in fulfilling this requirement (DAYS).

Measures of executive function

Participants were administered a battery of cognitive EF tasks via a laptop computer, as well as one paper-and-pen task. All the computer-based tasks were constructed and administered using the ‘PsychoPy’ program (v. 1.82.01). The EF battery consisted of tasks that are used to measure performance on three distinct EF processes often referenced in research study (e.g. Miyake et al., 2000; Bull & Scerif, 2001), and which Miyake et al. (2000) have found are separable constructs: inhibitory control (or ‘response inhibition’), cognitive flexibility (also called ‘shifting’ or ‘set-switching’), and updating of working memory (sometimes referred to simply as ‘working memory’). This battery included 5 tasks, two each of inhibitory control and cognitive flexibility, and one of working memory. (The battery was limited to 5 tasks due to pragmatic considerations, i.e. time restraints, as well as procedural considerations, i.e. the anticipated influence of fatigue on the performance of these tasks, which, as several participants expressed, can be demanding). A working memory task was included in order to identify the influence of EF processes that are due solely to inhibitory control and cognitive flexibility by controlling for the partial influence of possible working memory deficits on procrastination (being that these 3 EF processes were previously found to significantly correlate with one
an other (Miyake et al., 2000; Bull & Scerif, 2001)). As per Miyake et al., these tasks included the following testing paradigms: the ‘anti-saccade’ and ‘go no-go’ (a similar paradigm to the ‘stop-signal’ task employed by Miyake et al.) tasks as indicators of inhibitory control; the ‘plus-minus’ and ‘number-letter’ tasks as measures of cognitive flexibility; the ‘letter-memory task’ as an indicator of the ability to update working memory. The EF tasks used and the task design closely followed the procedure of Miyake et al. (2000), although the ‘go no-go’ task used a different medium as the inhibition response cue (visual, as opposed to an auditory signal).

Inhibitory control tasks: For the ‘anti-saccade’ task, a fixation cross appeared in the center of the screen for time periods varying from 1500 to 2700 milliseconds. Following the fixation cross, a small black square appeared randomly on either the far right or far left of the screen for a duration of 225 milliseconds, followed by a white square enclosing a black arrow whose head faced either up, down, or left, for a duration of 150 milliseconds. (The arrow stimuli were presented 4.5 inches away from the cross, and participants sat about 2 feet from the screen.) The participants’ task was to indicate which way the bordered arrow was facing by pressing the corresponding arrow key on the keyboard. According to Miyake et al. (2000), this task is a measure of inhibitory control because participants are required to inhibit the reflexive response of looking at the small black square in order to correctly identify the direction of the arrow.

Participants were given practice on 22 trials, and then began the actual task, which entailed 90 trials. Responses were recorded by the program. The dependent measure of interest was the proportion of incorrect responses (ANTISAC). For the ‘go no-go’ task, participants were first presented with a fixation cross for 500 ms, which was followed by an individual letter in blue. Instructions were to press the left arrow key if it was a capital letter and the right arrow key if it was lower-case. Participants had 1500 ms to respond to these letter stimuli. This first set of stimuli consisted of 48 trials, and was used to create a prepotent categorization response. The second stage of this task was similar to the first, save that the stimuli now included 147 letters in
blue and 45 letters in red, for a total of 192 trials. Participants were instructed not to press any key for these red letters. This task yielded two measures of inhibitory control: As per Miyake et al., one measure was the proportion of incorrect responses on the ‘no-go’ trials (key responses for red letters, labeled GONOGO). Another measure of inhibitory control, adopted from Hall et al. (2008), was the median of participants’ response times for correct responses on the ‘go’ trials (correct responses for blue-letters) in the second set of stimuli (CORNGMED). The median was a more accurate indicator of centrality for this measure than the mean because of the potential influence of a small amount of outlier response times on the distribution (a common feature of response-time distributions). The rationale for using these response times as a measure of inhibitory control is that the ability to inhibit a prepotent response entails the use of one's inhibition resources, and therefore the ease with which one can inhibit prepotent responses is directly related to the speed taken to give an accurate response (from correspondence with the author).

Measures of cognitive flexibility: For the ‘plus-minus’ task, participants were presented with three sets of 30 two-digit numbers on a sheet of paper. For the first set of numbers, instructions were to add three to each of the numbers. For the second set of numbers, instructions were to subtract three from each of the numbers. For the third set of numbers, participants were instructed to alternate between adding and subtracting three (e.g. 35+3=38, 72-3=69, 18+3=21, etc.). The time it took participants to complete each of the sets was recorded on a stopwatch. The average of the times taken to complete the non-switching (addition and subtraction) tasks was subtracted from the time taken to complete the switching (alternating) task to yield a switching-cost value, which was the measure of interest (PLUMIN). For the ‘number-letter’ task, participants were presented with number-letter pairs (e.g. A7, G4) at one of four corners of the screen, and instructed to indicate whether the letter was a vowel or a consonant by pressing the ‘z’ or ‘x’ key (respectively) if the pair appeared on the top portion of the screen, and to indicate
whether the number was even or odd by pressing the ‘n’ or ‘m’ key if the pair appeared on the bottom portion of the screen. A series of number-letter pairs was first presented in the two corners on the top of the screen (the letter condition), followed by another series of pairs in the corners on the bottom of the screen. Each of these series contained a total of 64 trials, and were preceded by a practice series of 22 trials. Then the pairs were presented in a counter-clockwise fashion at all four corners of the screen for a total of 256 trials, 128 of which necessitated switching between a letter and number condition. This series was preceded by a practice session of 48 trials. For the variable of interest, the average of the medians of the first two (non-switching) conditions was subtracted from the average of the medians of the last (switching) conditions to derive a value of the cost of switching (NLETMED). Medians were taken as a more accurate representation of centrality for this measure due to skew of its distribution.

Measure of working memory (updating): For the letter-memory task, a series of letters was presented individually on the screen, and participants were asked to try to remember and report the last 4 letters in each series. The length of the series of letters varied between 5, 7, 9, or 11, and was not known by the participant before the trial. There were 2 practice trials, which were followed by 12 actual trials. The measure of interest was the proportion of correct responses, which included partially correct responses (responses in which participants were able to recall part of the last 4 letters on a trial in the sequence they were presented; labeled LETMEM.)

Self-report Questionnaires

Dispositional Flow Scale, 2nd version: The ‘DFS-2’ (Jackson & Ecklund, 2002) is intended to measure the frequency with which one experiences flow when engaging in specific activities, such as work or learning-related tasks. In order to obtain a measure of ability to experience flow while working on academic tasks, participants were asked to consider an academic task they frequently engage in, for example, studying for exams, doing homework,
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writing a paper, and respond to the 9 items on the flow scale (example item: ‘I am completely focused on the task at hand’). Participants rated themselves on each item using a 5 point Likert scale (1=Never, 5=Always). The measure of interest was the total number of points entered for the 9-item scale (higher totals = greater levels of flow frequency, labeled DISFLOW).

Positive and negative affect schedule: The ‘PANAS’ (Watson et al., 1988) is a measure of relatively stable positive and negative affect. Participants were asked to indicate, using a 5-point Likert scale, how often they had experienced a series of emotions in recent weeks (e.g. cheerful, sad). The list consisted of 20 items, which were 10 adjectives of positive and 10 of negative affect, interspersed. This scale yielded two measures, one was the total of the scale ratings for adjectives of positive affect (POSAFF), and one was the total for adjectives of negative affect (NEGAFF).

General Self-Efficacy: Participants were administered the ‘General Self-Efficacy’ scale (GSE) (Schwarzer & Jerusalem, 1995), a 10 item scale intended to be a measure of an individual’s sense of personal agency, and which includes items such as ‘I can always manage to solve difficult problems if I try hard enough’. Participants are asked to respond to each item on a 4-point Likert scale. The measure of interest was the total number of points for the ratings of these 10 items (GSELF).

Self-regulatory self-efficacy: Being that domain specific self-efficacy, such as self-efficacy for a particular task or category of tasks, has been found to be a strong predictor of procrastination, and that self-efficacy for self-regulation specifically has been found to be a strong predictor of procrastination (Klassen et al., 2008), participants were asked to respond on a scale of self-efficacy for self-regulation, an 11 item, 7-point Likert scale (Zimmerman et al., 1992); the measure of interest was the total of the ratings for the 11 items (SRSELF).

Reliability statistics for validation of the above measures are included in appendix C.

Task-aversiveness: This value was derived from the items on the PIAR that asked
participants to rate the degree to which they disliked the prospect of doing a particular academic task, using a 9-point Likert scale. The average of the ratings for these tasks was used as an indicator of the perceived aversive nature of the tasks listed (avers) and included in analyses on the dependent measures AMTDIF and TIMDIF.

Results

All 105 participants completed the APS. 15 students either did not return or did not provide valid responses on the PIAR, and so the sample for analyses on dependent variables TIMDIF, AMTDIF, and DAYS included 90 participants. Two participants were unable to complete the ‘number-letter’ task. Data from three participants on the DFS-2 was omitted out of concern that their responses were not based on accurate instructions, and were therefore considered invalid. One participant did not complete the PANAS, and data for that participant was therefore not available for this measure.

Variable codes and their descriptions, as well as descriptive statistics for all dependent and independent variables are listed in Table 1. Pairwise correlations and group mean differences for these variables can be found in appendix B. The procrastination measures APS and TIMDIF were found to be significantly correlated (r=.38). A significant correlation was also observed for TIMDIF and AMTDIF (r=.54), although the strength of this association is likely due to the dependent nature of these two measures (values of 0 on AMTDIF meant that the corresponding value on TIMDIF would be 0 as well). A significant association was observed for TIMDIF and DAYS as well; however, after removal of the three highest values of DAYS, which were outliers that were observed to fall far from the rest of the distribution and were more than 3 sd from the upper quartile, a significant correlation was found between this variable and APS (r=.23), but it was no longer correlated with TIMDIF. Due to the fact that these values fell far from the range of remaining values for this variable, they were considered atypical of common procrastination tendencies (they also may have been the result of another process, such as forgetting), and results
including these values might not have been representative of normal procrastination; therefore, subsequent analyses including DAYS were conducted with the omission of these outlying values.

Table 1. Variable descriptions and descriptive statistics, range

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procrastination Measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>APS</td>
<td>Score on the ‘Academic Procrastination Scale’</td>
<td>105</td>
<td>63.75</td>
<td>18.08</td>
<td>32</td>
<td>104</td>
</tr>
<tr>
<td>TIMDIF</td>
<td>Average difference between the intended and actual times spent on academic tasks</td>
<td>90</td>
<td>1.033</td>
<td>1.12</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>AMTDIF</td>
<td>Average difference between the intended and actual amount of academic tasks completed</td>
<td>90</td>
<td>1.35</td>
<td>1.28</td>
<td>0</td>
<td>5.5</td>
</tr>
<tr>
<td>DAYS</td>
<td>Number of days taken to return the ‘Past Intended Action Report’</td>
<td>90</td>
<td>1.12</td>
<td>3.26</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td><strong>Executive Function Measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NLETMED</td>
<td>Cost of switching on the number-letter task, derived from the difference in median response time between switching &amp; non-switching trials</td>
<td>103</td>
<td>.63</td>
<td>.32</td>
<td>.0686</td>
<td>2.533</td>
</tr>
<tr>
<td>PLUMIN</td>
<td>Cost of switching on the plus-minus task, derived from the difference between switching &amp; non-switching trials</td>
<td>105</td>
<td>25.76</td>
<td>19.69</td>
<td>-7.75</td>
<td>79.75</td>
</tr>
<tr>
<td>GONOGO</td>
<td>Proportion of wrong responses (key presses) on no-go (red letter) trials</td>
<td>105</td>
<td>.04</td>
<td>.04</td>
<td>0</td>
<td>.2</td>
</tr>
<tr>
<td>ANTISAC</td>
<td>Proportion of wrong responses (arrow-key responses)</td>
<td>105</td>
<td>.23</td>
<td>.17</td>
<td>0</td>
<td>.7444</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORNGMED</td>
<td>Median response-time of correct responses (arrow-key responses on blue-letter trials)</td>
<td>105</td>
<td>0.56</td>
<td>0.07</td>
<td>0.421</td>
<td>0.8543</td>
</tr>
<tr>
<td>LETMEM</td>
<td>Proportion of letters remembered</td>
<td>105</td>
<td>0.63</td>
<td>0.16</td>
<td>0.125</td>
<td>0.9791</td>
</tr>
</tbody>
</table>

Self-Believe & Cognitive/Affective Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISFLOW</td>
<td>Score on the ‘Dispositional Flow Scale-2’</td>
<td>102</td>
<td>32.71</td>
<td>3.94</td>
<td>0.23</td>
<td>0.43</td>
</tr>
<tr>
<td>GSELF E</td>
<td>Score on the ‘General Self-Efficacy Scale’</td>
<td>105</td>
<td>32.30</td>
<td>3.68</td>
<td>0.22</td>
<td>0.40</td>
</tr>
<tr>
<td>SRSELF E</td>
<td>Score on the ‘Self-Regulatory Self-Efficacy Scale’</td>
<td>105</td>
<td>55.42</td>
<td>10.49</td>
<td>0.29</td>
<td>0.73</td>
</tr>
<tr>
<td>NEGAFF</td>
<td>Score on the ‘Negative Affect Schedule’</td>
<td>104</td>
<td>22.63</td>
<td>6.02</td>
<td>0.11</td>
<td>0.38</td>
</tr>
<tr>
<td>POSAFF</td>
<td>Score on the ‘Positive Affect Schedule’</td>
<td>104</td>
<td>34.69</td>
<td>6.12</td>
<td>0.19</td>
<td>0.49</td>
</tr>
<tr>
<td>AVERS</td>
<td>Average rate of aversion for academic tasks listed on the ‘Future Intended Action Report’</td>
<td>90</td>
<td>5</td>
<td>1.76</td>
<td>1</td>
<td>9</td>
</tr>
</tbody>
</table>

For the EF tasks NLETMED and CORNGMED, the median was used as a measure of central tendency in analyses. On the GONOGO task, 38 of the 105 participants performed at ceiling, and many others performed at near-ceiling rates (as apparent from the mean proportion of errors made on this task).

The only significant correlation found between the EF tasks and measures of procrastination was for CORNGMED, a measure of inhibitory control, and TIMDIF (r=.23).

Among the EF tasks, significant correlations were observed only between CORNGMED and the variables NLETMED (cognitive flexibility) (r=.29) and ANTISAC (inhibition) (r=.47). Due to the moderate correlation between these inhibitory control tasks, the data for these variables were standardized and their average used to create a single measure of inhibitory control: INHIB.

Reliability statistics for the survey measures derived from the study data are listed in
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APPENDIX C. With the exception of the Academic Procrastination Scale, alpha coefficients observed in this study were 5 to 8 points lower than those which have been reported in previous studies (also in APPENDIX C).

For association between measures of procrastination and survey measures, significant correlations were observed between APS and DISFLOW (r=-.30), SRSELFÉ (r=-.66), and POSAFF (r=-.26), and between TIMDIF and SRSELFÉ (r=-.27). These associations were all in the expected directions.

Two-sample t-tests were conducted to test the differences in group means for APS, LETMEM, as well as all survey measures. For the other measures of procrastination and measures of EF (whose distributions were highly skewed), Mann-Whitney tests were conducted for non-parametric tests of group differences. A table of variable differences according to group can be found in appendix C.

No significant differences between males and females were observed for three of the procrastination measures, however, males did have a significantly higher mean on the variable ‘DAYS’ (Mann-Whitney z = -2.013, p < .05). Males had significantly longer reaction times on the cognitive flexibility task NLETMED than females (mean .80 to .59, p<.05) though the size of this difference was due to one influential case (mean 2.5); excluding this case the mean difference between males and females was .71 to .59 (p=.06). Females made a higher proportion of errors on the anti-saccade task than males (mean .26 to .12, p<.001).

Significant differences were observed for college level on some of the procrastination measures: Undergraduates reported procrastinating more than graduates on the APS (mean 69.67 to 57.94, p<.001), and spent less time on tasks than they intended to as indicated by TIMDIF (mean 1.51) compared to graduates (mean 1.2; Mann-Whitney p<.05). Graduate students reported higher levels of self-efficacy for their self-regulatory ability than undergraduates (SRSELFÉ, mean 59 to 51.73, p<.001) and higher levels of positive affect (POSAFF, mean
35.94 to 33.39, $p<.05$). Group comparisons for school were similar to the trend observed for college level, which was expected because all the graduate student participants came from one school (school ‘h’). The only exception was for the procrastination measure DAYS, for which analyses revealed that students from school ‘c’ delayed significantly more than students from school ‘h’ in completing their research participation responsibilities by returning the PIAR (Mann-Whitney $p<.05$).

Results of analyses pertaining to the study hypotheses concerning the association of measures of procrastination to EF measures (Hypotheses 1 & 5) are presented first, followed by results related to survey measures (Hypotheses 2, 3, & 4). Being that the procrastination measures showed weak to moderate correlations with each other, these were treated as separate dependent variables, and tests of hypotheses were analyzed for each of these variables independently. Examination of plotted outcome vs. predictor variables, as well as standardized residuals vs predictors for multivariate regression models, did not indicate any strong violations of linearity between variables, and linear models were therefore a reasonable fit for the data. (The linear relationship of individual EF tasks with APS is depicted in Figure 1.) Bivariate linear regression models with EF tasks as predictors, as well as multivariate regression models that included all EF tasks together, did not reveal any of the EF tasks to be predictors for APS. Multivariate linear regression models with each of the EF variables, flow-frequency, and interaction term did not reveal there to be a significant interaction for these variables’ effects on APS. Because a significant interaction was not found for the composite inhibitory control variable INHIB, similar models were applied to the two tasks used to form this variable, ANTISAC and CORNGMED. Here, the interaction model did reveal there to be a significant effect of the interaction term of CORNGMED and flow-frequency on APS ($p<.05$). In a multivariate model that included all EF tasks along with the interaction term of CORNGMED and flow-frequency the interaction effect was observed to near significance ($p=.057$). A graph of margins of CORNGMED and flow-
frequency and their interaction on APS revealed a positive relationship of CORNGMED (reaction time on the go no-go task) with APS for lower levels of flow-frequency, whereas this relationship is observed to be negative for higher levels of flow (Figure 2). The finding of a positive relationship between the inhibitory control measure CORNGMED and APS for lower levels of flow is in line with hypothesis 1, although the negative relationship between these variables for higher levels of flow was unexpected.

Figure 1, a-f. Relationship between individual EF measures and APS.

a) GONOGO  

b) CORNGMED  

c) ANTISAC  

d) NLETMED  

e) PLUMIN  

f) LETMEM
Poisson quasi-likelihood regression models (with log link) were used to examine the relationship between TIMDIF and measures of EF. Although this method is ordinarily used for count (whole-integer) and not continuous variables, there are advantages to using this method as opposed to the more commonly-used log-linear analysis: the Poisson model accommodates zero-values (of which there were many for TIMDIF), as well as small values that may become influential in a log-linear analysis. It is thus the alternative recommended by several researchers (e.g. Woolridge, 2010). Robust estimators of variance were used to calculate standard errors (thereby allowing for some degree of overdispersion). (The linear relationship of individual EF tasks and TIMDIF is depicted in Figure 3.) In both bivariate and multivariate models, INHIB was not found to be a predictor of TIMDIF, and further analyses were therefore done on constituent tasks ANTISAC and CORNGMED. Bivariate models indicated a significant association for TIMDIF and the cognitive flexibility measure NLETMED (Wald $\chi^2 = 4.96$, pseudo $R^2=.01$, $p<.05$) and a small but statistically significant relationship with PLUMIN (Wald $\chi^2 = 3.98$, pseudo $R^2=.01$, $p<.05$). The strongest observed relationship was for TIMDIF and CORNGMED (Wald $\chi^2 = 4.96$, pseudo $R^2=.02$, $p<.05$). In a multivariate model that included all
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EF tasks, only CORNGMED was found to predict TIMDIF (z=3.73, p<.001; model statistics: Wald $\chi^2= 46.27$, pseudo R$^2=.05$, p<.0001). A model including CORNGMED, gender and the interaction of these two variables on TIMDIF showed a significant effect of the interaction term, and separate bivariate analyses for CORNGMED and TIMDIF by gender showed CORNGMED to be a predictor for males only (Wald $\chi^2= 15.14$, pseudo R$^2=.10$, p<.001). However, in full models that included all EF tasks, CORNGMED predicted TIMDIF for both males and females, though the effect for males was stronger (Coef. of 8.3, z= 3.51, p<.001 for males and Coef. of 4.8, z=2.69, p<.01 for females) (Table 2). (The relationship of CORNGMED with TIMDIF by gender is depicted in Figure 4). Based on residual deviance goodness of fit $\chi^2$ tests, above-mentioned whole-sample bivariate models were questionable fits to the data (p= .04 - .05), though the gender dependent and the full-EF models fit the data well. Based on Pearson $\chi^2$, all models were good fits to the data. There was no evidence for an effect on TIMDIF of the interaction between measures of EF and flow-level.

Figure 3, a-f. Relationship of individual EF tasks & TIMDIF.

a) GONOGO    b) CORNGMED    c) ANTISAC
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(Figure 3 cont.)

d) NLETMED
e) PLUMIN
f) LETMEM

![Graphs](image)

Figure 4. Relationship of CORNGMED & TIMDIF by gender.

![Graph](image)

Table 2. Poisson quasi-likelihood regression of TIMDIF on executive function measures, by gender.

<table>
<thead>
<tr>
<th>predictor</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coef.</td>
<td>Robust s.e.</td>
</tr>
<tr>
<td>GONOGO</td>
<td>12.0715</td>
<td>7.1194</td>
</tr>
<tr>
<td>CORNGMED</td>
<td>8.2796</td>
<td>2.3581</td>
</tr>
<tr>
<td>ANTISAC</td>
<td>-2.3628</td>
<td>2.5161</td>
</tr>
<tr>
<td>NLETMED</td>
<td>-.3400</td>
<td>.45431</td>
</tr>
</tbody>
</table>
Poisson quasi-likelihood regression was also applied to examine the relationship between AMTDIF and EF measures. (The linear relationship of individual EF tasks & AMTDIF is depicted in Figure 5.) Bivariate, and multivariate analyses including all EF measures, did not reveal any of these measures to be predictors of AMTDIF. There was no evidence for an effect of the interaction between measures of EF and flow-level on AMTDIF.

Figure 5, a-f. Relationship of individual EF tasks & AMTDIF.

a) GONOGO  b) CORNGMED  c) ANTISAC
Most of the participants did not delay their responses on the PIAR, so that the variable DAYS had many ‘0’ values. A zero-inflated poisson regression model was therefore used to examine the relationship between DAYS and predictor variables. (The linear relationship of individual EF tasks and DAYS is depicted in Figure 6.) Bivariate models did not show evidence of an association between DAYS and EF measures, nor did a multivariate model that included all EF tasks. Examination of the effect of the interaction of EF measures and flow-level did reveal some significant associations, all of which were counter to the relationship proposed in Hypothesis 1. For these models, the variable SRSELFE was entered as the inflation variable, as this variable was found to be the most reliable predictor for the procrastination measures used in this study. SRSELFE was found to predict zero-inflation in the models that will be described shortly, and entering the other predictors did not contribute to the $\chi^2$ score for the fit of any model. An effect of the interaction between PLUMIN and flow-frequency on DAYS was observed (Wald $\chi^2=70.51$, p<.0001). An effect for the interaction of inhibitory control variable GONOGO (proportion of incorrect responses on the ‘go no-go’ task) with flow-frequency was also found to be significant (Wald $\chi^2=23.47$, p<.0001). For both PLUMIN and GONOGO, participants low in flow-frequency procrastinated to a lesser degree than those higher in flow-frequency, counter to the relationship predicted by hypothesis 1. (It should be
pointed out that these associations may have been partially due to a combination of the extreme right-skewness of these variables and the inflation of zeros for the variable DAYS.)

Figure 6. a-f. Relationship of individual EF tasks & DAYS.

Aside from the gender difference observed for the effect of CORNGMED on TIMDIF, there were no effects of interaction between gender and EF measures on any measure of procrastination.

Examination of the survey measure predictors plotted against APS, and of residuals plotted against each predictor, did not reveal any true violations of assuming associations of linearity between these variables. (The linear relationship of individual survey measures and APS is depicted in Figure 7). Bivariate regressions of APS on the survey measures revealed statistically significant associations for DISFLOW (F= 9.82, R^2=.09, p<.01), SRSELF (F=...
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78.10, R²=.43, p<.0001), and POSAFF(F=7.23, R²=.07, p<.01). These associations were all in the expected direction. Multivariate regression models were then applied to examine the predictive power of these variables on APS when controlling for the influence of other variables. A model including DISFLOW, GSELFÉ, POSAFF, and NEGAFF predicted significant variance in APS (F= 6.45, R²=.21, p<.001), and each of these variables were found to predict a unique amount of variance in this model (DISFLOW, GSELFÉ, POSAFF significant at .01 level, NEGAFF at .05), however, GSELFÉ was found to be influential in an opposite (positive) direction to what was expected (Table 3). When SRSELFÉ was included in this model, it was found to predict APS (t=7.22, p<.001), while the other variables lost their predictive power, save for GSELFÉ (t= 3.45, p<.01) which again predicted APS in an unexpected (positive) direction (Table 4). (Partial effects for multivariate regression of APS on all survey measures excluding SRSELFÉ are depicted in Figure 8; partial effects for multivariate regression of APS on all survey measures excluding SRSELFÉ are depicted in Figure 9). The model with SRSELFÉ explained more than twice the variance (F=18.32, R² = .49, p<.0001), in APS than the model without it, and had significantly more predictive power as confirmed by a test of these models (Likelihood-ratio χ² = 44.13, p <.0001). The model including GSELFÉ explained significantly more of the variance in APS than a model with all the survey measures excluding GSELFÉ, as confirmed by a test of these models (LR χ² = 11.91, p<.001). Thus, hypotheses 2 and 4 were partially supported: both DISFLOW and NEGAFF predicted variation in APS when controlling for other variables; however, findings related to GSELFÉ were contrary to expectations, and DISFLOW did not predict variance in APS over that predicted by SRSELFÉ. Interactions between gender and these measures were non-significant, implying that these findings did not vary according to gender.
Figure 7. a-c. Relationship of individual survey measures & APS.

a) DISFLOW  

b) GSELFE  

c) SRSELFE  

d) NEGAFF  

e) POSAFF  

Figure 8. Partial regression plots for multivariate regression of APS on (in order from left to right) DISFLOW, GSELF, NEGAFF, POSAFF.
Figure 9. Partial regression plots for multivariate regression of APS on (in order from left to right) DISFLOW, GSELF, NEGAFF, POSAF, & SRSELF.

Table 3. Linear regression of APS on all survey measures excluding SRSELF

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISFLOW</td>
<td>-1.2129</td>
<td>.4529</td>
<td>-2.68**</td>
</tr>
<tr>
<td>GSELF</td>
<td>1.7275</td>
<td>.5229</td>
<td>3.30**</td>
</tr>
<tr>
<td>NEGAFF</td>
<td>.6134</td>
<td>.2923</td>
<td>2.10 *</td>
</tr>
<tr>
<td>POSAF</td>
<td>-0.8165</td>
<td>.3040</td>
<td>-2.69**</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>62.2753</td>
<td>21.7698</td>
<td>2.86</td>
</tr>
</tbody>
</table>

$R^2 = .2118$, F= 6.45***

*= p<.05, **= p<.01, ***=p<.001
Table 4. *Linear regression of APS on all survey measures including SRSELE*

<table>
<thead>
<tr>
<th>predictor</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISFLOW</td>
<td>.1228</td>
<td>.4101</td>
<td>0.30</td>
</tr>
<tr>
<td>GSELF</td>
<td>1.4624</td>
<td>.4241</td>
<td>3.45**</td>
</tr>
<tr>
<td>SRSELFE</td>
<td>-1.1253</td>
<td>.156</td>
<td>-7.22***</td>
</tr>
<tr>
<td>NEGAFF</td>
<td>.3765</td>
<td>.2384</td>
<td>1.58</td>
</tr>
<tr>
<td>POSAFF</td>
<td>-.3089</td>
<td>.2555</td>
<td>-1.21</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>77.3475</td>
<td>17.7127</td>
<td>4.37</td>
</tr>
</tbody>
</table>

*R^2 = .4908, F=18.32*

**= p<.01, ***=p<.001

Poisson quasi-likelihood regression models (with log link) were used to examine the relationship between TIMDIF and survey measures. (The relationship of individual survey measures and AVERS with TIMDIF is depicted in Figure 10.) Only SRSELFE was found to predict TIMDIF, in both bivariate models (Wald χ^2 = 6.95, pseudo R^2 = .03, p<.01) and in models including all survey measures (z=-2.14, p<.05; model statistics: Wald χ^2 = 14.28, pseudo R^2 = .05, p<.05) (Table 5). However, GSELF was found to predict TIMDIF at near-statistical significance in a model excluding SRELFE (z=1.93, p=.053), and to approach significance in the full model with SRSELFE (z=1.81, p=.07); these associations were positive, in the direction contrary to expectations. All other survey measures were associated with TIMDIF in the expected directions. AVERS was not a significant predictor of TIMDIF, and did not impact the predictive power of other variables in these models. A significant effect was found for the interaction of gender and NEGAFF on TIMDIF. Subsequent analyses showed NEGAFF to be a significant predictor of TIMDIF for males in this sample (p <.05), but not for females. Residual
deviance and Pearson goodness of fit $\chi^2$ tests showed these models were a reasonable fit for the data.

Figure 10, a-f. *Relationship of individual survey measures & AVERS with TIMDIF.*

Table 5. *Poisson quasi-likelihood regression of TIMDIF on all survey measures*

<table>
<thead>
<tr>
<th>predictor</th>
<th>Coef.</th>
<th>Robust s.e.</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISFLOW</td>
<td>-.0077</td>
<td>.0365</td>
<td>-0.21</td>
</tr>
<tr>
<td>GSELF E</td>
<td>.0645</td>
<td>.0356</td>
<td>1.81</td>
</tr>
<tr>
<td>SRSELF E</td>
<td>-.0268</td>
<td>.0125</td>
<td>-2.14*</td>
</tr>
<tr>
<td>NEGAFF</td>
<td>.0278</td>
<td>.0185</td>
<td>1.50</td>
</tr>
<tr>
<td>POSAFF</td>
<td>-.0100</td>
<td>.0233</td>
<td>-0.43</td>
</tr>
</tbody>
</table>
Poisson models were also used to examine the relationship between AMTDIF and survey measures. (The relationship of individual survey measures and AVERS with TIMDIF is depicted in Figure 13.) Bivariate regression models did not indicate any associations between these variables and AMTDIF. In the multivariate model including all survey measures, only GSELF was found to predict AMTDIF (z=2.08, p< .05); this association was again in the direction contrary to that predicted (Figure 11). All other measures were associated with AMTDIF in the anticipated direction (Table 6). This model did not explain much of the variance in AMTDIF, (Wald $\chi^2$ = 14.28, pseudo $R^2$=.05, p>.29)and goodness of fit tests indicated it was not a very good fit for the data (Deviance $\chi^2$=112, p =.02; Pearson $\chi^2$=105, p =.04)). AVERS was not a significant predictor of AMTDIF, and did not impact the predictive power of other variables in these models. No significant interactions were observed between gender and these measures.

Figure 11, a-f. Relationship of individual survey measures & AVERS with AMTDIF.

a) DISFLOW  

b) GSELF  

c) SRSELF
Table 6. Poisson quasi-likelihood regression of AMTDIF on all survey measures

<table>
<thead>
<tr>
<th>predictor</th>
<th>Coef.</th>
<th>Robust s.e.</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISFLOW</td>
<td>-0.0173</td>
<td>0.0309</td>
<td>-0.56</td>
</tr>
<tr>
<td>GSELFÉ</td>
<td>0.0546</td>
<td>0.0262</td>
<td>2.08*</td>
</tr>
<tr>
<td>SRSELFÉ</td>
<td>-0.0051</td>
<td>0.0119</td>
<td>-0.43</td>
</tr>
<tr>
<td>NEAFF</td>
<td>0.0112</td>
<td>0.019</td>
<td>0.59</td>
</tr>
<tr>
<td>POSAFF</td>
<td>-0.0217</td>
<td>0.0192</td>
<td>-1.13</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-0.1087</td>
<td>1.1598</td>
<td>-0.09</td>
</tr>
</tbody>
</table>

Pseudo $R^2 = 0.0186$, Wald $\chi^2 = 6.08$

* = p<.05

Zero-inflated poisson regression was used to examine the relationship between DAYS and survey measures. (The relationship of individual survey measures with DAYS is depicted in Figure 12). SRSELFÉ was used as the inflation variable, and inclusion of other predictors did not add to the explanatory value of the model. No significant association were observed for DAYS and these measures, though the associations between these variables were all in the anticipated
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direction for bivariate (though NEGAFF had a negative coefficient which was near zero (Coef. = -.001)) as well as multivariate models including all measures. Thus, hypotheses 2 & 4 were not supported for TIMDIF, AMTDIF, or DAYS.

Figure 12, a-e. Relationship of individual survey measures with DAYS.

a) DISFLOW  b) GSELFÉ  c) SRSELFÉ

d) NEGAFF  e) POSAFF

The proposed causal model of GSELFÉ \(\rightarrow\) NEGAFF \(\rightarrow\) DISFLOW (hypothesis 3) was not supported; although linear regression models confirmed that GSELFÉ did predict NEGAFF, NEGAFF was not found to predict DISFLOW in a model including GSELFÉ. However, although the causal model implicating the relationship of affect to flow frequency through NEGAFF was not supported, a similar model replacing NEGAFF with POSAFF was found to be accurate. (The relationship of the variables GSELFÉ and POSAFF with DISFLOW is depicted in
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Figure 13.) Regressing DISFLOW on GSELFÉ and POSAFF indicated POSAFF to be a predictor of DISFLOW (t=3.04, p < .01; model statistics: $F= 8.51, R^2 = 0.15, p<.001$), but not GSELFÉ. A bivariate model regressing POSAFF on GSELFÉ showed GSELFÉ to predict POSAFF ($F= 19.92, R^2 = .1634, p< .0001$) (Table 7a,b). (Partial effects for these variables on DISFLOW are depicted in Figure 14a; the relationship between GSELFÉ and POSAFF is depicted in Figure 14b). Examination of plotted predictors and residuals did not reveal any violations of linearity between these variables.

Figure 13, a-b. Relationship of DISFLOW with GSELFÉ & POSAFF.

| Figure 14a. Partial regression plots for multivariate regression of DISFLOW on (from left to right) POSAFF & GSELFÉ. |
Figure 14b. Relationship of GSELF and POSAFF.

![Graph showing the relationship between GSELF and POSAFF]

Table 7a: Linear regression of DISFLOW on POSAFF & GSELF. Only POSAFF predicts DISFLOW at a statistically significant level (p<.01).

<table>
<thead>
<tr>
<th>predictor</th>
<th>coef.</th>
<th>s.e.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSAFF</td>
<td>.1970026</td>
<td>.0647001</td>
<td>3.04**</td>
</tr>
<tr>
<td>GSELFE</td>
<td>.1463417</td>
<td>.1084618</td>
<td>1.35</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>21.13728</td>
<td>3.337665</td>
<td>6.33</td>
</tr>
</tbody>
</table>

\[ R^2 = 0.1479, F = 8.51*** \]

** = p<.01, *** = p<.001

Table 7b: Bivariate regression of POSAFF on GSELF. GSELF predicts POSAFF (p<.001).

<table>
<thead>
<tr>
<th>predictor</th>
<th>coef.</th>
<th>s.e.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSELF</td>
<td>.6709</td>
<td>.1503</td>
<td>4.46***</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>13.035</td>
<td>4.8839</td>
<td>2.67</td>
</tr>
</tbody>
</table>

\[ R^2 = .1634, F = 19.92**** \]

*** = p<.001, **** = p<.0001
College level (graduate vs undergraduate) was included in a multivariate model with all survey measures to determine if this variable added any explanatory value to prediction of the various procrastination measures. On 3 of the 4 measures, college level was not significantly associated with higher rates of procrastination when other personality measures were controlled for; however, the trend was for undergraduates to report higher rates of procrastination than graduate students. College level was found to be a significant predictor for the variable DAYS ($t= -2.13$, $p<.05$; model statistics, with SRSELF as the inflation variable: Wald $\chi^2 = 36.79$, $p<.0001$).

**Discussion**

The Academic Procrastination Scale (APS), a recently composed self-report measure of academic procrastination (McCloskey & Scielzo, 2015), was observed to correlate with semi-objective and objective academic procrastination measures (TIMDIF and DAYS), which is an indicator of convergent validity for this scale. The lack of correlation of the EF tasks for cognitive flexibility (the plus-minus and number-letter tasks) with one another was somewhat surprising, being that previous studies have found statistically significant albeit weak-to-moderate correlations between these, as well as other cognitive EF tasks of the same category (e.g. Miyake et al., 2000; Gustavson et al., 2015). Among the EF tasks for inhibitory control, the proportion of incorrect answers on the ‘go no-go’ task was observed to correlate at a level not far from statistical significance with the median response time for correct responses on this task ($p=.09$) and with the proportion of incorrect answers on the anti-saccade task ($p=.12$); however, contrary to the findings of the above mentioned studies, these correlations did not reach significance. A simple explanation for this outcome could be that almost all the participants performed near the ceiling for this task, which did not allow for enough variation to observe its association with the other inhibitory control tasks. Near-ceiling rates of performance have been reported in other studies using a similar paradigm for the ‘go no-go’ task to that used in this
study (correspondence with the author: Hall et al., 2008). In addition, it is important to note, that notwithstanding the above mentioned studies (e.g. Miyake et al., 2000; Gustavson et al., 2015) and others that have reported finding significant correlations between various measures of EF, a lack of correlation between EF tasks is a common finding of many studies that have implemented similar tasks, and particularly studies that have examined the convergent validity of tasks intended to measure inhibitory control (e.g. Fan et al., 2003; Stins et al., 2005; Humphrey and Valian, 2012; Paap & Greenberg, 2013). Findings such as these challenge the assertion that data derived from individual tasks that are purportedly indicators of EF ability are actually measures of a unitary construct.

The lack of association between the cognitive EF tasks and a self-report measure of procrastination does not necessarily contradict findings from other studies: Paulitzki (2010) reported finding that an inhibitory control measure that included median response-time on the ‘go no-go’ task and performance on the anti-saccade task was not correlated with self-reported procrastination. Gustavson et al. (2015) report a statistically significant negative correlation between a common EF measure that included inhibitory control and self-reported procrastination; however, this study used a much larger sample size (n=751) and the association was quite weak (r= -.15). In addition, no associations were observed in Gustavson et al.’s study between the self-report procrastination measure and cognitive flexibility and updating of working memory measures of EF. It is notable that the only EF measure for which an association with self-reported procrastination was observed in the present study was the ‘go no-go’ median response time (an inhibitory control measure), for which a positive association was observed for participants who indicated they were lower in ‘flow-frequency’ on academic tasks, and a negative association for participants who indicated they were higher in ‘flow-frequency’. This finding could be interpreted as a partial confirmation of hypothesis 1, though the negative association for ‘high-flow’ participants was unexpected. It may also suggest that the weak
correlation between self-reported procrastination and common EF reported by Gustavson et al. (2015) may be due in part to a lack of differentiation among participants on other cognitive/affective variables related to personality, such as level of ‘flow-frequency’. As alluded to above, the findings related to correct responses on the go no-go task were subject to ceiling effects. In addition, several participants did express some difficulty with perceiving the stimulus in the ‘anti-saccade’ task, which was the other task intended to measure inhibitory control in this study, and it is therefore possible that this task is not a pure measure of inhibitory control, and that speed of visual perception may be partly responsible for the correlation between the anti-saccade and go no-go median RT measures. If so, median response time on the go no-go task may have been the most representative measure of inhibitory control ability in this study.

The above mentioned relationship of median response time on the ‘go no-go’ task with self-reported procrastination was the only evidence of an interactive effect of flow-frequency and EF. The effect predicted in hypothesis 1 was not observed with respect to the semi-objective measures of procrastination used in this study. An interactive effect between the EF measures GONOGO (proportion of incorrect responses on the ‘go no-go’ task) and PLUMIN (switching-cost of alternating between addition and subtraction) with level of flow-frequency was observed for the objective procrastination measure, which was the number of days taken to return the PIAR: results indicated higher levels of procrastination for participants higher in flow-frequency, contrary to that which was hypothesized, and seem to be a refutation of the relationship proposed by hypothesis 1. Significant main effects were observed for EF tasks on the difference between intended and actual time spent on academic tasks: the cognitive flexibility ‘plus-minus and ‘number-letter’ tasks, as well as median response time on the ‘go no-go’ task (inhibitory control) had positive effects on this procrastination measure. However, after controlling for the effect of other EF tasks, only the median RT measure emerged as a predictor. The finding that only an EF measure of inhibitory control uniquely predicted greater levels of procrastination on this measure
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echoes the findings of Gustavson et al. (2015) mentioned above. That this inhibitory control measure predicted a greater discrepancy between intended and actual time spent on academic tasks, as well as higher levels of self-reported procrastination for the group that reported a lower probability of achieving flow-states while working on academic tasks, may provide some tentative evidence that difficulty with inhibiting prepotent responses is linked to procrastinating on academic tasks among university students (though the seemingly contradictory negative relationship of inhibitory control measures to the objective measure of days taken to respond is still problematic). Another finding of note related to inhibitory control as measured by median response time concerns the variation of its effect by gender; longer response-times predicted a greater discrepancy between intended and actual time spent on academic tasks for males than that found for females. These findings are compatible with those of Paulitzki (2010), who found that inhibitory control predicted higher rates of procrastination, as measured by a self-report survey, for males than for females, although contrary to Paulitzki the results of the present study found the same association to be significant for females as well (when controlling for the effect of other EF measures).

The variable that emerged as the strongest (in terms of effect) predictor of academic procrastination was self-belief of one’s efficacy for the capacity to self-regulate: the greater one’s self-efficacy for their self-regulatory ability, the less prone they were to rate themselves highly on engaging in procrastinating behaviors, or to fail at following through with their intention to spend time on academic tasks. This finding is consistent with Klassen et al. (2008), who found self-regulatory self-efficacy to be the strongest predictor of procrastination. Although other personality measures included in this study did predict self-ratings of procrastinating behavior, the effects of most of these measures were no longer visible once self-regulatory self-efficacy was controlled for. The nature of the relationship between these explanatory variables is unclear, though. It is possible that other personality measures did not explain any more of the
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variance in self-reported procrastination due to the predictive power of self-regulatory self-efficacy. Alternatively, the unexpected high-correlations between self-regulatory self-efficacy and two of these variables, flow-frequency and positive affect, suggests that certain of these variables may act as mediators of the effect of others on this measure of procrastination. That these personality measures all added to the predictive power of a model to explain self-reported procrastination when the effect of self-regulatory self-efficacy was ignored is indicative of the complex nature of the component causes of procrastination.

An unexpected finding was the relationship of general self-efficacy, a measure of one’s personal agency, and academic procrastination. Contrary to the hypothesized relationship, higher levels of general self-efficacy consistently predicted higher levels of procrastination. This finding was observed consistently across 3 of the 4 procrastination measures (although for one measure this relationship only approached statistical significance) used in this study: higher self-ratings of general self-efficacy were related to higher levels of self-reported procrastinating behavior, greater discrepancies between intended and actual time spent on academic tasks, and greater discrepancies between the intended and actual amount of academic tasks completed. The implication of this finding is that one’s general belief in their ability to effect change and work toward facilitating their goals may hinder the attainment of certain specific goals, such as completing academic tasks. These results contradict the findings of the studies referenced above that report a negative relationship between the construct of general self-efficacy and academic procrastination. In two of these studies researchers used a different measure of general self-efficacy than the one used here, and all three used different procrastination measures than the ones used in this study as well. However, an additional explanation for these divergent findings may be that these prior studies did not include other self-belief and cognitive/affective measures (self-regulatory self-efficacy, flow-frequency, positive and negative affect), and thus did not control for the influence of these variables on
procrastination, the implication being that much of the negative relationship between general self-efficacy and procrastination observed in these studies may have in fact been due to self-regulatory efficacy beliefs or characteristics of affective experience. Whether or not these suggested explanations serve to adequately reconcile the different findings of this and prior studies, the fact that the present study found general self-efficacy to be positively associated with academic procrastination on three separate indices of procrastination, and is the only one to have included semi-objective measures of the construct, lends credence to these results. A possible explanation for this finding comes from research on goal-setting. According to ‘Fantasy Realization Theory’ (Oettingen et al., 2001), cognitions focused on positive outcomes that are not contrasted with a present reality do not lead to the formation of actual expectations, and therefore do not activate an impetus to work toward those outcomes. Similarly, a sense of agency, or general belief in one’s ability to accomplish one’s goals, may be motivated by a sense of optimism that is not informed by a reckoning of attaining concrete goals or their potential obstacles. This optimism about future outcomes may produce a sense of complacency and hinder the activation of resources toward achieving actual goals (Oettingen et al., 2001). The present study suggests there may be a trait-level application of this theory, i.e., people who report higher rates of belief in their general ‘self-efficacy’, or personal agency, may be disposed to engage in more fantasy-based cognitions that are not coupled with realistic assessment of goal-attainment, which can hinder the activation of one’s goal-related resources and lead to procrastinating behavior. On the other hand, the present study also suggests that general belief’s in one’s efficacy is linked to certain affective experiences that might shield one from procrastinating, as observed with regard to the frequency of experiencing positive affect and flow-states.

As indicated by their low correlation, positive and negative affect are not on opposite ends of a single scale of affective experience, but are conceived of as operating along two independent scales (Watson et al., 1988). The variation in the strength of the relationship
between these measures of affect with other personality measures observed in our study is therefore not surprising. Specifically, the frequency of experiencing negative affect did not predict variation in the frequency of experiencing flow-states during an academic task, whereas the frequency of positive affective experiences did, both when the influence of general self-efficacy was and was not controlled for. As a result, the hypothesis concerning a negative association between the frequency of negative affect and flow experience was not supported, whereas a positive association between positive affect and flow experience was supported. Being that general self-efficacy did predict variation in positive affective experience, these findings provide some evidence for the role of one’s sense of personal agency for facilitating flow states.

The aversive nature of the academic tasks listed by participants on the ‘intended action report’ was not related to either measure of procrastination (difference between intended and actual time spent on tasks and amount of tasks completed a week later) derived from this report, which was surprising given the previous research alluded to above that has found an association between task-aversiveness and procrastination. Two of these studies used semi-objective procrastination measures (‘personal projects’: Lay, 1990; Blunt & Pychyl, 2000), similar to the measure used here. It is possible that the measure of task averseness used, an average of the ratings of the level of dislike for the tasks listed by each participant, was not a sensitive enough measure to detect its influence. Another possible explanation for this disparity in results could be that the design of the present study is distinct from the above mentioned studies in its combination of two features: procrastination scores were derived from activities that were limited to academic tasks only, and the ratings of aversiveness were ascribed by the participants. It is possible that the resistance to task-engagement normally associated with its being perceived as averse is compensated for by an induced motivation to meet externally imposed deadlines. The due dates of the various academic tasks listed by participants were not controlled for in this study, and the influence of the aversiveness of these tasks might not have been apparent as a
Aside from the gender difference for the association between inhibitory control (as measured by median response time on the go no-go task) and procrastination as measured by the discrepancy between intended and actual time spent on academic tasks, the only other difference observed between males and females concerned the association of negative affect and procrastination as measured by the same indicator (discrepancy between intended and actual time spent on academic tasks): for males, greater frequency of experiencing negative affect predicted larger discrepancies between intention and action, whereas for females this relationship was not observed. Although conclusions about gender based on the results of this study are questionable due to the small number of males included in the sample, these findings taken together suggest an interesting basis of inquiry for future research, as they might indicate that females are better able to regulate their cognitive and emotional states and overcome distractors in the process of working toward academic goals.

In summary, evidence of support for the study hypotheses is dependent on the particular explanatory and outcome measures in question: some evidence for Hypothesis 1 is observed for one inhibitory control measure, median response time on the ‘go no-go’ task, and procrastination as measured by self-report; Hypothesis 2 is confirmed for flow-frequency on academic tasks and self-reported procrastination, but not for general self-efficacy or negative affect, or any other measure of procrastination; Hypothesis 3 is not confirmed for negative affect, but the suggested causal model is confirmed when this component is replaced with positive affect; Hypothesis 4 is confirmed for the explanatory value of flow-frequency over that of negative affect, but not that of self-regulatory self-efficacy or task-aversiveness, and only for self-reported procrastination; regarding the question of gender differences in the relationship between the various explanatory and outcome variables, the only differences observed were for the effects of an inhibitory control measure, median response time on the ‘go no-go’ task, and negative affect on procrastination as
measured by the discrepancy between intended and actual time spent on academic tasks.

As a whole, the findings suggest that factors across different levels of our psychological experience may be linked to academic procrastination. Cognitive factors such as the ability to inhibit prepotent or intrusive thoughts and enter ‘flow-states’, affective factors such as positive and negative mood, and self-beliefs, such as self-efficacy regarding one’s ability to self-regulate their academic work and general self-efficacy regarding one’s ability to be an agent of their own outcomes, may all contribute to the tendency for procrastinating on academic tasks. Though all these factors may be linked to procrastination, the results of this study implicate self-beliefs as the most influential of these predictors. Self-efficacy for one’s ability to self-regulate their efforts on academic tasks is related to lower scores on self-reports of academic procrastinating behavior and lower discrepancy rates between the actual time spent and time intended to be spent on academic tasks. The predictive value of this construct as observed in the present study is in line with other studies that have linked self-regulatory self-efficacy with academic procrastination (Klassen et al., 2008) and other outcomes such as setting higher academic goals and pro-social behavior (Bandura et al., 1996), as well as outcomes outside of the academic domain, such as the achievement of exercise goals (Jung & Brawley, 2013). Given the prominence of self-regulatory self-efficacy among the other personality variables suggested as having explanatory value for procrastination in this study, it would be expected that mechanisms implicated in self-regulatory deficiency predict high levels of procrastination; this did appear to be the case, as an inhibitory control measure emerged as the only measure of EF for which there was some evidence of its link to both self-reported and semi-objective forms of academic procrastination. In all, the variables found to be predictors of academic procrastination in this study lend support to the conception of procrastination as a self-regulatory breakdown. This model for understanding procrastination is consistent with the phenomenon of ‘hyperbolic discounting’, suggested by Steel (2007) and others to be a fundamental component of procrastination. The term hyperbolic
discounting is derived from the distribution of the relationship between a given reward’s value and the delay in time until the reward is realized. Stotz (1956) investigated the preference of immediate over distal rewards, and described the relationship between the value of a given reward and the delay of its realization as having a hyperbolic shape, meaning that valuations for that reward decline sharply in a time frame that is very short-term (e.g. an immediate vs one-day delay of reward realization) but then decline at a much slower rate for time-frames that are more long term (e.g. a 1 month vs 2 month delay of reward realization). The tendency to irrationally discount a delayed reward in favor of another reward that can be realized immediately can be interpreted as a failure of one’s efforts to self-regulate the urge to act impulsively.

General self-efficacy, or the belief of one’s agency for bringing about desired outcomes, was also observed to be linked with academic procrastination. General self-efficacy, when controlling for the influence of self-regulatory self-efficacy, frequency of flow and affective states, was associated with higher ratings of self-reported procrastination, and there was evidence for its link to higher rates of discrepancies between the intended and actual time spent on academic tasks and the intended and actual amount of academic tasks completed as well. This finding was unexpected, but is not without a theoretical explanation: a predisposition to believe in one’s capability that is uncoupled from any real-world, situational assessment can foster a sense of complacency that may hinder the activation of resources toward an actual goal. On the other hand, general self-efficacy was observed to correlate with level of flow-frequency during an academic task and positive affect, variables that were found to predict lower levels of self-reported procrastination, and to correlate with self-regulatory self-efficacy at a nearly-statistically significant level. It is therefore feasible to propose a relationship between this construct and academic procrastination, and one that could motivate future research: that moderate level of belief in one’s personal agency may play an important role in facilitating cognitive and affective states necessary for goal-related activities, but that higher levels of this
belief may be counterproductive and actually hinder, or at least delay, the process of working toward academic goals.

Limitations

There are several limitations to this study: Any conclusion about the association of the EF process inhibitory control with academic procrastination is at most tentative. While a measure of inhibitory control was found to predict discrepancy between intended and actual time spent on academic tasks, as well as self-reported ratings for procrastinating behavior with respect to academic tasks for participants identified as experiencing lower frequency of academic task-flow, these results were only observed for one of the three measures of inhibitory control used in this study. Although it is possible that this measure, participants’ median response times on the ‘go no-go’ task, was the most representative inhibitory control measure included in the procedure due to methodological issues with the remaining measures (participants performed at or near ceiling for their accuracy on the go no-go task, while the difficulty of many participants on the ‘anti-saccade’ task may indicate that performance reflecting inhibitory control ability could be confounded with perceptual ability), it is not possible to form a strong argument for an inhibitory control-procrastination link on the basis of one measure (not to mention the fact that these results were reversed in terms of their effect on the objective measure of procrastination used in this study). A reliable determination of this link would necessitate using other measures of inhibitory control, or slightly modified versions of the measures used in this study. Specifically, it is recommended that the ‘Stroop’ task be included in future research on inhibitory control. Gustavson et al. (2015) did find an association between performance on this task and self-reported procrastination. This task was left out of the present study based on previous findings that it did not correlate with the other inhibitory control measures used in this study (Paulitzki, 2010); however, other studies have found that these measures are indeed correlated (Miyake et al. 2000; Gustavson et al., 2015). The ‘go no-go’ task used in this study was intentionally
designed to involve a lower level of difficulty than some other EF tasks out of concern that performance on tasks that are all of a high-level of difficulty would be compromised because of the effects of fatigue, and would thus not be pure measures of the executive functions they are intended for. As such, the objective for this task was to distinguish between upper and lower-case letters. It is recommended that this task paradigm be implemented with stimuli of a higher-difficulty level, such as distinguishing between plant and non-plant related words, as done by Miyake et al. (2000). The ‘anti-saccade’ task could be implemented using stimuli that are more easily distinguishable, such as by lengthening the presentation time of the arrows (which were only visible for 150 milliseconds, as per Miyake et al., 2000).

As alluded to earlier, an issue inherent in any study involving EF tasks is the potential for results to be confounded with participant fatigue effects. Although the number of EF tasks, and specifically tasks of a high-level of difficulty, were kept to a minimum, several participants reported various expressions consistent with frustration while engaging in these tasks. To improve on the validity of EF task results, research procedures might be designed to incorporate the administration of EF tasks in multiple sessions.

As discussed above, frequency of experiencing flow on an academic task, and both positive and negative affect predicted self-reported academic procrastination in a partial regression model, but were not found to add any explanatory value to the variance of this procrastination measure in a full model including self-regulatory self-efficacy. However, the nature of the effects of these variables on one another and ultimately on procrastinating behavior remains unclear: It is possible that the predictive value of these personality variables is subsumed by self-regulatory self-efficacy simply because they have elements in common with the more powerful predictor (flow-frequency and positive affect were correlated with self-regulatory self-efficacy, while the correlation for negative affect was nearly significant); on the other hand, it is possible that the variables in question influence self-reported academic procrastination in
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varying stages of the etiology of procrastination, so that flow-frequency and negative and positive affect may be more local predictors of procrastination, i.e. they are experienced in temporal proximity to a procrastination event, while self-regulatory self-efficacy is more distally related to procrastination, but plays a role in facilitating all three of the aforementioned variables. This question is left to future research investigation.

The measures of academic procrastination used in this study were not all correlated with one another, and the relationships that were observed could be characterized as weak to moderate. In addition, the relationship of the suggested explanatory variables with academic procrastination varied depending on whether the procrastination measure was self-reported, semi-objective, or objective, a result similar to that found in other studies (e.g. Steel, 2001, with regard to negative affect). These results raise questions about the degree to which these procrastination measures are all reflective of behavior on the same construct. However, a possible indicator of a variable’s validity for predicting procrastination might be its observed effects across more than one type of procrastination measure, as implied by the results of the present study: predictors whose effects were greater on the self-report measure of academic procrastination (i.e. self-regulatory self-efficacy and general self-efficacy) were also predictors of a semi-objective measure of procrastination.

None of the survey measures of suggested explanatory variables predicted procrastination on the objective measure of days taken to return the follow-up ‘past intended action report’, although this value may not have been an accurate measure of objective procrastination for two reasons: The effort and time involved in responding on this report and sending it via email was minimal, and many participants therefore found it easy to simply complete and return the form as soon as they received it (leading to the inflation of zeroes on this measure); in addition, the scoring units for this measure were days, and thus it may have been too broad a measure to capture minor increments of delaying in returning the form. It is recommended that future
research utilize an objective measure of procrastination that involves a task with a sufficient amount of effort so as to elicit an interest to procrastinate, and that is sensitive in terms of its capability to capture more subtle gradations of measurement.

The results of this study are limited in the scope of their application. First, the dependent measures used were specific to academic procrastination, and might not be informative about the tendency to procrastinate in general. In addition, although it appears clear that self-regulatory self-efficacy is associated with less academic procrastination, the measure used contained items specific to the self-regulation of academic activities. Whether self-efficacy for the self-regulation of other tasks is similarly linked to lower levels of procrastination would fall to future research.

The sample used in this study limits its application to a broader population of non-college students. However, in terms of its validity for the proscribed population of college students, the makeup of this sample is a strength, as the student body at the two campuses from which participants were recruited afforded a diversity that is more representative of the various ethnic groups present at most colleges. The gender differences indicated for certain variable relationships are suggestive but not conclusive, due to the small number of males in this sample. Future research study should include a sufficiently large number of both males and females to determine if gender differences actually exist in these relationships.

The implication that students with higher levels of self-regulatory self-efficacy are less prone to procrastinate on their schoolwork supports the view of procrastination as self-regulatory breakdown. Although it is not possible to conclude that there is a causal relationship between these two variables based on the present study, i.e. an interpretation of this relationship can be made in the opposite direction as well, as it is possible that people form judgments about their ability to self-regulate by their experience with completing their academic responsibilities in a timely manner, the vast amount of research that has found increases in self-efficacy appear to bring about positive outcomes (e.g. Bandura, 1977; Ewart et al., 1986; Marks & Allegrante,
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2005; Schnoll et al., 2011) lends support to the argument that self-regulatory self-efficacy for academic tasks is an important determinant of academic procrastination. The predictive power of this construct vis a vis academic procrastination found in this study recalls the argument of Klassen et al. (2008), that referring to procrastination as a self-regulatory issue may be too simplistic, as it ignores the role of self-beliefs in motivating the decision to act. In terms of ‘Temporal Motivation Theory’ (Steel, 2007), which implies a reductive relationship between motivational and temporal properties of task engagement, as expressed by the equation: E V/Γ D, self-regulatory self-efficacy would be an important factor in determining expectancy for succeeding at a specific task and diminishing the likelihood of procrastination. However, there may be some utility in distinguishing between the factors that are typically considered when evaluating one’s expectancy for success, such as self-efficacy concerning a specific skill, and factors that are specific to the self-regulation of one’s efforts toward effecting a desired outcome, such as self-regulatory self-efficacy. As reported in Zimmerman et al. (1992) with regard to academic achievement, self-efficacy for self-regulation appears to be an important facilitator of skill-level self-efficacy. Moreover, in regarding procrastination as a self-regulatory issue, belief in the ability to manage one’s goal-related efforts against a delay in reward realization (essentially, the answer to the question “How good am I at getting things done without putting them off?”) is inherently related to the degree to which time considerations are impactful, and it is thus not clear whether belief about self-regulatory capacity belongs in the numerator (motivation-related variables) or the denominator (time-related variables) of the aforementioned equation. Regardless of how these relationships are represented in a model or equation, it would seem more informative to apply a more elaborate definition of procrastination, as in one that included self-regulatory beliefs.

In contrast, the implication that people with higher levels of belief in their personal agency, or their ability to bring about outcomes that are commensurate with their goals in
general, may be more prone to procrastinating on academic tasks does not lend itself to a straightforward interpretation. As suggested above, it may be that people who report a high level of general optimism about achieving their desired outcomes are not as apt to engage in realistic assessments of the likelihood of achieving outcomes on particular tasks by attending to important task characteristics, such as difficulty, and thereby do not fully activate their resources toward a given goal. In any case, the reliability of this association should be addressed through replication in future study, in light of the divergence in results between this and prior studies.

This study has attempted to be fairly comprehensive in including the competing influences of many factors that prior research has identified as being linked to procrastination, but it does not claim to have accounted for all potential contributing factors. Other individual and contextual characteristics exist that would undoubtedly help form a more well-rounded investigation of the potential antecedents of the tendency to procrastinate. In particular, one dimension of personality that would probably add much to our understanding of individuals’ tendency to procrastinate is whether someone possesses an action vs a state orientation (Kuhl, 1981). According to Kuhl’s ‘action control theory’, individuals differ to the extent that they are ‘action oriented’, which implies one’s focus is on distinct actions and plans that can be used to overcome obstacles in reaching a desired goal, or ‘state oriented’, which implies one’s focus is on a future, past, or present state of the self. People with a state orientation appear to have a deficit with regard to initiating their intentions, and the tendency to procrastinate has therefore been theorized to be a common feature of people with a state orientation (Kuhl, 1981).

Empirical research has confirmed this assumption, finding moderate to strong relationships between these two variables (Beswick & Mann, 1994, as cited in Blunt & Pychyl, 2005; Blunt & Pychyl, 1998, 2005). This personality dimension is thought to influence the task-related behaviors of individuals in three main areas: one’s degree of preoccupation during a task, hesitation with regard to initiating a task, and volatility with regard to maintaining focus on a
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task. Research has found that differences between individuals with action or state orientations are more salient when the task in question is perceived as stressful or difficult, as is the case with many academic tasks. Due to the association of this personality variable with habits associated with procrastination, its inclusion would presumably add to the power of a model aimed at identifying individuals who are the most at risk for engaging in problematic levels of procrastination on academic tasks. Considering these areas of difference (alluded to above), this dimension may also provide some insight into the variables that were observed to predict academic procrastination in the present study. People identified as being predominantly state oriented are more often preoccupied with competing thoughts while engaged in a given task, e.g. they are more likely to indicate that they have a difficult time concentrating on anything else when they are concerned about something, or that they find it difficult to stop thinking about having lost in a given competition. Issues with preoccupation appear consistent with an inhibitory control deficit, and may be one interpretation of the results of this and other research studies that have found inhibitory control to be the executive function process most predictive of the tendency to procrastinate. State-oriented individuals also are apt to hesitate when initiating involvement on a task, and are more likely to indicate that they have to push themselves to get started with, or don’t think they will be able to overcome the obstacles inherent in, difficult tasks. This characteristic is consistent with the predictive value of self-regulatory self-efficacy for academic procrastination. These individuals are also more ‘volatile’ (to use Kuhl’s terminology) with respect to their task engagement, and will indicate, for example, that they will quickly tire of a new and interesting game they have learned, or that they like to do other things while watching a good movie. A tendency toward volatility while engaging in tasks (even those perceived as enjoyable) is in distinct contrast to individuals who frequently experience flow-like states during an activity. State-oriented individuals also have difficulty generating levels of positive affect that are important for task-initiation (Kazen et al., 2008), consistent with the link
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observed between positive affect and academic procrastination. A further possibility, although admittedly speculative, is that the characteristics of a state-orientation may help to explain the link between general self-efficacy and higher levels of academic procrastination. As per the suggestion made above, those who report a general optimism about future outcomes that is not informed by a realistic evaluation of a discrepancy between the present state and desired goal may be less motivated to initiate action toward actual goals. According to Oettingen et al. (2000), such fantasy-based cognitions may seduce individuals to “mentally enjoy a desired future in the here and now”. In contrast to the difficulty state-oriented people have with initiating action based on intentions, they appear to have an advantage where the cognitive representation of intentions is concerned (as indicated by their shorter response times on a recognition task involving words linked to previously formed intentions, Goschke & Kuhl, 1993). The researchers suggest this advantage is a byproduct of state-oriented people’s tendency to perseverate, or have issues inhibiting the recurrence of, a prior thought. It is possible that, given their cognitive profile, state-oriented individuals would be more likely to consistently engage in entertaining fantasy-based thoughts about future desired states, and thereby be more likely to encounter issues with action initiation; or, put another way, to procrastinate.

*Future Directions*

The findings of this study suggest some interesting directions for future research into the antecedent causes of and/or potential interventions for academic procrastination. As noted earlier, the tentative association indicated between inhibitory control and academic procrastination should motivate further study of this relationship with different, or modified versions of, measures of inhibitory control. The finding that a measure of general self-efficacy consistently predicted higher levels of academic procrastination was unexpected, and also contradicts some studies that have reported finding an opposite relationship between these variables; this finding therefore calls for replication in future study.
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Task-aversiveness was not found to be a significant predictor of procrastination as measured by the discrepancy between intention and action on academic tasks, however, this result is in contradiction with other studies that have found a positive association between these variables (Lay, 1990; Blunt & Pychyl, 2000), and may have been due to a lack of sensitivity of the measure of task aversiveness used in this study. Further research would be instrumental in elucidating the nature of the relationship between task aversiveness and academic procrastination, and should include an examination of the roles of the self-beliefs found to be the strongest predictors of procrastination in this study (belief in one’s self-regulatory ability and general efficacy) as potential mediators of this relationship.

The variable relationships indicated by the observational data provide the basis for further inquiry via experimental research. The negative association found between self-regulatory self-efficacy and academic procrastination suggests that raising students’ efficacy beliefs about their ability to regulate their academic task-related activities would reduce their tendency to procrastinate on these tasks. To this end, an experimental study that would test the effectiveness of an intervention aimed at raising self-regulatory self-efficacy, such as by allowing students’ to experience success at incrementally more challenging tasks involving self-regulation, or providing students with the vicarious experience of observing a model persevere and succeed at a difficult self-regulatory task, might be of value in the interest of supporting the self-regulatory efforts of severe procrastinators.

As noted above, the results of the present study may indicate that females have an advantage over males in the self-regulation of their task-related efforts, although the small number of males in the sample preclude any definitive conclusions regarding gender differences. To further investigate the possibility of an advantage for females in this area, an experimental design that would allow for the manipulation of distracting stimuli would prove informative.

The prevalence of current technologies, and especially their common use for academic
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tasks, creates a substantial challenge for students by presenting various obstacles to the self-
regulation of their learning and task completion, making it easier to procrastinate. In the current
context, the attention given to this issue in recent years, manifested by the amount of writing and
research dedicated to it, is not surprising. This research has yielded a number of suggestions, as
well as some empirically-based findings, about interventions for dealing with procrastination.
The results of the present study shed light on the potential effectiveness of some of these
strategies, and suggest the utilization of other means to address the particular role of the self-
beliefs and cognitive/affective aspects of one’s personality found to be linked to academic
procrastination in this study. The strategies that will be discussed address the tendency to
procrastinate on academic tasks in one of three areas: the conditions of the setting in which the
academic task is being engaged, motivation of students to engage in academic tasks (EV), and
sensitivity of students to time-related factors (TD, as per Steele, 2007).

A common refrain of many teachers, and parents for that matter, is that schoolwork
should be done without the presence of distractions. While this advice may be intuitive, it is
becoming increasingly difficult for students to avoid potential distractors while working on
academic tasks. Moreover, as suggested by this study’s findings, individuals who have a
tendency to procrastinate may be more susceptible to these distractors, as they may be dealing
with inhibitory control deficits and/or infrequently experience the characteristics of flow while
working on academic tasks. This combination of available distractors and the proclivity for
distraction of procrastinators makes the recommendation of attending to the features of the
environment made by procrastination researchers (e.g. Van Eerde, 2000; Steele, 2007) all the
more relevant. Practically, training students to curtail procrastinating by altering their working
environments implies their distancing of distractors, such as leaving their cell phones in another
location while working on academic tasks, or adding controls to restrict their accessibility to
certain web sites during the times intended to be used for academic tasks.
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An implication of the results of the current study is that people who lack the belief that they are able to regulate their academic-goal related activities are more apt to procrastinate on academic tasks. It follows that a prescription to reduce the amount of procrastinating among students should include efforts to raise students’ self-regulatory self-efficacy. One method by which this might be achieved is through administering more short-term, less complex tasks initially, in order to build confidence and change perceptions about self-regulatory ability through learning from one’s own accomplishments, the primary source of efficacy beliefs according to Bandura (1997). By beginning with more attainable goals, the ability to self-regulate one’s efforts toward longer-term academic goals is also supported through the process of shaping (Skinner, 1975). According to Bandura (1997), efficacy beliefs can also be formed through the vicarious experience of witnessing the efforts and successes of a model. Observing or hearing of the accounts of similar individuals who self-regulated their efforts and achieved comparable goals may therefore raise one’s self-regulatory self-efficacy as well (Steele, 2007).

Motivation that is brought about by one’s expectations of success when engaging in a given task requires planning about how to reach a desired goal and how to navigate the obstacles incumbent in doing so. In order for the motivation to act on achieving a goal to occur, it is necessary for an elaborate comparison between the desired future and present reality to be made, a process Oettingen and colleagues call ‘mental contrasting’ (Oettingen et al., 2001). As suggested by the present study, people who are likely to indulge in the optimistic expectation that they will be successful in whatever they endeavor to accomplish, or that things will ‘go their way’ in general, may be less likely to make comparisons that are based on actual aspects of the desired future and present reality, and therefore would not become sufficiently motivated to overcome the obstacles in their way. Research studies indicate that making mental contrasts of the kind described lead to higher levels of task engagement and completion (Oettingen et al., 2000; Oettignen et al., 2001; Oettingen et al., 2009). The research literature suggests other ways
in which the activation of goal-related intentions can be supported. Gollwitzer (1999) argues that expressing the intention to commit to a course of action in the context of a specific set of circumstances, such as by making if-then statements of the form ‘if this circumstance arises, then I will do this action’, creates a cue that serves as a trigger for the desired action to take place. The author refers to these types of expressions as ‘implementation intentions’ (Gollwitzer, 1990). Research studies indicate that making these statements does influence the likelihood of carrying out an intended action (Bransdstatter, 2001; Webb & Sheeran, 2003; Gawrilow & Gollwitzer, 2008). Moreover, this effect was observed in circumstances where the cue appears to be eliciting the desired response subconsciously (Schweiger et al., 2009; Bayer et al., 2009; Gollwitzer, et al., 2011). Some studies have indicated that the combination of both mental contrasting and implementation intentions appears to foster goal-related activities and outcomes to a greater extent than either of these devices individually (e.g. Adriaanse et al., 2010). Based on these findings, it would appear that an effective method of counteracting the tendency to procrastinate on academic tasks would be instructing students to make elaborate mental contrasts between the desired goal, i.e. completion of the academic task, and the aspects of the present that would create difficulties in reaching that goal, as well as to form implementation intentions by making statements that express their intent to act on academic task goals in a predefined situation, such as at a specific hour of the day.

The activation of one’s resources toward achieving a goal is also facilitated by experiencing positive affect prior to task engagement, as noted above (Schwarz & Bohner, 1996; Kuhl & Kazen, 1999). Moreover, individuals who are more inclined to procrastinate on academic tasks may have difficulty generating the requisite degree of positive affect for engaging in demanding tasks, as discussed above (Kuhl & Kazen, 1999). The assertion made in theoretical and empirical research regarding the importance of achieving positive affective states for task-engagement is consistent with the findings of the present study, which found the frequency with
which one experiences positive affect to be negatively associated with academic procrastination. The recommendation would follow, that work on academic tasks be done in environments with features that are capable of inducing positive moods, such as in well-lit, appealingly decorated study areas, or in the company of other people. As suggested by the hypothesis that exercise entails the release of endorphins that results in a feeling of elation (Ratey & Hagerman, 2008), doing brief exercises prior to working on academic tasks may result in more positive moods as well.

The theoretical and research literature on goal-attainment offer a number of suggestions that are relevant for counteracting the resistance procrastinators experience when working toward goals whose rewards are only distally-related, an issue which is more important when the goals in question are connected to tasks that are lengthy and demanding, as is the case with many academic tasks. Several authors focus on the importance of setting conducive goals, and promote teaching students to set goals that are proximal and specific (Schunk, 1995; Locke & Latham, 2002). Teaching students to break up large tasks and form short-term, concrete goals should help reduce some of the deleterious influence of a time-delay on the motivation to engage in academic tasks (van Eerde, 2000; Steele, 2007). Teaching students general self-regulation strategies, such as self-monitoring task progress at set time intervals (van Eerde, 2000; Voge, 2007), should also support their efforts toward reaching their academic goals and overcoming their susceptibility to discount distant reward-realization by making them aware of their current position in relation to end-goals and limiting the opportunity to rationalize delaying. Other research studies have tested interventions that are aimed at reducing the role of one's sensitivity to delayed gratification. Glick & Orsillo (2015) tested an acceptance-based treatment that included a mindfulness component, in which participants reflected on their awareness of being resistant to working on activities that don't present immediate rewards & were taught to view these feelings as transient phenomena that are not self-defining, a strategy that has been found helpful in reducing the
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anxiety attached to negative thought patterns & diminishing avoidance of an issue. (Roemer & Orsillo, 2009). These researchers report that participants who highly valued academic achievement and who took part in the acceptance-based treatment procrastinated to a lesser degree on an academic task than those who did not undergo this treatment.

The preceding paragraphs offer some suggestions of ways that individual students who have a tendency to procrastinate on their course work, as well as educators seeking to enhance their students’ academic well-being, can potentially curtail procrastination habits. An issue that is as pervasive in common experience and as invasive in the academic realm as procrastination does not carry any obvious or easy solutions for its amelioration, however. Further investigation into the personality correlates and aspects of task engagement that are associated with procrastination, and specifically, studies utilizing experimental methods that can test the effectiveness of the types of theory-based interventions proposed above, would be able to tell us more about the causes of this widely reported but still little-understood phenomenon of human experience.
APPENDIX A

Procrastination Measures

The Academic Procrastination Scale

The following questions assess your habits and routines as a student. Please answer the following as they apply to yourself.

How much do you, yourself agree to the following statements? (Scored on a 1 to 5 Likert-type scale, with 1= Disagree and 5= Agree)

1. I usually allocate time to review and proofread my work.*
2. I put off projects until the last minute.
3. I have found myself waiting until the day before to start a big project.
4. I know I should work on school work, but I just don’t do it.
5. When working on schoolwork, I usually get distracted by other things.
6. I waste a lot of time on unimportant things.
7. I get distracted by other, more fun, things when I am supposed to work on schoolwork.
8. I concentrate on school work instead of other distractions. *
9. I can’t focus on school work or projects for more than an hour until I get distracted.
10. My attention span for schoolwork is very short.
11. Tests are meant to be studied for just the night before.
12. I feel prepared well in advance for most tests. *
13. “Cramming” and last minute studying is the best way that I study for a big test.
14. I allocate time so I don’t have to “cram” at the end of the semester. *
15. I only study the night before exams.
16. If an assignment is due at midnight, I will work on it until 11:59.
17. When given an assignment, I usually put it away and forget about it until it is almost due.
18. Friends usually distract me from schoolwork.
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19. I find myself talking to friends or family instead of working on school work.

20. On the weekends, I make plans to do homework and projects, but I get distracted and hang out with friends.

21. I tend to put off things for the next day.

22. I don’t spend much time studying school material until the end of the semester.

23. I frequently find myself putting important deadlines off.

24. If I don’t understand something, I’ll usually wait until the night before a test to figure it out.

25. I read the textbook and look over notes before coming to class and listening to a lecture or teacher.*

* Indicates reverse-scored items
Future Intended Action Report

In the spaces provided, write down and describe 3 academic tasks (e.g. homework, study for an exam, write a paper, etc.) that you think you should do, and intend to do, in the coming week. For each task, respond to the items that follow by choosing a number (from 1 to 9) on the 9-point scale.

Name of task: ________________________________.
Description of task: ________________________________.

How much time do you plan to spend on this task? _____
Not Much                        A lot
               1     2     3     4     5     6     7     8     9

How much of this task do you plan to complete in the next 7 days? _____
Very Little                        All of it
         10%   20%   30%   40%   50%   60%   70%   80%   90%   100%

How much do you dislike the idea of doing this task?
Not at all                        Very Much
               1     2     3     4     5     6     7     8     9

Name of task: ________________________________.
Description of task: ________________________________.

How much time do you plan to spend on this task? _____
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How much of this task do you plan to complete in the next 7 days? ______

Very Little  All of it

10%  20%  30%  40%  50%  60%  70%  80%  90%  100%

How much do you dislike the idea of doing this task?

Name of task: ________________________________.

Description of task: _____________________________________________________________.

How much time do you plan to spend on this task? ______

Not Much  A lot

1  2  3  4  5  6  7  8  9

How much do you dislike the idea of doing this task?

Not at all  Very Much

1  2  3  4  5  6  7  8  9

Past Intended Action Report

In the spaces provided, please type the 3 academic tasks you indicated on the FIAR and their descriptions. For each task, respond to the items that follow by choosing a number on the scales below. All responses should be based on what you have done by the date you received the report (approx. 8 days after you filled out the Future Intended Action Report).

Name of task:  Click here to enter text.
Description of task:  Click here to enter text.

How much time did you spend on this task? Choose a number from the scale below:  Click here to choose a number

Not Much A lot
1 2 3 4 5 6 7 8 9

How much of this task did you complete in the past 7 days? Choose a percentage from the scale below:  Click here to choose a percentage.

Very Little All of it
10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

IGNORE THIS: (  Click here to choose a number )

Name of task:  Click here to enter text.
Description of task:  Click here to enter text.
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How much time did you spend on this task? Choose a number from the scale below:  
[Click here to choose a number]

Not Much                     A lot
1  2  3  4  5  6  7  8  9

How much of this task did you complete in the next 7 days? Choose a percentage from the scale below:  
[Click here to choose a percentage.]

Very Little                                 All of it
10%  20%  30%  40%  50%  60%  70%  80%  90%  100%

Name of task:  
[Click here to enter text.]

Description of task:  
[Click here to enter text.]

How much time did you spend on this task? Choose a number from the scale below:  
[Click here to choose a number]

Not Much                     A lot
1  2  3  4  5  6  7  8  9

How much of this task did you complete in the next 7 days?  
[Click here to choose a percentage.]

Very Little                                 All of it
10%  20%  30%  40%  50%  60%  70%  80%  90%  100%

If you did not notice the email with this attachment on the day you received it in your inbox, please type the date you noticed it here:
ACADEMIC PROCRASTINATION

*Predictor Measures*

*Executive Function Tasks*

‘Go No-Go’ Task (Inhibitory Control)

A series of letters was presented on-screen. For blue letters, participants were instructed to press the left arrow key if the letter was a capital and the right arrow key if the letter was lower-case (Image 1). For red letters, participants were instructed not to press any key (Image 2).

*Figure 15. Example of stimuli used for the ‘go no-go’ task*

*Image 1*  
*Image 2*
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‘Anti-Saccade’ Task (Inhibitory Control)

A small black square appeared on either the far-left or far-right of the screen for 225 ms. (Image 1), followed by a white square enclosing a black arrow for 150 ms. (Image 2). The arrows faced in either left, up, or down directions, and participants were asked to indicate the direction of the arrows by pressing the corresponding keys on the keyboard.

Figure 16. Example of stimuli used for the ‘anti-saccade’ task

‘Number-Letter’ Task (Cognitive Flexibility)

Number-Letter pairs were presented on the four corners of the screen in a clockwise rotation. When the pairs appeared on the top of the screen participants were instructed to indicate whether the letter was a consonant or vowel by a key response (‘X’ for consonant, ‘Z’ for vowel) (Image 2); when the pairs appeared on the bottom of the screen participants were instructed to indicate whether the number was even or odd (‘N’ for even, ‘M’ for odd) (Image 1).
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Figure 17. Example of stimuli used for the ‘number-letter’ task

Image 1

Image 2

‘Plus Minus’ Task (Cognitive Flexibility)

Participants were presented with a series of two digit numbers on a sheet of paper, and asked to alternate between adding and subtracting 3 from each digit in succession (Figure 18).

Figure 18. Example of stimuli used for the ‘plus-minus’ task

48 65 18 33 85 34
38 42 97 61 12 57
43 35 32 78 81 69
67 80 44 51 15 27
39 25 47 74 92 79
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‘Letter-Memory’ Task (Working Memory Updating)

A series of individual letters was presented on-screen one after the other. Participants were asked to recall the last four letters presented (Figure 19).

Figure 19. Example of stimuli used for the ‘letter-memory’ task
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Survey measures

The Dispositional Flow-Scale 2 (DFS-2) is copyrighted and therefore not included. (A sample copy was made available for the dissertation defense).

Self-Regulatory Self-Efficacy Scale

Response format: 1-not well at all, 3- not too well, 5- pretty well, 7- very well

How well can you:

___ 1. finish homework assignments by deadlines?
___ 2. study when there are other interesting things to do?
___ 3. concentrate on school subjects?
___ 4. take class notes of class instruction?
___ 5. use the library to get information for class assignments?
___ 6. plan your schoolwork?
___ 7. organize your schoolwork?
___ 8. remember information presented in class and textbooks?
___ 9. arrange a place to study without distractions?
___ 10. motivate yourself to do schoolwork?
___ 11. participate in class discussions?
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General Self-Efficacy Scale

Response Format: 1 = Not at all true  2 = Hardly true  3 = Moderately true  4 = Exactly true

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.
Positive And Negative Affect Schedule

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past few weeks. Use the following scale to record your answers.

1                                     2                       3                           4                              5
very slightly or not at all            a little            moderately          quite a bit          extremely

___ interested              ___ active
___ distressed           ___ afraid
___ excited
___ upset
___ strong
___ guilty
___ scared
___ hostile
___ enthusiastic
___ proud
___ irritable
___ alert
___ ashamed
___ inspired
___ nervous
___ determined
___ attentive
___ jittery
## APPENDIX B

### Table 8: Grouping of sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Grouping ((n))</th>
</tr>
</thead>
<tbody>
<tr>
<td>gen</td>
<td>Gender</td>
<td>Female = 81, Male = 24</td>
</tr>
<tr>
<td>grad</td>
<td>College level</td>
<td>Graduate = 53, Undergraduate = 52</td>
</tr>
<tr>
<td>school</td>
<td>College</td>
<td>(H = 65, C = 40)</td>
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</table>

### Table 9: Tests of gender differences on all variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Female(mean)</th>
<th>Male(mean)</th>
<th>t-score</th>
<th>p (2-sided)</th>
<th>MW z-score</th>
<th>p</th>
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<tbody>
<tr>
<td>aps</td>
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<td>67.88</td>
<td>-1.2757</td>
<td>.2049</td>
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<td></td>
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<tr>
<td>timdif</td>
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<td>.4232</td>
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<td>-0.784</td>
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<td></td>
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<td>days</td>
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<td>-2.013</td>
<td>.0441*</td>
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<td></td>
</tr>
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<td>nletmed</td>
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<td>.80</td>
<td>-2.169</td>
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<td>.033</td>
<td>0.324</td>
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### Table 10: Tests of college-level differences on all variables

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<tr>
<th>Variable</th>
<th>Under(mean)</th>
<th>Grad(mean)</th>
<th>t-score</th>
<th>p (2-sided)</th>
<th>MW z-score</th>
<th>p</th>
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Additional sig difference for school for the variable ‘days’ (z=-2.418, p=.0156), otherwise trend was equivalent to that for graduate level.

* = p < .5, ** = p < .01, *** = p < .001
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</table>

* Correlations for 'days' listed in the table were calculated for the entire sample; however, extreme outliers were excluded for analyses.
ACADEMIC PROCRASTINATION

APPENDIX C


Table 12: Reliability statistics of self-report scales in previous validation studies

<table>
<thead>
<tr>
<th>Measure</th>
<th>n</th>
<th>Score range</th>
<th>Mean</th>
<th>SD</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>APS (McCloskey &amp; Scielzo, 2015)</td>
<td>681</td>
<td>25-125</td>
<td>72.25</td>
<td>20</td>
<td>.94</td>
</tr>
<tr>
<td>DFS-2 Short (Jackson et al., 2008)</td>
<td>1653</td>
<td>9-45</td>
<td>19.1(3.82)++</td>
<td>(.48)</td>
<td>.77</td>
</tr>
<tr>
<td>*PANAS-PA (Watson et al., 1988)</td>
<td>586</td>
<td>10-50</td>
<td>32</td>
<td>7</td>
<td>.87</td>
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<tr>
<td>*PANAS-NA (Watson et al., 1988)</td>
<td>586</td>
<td>10-50</td>
<td>19.5</td>
<td>7</td>
<td>.87</td>
</tr>
<tr>
<td>GSE (Schwarzer &amp; Jerusalem, 1995)</td>
<td>1594</td>
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<td>32.53</td>
<td>na</td>
<td>.87</td>
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<tr>
<td>SRL (Miller et al., 1999)</td>
<td>500</td>
<td>11-77</td>
<td>56.1(5.1)***</td>
<td>(.86)</td>
<td>.87</td>
</tr>
</tbody>
</table>

++ Numbers in parentheses are those recorded in the source article, which divided the mean by 5. (SD is that reported for the mean of 3.82)

* Data taken from responses to self-reported affect over a few weeks

** Data taken from the US sample

*** Numbers in parentheses are those recorded in the source article, which divided the mean by the number of items (11). (SD is that reported for the mean of 5.1)
Table 13: Reliability statistics of self-report scales derived from the present study

<table>
<thead>
<tr>
<th>Measure</th>
<th>n</th>
<th>Score range</th>
<th>Mean</th>
<th>SD</th>
<th>α</th>
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</thead>
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<td>APS (McCloskey &amp; Scielzo, 2015)</td>
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<td>25-125</td>
<td>63.75</td>
<td>18.08</td>
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<td>DFS-2 Short (Jackson et al., 2008)</td>
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<td>32.71</td>
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<td>.69</td>
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<td>PANAS-PA (Watson et al., 1988)</td>
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<td>PANAS-NA (Watson et al., 1988)</td>
<td>104</td>
<td>10-50</td>
<td>22.63</td>
<td>6.02</td>
<td>.78</td>
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<tr>
<td>GSE (Schwarzer &amp; Jerusalem, 1995)</td>
<td>105</td>
<td>10-40</td>
<td>32.30</td>
<td>3.68</td>
<td>.79</td>
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<td>SRL (Miller et al., 1999)</td>
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<td>11-77</td>
<td>55.42</td>
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<td>.82</td>
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THE CITY UNIVERSITY OF NEW YORK
Graduate Center
Educational Psychology

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Title of Research Study: The role of executive function, flow experience, and personal agency in academic procrastination.

Principal Investigator: Marc Graff
Student

Faculty Advisor: Jay Verkuilen
Assistant Professor

You are being asked to participate in a research study because you are a student in good standing at a CUNY college.

Purpose:
The purpose of this research study is to investigate cognitive and emotional factors that may contribute to academic procrastination. The main hypotheses are: 1) The ability to inhibit irrelevant thoughts and avoid distraction, as well as the ability to initiate action and recover after a period of distraction, will predict lower levels of procrastination on academic tasks. 2) The frequency with which one experiences full absorption and engagement in academic tasks will predict lower levels of academic procrastination.

Procedures:
If you volunteer to participate in this research study, we will ask you to do the following:

- You will be asked to respond on a number of short surveys. These include:
  - The ‘Academic Procrastination Scale’, which includes items that relate to your attitude about completing school assignments on time.
  - The ‘Dispositional Flow Scale’, which asks about the frequency with which you feel absorbed and enjoy working on academic tasks.
  - The ‘Positive And Negative Affect Schedules’, which asks you to estimate how often you experience specific emotions (e.g. happy, anxious).
The 'General Self Efficacy scale', which has items that ask you about your overall feeling regarding whether you are able to succeed at what you undertake to do.

The ‘Self-Regulatory Self-Efficacy scale’, which includes items that relate to your belief about whether you are able to manage your academic responsibilities.

You will be asked to play a number of cognitive games on a laptop computer. These games are designed to measure executive function ability, and include:

- The ‘Go-NoGo task’ and ‘anti-saccade task’, which measure your ability to maintain focus on a goal and resist, or inhibit, interfering thoughts.
- The ‘Letter-Memory task’, which is a measure of your ability to hold and manipulate several pieces of information in your working memory.
- The ‘Number-Letter task’, which is a measure of your ability to shift from one goal or activity to another. In addition to this computer task, there is the paper-based ‘Plus-Minus task’ which also measures your ability to shift between competing goals.

You will be asked to fill out ‘Future Intended Action Reports’, on which you will be asked to name 3 academic project goals you would like to accomplish within a predetermined amount of time (a week), and asked to estimate the amount of time you plan to spend on the project, how much of the project you are planning to accomplish, and how much you like/dislike the prospect of working on the project. One week after you complete this report, you will be emailed a 'Past Intended Action Report', which will ask you to report on how much time you spent on each of these projects, and how much of the projects you completed.

All procedures will be carried out in the same session (except for the 'Past Intended Action Report', which will be emailed to you a week later), between the hours of 10 AM and 8PM, in a private office on the campus of ________ College.

**Time Commitment:**
Your participation in this research study is expected to last for a total of an hour and 15 minutes.

**Potential Risks or Discomforts:**
The executive function tasks you will be asked to engage in do require some effort and sustained attention, but are not designed to be overly demanding. Some of the items on the surveys you will be asked to respond to will ask you to be reflective about your activities and beliefs, which you may find to be somewhat difficult.

**Potential Benefits:**

- In the course of participating in this experiment, you may gain some insight into your attitudes concerning your academic responsibilities, as well as your beliefs about your own capabilities.
- This research study will seek to identify the factors that may contribute to academic procrastination. The findings will potentially indicate sub-populations of students
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who are most at risk for procrastinating on their work, and suggest the problem areas for which remediation would be most beneficial.

**Alternatives to Participation:**
If you choose not to participate in this study, you can earn course credit by either participating in a different research study, or by writing a paper (or papers) on a choice of predetermined topics, which you can find either in your course syllabus or by contacting your instructor.

**Payment for Participation:**
You will not receive any payment for participating in this research study, but you will receive two research participation credits, which is an obligation for your course.

**Confidentiality:**
We will make our best efforts to maintain confidentiality of any information that is collected during this research study, and that can identify you. We will disclose this information only with your permission or as required by law.

We will protect your confidentiality by giving you an alphanumeric code when signing this consent form and engaging in the procedures--actual names will not be recorded. Data collection will be done using participants' alphanumeric code. There will not be a sustained link between participants' data and their names.

The research team, authorized CUNY staff, and government agencies that oversee this type of research may have access to research data and records in order to monitor the research. Research records provided to authorized, non-CUNY individuals will not contain identifiable information about you. Publications and/or presentations that result from this study will not identify you by name.

**Participants' Rights:**

- Your participation in this research study is entirely voluntary. If you decide not to participate, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled.

- You can decide to withdraw your consent and stop participating in the research at any time, without any penalty.

**Questions, Comments or Concerns:**
If you have any questions, comments or concerns about the research, you can talk to the following researcher: Marc Graff, PhD student, at mgraff@gradcenter.cuny.edu.
If you have questions about your rights as a research participant, or you have comments or concerns that you would like to discuss with someone other than the researchers, please call the CUNY Research Compliance Administrator at 646-664-8918. Alternately, you can write to:

CUNY Office of the Vice Chancellor for Research
Attn: Research Compliance Administrator
205 East 42nd Street
New York, NY 10017

**Signature of Participant:**
If you agree to participate in this research study, please sign and date below. You will be given a copy of this consent form to keep.

_____________________________________________________
Printed Name of Participant

_____________________________________________________
Signature of Participant  Date

**Signature of Individual Obtaining Consent**

_____________________________________________________
Printed Name of Individual Obtaining Consent

_____________________________________________________
Signature of Individual Obtaining Consent  Date
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References


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