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Overcoming Procrastination with Positivity and Approach Motivation

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July 2018

Master Thesis MSc Programme of Work, Organizational, Personnel Psychology

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Abstract

Procrastination represents a serious risk factor for student's health and performance. Yet, it is highly prevalent in the academic context. While there is consensus regarding the looming consequences of procrastination, much less is known about its antecedents. The present study investigated the combined effects of implicit attitudes and a mastery-approach goal orientation in predicting procrastination behavior. As part of an online survey, participants completed a Go/No-Go Association Task (Nosek & Banaji, 2001), to give an indication of their implicit attitudes towards achievement. Additionally, they reported their study intentions and goal orientation. In a follow-up survey seven days later, I obtained a measurement of procrastination using the Academic Procrastination State Inventory (Schouwenburg, 1995). Contrary to my expectations, a positive implicit attitude towards achievement did not directly predict low procrastination. Instead, there was a two-way interaction, such that a mastery-approach goal orientation significantly reduced procrastination for individuals with low positivity towards achievement. This finding highlights the importance of approach motivation when it comes to overcoming procrastination.

Keywords: implicit attitudes, achievement goals, procrastination

Overcoming Procrastination with Positivity and Approach Motivation

Procrastination is ubiquitous. While nearly everyone has, at least occasionally, engaged in dilatory behavior before, it seems to be especially prevalent in the academic context with estimates ranging from 40% for habitual procrastinators (Onwuegbuzie, 2004; Rothblum, Solomon, & Murakami, 1986; Solomon & Rothblum, 1984) to up to 95% for occasional student procrastinators (Ellis & Knaus, 1977). What is striking is the irrationality of this behavior as it occurs despite an awareness of potential negative consequences. Yet, individuals frequently give into temptations at the cost of their work and well-being. What is more, procrastination is by no means limited to the academic context, it affects and creates similar issues for 15-20% of the general adult population (Harriott & Ferrari, 1996).

How can individuals overcome procrastination? Due to its prevalence, a considerable amount of literature has been published on the consequences and antecedents of procrastination (see Klingsieck, 2013; Steel, 2007; Steel & Klingsieck, 2016 for recent reviews). In essence, procrastination represents a difficult-to-control behavior, often rendering successful goal pursuit impossible. Hence, several authors argue that procrastination represents a deficiency in motivation and/or volition causing an intention-action gap (see Klingsieck, 2013). More specifically, research suggests that impaired goal pursuit caused by self-regulatory failure and inadequate goal orientation lie at the heart of the issue (e.g., Lay, 1986; Steel, 2007). In addition, goal-inconsistent behavior, such as procrastination, can result out of a lack of affective information signaling that the goal is desirable and worth pursuing (Custers & Aarts, 2005). I propose that adopting a mastery-approach goal can help to overcome these obstacles, especially among those who already hold a positive attitude towards the goal.

Existing research supports the claim that implicit attitudes and explicit goals are likely to interactively affect procrastination. Implicit attitudes describe spontaneous and implicit evaluations of incoming stimuli, such as objects or more abstract constructs, such as goals

(Bargh, Chaiken, Gavender, & Pratto, 1992; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Ferguson, 2007). In general, these attitudes signal desirability as well as approach or avoidance tendencies towards the corresponding stimuli (Chen & Bargh, 1999). Goal pursuit of long term goals, such as academic achievement, is marked by recurring opportunities to engage or not engage in related activities. Implicit evaluations represent a quick and efficient way of comparing these alternatives. As a consequence, implicit attitudes are predictive of behavioral goal pursuit (e.g., Ferguson, 2007). In addition, the automatic pull or push from the affective information linked to a goal, can be further amplified by more explicit goals. In short, achievement goals describe the reason and aim of an individual's achievement strivings. Thus, they influence goal pursuit by affecting the valence individuals experience toward a given goal. That is, achievement goals can emerge out of and reflect tendencies to approach or avoid achievement settings (Elliot & McGregor, 2001). As a result, they give rise to self-regulatory mechanisms that differently affect goal pursuit. Altogether, I propose that positive implicit attitudes towards achievement predict subsequent goal pursuit in the form of less procrastination. Furthermore, I expect this relationship to be moderated by the extent to which individuals adopt a mastery-approach goal orientation.

Implicit Attitudes as Predictors of Procrastination

When it comes to academic achievement, procrastination presents a frequently encountered and, at times, insurmountable obstacle during goal pursuit. It is commonly defined as a "voluntarily delay of an intended course of action despite expecting to be worse off for the delay" (Steel, 2007, p.66). In the context of academia, these actions refer to all tasks and behaviors associated with studying, such as writing an assignment or reading course literature. Refraining from procrastination seems to be an extremely difficult endeavor, despite being aware of the negative consequences it often entails. To illustrate, up to 65% of undergraduate students (Solomon & Rothblum, 1984) and graduate students (Onwuegbuzie, 2004) expressed a desire to reduce their procrastination on academic tasks. These numbers

highlight the extreme difficulties individuals face when attempting to pursue their goal of academic achievement.

Research on implicit attitudes towards goals suggest that positive attitudes can be helpful at behaving in a goal-consistent manner (e.g., Ferguson, 2007, 2008; Ferguson & Bargh, 2004). Notably, mental representations of goals encompass activities that can facilitate or prevent goal attainment (Aarts & Dijksterhuis, 2000). Accordingly, implicit attitudes towards goals comprise evaluative information regarding means of goal pursuit. In addition, implicit attitudes have been linked to behavioral propensities towards the corresponding stimulus. For instance, Chen and Bargh (1999) demonstrated that positive evaluations lead to approach tendencies, while negative evaluations are linked to avoidance tendencies. Similarly, Custers and Aarts (2005) showed that positive affect regarding a given goal serves as an implicit motivator, thereby facilitating goal pursuit. In contrast, negative affect exerts a demotivating influence reducing the desirability of the goal (Aarts, Custers, & Holland, 2007). In short, positive attitudes signal desirability and tendencies to approach a given goal which lead to goal-consistent behavior. Regarding academic achievement, positive attitudes are, thus, likely to reduce avoidance behavior in the form of procrastination.

Recent research has supported this claim by demonstrating how implicit attitudes can guide goal pursuit. To illustrate, consider the examples of individuals with the goal of being thin or expressing an egalitarian attitude. In a similar manner, they often form appropriate intentions but fail to act upon them. Impaired goal pursuit, then, manifests itself as a failure to regulate one's eating behavior or the use of prejudice. In a series of studies, Ferguson (2007) demonstrated that implicit attitudes towards the goal of thinness are predictive of subsequent resistance to tempting food. That is, individuals with a positive attitude were more likely to resist tempting food than individuals with a negative attitude towards the goal of thinness. Likewise, implicit attitudes towards egalitarianism predicted the use of subtle prejudice (Ferguson, 2007). In other words, these studies show that individuals who feel positively

about a goal are more likely to act in a goal-consistent manner. What is more, this seems to be especially true for goals that are hard to attain and, accordingly, for behavior that is difficult to monitor and control - such as procrastination.

Whereas no previous studies have examined the effects of implicit attitudes on procrastination directly, positive implicit attitudes have been linked to adaptive self-regulation more broadly (Critcher & Ferguson, 2016). Strikingly, there is a strong body of evidence suggesting that self-regulatory problems and a failure to act upon one's intentions are at the heart of procrastination (e.g., Lay, 1986; Steel, 2007). To illustrate, previous research shows that procrastinators do not express lower intentions to study compared to their more punctual counterparts (DeWitte & Schouwenburg, 2002). Instead, the use of maladaptive self-regulatory strategies seems to lead to goal-inconsistent behavior in the form of procrastination. Accordingly, by affecting self-regulatory processes positive implicit attitudes can help individuals to act in a goal-consistent manner and reduce procrastination.

Indeed, positive implicit attitudes convey information that a goal is desired and worth pursuing. In other words, implicitly associating an end-state with positive affect influences self-regulation by increasing the chances that individuals will engage in related activities (Aarts, Custers, & Holland, 2007; Custers & Aarts, 2005). With regards to academia, Critcher and Ferguson (2016) reported a positive effect of attitudes towards goals on effective self-regulation, in terms of persistence, and, ultimately, performance. Likewise, positive implicit attitudes towards math can lead to enhanced engagement and performance (Nosek & Smyth, 2011). Furthermore, it has been shown that, when confronted with cues for procrastination, only successful self-regulators automatically activate the higher-order goal of academic achievement (Fishbach, Friedman, & Kruglanski, 2003). Thus, positive implicit attitudes are linked to various forms of adaptive self-regulation, such as persistence and engagement, which are likely to lead to a decrease in procrastination.

In addition, the affective information stemming from positive implicit attitudes may counteract temporal discounting, a common indicator of self-regulatory failure among procrastinators (Steel, 2007). To illustrate, individuals often procrastinate on and, thereby, avoid tasks that are associated with distant rewards yet immediate costs in favor of a more tempting and immediately rewarding alternative. Accordingly, task aversiveness and delayed rewards positively predict procrastination (Solomon & Rothblum, 1984; Steel, 2007). As a matter of fact, tasks that are associated with negative emotions, such as fear of failure or test and evaluation anxiety, typically increase procrastination (Ferrari & Tice, 2000; Steel, 2007). While additional negative affective information resulting from negative attitudes might increase avoidance behavior in an effort to alleviate these negative emotions, positive affective information might shield intentions and sustain engagement by decreasing task aversiveness.

To summarize, implicit attitudes can provide valuable insights when it comes to explaining difficult-to-control behavior, such as procrastination. In particular, positive implicit attitudes induce approach tendencies and positive affect which foster adaptive self-regulation and, in turn, lead to increased task engagement. Hence, they are likely to reduce goal-inconsistent behavior in the form of procrastination. However, explicit goal intentions are likely to moderate this effect because they influence the way in which individuals interpret and respond to achievement situations.

Mastery-Approach Goals as Directors of Achievement Strivings

Whereas implicit attitudes are spontaneous evaluations of desired end-states, achievement goals are commonly defined as “the purpose for engaging in competence-relevant behavior” (Elliot & Hulleman, 2017, p.44), whereby purpose can denote a reason, aim or a combination of both. Specific achievement goals are associated with distinct affective, behavioral and cognitive processes (see Dweck & Leggett, 1988; Moller & Elliot, 2006). Therefore, they are categorically distinct from implicit attitudes and affect different

mental processes relevant to procrastination. More specifically, they promote the adoption of different self-regulation strategies (Elliot, McGregor, & Gable, 1999) and, in turn, influence procrastination (e.g., Howell & Watson, 2007; Howell & Buro, 2008). Achievement goals may operate independently but they are likely to moderate the effects of implicit attitudes because they foster different valences toward the goal itself and thereby influence the direction of an individual's achievement strivings.

In contrast to other achievement goals, mastery-approach goals seem especially likely to help individuals in overcoming procrastination. Indeed, achievement goals differ in their foci and their effects on affective, behavioral and cognitive processes (see Moller & Elliot, 2006). The "2 X 2 achievement goal framework" proposed by Elliot and McGregor (2001) is one of the most widely used frameworks that captures these crucial distinctions by contrasting achievement goals on valence and the standard that is used for evaluation. Due to the fact that mastery-approach goals combine the positive dimensions of approach and mastery, I propose that they are likely to moderate the effects of positive attitudes by influencing the kind of achievement settings individuals seek out as well as how they react to them.

In particular, by inducing positive rather than negative valence mastery-approach goals can channel an individual's efforts and thereby moderate the effects of positive implicit attitudes. In general, valence describes whether a goal's focus lies on approaching a positive outcome (success) or avoiding a negative outcome (failure). Whereas avoidance-oriented goals are frequently linked to negative and maladaptive patterns of self-regulation and performance, approach-oriented goals are associated with adaptive and positive patterns of self-regulation and performance (e.g., Elliot & Harackiewicz, 1996; Dweck & Leggett, 1988; Van Yperen, Blaga, & Postmes, 2014). In line with this, several researchers have argued that the approach-avoidance distinction is the decisive factor in predicting procrastination (Howell & Buro, 2009; Howell & Watson, 2007, Seo, 2009). Hence, in contrast to avoidance

motivation, approach motivation should maintain an individual's focus on the task at hand while fostering self-regulatory strategies that lead to success.

In addition to valence, goals are contrasted on the standard that is used for evaluation. Achievement goals that focus on developing competencies and, thus, use an absolute (task-based) or an intrapersonal (self-based) standard are referred to as mastery goals. In contrast, achievement goals using a normative (other-based) standard with a focus on demonstrating competence are referred to as performance goals. In a similar manner to an approach orientation, mastery-oriented goals are associated with more positive antecedents and outcomes than performance-oriented goals (e.g., Elliot & Hulleman, 2017; VanYperen, 2006). Accordingly, performance-approach goals represent a complex form of regulation as they combine positive (approach) and negative (performance) dimensions (for a review see Elliot & Hulleman, 2017). Conversely, mastery-approach goals are associated with a clearly positive and appetitive profile (VanYperen, 2006). As outlined above, negativity towards a given task is likely to increase procrastination (Steel, 2007). For this reason, performance-approach goals, which are rooted in fear of failure (Elliot & McGregor, 2001), are unlikely to assist an individual in overcoming procrastination. In contrast, studies repeatedly revealed negative correlations for mastery-approach goals and procrastination (Howell & Buro, 2009; Howell & Watson, 2007; Seo, 2009). Hence, the present study focuses on how mastery-approach goals can aid positive attitudes in reducing procrastination.

More specifically, mastery-approach goals are likely to moderate the effects of positive attitudes because they influence how individuals approach, interpret and react to achievement settings. To illustrate, individuals with a mastery-approach orientation are likely to construe achievement situations as a challenge and strive to do well compared to themselves or others (Elliot, 1999). Consequently, they seek out moderately challenging tasks in which effort will determine success (Conroy, 2017). In addition, approach-oriented goals are usually accompanied by a host of positive outcomes, such as high levels of intrinsic

motivation and task interest (Elliot & Harackiewicz, 1996; Elliot & Church, 1997). Thereby, they can decrease task aversiveness and increase task engagement resulting in high levels of effort and persistence (Elliot, 1999; Elliot & McGregor, 2001). Hence, in cases of high positivity towards achievement, that is, in the presence of positivity and approach tendencies, a mastery-approach orientation is likely to amplify these effects by further increasing approach motivation and maintaining the focus and direction of achievement strivings on attaining success. On the contrary, if mastery-approach orientation is low, individuals may experience achievement settings as a possible threat and become preoccupied with negative outcomes. The resulting increase in task aversiveness can interfere with optimal task engagement and thereby counterbalance the effects of positive implicit attitudes. In cases of low positivity towards achievement, a mastery-approach orientation may, at least to a certain extent, compensate for the absence of approach tendencies and provide the necessary motivation to engage with the task at hand. In contrast, individuals with low positivity and low mastery-approach orientation who lack approach motivation and positivity should procrastinate the most.

In sum, procrastination is highly prevalent and presents a risk-factor for student's mental health, well-being and academic performance (Steel, 2007). There is still uncertainty, however, regarding its antecedents. Recent research suggests that individuals need *positivity* as well as *approach motivation* to successfully pursue their goal of academic achievement without succumbing to procrastination. Whereas positivity emerges out of implicit attitudes, a mastery-approach orientation gives rise to approach motivation. Hence, in the present study I investigated whether implicit attitudes towards achievement are predictive of procrastination behavior. Based on the behavioral predispositions that arise from implicit attitudes, I predicted that positive attitudes towards achievement are negatively associated with procrastination. In addition, I examined possible moderating influences of consciously held

achievement goals. Specifically, I expected mastery-approach goals to further decrease procrastination for individuals with a positive attitude towards achievement.

Methods

Participants

The final sample consisted of 146 undergraduates from various degree programs at an international Dutch university who participated for either course credit or cash payment. Participants were recruited using the universities online network for psychological experiments. Whereas 323 responses were initially recorded for the first part of the study, 215 responses were recorded for the follow-up. However, 69 responses had to be excluded because they were either incomplete (16), could not be matched between the two parts (24), or were duplicates (29). Out of the remaining 146 participants, 33 were male, 110 were female, and three participants failed to indicate their gender. They were of diverse nationalities, mostly Dutch and German, and ranged in age from 18 to 36 ($M=22.5$, $SD=3.25$).

Procedure/Materials

The present study consisted of two parts, both of which were online surveys on *Qualtrics* that participants completed via their personal browser on a desktop computer or laptop in an interval of seven days. Whereas I measured implicit attitudes and achievement goal orientation during the first part, I assessed procrastination in a follow-up survey one week later. To ensure compatibility with the implicit attitudes measure, participants could not complete the survey on a mobile device. Before signing up for the study, participants were informed of the exact nature of the study (i.e. no mobile devices and follow-up survey seven days later). Furthermore, the present study was part of a collaborative study, and thus included a range of unrelated questionnaires.

Wave 1: Initial assessment. After giving informed consent, participants completed a computer task based on the Go/No-go Association Task (GNAT) that we created in order to measure implicit attitudes (Nosek & Banaji, 2001). In short, the GNAT measures the strength

of associations between a target category, in this case achievement, and an evaluative dimension, in this case, positive and negative. Reaction times and sensitivity scores serve as an indication of positivity towards the given target concept (a more detailed description of the GNAT will follow below). After the GNAT, participants indicated their study intentions for the upcoming week, in terms of days and hours. Additionally, participants responded to the Achievement Goal Questionnaire Revised (Elliot & Murayama, 2008), assessing their achievement goal orientation. Lastly, demographics, including age, gender, and nationality as well as their email address, were asked and participants were partially debriefed.

Wave 2: Follow-up. The second wave of this study was designed to assess the extent to which participants procrastinated during the week following initial assessment. Hence, participants received an email with the access code for the follow-up questionnaire seven days after responding to the first part. They were encouraged to log into the university's online network and complete the follow-up immediately. However, due to the fact that participants got compensated for each part individually and there were no penalties for not completing the follow-up, some participants failed to respond. At the onset of the questionnaire participants gave informed consent. Subsequently, they reported their study behavior, in terms of days and total hours, over the past seven days. Next, state procrastination was measured using the Academic Procrastination State Inventory (Schouwenburg, 1995). Lastly, participants were thanked for participation and fully debriefed.

Go/No-go Association Task. Participants completed the Go/No-go Association Task as a measure of the independent variable, namely implicit attitudes. The GNAT is a widely used measure of implicit attitudes that assesses participants' strength of association between a target category, in this case, achievement, and two ends of an attribute dimension, in this case evaluation with the two poles positive and negative (for an extensive review of implicit measures see Fazio & Olson, 2003). Accordingly, the GNAT measures implicit attitudes towards achievement by assessing associations between achievement-related words and

clearly positively and negatively valenced adjectives. To provide an indication of these associations, the task required participants to discriminate words belonging to the given target categories (achievement and positive in one and achievement and negative in the other block) from distractor words not belonging to these categories (socializing and either positive or negative). For target words participants were instructed to hit the space bar as fast as possible (“go”). For distractor words, on the other hand, participants had to refrain from hitting any key (“no-go”).

As a result, the GNAT provided two complementary indications of implicit attitudes. First, I compared the average time it took participants to correctly respond to trials pairing achievement and positive with trials pairing achievement and negative. Secondly, on the basis of signal detection theory I computed sensitivity scores by comparing participants’ hit and false alarm rates for these trials. Altogether, fast and accurate responses to trials pairing the target category with the evaluatively positive category signal a strong association and, consequently, a positive attitude toward the target category.

To familiarize participants with the categories and words being used, they were presented the complete lists prior to completing the GNAT measure (see Appendices A-D). In addition, to learn about the nature of the task they completed four blocks of practice trials. In two blocks each, participants discriminated between words belonging to two categories - achievement from socializing and positive from negative. The target category changed with each block in randomized order and was displayed in the top right-hand corner of the screen. These four practice blocks consisted of 20 trials each, altogether displaying every word used in the actual blocks twice.

Subsequently, the two actual blocks of trials, which were presented in randomized order, started. Whereas, one block paired the target category (achievement) with clearly positively valenced adjectives, the other block combined achievement with negatively valenced adjectives. Consequently, in one block participants had to hit the spacebar for

achievement-related and evaluatively positive words and refrain from hitting if a socializing-related or evaluatively negative word was presented. This block thus provided a measure of the strength of positive associations regarding achievement. Conversely, during the other block, participants had to hit the spacebar for achievement-related as well as evaluatively negative words and refrain from hitting for socializing-related words as well as evaluatively positive words. Accordingly, this block provided a measure of the strength of negative associations regarding achievement. Before each block, participants completed eight practice trials with the given target categories. The words used in these practice trials were not used during the subsequent blocks of trials.

During each block of trials, ten words from each category were presented in the middle of the screen one at a time, resulting in 40 trials per block and a signal to noise ration of 1:1. All words were capitalized and displayed in white font on a black background. Furthermore, the words were presented in randomized order and for a maximum of 850ms. Due to the fact that participants completed the study on their own computers and in an uncontrolled environment, I chose the longest display time that still produces acceptable error rates (Nosek & Banaji, 2001). As a reminder, the target category (*Achievement* vs. *Socializing*) and target attribute (*Positive* vs. *Negative*) for a given block of trials were displayed in the top right-hand and left-hand corner of the screen. After each correct response a green “O” and after each incorrect response a red “X” was presented in the middle of the screen for 150ms. Hence, participants received continuous feedback about their response accuracy. Correct responses included hitting the space bar when a target was presented (hit) and correctly refraining from hitting when a distractor was presented (correct rejection). Erroneous responses included hitting the space bar for distractor stimuli (false alarm) and incorrectly refraining from hitting for target stimuli (miss).

Stimuli. In order to assess the strength of positive and negative associations regarding achievement, four different categories of words are required. First, a target category

consisting of words related to achievement, such as *strive*, *succeed* and *accomplish*. Second, a distractor category that, in the present study, consisted of words related to socializing, including *affiliate*, *gather* and *dance*. I chose socializing as the distractor category because it represents a common temptation and cause for procrastination among students. The third category comprised evaluatively positive words, among others *satisfying*, *magnificent* and *pleasant*, and the fourth category consisted of evaluatively negative words, like *awful*, *hideous* or *horrible* (a complete list of stimuli can be found in Appendices A-D). To ensure comparability, the target and distractor stimuli consisted only of verbs, related to achievement and socializing respectively, that have been used in related research before (e.g., Leander & Chartrand, 2017; Sheeran, Aarts, Custers, Rivis, Webb, & Cooke, 2005). Likewise, for the evaluatively positive and negative categories I used clearly valenced adjectives that were either synonymous with positive or negative and have been used in similar studies before (e.g., Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Nosek & Banaji, 2001). In addition, words in the target and distractor as well as both of the attribute dimensions were matched in terms of average length. Furthermore, I balanced the words belonging to the evaluation categories with regards to their evaluative strength.

Measurements. Due to the fact that the GNAT task was embedded in a *Qualtrics*-survey, all responses for each participant were saved in one single data field. In order to separate the distinct measurements and tabulate the data, I wrote a formula using *RStudio*. Subsequently, I was able to calculate the average reaction times and sensitivity scores using yet another formula (see Appendix E for the complete code). Afterwards, I exported the data into SPSS format and added the variables to my data set.

As outlined above, two complementary measurements of implicit attitude activation can be derived from the GNAT. Due to the fact that both scores are equally indicative of the positivity of attitudes, I used each of them in separate analyses. In particular, the GNAT assesses participants' reaction times as well as sensitivity (Nosek & Banaji, 2001). Fast

responses on trials pairing *achievement* and *positive* indicate a strong association between these concepts and, thus, a positive implicit attitude towards achievement. For the reaction time measure only “hits”, that is, correct responses to a “go” trial, are analyzed. Erroneous responses, as well as correct rejections are not included in the calculation. In particular, I analyzed participants’ average “hit” response times for trials pairing *achievement* and *positive* as well as the difference between this score and the score for trials pairing *achievement* and *negative*. On average, participants were faster at correctly responding to trials pairing *achievement* and *positive* ($M = 603.43$, $SD = 52.36$) than to trials pairing *achievement* and *negative* ($M = 619.19$, $SD = 52.02$).

In addition, I assessed participants’ sensitivity, which represents the ability to discriminate between target and distractor words. To illustrate, greater sensitivity on trials pairing *achievement* and *positive* compared to *achievement* and *negative* indicate a positive automatic association between the two concepts. In other words, a positive attitude towards achievement manifests itself in more accurately discriminating *achievement* and *positive* from distractors, than *achievement* and *negative*. Thus, sensitivity describes the strength of association between the target category and attribute.

On the basis of signal detection theory, I calculated sensitivity or d-prime (d') by comparing the hit and false alarm proportions for the two blocks of trials (Stanislaw & Todorov, 1999). Whereas a hit describes correctly hitting the space bar for a target word, a false alarm occurs when a participant hits the space bar for a distractor word. First, I calculated the proportions of hits and false alarms for each block and converted these to z-scores. The difference between the resulting z-score values is the d-prime measure for each of the blocks. In addition to the sensitivity score for trials pairing *achievement* and *positive*, I analyzed the difference between this score and the sensitivity score for the trials pairing *achievement* and *negative*. Overall, participants showed greater sensitivity during blocks

pairing *achievement* and *positive* ($M = 1.48$, $SD = 0.77$) than during blocks pairing *achievement* and *negative* ($M = 1.39$, $SD = 0.84$).

I corrected for perfect hit and false alarms rates of 1 as well as rates of 0 following the approach recommended by Macmillan and Creelman (1991). That is, I replaced ones with $1 - 1/2N$ and zeros with $1/2N$, where N is the number of targets. As there were 20 targets in each block, the corrected rates equaled 0.975 and 0.025 respectively.

Achievement Goals. In order to test for moderating influences of a mastery-approach orientation on the effects of implicit attitudes on procrastination, I assessed participants' achievement goals as conceptualized in the 2x2 achievement goal framework (Elliot, 1999; Elliot & McGregor, 2001). The Achievement Goal Questionnaire Revised (Elliot & Murayama, 2008) was used to measure the degree to which individuals pursue mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance goals. Due to the fact that my predictions focus on mastery-approach goals specifically, the remaining goal orientations were used for exploratory analyses only. The questionnaire consists of twelve items with three items relating to each of the four subscales. The average score on each subscale indicates goal orientation. Participants responded to all items using a 5-point Likert scale (from 1 = "*Strongly disagree*" to 5 = "*Strongly agree*"). Some questions were slightly adapted to fit the experimental design and to shift the focus from a specific course to all classes the participants are taking at the moment. For example, the question "*My aim is to completely master the material presented in this class.*", concerning mastery-approach goals, was changed into "*My aim is to completely master the material presented in class*". Further sample items include, "*My aim is to avoid learning less than I possibly could.*" for mastery-avoidance goals, "*My aim is to perform well relative to other students.*" for performance-approach goals, and "*My aim is to avoid doing worse than other students.*" for performance-avoidance goals. The subscales showed internal consistencies of $\alpha = .86, .82, .94$, and $.93$ respectively. On average, participants most strongly endorsed mastery-approach goals ($M =$

3.90, SD = 0.90), followed by performance-approach (M = 3.59, SD = 1.02), performance-avoidance (M = 3.54, SD = 1.09), and mastery-avoidance goals (M = 3.50, SD = 0.87).

Procrastination. To assess whether implicit attitudes and mastery-approach goals interactively affect procrastination, participants responded to thirteen items comprising the procrastination subscale of the Academic Procrastination State Inventory (APSI) (Schouwenburg, 1995) using a 5-point Likert scale (from 1 = “*Never*” to 5 = “*Always*”). I chose this subscale from the available procrastination measures because it specifically asks about procrastination behaviors associated with the academic context and provides a measure of state procrastination. More specifically, the subscale asks participants to indicate how frequently they engaged in procrastination behaviors over the last week. Sample items include: “*Did so many other things that there was insufficient time left for studying.*”, “*Gave up when studying was not going well.*”, and “*Interrupted studying for a while in order to do other things.*” The internal consistency coefficient in the present study was $\alpha = 0.82$.

In addition, I assessed the difference in reported intentions and actual study behavior during the week after completion of the first part of the study as done in previous procrastination research studies (e.g., DeWitte & Schouwenburg, 2002; Krause & Freund, 2014). More specifically, I compared the number of hours participants intended to study with the number of hours they actually studied over the past seven days. On average, participants intended to study more hours than they actually did (M = 25.60, SD = 14.20; M = 19.16, SD = 14.47). Additionally, this behavioral measure offers insights into the differences in study intentions between high (above median score) and low (below median score) procrastinators. Contrary to existing literature, high procrastinators (M = 23.26, SD = 12.49) intended to study significantly less hours than low procrastinators (M = 28.08, SD = 15.51), $t(144) = 2.072$, $p = .04$ (95% CI: .22, 9.41). Nevertheless, the difference between intended and actual study hours was nonsignificant. Still, while this difference represents a rough estimate of dilatory behavior, the state-based self-report measure (APSI) offers more specific insights into

procrastination behavior. Hence, my predictions focus on the APSI score and the study hour difference was only used in exploratory analyses.

To summarize, using the GNAT I extracted two distinct measurements of positivity of implicit attitudes, namely reaction times and sensitivity scores, serving as my independent variables. In addition, in order to check for moderation by achievement goal orientation, I measured the extent to which participants endorse a mastery-approach goal. Lastly, the dependent measurement of procrastination behavior was obtained in a follow-up seven days later using the procrastination subscale of the Academic Procrastination State Inventory.

Results

In order to assess whether implicit attitudes and achievement goal orientation interactively predict procrastination behavior, separate regression analyses predicted the average Academic Procrastination State Inventory score as a function of participant's Go/No-Go Association Task measurements, their mastery-approach goal orientation and the interaction of these variables. To avoid multicollinearity and ease the interpretation, the predictor variables were standardized prior to creating interaction terms (see Aiken & West, 1991). Due to the fact that there are multiple ways to operationalize implicit attitudes using the GNAT measurements, I took an exploratory approach and analyzed average reaction times as well as sensitivity scores. In addition, for each of these measurements the GNAT provides two complementary scores that both indicate the positivity of implicit attitudes. That is, a score for trials pairing achievement and positive as well as the difference between this score and the score for trials pairing achievement and negative. Consequently, for both reaction times as well as sensitivity I performed two separate analyses using each of these

scores. However, contrary to my expectations neither regression analyses using reaction times as an indicator of implicit attitudes approached significance¹.

In contrast, the regression analyses using sensitivity, that is the ability to discriminate target from distractor words, as an indicator of implicit attitudes revealed more interesting results. Notably, whereas a high sensitivity score indicates positivity, a score below zero indicates that the participant was unable to discriminate target from distractor words and responded worse than 'chance' responding (i.e. a sensitivity score of zero). Hence, responses with sensitivity scores of zero or below were excluded from the analysis. Consequently, the analysis using the sensitivity score for trials pairing achievement and positive was completed with 142 participants, whereas the analysis using the difference score was completed with 139 participants.

Surprisingly, the regression using the difference in sensitivity scores, mastery-approach orientation and the interaction thereof did not approach significance (see Table 1). However, the sensitivity scores for trials pairing achievement and positive (standardized), mastery-goal orientation (standardized), and the interaction of these variables significantly predicted procrastination behavior (see Table 2). Overall, the model explained a significant proportion of variance in the procrastination score, $R^2 = .090$, $F(3, 138)=4.527$, $p= 0.005$. No

¹ The final analyses using reaction times as an indicator of implicit attitudes were completed with 145 participants. One response had to be excluded because the data clearly showed that this participant did not complete the GNAT task as instructed (i.e. response time average of 160ms across blocks of trials). In order to ease interpretation, I reverse coded the reaction times for trials pairing achievement and positive by subtracting the score from the maximum amount of time participants could have taken to respond (850ms). Accordingly, a higher the score represents a more positive implicit attitude.

Separate multiple regression analyses predicted procrastination as a function of each of the reaction time scores, participants' mastery-approach orientation and the interaction thereof. Contrary to my expectation, neither regression approached significance (see Tables 3 and 4). That is, neither implicit positivity, as indicated by reaction times, nor mastery-approach orientation, nor their interaction, predicted procrastination as measured by the APSI.

direct effect of the sensitivity score was found, $B = .018$, $t(138) = .362$, $p = .718$ (95% CI: $-.078, .114$). This suggests that implicit attitudes do not exert a direct influence on procrastination. However, results indicate a direct effect of mastery-approach orientation, $B = -.103$, $t(138) = -2.228$, $p = .027$ (95% CI: $-.195, -.012$). In other words, individuals with a strong mastery-approach orientation procrastinated less than individuals with a less strong mastery-approach orientation. However, this effect was qualified by a significant interaction effect with participant's sensitivity score, $B = .172$, $t(138) = 3.295$, $p = .001$ (95% CI: $.069, .276$). In order to gain a better understanding of this interaction effect, I conducted a simple slope analysis at low (1 SD below the mean) and high (1 SD above the mean) levels of positivity (see Figure 1). The test revealed a nonsignificant simple slope for participants with relatively high positivity, $B = .069$, $t(138) = 1.260$, $p = .210$ (95% CI: $-.50, .188$). However, for participants with relatively low positivity a significant simple slope was found $B = -.275$, $t(138) = -3.287$, $p = .0001$ (95% CI: $-.431, -.121$). Hence, a mastery-approach orientation indeed decreased procrastination, but only among those who lacked positivity towards the goal (1SD below mean implicit positivity). In other words, adopting a mastery-approach orientation can reduce procrastination by compensating for the absence of approach tendencies associated with low positivity. Yet, in the presence of approach tendencies, a mastery-approach orientation seems to increase procrastination behavior, albeit nonsignificantly. Notably, both the direct effect of mastery-approach orientation as well as the interaction with positivity remained significant when controlling for the remaining achievement goal orientations (see Table 5). Hence, the decrease in procrastination can be attributed specifically to achievement goals that combine a mastery and an approach orientation rather than goals that include only one or none of these orientations.

Due to the fact that my initial analyses hinted at the importance of approach motivation in reducing procrastination, I performed an ad hoc analysis that represent an alternative way of testing the same claim. In particular, I performed an exploratory analysis

using mastery-avoidance goal orientation as well as a different indicator of procrastination as predictors. That is, instead of the Academic Procrastination State Inventory, I used the difference in intended and actual study hours as an estimate of dilatory behavior. Across regression analyses, that is using reaction time and sensitivity measurements, I found a direct positive effect of mastery-avoidance orientation on the difference in study hours. In other words, the stronger an individual's mastery-avoidance orientation the bigger his or her intention-action gap. These results provide indirect support for the claim that approach motivation reduces procrastination. However, neither implicit positivity nor the interaction significantly predicted procrastination.

Discussion

A growing body of literature has examined the possible antecedents of procrastination and hinted at the importance of effective self-regulation in overcoming it (see Steel, 2007). The present study adds another piece to the puzzle by extending existing research on the predictive validity of implicit attitudes when it comes to downstream goal pursuit. In particular, I investigated whether implicit attitudes towards achievement are predictive of procrastination behavior among university students. Furthermore, I examined moderating influences of a mastery-approach goal orientation. I assessed procrastination and achievement goal orientation using widely used self-report measurements. In contrast, a behavioral measurement of reaction time and sensitivity was used to determine implicit attitudes. Based on existing literature, I expected positive implicit attitudes to be associated with low procrastination. In addition, I hypothesized that this effect would be amplified for individuals with a strong mastery-approach goal orientation and weakened for individuals with a low mastery-approach goal orientation.

Surprisingly, my hypotheses were not supported by the data. In contrast, the results of this study indicate that implicit attitudes towards achievement exert no direct influence on procrastination behavior. Still, in line with existing literature, the study revealed a direct effect

of mastery-approach goal orientation (e.g., Howell & Buro, 2009; Howell & Watson, 2007; Seo, 2009). That is, participants procrastinated less the stronger their mastery-approach goal orientation. However, this effect was qualified by the interaction with implicit attitudes. More specifically, a strong mastery-approach orientation was only associated with less procrastination for individuals with low positivity towards achievement.

The fact that the present study did not reveal a direct effect of implicit attitudes is surprising because there is a strong body of evidence demonstrating how positive attitudes predict goal-consistent behavior, especially when this behavior is difficult to control (e.g., Ferguson, 2007). However, even though most studies highlight the maladaptive nature of procrastination, several authors have argued for potential adaptive effects, such as prioritizing of efforts and possible benefits of working under increased pressure (e.g., Chu & Choi, 2005; Schraw, Wadkins, & Olafson, 2007). From this point of view, procrastination in the early stages can be conceived as goal-consistent behavior and thus fostered by positive implicit attitudes. Furthermore, recent research has shown that the effects of implicit attitudes on performance and persistence are mediated by the implicit importance associated with the means of goal pursuit (Critcher & Ferguson, 2016). While one can assume that achieving is generally important to university students, individuals undoubtedly do not attach the same importance to every task or assignment. Hence, measuring and controlling for the importance participants attach to their studies can offer additional insights.

In line with existing literature, the present study demonstrated that mastery-approach goals are linked to low amounts of procrastination (Howell & Buro, 2009; Howell & Watson, 2007; Seo, 2009). However, contrary to my expectations, a strong mastery-approach orientation reduced procrastination for individuals with low rather than high positivity towards achievement. In other words, instead of capitalizing on the presence of positivity and approach tendencies, a mastery-approach orientation seems to compensate for their lack by providing the necessary motivation to initiate and sustain effort. This underlines the

importance of approach motivation when it comes to overcoming procrastination. Indeed, whether this motivation stems from implicit attitudes or goal orientation seems be of less importance than its general presence. The fact that a mastery-avoidance orientation was positively linked to procrastination, when operationalized as the difference in intended and actual hours of studying, provides indirect support for this claim.

One strength of the experimental set-up is the fact that I used an indirect, behavioral measure to assess attitudes. In contrast to explicit or self-report measures, implicit and behavioral measures are less susceptible to presentational strategies and can provide more accurate estimates of individual's attitudes and motivation (see Fazio & Olson, 2003; Greenwald & Banaji, 1995). Furthermore, the fact that this study was conducted online rather than in a laboratory enabled me to recruit a relatively high number of participants. However, out of the 323 participants that responded to the first part of the study, 215 also responded to the follow-up questionnaire with only 146 meaningful responses. The irony of designing a two-part study, in which the follow-up is barely rewarded, for investigating procrastination is not lost on me.

However, even though the Go/No-Go Association Task is a widely used measure of implicit attitudes (for a review see Fazio & Olson, 2003), two limitations with regards to the present study have to be acknowledged. Firstly, due to the fact that this task was embedded in an online survey, participants might have been less concentrated and focused on the task than in laboratory settings in which the test is usually administered. Secondly, owing to the fact that the present study was part of a collaborative study, the GNAT measured attitudes towards achievement in general. Hence, the possibility that participants associated achievement with activities or settings unrelated to academia cannot be ruled out. In contrast, the procrastination measure focused specifically on behaviors associated with academia. Hence, attitudes towards academic achievement might have been a more adequate predictor of academic procrastination. Likewise, in an effort to counteract the obscuring effects of the variability in

workload, I decided to measure achievement goal orientation in general and not pertaining to a specific class. However, individuals tend to adopt different achievement goals for different achievement settings (VanYperen, 2006). Hence, one explanation for the lack of significant findings could be the fact that the tasks on which students did (or did not) procrastinate did not correspond to the achievement goal orientation that they reported. Reconciling these issues, future research should focus on participants' attitudes and achievement goals towards a specific course, while ensuring that the study is conducted during a time in which participants have a high workload.

Another unexpected finding was the lack of convergence between the different operationalizations of the GNAT measurements. Both participants' reaction times and sensitivity scores should represent the strength of their implicit positivity towards achievement. However, I obtained different results when using either variable as a predictor. Future research should examine these differences in order to give specific recommendations for researchers.

To return to the question raised at the onset of this paper, contrary to my expectations, the present data do not support the claim that positive implicit attitudes predict low procrastination behavior. However, the data points at the importance of approach motivation in general. That is, the present study demonstrated that a mastery-approach goal orientation can help individuals to overcome procrastination. The fact that this is especially true for individuals with low positivity towards achievement is of special importance for practitioners. Due to the fact that those who are less skilled are also less likely to show positive implicit attitudes towards a given goal (Ferguson, 2008), adopting mastery-approach goals seems to be especially beneficial for at-risk students. Consequently, practitioners should inform students, teachers and parents about these benefits and actively promote appropriate goal setting. All in all, the present study moves us one step closer to solving the mystery behind procrastination

by illuminating a fact that was hiding in plain sight – if one wants to stop avoiding, one needs to start approaching.

References

- Aarts, H., & Dijksterhuis, A. (2000). Habits as knowledge structures: Automaticity in goal-directed behavior. *Journal of Personality and Social Psychology*, 78(1), 53-63.
- Aarts, H., Custers, R., & Holland, R. W. (2007). The nonconscious cessation of goal pursuit: When goals and negative affect are coactivated. *Journal of Personality and Social Psychology*, 92(2), 165-178.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA, US: Sage Publications, Inc.
- Bargh, J. A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic attitude activation effect. *Journal of Personality and Social Psychology*, 62(6), 893-912.
- Chen, M., & Bargh, J. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin*, 25(2), 215-224.
- Chu, A. C., & Choi, J. N. (2005). Rethinking procrastination: Positive effects of 'active' procrastination behavior on attitudes and performance. *The Journal of Social Psychology*, 145(3), 245-264.
- Conroy, D. E. (2017). Achievement Motives. In Elliot, A., Dweck, C., & Yeager, D. (Eds.). *Handbook of competence and motivation: Theory and application* (Second edition. ed.) (pp.25-42). New York: Guilford Press.
- Critcher, C. R., & Ferguson, M. J. (2016). 'Whether I like it or not, it's important': Implicit importance of means predicts self-regulatory persistence and success. *Journal of Personality and Social Psychology*, 110(6), 818-839.
- Custers, R., & Aarts, H. (2005). Positive affect as implicit motivator: On the nonconscious operation of behavioral goals. *Journal of Personality and Social Psychology*, 89(2), 129-142.

- DeWitte, S., & Schouwenburg, H. C. (2002). Procrastination, temptations, and incentives: The struggle between the present and the future in procrastinators and the punctual. *European Journal of Personality, 16*(6), 469-489.
- Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256-273.
- Elliot, A. J. (1999). Approach and avoidance motivation and achievement goals. *Educational Psychologist, 34*(3), 149-169.
- Elliot, A. J., & Church, M. A. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology, 72*(1), 218-232.
- Elliot, A. J., & Harackiewicz, J. M. (1996). Approach and avoidance achievement goals and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology, 70*(3), 461-475.
- Elliot, A. J., & Hulleman, C. S. (2017). Achievement Goals. In Elliot, A., Dweck, C., & Yeager, D. (Eds.). *Handbook of competence and motivation: Theory and application* (Second edition. ed.) (pp.43-60). New York: Guilford Press.
- Ellis, A., & Knaus, W. J. (1977). *Overcoming procrastination*. New York, NY, US: Institute for Rational Living.
- Elliot, A. J., McGregor, H. A., & Gable, S. (1999). Achievement goals, study strategies, and exam performance: A mediational analysis. *Journal of Educational Psychology, 91*(3), 549-563.
- Elliot, A. J., & McGregor, H. A. (2001). A 2 x 2 achievement goal framework. *Journal of Personality and Social Psychology, 80*(3), 501-519.
- Elliot, A. J., & Murayama, K. (2008). On the measurement of achievement goals: Critique, illustration, and application. *Journal of Educational Psychology, 100*(3), 613-628.

- Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and uses. *Annual Review of Psychology, 54*, 297-327.
- Fazio, R. H., Sanbonmatsu, D. M., Powell, M. C., & Kardes, F. R. (1986). On the automatic activation of attitudes. *Journal of Personality and Social Psychology, 50*(2), 229-238.
- Ferrari, J. R., & Tice, D. M. (2000). Procrastination as a self-handicap for men and women: A task-avoidance strategy in a laboratory setting. *Journal of Research in Personality, 34*(1), 73-83.
- Ferguson, M. J. (2007). On the automatic evaluation of end-states. *Journal of Personality and Social Psychology, 92*(4), 596-611.
- Ferguson, M. J. (2008). On becoming ready to pursue a goal you don't know you have: Effects of nonconscious goals on evaluative readiness. *Journal of Personality and Social Psychology, 95*(6), 1268-94.
- Ferguson, M. J., & Bargh, J. A. (2004). Liking Is for Doing: The Effects of Goal Pursuit on Automatic Evaluation. *Journal of Personality and Social Psychology, 87*(5), 557-572.
- Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading us not unto temptation: Momentary allurements elicit overriding goal activation. *Journal of Personality and Social Psychology, 84*(2), 296-309.
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102*(1), 4-27.
- Harriott, J., & Ferrari, J. R. (1996). Prevalence of procrastination among samples of adults. *Psychological Reports, 78*(2), 611-616.
- Howell, A. J., & Watson, D. C. (2007). Procrastination: Associations with achievement goal orientation and learning strategies. *Personality and Individual Differences, 43*(1), 167-178.
- Howell, A. J., & Buro, K. (2009). Implicit beliefs, achievement goals, and procrastination: A mediational analysis. *Learning and Individual Differences, 19*(1), 151-154.

- Krause, K., & Freund, A. M. (2014). Delay or procrastination—A comparison of self-report and behavioral measures of procrastination and their impact on affective well-being. *Personality and Individual Differences, 63*, 75-80.
- Klingsieck, K. B. (2013). Procrastination: When good things don't come to those who wait. *European Psychologist, 18*(1), 24-34.
- Lay, C. H. (1986). At last, my research article on procrastination. *Journal of Research in Personality, 20*(4), 474-495.
- Leander, N. P., & Chartrand, T. L. (2017). On thwarted goals and displaced aggression: A compensatory competence model. *Journal of Experimental Social Psychology, 72*, 88-100.
- Moller, A. C., & Elliot, A. J. (2006). The 2 × 2 Achievement Goal Framework: An Overview of Empirical Research. In A. V. Mittel (Ed.), *Focus on educational psychology* (pp. 307-326). Hauppauge, NY, US: Nova Science Publishers.
- Nosek, B. A., & Banaji, M. R. (2001). The go/no-go association task. *Social Cognition, 19*(6), 625-644.
- Nosek, B. A., & Smyth, F. L. (2011). Implicit social cognitions predict sex differences in math engagement and achievement. *American Educational Research Journal, 48*(5), 1125-1156.
- Onwuegbuzie, A. J. (2004). Academic procrastination and statistics anxiety. *Assessment & Evaluation in Higher Education, 29*(1), 3-19.
- Rothblum, E. D., Solomon, L. J., & Murakami, J. (1986). Affective, cognitive, and behavioral differences between high and low procrastinators. *Journal of Counseling Psychology, 33*(4), 387-394.
- Schouwenburg, H. C. (1995). Academic procrastination: Theoretical notions, measurement, and research. In J. R. Ferrari, J. L. Johnson, & W. G. McCown, *Procrastination and*

- task avoidance: Theory, research, and treatment* (pp.71-96). New York, NY, US: Plenum Press.
- Schraw, G., Wadkins, T., & Olafson, L. (2007). Doing the things we do: A grounded theory of academic procrastination. *Journal of Educational Psychology, 99*(1), 12-25.
- Seo, E. H. (2009). The relationship of procrastination with a mastery goal versus an avoidance goal. *Social Behavior and Personality, 37*(7), 911-920.
- Sheeran, P., Aarts, H., Custers, R., Ravis, A., Webb, T. L., & Cooke, R. (2005). The goal-dependent automaticity of drinking habits. *The British Journal of Social Psychology, 44*(1), 47-63.
- Sideridis, G. D. (2008). The regulation of affect, anxiety, and stressful arousal from adopting mastery-avoidance goal orientations. *Stress and Health: Journal of the International Society for the Investigation of Stress, 24*(1), 55-69.
- Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive behavioral correlates. *Journal of Counseling Psychology, 31*(4), 503-509.
- Stanislaw, H., & Todorov, N. (1999). Calculation of signal detection theory measures. *Behavior Research Methods, Instruments, and Computers, 31*(1), 137-149.
- Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin, 133*(1), 65-94.
- Steel, P., & Klingsieck, K. B. (2016). Academic procrastination: Psychological antecedents revisited. *Australian Psychologist, 51*(1), 36-46.
- Van Yperen, N. W. (2006). A Novel Approach to Assessing Achievement Goals in the Context of the 2 × 2 Framework: Identifying Distinct Profiles of Individuals with Different Dominant Achievement Goals. *Personality and Social Psychology Bulletin, 32*(11), 1432-1445.

Van Yperen, N. W., Blaga, M., & Postmes, T. (2014). A meta-analysis of self-reported achievement goals and non-self-report performance across three achievement domains (work, sports, and education). *PLoS ONE*, *9*, 1–16.

Table 1

Regression Coefficients Predicting Academic Procrastination (N = 139)

	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI	
						<i>LL</i>	<i>UL</i>
(Constant)	2.976	.047		63.37	.000	2.883	3.069
D-Prime Difference	-.006	.048	-.011	-.123	.902	-.102	.090
Mastery- Approach	-.046	.047	-.084	-.966	.336	-.139	.048
D-Prime Difference × Mastery- Approach	-.013	.056	-.021	-.241	.810	-.124	.097

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

Table 2

Regression Coefficients Predicting Academic Procrastination (N = 142)

	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI	
						<i>LL</i>	<i>UL</i>
(Constant)	2.990	.045		66.019	.000	2.900	3.079
D-Prime	.018	.049	.030	.362	.718	-.078	.114
Mastery- Approach	-.103	.046	-.188	-2.228	.027	-.195	-.012
D-Prime × Mastery- Approach	.172	.052	.281	3.295	.001	.069	.276

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

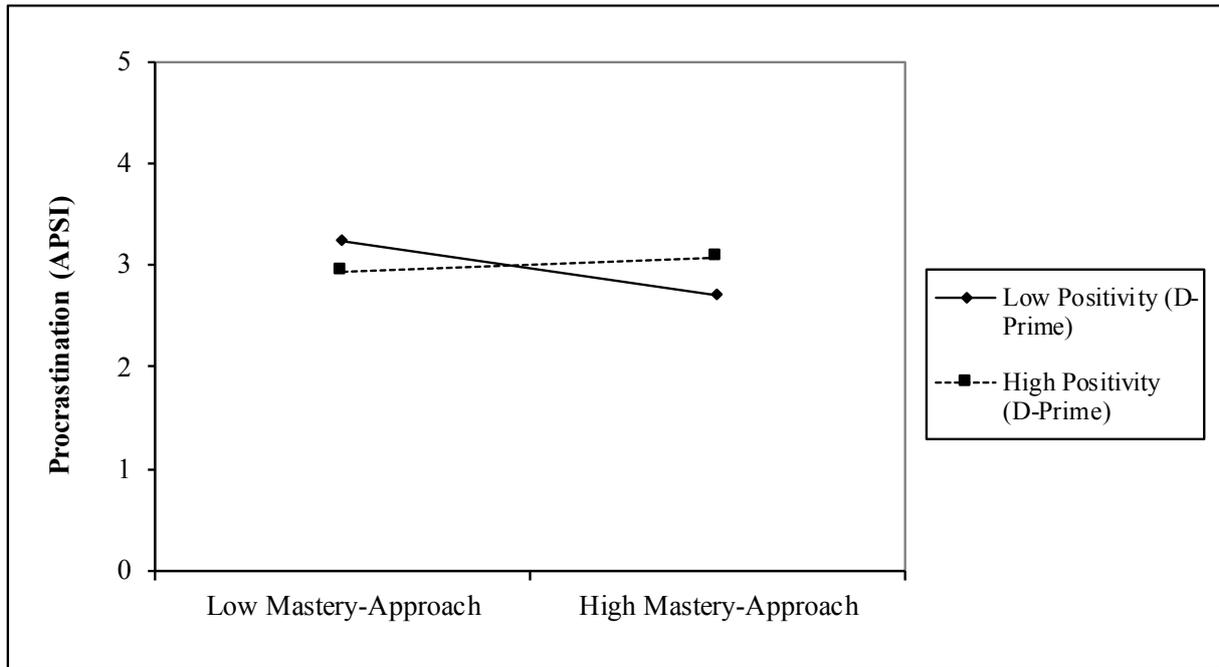


Figure 1: Average Academic Procrastination State Inventory score as a function of mastery-approach orientation at low and high levels of positivity, as indicated by D-Prime

Table 3

Regression Coefficients Predicting Academic Procrastination (N = 145)

	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI	
						<i>LL</i>	<i>UL</i>
Constant	2.996	.046		64.46	.000	2.904	3.088
Reaction Time	-.029	.059	-.043	-.502	.616	-.145	.086
Mastery- Approach	-.060	.047	-.108	-1.269	.207	-.154	.034
Interaction Reaction Time × Mastery- Approach	-.020	.071	-.025	-.285	.776	-.161	.120

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

Table 4

Regression Coefficients Predicting Academic Procrastination (N = 145)

	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI	
						<i>LL</i>	<i>UL</i>
(Constant)	2.993	.046		64.558	.000	2.901	3.085
Reaction Time Difference	-.024	.046	-.044	-.523	.602	-.116	.067
Mastery- Approach	-.060	.046	-.108	-1.287	.200	-.152	.032
Reaction Time Difference \times Mastery- Approach	.040	.059	.057	.679	.498	-.076	.156

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

Table 5

Regression Coefficients Predicting Difference in Intended and Actual Study Hours (N = 142)

	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>	95% CI	
						<i>LL</i>	<i>UL</i>
Constant	2.994	.047		64.29	.000	2.902	3.086
D-Prime	.013	.050	.022	.257	.798	-.086	.111
Mastery- Approach	-.146	.059	-.264	-2.449	.016	-.263	-.028
Mastery- Avoidance	.034	.060	.061	.573	.568	-.084	.153
Performance- Approach	.065	.060	.118	1.080	.282	-.054	.184
Performance- Avoidance	.014	.060	.026	.238	.813	-.104	.132
D-Prime × Mastery- Approach	.188	.077	.306	2.439	.016	.035	.340
D-Prime × Mastery- Avoidance	.013	.063	.023	.199	.842	-.112	.137
D-Prime × Performance- Approach	-.065	.074	-.107	-.882	.379	-.212	.081
D-Prime × Performance- Avoidance	.038	.067	.066	.575	.566	-.093	.170

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

Appendix A

List of Achievement-related Words

Words used in actual trials:

Gain

Attain

Win

Succeed

Prosper

Accomplish

Complete

Excel

Strive

Improve

Words used in practice trials:

Develop

Finish

Appendix B

List of Socializing-related Words

Words used in actual trials:

Affiliate

Join

Accompany

Acquaint

Greet

Gather

Invite

Talk

Befriend

Connect

Words used in practice trials:

Dance

Celebrate

Appendix C

List of Evaluatively Positive Words

Words used in actual trials:

Satisfying

Enjoyable

Appealing

Marvelous

Delightful

Pleasant

Joyful

Wonderful

Good

Excellent

Words used in practice trials:

Magnificent

Outstanding

Appendix D

List of Evaluatively Negative Words

Words used in actual trials:

Awful

Sickening

Hideous

Annoying

Miserable

Disgusting

Painful

Horrible

Bad

Disastrous

Words used in practice trials:

Tragic

Offensive

Appendix E

R Code

```

#file.edit(".Rprofile")      # change the libraries
cat("\014")    # clear console
rm(list=ls())  # clear workspace
setwd(dirname(rstudioapi::getActiveDocumentContext())$path)) # set working
directory
gc()    # run garbage collector
if (!require("pacman")) install.packages("pacman")
pacman::p_load(stringr,psych, Hmisc, foreign, ggplot2, reshape2,data.table,
lme4, lmerTest, effects, metafor, robumeta)
#source("fun.R")

# Load Data from Excel-----

dat.full = fread('GNATTask2018-
CopySONA_May212C2018_07.46.csv',header=T,sep=',') #uses all available CPUcores
(parallel processing)

dat = data.frame(ResponseID = dat.full$ResponseId, Task =
dat.full$gnat_experimental_results, Score = dat.full$SC0, rand =
dat.full$rand)
dat = dat[-(1:2),] #remove first two rows (junk in there)
dat$IDNum = c(1:length(dat[,1])) # add running number
dat = dat[,c(5,1:4)] #reorder columns
dat = dat[complete.cases(dat$Task),]

dat.equal = subset(dat, dat$rand == 2 | dat$rand == 4| dat$rand == 6|
dat$rand == 8
| dat$rand == 10 | dat$rand == 12)
dat.unequal = subset(dat, dat$rand == 1 | dat$rand == 3| dat$rand == 5|
dat$rand == 7
| dat$rand == 9 | dat$rand == 11)

# generate df per participant FOR EQUAL -----

PP.equal = as.list(dat.equal$Task)#make a list of all the GNAT data
names(PP.equal) <- paste0("PP_",
sprintf("%04.0f",seq_along(PP.equal)),sep="") #name the list names acc to pp

f.split = function(x,...){
  x = substring(x, 3)
  x = t(unlist(strsplit(as.character(x),"[,]")))
  x = as.data.frame(matrix(x, ncol = 8, nrow = 168, byrow=T))
  colnames(x) =
  c("response","type","key_press","time","text","key_hit","key_rej","time_displ")
}

```

```

x$response = substring(x$response, 23)
x$type = substring(x$type, 12)
x$type = substr(x$type,1,nchar(x$type)-2) #remove last two letters
x$key_press = substring(x$key_press, 17)
x$time = substring(x$time, 15)
x$text = substring(x$text, 20)
x$text = substr(x$text,1,nchar(x$text)-2)
x$key_hit = substring(x$key_hit, 13)
x$key_rej = substring (x$key_rej, 16)
x$time_displ = substring (x$time_displ, 21)
x$time_displ = substr(x$time_displ,1,nchar(x$time_displ)-1)
x = x[c(81:120,129:168),]
x$block = c(rep(1,40), rep(2,40))
x[x == "\"spacebar\""] = "spacebar"
x[x == ":false" ] ="false"
x[x == ":true" ] ="true"
x$response = as.factor(x$response)
x$type = as.factor(x$type)
x$key_press = as.factor(x$key_press)
x$key_hit = as.factor(x$key_hit)
x$key_rej = as.factor(x$key_rej)
x$time = as.numeric(x$time)
x
}

```

```
PP.equal = lapply(PP.equal, f.split)
```

```
# generate df per participant FOR UNEQUAL -----
```

```
PP.unequal = as.list(dat.unequal$Task) #make a list of all the GNAT data
names(PP.unequal) <- paste0("PP_",
sprintf("%04.0f",seq_along(PP.unequal)),sep="") #name the list names acc to
pp
```

```
PP.unequal = lapply(PP.unequal, f.split)
```

```
# calculate DVs for EQUAL -----
```

```
DV.equal = data.frame(IDNum = c(1:nrow(dat.equal)))
DV.equal$responseId = as.character(dat.equal$responseID)
```

```
# Signal Detection "H" Hits (40 trials)
```

```
DV.equal$H.all.an = sapply(PP.equal,function(pp,...){
  table(pp$response=="true" & pp$block == 1,
        pp$type == "hit" & pp$block == 1)[4]/20})
```

```
DV.equal$H.all.ap = sapply(PP.equal,function(pp,...){
```

```

    table(pp$response=="true" & pp$block == 2,
          pp$type == "hit" & pp$block == 2)[4]/20})

DV.equal$FA.all.an = sapply(PP.equal,function(pp,...){
  table(pp$response=="false" & pp$block == 1,
        pp$type == "reject" & pp$block == 1)[4]/20})

DV.equal$FA.all.ap = sapply(PP.equal,function(pp,...){
  table(pp$response=="false" & pp$block == 2,
        pp$type == "reject" & pp$block == 2)[4]/20})

#code 1 ratio as 0.975

DV.equal$H.all.an[DV.equal$H.all.an == 1] <- 0.975

DV.equal$H.all.ap[DV.equal$H.all.ap == 1] <- 0.975

DV.equal$FA.all.an[DV.equal$FA.all.an == 1] <- 0.975

DV.equal$FA.all.ap[DV.equal$FA.all.ap == 1] <- 0.975

# Code 0 ratio as 0.025

DV.equal$H.all.an[is.na(DV.equal$H.all.an)] <- 0.025

DV.equal$H.all.ap[is.na(DV.equal$H.all.ap)] <- 0.025

DV.equal$FA.all.an[is.na(DV.equal$FA.all.an)] <- 0.025

DV.equal$FA.all.ap[is.na(DV.equal$FA.all.ap)] <- 0.025

# d prime

DV.equal$dprime.an_new = qnorm(DV.equal$H.all.an) -
  qnorm(DV.equal$FA.all.an)

DV.equal$dprime.ap_new = qnorm(DV.equal$H.all.ap) -
  qnorm(DV.equal$FA.all.ap)

#response latency

DV.equal$rt.achiev.pos = sapply(PP.equal,function(pp,...){
  mean(pp[pp$type=="hit" & pp$key_hit=="spacebar" & pp$block == 2,
        "time"])}))

DV.equal$rt.achiev.neg = sapply(PP.equal,function(pp,...){
  mean(pp[pp$type=="hit" & pp$key_hit=="spacebar" & pp$block == 1,

```

```
"time"]]);)
```

```
# calculate DVs for UNEQUAL -----
DV.unequal = data.frame(IDNum = c(1:nrow(dat.unequal)))
DV.unequal$ResponseId = as.character(dat.unequal$ResponseID)

# Signal Detection "H" Hits (40 trials)
DV.unequal$H.all.an = sapply(PP.unequal,function(pp,...){
  table(pp$response=="true" & pp$block == 2,
        pp$type == "hit" & pp$block == 2)[4]/20})
DV.unequal$H.all.ap = sapply(PP.unequal,function(pp,...){
  table(pp$response=="true" & pp$block == 1,
        pp$type == "hit" & pp$block == 1)[4]/20})
DV.unequal$FA.all.an = sapply(PP.unequal,function(pp,...){
  table(pp$response=="false" & pp$block == 2,
        pp$type == "reject" & pp$block == 2)[4]/20})
DV.unequal$FA.all.ap = sapply(PP.unequal,function(pp,...){
  table(pp$response=="false" & pp$block == 1,
        pp$type == "reject" & pp$block == 1)[4]/20})

#code 1 ratio as 0.975
DV.unequal$H.all.an[DV.unequal$H.all.an == 1] <- 0.975
DV.unequal$H.all.ap[DV.unequal$H.all.ap == 1] <- 0.975
DV.unequal$FA.all.an[DV.unequal$FA.all.an == 1] <- 0.975
DV.unequal$FA.all.ap[DV.unequal$FA.all.ap == 1] <- 0.975

# Code 0 ratio as 0.025
DV.unequal$H.all.an[is.na(DV.unequal$H.all.an)] <- 0.025
DV.unequal$H.all.ap[is.na(DV.unequal$H.all.ap)] <- 0.025
DV.unequal$FA.all.an[is.na(DV.unequal$FA.all.an)] <- 0.025
DV.unequal$FA.all.ap[is.na(DV.unequal$FA.all.ap)] <- 0.025
```

```
# d prime

DV.unequal$dprime.an_new = qnorm(DV.unequal$H.all.an) -
  qnorm(DV.unequal$FA.all.an)

DV.unequal$dprime.ap_new = qnorm(DV.unequal$H.all.ap) -
  qnorm(DV.unequal$FA.all.ap)

#responce latency

DV.unequal$rt.achiev.pos = sapply(PP.unequal,function(pp,...){
  mean(pp[pp$type=="hit" & pp$key_hit=="spacebar" & pp$block == 1,
    "time"])}))

DV.unequal$rt.achiev.neg = sapply(PP.unequal,function(pp,...){
  mean(pp[pp$type=="hit" & pp$key_hit=="spacebar" & pp$block == 2,
    "time"])}))

# export data -----

fwrite(DV.equal, "DV_equal.txt", sep=",") #export to csv
fwrite(DV.unequal, "DV_unequal.txt", sep=",") #export to csv
```