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### Publication Date

2019

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UNIVERSITY OF CALIFORNIA  
RIVERSIDE

When Doing Things Later is the Best Choice: Precrastination as an Individual Difference

A Dissertation submitted in partial satisfaction  
of the requirements for the degree of

Doctor of Philosophy

in

Psychology

by

Kyle Sauerberger

June 2019

Dissertation Committee

Dr. David C. Funder, Chairperson

Dr. David A. Rosenbaum

Dr. Keith F. Widaman

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The Dissertation of Kyle Sauerberger is approved:

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Committee Chairperson

University of California, Riverside

## **Acknowledgements**

Never one to believe in the myth of meritocracy (strictly speaking), I have many people to whom I owe thanks. Without these people, I could not have accomplished as much as I have – without them, this document may not even exist.

I would first like to thank my mother. She fought for me tirelessly while I was growing up, making sure that I had all the tools I needed to succeed. Her love and support kept me going when I was ready to give up. She taught me that questioning one's deeply held beliefs is not to be feared, but celebrated.

I would like to thank my soon-to-be wife, Katie, for her love and support during our long 6 years in Riverside. Over the last 11 years, Katie and I have grown closer every day. We've had some incredible experiences in our time here, some mundane, and some difficult. Katie has made the good times even better, the mundane less lonely, and the difficult more bearable. I'm excited for this new chapter in our lives, and I couldn't imagine experiencing it without Katie. And maybe, someday, we will fulfill Katie's wish of living in a place with four seasons.

I would like to thank Erica, my labmate and sister I never had, for sharing with me the journey through graduate school. Erica and I are such different people that we would likely never meet if we were not thrown into the same situation. We have become inseparable and remain good friends, even after she left campus. Outside of my family and fiancé, Erica probably knows more about me than anyone in the world. I am very grateful that we found each other.

I would like to thank my other labmates for their help and companionship. Esther and Elysia were excellent resources when acclimating to the lab. Patrick Morse was incredibly helpful when acclimating to graduate life. He went out of his way to help both me and Erica for the short time we shared together, and for that I will forever be grateful. Gwen is a great colleague and has become a close friend. Daniel has become quite a competent graduate student, no doubt due to my mentorship while he was an undergraduate.

I would like to thank Chris Nave, without whom I surely would not be here. Chris gave me a chance to work under him even as a student transferring into the psychology department. He trusted me with running his lab the same day he took me on, and that meant the world to me. Chris taught me how to run a lab, organize a team, and network with other researchers. And Chris also wrote the recommendation that certainly got me into this PhD program.

I would like to thank David Funder, whose mentorship has left a big impact on me. David challenged me in ways I had never been challenged before, and I am a better researcher for it. He taught me to be confident in presenting my work, and to be steadfast in defense of my ideas. I would especially like to thank David for all of the opportunities he has given me. I've been able to work on data gathered from dozens of countries; I've gone to Vietnam and Germany to present my research; and I've been introduced to researchers I would have never met otherwise.

I would like to thank David Rosenbaum, who opened up a whole new world of research for me. David has also given me a plethora of opportunities, and has introduced

me to collaborators whom share my interests. David quite literally changed my entire course of research; indeed, this very document represents my new interests. David has always been exceedingly kind and encouraging, and I appreciate our relationship.

Finally, I would like to thank the many research assistants who gathered all of the data contained herein. Over 50 research assistants tested participants, entered data, scanned consent forms, edited videos, coded videos, and performed various other tasks too numerous to list here. I would like to thank, especially, the research assistant who was kind enough to model a sample experimental trial and allowed me to show her pictures.

## ABSTRACT OF THE DISSERTATION

When Doing Things Later is the Best Choice: Precrastination as an Individual Difference

By

Kyle Sauerberger

Doctor of Philosophy, Graduate Program in Psychology  
University of California, Riverside, June 2019  
Dr. David C. Funder, Chairperson

Precrastination is doing something early at an extra expense. That expense may impact financial well-being, health, or physical or mental effort. Although the scientific community is developing interest in this new phenomenon, it has yet to be related to individual differences. Using 300 participants, I replicated one of the designs found in the study that first described the phenomenon (Rosenbaum et al., 2014) and added a wide array of personality measures. Participants were asked to walk along a path and to pick up a bucket on the way to the end of the walking path. Buckets were weighted with rocks and precrastination was defined as a choice to pick up the bucket closer to the starting line. The majority of the sample chose to precrastinate, and these choices were highly stable within individuals.

Personality traits were chosen based on the procrastination literature. Self-report measures assessed: the Big Five traits, procrastination, intolerance of uncertainty, ego-resiliency, impulsiveness, and coordination. I found that precrastination was positively related to conscientiousness and the extraversion facet of energy. I also found that precrastination was *not* related to impulsiveness or procrastination, suggesting that the choice to precrastinate is rational.



## TABLE OF CONTENTS

Acknowledgements .....	iv
Abstract .....	vii
Table of Contents .....	viii
List of Figures .....	x
List of Tables .....	xi
Chapter 1: Introduction .....	1
Precrastination: A New Phenomenon .....	3
Alternative Definitions of Precrastination .....	4
Precrastination’s Intuitive Appeal.....	5
Where Should a Personality Description Start? Mining the Procrastination Literature ..	6
The Big Five .....	6
Conscientiousness .....	6
Impulsiveness.....	7
Self-handicapping .....	7
Depression.....	7
Chapter 2: Hypotheses and Research Questions.....	7
Research Question 1: Will the finding that a majority of participants choose to precrastinate replicate?.....	8
Research Question 2: Is precrastination a stable individual difference? .....	8
Research Question 3: Is there enough variability in precrastination to find inter- individual differences?.....	8
Research Question 4: How will precrastination be related to the Big Five traits? .....	9
Hypothesis 1: Precrastination will be positively related to conscientiousness. ....	9
Hypothesis 2: Precrastination will be positively related to neuroticism. ....	9
Hypothesis 3: Precrastination will not be related to procrastination .....	9
Research Question 5: What other individual differences could be related to precrastination?.....	11
Research Question 6: Is the prevalence of precrastination in physical behaviors affected by individual differences in physical capability?.....	11
Precrastination and Rationality .....	11
Chapter 3: Method .....	12
Participants.....	12
Procedure .....	12
Measures .....	18
Big Five Inventory-2 (BFI-2).....	18
California Adult Q-set (CAQ) .....	19
Procrastination scale .....	19
Intolerance of Uncertainty Scale, Short Form (IUS-12).....	20
Ego-resiliency scale .....	20
Barratt Impulsiveness Scale Version 11 (BIS-11).....	20
Adult Developmental Co-ordination Disorders/Dyspraxia Checklist (ADCD) .....	21
Precrastination scale.....	21

Open-ended questions.....	21
Chapter 4: Results .....	22
A Note on Bucket Weights .....	22
Research Question 1: Precrastination frequency .....	25
Research Question 2: Precrastination stability .....	26
Research Question 3: Inter-individual variability of precrastination.....	27
Research Question 4: Precrastination and Big Five traits.....	27
Hypothesis 3: Precrastination will not be related to procrastination .....	31
Research Question 5: Precrastination and other individual differences .....	31
Research Question 6: Precrastination and physical capability .....	40
Chapter 5: Discussion .....	41
How often do people precrastinate?.....	42
Precrastination’s Stability and its Viability as a Unique Individual Difference .....	44
Who precrastinates? .....	44
Conscientiousness .....	45
Neuroticism.....	45
Agreeableness .....	46
Clumsiness .....	47
Is precrastination irrational? .....	48
Precrastination as a Rational Strategy.....	49
Limitations .....	50
Future Directions .....	50
Why does precrastination matter?.....	51
References .....	53
Appendices.....	57
Appendix A: Experimenter Instructions for First Questionnaires .....	57
Appendix B: Consent Form .....	58
Appendix C: Questionnaires Given Before Physical Experiment .....	62
Appendix D: Video Recording Warning Sign .....	66
Appendix E: Experimenter Instructions for Outside Portion.....	67
Appendix F: Example Data Collection Sheet .....	68
Appendix G: Experimenter Instructions for Last Questionnaires and Debriefing .....	69
Appendix H: Debriefing Form.....	70
Appendix I: California Adult Q-set (Revised version presented below).....	71
Appendix J: Precrastination Choices by Condition .....	75
Appendix K: Trial Example Images .....	76
Appendix L: Condition 1-4 Images .....	77
Appendix M: Condition 5-8 Images .....	78

## LIST OF FIGURES

Figure #	Title	Page
Figure 1a	<i>Research area set up before participant arrives</i>	26
Figure 1b	<i>Experimenter giving instructions to participant</i>	26
Figure 2a	<i>Experimenter preparing a trial</i>	27
Figure 2b	<i>Participant beginning a trial</i>	27
Figure 3	<i>Trial Example</i>	86
Figure 4	<i>Conditions 1-4</i>	87
Figure 5	<i>Conditions 5-8</i>	88

## LIST OF TABLES

Table #	Title	Page
Table 1	<i>BFI Trait and Facet Correlates of Lab Precrastination Behavior for Females in 7.0 lb. Bucket Conditions</i>	23
Table 2	<i>Physical Attribute Correlates of Lab Precrastination Behavior</i>	24
Table 3	<i>Physical Attribute Correlates of Lab Precrastination Behavior in All Subsamples</i>	25
Table 4	<i>Number of Consistent Precrastinators and Non-Precrastinators by Definition</i>	27
Table 5	<i>BFI Trait and Facet Correlates of Lab Precrastination Behavior</i>	29
Table 6	<i>Procrastination Correlated with Lab Precrastination Behavior</i>	31
Table 7	<i>CAQ Correlates of Lab Precrastination Behavior</i>	33-36
Table 8	<i>Intolerance of Uncertainty and Factor Correlates of Lab Precrastination Behavior</i>	38
Table 9	<i>Ego Resiliency Correlated with Lab Precrastination Behavior</i>	38
Table 10	<i>Impulsiveness Trait and Factor Correlates of Lab Precrastination Behavior</i>	39
Table 11	<i>Clumsiness Correlates of Lab Precrastination Behavior</i>	41

**When doing things later is the best choice: Precrastination as an individual  
difference**

**Chapter 1: Introduction**

Imagine that you are at the airport, waiting to fly across the country to go on vacation. You are sitting near your gate waiting for boarding to begin and you have confirmed that you are in the right place. Looking at the signs, you see that boarding will begin in about 15 minutes, and boarding will end about 30 minutes after that. You now think about when you will board yourself; when should you stand and move toward the gate? Should it be when boarding is announced? Should it be when your assigned boarding group is called? Should you wait until everyone else has boarded and there is no line? If your choice would be to stand up and move toward the gate at the moment boarding was called – or maybe even the moment the thought of boarding crosses your mind – then you are likely to be someone who engages in precrastination.

Precrastination is doing something early at extra expense. That expense could be time, money, effort, health, or some other finite resource. In the example above, the extra expense is effort. If a passenger gets up from his or her seat at the gate early, he or she must stand – potentially with heavy bags – for 10, 20, or 30 minutes, or perhaps even longer if there is some delay. The precrastinating passenger may also have to continuously move out of the way of other passengers whose boarding groups have already been called. Precrastination is inefficient; passengers who stand up and get in the line at the gate when their boarding group is called rather than before will reduce their standing time. Non-precrastinating passengers who get in line when their boarding group

is called are just as likely to safely make it onto the plane as precrastinating passengers. Passengers may benefit from precrastinating (e.g., getting convenient overhead space for carryon baggage), but any potential benefit comes at a cost.

Other real-world examples of precrastination are less mundane. For example, when patients are diagnosed with cancer, they must make decisions such as whether they want follow-up tests, whether they should get a second opinion, and what potential treatment options they should pursue. Delaying a medical decision or treatment can be deadly (Steel, 2007); however, deciding to take an aggressive approach early may lead to unnecessary medical complications. This is especially true of slowly progressing diseases such as prostate cancer.

Prostate cancer is the second leading cause of cancer-related deaths in men (Fenton et al., 2018). However, detection is difficult, and treatment outcomes are far from certain. Prostate cancer screening (i.e., a PSA blood test) is fraught with difficulties and produces a staggering number of false positives – as many as two-thirds of positive tests may be false positives (Grossman et al., 2018). To save a single life, nearly 1,000 men have to be screened. Of those thousand men screened, roughly 15% will have a false positive test result, and another 20-50% of men will be over diagnosed. Some of those men will undergo further testing. although it may seem benign to undergo further testing, it is not without risks. A biopsy, for example, can result in incontinence, erectile dysfunction, and even death due to infection. And, on top of this, the survival rates of those tested for prostate cancer do not improve in those who undergo screening (Grossman et al., 2018).

If a patient is correctly diagnosed with prostate cancer and decides to undergo treatment such as radiation therapy or complete removal of the prostate, he is at an even greater risk of complications. The standard of care now (barring any extenuating individual circumstances such as family history) is to engage in “active surveillance.” With active surveillance, a man is regularly checked by his doctor to make sure that his cancer has not progressed; in this way, a patient would only undergo radical treatment when it becomes necessary. Because the median age of death from prostate cancer is 80 (Grossman et al., 2018), it is most efficient to take an active surveillance approach; getting aggressive treatment early could be considered precrastination. Getting a better understanding of precrastination will be increasingly beneficial in the medical field, as, sadly, the improvement of technology for screening outpaces improvements in treatment.

### **Precrastination: A New Phenomenon**

At the time I began this research, there were two empirical articles written on precrastination: Rosenbaum, Gong, & Potts' (2014) original study that discovered and described the phenomenon, and Wasserman and Brzykcy's (2015) study that described precrastination behavior in pigeons. These studies were groundbreaking and have attracted the attention of both the field of cognitive psychology and the general public.

The pilot for the original study (Rosenbaum et al., 2014) had participants walk along a path that was flanked by a bucket on each side, placed on a stool. These buckets were placed at varying distances from the starting point; participants were asked to pick up a bucket of their choosing on the way to the end of the path. To the researchers' surprise, participants showed a strong preference for picking up the closer bucket, even

though they were both weighted. When conducting the experiments again for the actual study, they observed the same tendency. What was particularly strange was that choosing the first bucket did not get participants any closer to their goal – they still needed to walk the full length of the path. In follow-up experiments in the same study, the researchers were able to quantify participants’ sensitivity for short approach distances over long carrying distances – bucket approach differences were *three times* more important to participants when they made their choices. Rosenbaum et al. (2014) found that participants were indeed not insensitive to changes in carrying distance, and that their results were unlikely due to participants being more able to predict their physical movements are shorter distances. The authors suggested that the benefit of precrastination was a reduction in cognitive load; that is, if people are able to check a task off of their mental to-do list, they have more mental resources to use on other tasks, both known and potential.

### **Alternative Definitions of Precrastination**

Precrastination has been defined as doing something early at the expense of extra physical effort (Rosenbaum et al., 2014), doing something early with the illusion of moving closer to one’s goal (Wasserman & Brzykcy, 2015), to take a loss sooner rather than later (Haushofer, 2015), doing a more cognitively taxing task before an easier task (VonderHaar, McBride, & Rosenbaum, 2019), doing a harder task before an easier task (Steel, Svartdal, Thundiyil, & Brothen, 2018), or simply doing something early (Wasserman, 2018). As precrastination is a new phenomenon, the definition is still in flux. However, I use the definition of “doing something early at an extra expense”



because it allows for costs other than effort (whether physical or mental). When getting up to board a flight, it will cost extra effort but little else. When making a hasty medical decision, however, the costs are much different: patients could be left with debilitating complications, large medical bills, and the mental anguish that goes along with the consequences of those choices.

### **Precrastination's Intuitive Appeal**

Precrastination is intuitively understood by both researchers and laypeople. When describing precrastination to someone who has never heard of it, a single example leads people to immediately come up with examples from their own lives – no convincing is needed. Many media outlets have written stories about precrastination as well, soon after publication of the first study (Rosenbaum et al., 2014) all the way through May of 2019 (when this dissertation was being prepared). Precrastination has been featured in the New York Times (DeMelo, 2019), New York Magazine (Dahl, 2014), The Atlantic (Khazan, 2014), The Guardian (Burkeman, 2014), Psychology Today (Pychyl, 2019), the Psychonomic Society (Hill, 2018), and several other outlets (Evans, 2014; Hullinger, 2015; Krasny, 2014; Pothier, 2016; Silberstein, 2019). Of great interest to the majority of the journalists who write about precrastination is: Who are these precrastinators? What are they like? And, by implication – What are their personality traits? What makes them different?

## **Where Should a Personality Description Start? Mining the Procrastination**

### **Literature.**

Similar to those journalists, I was interested in what distinguishes procrastinators from non-procrastinators – those who picked up the first bucket in Rosenbaum et al.'s (2014) study from those who picked up the second bucket. However, there was no personality literature at the time to draw from in order to guide my research on individual differences in procrastination. I turned to the procrastination literature for ideas.

**The Big Five.** The Big Five traits are extraversion, agreeableness, conscientiousness, neuroticism, and openness<sup>1</sup>. The Big Five traits are broad and capture many aspects of personality. Those high in extraversion are sociable, assertive, and energetic. Those high in agreeableness are compassionate, respectful, and trusting. Those high in conscientiousness are productive, organized, and responsible. Those high in neuroticism are anxious, depressed, and emotionally volatile. Those high in openness are intellectually curious, sensitive to aesthetics, and have creative imaginations.

**Conscientiousness.** One of the best predictors of procrastination is conscientiousness (Steel, 2007; Steel et al., 2018). Those high in conscientiousness are less likely to procrastinate. People high in conscientiousness are also more likely to be productive, organized, and responsible – all things that a lack of would get in the way of completing a task. Conscientious people are also more likely to persist when

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<sup>1</sup> Two trait names have been changed in the recent iteration of the Big Five Inventory (Soto & John, 2017). The original trait names are used here instead. New trait names (original): negative emotionality (neuroticism) and open-mindedness (openness).

experiencing setbacks. Someone who is low in conscientiousness tends to be lacking in these things.

**Impulsiveness.** Impulsiveness is also strongly related to procrastination. Those who are impulsive are less likely to be able to ignore distractions. They are also more likely to avoid tasks that are unpleasant.

**Self-handicapping.** Self-handicapping is intentionally decreasing one's capability of success by performing (or not performing) actions that would lead to a more favorable outcome. Procrastination itself could be conceptualized as self-handicapping; one researcher went as far as to say that it is "self-harm" (Lieberman, 2019).

**Depression.** Depression is associated with procrastination because it is associated with low self-efficacy. If one does not feel he or she is capable of completing a task, the task may never be started.

## **Chapter 2: Hypotheses and Research Questions**

When beginning this line of research, I had few hypotheses but many questions. I favored an exploratory approach to uncover as many personality-procrastination behavior relationships as possible, since procrastination is a new phenomenon. Further, there is no published research regarding how individual differences may influence procrastination. As with my choices of personality measures, my hypotheses and questions were inspired by the literature on procrastination.

**Research Question 1: Will the finding that a majority of participants choose to precrastinate replicate?**

Across all experiments of the original study (Rosenbaum et al., 2014), the authors found that the majority of participants precrastinated in their choices. This was substantial: in Experiment 1<sup>2</sup>, 71% of participants chose to precrastinate. Of the studies conducted to date, precrastination has often been found to be favored by the majority of participants (at least in physical tasks).

**Research Question 2: Is precrastination a stable individual difference?**

To treat precrastination as an individual difference, I must show that choosing to precrastinate is stable. An individual difference is a consistent pattern of thoughts, feelings, and/or behaviors over time and contexts. If precrastination choices were shown to be inconsistent, that would imply that an underlying individual difference factor is not driving the choice to complete a task early. Precrastination, in that case, would be driven by the situation or some other environmental factor.

**Research Question 3: Is there enough variability in precrastination to find inter-individual differences?**

Rosenbaum et al.'s (2014) original Experiment 1 found that over 70% of their sample chose to precrastinate, averaged across trials. Fournier et al. (2019) found that up to 82% of their sample chose to precrastinate, averaged across trials in their Experiment 1. Wasserman and Brzykcy (2015) found that all of their pigeon subjects made precrastination choices nearly 100% of the time by the eighth day of training. If the rate

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<sup>2</sup> I was only able to obtain raw data from Experiment 1.

of precrastination were this high in my study, it would be difficult to find any relationships between precrastination and other individual differences – if two variables are to vary similarly, they must vary themselves.

#### **Research Question 4: How will precrastination be related to the Big Five traits?**

For the Big Five traits, I had clear hypotheses for conscientiousness and neuroticism; however, I did not have clear hypotheses for the other three traits of the Big Five, extraversion, agreeableness, and openness. I decided to do exploratory analyses to look at the three other Big Five traits and their relation to precrastination, but I had no *a priori* predictions regarding their relationships. My hypotheses regarding conscientiousness and neuroticism are follow

##### **Hypothesis 1: Precrastination will be positively related to conscientiousness.**

Given that conscientiousness is about getting things done, one would expect that those high in conscientiousness would likely want to accomplish tasks as early as possible. Regardless of inefficiency, individuals high in conscientiousness would have a drive to complete tasks as soon as possible.

**Hypothesis 2: Precrastination will be positively related to neuroticism.** Those high in neuroticism should also have an urge to complete tasks as soon as possible, but for different reasons. People high in neuroticism should be more sensitive to the presence of an incomplete task, and should want to eliminate that discomfort by completing tasks.

##### **Hypothesis 3: Precrastination will not be related to procrastination**

My final hypothesis was that precrastination would be unrelated to procrastination. Intuition might, at first glance, say that the two would be inversely

related, but I did not believe that would be the case. Procrastination is, by definition, irrational. Someone who is procrastinating is delaying a task or decision with the knowledge that they will be worse off by doing so. It is not simply “waiting,” it is waiting when you know (or should know) that doing so will impede your progress toward a goal.

Procrastination can alternatively be defined as an active strategy in which a person purposely delays a task in order to *improve* outcomes (Chu & Choi, 2005). The individual could use the extra time to think more about the task or wait for more relevant information. This alternative definition is not often used in the literature (Steel, 2007) and so it is not used here. Procrastination is commonly understood to be associated with negative outcomes (e.g., impaired academic performance) and levels of personality traits that are similarly associated with these outcomes (e.g., low conscientiousness; Rabin, Fogel, & Nutter-Upham, 2011).

Precrastination, on the other hand, was thought to be not necessarily irrational; there is a cost associated with completing the task early, but completing the task early may have benefits. Precrastination also explicitly has a cost associated with it. Delay due to procrastination need not result in extra cost for the person, but precrastination must.

An important point to note is that performing a task early to put off another, less-desirable task is *not* precrastination. In fact, this is textbook procrastination behavior. Answering emails when you should be working on your taxes is a manifestation of avoiding your taxes, not of wanting to get the emails done. Procrastination is not being productive on a vital task, not avoiding productivity altogether.

**Research Question 5: What other individual differences could be related to procrastination?**

Because there was no procrastination-personality literature to draw from, I felt it necessary to administer as many questionnaires as possible to flesh out the phenomenon. Questionnaires on impulsiveness, intolerance of uncertainty, ego-resiliency, and a more fine-grained measure of personality (CAQ; Block, 1968) were added. These scales were administered for the purpose of exploratory analyses.

**Research Question 6: Is the prevalence of procrastination in physical behaviors affected by individual differences in physical capability?**

While conducting the study, I realized that physical capability might play a role in task performance. Because the task itself was physical in nature, participants' balance, strength, or dexterity, for example, could play a role in their movements and choices. Hand-eye coordination may even contribute to physical movements, as factors such as grasp planning may be more difficult for farther objects (Rosenbaum & Sauerberger, 2019). Due to time constraints, I was unable to administer a physical test of participants' physical characteristics. However, I did find a short (20-item) measure of coordination disorders that is administered as a self-report questionnaire. I hoped this self-report scale could capture coordination issues, which are typically diagnosed via observations of physical movement.

**Procrastination and Rationality**

An overarching question to be addressed in this work is whether procrastination is irrational. As has already been described, procrastination is irrational; delaying a task or

decision with the knowledge that you will be worse off by doing so cannot be described in any other way. Can precrastination be described as irrational as well? This seems unlikely in real-world situations. People who prepare to board early may secure valuable overhead luggage space. Those who move into the right lane on the freeway 20 miles before their exit are unlikely to miss their exit, and people diagnosed with cancer could understandably want any tumors removed from their body

Precrastination could instead be about inefficiency rather than irrationality. Although decisions to precrastinate may be rational, they may still be maladaptive. People who move into the right lane early on the freeway put themselves at greater risk of an accident due to moving traffic. People send emails early which may have benefitted from proofreading, potentially causing embarrassment. And people who have surgery early, unnecessarily, may needlessly die of infection.

### **Chapter 3: Method**

#### **Participants**

Participants were 300 UCR undergraduates who were compensated with research credit for their time. The ethnic makeup of the participants was 43.3% Asian, 36% Hispanic/Latino, 9.3% white, 6% Middle Eastern, and 5% black. The mean age of the sample was 19.45 ( $SD = 1.91$ ) and 88% of participants were righthanded.

#### **Procedure**

My study's design is based largely on the experiments of the original study (Rosenbaum et al., 2014). Participants were tested in one-hour blocks from 9 AM to 5 PM five days per week, and only one participant was tested at a time. Two experimenters



were present at all times – one inside the lab who administered questionnaires (to whom I refer as the “inside experimenter”) and one in the research area who conducted the physical portion of the experiment (to whom I refer as the “outside experimenter”). When participants arrived at the lab they were welcomed by the inside experimenter and asked to sit in front of a laptop (for the complete inside experimenter welcome script, please see Appendix A). After the participants were seated, inside experimenters gave participants a consent form (Appendix B) and asked them to read and sign it if they agreed to participate in the study. Once the consent form was signed and given back to the inside experimenter, that experimenter read the study’s instructions to the participant. Participants were told that they would take several questionnaires on the laptop in front of them, be brought outside for a physical task, and then return to the lab to complete a final questionnaire and be debriefed.

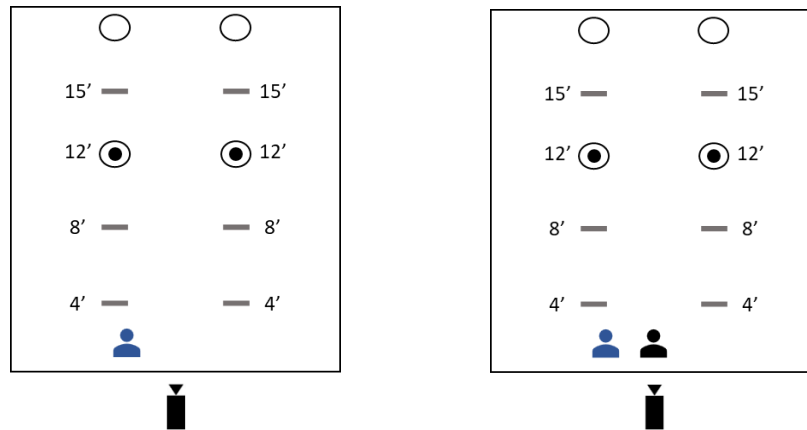
Participants then began work on the questionnaires on Qualtrics using the laptop provided for them on a table (see Appendix C). They answered several demographic questions and several more on handedness, and then were presented with one questionnaire at a time. The questionnaires were, in order of appearance: Big Five Inventory-2 (Soto & John, 2017); California Adult Q-set (Block, 1978); Procrastination Scale (Lay, 1986); Barratt Impulsiveness Scale Version 11 (Patton, Stanford, & Barratt, 1995); 12-item Intolerance of Uncertainty Scale, Short Form (Carleton, Norton, & Asmundson, 2007); ego-resiliency (Letzring, Block, & Funder, 2005); and a self-developed procrastination scale. This portion of the study took about 25-30 minutes,

during which the experimenter sat in the room working on his or her laptop in case the participant had questions.

While the participants completed the questionnaire, the outside experimenter ensured that the research area was prepared. The research area was always set up, prior to the participant arriving, in the same way by the outside experimenter (Figure 1a; person symbol in blue represents the experimenter). Every morning, the area was cordoned off with yellow caution tape and secured with duct tape; this tape was not visible to participants. A camera was placed on a tripod 5 feet behind the research area and was raised 5 feet high; the camera was centered on the walking path. Four stools were positioned inside the research area: two target stools at 16 feet and two bucket-platform stools at 12 feet (relative to the starting position). The buckets were filled with stones to the appropriate weight.

To facilitate correct stool placement, measurements were made at the beginning of each academic quarter using a measuring tape. Gray duct tape was placed on the ground in the research area at 4, 8, 12, 15, and 16 feet on either side of the research area, creating a 3-foot-wide walking path (stools were always placed on a piece of tape with their inside leg farthest from the starting line). This tape remained in place for the duration of each academic quarter – it was gray and non-reflective, blended in with the concrete ground, and was not readily visible. Finally, signs were hung from the caution tape warning passersby that video recording was taking place, and that they could be recorded as a result (Appendix D). This warning sign was required by the UCR Institutional Review Board.

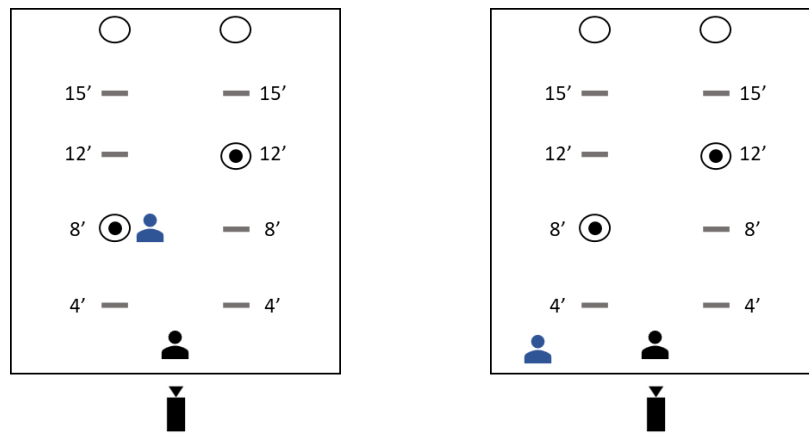
When the participants finished the first round of questionnaires, the inside experimenter walked them to the outside experimenter – the inside experimenter then returned to the lab. The outside experimenter welcomed the participants into the research area, first removing the caution tape from their path so they did not have to duck under it. The participants then stood at the starting position (Figure 1b; the person symbol in black) and the experimenter read them instructions from a script (Appendix E). During the instructions, the buckets sat on stools placed at the 12-foot positions so that participants could have an idea of what the walking path would look like without spoiling a trial (i.e., there was no condition with equidistant buckets). After reading the script in its entirety, the experimenter asked the participant to repeat the instructions back in their own words to ensure comprehension of the instructions. The experimenter then clarified any instructions the participant did not understand.



*Figures 1a and 1b.* Depictions of the outside research area once setup is completed (Figure 1a) and instructions are being given (Figure 1b).

Once the outside experimenter was confident that the participant understood the instructions, the experimenter began recording the participant if he or she indicated that

we had permission to film him or her. If the participant indicated that we did not have permission to film, the experimenter conspicuously placed the lens cap on the camera and told the participant that he or she was doing so. The camera was always left in place to give participants a point of reference when returning to the starting position.



*Figures 2a and 2b.* Depictions of the outside research area during trial preparation (Figure 2a) and prior to asking the participant to begin (Figure 2b).

Once the participant was in the starting position – centered in front of the walking path, facing the camera – the outside experimenter set up the research area for the first trial (Figure 2a) with the aid of a pre-prepared data sheet (Appendix F). Once the outside experimenter finished setting up, he or she returned to the starting end of the research area, as much to the side as possible (as detailed in the outside instructions). The experimenter depicted in Figure 2b is standing stage left, but he or she could also stand on the right side. This was not pre-specified in the instructions given to experimenters, but was somewhat influenced by the side where the last bucket placed. However, experimenters showed a strong preference for standing on the left side of the research area.

The ordering of the conditions was randomized and a diagram similar to Figure 1b was provided for reference (see Appendix F for the entire data entry sheet given to experimenters). Eight trials were run for each participant, one for each condition. After each trial was completed, participants returned to the starting position facing toward the camera. Once the participants were in position, the experimenter again walked into the research area and set up the next trial. Then the experimenter stood to the side at the starting line and simply said “Go.” At this time, participants began walking down the path. In total, the outside portion of the study took roughly 5 minutes. Participants occasionally asked experimenters clarifying questions, typically after the first trial. The most common question was regarding what to do after a trial was complete, to which the experimenter would respond “Please return to the starting position.” After completing the outside portion, the outside experimenter thanked the participants for their participation and instruct them to return to the lab for the last part of the study. The experimenter once again removed the caution tape to allow the participants to leave the research area without having to bend down.

Once the participants returned to the inside experimenter, they were given the second round of questionnaires on a separate Qualtrics link. The inside experimenter filled in the participants’ identifying information, including their participant number and first and last name. The second questionnaire began with asking participants which bucket they thought they chose more often (choosing the closer bucket more often would indicate a preference for precrastination). This was included to make sure that we were clear what the response to the second question was in reference to (i.e., some participants

indicated that they chose the first bucket more often when that was objectively not the case, and vice versa). The second question, which was open-ended, asked participants why they chose the indicated bucket more often. The most common responses for both preferences were “it was easier” and “it was faster.” Participants then took a questionnaire on coordination disorders, the Adult Developmental Co-ordination Disorder Questionnaire (Kirby, Edwards, Sugden, & Rosenblum, 2010). This portion of the study took about 10 minutes. After completing the second questionnaire, participants were debriefed (for experimenter debriefing script, please see Appendix G). Once debriefing was complete, participants were encouraged to ask any questions they had and were given a debriefing form to take with them (Appendix H). Very few participants had questions at the end of the study.

## **Measures**

**Big Five Inventory-2 (BFI-2).** The Big Five Inventory-2 (Soto & John, 2017) is the second iteration of the original Big Five Inventory (John & Srivastava, 1999) is a 60-item scale used to measure the Big Five personality traits. The BFI-2 also measures three “facets” for each of the five factors, which are lower-level factors that are subsumed by their respective trait. Sample items include “is outgoing, sociable” (extraversion), “is compassionate, has a soft heart” (agreeableness), “is reliable, can always be counted on” (conscientiousness), “worries a lot” (negative emotionality), “is original, comes up with new ideas” (open-mindedness). It has been translated into over 40 languages as part of an ongoing study (Lee, Baranski, Gardiner, Members of the International Situations Project, & Funder, 2020).

**California Adult Q-set (CAQ).** The California Adult Q-set (Block, 1968) is a 100-item, forced-choice measure of a broad range of personality characteristics (for a full list of items see Appendix I). Sample items include “is critical, skeptical, not easily impressed,” “tends to fantasize and daydream,” and “is productive, gets things done.” The CAQ has participants “sort” items into 9 categories from “Extremely Uncharacteristic” to “Extremely Characteristic,” essentially rank ordering the items against each other. However, due to time constraints (the traditional CAQ can take up to an hour to complete), the CAQ was administered as a Likert scale. The items were rated on a 1 to 7 scale rather than a 1 to 9 scale to accommodate computer screens, as nine categories visually distorted the scale (“Quite Uncharacteristic” and “Quite Characteristic” were removed). Research assistants, when piloting the study, also had trouble distinguishing between “Somewhat” un/characteristic and “Quite” un/characteristic. This distinction is intuitive when traditionally sorting items due to the CAQ’s forced-choice rank ordering, but it proved to be too confusing when translating the measure to a Likert format.

**Procrastination scale for student populations.** The procrastination scale (Lay, 1986) is a 20-item measure adapted for use in student populations. Sample items include “I generally delay before starting on work I have to do,” “I often find myself performing tasks that I had intended to do days before,” and “In preparing for some deadline, I often waste time by doing other things.” A scale for student populations was created because college students have been found to procrastinate at much higher levels than the adult population: estimates of procrastination in college students are as high as 95% (Steel,

2007), as compared to the adult population prevalence of about 20% (Harriott & Ferrari, 1996).

**Intolerance of Uncertainty Scale, Short Form (IUS-12).** The Intolerance of Uncertainty Scale (Carleton et al., 2007) is used to measure the discomfort one has with uncertain events. The IUS-12 also has two subscales, prospective IU (discomfort as related to uncertain future events) and inhibitory IU (paralysis in the face of uncertainty). The IUS-12 has been found to relate to many psychopathologies, but (not surprisingly) most strongly to anxiety disorders (Fourtounas & Thomas, 2016).

**Ego-resiliency scale.** The ego-resiliency scale (Block & Kremen, 1996) was developed for use in non-clinical samples and, in part, to allow for the measurement of ego-resiliency without the use of the labor-intensive aforementioned CAQ (Letzring et al., 2005). Ego-resiliency is the ability of a person to adapt to life changes and negative events. In this sense, ego-resiliency is thought of as an enduring individual difference, although there is some intraindividual change as well (Block & Kremen, 1996).

**Barratt Impulsiveness Scale Version 11 (BIS-11).** The Barratt Impulsiveness Scale (Patton et al., 1995) is a 30-item measure of impulsiveness, its 6 first-order factors, and its 3 second-order factors. The first order factors (a \* indicates that the factor's name is changed<sup>3</sup>) are inattention\* ("I don't 'pay attention'"), action\* ("I do things without thinking"), lack of self-control\* ("I say things without thinking"), cognitive simplicity\*

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<sup>3</sup> BIS-11 factor names are unclear, and so they will be referred to by revised names. The original (and my) names for the changed first-order factors are: attention (inattention), motor (action), self-control (lack of self-control), cognitive complexity (cognitive simplicity), perseverance (inconsistency); second order factors: motor impulsiveness (action impulsiveness) and non-planning impulsiveness (planning impulsiveness).



(“I [do not] like to think about complex problems”), inconsistency\* (“I change jobs”), and cognitive instability (“I often have extraneous thoughts when thinking”). The second order factors are attentional impulsiveness (combination of inattention and cognitive instability factors), action impulsiveness\* (combination of action and inconsistency factors), and planning impulsiveness\* (lack of self-control and cognitive simplicity factors). The total score for the scale can also be used as a global measure of impulsiveness.

**Adult Developmental Co-ordination Disorders/Dyspraxia Checklist (ADCD).**

The Adult Developmental Co-ordination Disorders/Dyspraxia Checklist (Kirby et al., 2010) is a 40-item questionnaire used to measure coordination disorders in adults, rather than in children. It has three subscales: the first asks participants questions about coordination issues they may have had as children. This is relevant because those who have currently have coordination difficulties in college most likely had coordination difficulties as children as well (Kirby et al., 2010).

**Precrastination Scale.** The Precrastination Scale was developed by myself as a first attempt to capture precrastination globally (i.e., not restricted to physical tasks) via self-report. Sample items include “I try to complete tasks as soon as possible,” “I like to check things off my to-do list,” and “I am always in a rush, even if I am not late for something.” It was developed using items that were, in my opinion, face-valid in relation to my definition of the construct.

**Open-ended questions.** Finally, I included several open-ended questionnaires to get a better idea of why people do or do not engage in precrastination in three separate

examples. I ask participants to think about when they board airplanes (assuming they had done so at least once), and when they move into the right lane when exiting a freeway (assuming they had done so at least once), and when they were picking up buckets outside. I ask participants to tell me why they did or did not precrastinate in those situations. These qualitative responses were intended to be used to generate new ideas to refine my precrastination scales.

## **Chapter 4: Results**

### **A Note on Bucket Weights**

Buckets for the currently reported study weighed 7.0 lbs. for men and 3.5 lbs. for women. My original study consisted of both men and women carrying 7.0 lb. buckets. However, personality traits were not related to females' bucket choices in the 7.0 lb. bucket sample (Table 1). This was despite the fact that men (57%) and women (61%) chose the closer bucket at similar rates.

Table 1. *BFI Trait and Facet Correlates of Lab Preceastination Behavior for Females in 7.0 lb. Bucket Conditions*

<b>BFI Trait</b>	<b>Females</b>
<b>Extraversion</b>	.00
Sociability	-.01
Assertiveness	.01
Energy	-.01
<b>Agreeableness</b>	.05
Compassion	.02
Respect	.00
Trust	.08
<b>Conscientiousness</b>	.09
Organization	.08
Productiveness	.10
Responsibility	.04
<b>Neuroticism</b>	.03
Anxiety	.00
Depression	.01
Emotional	.05
<b>Openness</b>	.01
Intellectual	.03
Aesthetic	.08
Creative	-.10

Note: N = 150. Females carried buckets weighing 7.0 lbs.

Upon further reflection, participant strength was proposed as potentially related to women's bucket choices. As my only available proxy of strength, body mass index (calculated via self-reported height and weight), was correlated with preceastination behavior. BMI was moderately associated with preceastination in the female sample ( $r(148) = .19, p = .02$ ), and weight showed an even greater relationship (Table 2). In fact,

in the female 7.0 lb. bucket sample, the correlation between precrastination and participant weight ( $r(148) = .23, p < .01$ ) was as strong as the correlation between precrastination and conscientiousness in males ( $r(148) = .24, p < .01$ ).

Table 2. *Physical Attribute Correlates of Lab Precrastination Behavior*

<b>Physical Attribute</b>	<b>Females</b>	<b>Males</b>
Height	.12	-.09
Weight	.23**	-.13
BMI	.19*	-.10

**Note:** N = 300, Female  $n = 150$ . \*\* $p < .01$ ; \* $p < .05$ . All participants carried buckets that were 7.0 lbs. each.

No such relationship between physical characteristics and precrastination choices was observed for men (between precrastination and BMI:  $r = -.10, p = .21$ ; between precrastination and weight:  $r = -.13, p = .12$ ). Therefore, I decided to halve the weight of the buckets and collect an independent sample of 150 female participants. Once the weight was reduced, the significant relationships between weight and precrastination and BMI and precrastination were no longer present in females (Table 3).

It was not deemed necessary to reduce the weight of the males' buckets and collect 150 more at 3.5 lbs., since the undesired effect did not occur in that sample. Practical considerations also led to this decision: The University of California, Riverside research pool is two-thirds female. Running the 150 men at 7 lbs. took two academic quarters (20 weeks), and it was not feasible to take another 20 weeks to gather another full sample of men.

Table 3. *Physical Attribute Correlates of Lab Precrastination Behavior in All Subsamples*

<b>Physical Attribute</b>	<b>Females (7.0 lbs.)</b>	<b>Females (3.5 lbs.)</b>	<b>Males (7.0 lbs.)</b>
Height	.12	.10	-.09
Weight	.23**	.00	-.13
BMI	.19*	-.03	-.10

**Note:** N = 300, Each subsample  $n = 150$ . \*\* $p < .01$ ; \* $p < .05$ . All participants carried buckets that were each of specified weight.

**Research Question 1: Will the finding that a majority of participants choose to precrastinate replicate?**

I successfully replicated the finding that a majority of participants choose to precrastinate (Appendix J). On average, across trials, participants chose the near bucket (i.e., precrastinated) 60.69% of the time. On average, across trials, female participants chose the near bucket (i.e., precrastinated) 64.75% of the time, and male participants precrastinated 56.63% of the time. Some conditions had higher rates of precrastination than others. For example, Condition 8 (15', 4') saw the highest rate of precrastination (67.50% across all participants). This is surprising in that the difference between the two buckets in this condition is the most extreme. If participants did not precrastinate in this condition, they would have only had to carry the bucket 1 foot. Instead, participants, on average, opted to take the closer bucket, thereby carrying the bucket 12 feet. This is even true for Condition 7, where the nearer bucket was on the left side (the majority of participants' non-dominant hand). Indeed, this condition has the second highest percentage of participants who chose to precrastinate (62.50% across all participants).

## **Research Question 2: Is precrastination a stable individual difference?**

In order to treat precrastination as an individual difference, I first had to establish that it is stable, in this case, across trials. Consistent with the necessary qualities of an individual difference, I found that precrastination was indeed stable across trials. A participant who chose the first bucket in Trial 1 was likely to choose the first bucket in Trial 8; a participant who chose the second bucket in Trial 1 was likely to choose the second bucket in Trial 8. The alpha reliability was quite high at  $\alpha = .85$ . Precrastination choices were highly reliable.

In fact, 172 participants (57.33%) deviated no more than once in their choices (Table 4). With this cutoff, 118 (39.33%) participants would be considered consistent precrastinators and 54 (18.00%) would be considered consistent non-precrastinators. When examining results by gender, 63 (42.00%) females would be considered precrastinators and 20 (13.33%) would be considered non-precrastinators; 55 (36.67%) males would be considered precrastinators and 34 (22.67%) would be considered non-precrastinators.

Using 2 deviations as the cutoff for determining who is and isn't a precrastinator, the consistency is even more stark: nearly three quarters of participants would be classified as either consistent precrastinators or non-precrastinators (223 participants, or 74.33%). With this cutoff, 146 (48.67%) participants would be considered precrastinators and 77 (25.67%) would be considered non-precrastinators. When examining results by gender, 79 (52.67%) females would be considered precrastinators and 30 (20.00%) would

be considered non-precrastinators; 67 (44.67%) males would be considered precrastinators and 47 (31.33%) would be considered non-precrastinators.

Table 4. *Number of Consistent Precrastinators and Non-Precrastinators by Definition*

<b>Group</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
<b>1 Deviation or Fewer</b>	172 (57.33%)	83 (55.33%)	89 (59.33%)
Precrastinator	118 (39.33%)	63 (42.00%)	55 (36.67%)
Non-Precrastinator	54 (18.00%)	20 (13.33%)	34 (22.67%)
<b>2 Deviations or Fewer</b>	223 (73.33%)	109 (72.67%)	114 (76.00%)
Precrastinator	146 (48.67%)	79 (52.67%)	67 (44.67%)
Non-Precrastinator	77 (25.67%)	30 (20.00%)	47 (31.33%)

**Note:** N = 300, Female  $n = 150$ . Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs. “Deviations” refers to a consistent precrastinator switching to not precrastinating for the specified number of trials, and to a consistent non-precrastinator switching to precrastinating for the specified number of trials.

### **Research Question 3: Is there enough variability in precrastination to find inter-individual differences?**

For precrastination to be a viable individual difference, it must be relatively stable within participants, across trials – my previous analyses supported this conclusion. However, for precrastination to meaningfully correlate with other individual differences, there must be enough variability between participants on precrastination. We found substantial variability: for a mean proportion of .61 precrastination choices across trials, I found a standard deviation of .34 (variance of .12).

### **Research Question 4: How will precrastination be related to the Big Five traits?**

The first individual differences examined were the Big Five personality traits (Table 5). I had no predictions for precrastination’s relationship with extraversion, agreeableness, and openness, but predicted that both conscientiousness (Hypothesis 1)

and neuroticism (Hypothesis 2) would be positively related to precrastination. I found that extraversion was positively correlated with precrastination behavior for all participants ( $r(298) = .16, p < .01$ ), for men ( $r(148) = .19, p = .02$ ), and less so for women ( $r(148) = .14, p = .09$ ). This was especially true of the extraversion facet of energy: energy was positively correlated with precrastination behavior for all participants ( $r(298) = .21, p < .01$ ), for men ( $r(148) = .27, p < .01$ ), and less so for women ( $r(148) = .16, p = .06$ ).



Table 5. *BFI Trait and Facet Correlates of Lab Preceastination Behavior*

<b>BFI Trait</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
<b>Extraversion</b>	.16**	.14+	.19*
Sociability	.16*	.12	.18*
Assertiveness	.03	.08	.00
Energy	.21**	.16+	.27**
<b>Agreeableness</b>	.14*	.00	.23*
Compassion	.13*	.01	.18*
Respect	.08	.01	.10
Trust	.14*	-.03	.25**
<b>Conscientiousness</b>	.22**	.21*	.24**
Organization	.20**	.15+	.26**
Productiveness	.15*	.17*	.16+
Responsibility	.18**	.19*	.16+
<b>Neuroticism</b>	-.06	-.09	-.12
Anxiety	.00	-.10	-.01
Depression	-.13*	-.14+	-.18*
Emotional	-.01	.02	-.12
<b>Openness</b>	.01	.05	-.07
Intellectual	-.08	-.06	-.11
Aesthetic	.06	.12	-.06
Creative	.04	.06	.01

Note: N = 300 (Female  $n = 150$ ). \*\* $p < .01$ ; \* $p < .05$ ; + $p < .10$ . Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs.

Unexpectedly, agreeableness had a moderately strong correlation with preceastination behavior in men ( $r(148) = .23, p = .01$ ). This was not true for women ( $r(148) = .00, p = .95$ ). The strongest relationship between an agreeableness facet and preceastination behavior in men was for the facet of trust ( $r(148) = .25, p < .01$ ). These relationships were being driven entirely by men, and all of the agreeableness facet-preceastination correlations were near zero for women.

Openness had no significant relationships with precrastination behavior either with the entire sample ( $r(298) = .23, p = .01$ ), or in men ( $r(148) = -.07, p = .42$ ) or women ( $r(148) = .05, p = .58$ ). Its facets also had no significant relationships with precrastination behavior.

I predicted based on Hypothesis 1 that conscientiousness would be positively correlated with precrastination behavior. I found support for this hypothesis: Conscientiousness was positively correlated with precrastination in the entire sample ( $r(298) = .22, p < .01$ ), in men ( $r(148) = .24, p < .01$ ), and in women ( $r(148) = .21, p = .01$ ). The conscientiousness facet correlated most strongly with precrastination was organization:  $r(298) = .20, p < .01$  in the entire sample;  $r(148) = .26, p < .01$  in men; and  $r(148) = .15, p = .07$  in women.

I predicted based on Hypothesis 2 that neuroticism would be positively correlated with precrastination behavior. I did not find support for this hypothesis: Neuroticism was not significantly correlated with precrastination in the entire sample ( $r(298) = -.06, p = .30$ ), in men ( $r(148) = -.12, p = .14$ ), or in women ( $r(148) = -.09, p = .30$ ). The neuroticism facet correlated most strongly with precrastination, however, was depression:  $r(298) = -.13, p = .02$  in the entire sample;  $r(148) = -.18, p = .03$  in men; and  $r(148) = -.14, p = .08$  in women. Although the majority of the neuroticism facet correlations do not reach the conventional level of statistical significance, they are almost all in the negative direction. With further studies, we may find that neuroticism is actually inversely related to precrastination (i.e., is associated with performing tasks later, not earlier).

### **Hypothesis 3: Procrastination will not be related to procrastination**

Hypothesis 3 was that procrastination, as measured by the procrastination scale (Lay, 1986), would be unrelated to procrastination behavior (Table 6). Procrastination and procrastination were indeed unrelated in the entire sample ( $r(298) = -.04, p = .45$ ), in the male sample ( $r(148) = -.07, p = .39$ ), and in the female sample ( $r(148) = -.05, p = .53$ ).

Table 6. *Procrastination Correlated with Lab Procrastination Behavior*

<b>Trait</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
Procrastination	-.04	-.05	-.07

Note: N = 300, Female  $n = 150$ . Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs.

### **Research Question 5: What other individual differences could be related to procrastination?**

Given that this is the first study to examine individual differences in the context of procrastination, various questionnaires were administered and their relationships with procrastination were examined in an exploratory fashion. The California Adult Q-set (CAQ; Block, 1968) was administered to complement the BFI-2. The other individual differences measured were intolerance of uncertainty, ego-resiliency, and impulsiveness.

Procrastination behavior was correlated with all 100 of the items on the CAQ (Table 7). The CAQ is meant to be analyzed item by item, and is not meant to be factor analyzed. Because of the sheer number of correlations that the CAQ requires, I performed a randomization test that establishes how many significant correlations one could expect

by chance, given a body of correlations. I found 26 significant correlations for the entire sample (probability of finding 26 significant correlations by chance,  $p < .01$ ), 23 significant correlations for the male sample (probability of finding 23 significant correlations by chance,  $p < .01$ ), and 8 significant correlations for the female sample (probability of finding 8 significant correlations by chance,  $p = .18$ ). Although females had fewer significant correlations between precastination and CAQ items than males, the pattern of correlations between males and females was very similar (vector correlation:  $r(98) = .57, p < .01$ ).

Table 7. *CAQ Correlates of Lab Precoastination Behavior*

#	CAQ Item Text	All	Females	Males
<b>Positive Correlations</b>				
84	Is cheerful, happy	.25**	.26**	.25**
26	Is productive; gets things done	.19**	.23*	.18*
35	Has the capacity for close relationships; compassionate	.17**	.09	.20*
71	Is ambitious; sets high personal goals	.16**	.18*	.15+
75	Is easy to understand and describe	.16**	.15+	.19*
60	Knows self well	.15*	.22*	.10
5	Is giving, generous toward others	.14*	.05	.19*
4	Is a talkative person	.14*	.10	.14+
54	Is sociable, gregarious	.14*	.10	.16+
77	Appears straightforward, candid, frank in dealing with others	.14*	.17*	.13
2	Is dependable and responsible	.13*	.20*	.06
3	Has a wide range of interests	.12*	.03	.17*
6	Is fastidious, meticulous, careful, and precise	.12*	.14+	.11
17	Behaves in a sympathetic and considerate manner	.12*	.02	.18*
95	Gives advice; concerns self with the business of others	.12+	.00	.21*
57	An interesting, colorful person	.11+	.13	.07
32	Seems to be aware of the impression he/she makes on others	.11+	.21*	.02
56	Responds to and appreciates humor	.10+	.09	.09
76	Tends to project own feelings and motivations onto others	.10+	.00	.22*
20	Behaves and acts quickly	.09	.03	.15+
74	Feels satisfied with self; is unaware of self-concern	.09	.13	.09
15	Is skilled in social techniques of imaginative play, pretending, and humor	.09	.09	.10
28	Tends to arouse liking and acceptance in people	.08	.08	.09
31	Regards self as physically attractive	.08	.03	.13
11	Is protective of those close to him/her	.08	.05	.07

18	Initiates humor	.08	.07	.10
73	Tends to see sexual overtones in many situations	.07	.13	.04
80	Is sexually interested in others	.07	.09	.09
85	Tends to communicate through non-verbal behavior	.07	.08	.05
58	Appears to enjoy sensuous experiences	.07	.10	.03
52	Behaves in an assertive fashion	.06	.16+	-.03
70	Behaves ethically; has a personal value system and is faithful to it	.06	.05	.07
7	Favors conservative values in a variety of areas	.06	.10	.06
25	Has excessive self-control; postpones pleasures unnecessarily	.06	.04	.11
91	Values power in self and others	.05	.02	.07
29	Is turned to or sought out for advice and reassurance	.05	-.02	.08
59	Is concerned about own body, its health	.04	.10	-.01
67	Is self-indulgent; tends to pamper himself or herself	.04	.07	-.04
96	Values own independence and autonomy	.04	.03	.05
21	Arouses nurturant feelings in others	.04	-.06	.10
41	Makes moral judgments	.04	.00	.07
66	Is aesthetically sensitive	.04	.04	-.02
88	Is personally charming	.03	-.05	.11
83	Able to see to the heart of important problems	.03	.06	.03
33	Is calm, relaxed in manner	.03	.03	.10
92	Has social poise and presence; appears socially at ease	.03	.09	-.01
64	Is socially perceptive	.03	.11	-.05
81	Is physically attractive	.02	-.03	.08
98	Is verbally fluent	.02	.06	-.01
90	Is concerned with philosophical problems	.02	.00	.02
8	Appears to have a high degree of intellectual capacity	.01	.07	-.01
47	Has a readiness to feel guilty	.01	-.03	.00
87	Tends to interpret clear-cut, simple situations in complicated ways	.00	-.02	.02

### Negative Correlations

97	Is an unemotional person	-.20**	-.18*	-.17*
37	Is guileful, deceitful, manipulative, opportunistic	-.18**	-.05	-.23*
48	Keeps people at a distance	-.16**	-.07	-.25**
94	Expresses hostility and angry feelings directly	-.16**	-.11	-.20*
78	Feels cheated and victimized by life	-.15*	-.01	-.29**
49	Is basically distrustful of people	-.14*	-.01	-.26**
55	Is self-defeating	-.14*	-.15+	-.15+
1	Is critical, skeptical, not easily impressed	-.14*	-.12	-.11
53	Is impulsive; has little self-control	-.13*	-.05	-.21*
62	Tends to be rebellious and nonconforming	-.13*	-.16+	-.10
51	Places high value on intellectual and cognitive matters	-.12+	-.13	-.08
22	Feels a lack of meaning in life	-.11+	-.04	-.19*
42	Reluctant to commit self to any definite course of action	-.11+	-.08	-.13
65	Resists limits and rules; sees what he/she can get away with	-.10+	-.04	-.13
34	Is irritable; overreacts to minor frustrations	-.10+	-.07	-.17*
69	Is quick to feel imposed on	-.10+	-.03	-.20*
79	Tends to ruminate and have persistent, preoccupying thoughts	-.10+	-.13	-.06
100	Relates to everyone in the same way	-.10+	-.15+	-.06
24	Prides self on being rational, logical, and objective	-.09	-.06	-.08
45	Is psychologically frail, vulnerable	-.09	-.08	-.17*
36	Tends to undermine, obstruct, or sabotage other people	-.09	.05	-.17*
72	Has doubts about own adequacy as a person	-.08	-.07	-.13
89	Compares self with others	-.08	-.01	-.15+
40	Is generally fearful	-.08	-.04	-.17*
44	Evaluates the motives of others	-.08	.02	-.18*
12	Tends to be self-defensive	-.07	-.02	-.11
99	Is self-dramatizing; seeks attention	-.06	-.05	-.10

27	Is condescending toward others; acts superior to others	-.06	-.07	-.01
50	Is unpredictable and changeable in attitudes and behavior	-.06	.04	-.16+
86	Denies the presence of anxiety and conflicts	-.06	-.06	-.05
30	Gives up and withdraws when possible in the face of frustration	-.06	-.04	-.12
13	Takes offense easily	-.06	-.01	-.15+
38	Has hostility toward others	-.06	.00	-.09
68	Is basically anxious	-.05	-.11	-.08
39	Thinks about ideas in unusual ways	-.05	-.05	-.04
43	Has large or vivid facial expressions or gestures	-.04	-.13	.02
82	Has fluctuating moods	-.04	-.02	-.12
10	Develops physical symptoms in reaction to stress and anxiety	-.04	-.11	-.06
19	Seeks reassurance from others	-.03	-.02	-.10
14	Genuinely submissive; gives in easily	-.03	-.03	-.09
63	Is influenced by social pressures	-.03	-.06	-.01
46	Tends to fantasize and daydream	-.03	.02	-.09
93	Behaves in a gender-congruent style	-.03	.02	-.05
61	Likes others to be dependent on him/her	-.03	-.07	.06
16	Is introspective	-.02	.01	-.05
23	Tends to blame others for own mistakes, failures, and shortcomings	-.02	.08	-.11
9	Is uncomfortable with uncertainty and complexity	-.01	-.02	-.03
Number Significant <i>r</i> 's Obtained		26**	8	23**
Mean <i>r</i> Obtained		.08**	.07	.11**

Note: N = 300, Female *n* = 150. \*\**p* < .01; \**p* < .05; +*p* < .10. Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs. Male-female vector correlation is *r* = .57. Significance levels associated with the number of significant *r*'s obtained and the mean *r* obtained are derived from randomizations tests that assess the likelihood of finding those obtained values by chance alone.



For the overall sample, the items most strongly, positively correlated with precrastination was “is cheerful, happy” ( $r(298) = .25, p < .01$ ), “is productive, gets things done” ( $r(298) = .19, p < .01$ ), and “has the capacity for close relationships; compassionate” ( $r(298) = .17, p < .01$ ). The items most strongly, negatively correlated with precrastination was “is an unemotional person” ( $r(298) = -.20, p < .01$ ), “is guileful, deceitful, manipulative, opportunistic” ( $r(298) = -.18, p < .01$ ), and “keeps people at a distance” ( $r(298) = -.16, p < .01$ ). Many, if not nearly all of the items significantly correlated with precrastination resemble the traits of conscientiousness and agreeableness.

Intolerance of uncertainty was unrelated to precrastination (Table 8) for the entire sample ( $r(298) = -.01, p = .83$ ), for the male sample ( $r(148) = -.04, p = .63$ ), and for the female sample ( $r(148) = .02, p = .76$ ). The same pattern of non-relationships was found with the two subscales of the IUS-12. Prospective intolerance of uncertainty was unrelated to precrastination for the entire sample ( $r(298) = .00, p = .97$ ), the male sample ( $r(148) = -.04, p = .61$ ), and the female sample ( $r(148) = .06, p = .44$ ). Inhibitory intolerance of uncertainty was unrelated to precrastination for the entire sample ( $r(298) = -.03, p = .64$ ), the male sample ( $r(148) = -.03, p = .72$ ), and the female sample ( $r(148) = -.02, p = .77$ ).

Table 8. *Intolerance of Uncertainty and Factor Correlates of Lab Precrastination Behavior*

<b>Trait</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
Intolerance of Uncertainty	-.01	.02	-.04
Prospective	.00	.06	-.04
Inhibitory	-.03	-.02	-.03

Note: N = 300, Female  $n = 150$ . Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs.

Ego resiliency was positively related to precrastination (Table 9) for the entire sample ( $r(298) = .14, p = .02$ ). This was true for the male sample ( $r(148) = .18, p = .03$ ), but not for the female sample ( $r(148) = .08, p = .31$ ). In light of my BFI findings, this gender-dependent relationship makes sense; the ego-resiliency scale contains several items that resemble the trait of conscientiousness (e.g., “I usually think carefully about something before acting”), and many items that resemble agreeableness (e.g., “I am generous with my friends”).

Table 9. *Ego Resiliency Correlated with Lab Precrastination Behavior*

<b>Trait</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
Ego Resiliency	.14*	.08	.18*

Note: N = 300, Female  $n = 150$ . \* $p < .05$ . Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs.

Impulsiveness, as a single scale score of the entire BIS-11, was unrelated to precrastination in the entire sample ( $r(298) = -.04, p = .44$ ; Table 10). This was also true of both the male sample ( $r(148) = -.06, p = .50$ ), and the female sample ( $r(148) = -.04, p = .65$ ). The BIS-11 has 6 first-level factors, and they were all unrelated to precrastination:

inattention ( $r(298) = -.03, p = .59$ ; “I don’t ‘pay attention’”), action ( $r(298) = .04, p = .44$ ; “I do things without thinking”), lack of self-control ( $r(298) = -.08, p = .18$ ; “I say things without thinking”), cognitive simplicity ( $r(298) = .01, p = .87$ ; “I [do not] like to think about complex problems”), inconsistency ( $r(298) = -.06, p = .28$ ; “I change jobs”), and cognitive instability ( $r(298) = -.09, p = .13$ ; “I often have extraneous thoughts when thinking”). This was also true for the male and female samples. For males, the mean effect size  $r$  between BIS-11 first-order factors and precastination behavior was  $r(148) = -.04$ . For females, it was  $r(148) = -.04$ .

Table 10. *Impulsiveness Trait and Factor Correlates of Lab Precastination Behavior*

<b>Impulsiveness Factor</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
<b>First Order Factors</b>			
Inattention*	-.03	-.05	-.04
Action*	.04	.02	.08
Lack of Self-Control*	-.08	-.04	-.11
Cognitive Simplicity*	.01	.04	-.01
Inconsistency*	-.06	-.07	-.05
Cognitive Instability	-.09	-.07	-.11
<b>Second Order Factors</b>			
Attentional Impulsiveness	-.07	-.07	-.09
Action Impulsiveness*	.01	-.01	.05
Planning Impulsiveness*	-.05	-.01	-.08
<b>Total Impulsiveness</b>	<b>-.04</b>	<b>-.04</b>	<b>-.06</b>

Note:  $N = 300$ , Female  $n = 150$ . \* indicates that the factor's name has been changed for the sake of clarity. Original names, in descending order, are: attention, motor, self-control, cognitive complexity, perseverance, attentional impulsiveness, motor impulsiveness, and non-planning impulsiveness. Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs.

Second order factors from the BIS-11 were also unrelated to precastination.

Attentional impulsiveness, a combination of first-order factors inattention and cognitive instability, was not correlated with precastination in the entire sample ( $r(298) = -.07, p = .24$ ), in the male sample ( $r(148) = -.09, p = .25$ ), or in the female sample ( $r(148) = -.07, p = .40$ ). Action impulsiveness, a combination of first-order factors action and inconsistency, was not correlated with precastination in the entire sample ( $r(298) = .01, p = .82$ ), in the male sample ( $r(148) = .05, p = .56$ ), or in the female sample ( $r(148) = -.01, p = .87$ ). Finally, planning impulsiveness, a combination of first-order factors lack of self-control and cognitive simplicity, was not correlated with precastination in the entire sample ( $r(298) = -.05, p = .42$ ), in the male sample ( $r(148) = -.08, p = .32$ ), or in the female sample ( $r(148) = -.01, p = .92$ ).

**Research Question 6: Is the prevalence of precastination in physical behaviors affected by individual differences in physical capability?**

Clumsiness<sup>4</sup> was measured using the ADCD in order to have a measure of a relevant, non-psychological individual difference. It is reasonable to suspect that individuals who are aware of their physical limitations would behave differently when faced with a physical task. They may be more careful in planning their movements, for example. I found limited evidence suggesting that this might be the case (Table 11). For the overall sample, clumsiness reported in adulthood was significantly, *inversely* correlated with precastination ( $r(268) = -.13, p = .04$ ). That is, participants who rated

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<sup>4</sup> I use “clumsiness” rather than “coordination disorder” because I do not mean to imply a clinical diagnosis.

themselves as more clumsy were *less* likely to pick up the first bucket. However, this effect was driven entirely by the males (males:  $r(118)^5 = -.18, p = .04$ ; females:  $r(148) = -.10, p = .24$ ). Additionally, self-reported childhood clumsiness was not associated with precrastination ( $r(298) = -.05, p = .44$ ).

Table 11. *Clumsiness Correlates of Lab Precrastination Behavior*

<b>ADCD Subscale</b>	<b>All</b>	<b>Females</b>	<b>Males</b>
Childhood Clumsiness	-.05	-.09	.00
Adult Clumsiness	-.13*	-.10	-.18*

Note: N = 270, Female  $n = 150$ , Male  $n = 120$ . \* $p < .05$ .  
 Females carried buckets weighing 3.5 lbs.; Males carried buckets weighing 7.0 lbs. The term "clumsiness" is used here rather than "coordination disorders."

## Chapter 5: Discussion

The purpose of this study was to uncover some of the individual differences potentially associated with precrastination. Inspired by Rosenbaum and colleagues' 2014 study, I was interested in the difference between those participants who precrastinated in their study, and those who did not. To investigate this further, I simply replicated and modified one of their experiments and added personality measures. I felt this was the most straightforward way to start this new line of research exploring individual differences in cognitive psychological phenomena – of merging the two fields of cognitive and personality psychology.

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<sup>5</sup> Twenty of the males in the sample are missing data on the Adult Developmental Co-ordination Disorders/Dyspraxia Checklist. The questionnaire was added after those participants took part in the study.

### **How often do people precrastinate?**

The differences between my study and that of Rosenbaum and colleagues (2014) were small, and I found that a majority of my participants precrastinated as did theirs. However, a recent study done by Fournier, Stubblefield, Dyre, and Rosenbaum (2018), using a design markedly different from mine and that of the original study, found this same precrastination preference. In one of the experiments in that study, participants were asked to pick up two buckets – one at a time – and pour the ping pong balls they contained into a bowl. Participants overwhelmingly preferred picking up the closer bucket first, regardless of the number of ping pong balls in each bucket. In physical tasks, at least, precrastination seems to be a natural urge that the majority of us have.

This preference is not immutable, however. Fournier and colleagues (2019) reduced precrastination to 31%, down from 82%, simply by making their objects more difficult to carry (i.e., participants had to carry cups of water and were told not to spill). A recent paper I co-authored with David Rosenbaum (Rosenbaum & Sauerberger, 2019) described a study in which we reduced the rate of precrastination by manipulating target heights. When participants faced conditions where choosing to precrastinate – picking up the first bucket – would allow them to avoid having to bend over to place the bucket on a target, the rate of precrastination was 72.5%. However, in conditions where choosing to precrastinate – picking up the first bucket – would *force* participants to bend over to place the bucket on a target, the rate of precrastination was reduced to 41.5%. The rate of precrastination can also be increased by adding a memory load task to the experimental design (Fournier et al., 2018). The latter outcome was predicted by Fournier et al. (2018)

from the idea that precrastination might be viewed as a way of unloading demands on working memory. As working-memory is increased, the pressure to reduce working-memory demands is even greater.

At the moment it is unknown how often people precrastinate “in the wild,” but it is reasonable to assume that with the endless examples one could generate, it is more common than we realize. When people unfamiliar with precrastination have the phenomenon explained to them, they not only immediately understand the concept but, unprompted, start coming up with their own examples. People attempt to board planes earlier than they should; they move over too soon on the highway, exposing themselves to the danger of merging traffic; they make decisions to pursue aggressive medical treatment before it is truly necessary; they send emails too early, possibly writing something they might later be embarrassed by; they pay credit card bills too early, leaving insufficient liquid money for things that can only be paid in cash, or at a penalty for paying with a credit card (e.g., rent, taxes, loans); they show up to appointments too early, potentially waiting for hours; and so on.

Many examples could be generated, but precrastination, like procrastination, is likely to be domain specific. A student may procrastinate writing a paper for as long as possible, but not procrastinate household chores. I expect that precrastination would share this characteristic. People may precrastinate with emails, but not with driving; or they may precrastinate when boarding a plane, but show up on time to appointments. The main driver of procrastination being applied to a domain is aversiveness of task, but I am not convinced that this will be the case with precrastination.

### **Precrastination's Stability and its Viability as a Unique Individual Difference**

In all precrastination studies to date, precrastination behavior has been found to be remarkably stable, at least within the experimental context. If a participant is observed to precrastinate in the first trial, he or she is likely to precrastinate in the last trial.

Alternatively, if a participant is observed to not precrastinate in the first trial, he or she is not likely to precrastinate in the last trial. David Rosenbaum and Lisa Fournier were kind enough to share previously collected data, allowing me to analyze the stability of precrastination behavior across the multiple trials of their studies. I found alphas as high as  $\alpha = .97$ , indicating that this is indeed a coherent construct that deserves further study.

If it is found that this stability is consistent across contexts and over longer periods of time, I would argue that precrastination is an individual difference worth studying in its own right. The current studies are a bit contrived and perhaps not representative of real-world situations in which precrastination occurs, but I have sufficiently demonstrated that precrastination does exist. I can isolate it in the lab, can manipulate its frequency, and can even relate precrastination-relevant behavior to other individual differences. Future research will examine more representative contexts.

### **Who precrastinates?**

Many individual difference measures were administered, and I found both null and positive results that give a better idea of what precrastination is (and is not). I found that precrastination was unrelated to procrastination, as I had predicted, and that conscientiousness was associated with precrastination as well. Contrary to expectations,



neuroticism was not related to precrastination behavior. Not a single factor of impulsiveness was related to precrastination, and neither was intolerance of uncertainty.

**Conscientiousness.** One of my hypotheses was that conscientiousness would be positively related to precrastination. This hypothesis was supported, and it makes intuitive sense. Those who are conscientious are eager to get things done, and so picking up a bucket as soon as possible should be appealing to them. My study had two tasks for participants to accomplish: picking up a bucket and putting it on a target stool. This is analogous to having a to-do list in day-to-day life. People high in conscientiousness would like to check things off their to-do lists – whether physical or mental – as soon as possible in order to reduce that list.

**Neuroticism.** Neuroticism was not associated with precrastination in the current study, but there are at least a couple potential reasons for this lack of association. First, very little was at stake for participants. Participants' bucket choices did not have consequences outside of the task at hand. Choosing the first bucket increased physical effort for a brief period of time and mild discomfort may have been the most extreme result. Second, there was no uncertainty involved with the task. The participants had to complete two tasks: pick up a bucket and place it on a stool. A third task was never added, and the implications of picking up one bucket over the other were unambiguous.

In real world examples of precrastination, neuroticism clearly plays a strong role. Choosing to accomplish a task early may benefit people if an unexpected task arises, but this behavior will certainly come with costs. Those who are more anxious about flying will get to the airport exceedingly early, get to their gate and not move from it until

boarding (e.g., not leaving to go to the bathroom or get something to eat), and will stand up early to board. Rather than feeling intrinsically rewarded by accomplishing goals – by checking things off their to-do lists – as conscientious people are, those high in neuroticism want to get things done because it causes them anxiety to have many tasks to do. When asking participants in the open-ended questions about why they move over into the right lane early before exiting, a very common response was “I’m afraid of missing my exit.”

**Agreeableness.** The most unexpected effect found was the relationship between agreeableness and precrastination. It is unclear why this would be the case. It could be that expectancy effects played a role in participants’ decisions, with experimenters unwittingly communicating to participants that choosing the closer bucket was the “correct” response. It could also be that it is normative to get tasks accomplished as soon as possible. This would obviously be limited by how difficult or unpleasant the task is. Given that the effect was found in males and not females, and that the majority of experimenters was female, male participants may have wanted to impress the experimenters. However, males did not precrastinate to a greater extent as a whole. So, unless there is an interaction between agreeableness and gender of experimenter, it is unlikely that this is a viable hypothesis.

In real-world examples, agreeableness can be thought of as either positively or negatively related to precrastination. I asked participants to explain why they either precrastinate or do not precrastinate when exiting a freeway or boarding a plane. When giving reasons for moving over into the rightmost lane on a freeway early (i.e.,

precrastinating), many participants gave pro-social reasons: to avoid cutting other drivers off, to be more predictable, and to follow the rules learned in driving classes. However, the reasons participants gave for standing up early to board a plane (i.e., precrastinating) were entirely self-focused. Participants gave reasons such as fear of missing one's plane, impatience, and ensuring space for their luggage in overhead compartments. In a complete reversal of the freeway example, participants who said that they do *not* precrastinate when preparing to board a flight give prosocial examples, such as to be respectful, to follow rules, and to "make things easier" for the airline boarding crew. Agreeableness will likely have context-dependent relationships with various instances of precrastination and will not always be associated with precrastination in the same direction.

**Clumsiness.** Clumsiness was a variable added after data collection began. Clumsiness was appealing as an individual difference variable because there is inter-individual variation in movement that is not captured by any of the currently administered personality measures. This was important to assess because of the physical nature of the task. Interestingly, in our non-clinical sample of college-age adults, clumsiness was negatively related to precrastination. That is to say that if participants rated themselves as having coordination issues, they were less likely to pick up the first bucket. This may have been due to concerns about dropping stones out of the buckets (7.0-pound buckets were filled to the brim with rocks), although no rock ever spilled from the buckets. Participants who were clumsy may have wanted to avoid any extra physical burden that the weighted buckets would provide.

### **Is precrastination irrational?**

When beginning this project, I thought precrastination was irrational. However, after thinking about the topic for nearly three years and studying those who precrastinate, the picture is not so clear. The question of whether precrastination is irrational became an important one for me to explore. When generating examples of real-world precrastination, it is clear that there is a degree of inefficiency involved in doing something excessively early. How can I reconcile that precrastination seems to be inefficient, yet rational?

The inefficiency arising from precrastination decisions might be in service of a gain. There may be a tradeoff of some kind, where incurring a higher cost now could have a benefit later. For example, a person who stands up to board a plane early before their designated time may guarantee themselves overhead space for their carryon luggage, whereas others in his or her boarding group may have to check their bags at the gate. Patients who get to a doctor's appointment hours early may be spending their valuable time waiting in a doctor's office, but they are less likely to miss their appointment. And people who pay bills early are less likely to forget about paying them at all.

When thinking about precrastinating participants, it seems hard to imagine that those who chose to pick up a weighted bucket sooner rather than later are behaving rationally; that they are purposefully choosing to carry a heavy object for longer than necessary when they are unambiguously exerting more physical effort than needed. However, participants who choose the second bucket may be exerting more cognitive

effort in terms of saving physical effort. Rosenbaum and colleagues (2014) suggested that reducing cognitive load by completing tasks early could be a reason to precrastinate. This is supported by more recent work demonstrating an increased likelihood of precrastination when cognitive load is increased (Fournier et al., 2019; VonderHaar et al., 2019). Fournier and colleagues (2018) even suggested that simply beginning a task, rather than completing it, frees up cognitive resources. Following this reasoning – and in opposition to my original position – could it be argued that *not* precrastinating in certain situations is irrational?

### **Precrastination as a Rational Strategy**

This study does not provide support for the idea that precrastination is irrational. Precrastination was not related to procrastination (which is irrational by definition) or any of the many facets of impulsivity. It was also unrelated to intolerance of uncertainty, which includes items that relate to inhibiting behaviors necessary to overcome an obstacle. All evidence described in this body of work points to precrastination as a rational strategy that can be employed to quickly accomplish a goal, in spite of its associated costs.

Those who precrastinate (or do not) make deliberate decisions. They are thinking about their choices. When participants in this study were asked about why they precrastinated while boarding a plane, exiting a freeway, or picking up buckets, they were able to supply face-valid answers. Participants are not immune to information found in the environment, as participants had lower precrastination rates when choosing to precrastinate was paired with bending down (Rosenbaum & Sauerberger, 2019), when

target distances were increased (Rosenbaum et al., 2014), and when objects were more difficult to carry (Fournier et al., 2019). In the current study, participants aware of their physical limitations reduced their rate of precastination. All of these pieces of evidence point to precastination as a thoughtful strategy, rather than an automatic, impulsive behavior.

### **Limitations**

The greatest limitation of the current study is its design. Although I was able to isolate precastination in a controlled environment, the design is arguably not representative of real-world conditions. Participants have no personal investment in the tasks being assigned and this may be why I did not find an association between neuroticism and precastination. If we are to claim that precastination varies in quantity and quality by domain, it is hard to see how this design fits into one's day-to-day life.

### **Future Directions**

I would like to expand precastination research through further collaboration with cognitive psychologists, and to replicate the findings of the personality measures used here in regard to precastination. Another goal is to go beyond physical tasks, which are just one domain where precastination takes place. If precastination is about reducing cognitive load, then domains where cognitive load is higher (e.g., work or school) should also yield precastination behaviors. Anxiety-inducing situations should perhaps bring out the relationship between neuroticism and precastination. The association between agreeableness and precastination should also be explored. That relationship may be most prevalent when social norms are made salient.

### **Why does precrastination matter?**

Simply put, precrastination matters because precrastination exists. As a phenomenon it was only described in 2014, but trait precrastination is a motivation for behaviors that can be, at the same time, costly and productive. Studies of precrastination have been thus far restricted to cognitive psychological phenomena such as motor planning and cognitive load, but the implications of precrastination are wide-reaching. Finding a way to get people to complete tasks at optimal times could reduce wasted time and money, increase efficiency, or even save lives.

Precrastination may be a focus on preparing for future contingencies. To return to our prostate cancer example: a patient diagnosed with prostate cancer is given the choice of undergoing a radical prostatectomy (removal of the prostate and surrounding tissues). His doctor recommends an active surveillance approach (i.e., ongoing monitoring), tells the patient that he has no better chance of survival if the doctor intervenes now, and reads the patient a list of potential complications following surgery. The patient absorbs this information and decides to go ahead with surgery immediately. Why would the patient make that decision? Did he not understand the risks, or that the surgery was deemed potentially unnecessary? The patient could have been worried about a visit with that doctor in the future where he is told they caught the growth of the cancer too late.

A parallel could be drawn to findings on the phenomenon of end-state comfort. When grasping objects, people prefer beginning in an uncomfortable position (e.g., grasping an object thumb down) and ending in a comfortable position (e.g., grasping an object thumb up). This may be to allow for the hand to be in position to perform another

task after releasing the grasp on an object. This is analogous to removing things from a to-do list as quickly as possible – to prepare for an unseen future task. However, precrastinating in order to prepare for the future can be much more costly than a simple movement of the wrist. Precrastinators may perform a task early with the intent of leaving enough time to perform it, only to artificially shorten the deadline. Some emails need to be replied to quickly, but once an email is sent, it cannot be rescinded. Discovering the mechanisms behind precrastination will allow us to understand why precrastinators prepare for a future that may never come.



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## Appendices

### Appendix A: Experimenter Instructions for First Questionnaires

#### **Welcome script [Bold portions are notes for you]:**

“Welcome to the Moving and Memorizing study! Please take a seat on the couch, and I will tell you about what you will be doing today.”

#### **[Hand participant consent form]**

“Here is the consent form. Please read it and sign the last page if you agree to participate in the study. Please note that the consent form has information about memorization tasks. You are not in a condition that includes memorization, so you can ignore that part of the consent form.”

**[Let the participant read the consent form and sign it. Please check to see if the participant selected a preference for video and audio recording on page 2 of the consent form. If they did not check either “Yes” or “No”, please bring this to their attention and ask them to mark their preference. *Do not* pressure participants to consent to any form of recording – however, they must indicate their preference on the consent form.]**

“Now that you’re done with the consent form, I’m going to tell you a little about what you’ll be doing today. First, I’m going to give you some questionnaires on this computer that ask about you. There are no right or wrong answers, we’re just interested in learning about your personality. Next, you will be walking and picking up objects outside, in the area blocked off by caution tape that you probably saw when coming into the lab. Finally, you will be brought back into this room for a final questionnaire and debriefing. Do you have any questions?”

**[If a participant asks about the portion of the experiment that takes place outside, just tell them that the experimenter outside will explain it more when they go outside. It’s too hard to explain what’s going on without actually seeing it.]**

**[Get the participant started on the computer. Wait for them to let you know they’re done. Please avoid going on your phone too much – it makes participants feel like you’re not willing to answer their questions. Using a computer to keep yourself occupied will look more professional.]**

“Ok, now that you’re done with the questionnaires, I will take you outside to complete the next part of the study”

**[Walk the participant out to the outside RA. Give the outside RA the consent form so they can confirm the participant’s preferences for recording audio/video.]**

## Appendix B: Consent Form

### Informed Consent Form

University of California, Riverside

### Title of Project

Moving and Memorizing

### Principal Investigator

Professor David A. Rosenbaum

Department of Psychology

david.rosenbaum@ucr.edu

814-571-1891



### Purpose of Study

This study is designed to provide information about the way people compare the difficulty of different tasks with various physical (moving) and mental (memorizing) characteristics.

### Exclusion Criterion

The only exclusion criterion for participation in this study is an inability to understand English. Your participation is predicated on your being able to understand English.

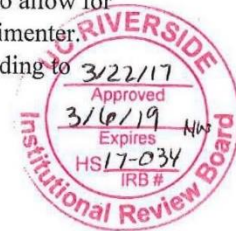
### Procedure

If you agree to take part in this study, you will be asked to fill out some short forms about your hand preferences and personal characteristics. Then you will be asked to participate in a series of tasks involving moving and memorizing. You will do these tasks here in the lab or outside the lab in a public space here on the UCR campus. If the study is done outside the lab in a public space, your behavior could be observed by passersby and if you would like to discontinue your participation for that reason, you can. You will be asked to stand at a specified location and then to walk forward, picking up one object or another depending on which you think will be easier to take to a destination on the other side of the room. The objects will occupy different positions in different trials and will also be associated with different memory demands. If you pick up and carry one object, you will be asked to memorize some number of items based on that object's color. If you pick up and carry the other object, you will be asked to memorize some other number of items based on the color of *that* object.

Once the study begins (after you have signed this form), you will be asked to fill out the forms. Then you will begin the main experiment. In the main experiment, you will first be given instructions about the specific response rules you should follow. No data

will be collected from you when you are being instructed. Only when you start performing the actual task will data be collected about your performance. Your performance will be video- and audio-taped if you consent to such recording. Your data (the choices you make and the number of items you get correct) will be recorded by hand by the experimenter otherwise. The only experimental data that will be collected from you will be your responses on the forms you fill out, your video- and/or audio-recorded performance on the move-and-memorize tasks if you agree to allow for either or both of these recordings, or the data recorded by hand by the experimenter. Please put a check mark on the line to the right of any item below corresponding to your wishes concerning video- and/or audio-recording.

Video recording: Yes \_\_\_ No \_\_\_  
Audio recording: Yes \_\_\_ No \_\_\_



After the experimental data have been collected, you will be asked to participate in a short debriefing period. Here you will be able to offer your comments on the experiment. Finally, you will be given a debriefing form which explain the background to and predictions for this study as well as the anticipated broader implications of the research. The entire study will take less than an hour. The only exclusion criterion is that you understand English.

#### **Compensation, Costs and Reimbursement**

You can participate for credit. Your decision to participate or not participate will not affect your relationship with UCR, or any other benefit to which they are entitled. If you decide to terminate your participation because of any discomfort you feel at being observed by passersby if this study is conducted in a public place, you will still receive credit.

#### **Risks**

There are no foreseeable risks.

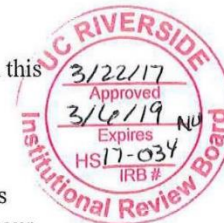
#### **Benefits**

The benefits of participating in the study are that you will gain first-hand exposure to methods of research in psychology as applied to the topic for which the research was designed. Also, knowledge gained from this research will benefit society in domains where moving and memorizing occur.

#### **Withdrawal or Termination from Study**

As stated above, you have the right to withdraw from this study. The experimenter will also have the right to withdraw you from the study if it is clear that you are not taking the basic task instructions seriously, that is, if you are not taking the time to consider

the choice options or to study the items to be memorized. If you withdraw from this study your data be deleted and will not be used.



**Confidentiality**

Your participation in this research is confidential. No one except the researchers involved in this project will have access to your data, which will be limited to your responses to the questionnaires and your performance on the main move and memorize tasks. The data will be used only for research purposes related to this specific project. The data will be stored on password-encrypted computers used for this research and will not have any information about your identity, except your participant number, which will be known only to the researchers who have been approved by the UC Riverside Office of Research Integrity for this particular study. The computers storing the data will be kept in a locked research room in this lab (419 Olmsted) at UC Riverside. The data will be destroyed when the study is completed. Others in positions of authority may potentially review and copy records related to this research, but only in connection with enforcement and reviews of the ethical conduct of the research: The Office of Human Research Protections of the U.S. Dept. of Health and Human Services; UCR's Institutional Review Board (IRB); and the UCR Office of Research Integrity. In the event of publication of this research, no personally identifying information about you will be disclosed.

**Further Notification**

In some instances, a representative of Office of Research Integrity (ORI) may review research-related records for quality assurance in order to ensure that relevant laws and guidelines are followed. All information accessed by ORI will be held to the same level of confidentiality that has been stated by the research team.

**Alternatives to Participation**

If you refuse to participate or withdraw from this study and would have participated in full for class-specific credit, the instructor for that class should be able to provide a reasonable alternative way for you to earn that credit. If your expected compensation for participation in the study is research credit via the UCR Psychology Department Subject Pool, an alternative to earning research credit will be to attend a research lecture, as described in the UCR introductory Psychology Research Participation Requirement.

**Contact Information**

If you have any study-related questions, please feel free to contact Professor David Rosenbaum at 814-571-1891 or at david.rosenbaum@ucr.edu. If you have any concerns, complaints, or questions regarding the study and/or your rights as a research subject, contact the IRB Chairperson at 951-827-4802 during business hours or via



email at irb@ucr.edu.

**Voluntary Participation**

Your participation is voluntary. As mentioned above, you are free to stop participating at any time. You can decline to perform any task you wish or to decline to answer any specific questions. Refusal to take part in or withdrawing from this study will not result in a penalty of any kind or loss of benefits you would otherwise receive. Your decision to participate or not is solely up to you.

**Signature**

If you agree to participate in this study of Moving and Memorizing, please sign below.

You must be at least 18 years of age to participate. You will receive a signed copy of this consent form.

\_\_\_\_\_  
Participant's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Person Obtaining Consent's Signature

\_\_\_\_\_  
Date



## Appendix C: Questionnaires Given Before Physical Experiment

University of California, Riverside  
Department of Psychology

---

Participant Number

---

### 1. Background information

---

Name

First

Last

---

Sex

---

Birthdate (mm/dd/yyyy)

---

Age

---

Email Address

---

May we contact you in the future using this email address?

---

Height (feet, inches)

Feet

Inches

---

Weight

---

Race/Ethnic Identity (Requested only to provide summary statistics to the agency that has provided grant support for this research, at their insistence)



## 2. Miscellaneous information

---

Do you have musical experience?

---

If you have musical experience, please specify what and how long:

---

Do you have athletic experience?

---

If you have athletic experience, please specify what and how long:

---

Do you have computer/video gaming experience?

---

If you have computer/video gaming experience, please specify what and how long:

>>

### 3. Handedness Questionnaire

---

Read each of the questions below. Decide which hand you use for each activity and then pick the answer that describes you the best. If you aren't sure, try acting it out to see which hand you are using.

	Left	Either	Right
With which hand do you normally write?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With which hand do you draw?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Which hand would you use to throw a ball to hit a target?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In which hand do you use your racquet for tennis, squash, etc.?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With which hand do you use your toothbrush?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Which hand holds a knife when you are cutting things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Which hand holds the hammer when you are driving a nail?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When you strike a match, which hand holds the match?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In which hand would you use an eraser on paper?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Which hand removes the top card when you are dealing from a deck?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In which hand would you hold a fly swatter?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



**Appendix D: Video Recording Warning Sign**

Experiment in Progress

Please be aware that your image might be captured on the video being recorded here (if a video camera is being used). Please avoid the camera and stay clear of the test area.

This is an experiment being conducted under the direction of Professor David Rosenbaum, Department of Psychology, with permission of the UCR Institutional Review Board (HS-17-034).

## Appendix E: Experimenter Instructions for Outside Portion

### **Outside script [Bold portions are notes for you]:**

“Hi! Please enter the research area.”

**[Remove the caution tape on one side to let the participant in. *Do not* make the participant crawl under the caution tape.]**

**[If the participant indicated that they are ok with video recording, turn on the camera now. Then, put the checklist paper in front of the camera for a second or two with the participant number clearly visible. If they do not want to be recorded, put the lens cap on the camera and let the participant know that you are doing so.]**

“As the experimenter in the lab said, you will be walking along this path and picking up the buckets you see in front of you. The buckets are filled with rocks, and each weighs 7 pounds. You will do this several times. Between each trial, I will rearrange the experimental area while you face in the opposite direction, in front of the tripod. When I say ‘Go’, you may turn around and begin walking. As you walk, you must pick up **one** bucket and place it on a stool at the end of the path. If you pick up the bucket on the left, you must pick it up with your left hand and put it on the stool on the left. If you pick up the bucket on the right, you must pick it up with your right hand and put it on the stool on the right. You may pick up whichever bucket seems easier to take to the end of the path. Can you please paraphrase the instructions back to me so I am sure that you understand the task?”

**[Ensure that the participant gets it. Clarify any confusion and answer any questions they may have. Step as far to the side as you can before beginning each trial and wait for the participant to return to the starting point before resetting the experiment. Once you have set up the next trial and are standing off to the side again, say “Go”.]**

**[Once all trials are complete.]**

“You are done with this part of the study, thank you for your participation! Please return to the experimenter in the lab to complete the study.”

## Appendix F: Example Data Collection Sheet

Participant #101

Name: \_\_\_\_\_

Audio            Yes            No  
Video            Yes            No

Date & Time: \_\_\_\_\_

Done	Trial	Left Bucket	Right Bucket	Participant chose bucket on the...	
_____	1	8	12	Left	Right
_____	2	8	4	Left	Right
_____	3	4	12	Left	Right
_____	4	12	8	Left	Right
_____	5	12	4	Left	Right
_____	6	4	8	Left	Right
_____	7	15	4	Left	Right
_____	8	4	15	Left	Right

RA Inside: \_\_\_\_\_

RA Outside: \_\_\_\_\_

Entered into computer (name, date, & time): \_\_\_\_\_

Comments (anything out of the ordinary):

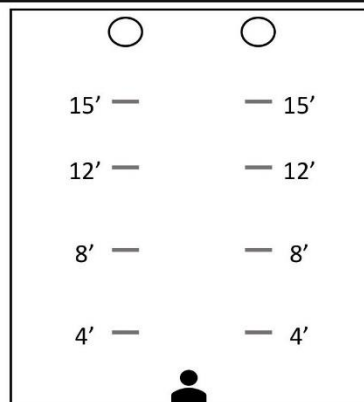
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## Appendix G: Experimenter Instructions for Last Questionnaires and Debriefing

### **Closing script [Bold portions are notes for you]:**

**[While the participant is outside, open the “After Experiment” questionnaire found in the “Participant Questions” folder on the desktop. Fill in the participant’s participant number, first name, and last name so they don’t have to do it again.]**

**[When the participant enters the room, tell them to have a seat.]**

“Now that you’ve finished the physical portion of the study, I will give you just one more questionnaire on the computer.”

**[Wait for the participant to finish.]**

“Thank you for your participation. I will now tell you a little bit about the purpose of our study.”

“The purpose of the study was to shed light on the way people judge the relative difficulty of physical tasks. The first task was picking up the weighted bucket, and the second was carrying it to the end of the path. The hypothesis, based on previous literature, was that people have a natural urge to complete the first task as soon as possible. We predicted that many participants would prefer picking up the closer bucket in order to get that task out of the way. Personality inventories were used to identify the individual-difference factors that might predispose participants to choose one bucket over the other.”

**[Hand participant debriefing form]**

“Here is the debriefing form, which contains the information I just told you. You may take it with you. Thank you again for your participation!”

**[The participant will either leave at this point or ask you questions before leaving. Answer their questions as best you can. If they are not satisfied with your answers or they have concerns, encourage them to contact myself or Dr. Rosenbaum. His contact information is on the debriefing form.]**

## Appendix H: Debriefing Form

### Moving and Memorizing Debriefing Form

Thank you for participating in this study. The purpose of the study was to shed light on the way people judge the relative difficulty of physical and mental tasks. Here the physical task was carrying. The mental task was memorizing. The overarching hypothesis was that there is some common currency for evaluating physical and mental task difficulty. This common currency, by hypothesis, makes it possible for people to show systematic preferences for some physical-and-mental tasks over others. For example, we expected most subjects to prefer a short walk with a light memory load compared to a long walk with a heavier memory load. On the other hand, some subjects might not have that preference. Personality inventories were used to identify the individual-difference factors that might predispose subjects to make one kind of choice or another. If you were in a version of the experiment in which there were two differently-colored buckets, the colors were used to see whether more attention-grabbing objects might lead some people to take those objects. If you were in a version of the experiment in which there were weighted buckets, the weights were used to see how people treat mental load and physical load.

Now that you have read this, we would welcome any further thoughts you might have. You are welcome to contact the primary researcher for this project, Professor David Rosenbaum, [david.rosenbaum@ucr.edu](mailto:david.rosenbaum@ucr.edu), 814-571-1891, or the research assistant who may have tested you instead.

We deeply appreciate your help. The data you have provided, which will always remain completely anonymous in all reports we prepare, will help us develop a better understanding of task difficulty. By having a better understanding of task difficulty, it will be possible to design real-world systems and instruct people in ways that will boost efficiency and reduce the chance of accidents or mistakes of other kinds.

If you are interested in receiving write-ups of this research, please email the primary investigator: Professor David Rosenbaum, [david.rosenbaum@ucr.edu](mailto:david.rosenbaum@ucr.edu), 814-571-1891.

If you have questions about your rights or complaints as a research subject, please contact the IRB Chairperson at (951) 827- 4802 during business hours, or contact them by email at [irb@ucr.edu](mailto:irb@ucr.edu).

Thank you again!

## **Appendix I: California Adult Q-set (Revised version presented below)**

1. Is critical, skeptical, not easily impressed.
2. Is dependable and responsible (low placement implies undependable and irresponsible).
3. Has a wide range of interests (regardless of how deep or superficial the interests are).
4. Is a talkative person.
5. Is giving, generous toward others (regardless of the motivation).
6. Is fastidious, meticulous, careful and precise.
7. Favors conservative values in a variety of areas; emphasizes traditional values and beliefs (low placement implies rejection of traditional values).
8. Appears to have a high degree of intellectual capacity (whether or not this capacity translates into actual accomplishments).
9. \*Is uncomfortable with uncertainty and complexity.
10. \*Develops physical symptoms in reaction to stress and anxiety (e.g., sweating, racing heart, headaches, stomach aches, rashes, asthma, etc.).
11. \*Is protective of those close to him/her (high placement implies overprotective; medium placement implies appropriate caring; low placement implies lack of concern).
12. Tends to be self-defensive; unable to acknowledge personal shortcomings or failures; quick to defend self from criticism
13. \*Takes offense easily; is sensitive to anything that can be construed as a criticism or insult.
14. Genuinely submissive; accepts domination comfortably; gives in easily.
15. Is skilled in social techniques of imaginative play, pretending and humor.
16. \*Is introspective; thinks about self; examines own thoughts and feelings (does not necessarily imply that the person understands himself/herself well).
17. Behaves in a sympathetic and considerate manner (low placement implies unsympathetic and inconsiderate behavior).
18. Initiates humor; makes spontaneous funny remarks.
19. Seeks reassurance from others (high placement implies lack of self-confidence).
20. \*Behaves and acts quickly.
21. Arouses nurturant feelings in others; behaves in ways that lead others to feel caring and protective toward him/her.
22. Feels a lack of meaning in life.
23. Tends to blame others for own mistakes, failures, and shortcomings.
24. \*Prides self on being rational, logical and objective (high placement implies a person who is more comfortable with intellectual concepts than with feelings; low placement implies a person who is irrational and overly emotional).
25. \*Has excessive self-control; postpones pleasures unnecessarily.
26. Is productive; gets things done.
27. \*Is condescending toward others; acts superior to others.

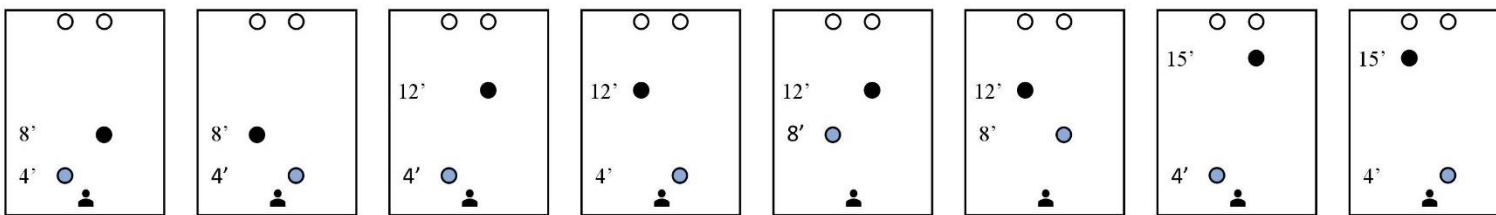
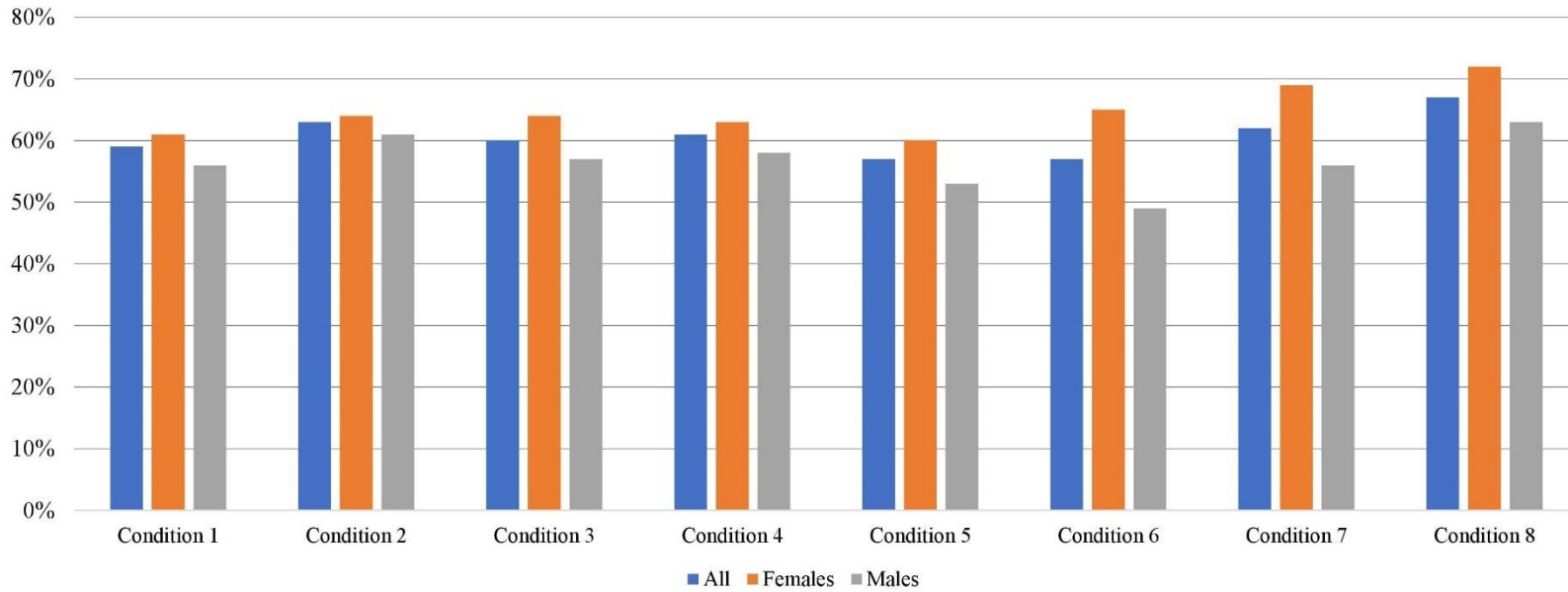
28. Tends to arouse liking and acceptance in people (low placement implies a tendency to arouse dislike and rejection).
29. Is turned to or sought out for advice and reassurance.
30. Gives up and withdraws when possible in the face of frustration and adversity (high placement implies person gives up easily; low placement implies person does not know when, realistically, it is time to give up).
31. \*Regards self as physically attractive (this item refers to how person sees himself/herself, whether accurate or not).
32. Seems to be aware of the impression he/she makes on others (low placement implies person is unaware of the impression he/she makes).
33. Is calm, relaxed in manner.
34. Is irritable; overreacts to minor frustrations.
35. Has warmth; has the capacity for close relationships; compassionate.
36. \*Tends to undermine, obstruct, or sabotage other people.
37. Is guileful, deceitful, manipulative, opportunistic; takes advantage of others.
38. \*Has hostility toward others (whether or not the hostile feelings are actually expressed).
39. \*Thinks about ideas in unusual ways; has unconventional thought processes.
40. Is generally fearful; is vulnerable to real or imagined threat.
41. Makes moral judgments; judges self and others in terms of right and wrong (regardless of the nature of the moral code, whether traditional or liberal; high placement implies being moralistic and self-righteous; low placement implies an unwillingness to make value judgments).
42. Reluctant to commit self to any definite course of action; tends to delay or avoid making decisions or taking action.
43. \*Has large or vivid facial expressions or gestures.
44. \*Evaluates the motives of others; tries to figure out the intentions underlying people's actions (accuracy is not assumed).
45. \*Is psychologically frail, vulnerable; has poor ability to cope with stress.
46. \*Tends to fantasize and daydream.
47. Has a readiness to feel guilty (high placement implies a tendency to feel guilt even when he/she is not at fault).
48. Keeps people at a distance; avoids close relationships.
49. Is basically distrustful of people in general; questions their motivations.
50. \*Is unpredictable and changeable in attitudes and behavior.
51. Places high value on intellectual and cognitive matters (does not necessarily imply high intellectual achievement or intellectual ability).
52. Behaves in an assertive fashion; not afraid to express opinions; speaks up to get what he/she wants.
53. \*Is impulsive; has little self-control; unable to postpone pleasure.
54. Is sociable, gregarious; emphasizes being with others.
55. Is self-defeating; acts in ways that frustrate, hurt, or undermine own chances to get what he/she wants.
56. Responds to and appreciates humor.

57. Is an interesting, colorful person.
58. Appears to enjoy sensuous experiences (e.g., touch, taste, smell, bodily contact).
59. \*Is concerned about own body, its health and adequacy of functioning (high placement implies excessive concern or hypochondriasis).
60. Has insight into and understands own needs, motives and behavior; knows self well (low placement implies little insight into own motives and behavior).
61. \*Likes others to be dependent on him/her; likes to be thought needed by others (low placement implies encouraging others to be independent of him/her).
62. Tends to be rebellious and nonconforming.
63. \*Is influenced by social pressures (e.g., "popularity," conventional social norms).
64. \*Is socially perceptive; is alert to cues from other people that reveal what they are thinking and feeling.
65. \*Resists limits and rules; sees what he/she can get away with.
66. \*Enjoys aesthetic impressions; is aesthetically sensitive (appreciates art, music, drama, etc.).
67. \*Is self-indulgent; tends to pamper himself or herself.
68. Is basically anxious.
69. Is sensitive to anything that can be construed as a demand or request for favors; is quick to feel imposed on.
70. Behaves ethically; has a personal value system and is faithful to it.
71. \*Is ambitious; sets high personal goals.
72. \*Has doubts about own adequacy as a person; appears to have feelings of inadequacy.
73. \*Tends to see sexual overtones in many situations (high placement implies reading sexual meanings into situations in which none exist; low placement implies inability to recognize sexual signals).
74. \*Feels satisfied with self; is unaware of self-concern.
75. \*Is easy to understand and describe (low placement implies someone who is difficult to understand and describe).
76. \*Imagines that the needs, wishes and feelings of others are the same as his/her own; tends to project own feelings and motivations onto others.
77. Appears straightforward, candid, frank in dealing with others.
78. Feels cheated and victimized by life; self-pitying; feels sorry for self.
79. Tends to ruminate and have persistent, preoccupying thoughts.
80. \*Is sexually interested in others (whether of the opposite sex or same sex; low placement implies an absence of sexual interest).
81. \*Is physically attractive; is good looking (as defined by the relevant culture).
82. Has fluctuating moods; moods go up and down.
83. Able to see to the heart of important problems; does not get caught up or sidetracked by irrelevant details.
84. Is cheerful, happy (low placement implies depression).
85. Tends to communicate through actions, deeds, and non-verbal behavior, rather than through words.

86. Denies the presence of anxiety and conflicts; tends to convince himself/herself that unpleasant thoughts and feelings do not exist; deceives self into thinking everything is fine, when everything is not fine.
87. Tends to interpret clear-cut, simple situations in complicated ways.
88. Is personally charming.
89. Compares self with others; is alert to real or imagined differences between self and others in status, appearance, achievement, abilities, and so forth.
90. Is concerned with philosophical problems, for example, religions, values, free will, the meaning of life, and so forth.
91. \*Values power in self and others.
92. Has social poise and presence; appears socially at ease.
93. If person is male, rate 93a; if person is female, rate 93b... The cultural definition of masculinity and femininity are intended here.
  - (a) Behaves in a masculine style or manner
  - (b) Behaves in a feminine style or manner
94. \*Expresses hostility and angry feelings directly (low placement implies someone who is unable to express hostility, who holds angry feelings in).
95. \*Gives advice; concerns self with the business of others.
96. Values own independence and autonomy; emphasizes his/her freedom to think and act without interference or help from others.
97. \*Is an unemotional person; tends not to experience strong emotions (low placement implies a highly emotional person).
98. Is verbally fluent; can express ideas well in words.
99. \*Is self-dramatizing; theatrical; prone to exaggerate feelings; seeks attention.
100. \*Relates to everyone in the same way (low placement implies a person who acts differently with different people).

## Appendix J: Precrastination Choices by Condition

Precrastination Choices by Condition



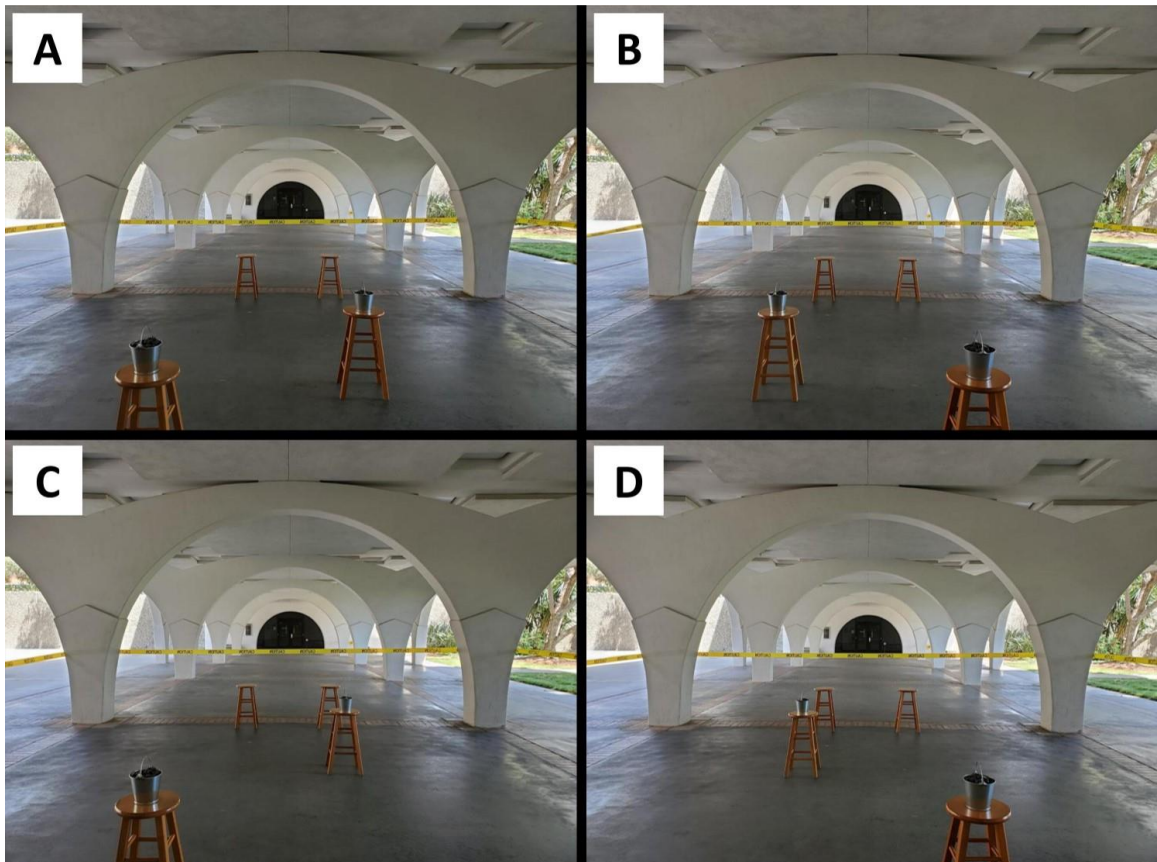
## Appendix K: Trial Example



Note: Condition 8 is depicted in these images. The individual in the images gave permission for her face to be shown. Cell A: Research area setup without an experimenter or participant. Cell B: Picking up a bucket, from the perspective of the camera. Cell C: Walking while holding a bucket. Cell D: Placing a bucket on a target stool.

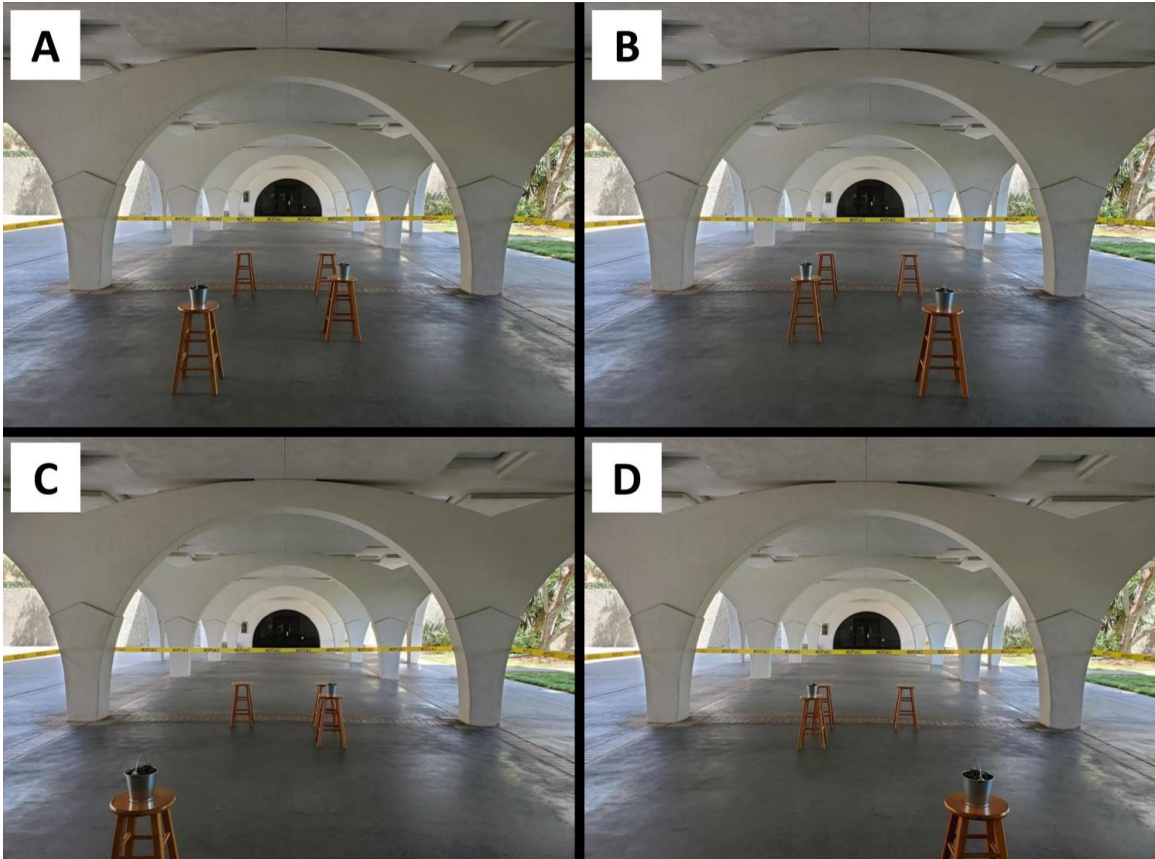


**Appendix L: Conditions 1-4**



Note: Cell A: Condition 1 (L: 4', R: 8'). Cell B: Condition 2 (8',4'). Cell C: Condition 3 (4',12'). Cell D: Condition 4 (12',4').

**Appendix M: Conditions 5-8**



Note: Cell A: Condition 5 (L: 8', R: 12'). Cell B: Condition 6 (12', 8'). Cell C: Condition 7 (4', 15'). Cell D: Condition 8 (15', 4').