View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by ScholarlyCommons@Penn

University of Pennsylvania
ScholarlyCommons

Publicly Accessible Penn Dissertations

1-1-2012

Resisting Everything Except Temptation: Evidence and an Explanation for Domain-Specific Impulsivity

Eli Tsukayama
University of Pennsylvania, elit.upenn@gmail.com

Follow this and additional works at: http://repository.upenn.edu/edissertations

Part of the Psychology Commons

Recommended Citation
Tsukayama, Eli, "Resisting Everything Except Temptation: Evidence and an Explanation for Domain-Specific Impulsivity" (2012). *Publicly Accessible Penn Dissertations*. 590.
http://repository.upenn.edu/edissertations/590

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/edissertations/590
For more information, please contact libraryrepository@pobox.upenn.edu.

Resisting Everything Except Temptation: Evidence and an Explanation for Domain-Specific Impulsivity

Abstract
Why do people act self-controlled in some situations but not others? More specifically, why does it appear that an individual can be self-controlled in one domain (e.g., work) but impulsive in another (e.g., food)? This investigation tests a model that incorporates and explains both domain-specific and domain-general differences in impulsive behavior. Specifically, the model predicts that within-individual variation across domains is explained by subjective domain-specific appraisals of temptation and perceived harm, whereas domain-general impulsivity is explained by domain-general self-control strategies (e.g., pre-commitment) and resources (e.g., working memory). In Chapter 1, four studies test this model in adults. Studies 1 and 2 present the development and validation of a self-report questionnaire assessing impulsive behavior in six domains: work, interpersonal relationships, drugs, food, exercise, and finances. In Study 3, domain-specific appraisals of temptation and perceived harm are shown to explain within-individual variance in impulsive behavior, whereas domain-general self-control explains variance in domain-general impulsive behavior between individuals. Study 4 confirms that individuals in special interest groups (e.g., procrastinators) who are especially tempted in the target domain (e.g., work) are not likely to be more tempted in unrelated domains (e.g., food). Chapter 2 explores domain-specificity through the temporal discounting paradigm. Whereas self-report measures of impulsivity are sensitive to social desirability biases, choices in temporal discounting (sooner-smaller vs. later-larger rewards) are not as transparent. As predicted, temporal discounting is domain-specific, and domain-specificity in temptation partially explains domain-specificity in temporal discounting. Chapter 3 presents the development and validation of a domain-specific measure for children, motivated by the idea that some of the domains relevant for adults may not be relevant for children given that the average child presumably is either not attracted to certain temptations, does not perceive them as harmful, or does not frequently encounter them. For children, interpersonal and schoolwork impulsivity are shown to be correlated but distinct behavioral tendencies, demonstrating differentiated relationships with dimensions of childhood temperament, Big Five personality factors, and school outcomes. Collectively, these findings highlight the utility of a domain-specific approach, namely in terms of understanding psychological processes, improved prediction, and targeted interventions.

Degree Type
Dissertation

Degree Name
Doctor of Philosophy (PhD)

Graduate Group
Psychology

First Advisor
Angela L. Duckworth

This dissertation is available at ScholarlyCommons: http://repository.upenn.edu/edissertations/590

Keywords
domain-specific, domain-specificity, impulsivity, self-control, temptation

Subject Categories
Psychology

This dissertation is available at ScholarlyCommons: http://repository.upenn.edu/edissertations/590

RESISTING EVERYTHING EXCEPT TEMPTATION:

EVIDENCE AND AN EXPLANATION FOR DOMAIN-SPECIFIC IMPULSIVITY

Eli Tsukayama

A DISSERTATION

in

Psychology

Presented to the Faculties of the University of Pennsylvania in

Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

2012

Supervisor of Dissertation

_____

Angela Lee Duckworth, Ph.D.
Assistant Professor, Psychology

Graduate Group Chairperson

_____

John Trueswell, Ph.D.
Professor, Psychology

Dissertation Committee

Joseph W. Kable, Ph.D.
Assistant Professor, Psychology

Paul Rozin, Ph.D.
Professor, Psychology

Henry May, Ph.D.
Adjunct Assistant Professor, Education

Acknowledgments

Chris Peterson summarized positive psychology in three words: “Other people matter.” When you have so many “other people” who you are grateful to and for, it is more difficult to write a succinct acknowledgment without being perfunctory or clichéd than it is to write a dissertation. Unfortunately, the acknowledgments have to be shorter than the actual dissertation, so I will not be able to pay the respect, detail, and attention that each person deserves. Nonetheless, to quote Funder’s Third Law, “Something beats nothing, two times out of three.”

While it is not an exaggeration in a causal sense to state that many people were responsible for this dissertation, it is also not an exaggeration to say that the sine qua non and person I am most indebted to is my mentor, Angela Lee Duckworth. Given two amazing opportunities for graduate school, I vacillated for months up to the deadline before finally deciding to work with Angela. I never regretted that decision. Her wise counsel, appropriate feedback, and genuine concern for my well-being—both objective and subjective—were just what I needed to excel. I could not ask for a better mentor. In the future, when Angela is even more world renowned, I will take great pride in being able to say that I was her first graduate student.

I would also like to thank my dissertation committee for guiding my development as an academic. Joe Kable is generous in every sense of the word, and I hope I am as down to earth if or when I become an accomplished professor. Anybody who is familiar with Paul Rozin knows that it is not hyperbole to say that he is one of the nicest people in the world. Being one of the most ingenious psychologists of our time is just icing on the cake. Although Henry May graciously agreed to serve on my committee in an official capacity relatively recently, he has been a perennial source of guidance and support over the last four years. I am not joking when I say I want to be like Henry May when I grow up. It has been an honor working with all of you.

I owe an incalculable debt to my first academic mentors—Drs. Larry Fujinaka and Leslie-Ann Munro at Leeward Community College and Ashley Maynard, Karl Minke, Elaine

Hatfield, and Edward Chronicle at the University of Hawaii. I wouldn't have made it this far without you. I also thank Jonathan Baron, Ann-Renée Blais, Martha Farah, Jay Fournier, Robert Gallop, Leonard Green, Christopher Peterson, Patrick Quinn, Howard Rachlin, Marc Schulz, and Elke Weber for their helpful feedback in conducting this investigation.

To my colleagues from the Positive Psychology Center (where I spent most of my waking hours), thanks for the good times both in and outside of the lab. Betty Kim, Teri Kirby, Rachel Abenavoli, Eric Kim, Derek Freres, Liz Van Leer, Kate Von Culin, Kelly Allred, Caroline Haimm, Madison Silverstein, Katie Eichner, William Hopkins, Peter Schulman, Linda Newsted, and Lauren Eskreis-Winkler, I appreciate all of your help with any and everything as well as (if applicable) our scintillating lunch conversations. Special thanks to my academic cousins—Acacia Parks, Eranda Jayawickreme, Marie Forgeard, Pam Stokes, Annie Roepke, Alejandro Adler, Johannes Eichstaedt, and Peggy Kern—for always being there whenever I had questions or needed advice on anything. I'd like to thank Stephen Scheuller in particular for being a shining example of positive psychology in practice. Finally, thanks to Marty Seligman, James Pawelski, Gordon Bermant, and Barry Schwartz for challenging me intellectually and helping me to think outside the box.

To my fellow graduate students in the psychology department, grad school wouldn't have been as fun without you. Julian Lim, in particular, thank you for being the nice older brother I never had. Kinjal Doshi, Alyson Zalta, Jared Minkel, Thomas Lee, Ewa Szymanska, Hilary Dingfelder, Grace Freed-Brown, Daniel Hackman, Christian Webb, Andrea Glenn, Pavel Atanasov, Laura Sockol, Emily Gentes, Noah Snyder-Mackler, Nicholas Hindy, Marc Coutanche, Lauren Hallion, Dahlia Mukherjee, Anna Rudo-Hutt, Justus Myers, who knew that graduate school could be so much fun if you're with the right people?

The Penn Hawaii Club, my ohana away from home. Cory Wong, Richard Chiang, Brandon Cheong, Allie Galati, Joel Kuhn, Zoë Dare-Attanasio, Christine Loui, Janie Shin, Brittni Luke, Aaron Hoo, Alycia Hatashima, Ryan Nakesone, Marisa Wang, Marisa Schoen, Alex Paer,

Lake Casco, Diana Lu, Emily Kuo, Christi Economy, Kenji Tulman, Eric Wong, Jasmine Pang, Reid Oshiro, Kelsey Ige, and Keola Yee, hope to see all of you back in Hawaii when we're old and grey!

To my friends from Hawaii who helped shaped who I am today, Steven Boun, Amy Ching, Lisa Ching, Daniel Chun, RJ, Chun, Malia Tungol, Kristin Misaki, Tina Hunt, Terisa Lee, DJ Danner, Cheryl Danner, Justin Takaki, Dawn Nakagawa, Stephanie Ho, Mark DeBlois, Ed Lam, Rena Leong, Bradlee Sako, John Cheng, Janice Quach, Kayla Sakimoto, Iris Teruya, Jillian Haraguchi, Tyler Tamashiro, Krystle Salazar, Grace Kwan, Jason Nagaoka, Jacklyn Palola, Carlo Barbasa, Reyn Matsumoto, Justin Matsumoto, Junho "Cyrus" Kwon, Corey-Jo Tashima, Davin Tashima, Erika Tsutsui, Joy Tsutsui, Rayna Isaki, Sherrill Watanabe, Jeff Laupola, Justin Laupola, J, and Tabitha Carreira, aloha nui loa!

Last, but definitely not least, thanks to my family, especially mom and dad. Mom, thank you for sacrificing a career to homeschool us. I also think it's ironic that you tried to push me to work harder (or at all) when I was young, and now you have to encourage me to work less. Dad, thanks for instilling a love of learning. Ty, thank you for teaching me humility and compassion, and Dane, Jessi, and Kelly, thanks for teaching me patience. Thanks also to Grandma Ellen and Grandma Peggy, Grandpa Shigeru and Grandpa Shigeru, Aunty Linda, Uncle Mike and Aunty Darlene, Aunty Cynthia and Uncle Bobby, Aunty Robin, Uncle Rey, Leanne and Corey, David, Teri, Carl and Laurie, and Christine and David.

The research reported here was supported by the John Templeton Foundation, Grant K01-AG033182 from the National Institute on Aging, and Grant R305B090015 from the Institute of Education Sciences, U.S. Department of Education. The opinions expressed are those of the authors and do not represent views of the U.S. Department of Education.

Finally, thank you (and my deepest apologies) to anybody I may have inadvertently forgotten. Mahalo nui loa!

Abstract

Resisting Everything Except Temptation:

Evidence and an Explanation for Domain-Specific Impulsivity

Eli Tsukayama

Advisor: Angela Lee Duckworth

Why do people act self-controlled in some situations but not others? More specifically, why does it appear that an individual can be self-controlled in one domain (e.g., work) but impulsive in another (e.g., food)? This investigation tests a model that incorporates and explains both domain-specific and domain-general differences in impulsive behavior. Specifically, the model predicts that within-individual variation across domains is explained by subjective domain-specific appraisals of temptation and perceived harm, whereas domain-general impulsivity is explained by domain-general self-control strategies (e.g., pre-commitment) and resources (e.g., working memory). In Chapter 1, four studies test this model in adults. Studies 1 and 2 present the development and validation of a self-report questionnaire assessing impulsive behavior in six domains: work, interpersonal relationships, drugs, food, exercise, and finances. In Study 3, domain-specific appraisals of temptation and perceived harm are shown to explain within-individual variance in impulsive behavior, whereas domain-general self-control explains variance in domain-general impulsive behavior between individuals. Study 4 confirms that individuals in special interest groups (e.g., procrastinators) who are especially tempted in the target domain (e.g., work) are not likely to be more tempted in unrelated domains (e.g., food). Chapter 2 explores domain-specificity through the temporal

discounting paradigm. Whereas self-report measures of impulsivity are sensitive to social desirability biases, choices in temporal discounting (sooner-smaller vs. later-larger rewards) are not as transparent. As predicted, temporal discounting is domain-specific, and domain-specificity in temptation partially explains domain-specificity in temporal discounting. Chapter 3 presents the development and validation of a domain-specific measure for children, motivated by the idea that some of the domains relevant for adults may not be relevant for children given that the average child presumably is either not attracted to certain temptations, does not perceive them as harmful, or does not frequently encounter them. For children, interpersonal and schoolwork impulsivity are shown to be correlated but distinct behavioral tendencies, demonstrating differentiated relationships with dimensions of childhood temperament, Big Five personality factors, and school outcomes. Collectively, these findings highlight the utility of a domain-specific approach, namely in terms of understanding psychological processes, improved prediction, and targeted interventions.

Table of Contents

Acknowledgments ii

Abstract v

Table of Contents vii

List of Tables viii

List of Figures ix

Chapter 1: Resisting Everything Except Temptation: Evidence and an Explanation for Domain-Specific Impulsivity 1

Chapter 2: Domain-Specific Temporal Discounting and Temptation 65

Chapter 3: Domain-Specific Impulsivity in School-Age Children 92

List of Tables

Chapter 1

Table 1 *Factor Loadings, Subscale Corrected Item-Total Correlations, and Subscale Alphas for Six-Factor Solution with Orthogonal Varimax Rotation for the Domain-Specific Impulsivity Scale in Study 1a* 48

Table 2 *DSIS Subscale and Self-Control Scale Means, Standard Deviations, and Intercorrelations in Study 1a* 51

Table 3 *Factor Loadings, Subscale Corrected Item-Total Correlations, and Subscale Alphas for Confirmatory Six-Factor Model of the Domain-Specific Impulsivity Scale in Study 1b* 52

Table 4 *DSIS Subscale and Self-Control Scale Means, Standard Deviations, and Intercorrelations in Study 1b* 56

Table 5 *Mean, Standard Deviations, and Intercorrelations for the DSIS-B and Self-Control Scale, DSIS-T, and DSIS-H in Study 2* 57

Table 6 Summary of Hierarchical Linear Models Predicting Domain-Specific Impulsive Behavior in Study 2 59

Table 7 *Group Means on the DSIS-T Subscales in Study 3* 60

Table 8 *Group Differences in DSIS-T Subscales in Study 3* 61

Chapter 2

Table 1 *Means, standard deviations, and Spearman rho correlations for candy, chips, beer, and money discount rates using listwise deletion* 77

Chapter 3

Table 1 *Exploratory Factor Analysis Loadings and Internal Reliability Estimates for Student-, Teacher-, Parent-Report Items in Studies 1 and 2* 126

Table 2 *Two-Factor Confirmatory Factor Analysis Results for Student-, Teacher-, and Parent-Report Models in Study* 127

Table 3 *Domain-Specific Associations Between Interpersonal and Schoolwork Impulsivity and Temperament, Personality, and Other Outcomes* 128

Table 4 *Cross-Tabulation of Students into High, Medium, and Low Schoolwork and Interpersonal Impulsivity Groupings* 129

List of Figures

Chapter 1

Figure 1. Illustration of model that explains between-individual (1a) and within-individual (1b) variance in impulsive behavior. 63

Figure 2. Mean Temptation by domain and subgroups. Error bars represent standard errors. 64

Chapter 2

Figure 1. Illustration of the Area Under the Curve. The maximum reward and the maximum delay were set to one. We then converted the indifference points to proportions of the maximum reward, and the delays to proportions of the maximum delay..... 75

Figure 2. Temporal discounting functions for money, candy, chips, and beer using mean indifference points. Subjective value was computed as the proportion of the amount of the delayed reward. Standard errors ranged from .01 to .02. Error bars are not presented because they were barely visible. 78

Figure 3. Mean discount rate as a function of ratings on the corresponding temptation item. Error bars represent the standard error of the mean..... 79

Figure 4. Mean discount rate as a function of reward type (candy or beer) and group (candylovers or beerlovers). Error bars represent the standard error of the mean.81

Figure 5. Mean discount rate as a function of reward type (chips or beer) and group (chiplovers or beerlovers). Error bars represent the standard error of the mean. . 82

Chapter 3

Figure 1. Confirmatory Two-Factor Model for Domain-Specific Impulsivity Scale for Children (DISC)..... 130

Chapter 1: Resisting Everything Except Temptation: Evidence and an Explanation for Domain-Specific Impulsivity

This chapter originally appeared as Tsukayama, E., Duckworth, A. L., & Kim, B. E. (in press). Resisting everything except temptation: Evidence and an explanation for domain-specific impulsivity. *European Journal of Personality*. Copyright permissions have been granted by John Wiley and Sons.

Abstract

We propose a model of impulsivity that predicts both domain-general and domain-specific variance in behaviors that produce short-term gratification at the expense of long-term goals and standards. Specifically, we posit that domain-general impulsivity is explained by domain-general self-control strategies and resources, whereas domain-specific impulsivity is explained by how tempting individuals find various impulsive behaviors, and to a lesser extent, in perceptions of their long-term harm. Using a novel self-report measure, factor analyses produced six (non-exhaustive) domains of impulsive behavior (Studies 1-2): work, interpersonal relationships, drugs, food, exercise, and finances. Domain-general self-control explained 40% of the variance in domain-general impulsive behavior between individuals, r_{effect} = .71. Domain-specific temptation (r_{effect} = .83) and perceived harm (r_{effect} = -.26) explained 40% and 2% of the unique within-individual variance in impulsive behavior, respectively (59% together). In a third study, we recruited individuals in special interest groups (e.g., procrastinators) to confirm that individuals who are especially tempted by behaviors in their target domain are not likely to be more tempted in non-target domains.

Resisting Everything Except Temptation:
Evidence and An Explanation for Domain-Specific Impulsivity

"I can resist everything except temptation."
–Oscar Wilde (1893)

"All men are tempted. There is no man that lives that can't be broken down, provided it is the right temptation, put in the right spot."
–Henry Ward Beecher (1887)

On December 11, 2009, Tiger Woods (2009) confessed publicly that he had been unfaithful to his wife and announced "an indefinite break from professional golf" (¶ 3). Just over two months later, after 15 different women alleged having had an affair with him (Mueller, 2009), Woods (2010) made a second public statement, in which he acknowledged that infidelity went against his "core values" and that he had known at the time his actions were wrong (¶ 11). Still, he could not resist "all the temptations" around him (¶ 11). The news was particularly sensational given Wood's "squeaky clean image" (Araton, 2010, ¶ 1), which personified "almost fanatical self-control" (Tanenhaus, 2009, ¶ 11). As Surowiecki (2009) notes, "Woods's appeal was based, ultimately, not on his physical abilities but on his mental toughness, his extraordinary capacity for focus and discipline" (¶ 3). Known as "the exemplar of mental discipline" (Brooks, 2008, ¶ 3), Woods demonstrated remarkable self-control in many domains of life. By all accounts, Woods had an incredible work ethic that enabled him to maintain a grueling physical training regimen. In public, he was always poised and in control of his emotions. He did not smoke, do drugs, or drink heavily. Thus, it seems that Tiger Woods epitomized self-control in many arenas. Yet, he was impulsive when it came to extramarital sex.

How do we explain Tiger Woods? Is he a paragon of self-control—"the capacity for altering one's own responses, especially to bring them into line with standards such as

ideals, values, morals, and social expectations" (Baumeister, Vohs, & Tice, 2007, p. 351)—or the epitome of impulsivity?[1] Or, is this the wrong question to ask—is impulsive behavior so dependent upon situational factors that it makes no sense to think about impulsivity in domain-general terms? The current investigation addresses these questions. We propose and test a model that explains both domain-general and domain-specific variance in impulsive behavior. Our approach was as follows: First, we used factor analyses to identify (Study 1a) and confirm (Study 1b) distinct domains of impulsive behavior. Then, we tested whether between-individual domain-general impulsivity could be explained by domain-general self-control, and whether within-individual variation in impulsivity across domains could be explained by corresponding differences in the subjective temptation and perceived harm of these behaviors (Study 2). Finally, we recruited individuals in special interest groups (e.g., procrastinators, impulse shoppers) from a social networking website to confirm that temptation is domain-specific (Study 3).

Domain-General and Domain-Specific Aspects of Personality

It is now generally recognized that behavior is both domain-general and domain-specific (Epstein & O'Brien, 1985),[2] and we do not claim that either domain-general or domain-specific processes are "stronger" than the other in this paper. Nonetheless, some historical context on the general versus specific debate would frame our investigation.

Whether situational factors or domain-general personality traits hold the upper hand in determining behavior has been fiercely debated since Walter Mischel's (1968)

[1] The terms *impulsivity* and *self-control* are used differently by different authors (Duckworth & Kern, 2011). Our definition of impulsivity emphasizes the failure to bring one's behavior in line with ideals, values, morals, and social expectations.

[2] By domain general, we mean that behavior (that reflects a trait) in one situation tends to be correlated with similar behavior across different situations. For instance, impulsive behavior in one domain is predicted to correlate with impulsive behavior in other domains.

controversial monograph, *Personality and Assessment*. Reviewing the extant literature on domain-generality in personality, Mischel (1968) concluded, “Although behavior patterns often may be stable, they usually are not highly generalized across situations” (p. 282). Some psychologists, notably those in the social psychology tradition, have since questioned the utility of domain-general personality traits. Ross and Nisbett (1991), for instance, suggested, “Manipulations of the social situation can overwhelm in importance the type of individual differences in personal traits or dispositions that people normally think of as being determinative of social behavior” (p. xiv).

Three sources of empirical evidence argue convincingly against an extreme situationist explanation for impulsive behavior. First, Baumeister and colleagues have shown in laboratory studies that factors determining self-controlled behavior are, at least to some extent, domain-general (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, et al., 2007; Muraven & Baumeister, 2000). In a typical experiment, exerting self-control in one domain is shown to impair subsequent attempts to exercise self-control in other domains. For instance, suppressing emotions diminishes physical stamina, suppressing an unwanted thought decreases the ability to suppress emotions, and refraining from eating warm chocolate chip cookies reduces persistence in working on problem-solving tasks (Baumeister, et al., 1998; Muraven, Tice, & Baumeister, 1998).

Second, personality psychologists who study impulsivity have succeeded in predicting theoretically relevant and objectively measured life outcomes using domain-general personality questionnaire items such as “I am self-disciplined.” For example, in prospective, longitudinal studies in which socioeconomic background and general intelligence were controlled, domain-general questionnaire measures of impulsivity in

childhood have been shown to predict decreases in report card grades (Duckworth, Tsukayama, & May, 2010), unhealthy weight gain (Duckworth, Tsukayama, & Geier, 2010; Tsukayama, Toomey, Faith, & Duckworth, 2010), and informant ratings of substance abuse and government records of criminal convictions (Moffitt et al., 2011).

Finally, Mischel himself has shown in a series of experiments that self-control in young children is facilitated by domain-general metacognitive strategies (Mischel & Mendoza-Denton, 2003). For example, in the preschool delay of gratification task, children cued to dwell on the "cool" features of rewards (e.g., "If you want to, when you want to, you can think about how the marshmallows look like white puffy clouds") were able to wait twice as long as children cued to dwell on their consummatory, "hot" features (e.g., "If you want to, when you want to, you can think about how sweet and chewy the marshmallows taste") (Mischel & Baker, 1975). The same psychological distancing strategy has been shown to facilitate self-control in other domains, including emotion regulation (Kross & Ayduk, 2008; Kross, Ayduk, & Mischel, 2005; Kross, Duckworth, Ayduk, Tsukayama, & Mischel, in press; Ochsner & Gross, 2004). Strategies that reduce the hedonic pull of temptations—for example by manipulating their salience or representation—should in theory be deployable in any domain (see Carlson & Beck, in press; Fujita & Han, 2009; Fujita, Henderson, Eng, Trope, & Liberman, 2006; Fujita, Trope, Liberman, & Levin-Sagi, 2006; Trope & Liberman, 2003). Indeed, children who can wait longer in the preschool delay of gratification task grow up to be more competent across health, interpersonal, academic, and work domains (Mischel & Ayduk, 2004; Mischel, Shoda, & Rodriguez, 1989). Hence, *ceteris paribus*, individuals equipped with these strategies should be more self-controlled across all domains.

And, yet, Tiger Woods and many less famous individuals defy easy categorization as either impulsive or self-controlled. In practice, most personality questionnaire items (e.g., “I am self-disciplined”) are domain-general in the sense that they do not explicitly specify context. The omission of explicit target situations requires the respondent to consider his overall level of behavior. One can imagine a respondent whose self-control is extraordinary when it comes to finishing work assignments on time but minimal when it comes to kicking a smoking habit; faced with a question on his overall level of self-control, this individual might say “moderate.” Mischel and Shoda (1995) have pointed out that such practices implicitly treat domain-specific deviations from mean levels of behavior as error or noise.

As Mischel himself advocated, both in his 1968 monograph and in more recent writings (e.g., Mischel, 2004), the search for coherence in personality lies not in the negation of the situation but in its active study. In doing so—and specifically in examining patterns of behavior that are consistent across certain types of situations—we might “reconcile the variability of the individual’s behavior across situations with our intuitive conviction that each individual is characterized by stable and distinctive qualities” (Mischel, 2009, p. 284). This nuanced, moderate position—and the need to examine within-individual differences in behavior—has also been advocated by other leaders in personality psychology (Fleeson, 2001, 2007; Funder, 2009; Lucas & Donnellan, 2009; Roberts, 2007). Still, empirical efforts that focus on domain-specificity in personality remain rare: “Despite the intrinsic contextualized nature of personality traits, the measurement of situations is typically tossed unceremoniously into the black box of the personality trait inventory” (Roberts, 2007, p. 1077). Domain-specific “if-

then" profiles of behavior patterns (e.g., if Woods is in the sex domain, then he is likely to give into temptation, but if he is in the work domain, then he is likely to act self-controlled) should improve predictive validity and, more importantly, provide a deeper understanding of individual differences in impulsivity.

A Model of Impulsive Behavior

Our model of impulsive behavior begins with the assumption that individuals are often faced with two mutually exclusive options. The impulsive choice brings immediate gratification with deferred negative consequences (e.g., eating a big piece of chocolate cake right now brings immediate pleasure but also regret and worse health later on), whereas the self-controlled choice brings greater utility but only after some delay (e.g., not eating the cake brings no pleasure now but better physical health later on). Deciding between indulgence and abstinence requires a subjective evaluation of the gratification associated with the choice as well as some consideration of the attendant long-term consequences (i.e., harm).

We propose that subjective temptation and perceived harm are psychologically meaningful aspects of impulsive behavior that can explain domain-specificity. Specifically, we suggest that both subjective temptation and perceived harm are domain-specific, whereas willpower resources and strategies are domain-general.[3] Consistent with the empirical work by Baumeister and colleagues, we assume the processes that underpin the inhibition of impulses to rely on resources that are finite and therefore

[3] Our model is inspired by research on domain-specificity in risk-taking by Weber and colleagues (Weber, Blais, & Betz, 2002). Like most traits, risk aversion has traditionally been assumed by economists and psychologists alike to be domain-general, despite abundant empirical evidence that risk-taking behavior varies across domains (e.g., MacCrimmon & Wehrung, 1990). Weber and colleagues (2002) found that "domain differences in apparent risk taking seem to be associated primarily with differences in the perception of the activities' benefits and risks" (p. 282).

judiciously allocated. The "cost" of resisting any temptation can be dramatically reduced by cognitive and behavioral strategies (e.g., mental transformation). Thus, our model predicts both domain-general and domain-specific variance in impulsive behavior. Individuals who are more self-controlled, generally, than others have more self-control resources to deploy and more effective strategies for reducing the cost of resisting temptation. Consequently, their overall level of impulsive behavior will be lower than their less self-controlled peers (see Figure 1a). In contrast, an individual's observed behavior will vary across domains as a function of his or her idiosyncratic, domain-specific subjective evaluations of temptation and perceived harm (see Figure 1b).

Returning to our early example, Tiger Woods might have prodigious self-control resources and effective strategies for reducing the cost of resisting temptation. But, relative to other temptations that Woods did successfully resist, the particular improprieties which were Wood's undoing must have elicited exceptionally strong urges and/or been evaluated as benign.

Our model is consistent with Hofmann, Friese, and Strack's (2009) dual-system model of self-control where self-control outcomes (i.e., impulsive behavior) are predicted by impulsive precursors (e.g., temptation) and reflective precursors (e.g., perceived harm). In their model, the impulsive system does not only produce impulses that lead to detrimental behavior. Some impulses (e.g., drinking water when one is thirsty) are aligned with the reflective system. In addition, impulsive behavior may consist of inaction (e.g., procrastinating or not exercising), and the reflective system may be required to override the impulse to be inactive. Their model also predicts that "boundary conditions" (e.g., domain-general self-control) moderate the effects of impulsive and

reflective precursors on behavior. Research applying their model has focused on *between-individual* differences within a domain, whereas our investigation focuses on *within-individual* differences across domains.

Our model is also consistent with Fleeson's (2001) density distribution approach. From this perspective, traits can be thought of as density distributions of states, which are characterized by distribution moments (e.g., mean, variance, skew, and kurtosis). As a resolution to the person-situation debate, Fleeson demonstrated that "trait concepts are inclusive of both impressive levels of within-person stability and impressive levels of within-person variability" (p. 1011). Specifically, he showed that while marked within-individual variance exists (and single states demonstrate relatively low test-retest stability), their means are highly stable (*r*s > .90). Relevant to the current investigation, Fleeson makes a distinction between structural and process approaches: "The structural approach emphasizes broad tendencies that are manifest in stable and situation-independent behavioral averages. The process approach emphasizes laws relating situational conditions to individuals' behavioral reactions…The structural approach can focus on correlates of highly reliable means, and the process approach can explain the plentiful deviations from these means" (p. 1023). Our model encompasses and applies both of these approaches.

The Present Studies

The goals of this investigation were to 1) substantiate distinct domains of impulsive behavior and 2) explain within-individual variance across domains as a function of the subjective temptation and perceived harm of impulsive behavior. In Study 1a, we developed the Domain-Specific Impulsivity Scale (DSIS), administered the DSIS

to a large sample of undergraduates, and conducted exploratory factor analyses to assess the dimensionality of the scale. In Study 1b, we refined the DSIS and conducted confirmatory factor analyses on a national Internet sample of adults. In Study 2, we tested the hypothesis that variance in domain-specific impulsive behavior could be explained by temptation and perceived harm. In Study 3, we used targeted subsamples to confirm that individuals who are highly tempted in one domain (e.g., dieters in the food domain) are only moderately tempted in other domains (e.g., impulse shoppers in the finance domain).

Study 1a

In Study 1a, we developed and validated a novel self-report questionnaire of domain-specific impulsive behavior. We used exploratory factor analyses to test the hypothesis that impulsive behavior is multi-dimensional. To establish convergent validity, we analyzed correlations between impulsive behavior in each domain and a domain-general self-control scale, and to test criterion-related validity, we conducted multiple regression analyses predicting measures of academic achievement, positive social relations, physical health, and facets of impulsivity from domain-specific impulsive behavior.

We predicted that (1) exploratory factor analyses would produce domain-specific factors; (2) impulsive behavior within each domain would show convergent validity with a widely-used self-control scale (i.e., negatively correlated); (3) domain-specific impulsive behavior would show convergent validity with outcomes theoretically predicted to vary with specific domains (e.g., work with GPA); (4) domain-specific impulsive behavior would provide incremental predictive validity over domain-general self-control in predicting theoretically-relevant outcomes; and (5) the variance in domain-

specific impulsive behavior within individuals will be significantly larger than domain-general impulsive behavior between individuals.

Method

Participants. Two hundred ninety-three undergraduate students enrolled in psychology courses at a large, private university participated in this study for research experience credit (*M* = 19.5 years, *SD* = 1.3; 56.6% women). Approximately 64.5% of the participants were Caucasian, 18.1% were Asian, 5.5% were Latino, 4.4% were Black, and 7.5% were either of mixed or of other ethnic backgrounds.

Procedure and measures. We posted this study online and advertised it on the psychology department's subject pool website as a survey of personality and behavior. To obviate order effects, we randomized the sequence of DSIS items for each participant. In addition to the DSIS items, participants completed a domain-general measure of self-control and answered questions about their physical health, social relationships, demographic characteristics, and GPA.

Domain-specific impulsive behavior. Sixty-eight items were generated in ten domains of impulsivity: alcohol, emotion, exercise, finance, food, relationship, media, sex, smoking, and work. We generated items through focus groups instructed to nominate behaviors that reflect impulsivity or self-control and, in addition, by examining existing measures of impulsivity and self-control (e.g., Tangney, Baumeister, & Boone, 2004; Whiteside & Lynam, 2001). Although we strived to include a broad sample, the items in this investigation were not an exhaustive set of impulsive behaviors. For instance, road rage and speeding are not represented. However, exhaustive coverage was not necessary for our goals of (1) demonstrating that impulsive behavior varies across domains and (2)

examining potential explanations for domain-specificity. The DSIS instructed participants to "indicate the likelihood of engaging in the following" on a 5-point scale ranging from 1 = *Very unlikely* to 5 = *Very likely* (see Appendix for the full set of instructions).

Domain-general self-control. The Brief Self-Control Scale (BSCS; Tangney, et al., 2004) is a 13-item self-report questionnaire. Participants rated how well each item (e.g., "I am good at resisting temptation.") described them on a 5-point scale ranging from 1 = *Not at all like me* to 5 = *Very much like me*. The observed internal reliability was .84.

Health and positive social relations. We included three questions to assess physical health—"I am healthy," "I am in great physical shape," and "Physically, I feel great"—and three questions to assess positive social relations—"People like me," "I have a lot of friends," and "I get along well with others." These items were rated on a 5-point scale ranging from 1 = *Strong disagree* to 5 = *Strongly agree*. The three health items had an internal reliability coefficient of .86, and the three social relations items had an internal reliability coefficient of .83.

Facets of impulsivity. The Urgency, (lack of) Premeditation, (lack of) Perseverance, and Sensation Seeking (UPPS) scale (Whiteside & Lynam, 2001) is a 45-item self-report questionnaire. Participants rated how well each item described them on a 5-point scale ranging from 1 = *Not at all like me* to 5 = *Very much like me*. Example items include "I have trouble controlling my impulses" for the Urgency subscale, "I usually think carefully before doing anything" for the (lack of) Premeditation subscale, "I finish what I start" for the (lack of) Perseverance subscale, and "I generally seek new and

exciting experiences and sensations" for the Sensation Seeking subscale. The observed internal reliabilities ranged from .85 to .91.

Results and Discussion

Exploratory factor analysis. We reduced the number of items to 50 (see Table 1 for the final set of items) by removing items that either had less than a .40 corrected item-total correlation within their subscale or were theoretically expected to load in more than one domain (e.g., "watching pornographic movies" was related to both sex and media). Exploratory factor analyses on this set of 50 items suggested six domain-specific factors, which were interpretable as impulsive behavior in the work, relationship, drug, food, exercise, and finance domains. We used the squared multiple correlation (SMC) method to compute the prior communality estimates, set the factor loading criteria at .40, and used an orthogonal varimax rotation. We used a combination of scree and parallel tests, the Kaiser criterion, the Minimum Average Partial (MAP) criterion, and interpretability of the factors to determine the number of factors to extract. The final solution is shown in Table 1, and subscale means, standard deviations, and intercorrelations are in Table 2.[4]

DSIS convergent, criterion, and incremental predictive validity. As predicted, domain-general self-control was significantly negatively correlated with impulsive behavior within each of the six domains, *r*s from -.26 to -.64, *p*s < .001. (see Table 2). We also predicted that impulsive work behavior would correlate negatively with GPA, impulsive relationship behavior would correlate negatively with social relations, and

[4] We Winsorized (Erceg-Hurn & Mirosevich, 2008) subscale (e.g., food behavior subscale) and outcome (e.g., GPA) distributions by replacing outliers, defined as scores greater than 3.29 standard deviations from the mean, with the closest score that was not greater than 3.29 standard deviations from the mean (<1% of the scores; a *z*-value of 3.29 corresponds to a two-tailed *p*-value of .01). Kline (2005) noted that absolute values of the skew index greater than 3.0 is considered extreme and that a kurtosis index greater than 10.0 may suggest a problem. All of the subscales and outcomes had skew and kurtosis indices that were less than 2.0.

impulsive (lack of) exercise and food behavior would correlate negatively with health. As shown in Table 2, the results supported our predictions Overall, domain-specific impulsivity scores predicted these theoretically-related outcomes (average r = -.25) better than they predicted theoretically-unrelated outcomes (average r = -.09).[5]

Multiple regression analyses demonstrated that the DSIS subscales provided incremental predictive validity over domain-general self-control in predicting theoretically relevant outcomes in three out of four analyses. The domain-specific food, β = -.16, part r = -.16, $p < .01$, exercise, β = -.44, part r = -.40, $p < .001$, and relationship subscales, β = -.15, part r = -.13, $p < .05$, provided incremental predictive validity over domain-general self-control in predicting health (for the food and exercise domains) and positive social relations (for the relation domain). The work subscale did not provide incremental predictive validity over domain-general self-control in predicting GPA, β = -.01, part r = -.01, *ns*. This occurred because of the relatively large amount of variance shared between the work subscale and the self-control scale (r^2 = .41). Indeed, several items on the self-control scale relate directly to work (e.g., "I am lazy") and the work subscale had the highest correlation (r = -.64) with the self-control scale.[6]

DSIS correspondence with UPPS. Domain-specific impulsive behavior demonstrated theoretically-predicted relationships with facets of impulsivity. We predicted that UPPS Urgency would be associated with impulsive interpersonal, drug, food, and finance behavior because urgency involves impulses (such as for saying things

[5] These averages were computed by using Fisher's r to z formula to convert rs to zs, averaging the zs, then converting the average zs back to rs. By "larger," we are referring to the point estimates. We are not aware of an inferential test that can compare average rs computed with the same variables within the same sample. However, in this sample, a correlation of r = .25 is significant at $p < .001$, whereas a correlation of r = .09 is not significant.

[6] The participants, being students, may have considered the work domain to exemplify impulsivity because schoolwork is salient. As a result, they may have subjectively overemphasized the work domain when rating the domain-general items (e.g., "I wish I had more self-discipline").

and buying things on impulse) and cravings (such as for food and drugs). We predicted that UPPS (lack of) Premeditation would be associated with interpersonal and finance behavior because premeditation involves thinking carefully before saying things and planning for the future. We predicted that UPPS Perseverance would be associated with work and exercise behavior because perseverance is necessary to finish arduous and boring work tasks as well as many forms of exercise. Finally, we predicted that UPPS Sensation Seeking would be associated with drug behavior because drug use has been connected with sensation seeking (Donohew et al., 1999; Robbins & Bryan, 2004). As shown in Table 2, the results supported our predictions. Overall, UPPS subscales predicted theoretically-related DSIS subscales (average r = .29) better than they predicted theoretically-unrelated DSIS subscales (average r = .10).

Hierarchical linear model. A hierarchical linear model (HLM; estimated with the program HLM 6.08) revealed that the variance in domain-specific impulsive behavior within individuals was significantly larger than domain-general impulsive behavior between individuals.[7] At Level 1, the outcome variable was the domain-specific behavior subscales of the DSIS, with six measures (one for each domain) nested within each participant (N = 293) for a total of 1,758 data points. Participants were the level-two units. In this unconditional (i.e., no predictor/s) model, behavior in domain d for

[7] Comparing variance components at different levels is one of the main applications of multilevel analyses (Bickel, 2007; Raudenbush & Bryk, 2002; Singer & Willett, 2003). The interpretation is equivalent to thinking about variance partitioning in a between-subjects ANOVA: is there more variance between groups vs. within-groups? Imagine that 99% of the variance in impulsive behavior were within individuals across domains, and only 1% were between individuals. This would suggest that most of the variance in impulsive behavior is across domains (i.e., an individual can be highly impulsive in one domain but not in others) and that there is relatively little variance between individuals (i.e., it doesn't make sense to say that one individual is generally more impulsive than another). Conversely, if we had found that 1% of the variance were within-individuals across domains, and 99% were between individuals, then that would suggest that impulsive behavior for a particular individual does not vary across domains (i.e., if an individual is impulsive in one domain, then s/he is impulsive in others as well), but there are reliable differences in impulsivity among individuals (i.e., if an individual is impulsive, then s/he is generally more impulsive in all domains compared to other individuals).

individual i (Y_{di}) is a function of the grand mean (γ_{00}), deviation from the grand mean by individual i (ζ_{0i}), and deviation from individual i's mean (β_{0i}) by domain d (ε_{di}).

Level 1 – Within individual: $Y_{di} = \pi_{0i} + \varepsilon_{di}$ (1a)

Level 2 – Between individual: $\pi_{0i} = \beta_{00} + \zeta_{0i}$ (1b)

Combined model: $Y_{di} = \beta_{00} + \zeta_{0i} + \varepsilon_{di}$ (1c)

The within-individual variance in impulsive behavior across domains (.68; 79% of the total variance) was significantly larger than the between-individual variance (.18; 21% of the total variance; $F(1465,292) = 3.79$, $p < .001$), which indicates that most of the variance in impulsive behavior is within individuals and provides further evidence that impulsive behavior is domain-specific.

Study 1b

Study 1a provided preliminary support for distinct domains of impulsive behavior. In Study 1b, we replicated and extended our findings in a large sample of adults recruited through the Internet. We revised the DSIS instructions so that participants were asked to "indicate how often you do the following" on a 5-point scale ranging from 1 = *Never* to 5 = *Very often* instead of the more hypothetical "indicate the likelihood of engaging in the following." We revised the DSIS so that the remaining items represented more concrete or observable behavior (e.g., we removed "Envying Others" and revised "Being greedy" to "Taking more than my fair share (i.e., being greedy)"), were less ambiguous (e.g., we changed "Telling secrets" to "Telling another person's secret"), and were less complex (e.g., we changed "Being sedentary instead of exercising" to "Being sedentary"). When possible, we revised common initial verbs (e.g., "eating" for the food items) to decrease inflated common source variance. In order to reduce social desirability

effects, we made an effort to revise or remove items that had negative connotations (e.g., "Behaving inappropriately when I am emotional" was removed); admittedly, this attempt was not fully successful as several items that could be construed as negative were retained (e.g., "Lying" and "Procrastinating"). Finally, we added three new items to the relationship domain, two to the finance domain, and one to the drug domain to increase internal reliability. The full set of revised items is presented in the Table 3.

Method

Participants. Fourteen hundred eighty-six adults participated in this study (*M* = 41.1 years, *SD* = 12.7; 79.2% women). Approximately 79.9% of the participants were Caucasian, 7.5% were Asian, 5% were Latino, 3.6% were Black, and 4% were either of mixed or of other ethnic backgrounds.

Procedure and measures. We posted this study online and set up a link on the www.authentichappiness.com website inviting visitors to participate in research on domain-specific self-control. This noncommercial website provides free information about psychology research, access to self-report measures, and opportunities to participate in research. To obviate order effects, the sequence of DSIS items were randomized for each participant. In addition to the DSIS items, participants filled out the BSCS (observed $\alpha = .83$) and a demographic questionnaire, which included items about gender, ethnicity, year of birth, height, and weight. We used the height and weight information to compute Body Mass Index (BMI) scores.

Results and Discussion

Confirmatory factor analyses. We used confirmatory factor analysis to compare the fit of a domain-specific six-factor model to a domain-general one-factor model. In the

six-factor model, items were allowed to load freely on their respective factor (domain), the factor loadings with other factors were set to zero, and the covariances among the factors were freely estimated (see Table 3). In the one-factor model, all items were allowed to load freely on a single factor. In both models, the factors were scaled by setting the variance to equal 1.0.

A chi-square difference test indicated that the domain-specific six-factor model fit the data better than the domain-general one-factor model, $\chi^2(15, N = 1486) = 15{,}389.39$, $p < .001$. Fit indices suggested an adequate fit to the data for the six-factor CFA model: $\chi^2(1209, N = 1486) = 7{,}740.65$, $p < .001$; RMSEA = .060 (90% confidence interval = .059 to .062); CFI = .82; and SRMR= .06 (see Kline, 2005 for a discussion of fit indices).[8] All of the fit statistics were substantially worse in the one-factor CFA model: $\chi^2(1224, N = 1486) = 23{,}130.04$, $p < .001$; RMSEA = .11 (90% confidence interval = .109 to .111); CFI = .40; and SRMR = .11.

DSIS convergent, criterion, and incremental predictive validity. Domain-general self-control was negatively correlated with impulsive behavior in each of the six domains (see Table 4). Food and (lack of) exercise domain-specific impulsivity scores predicted BMI (average $r = .38$) better than theoretically-unrelated domain-specific scores (average $r = .06$). Multiple regression analyses demonstrated that the food, $\beta = .34$, part $r = .32$, $p < .001$, and (lack of) exercise, $\beta = .35$, part $r = .31$, $p < .001$, DSIS subscales provided incremental predictive validity over domain-general self-control in predicting BMI.

[8] CFI values over .90 indicate a good fit; however, Kenny and McCoach (2003) note that "the CFI tend[s] to demonstrate worse fit as the number of variables in the model increases…Therefore, it appears that the CFI…do[es] not function well with correctly specified models that include a large number of variables" (p. 349). Kenny and McCoach's "large" model had 40 variables; the current model had 51.

Hierarchical linear model. The within-individual variance in impulsive behavior across domains (.68; 88% of the total variance) was significantly larger than the between-individual variance (.09; 12% of the total variance; $F(7430,1485) = 7.48$, $p < .001$), which again indicates that most of the variance in impulsive behavior is within individuals.

Study 2

Studies 1a and 1b provided evidence for distinct domains of impulsive behavior. In Study 2, we tested our theory that within-individual differences in domain-specific impulsive behaviors could be largely explained by domain-specific differences in their subjective temptation and perceived harm. In addition, we tested the hypothesis that individual-differences in the effects of temptation and perceived harm would predict individual differences in within-individual variability in domain-specific behavior. As Fleeson (2001) explains, "being sensitive to the cues for a particular trait would result in the individual acting more variably on that trait, in particular. That is, a person whose actions differ from each other on a trait may be a person who responds strongly to the momentary cues for that trait" (p. 1014). He goes on to say, "If within-person variability in behavior is partially due to sensitivity to trait-relevant cues, then individual differences in within-person variability may be due to individual differences in sensitivity to trait-relevant cues" (p. 1019). In addition to sensitivity to cues (i.e., the individual-specific effects of temptation and perceived harm), we also predicted that within-individual variability in domain-specific temptation and perceived harm as well as their interactions with their effects (e.g., individual-specific effects of temptation with within-individual variability in domain-specific temptation) would predict within-individual variability in

domain-specific impulsive behavior. The rationale is that if within-individual variability in domain-specific impulsive behavior is due to corresponding variability in temptation and perceived harm, then individual differences in the effects of temptation and perceived harm, within-individual variability in temptation and perceived harm, and the variability by effect interactions should predict within-individual variability in domain-specific impulsive behavior.

Method

Participants. Three hundred fifty-three undergraduate students enrolled in psychology courses at a large, private university participated in this study for research experience credit (*M* = 20.3 years, *SD* = 2.7; 64.6% women). Approximately 59.8% of the participants were Caucasian, 19.8% were Asian, 5.9% were Latino, 4.8% were Black, and 9.7% were either of mixed or of other ethnic backgrounds.

Procedure and measures. We posted this study online and advertised it on the psychology department's subject pool website as a survey of personality and behavior. To avoid order effects, we randomized the sequence of DSIS items within each scale for each participant. In addition to the DSIS items, participants filled out the BSCS described in Study 1a and a demographic questionnaire.

We used the DSIS revision described in Study 1b in this study. However, in addition to the behavior scale (DSIS-B), the same set of 51 DSIS items was presented two more times with different prompts each time to gauge temptation and perceived harm. For the temptation scale (DSIS-T), participants were asked to "please rate how tempted you would be to do the following" on a 5-point scale ranging from 1 = *Not tempted at all* to 5 = *Very tempting*. For the perceived-harm scale (DSIS-H), participants

were asked to "rate how bad you think the following activities are" on a 5-point scale ranging from 1 = *Not bad at all* to 5 = *Very bad*. See Appendix for the full set of instructions and anchors. Alphas ranged from .81 to .94, average = .88.

Results and Discussion

Confirmatory factor analyses. A chi-square difference test indicated that the domain-specific six-factor model of impulsive behavior fit the data better than did the domain-general one-factor model, $\chi^2(15, N = 353) = 4{,}003.99$, $p < .001$. Fit indices suggested adequate fit to the data for the six-factor model: $\chi^2(1209, N = 353) = 3{,}054.44$, $p < .001$; RMSEA = .066 (90% confidence interval = .063 to .069); CFI = .80; and SRMR= .07. The fit statistics were substantially worse in the one-factor model: $\chi^2(1224, N = 353) = 7{,}058.43$, $p < .001$; RMSEA = .116 (90% confidence interval = .114 to .119); CFI = .36; and SRMR = .13.

Hierarchical Linear Models. Hierarchical linear models revealed that the variance in domain-specific impulsive behavior within individuals was significantly larger than domain-general impulsive behavior between individuals and that temptation predicted substantially more unique variance in within-individual domain-specific impulsive behavior than did perceived harm, although both were significant predictors. We first fit an unconditional model to (Model 1) to provide an estimate of the proportion of total variance within and between individuals in impulsive behavior and serve as a baseline model to compare the reduction in variance among the more complex models. Subsequent models examined the amount of within-individual variance in impulsive behavior across domains explained by temptation (Model 2), perceived harm (Model 3), and temptation and perceived harm (Model 4). In Model 5, we added domain-general

self-control as a Level 2 predictor to explain between-individual variance in domain-general impulsive behavior and to examine whether domain-general self-control moderated the within-individual effects of temptation and perceived harm. We individual-mean centered the Level 1 predictors and grand-mean centered the Level 2 predictors (see Raudenbush & Bryk, 2002 for a discussion of centering).

Model 1 (see equations 1a-1c and Table 6) revealed that the within-individual variance in impulsive behavior across domains (.54; 87% of the total variance) was significantly larger than the between-individual variance (.08; 13% of the total variance; $F(1765,352) = 6.78$, $p < .001$).

In Model 2, we included temptation as a Level 1 predictor of impulsive behavior to examine the amount of variance explained by temptation alone.

Level 1 – Within individual: $$Y_{di} = \pi_{0i} + \pi_{1i}(\text{Temptation}) + \varepsilon_{di} \quad (2a)$$

Level 2 – Between individual: $$\pi_{0i} = \beta_{00} + \zeta_{0i} \quad (2b)$$

$$\pi_{1i} = \beta_{10} + \zeta_{1i} \quad (2c)$$

Combined model: $$Y_{di} = \beta_{00} + \beta_{10}(\text{Temptation}) + \zeta_{0i} + \zeta_{1i}(\text{Temptation}) + \varepsilon_{di} \quad (2d)$$

The pseudo-R^2_{ε} (see Singer & Willett, 2003) was .57, which indicated that adding temptation as a Level 1 predictor accounted for 57% of the within-individual variance in impulsive behavior across domains. This model also provided an estimate of the average slope (across individuals) of temptation: .58, $t(352) = 32.15$, $p < .001$, $r_{\text{effect}} = .86$.[9]

[9] Following Karney and Bradbury (1997), we used the following formula to compute the effect-size correlations: $r_{\text{effect}} = \sqrt{[t^2/(t^2 + df)]}$.

In Model 3, we removed temptation and added perceived harm as a Level 1 predictor of impulsive behavior.

Level 1 – Within individual: $Y_{di} = \pi_{0i} + \pi_{1i}(\text{Perceived harm}) + \varepsilon_{di}$ (3a)

Level 2 – Between individual: $\pi_{0i} = \beta_{00} + \zeta_{0i}$ (3b)

$\pi_{1i} = \beta_{10} + \zeta_{1i}$ (3c)

Combined model: $Y_{di} = \beta_{00} + \beta_{10}(\text{Perceived harm}) + \zeta_{0i} + \zeta_{1i}(\text{Perceived harm}) + \varepsilon_{di}$ (3d)

The pseudo-R^2_ε was .19, and the estimated average slope (across individuals) of perceived harm was -.35, $t(352) = -11.54$, $p < .001$, $r_{effect} = -.52$.

In Model 4, we added temptation and perceived harm simultaneously as Level 1 predictors of impulsive behavior.

Level 1 – Within individual: $Y_{di} = \pi_{0i} + \pi_{1i}(\text{Temptation}) + \pi_{2i}(\text{Perceived harm}) + \varepsilon_{di}$ (4a)

Level 2 – Between individual: $\pi_{0i} = \beta_{00} + \zeta_{0i}$ (4b)

$\pi_{1i} = \beta_{10} + \zeta_{1i}$ (4c)

$\pi_{2i} = \beta_{20} + \zeta_{2i}$

(4d)

Combined model: $Y_{di} = \beta_{00} + \beta_{10}(\text{Temptation}) + \beta_{20}(\text{Perceived harm}) + \zeta_{0i} + \zeta_{1i}(\text{Temptation}) + \zeta_{2i}(\text{Perceived harm}) + \varepsilon_{di}$ (4e)

The pseudo-R^2_ε was .59. Temptation and perceived harm explained 40% and 2% of the unique within-individual variance in impulsive behavior, respectively. The average slopes (across individuals) of temptation controlling for perceived harm, and perceived harm controlling for temptation were .53, $t(352) = 27.69$, $p < .001$, $r_{effect} = .83$, and -.10,

$t(352) = -4.82$, $p < .001$, $r_{effect} = -.25$, respectively. The variance components for the slopes of temptation (.05, $\chi^2(344) = 570.24$, $p < .001$) and perceived harm (.03, $\chi^2(344) = 396.70$, $p = .026$) suggested that the effects of temptation and perceived harm ranged from about .09 to .98 and -.45 to .24, respectively, for 95% of the participants. Temptation was a significantly better predictor than perceived harm, $t(352) = 19.05$, $p < .001$.

In Model 5, we added self-control as a Level 2 predictor of the intercept, temptation slope, and perceived harm slope. Because the Level 1 predictors were individual-mean centered, the Level 1 intercept represented each individual's average (or domain-general) level of impulsive behavior.

Level 1 – Within individual:

$$Y_{di} = \pi_{0i} + \pi_{1i}(\text{Temptation}) + \pi_{2i}(\text{Perceived harm}) + \varepsilon_{di} \quad (5a)$$

Level 2 – Between individual:

$$\pi_{0i} = \beta_{00} + \beta_{01}(\text{Self-control}) + \zeta_{0i} \quad (5b)$$

$$\pi_{1i} = \beta_{10} + \beta_{11}(\text{Self-control}) + \zeta_{1i} \quad (5c)$$

$$\pi_{2i} = \beta_{20} + \beta_{21}(\text{Self-control}) + \zeta_{2i} \quad (5d)$$

Combined model:

$$Y_{di} = \beta_{00} + \beta_{10}(\text{Temptation}) + \beta_{20}(\text{Perceived harm}) + \beta_{01}(\text{Self-control}) + \beta_{11}(\text{Self-control x Temptation}) + \beta_{21}(\text{Self-control x Perceived harm}) + \zeta_{0i} + \zeta_{1i}(\text{Temptation}) + \zeta_{2i}(\text{Perceived harm}) + \varepsilon_{di} \quad (5e)$$

The pseudo-$R^2_{\zeta 0}$ indicated that adding self-control as a Level 2 predictor of the Level 1 intercept accounted for approximately 40% of the domain-general variance in impulsive behavior between individuals. The slope of self-control was -.49, $t(351) = -18.84$, $p < .001$, $r_{effect} = -.71$. As predicted, between-individual domain-general self-control

moderated the within-individual effects of temptation, -.08, $t(351) = -2.37$, $p < .05$, $r_{effect} = -.13$, and perceived harm, -.19, $t(351) = -5.90$, $p < .001$, $r_{effect} = -.30$, on impulsive behavior, indicating that temptation has less of an effect and perceived harm has a greater effect on impulsive behavior for individuals with more self-control. More specifically, these cross-level interactions indicate that the effects of temptation and perceived harm are .45 and -.30, respectively, for individuals who are one point above the mean on self-control, whereas the same effects are .61 and .08 for individuals one point below the mean. Pseudo-$R^2_{\zeta 1}$ and Pseudo-$R^2_{\zeta 2}$ indicated that adding self-control as a Level 2 predictor of the Level 1 temptation and perceived harm slopes explained about 6% and 46% of the between-individual variance of the within-individual effects of temptation and perceived harm, respectively.

Finally, we tested our hypothesized predictors of individual differences in within-individual variability in domain-specific behavior. In Step 1 of a hierarchical regression analysis, the effects of temptation ($\beta = .66$, $p < .001$) and perceived harm ($\beta = .18$, $p < .001$) as well as within-individual variability in domain-specific temptation ($\beta = .44$, $p < .001$) and perceived harm ($\beta = .12$, $p = .001$) predicted individual differences in within-individual variability in domain-specific behavior.[10] In Step 2, the temptation effect by temptation variability interaction ($\beta = .07$, $p = .064$) and the perceived harm effect by perceived harm variability interaction ($\beta = .08$, $p = .02$) were added and found to be marginally significant and significant, respectively.

Study 3

[10] We took the empirical Bayes residuals for the temptation and perceived harm slopes, added the corresponding estimated slopes, and used the absolute values as individual-specific effects. We used the within-individual standard deviations for domain-specific impulsive behavior, temptation, and perceived harm as measures of within-individual variability.

Collectively, the first three studies provided evidence for both domain-specific and domain-general aspects of impulsive behavior. In Study 2, we found evidence that individuals vary dramatically in their ability to exercise self-control across domains primarily because they find some activities more tempting than others. To confirm the hypothesis that temptation is highly domain-specific (i.e., what is tempting to one individual can hold no appeal whatsoever to another), in Study 3, inspired by Hanoch, Johnson, and Wilke's (2006) study on domain specificity in participant recruitment, we recruited targeted subsamples from www.facebook.com, a social networking website.

Facebook is a free online community with over 200 million users that provides its members with tools for interacting with friends, colleagues, and family members. In addition, it allows members to connect with other individuals who share specific common interests through 30 million special interest groups. Members can find and join groups by searching their names and descriptions using key words or phrases. We expected members of targeted interest groups to deem relevant temptations to be particularly attractive or enjoyable. For instance, shopaholics should be more tempted to engage in impulse buying but not more tempted to drink or avoid exercise.

In sum, we hypothesized that (1) targeted subsamples would be more tempted in the hypothesized domain relative to the other groups, and (2) subsamples would not differ in their overall levels of temptation. In addition to providing further evidence for convergent and discriminant validity, this study is noteworthy in that it examines real-world behavior (i.e., membership in domain-specific groups), uses a diverse sample (i.e., not just college students), and demonstrates the utility of using the Internet for psychological research.

Method

Participants. Four hundred nineteen adult participants (*M* = 25.1 years, *SD* = 8.1; 77% women) were recruited from the work domain (*n* = 152), the food domain (*n* = 61), the finance domain (*n* = 102), the drug and alcohol domain (*n* = 78), and the exercise domain (*n* = 26).

Procedure and measures. We used key words and phrases to identify special interest groups in five domains:[11] work (e.g., "Experts of Procrastination"), food (e.g., "Binge Eating Group"), finance (e.g., "Addicted to Shopping"), drug and alcohol (e.g., "Wreckless Drinking"), and exercise (e.g., "I Hate Exercise"). Key terms used to identify special interest groups included the following–work: *procrastinators, procrastination*; food: *dieters, binge eaters, weight loss, I love eating, I eat too much*; finance: *shopaholics, shopping addiction, I love shopping*; drug and alcohol: *alcoholics, drinking, binge drinking, alcohol, beer, shots, black out*; and exercise: *exercise, fitness, couch potato*. Once special interest groups were identified, we contacted the group administrators for permission to invite their members to participate in our study. Group administrators either forwarded our invitation or let us message their members directly. We invited members to participate in our study "on personality, lifestyle, and behavior" and directed them to five separate (but identical) websites.[12] Importantly, we did not mention in our invitation or on the study website itself our interest in domain-specificity

[11] We could not find groups representing relationship impulsive behavior using the following keywords: *temper, lying, anger management*.

[12] Because participation was anonymous, we cannot not rule out the possibility that participants were in more than one group. However, the probability of the same Facebook members being in more than one group seems reasonably low, given that Facebook had over 200 million members at the time of data collection.

or impulsivity per se. Participants completed the DSIS-T scale, as well as a demographics questionnaire.

Results and Discussion

As predicted, within each domain, the target group was more tempted to engage in domain-specific impulsive behavior relative to the other groups but not more tempted overall. Specifically, a 5 (domain) x 5 (group) mixed-design ANOVA predicting temptation revealed a significant main effect for domain, $F(4, 1656) = 126.04$, $p < .001$, and a significant domain by group interaction, $F(16, 1656) = 12.76$, $p < .001$, but no effect for group, $F(4, 414) = 1.15$, $p = .33$. As summarized in Figure 2 and Tables 7 and 8, the differences between target groups and other groups were all significant and ranged from small to large in effect size. Overall, these results suggest that individuals are in "impulsive-problem" groups because of domain-specific temptation.

General Discussion

This investigation presents support for our proposed model of impulsivity. Some individuals are more impulsive than others on average, and the tendency to be impulsive in one domain (e.g., finances) correlates with the tendency to be impulsive in other domains (e.g., food and drugs). But, it is also true that any given individual varies dramatically in how gratifying he or she finds particular activities, and consequently, in the relative frequency with which he or she indulges in them. In contrast, within-individual differences in the perceived harm associated with indulging explain only minimal unique variance in within-individual differences in impulsive behavior. Moreover, as predicted, temptation has less of an effect on individuals who were more

self-controlled than others in general, and these individuals were also less likely to engage in behaviors deemed harmful.

When submitted to exploratory factor analyses, the scale we developed for this investigation produced distinct, interpretable factors. Likewise, domain-specific confirmatory factor models fit the data better than did domain-general (i.e., one factor) models of impulsive behavior. The DSIS subscales demonstrated convergent validity with a widely-used domain-general measure of self-control and incremental predictive validity above and beyond this domain-general measure for theoretically-relevant outcomes (e.g., impulsive behavior in the food domain predicted BMI over and beyond a domain-general self-control questionnaire). Finally in Studies 1a, 1b, and 2, the within-individual variance in impulsive behavior across domains (i.e., domain-specific behavior) was significantly larger than the domain-general variance across individuals.

Individuals behaved more impulsively in domains that they found tempting and, to a much lesser extent, resisted vices they perceived as harmful. Specifically, temptation and perceived harm together explained 59% of the within-individual variance across domains, whereas temptation explained 40% of the unique variance compared to 2% for perceived harm. On its own, temptation explained most of the variance (57%) in domain-specific impulsive behavior. As predicted by Hofmann et al.'s (2009) model, temptation had a weaker effect and perceived harm had a stronger effect for individuals with higher self-control. That is, more self-controlled individuals are better at overcoming their idiosyncratic temptations and refraining from behaviors they deem harmful. Finally, consistent with the idea that domain-specific impulsive behavior is partially due to domain-specific temptation and perceived harm, individuals with greater sensitivity to

temptation and perceived harm and who had more variability in domain-specific temptation and perceived harm had more variance in impulsive behavior across domains.

Why does perceived harm account for relatively little variance in impulsive behavior? Metcalfe & Mischel (1999) proposed that there are two systems that influence impulsivity: a *hot* emotional system that is fast and reflexive and a *cool* cognitive system that is slow and reflective. Visceral hot influences can have powerful effects that overwhelm the cool system (Loewenstein, 1996). If temptation reflects the hot system and perceived harm reflects the cool system, then temptation may have a greater influence on impulsive behavior than does perceived harm. Another explanation is that individuals may generally be more consistent in evaluating harm versus temptation. Thus, there may be relatively little variance in perceived harm to explain variance in impulsive behavior. Indeed, in Study 2, estimates for the within-individual variance across domains were .82 for temptation and .46 for perceived harm (in separate unconditional HLM models with temptation and perceived harm as outcomes; results not reported).

Our findings are consistent with recent research on domain-specificity in risk-taking by Weber and colleagues (Blais & Weber, 2006; Weber, et al., 2002). Like most traits, risk aversion has traditionally been assumed by economists to be domain-general, despite evidence that risk-taking behavior varies across domains (e.g., MacCrimmon & Wehrung, 1990). Weber and colleagues (2002) found that "domain differences in apparent risk taking seem to be associated primarily with differences in the perception of the activities' benefits and risks" (p. 282). Notably, Weber and colleagues found content domains of risk that did not correspond with our domains of impulsivity. This suggests that impulsivity and risk do not conform to universal "life domains." More generally, we

speculate that psychologically meaningful boundaries that demarcate domains vary across personality traits.

While it is possible that domain-specific impulse-control systems or the opportunity to engage in impulsive behavior explains domain-specificity, this study suggests that domain-general self-control combined with domain-specific temptation (and other potential factors) can give rise to domain-specific impulsive behavior. This is congruent with Mischel's (1973) proposal that an individual's "inconsistent" behavior across domains is a function of the individual's construal of the situation. If an individual subjectively perceives temptation to be high (or harm to be low), then that individual is more likely to engage in impulsive behavior.

Limitations

We see four limitations of the current investigation. First, we relied exclusively on self-report questionnaires, which are susceptible to response biases, such as social desirability and acquiescence (Paulhus, 1991). Although these biases could inflate correlations between scales, they could also increase the difficulty of finding distinct factors as EFA depends on differential variance. A related issue is that the relationship between self-report behavior and attitudes may be spuriously inflated (Bem, 1967). For example, if an individual says that she eats fried food often, and then is asked if she likes fried food, then she might decide (perhaps unconsciously) that she must like fried food if she eats it often. Against this possibility, the construct of self-control (i.e., avoiding behaviors one finds tempting but regards as harmful vs. engaging in tempting behaviors that are deemed harmful) suggests that individuals can distinguish between temptation, perceived harm, and behavior. For instance, one may avoid procrastination yet still be

tempted to procrastinate: that is, the temptation and behavior are distinct. Finally, the scale anchors (e.g., "very tempting") were subjective and open to interpretation.[13] Because these are common limitations to questionnaire-based research, further studies should investigate domain-specific impulsivity through alternative methods, such as using implicit measures to assess temptation.

The second limitation of this investigation pertains to content-related validity. We reiterate that the items in this investigation were not an exhaustive set of impulsive behaviors, and thus all possible domains were not included. Because the results of exploratory factor analyses are dependent on the included items, researchers with different items might obtain different results. Consequently, these results must be interpreted with caution as a study using a different set of items might not find coherent domain-specific factors. Moreover, the domains included in this investigation may vary in their bandwidth and level of specificity. For instance, the work domain may be relatively broad whereas exercise may be relatively narrow. One can imagine that the work domain may encompass diverse subdomains, such as school, career, and personal projects, whereas a domain like exercise may only encompass aerobic and anaerobic exercise. In sum, our factors should not be considered a complete taxonomy of domains with the same level of bandwidth and specificity.

Third, while the DSIS items were nominated in focus groups as behaviors requiring inhibition, certain items may seem—to some individuals—out of place on an

[13] Given the possibility that some participants may implicitly use their own personal minimum and maximum as anchors when rating the frequency of their behavior (which could inflate within-individual variance), we recruited 106 participants from Amazon.com's Mturk to complete a version of the DSIS-B that asked "How many days out of the last seven days did you do the following activities?" The within-individual variance across domains (1.40; 62% of the total variance) was still significantly larger than the between-individual variance (0.86; 38% of the total variance), $F(530,105) = 1.62$, $p = .001$.

impulsivity scale. For instance, drinking one glass of red wine may be considered healthy. However, many people drink wine for other reasons, and in fact, struggle not to drink too much. Consistent with this observation, each of the DSIS subscales was significantly inversely correlated with a domain-general self-control scale. Moreover, the average temptation rating of 2.75 and perceived harm rating of 3.16 suggests that as a group, DSIS items are generally perceived as being moderately tempting and moderately bad. In addition, the pattern of results was identical when behavior data points rated as "Not Tempting" or "Not Bad at All" were excluded from analyses. Furthermore, it is common practice for impulsivity scales to contain items that do not capture impulsivity or self-control for all individuals. For example, "I eat healthy foods" for the Self-Control Scale (Tangney, et al., 2004), "I make up my mind quickly" on the Barratt Impulsivity Scale (Patton, Stanford, & Barratt, 1995), and "Does the child sit still?" on the Self-Control Rating Scale (Kendall & Wilcox, 1979).

Finally, these studies were cross-sectional and correlational in design. Experimental studies that manipulate temptation or perceived harm should be conducted to establish causal relationships with impulsive behavior. Future studies should also use longitudinal designs to establish true predictive relationships between the DSIS and theoretically-relevant behavior. Furthermore, while the cross-level interactions in this investigation revealed that more self-controlled individuals are better at overcoming their idiosyncratic temptations and refraining from behaviors they deem harmful, our data do not allow us to determine how or why this occurs. This finding highlights the importance of identifying the specific psychological mechanisms by which impulses are regulated.

Implications

We agree with Epstein and O'Brien (1985) that "behavior is unquestionably to some extent general and to some extent specific, and one can choose to study one aspect or the other" (p. 513). Unfortunately, researchers most often choose to study the first aspect and disregard the latter entirely. As demonstrated in this investigation, examining domain-specific aspects of behavior revealed that the influence of context on behavior is both substantial and systematic. In addition, domain-specific impulsive behavior provided incremental predictive validity in predicting theoretically-relevant outcomes over and beyond domain-general self-control.

Although we place special emphasis on domain-specificity, we do not wish to downplay the importance of domain-general processes, nor do we claim that domain-specific processes are "stronger" than domain-general processes. Indeed, this investigation demonstrates the value of domain-general self-control in predicting impulsive behavior over a diverse range of domains. Both aspects are important. We accentuate the domain-specific aspect because it has largely been ignored. Although interest in domain-specificity has been increasing (e.g., Goldstein & Weber, 1997; Shoda, Mischel, & Wright, 1994; Weber, et al., 2002), empirical domain-specific studies are still rare. In order to obtain a more complete understanding of personality, domain-specificity must be accounted for instead of ignored.

Funder (2009) has pointed out that a focus on within-person variance across domains begs two questions: "Where do these patterns come from? How are they important?" (p. 122). Likewise, Mischel and colleagues have asserted, "By addressing not only the average level of behavior (e.g., overall agreeableness) but also when, where,

and with whom it occurs, one can see the individual's distinctive coherent, and systematic patterns of behavior variation and glimpse the psychological processes and person variables that underlie them" (Shoda, et al., 1994, p. 686). We agree. Whereas the standard practice of averaging across domains can obscure important individual differences (Mischel, Shoda, & Mendoza-Denton, 2002), examining domains as variables of interest can provide a more nuanced and accurate view of personality. As Shoda et al. (1994), Weber et al. (2002), and the current investigation have demonstrated, psychologically salient aspects of the domain (temptation, in this investigation) can to a large extent explain variance in domain-specific behavior. Further, we suggest that examining both within- and between-individual variance simultaneously can lead to important insights. For example, the cross-level interactions in this investigation revealed that more self-controlled individuals are better at overcoming temptations they found alluring yet harmful.

Conclusion

This investigation provides an explanation for the variation in impulsive behavior within individuals across domains: domain-specific impulsive behavior is a result of domain-specific temptation and, to a lesser extent, perceived harm.

So, why was Tiger Woods impulsive when it came to sex but self-controlled in other domains? One possibility is that Woods did not think he would be caught (Magary, 2010), and thus did not perceive the harm of his illicit trysts to be very high. The present investigation argues against this possibility. Instead, we suggest that Woods was more *tempted* to engage in impulsive sexual behavior than to procrastinate, lose his temper, or

take drugs. As Oscar Wilde's quote suggests, Woods could resist everything but temptation.

References

Araton, H. (2010). Apologizing, Woods sets no date for return to golf. *New York Times.* Retrieved March 13, 2010, from http://www.nytimes.com/2010/02/20/sports/golf/20woods.html

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology, 74*, 1252-1265.

Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current Directions in Psychological Science, 16*, 351-355.

Beecher, H. W. (1887). *Proverbs from Plymouth pulpit*. New York: D. Appleton and Company.

Bem, D. J. (1967). Self-Perception: an Alternative Interpretation of Cognitive Dissonance Phenomena. *Psychological Review, 74*, 183-200.

Bickel, R. (2007). *Multilevel analysis for applied research*. New York: Guilford.

Blais, A.-R., & Weber, E. U. (2006). A domain-specific risk-taking (DOSPERT) scale for adult populations. [Journal Article]. *Judgment and Decision Making, 1*, 33-47.

Brooks, D. (2008). The frozen gaze. *New York Times.* Retrieved March 13, 2010, from http://www.nytimes.com/2008/06/17/opinion/17brooks.html?_r=1

Carlson, S. M., & Beck, D. M. (in press). Symbols as tools in the development of executive function. In A. Winsler, C. Fernyhough & I. Montero (Eds.), *Private Speech, Executive Functioning, and the Development of Verbal Self-regulation*. New York: Cambridge University Press.

Donohew, R. L., Hoyle, R. H., Clayton, R. R., Skinner, W. F., Colon, S. E., & Rice, R. E. (1999). Sensation seeking and drug use by adolescents and their friends: Models for marijuana and alcohol. *Journal of Studies on Alcohol, 60*, 622-631.

Duckworth, A. L., & Kern, M. L. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality, 45*, 259-268.

Duckworth, A. L., Tsukayama, E., & Geier, A. (2010). Self-controlled children stay leaner in the transition to adolescence. *Appetite, 54*, 304-308.

Duckworth, A. L., Tsukayama, E., & May, H. (2010). Establishing causality using longitudinal hierarchical linear modeling: An illustration predicting achievement from self-control. *Social Psychology and Personality Science, 1*, 311-317.

Epstein, S., & O'Brien, E. J. (1985). The person-situation debate in historical and current perspective. *Psychological Bulletin, 98*, 513-537.

Erceg-Hurn, D. M., & Mirosevich, V. M. (2008). Modern robust statistical methods: An easy way to maximize the accuracy and power of your research. *American Psychologist, 63*, 591-601.

Fleeson, W. (2001). Toward a structure- and process-integrated view of personality: Traits as density distributions of states. *Journal of Personality and Social Psychology, 80*, 1011-1027.

Fleeson, W. (2007). Situation-based contingencies underlying trait-content manifestation in behavior. *Journal of Personality, 75*, 825-862.

Fujita, K., & Han, H. A. (2009). Moving beyond deliberative control of impulses: The effect of construal levels on evaluative associations in self-control conflicts. *Psychological Science*1-6.

Fujita, K., Henderson, M. D., Eng, J., Trope, Y., & Liberman, N. (2006). Spatial distance and mental construal of social events. *Psychological Science, 17,* 278-282.

Fujita, K., Trope, Y., Liberman, N., & Levin-Sagi, M. (2006). Construal levels and self-control. *Journal of Personality and Social Psychology, 90,* 351-367.

Funder, D. C. (2009). Persons, behaviors and situations: An agenda for personality psychology in the postwar era. *Journal of Research in Personality, 43,* 120-126.

Goldstein, W. M., & Weber, E. U. (1997). Content and discontent: Indications and implications of domain specificity in preferential decision making. In W. M. Goldstein & R. Hogarth (Eds.), *Research in Judgement and Decision Making* (pp. 566-617). Cambridge: Cambridge University Press.

Hanoch, Y., Johnson, J. G., & Wilke, A. (2006). Domain Specificity in Experimental Measures and Participant Recruitment: An Application to Risk-Taking Behavior. *Psychological Science, 17,* 300-304.

Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science, 4,* 162-176.

Karney, B. R., & Bradbury, T. N. (1997). Neuroticism, marital interaction, and the trajectory of marital satisfaction. *Journal of Personality and Social Psychology, 72,* 1075-1092.

Kendall, P. C., & Wilcox, L. E. (1979). Self-Control in Children: Development of Rating Scale. *Journal of Consulting and Clinical Psychology, 47,* 1020-1029.

Kenny, D. A., & McCoach, D. B. (2003). Effect of the number of variables on measures of fit in structural equation modeling. *Structural Equation Modeling, 10,* 333-351.

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling* (2nd ed.). New York: Guilford.

Kross, E., & Ayduk, O. (2008). Facilitating adaptive emotional analysis: Distinguishing distanced-analysis of depressive experiences from immersed-analysis and distraction. *Personality and Social Psychology Bulletin, 34*, 924-938.

Kross, E., Ayduk, O., & Mischel, W. (2005). When asking "Why" does not hurt: Distinguishing rumination from reflective processing of negative emotions. *Psychological Science, 16*, 709-715.

Kross, E., Duckworth, A. L., Ayduk, O., Tsukayama, E., & Mischel, W. (in press). Differential effects of self-distanced vs. self-immersed reflection for affect and cognition among children. *Emotion*.

Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes, 65*, 272-292.

Lucas, R. E., & Donnellan, M. B. (2009). If the person-situation debate is really over, why does it still generate so much negative affect? *Journal of Research in Personality, 43*, 146-149.

MacCrimmon, K. R., & Wehrung, D. A. (1990). Characteristics of risk taking executives. *Management Science, 36*, 422-435.

Magary, D. (2010). Tiger Woods Is Finished. *New York Magazine* Retrieved September 20, 2010, from http://nymag.com/daily/sports/2010/08/tiger_woods_is_finished.html

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review, 106*, 3-19.

Mischel, W. (1968). Personality and assessment. *Hoboken, NJ, US: John Wiley & Sons, Inc*.

Mischel, W. (1973). Toward a cognitive social learning reconceptualization of personality. *Psychological Review, 80*, 252-283.

Mischel, W. (2004). Toward an integrative science of the person. *Annual Review of Psychology, 55*, 1-22.

Mischel, W. (2009). From personality and assessment (1968) to personality science, 2009. *Journal of Research in Personality, 43*, 282-290.

Mischel, W., & Ayduk, O. (2004). Willpower in a cognitive-affective processing system: The dynamics of delay of gratification. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of Self-Regulation: Research, Theory, and Applications* (pp. 99-129). New York: The Guilford Press.

Mischel, W., & Baker, N. (1975). Cognitive appraisals and transformations in delay behavior. *Journal of Personality and Social Psychology, 31*, 254-261.

Mischel, W., & Mendoza-Denton, R. (2003). Harnessing willpower and socioemotional intelligence to enhance human agency and potential. In L. G. Aspinwall & U. M. Staudinger (Eds.), *A psychology of human strengths: Fundamental questions and future directions for a positive psychology.* (pp. 245-256). Washington, DC, US: American Psychological Association.

Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review, 102*, 246-268.

Mischel, W., Shoda, Y., & Mendoza-Denton, R. (2002). Situation-behavior profiles as a locus of consistency in personality. *Current Directions in Psychological Science, 11*, 50-54.

Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children. *Science, 244*, 933-938.

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H. L., . . . Ross, S. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences, 108*, 2693.

Mueller, C. (2009). Tiger Woods has 15 mistresses, sex tapes, and nude pics?: Something sounds fishy. *Bleacher Report* Retrieved October 8, 2010, from http://bleacherreport.com/articles/305852-tiger-woods-has-11-mistresses-sex-tapes-and-nude-pics-sounds-fishy

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*, 247-259.

Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology, 74*, 774-789.

Ochsner, K. N., & Gross, J. J. (2004). Thinking makes it so: A social cognitive neuroscience approach to emotion regulation. In R. F. Baumeister & K. D. Vohs (Eds.), *Handbook of Self-Regulation* (pp. 229-255). New York: The Guilford Press.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology, 51*, 768-774.

Paulhus, D. L. (1991). Measurement and control of response bias. In J. P. Robinson, P. R. Shaver & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes. Measures of social psychological attitudes, Vol. 1*. (pp. 17-59). San Diego, CA: Academic Press.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks: Sage.

Robbins, R. N., & Bryan, A. (2004). Relationships Between Future Orientation, Impulsive Sensation Seeking, and Risk Behavior Among Adjudicated Adolescents. *Journal of Adolescent Research, 19*, 428-445.

Roberts, B. W. (2007). Contextualizing personality psychology. *Journal of Personality, 75*, 1071-1082.

Ross, L., & Nisbett, R. E. (1991). *The person and the situation: Perspectives of social psychology*. Philadelphia, PA: Temple University Press.

Shoda, Y., Mischel, W., & Wright, J. C. (1994). lntra-individual stability in the organization and patterning of behavior: Incorporating psychological situations into the idiographic analysis of personality. *Journal of Personality and Social Psychology, 67*, 674-687.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.

Surowiecki, J. (2009). Branded a cheat. *The New Yorker*. Retrieved March 13, 2010, from http://www.newyorker.com/talk/financial/2009/12/21/091221ta_talk_surowiecki

Tanenhaus, S. (2009). Tiger Woods and the perils of modern celebrity. *The New York Times.* Retrieved March 13, 2010, from http://www.nytimes.com/2009/12/13/weekinreview/13tanenhaus.html

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*, 271-322.

Trope, Y., & Liberman, N. (2003). Temporal construal. *Psychological Review, 110*, 403-421.

Tsukayama, E., Toomey, S. L., Faith, M. S., & Duckworth, A. L. (2010). Self-control as a protective factor against overweight status in the transition from childhood to adolescence. *Archives of Pediatrics & Adolescent Medicine, 164*, 631-635.

Weber, E. U., Blais, A.-R. e., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. *Journal of Behavioral Decision Making, 15*, 263-290.

Whiteside, S. P., & Lynam, D. R. (2001). The Five Factor Model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*, 669-689.

Wilde, O. (1893). *Lady Windermere's Fan*. New York: G. P. Putnam's Sons.

Woods, T. (2009). Tiger Woods taking hiatus from golf. *TigerWoods.com.* Retrieved March 15, 2010, from http://web.tigerwoods.com/news/article/200912117801012/news/

Woods, T. (2010). Transcript: Tiger's public statement. *TigerWoods.com.* Retrieved March 15, 2010, from http://web.tigerwoods.com/news/article/201002198096934/news/

Appendix

Domain-Specific Impulsivity Scale Instructions

Domain-Specific Impulsivity Scale Instructions in Study 1a

Please answer the following items as they apply to you. On a scale from 1 to 5—ranging from 1 being "Very unlikely" to 5 being "Very likely"—please indicate the **likelihood of engaging in the following**:

1	2	3	4	5
Very unlikely	Unlikely	Somewhat likely	Likely	Very Likely

Revised Domain-Specific Impulsivity Scale Instructions in Studies 1b and 2

On the following scale, please rate **how often you do the following activities**:

1	2	3	4	5
Never	Rarely	Sometimes	Often	Very Often

Domain-Specific Impulsivity Scale Instructions for Temptation and Perceived Harm Scales in Study 2

How much would you enjoy the following activities *if there were no long-term consequences for yourself or anyone else*? That is, how attracted are you to these activities regardless of how harmful you might think they are. On the following scale, **please rate how tempted you would be to do the following activities**:

1	2	3	4	5
Not tempted at all	|	Moderately tempted	|	Very tempted
	Somewhat tempted		Tempted	

How important is it to you to *avoid* the following behaviors? That is, how harmful to yourself or others do you think the following behaviors are? On the following scale, **please rate how bad you think the following activities are**:

1	2	3	4	5
Not bad at all	|	Moderately bad	|	Very bad
	Somewhat bad		Bad	

Table 1

Factor Loadings, Subscale Corrected Item-Total Correlations, and Subscale Alphas for Six-Factor Solution with Orthogonal Varimax Rotation for the Domain-Specific Impulsivity Scale in Study 1a

Item	Factor loading 1	2	3	4	5	6	Item-total *r*	Subscale α
Work								.91
Procrastinating	**.80**	.05	.00	.14	.06	.07	.69	
Doing my work at the last minute	**.76**	.02	.05	.09	-.01	.08	.63	
Wasting time in general	**.76**	.13	-.01	.18	.22	.05	.76	
Letting responsibilities pile up	**.73**	.19	.14	.06	.09	.11	.70	
Sitting around when I have work to do	**.72**	.12	.05	.14	.33	.09	.77	
Being lazy when I have something to do	**.69**	.12	.06	.16	.33	.04	.75	
Being inactive when I have work to do	**.65**	.12	.04	.11	**.49**	.02	.74	
Giving in to distractions	**.64**	.16	-.01	.17	.12	.10	.66	
Giving up when I get bored	.39	.35	-.01	.05	.25	.07	.55	
Giving up when I get tired	.32	.34	-.01	.15	.26	.11	.51	
Giving up when I am frustrated	.31	**.43**	-.04	.14	.26	.07	.53	
Giving up when I encounter problems	.18	**.47**	.00	.13	.33	.19	.45	

Relationship								.85
Getting angry easily	.05	**.67**	.05	-.08	.05	.03	.59	
Losing my temper	.08	**.62**	.05	-.05	.01	-.08	.53	
Being overly emotional	.00	**.61**	-.06	.10	.04	.25	.57	
Behaving inappropriately when I am emotional	.15	**.58**	-.02	.06	.01	.13	.54	
Saying things I later regret	.14	**.57**	.04	.15	-.05	.12	.56	
Speaking before thinking	.18	**.57**	.08	.16	-.01	.11	.56	
Telling secrets	-.08	**.55**	.15	.10	.07	.00	.52	
Interrupting people	.00	**.50**	.14	.16	.02	.15	.51	
Breaking promises	.05	**.49**	.15	.03	.16	.02	.46	
Lying	.14	**.49**	.20	.06	.05	.01	.49	
Being greedy	.01	**.48**	.14	.06	.09	.16	.49	
Envying Others	.12	**.47**	.10	.11	.02	.25	.50	
Drug								.88
Drinking alcohol in general	.22	.04	**.82**	.09	-.16	.07	.75	
Drinking beer	.16	.02	**.81**	-.02	-.10	-.09	.75	
Drinking hard liquor	.09	.14	**.79**	.03	-.10	.10	.73	
Binge drinking	.09	.12	**.74**	-.07	-.07	.04	.71	
Smoking in general	-.10	.15	**.64**	-.08	.28	.11	.60	
Drinking wine	.06	.05	**.60**	.03	-.18	.19	.56	
Doing marijuana	.05	.18	**.59**	-.10	.23	-.06	.57	
Smoking cigarettes	-.18	.14	**.54**	-.09	.27	.10	.51	
Smoking cigars	-.17	.08	**.43**	-.09	.07	-.10	.38	

Food								.85
Eating junk food	.23	.10	.03	**.74**	.18	-.03	.71	
Eating snacks	.27	.08	-.06	**.67**	.08	.05	.67	
Eating dessert	.00	.10	-.15	**.67**	.01	.13	.61	
Eating candy	.09	.07	-.08	**.66**	.09	.13	.62	
Eating chips and other salty snacks	.19	.16	.03	**.64**	.20	.00	.62	
Eating chocolate	-.01	.02	-.09	**.59**	.03	.15	.51	
Eating fried food	.11	.18	.12	**.55**	.23	-.17	.48	
Eating more than I should	.31	.12	.03	**.41**	.01	.25	.48	
Eating when I am not hungry	.26	.26	-.03	.38	-.02	.33	.46	
Exercise								.95
Being inactive instead of working out	.28	.12	.02	.20	**.80**	.16	.90	
Being inactive instead of doing aerobic exercise	.32	.10	-.03	.21	**.77**	.16	.88	
Being sedentary instead of exercising	.32	.11	-.01	.18	**.76**	.13	.87	
Staying home instead of going to the gym	.29	.09	.01	.17	**.75**	.14	.85	
Finance								.91
Buying things when I don't really need them	.09	.14	.04	.09	.19	**.81**	.81	
Buying too many things	.15	.22	.07	.14	.12	**.79**	.82	
Buying things on impulse	.12	.29	.06	.06	.13	**.73**	.77	
Spending too much money	.11	.29	.11	.14	.13	**.70**	.76	

Note. Factor loadings .40 and greater are shown in bold.

Table 2

DSIS Subscale and Self-Control Scale Means, Standard Deviations, and Intercorrelations in Study 1a

			Correlations						
Measure	*M*	*SD*	1	2	3	4	5	6	7
1. Work	3.18	0.73	-						
2. Relationship	2.47	0.60	.39***	-					
3. Drug	2.32	0.87	.13*	.25***	-				
4. Food	3.19	0.75	.46***	.31***	-.01	-			
5. Exercise	3.11	1.11	.58***	.26***	.04	.39***	-		
6. Finance	2.77	0.99	.36***	.42***	.16**	.32***	.35***	-	
7. Self-Control Scale	3.01	0.62	**-.64*** **	**-.42*** **	**-.34*** **	**-.26*** **	**-.40*** **	**-.31*** **	-
8. GPA[a]	3.32	0.35	**-.17***	-.09	.07	-.12	-.03	-.06	.28***
9. Social Relations	4.04	0.70	-.08	**-.17****	.05	.02	-.06	.00	.12*
10. Health	3.59	0.87	-.35***	-.26***	-.06	**-.26*** **	**-.52*** **	-.19**	.40***
11. Urgency	2.71	0.71	.31***	**.63*** **	**.27*** **	**.13***	.22***	**.33*** **	-.55***
12. (Lack of) Premeditation	3.42	0.73	.08	**.17****	.29***	-.01	-.06	**.16****	-.41***
13. (Lack of) Perseverance	3.44	0.64	**.46*** **	.14*	.07	.15*	**.22*** **	.17**	-.57***
14. Sensation Seeking	3.19	0.83	.03	-.02	**.28*** **	-.07	-.19**	-.08	-.19**

Note. DSIS = Domain-Specific Impulsivity Scale. Correlations shown in bold were predicted to be significant.

[a]The number of cases for GPA was reduced to 188 because the freshmen in this study did not yet have a college GPA.

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

Table 3

Factor Loadings, Subscale Corrected Item-Total Correlations, and Subscale Alphas for Confirmatory Six-Factor Model of the Domain-Specific Impulsivity Scale in Study 1b

Item	Factor loading 1	2	3	4	5	6	Item-total *r*	Subscale α
Work								.92
Putting off work that needs to get done	**.84**	.00	.00	.00	.00	.00	.79	
Procrastinating	**.80**	.00	.00	.00	.00	.00	.74	
Letting responsibilities pile up	**.77**	.00	.00	.00	.00	.00	.72	
Doing nothing when I have work to do	**.77**	.00	.00	.00	.00	.00	.73	
Wasting time	**.77**	.00	.00	.00	.00	.00	.73	
Delaying the start of big projects	**.76**	.00	.00	.00	.00	.00	.72	
Doing my work at the last minute	**.76**	.00	.00	.00	.00	.00	.71	
Getting distracted from my work	**.72**	.00	.00	.00	.00	.00	.69	
Quitting when I am frustrated	**.57**	.00	.00	.00	.00	.00	.60	
Giving up when I encounter problems	**.55**	.00	.00	.00	.00	.00	.57	
Quitting when I get bored	**.52**	.00	.00	.00	.00	.00	.54	
Stopping my work when I get tired	**.46**	.00	.00	.00	.00	.00	.46	

Food								.86
Snacking on junk food	.00	**.84**	.00	.00	.00	.00	.76	
Eating snacks	.00	**.74**	.00	.00	.00	.00	.68	
Consuming more food than I should	.00	**.70**	.00	.00	.00	.00	.62	
Eating when I am not hungry	.00	**.69**	.00	.00	.00	.00	.61	
Eating chips and other salty snacks	.00	**.66**	.00	.00	.00	.00	.58	
Eating candy	.00	**.63**	.00	.00	.00	.00	.61	
Eating chocolate	.00	**.49**	.00	.00	.00	.00	.48	
Having dessert	.00	**.49**	.00	.00	.00	.00	.49	
Eating fried food	.00	**.49**	.00	.00	.00	.00	.42	
Finance								.91
Purchasing things when I don't really need	.00	.00	**.85**	.00	.00	.00	.78	
Buying a lot of things	.00	.00	**.84**	.00	.00	.00	.79	
Buying things I hadn’t planned to buy	.00	.00	**.83**	.00	.00	.00	.77	
Buying things on impulse	.00	.00	**.81**	.00	.00	.00	.77	
Spending a lot of money	.00	.00	**.77**	.00	.00	.00	.74	
Spending rather than saving my money	.00	.00	**.67**	.00	.00	.00	.65	

Relationship								.80
Complaining about my problems	.00	.00	.00	**.59**	.00	.00	.52	
Gossiping	.00	.00	.00	**.57**	.00	.00	.49	
Telling another person's secret	.00	.00	.00	**.55**	.00	.00	.49	
Losing my temper	.00	.00	.00	**.54**	.00	.00	.50	
Getting angry	.00	.00	.00	**.54**	.00	.00	.49	
Taking more than my fair share[a]	.00	.00	.00	**.52**	.00	.00	.44	
Holding a grudge	.00	.00	.00	**.51**	.00	.00	.44	
Breaking promises	.00	.00	.00	**.48**	.00	.00	.40	
Speaking before thinking	.00	.00	.00	**.46**	.00	.00	.42	
Lying	.00	.00	.00	**.45**	.00	.00	.39	
Interrupting people when they are talking	.00	.00	.00	**.45**	.00	.00	.40	
Drug								.78
Getting drunk	.00	.00	.00	.00	**.90**	.00	.74	
Binge drinking	.00	.00	.00	.00	**.78**	.00	.65	
Drinking hard liquor	.00	.00	.00	.00	**.68**	.00	.58	
Drinking beer	.00	.00	.00	.00	**.62**	.00	.56	
Drinking wine	.00	.00	.00	.00	**.51**	.00	.39	
Getting high on drugs	.00	.00	.00	.00	.37	.00	.43	
Smoking marijuana	.00	.00	.00	.00	.35	.00	.40	
Smoking cigarettes	.00	.00	.00	.00	.32	.00	.31	
Smoking cigars	.00	.00	.00	.00	.25	.00	.26	

Exercise								.90
Avoiding physical exercise	.00	.00	.00	.00	.00	**.92**	.84	
Remaining physically inactive	.00	.00	.00	.00	.00	**.87**	.82	
Avoiding working out[b]	.00	.00	.00	.00	.00	**.83**	.76	
Being sedentary	.00	.00	.00	.00	.00	**.70**	.66	

Note. Factor loadings .40 and greater are shown in bold. All factor loadings were significant at $p < .001$.

[a]The full item was "Taking more than my fair share (i.e., being greedy)." [b]The full item was "Avoiding working out (e.g., jogging, going to the gym, etc.)."

Table 4

DSIS Subscale and Self-Control Scale Means, Standard Deviations, and Intercorrelations in Study 1b

			Correlations						
Measure	*M*	*SD*	1	2	3	4	5	6	7
1. Work	2.97	0.71	-						
2. Relationship	2.43	0.49	.47***	-					
3. Drug	1.65	0.56	.12***	.08**	-				
4. Food	2.98	0.71	.31***	.35***	-.06*	-			
5. Exercise	3.07	1.00	.47***	.29***	.02	.41***	-		
6. Finance	2.64	0.79	.40***	.42***	.12***	.31***	.24***	-	
7. Self-Control Scale	3.27	0.65	**-.69*** **	**-.51*** **	**-.26*** **	**-.38*** **	**-.46*** **	**-.44*** **	-
8. BMI[a]	25.83	6.13	.11***	.09**	-.10***	**.38*** **	**.38*** **	.15***	-.23***

Note. DSIS = Domain-Specific Impulsivity Scale. Correlations shown in bold were predicted to be significant.

[a]BMI = Body Mass Index. These analyses are based on the 1,436 cases that reported height and weight information.

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

Table 5

Mean, Standard Deviations, and Intercorrelations for the DSIS-B and Self-Control Scale, DSIS-T, and DSIS-H in Study 2

Measure			Correlations					
DSIS-B Subscale	*M*	*SD*	1	2	3	4	5	6
1. Work	3.04	0.66	-					
2. Relationship	2.50	0.46	.44***	-				
3. Drug	1.92	0.67	.09	.17**	-			
4. Food	3.06	0.61	.41***	.37***	-.04	-		
5. Exercise	2.77	0.90	.48***	.30***	-.03	.32***	-	
6. Finance	2.63	0.73	.32***	.32***	.24***	.28***	.13*	-
Self-Control Scale	3.21	0.59	-.69***	-.52***	-.34***	-.32***	-.40***	-.37***
DSIS-T Subscale			1	2	3	4	5	6
1. Work	3.05	0.93	-					
2. Relationship	2.25	0.75	.56***	-				
3. Drug	2.16	0.97	.31***	.35***	-			
4. Food	3.28	0.92	.50***	.42***	.30***	-		
5. Exercise	2.59	1.14	.60***	.42***	.14*	.44***	-	
6. Finance	3.19	1.14	.54***	.43***	.43***	.50***	.28***	-

DSIS-H Subscale			1	2	3	4	5	6
1. Work	3.33	0.72	-					
2. Relationship	3.39	0.64	.60***	-				
3. Drug	3.25	0.91	.41***	.32***	-			
4. Food	2.53	0.85	.43***	.45***	.33***	-		
5. Exercise	3.41	0.85	.60***	.49***	.28***	.54***	-	
6. Finance	3.04	0.75	.60***	.53***	.37***	.55***	.48***	-

Note. DSIS = Domain-Specific Impulsivity Scale. -B = Behavior. -T = Temptation. -H = Perceived harm

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

Table 6

Summary of Hierarchical Linear Models Predicting Domain-Specific Impulsive Behavior in Study 2

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed components					
Intercept	2.65 (0.02)	2.65 (0.02)	2.65 (0.02)	2.65 (0.02)	2.65 (0.02)
Temptation[a]		0.58 (0.02)		0.53 (0.02)	0.53 (0.02)
Perceived harm[a]			-.35 (0.03)	-0.10 (0.02)	-0.11 (0.02)
Self-control[b]					-0.49 (0.02)
Self-control x Temptation[b]					-0.08 (0.03)
Self-control x Perceived harm[b]					-0.19 (0.03)
Random components					
Between-individual variance					
Intercept, ζ_0	.08	.13	.10	.13	.05
Temptation slope, ζ_1		.04		.05	.05
Perceived-harm slope, ζ_2			.10	.03	.02
Within-individual variance, ε	.54	.23	.04	.22	.22

Note. All of the fixed components and between-individual variance components were significant at $p < .001$, except for the Self-control x Temptation fixed component in Model 5 ($p < .05$) and the variance component of the perceived-harm slope in Models 4 ($p < .05$) and 5 (ns).

[a]Variable was individual-mean centered. [b]Self-control was between-individual grand-mean centered.

Table 7

Group Means on the DSIS-T Subscales in Study 3

	Subscale (Domain)					
Group	Work	Food	Finance	Drug	Exercise	*n*
			DSIS-T			
Work	3.60[a]	3.42	3.28	2.23	2.87	152
Food	3.06	3.64[a]	3.41	2.17	2.95	61
Finance	2.96	3.45	3.66[a]	2.25	2.54	102
Drug	2.92	3.19	3.33	2.88[a]	2.41	78
Exercise	3.26	3.54	3.72	1.97	3.61[a]	26
All	3.22	3.42	3.43	2.33	2.76	419

Note. DSIS-T = Domain-Specific Impulsivity Scale - Temptation.

[a]Mean is significantly higher ($p < .05$) than the mean of the rest of the sample in this domain.

Table 8

Group Differences in DSIS-T Subscales in Study 3

	Target Group		All Other Groups		
Measure	*M*	*SD*	*M*	*SD*	*d*
DSIS-T Subscale					
Work	3.60	0.79	3.00	0.87	.72***
Food	3.64	0.89	3.39	0.91	.28*
Finance	3.66	1.06	3.35	1.14	.27*
Drug	2.88	0.79	2.20	0.95	.74***
Exercise	3.61	1.01	2.71	1.05	.86***

Note. DSIS-T = Domain-Specific Impulsivity Scale - Temptation.

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

Figure Caption

Figure 1. Illustration of model that explains between-individual (1a) and within-individual (1b) variance in impulsive behavior. OIB = Overall Impulsive Behavior. DGSC = Domain-General Self-Control. DSIB = Domain-Specific Impulsive Behavior. DST = Domain-Specific Temptation.

Figure 2. Mean Temptation by domain and subgroups. Error bars represent standard errors.

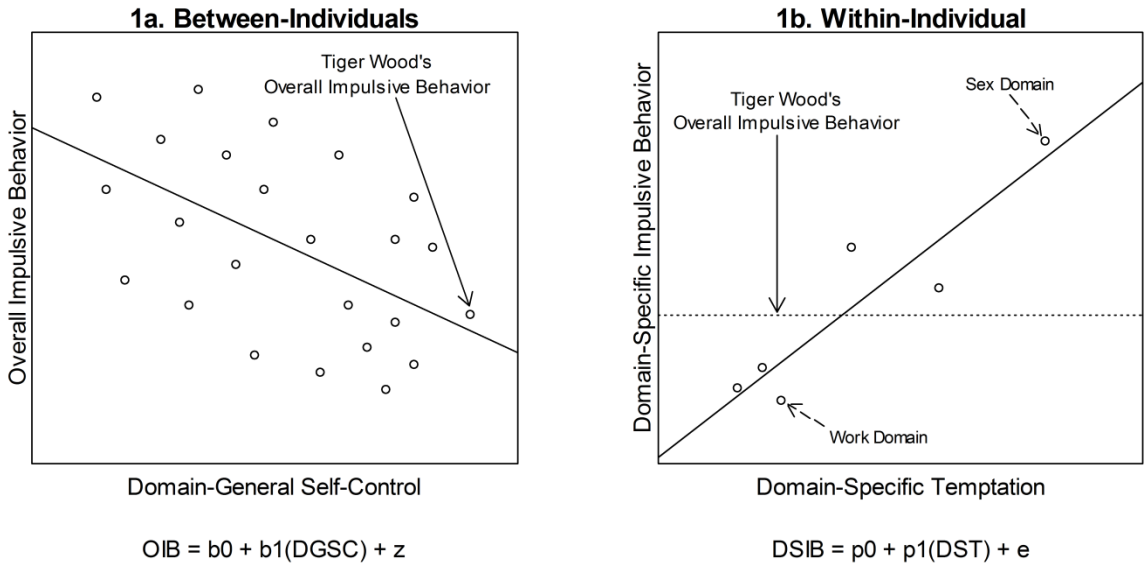

Figure 1. Illustration of model that explains between-individual (1a) and within-individual (1b) variance in impulsive behavior.

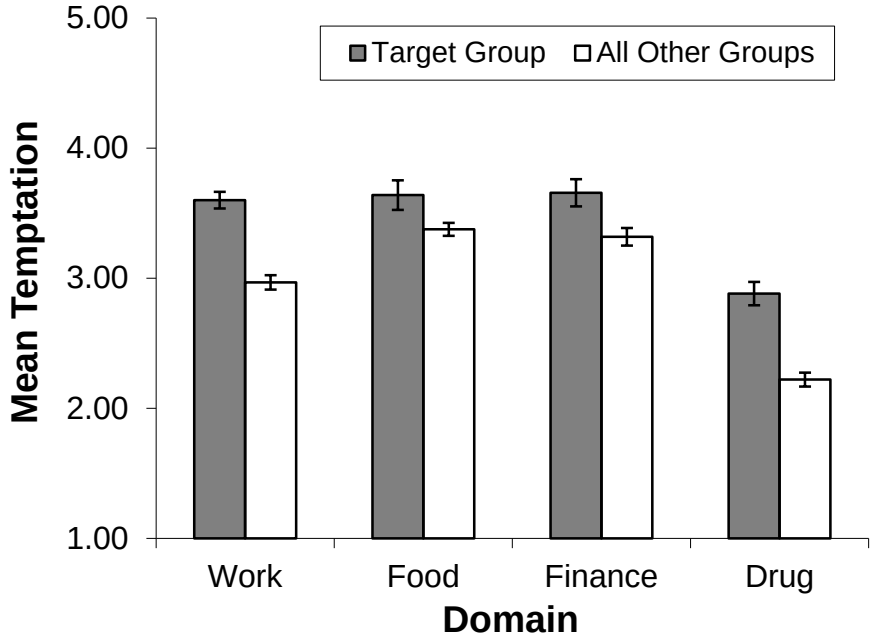

Figure 2. Mean Temptation by domain and subgroups. Error bars represent standard errors.

Chapter 2: Domain-Specific Temporal Discounting and Temptation

This chapter originally appeared as Tsukayama, E., & Duckworth, A. L. (2010) Domain-specific temporal discounting and temptation. *Judgment and Decision Making*, 5, 72-82.
According to the Society for Judgment and Decision Making, copyright permissions for articles in *Judgment and Decision Making* remain with the author.

Abstract

In this investigation, we test whether temporal discounting is domain-specific (i.e., compared to other people, can an individual have a relatively high discount rate for one type of reward but a relatively low discount rate for another?) and examine whether individual differences in the types of rewards one finds tempting explain domain-specificity in discount rates. Adults discounted delayed rewards they found particularly tempting (defined as the visceral attraction to and enjoyment of a reward) more steeply than did adults who did not find the rewards as tempting, contrary to what might be expected from the magnitude effect. Furthermore, we found significant group by domain interactions (e.g., chip lovers who do not like beer have relatively high discount rates for chips and relatively low discount rates for beer, whereas beer lovers who do not like chips showed the opposite pattern). These results suggest that domain-specificity in temptation partially accounts for corresponding domain-specificity in temporal discounting.

Key words: temporal discounting, time preference, intertemporal choice, domain-specific, temptation

Domain-specific temporal discounting and temptation

1 Introduction

Temporal discounting refers to the tendency to discount the subjective value of future goods as a function of the delay to receiving them. Generally, people prefer not to wait for rewards; however, the degree to which delayed rewards are discounted varies across individuals. Most research on temporal discounting has examined temporal discounting of monetary rewards (Frederick, Loewenstein, & O'Donoghue, 2002). In this study, we test whether temporal discounting is domain-specific (i.e., compared to other people, can an individual have a relatively high discount rate for one type of reward but a relatively low discount rate for another?). Moreover, we examine whether individual differences in the types of rewards one finds tempting explain domain-specificity in discount rates.

According to the normative model of intertemporal choice, utility from different types of rewards should be discounted at the same rate. Otherwise, discounting exchangeable goods at different rates would lead to preference reversals. Chapman (1996) showed that discount rates were domain-specific and tested a utility function explanation for domain-specificity. According to the utility function explanation, domain-specific discount rates may be due to individual differences in the relative valuation of goods in different domains combined with the magnitude effect, where smaller outcomes are discounted more steeply than larger outcomes (Thaler, 1981). For instance, a person may discount money more steeply than she discounts health because she values health (the larger outcome) more than she values money (the smaller outcome). Chapman ruled out the utility function explanation by showing that domain-

specificity persisted even after matching outcomes in utility. She concluded that "important topics for future research are other possible causes of this effect" (p. 787).

We propose that individuals have steeper discount rates for rewards that they desire and enjoy more. Specifically, we hypothesize that temptation—defined as the visceral attraction to and enjoyment of a reward, regardless of the associated harm—increases the tendency to choose smaller-sooner rewards over larger-later rewards.[14] For instance, if someone derives tremendous gratification from eating chocolate, then she would require a larger amount of delayed chocolate to match the subjective value of the immediate amount. This prediction is consistent with dual-process models that posit a "hot" emotional system that is mainly influenced by immediate considerations, and a "cool" deliberative system that is influenced by both immediate and long-term considerations (e.g., Loewenstein & O'Donoghue, 2007; Metcalfe & Mischel, 1999). The beta-delta preference model formally represents these processes through a quasi-hyperbolic discount function composed of a beta parameter that makes a sharp distinction between the present and future and a delta parameter that discounts at a constant rate across time (Laibson, 1997; McClure, Laibson, Loewenstein, & Cohen, 2004). Steep discount rates, in this view, arise from relatively high activation of the hot system represented by the beta parameter. To continue our example, the prospect of an immediately consumable chocolate donut would disproportionately activate the chocolate lover's hot system, which would increase the value of the immediate option and lead to steeper discounting.

[14] How does temptation differ from utility? Utility is a summary measure which reflects the achievement of *all* the goals an individual holds. Temptation affects utility, but so do judgments of associated harm and other factors (e.g., when assessing the utility of drinking wine, one might consider the beneficial antioxidant effects).

In support of our hypothesis, addicts and substance users have steeper discount rates for their favored addictions than for money (Bickel, Odum, & Madden, 1999; Coffey, Gudleski, Saladin, & Brady, 2003; Madden, Petry, Badger, & Bickel, 1997; Petry, 2001).[15] Specifically, these studies have found evidence for domain effects (e.g., discount rates in the alcohol domain are higher than in the money domain) and group effects (e.g., alcoholics have higher discount rates than non-alcoholics), but they do not report effects for an interaction.[16] These domain and group effects are consistent with but do not provide sufficiently convincing evidence for our hypothesis. It is possible, for example, that alcohol is discounted more steeply than money by both alcoholics and non-alcoholics (i.e., a domain effect), and alcoholics may just have steeper discount rates in general than non-alcoholics (i.e., a group effect).

A group by domain interaction would present strong support for our hypothesis that temptation increases discounting. Specifically, we predict that individuals who are tempted within one domain (e.g., alcohol) will have relatively high discount rates in that domain (relative to both themselves across domains and with other groups within that domain) after accounting for domain and group differences. In the current study, we predict that a) discount rate correlations will be stronger within a domain than between domains, b) individuals who are tempted by a reward will have steeper discount rates for

[15] Except for Petry's (2001) study, the discounted substance was equal in value with the monetary reward in each study. In Petry's study, the discounted substance (alcohol) was roughly equal in value to the monetary rewards used (15 bottles of alcohol vs. $100 and 150 bottles of alcohol vs. $1000).

[16] What we refer to as *domain effect* is distinct from *domain-specificity*. By *domain-specificity* we refer to the idea that "compared to other people, an individual can have a relatively high discount rate for one type of reward but a relatively low discount rate for another". In contrast, we use the term *domain effect* to refer to the idea that the mean discount rate in one domain is higher than in another. Although we report domain effects in one section of the results (titled "Domain effects"), the focus in this paper is on domain-specificity.

that reward compared to individuals who are less or not tempted by the reward, and c) individuals will have steeper discount rates for rewards that they find tempting compared to rewards that they do not find as tempting.

2 *Method*

2.1 Participants

Five hundred nineteen undergraduate students enrolled in psychology courses at a large, private university in the Northeast participated in this study for research experience credit (M = 20.9 years, SD = 1.9; 66% were women). We removed forty-eight outliers who took longer than 12 minutes (i.e., $z > 2.58$) to finish the temporal discounting tasks,[17] resulting in a final sample of N = 471. Approximately 58% of the participants were Caucasian, 26% were Asian, 7% were Latino, 5% were Black, and 4% were of other ethnic backgrounds.

2.2 Procedure

From March 2008 to May 2009, we posted this study online and advertised it as a survey of personality and behavior on the psychology department's subject pool website. Participants first filled out an online questionnaire asking how tempting they found certain behaviors.[18] They were then directed to another website to complete the temporal

[17] The distribution of time spent on the temporal discounting task was extremely right-skewed: absolute skew index of 16.71; 3.0 is considered extreme (Kline, 2005). As a result, there were only positive outliers and the number of outliers was higher than would be expected from a normal distribution. According to the website timestamps, several of the participants took over an hour to complete the task. Although this may suggest that they were painstakingly thoughtful in responding, we think that it is more like that they were not being attentive and multitasking, or that some glitch occurred that disrupted the timestamp. Because either might be problematic, we decided to remove outliers. We chose 12 minutes because it corresponded to a z-value of 2.58, which in turn corresponds to a two-tailed p-value of .01. Absolute differences between the discount rate correlations from the full sample and the sample with outliers removed ranged from .01 to .03, average = .02; mean differences ranged from .00 to .01, average = .00; and there were no differences (i.e., above .005) in standard deviations.

[18] Participants also filled out questionnaires asking how often they engaged in and how harmful they deemed those behaviors. Those questionnaires were used for another study and are not discussed further.

discounting measures. Finally, participants completed a demographics questionnaire and were forwarded to a debriefing page.

2.3 Material

2.3.1 Temptation

Participants were asked to "rate how tempted you would be to do the following" on a 5-point scale ranging from 1 = *Not tempted at all* to 5 = *Very tempting*. To clarify our definition of temptation, we presented the following description: "How much would you enjoy the following activities *if there were no long-term consequences for yourself or anyone else*? That is, how attracted are you to these activities regardless of how harmful you might think they are." The three focal items—*Eating candy*, *Eating chips and other salty snacks*, and *Drinking beer*—were presented in a set of 51 items (see Appendix A for the questionnaire instructions and items).

2.3.2 Temporal discount rates

The instructions for the temporal discounting task were as follows:

> The purpose of this study is to examine preferences about rewards of money, chips, candy, and beer. You will be asked to choose between an amount that can be received immediately and another amount that can be received after a delay. You will not actually receive the rewards. However, please make each choice **as if it were real**.
>
> When making your choices, please assume the following: There are no risks associated with the delayed option. In other words, you are guaranteed to receive it after the specified delay. Also, choosing the

delayed option does not mean that you will receive old goods. Delayed goods are brand new, but you will not receive them until after the delay.

Each participant made choices about four types of rewards—dollars, candy bars, bags of chips, and bottles of beer—at five delays: one week, one month, six months, one year, and three years. For each reward, participants made four choices at each delay for a total of eighty choices (four rewards x five delays x four choices). We randomized the order of rewards for each participant. Likewise, within each type of reward, we randomized the order of delays.

Within each reward by delay set (e.g., dollars in one month), a staircase method was used to converge on participants' indifference points (the amount of immediate reward equal in subjective value to the delayed reward). The first choice was between an immediate reward of eight units (i.e., dollars, candy bars, bags of chips, or bottles of beer) and a delayed reward of sixteen units. In the three subsequent choices, the delayed reward was held constant, but the immediate amount varied depending on the preceding choice. If the participant selected the immediate reward, the next immediate reward was decreased. However, if the participant selected the delayed reward, the next immediate reward was increased. The size of the adjustment (the increase or decrease in the immediate reward) decreased by fifty percent after every choice: the first adjustment was four units, the second was two, and the last was one. For example, if a participant chose sixteen dollars in a month over eight dollars immediately, the next choice would be between twelve dollars immediately and sixteen dollars in one month. If the participant then chose twelve dollars immediately, the next choice would be between ten dollars immediately and sixteen dollars in one month. See Appendix B for a flowchart of

possible choices. After the discounting task, participants were presented with the following question for each type of reward:

Was it difficult to make decisions about [reward]?

- Not at all
- Somewhat, but I eventually came to a decision that felt right
- Very much so, because I do not like [reward] and I did not have strong preferences between immediate and delayed options
- Other, please specify:

2.4 Data analyses

2.4.1 Discount rate computation

An indifference point is the amount of immediate reward that is equal in subjective value to the delayed reward. We computed indifference points as the average of the last immediate reward that was selected and the last immediate reward that was rejected. In the two (out of sixteen) possible circumstances that preferences did not change—always selecting the immediate reward or always selecting the delayed reward—we computed the indifference point as the average of the last immediate amount (either $1 or $15) and the limit ($0 or $16). That is, if the participant always selected the immediate reward, we computed the indifference point as $0.50, and if the participant always selected the delayed reward, we computed the indifference point as $15.50. Thus, there were 16 evenly spaced indifference points ranging from $0.50 to $15.50.

With the indifference points, we computed the area under the curve (AUTC: Myerson, Green, & Warusawitharana, 2001) measure of temporal discounting for each reward type for each participant (i.e., four AUTCs per participant). This measure of discounting does not require the data to conform to a particular model or theory and is generally less skewed than other measures of discounting (Myerson et al., 2001). To compute the AUTCs, we first set the maximum reward (16 units) and the maximum delay

(3 years) to equal one. Then, we converted the indifference points to proportions of the maximum reward, and the delays to proportions of the maximum delay. For example, if an indifference point was 14.5 units, we would divide 14.5 by 16 for a new value of .90625. With these new values, we computed the area of trapezoids using the following formula: $(x_2 - x_1)\ [\ (y_1+y_2) / 2\ ]$, where "$x_2$" and "$x_1$" are consecutive delays (with the "immediate delay" being equal to "0") and "y_1" and "y_2" are the indifference points associated with those delays (or "1" for the "immediate delay"). The AUTC is then computed by summing the area of the trapezoids (see Figure 1). Theoretically, AUTCs calculated in this manner can range from 0 to 1.0. However, because the indifference points in this study ranged from 0.5 units to 15.5 units (and not 0 to 16), the effective range of AUTCs was 0.034 to 0.969. So that higher values would indicate steeper discount rates, we reverse-scored the AUTCs (1-AUTC) to use as our measure of temporal discount rates.

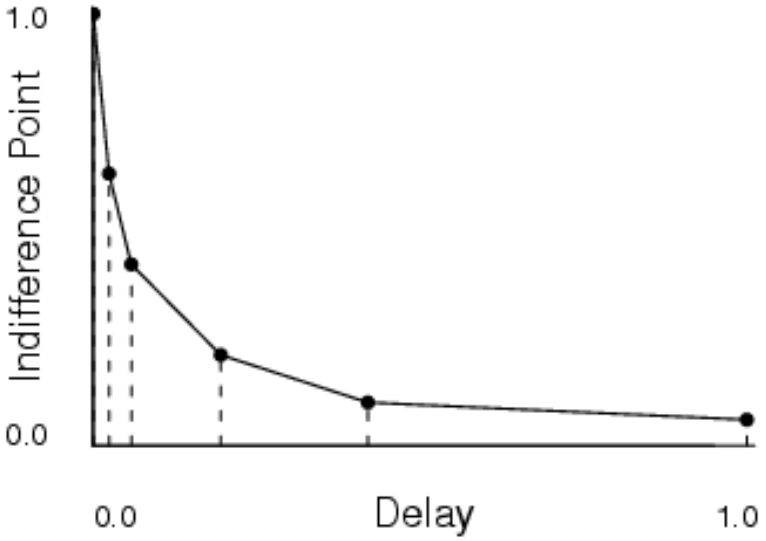

Figure 1. Illustration of the Area Under the Curve. The maximum reward and the maximum delay were set to one. We then converted the indifference points to proportions of the maximum reward, and the delays to proportions of the maximum delay.

We calculated discount rates for all participants who completed all relevant trials and who answered either "not at all" or "somewhat, but I eventually came to a decision that felt right" to the difficulty of responding question.[19] Out of 471 participants, 96% had discount rates for dollars, 86% had discount rates for candy, 77% had discount rates for chips, and 74% had discount rates for beer.

The distributions of discount rates were slightly negatively skewed (absolute values ≥ -0.93) and platykurtic (absolute values ≥ -1.04). Natural log transformations

[19] Our pilot study indicated that some participants chose to respond at random because they had a difficult time making a decision between immediate and delayed rewards that they did not like. Similarly, discounting could be flat because utility for an item is always zero. Because of these potential problems, we only retained discount rates for participants who responded "not at all" or "somewhat, but I eventually came to a decision that felt right" to the difficulty of responding question. If we included the data from participants who had a difficult time completing the task because they did not like the reward, the rho correlations between temptation ratings and the corresponding discount rates would have increased slightly on average: absolute differences ranged from .01 to .03, average = .02. Absolute differences between discount rate correlations ranged from .00 to .03, average = .02; differences in discount rate means ranged from .00 to .03, average = .01; and differences in standard deviations ranged from .00 to .02, average = .01.

(conducted before reverse-scoring the AUTCs) reduced the skew (absolute values ≥ -0.75) but exacerbated kurtosis (absolute values ≥ -1.24). Consequently, we conducted Spearman's Rho (ρ) correlations and ANOVAs on the untransformed data.[20]

2.4.2 Candylover, chiplover, and beerlover groups

In order to test our predicted group by domain interaction, we created comparison groups. We predicted that individuals who are tempted by reward x but not reward y would have relatively high discount rates for x and relatively low discount rates for y compared to individuals who are tempted by y but not x. For instance, individuals who like candy but not beer should have relatively high discount rates for candy and relatively low discount rates for beer. We labeled these individuals "candylovers" (n = 93) and operationally defined them as individuals who rated the temptation to eat candy as three or more and the temptation to drink beer as two or less on the five-point scales. We did the same for "chiplovers" (except for the chip item instead of candy; n = 84) and the opposite for "beerlovers" (i.e., individuals who rated the temptation to drink beer as three or more and the temptation to eat candy, or chips depending on the comparison, as two or less; n = 34 in both comparisons).

3 Results

3.1 Discount rate correlations

As predicted, discount rates for the two food items (candy and chips) were more strongly associated than any other pair of discount rates, and the discount rates for

[20] ANOVAs and t-tests based on large samples (about n > 30 within each group) are robust to violations of the assumption of normality because sampling distributions of means approach normality as sample size increases (Myers & Well, 1995; Tabachnick & Fidell, 2007). Although regression coefficients in general are asymptotically normally-distributed (Berry, 1993), to our knowledge there are no clear guidelines about what constitutes a large-enough sample for the coefficients of continuous predictors to be approximately normal. Consequently, we erred on the side of caution and used non-parametric rho correlations instead of Pearson product-moment correlations. Absolute differences between the rho and Pearson discount rate correlations ranged from .00 to .04, average = .02.

consumables (candy, chips, and beer) were more strongly associated with each other than with the discount rates for money. Pairwise and listwise analyses yielded similar results (correlation differences ranged from .01 to .06, average difference = .03), so listwise analyses (n = 260) are presented in Table 1. All correlations were significant at $p < .001$. The correlation between candy and chips ($\rho = .60$) was significantly larger than any other (ps < .05). In turn, the correlation between candy and beer ($\rho = .49$) was higher than the correlations between candy and money ($\rho = .34$; $z = 2.31$, $p = .02$) and beer and money ($\rho = .29$, $z = 3.14$, $p = .002$); and the correlation between chips and beer ($\rho = .47$) was higher than the correlations between chips and money ($\rho = .30$, $z = 2.56$, $p = .01$) and beer and money ($\rho = .29$, $z = 2.73$, $p = .006$).

Table 1

Means, standard deviations, and Spearman rho correlations for candy, chips, beer, and money discount rates using listwise deletion

			ρ		
Discount rate	*M*	*SD*	Candy	Chips	Beer
1. Candy	.68	.30	-		
2. Chips	.67	.32	.60	-	
3. Beer	.65	.32	.49	.47	-
4. Money	.57	.29	.34	.30	.29

Note. n = 260. All correlations were significant at $p < .001$.

3.2 Domain effects

Discount rates for money were significantly lower than discount rates for alcohol and food. A one-way repeated measures ANOVA revealed a main effect for domain, $F(2.77, 717.33) = 11.13$, $p < .001$ (see Table 1 and Figure 2). Bonferroni-corrected t-tests

indicated that money was discounted less steeply than the other rewards (*p*s < .05) but the discount rates for the other rewards did not differ from each other (*p*s > .29).

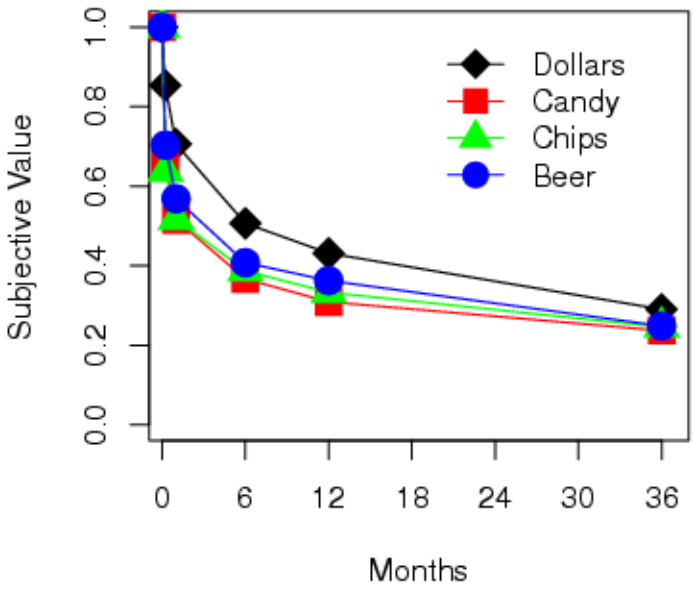

Figure 2. Temporal discounting functions for money, candy, chips, and beer using mean indifference points. Subjective value was computed as the proportion of the amount of the delayed reward. Standard errors ranged from .01 to .02. Error bars are not presented because they were barely visible.

3.3 Associations between discount rates and temptation

As expected, individuals who were more tempted by a reward tended to have steeper discount rates for that reward, ρ = .14, *p* = .008 for chips and ρ = .19, *p* < .001 for beer. Although the rho correlation for candy was not significant (ρ = .03, *ns*), trend analyses revealed significant linear effects of temptation on discount rates for candy (*F*(1,

399) = 6.08, p = .01), as well as chips (F(1, 357) = 16.00, p < .001), and beer, F(1, 343) = 16.78, p < .001.[21] Figure 3 shows these upward trends.

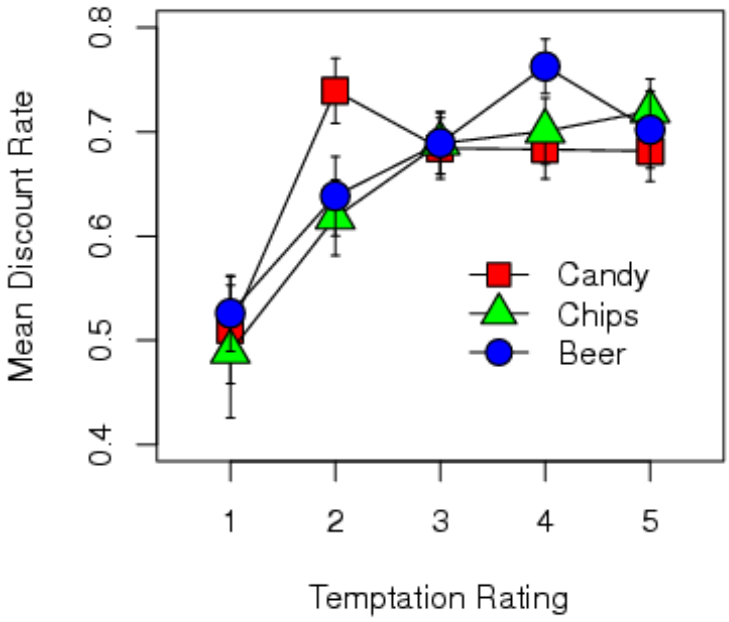

Figure 3. Mean discount rate as a function of ratings on the corresponding temptation item. Error bars represent the standard error of the mean.

3.4 Candylover-beerlover and chiplover-beerlover interactions

As predicted, individuals had steeper discount rates for rewards they found tempting than for rewards they did not. Two-way mixed-design ANOVAs with groups (either candylovers vs. beerlovers or chiplovers vs. beerlovers) as the between-individual factor and reward type (either candy and beer or chips and beer) as the within-individual factor revealed significant interaction terms: F(1, 125) = 4.83, p = .03, partial η^2 = .04, for

[21] Trend analysis is a planned comparison following an ANOVA that examines linear and higher-order polynomial trends of the dependent variable means as a function of an ordered categorical independent variable (Field, 2005; Keppel, 1991; Myers & Well, 1995; Tabachnick & Fidell, 2007).

the candylover-beerlover comparison (see Figure 4) and $F(1, 116) = 8.33$, $p = .005$, partial $\eta^2 = .07$, for the chiplover-beerlover comparison (see Figure 5). Except for the group effect in the candylover-beerlover comparison, $F(1, 125) = 6.55$, $p = .01$, partial $\eta^2 = .05$, none of the main effects were significant. Planned comparisons revealed that the candylovers and chiplovers had steeper discount rates for candy ($t(92) = 2.17$, $p = .03$, $d = .23$) and chips ($t(83) = 2.81$, $p = .006$, $d = .31$, respectively, compared to beer. Although similar analyses for beerlovers did not reveal significant differences for candy versus beer ($t(33) = -1.57$, $p = .13$, $d = -.27$, and for chips versus beer ($t(33) = -1.67$, $p = .10$, $d = -.29$ the results were in the predicted direction, and the effect sizes were larger on average than in candylover and chiplover analyses, suggesting that these analyses did not reach significance because of the relatively small sample size for beerlovers.[22]

[22] Using the observed effect sizes, power analyses revealed that beerlover sample sizes of $n = 111$ for the candy versus beer analysis and $n = 98$ for the chips versus beer analysis would be required for a power of .80 with a two-tailed alpha of .05.

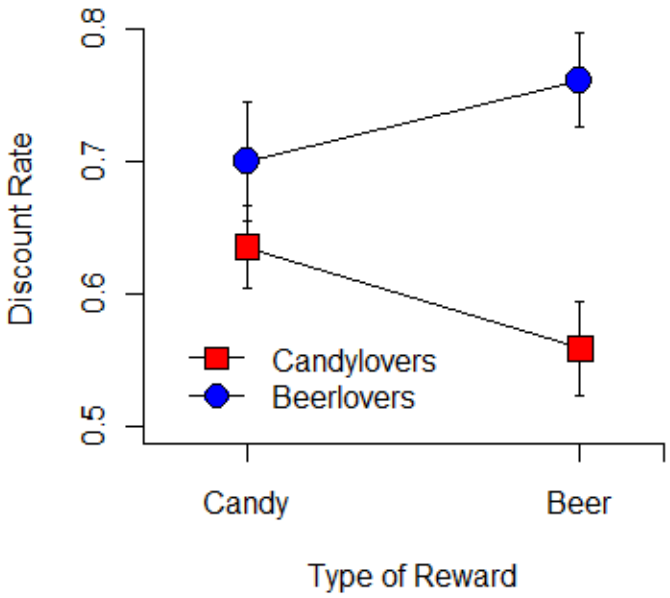

Figure 4. Mean discount rate as a function of reward type (candy or beer) and group (candylovers or beerlovers). Error bars represent the standard error of the mean.

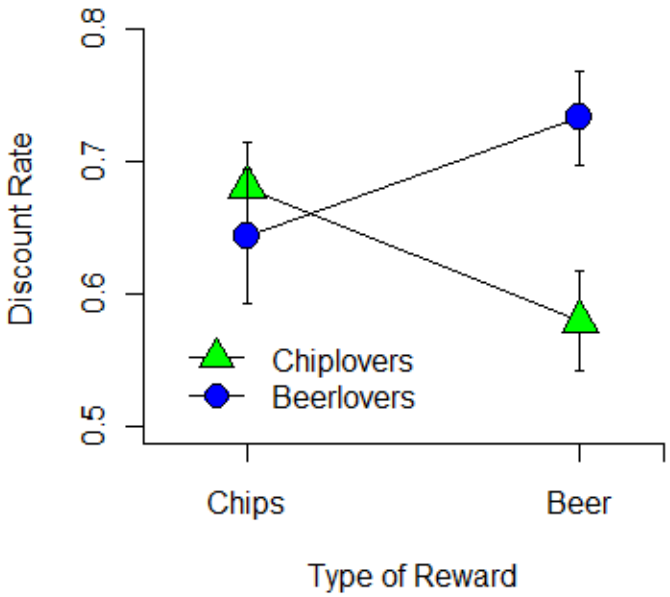

Figure 5. Mean discount rate as a function of reward type (chips or beer) and group (chiplovers or beerlovers). Error bars represent the standard error of the mean.

4 Discussion

The current investigation found empirical support for domain-specificity in temporal discounting. Discount rate correlations showed a hierarchical pattern: the correlation between food items was higher than the correlations between other items, and correlations between consumable (food and alcohol) items were larger than correlations between consumable items and money.

Nevertheless, the discount rates were all positively correlated ($\rho s \geq .29$), suggesting that there is also a domain-general aspect of temporal discounting. Which processes affect temporal discounting across domains? Time perspective is one factor that influences decisions about the present and future (Zimbardo & Boyd, 1999). Present-oriented people might have steeper discount rates in general than those with a

predominant future time perspective. It is also possible that people make domain-general decision rules (e.g., if the delay for any reward is less than a month, choose the larger reward; otherwise, choose the immediate reward), which could lead to similar discounting across domains. Another possibility is that working memory, "the ability to maintain active representations of goal-relevant information despite interference from competing or irrelevant information", is necessary to process and integrate goals and values to make decisions (Shamosh et al., 2008, p. 904). Regardless of domain, individuals with low working memory capacity may be less proficient at evaluating delayed options, and thus may default to immediate options.

Notwithstanding evidence of domain-general processes involved in discounting, individuals in our study tended to have higher discount rates for rewards that they found more tempting. This result is particularly noteworthy because it runs counter to a prediction based on the magnitude effect: the observation that discount rates are lower for more valuable rewards (Thaler, 1981). If temptation were a proxy of overall value, then there should be lower discount rates in tempting domains, not higher discount rates, as we predicted and found. The beta-delta preference model of temporal discounting (Laibson, 1997; McClure et al., 2004) provides a framework that reconciles these apparently paradoxical findings. Temptation directly affects the hot system (represented by the beta parameter), whereas temptation is only indirectly "valued" through the cool system's evaluation of the impact of temptation on the emotional system (Loewenstein & O'Donoghue, 2007). Consequently, temptation is predicted to have a disproportionate effect on the immediate option through the beta parameter, which would lead to steeper discounting. A possible explanation for the magnitude effect is that large amounts might

seem hypothetical and are thus evaluated by deliberative cognitive systems as opposed to visceral emotional systems. According to the beta-delta model, these larger amounts would then be discounted less steeply than smaller amounts that evoke the emotional system.[23]

Although we were not primarily interested in *domain effects* (i.e., the mean discount rate in one domain is higher than another), it is noteworthy that our study replicates the finding that consumable rewards are discounted more steeply than non-consumable rewards (Charlton & Fantino, 2008; Estle, Green, Myerson, & Holt, 2007; Odum, Baumann, & Rimington, 2006; Odum & Rainaud, 2003). Furthermore, it is interesting to note that the discount rates for rewards by which participants reported "not tempted at all" did not differ from the discount rate for money (all ts < 1.27; all ps > .21). One interpretation of these findings is that the people who were not tempted by a particular reward considered that reward to be essentially non-consumable.[24]

4.1 Limitations and future directions

This study had several limitations. First, we did not match rewards for utility.[25] It is possible, therefore, that we would not have found domain-specificity had we controlled for utility. Against this possibility, Chapman (1996) matched rewards for subjective value and shape of utility functions and still found domain-specificity in discount rates.

---

[23] Another possible explanation for the magnitude effect is that the ratio of two large amounts seems greater than the same ratio of small amounts (e.g., $100/$50 seems larger than $10/$5). Consequently, one may prefer $5 now over $10 in a year, but also prefer $100 in a year over $50 immediately because the ratio seems larger in the latter case. Prelec and Loewenstein (1991) call this effect "increasing proportional sensitivity". There is also some evidence to suggest that the magnitude effect is actually a number effect (Furlong & Opfer, 2009). That is, it may be the number associated with the reward and not the actual value of the reward that affects discounting (e.g., $1 is equivalent to 100 cents, but the latter may be discounted more steeply). However, the study by Furlong and Opfer (2009) examined the prisoner's dilemma and not temporal discounting. We thank an anonymous reviewer for this lead on the magnitude as number effect.

[24] We thank an anonymous reviewer for this insight.

[25] The rewards used in this study were roughly comparable in price. A large candy bar is about $1, a "personal-size" bag of chips is about a $1, and a bottle of beer is about $1-2.

Second, the small number of items used to represent domains limits our ability to generalize to other items and domains. Moreover, the focal items (candy, chips, and beer) in our study were all consumable and potentially perceived as harmful, whereas money and health are generally perceived as being unequivocally good. Future studies should include more items and domains to extend these findings.

Third, we used hypothetical rather than real rewards. While at least one study suggests that real rewards are discounted more steeply than hypothetical rewards (Kirby, 1997), several more recent studies suggest that hypothetical and real rewards are discounted similarly (Johnson & Bickel, 2002; Lagorio & Madden, 2005; Madden, Begotka, Raiff, & Kastern, 2003; Madden et al., 2004). Nevertheless, future studies are needed to replicate the current investigation using real rewards.

Fourth, the correlational design of the current investigation limits causal inference. Our conjecture that temptation drives discount rates seems more plausible than the possibility that discount rates drive temptation. However, unmeasured third-variable confounds cannot be ruled out. In an experimental study, temptation for specific rewards might be manipulated (e.g., increasing the temptation of food rewards by requiring participants to fast beforehand) and consequent effects on domain-specific discount rates observed.

Finally, when asking our participants to rate temptation, we did not distinguish between wanting (the motivation for a reward) and liking (the hedonic experience of a reward), which are dissociable processes at the neuroanatomical level (Berridge & Kringelbach, 2008; Berridge, Robinson, & Aldridge, 2009). Although wanting and liking generally tend to co-occur, it would be interesting to examine whether these two

processes have different effects on discount rates. A priori, we would predict that wanting would have a stronger effect on discounting as liking presumably exerts its effect on decision-making through wanting (e.g., I want an apple because I like apples). Indeed, the fact that drug addicts can want drugs that they do not like (Robinson & Berridge, 2000), suggests that wanting, and not liking, leads to drug abuse. Because wanting and liking are difficult, if not impossible, to dissociate at the conscious level, it is not clear to us how to test this hypothesis experimentally. Nevertheless, we see this as an important direction for future research.

4.2 Conclusion

Although prior studies have examined variation in discount rates by domain (e.g., Estle et al., 2007; Odum & Rainaud, 2003) and across individuals (e.g., Chao, Szrek, Pereira, Pauly, & Center, 2009; Ersner-Hershfield, Garton, Ballard, Samanez-Larkin, & Knutson, 2009; Kirby et al., 2002), this is the first study to our knowledge that simultaneously models and predicts both between- and within-individual differences in domain-specific temporal discount rates. In addition to corroborating Chapman's (1996) findings that temporal discounting is domain-specific, we provide a possible explanation for this phenomenon. Specifically, we show that temptation partially explains domain-specific temporal discounting: an individual may have a high discount rate for candy but a low discount rate for beer in part because she finds candy more tempting.

References

Berridge, K. C., & Kringelbach, M. L. (2008). Affective neuroscience of pleasure: Reward in humans and animals. *Psychopharmacology, 199*, 457-480.

Berridge, K. C., Robinson, T. E., & Aldridge, J. W. (2009). Dissecting components of reward: 'Liking','wanting', and learning. *Current Opinion in Pharmacology, 9*, 65-73.

Berry, W. D. (1993). *Understanding regression assumptions*. Newbury Park, CA: Sage.

Bickel, W. K., Odum, A. L., & Madden, G. J. (1999). Impulsivity and cigarette smoking: Delay discounting in current, never, and ex-smokers. *Psychopharmacology. Special Issue: Impulsivity, 146*, 447-454.

Chao, L. W., Szrek, H., Pereira, N. S., Pauly, M. V., & Center, P. S. (2009). Time preference and its relationship with age, health, and survival probability. *Judgment and Decision Making, 4*, 1-19.

Chapman, G. B. (1996). Temporal discounting and utility for health and money. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22*, 771-791.

Charlton, S. R., & Fantino, E. (2008). Commodity specific rates of temporal discounting: Does metabolic function underlie differences in rates of discounting? *Behavioural Processes, 77*, 334-342.

Coffey, S. F., Gudleski, G. D., Saladin, M. E., & Brady, K. T. (2003). Impulsivity and rapid discounting of delayed hypothetical rewards in cocaine-dependent individuals. *Experimental and Clinical Psychopharmacology, 11*, 18-25.

Ersner-Hershfield, H., Garton, M. T., Ballard, K., Samanez-Larkin, G. R., & Knutson, B. (2009). Don't stop thinking about tomorrow: Individual differences in future self-continuity account for saving. *Judgment and Decision Making, 4*, 280-286.

Estle, S. J., Green, L., Myerson, J., & Holt, D. D. (2007). Discounting of monetary and directly consumable rewards. *Psychological Science, 18*, 58-63.

Field, A. (2005). *Discovering statistics using SPSS* (2nd ed.). London: Sage Publications.

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature, 40*, 351-401.

Johnson, M. W., & Bickel, W. K. (2002). Within-subject comparison of real and hypothetical money rewards in delay discounting. *Journal of the Experimental Analysis of Behavior, 77*, 129-146.

Keppel, G. (1991). *Design and analysis: A researcher's handbook* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Kirby, K. N. (1997). Bidding on the future: Evidence against normative discounting of delayed rewards. *Journal of Experimental Psychology: General, 126*, 54-70.

Kirby, K. N., Godoy, R., Reyes-GarcÃa, V., Byron, E., Apaza, L., Leonard, W., et al. (2002). Correlates of delay-discount rates: Evidence from Tsimane' Amerindians of the Bolivian rain forest. *Journal of Economic Psychology, 23*, 291-316.

Kline, R. B. (2005). *Principles and Practice of Structural Equation Modeling* (2nd ed.). New York: Guilford.

Lagorio, C. H., & Madden, G. J. (2005). Delay discounting of real and hypothetical rewards III: Steady-state assessments, forced-choice trials, and all real rewards. *Behavioural Processes, 69*, 173-187.

Laibson, D. (1997). Golden Eggs and Hyperbolic Discounting. *The Quarterly Journal of Economics, 112*, 443-477.

Loewenstein, G., & O'Donoghue, T. (2007). The heat of the moment: Modeling interactions between affect and deliberation. Unpublished manuscript.

Madden, G. J., Begotka, A. M., Raiff, B. R., & Kastern, L. L. (2003). Delay discounting of real and hypothetical rewards. *Experimental and Clinical Psychopharmacology, 11*, 139-145.

Madden, G. J., Petry, N. M., Badger, G. J., & Bickel, W. K. (1997). Impulsive and self-control choices in opioid-dependent patients and non-drug-using control patients: Drug and monetary rewards. *Experimental and Clinical Psychopharmacology, 5*, 256-262.

Madden, G. J., Raiff, B. R., Lagorio, C. H., Begotka, A. M., Mueller, A. M., Hehli, D. J., et al. (2004). Delay discounting of potentially real and hypothetical rewards: II. Between-and within-subject comparisons. *Experimental and Clinical Psychopharmacology, 12*, 251-260.

McClure, S. M., Laibson, D. I., Loewenstein, G., & Cohen, J. D. (2004). Separate neural systems value immediate and delayed monetary rewards. *Science, 306*, 503-507.

Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review, 106*, 3-19.

Myers, J. L., & Well, A. D. (1995). *Research Design and Statistical Analysis*. Hillsdale: Lawrence Erlbaum Associates.

Myerson, J., Green, L., & Warusawitharana, M. (2001). Area under the curve as a measure of discounting. *Journal of the Experimental Analysis of Behavior, 76*, 235-243.

Odum, A. L., Baumann, A. A. L., & Rimington, D. D. (2006). Discounting of delayed hypothetical money and food: Effects of amount. *Behavioural processes, 73*, 278-284.

Odum, A. L., & Rainaud, C. P. (2003). Discounting of delayed hypothetical money, alcohol, and food. *Behavioural processes, 64*, 305-313.

Petry, N. M. (2001). Delay discounting of money and alcohol in actively using alcoholics, currently abstinent alcoholics, and controls. Psychopharmacology, 154, 243-250.

Robinson, T. E., & Berridge, K. C. (2000). The psychology and neurobiology of addiction: an incentive-sensitization view. Addiction, 95, S91-S117.

Shamosh, N. A., DeYoung, C. G., Green, A. E., Reis, D. L., Johnson, M. R., Conway, A. R. A., et al. (2008). Individual differences in delay discounting: Relation to intelligence, working memory, and anterior prefrontal cortex. *Psychological Science, 19*, 904-911.

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics (5th ed.). Boston: Allyn & Bacon.

Thaler, R. (1981). Some empirical evidence on dynamic inconsistency. *Economics Letters, 8*, 201-207.

Zimbardo, P. G., & Boyd, J. N. (1999). Putting time in perspective: A valid, reliable individual-differences metric. *Journal of Personality and Social Psychology, 77*, 1271-1288.

Chapter 3: Domain-Specific Impulsivity in School-Age Children

This chapter is under preparation as Tsukayama, E., Duckworth, A. L., & Kim, B. E. (in prep). Domain-Specific Impulsivity in School-Age Children.

Abstract

Impulsivity is a salient individual difference in children with well-established predictive validity for life outcomes. The current investigation proposes that impulsive behaviors vary systematically by domain. In a series of studies with ethnically and socioeconomically diverse samples of middle school students, we find that schoolwork-related and interpersonal-related impulsivity, as observed by teachers, parents, and the students themselves, are distinct, moderately correlated behavioral tendencies. Each demonstrates differentiated relationships with dimensions of childhood temperament, Big Five personality factors, and outcomes, such as sociometric popularity, report card grades, and classroom conduct. Implications for theoretical conceptions of impulsivity as well as for practical applications (e.g., domain-specific interventions) are discussed.

Keywords: impulsivity, self-control, domain-specificity, academic achievement

Domain-Specific Impulsivity in School-Age Children

Impulsivity is an individual difference of special interest to both psychologists and educators. Defined as the inability to regulate behavior, attention, and emotions in the service of long-term goals, impulsivity[26]—and its obverse, self-control—has held a central role in conceptions of socialization and development at least since Freud (1922). Two decades earlier, in a series of lectures entitled *Talks to Teachers*, James (1899) posited that the question of how conflicting goals were reconciled—the "compounding of our impulsions with our inhibitions" —was of central importance for both theoretical and pedagogical reasons (p. 178). The ability to regulate oneself, with decreasing reliance on others to enforce behavioral standards, is now widely recognized as a foundational skill for a wide array of developmental processes (Eisenberg et al., 2004; Kochanska, Murray, & Harlan, 2000; Mischel, Shoda, & Rodriguez, 1989).

Empirical interest in impulsivity has increased in recent years. By 2009, more than 3% of all PsycInfo articles were indexed by impulsivity or a closely-related keyword (Duckworth & Kern, 2011). Conspicuously absent from this burgeoning literature is any serious investigation of how impulsive behaviors in children might vary systematically by domain. The omission is not surprising. Contemporary temperament and personality research tends to focus on individual differences that are relatively stable across time and kinds of situations (Mischel, 2004). To an extent, viewing individual differences through a domain-general lens is justified: It is true, important, and interesting that some children are generally more impulsive than others. On the other hand, it seems equally plausible,

[26] The terms *impulsivity* and *self-control* are used differently by different authors (Duckworth & Kern, 2011). Our definition of the term self-control corresponds to Rothbart and Rueda's (2005) and Eisenberg et al.'s (2004) concept *effortful control* and emphasizes the volitional, effortful performance of subdominant responses rather than dominant, immediately rewarding responses in order to achieve long-term reward.

important, and interesting that, for instance, some children particularly struggle with controlling their temper, while others are especially prone to daydreaming during class.

Mischel and colleagues have argued persuasively against considering situation-specific variance in behavior as merely "noise" or "error" that obscures domain-general differences in personality (Mischel, Shoda, & Mendoza-Denton, 2002). Instead, distinctive situation-behavior profiles constitute an important locus of consistency in personality. For instance, in the classroom doing quiet work, a child may be consistently self-controlled, but in social situations involving interpersonal conflict, she may be more impulsive. As Bandura (1999) has pointed out, "Given the highly conditional nature of human functioning, it is unrealistic to expect personality measures cast in nonconditional generalities to shed much light on the contribution of personal factors to psychosocial functioning in different task domains under diverse circumstances across all situations" (p. 12). Susan Harter's work, for instance, exemplifies the important contributions a domain-specific approach can make toward understanding individual differences in children's self-concept (Harter, 1982; Harter, Bresnick, Bouchey, & Whitesell, 1997).

Domain-Specific Impulsivity in Children

In our review of the developmental literature, we found only one investigation of domain-specific impulsivity in children: Humphrey (1982) asked fourth and fifth grade teachers to rate their students on 15 specific impulsive behaviors. Factor analyses suggested two related (r = .61) but distinct factors, labeled by Humphrey as "cognitive/personal" and "behavioral/interpersonal" behaviors. Items Humphrey considered impulsive cognitive acts included "fails to complete assignments when the adult is not watching" and "is distracted from work or responsibilities"; examples of

interpersonal impulsivity included “gets into arguments and/or fights with other children” and “talks out of turn.” Two other studies provide further support for this distinction. In a study on teaching ratings of classroom behavior, Alexander, Entwisle, and Dauber (1993) suggested distinct factors for “Attention Span-Restlessness” and “Cooperation-Compliance.” Similarly, in a study on teacher and parent ratings of temperament, Caspi, Henry, McGee, Moffitt, and Silva (1995) found factors which they labeled “Distractability” and “Irritability.” While the discovery of these factors supports our claim, none of these studies systematically substantiated these factors as distinct domain-specific constructs (e.g., comparing the predictive validities of the factors for predicting domain-specific outcomes).

Development of a Domain-Specific Impulsivity Scale for Children

In light of these prior studies, our major hypothesis in the current investigation is that for school-age children, impulsive behavior in the social context is related to, yet distinct from, the impulsive behavior in the schoolwork context. To test this hypothesis, we developed a novel questionnaire called the Impulsivity Scale for Children (ISC). In addition to developing a scale that could be used as both a domain-specific and a general measure (by averaging subscales), five design objectives guided our efforts. First, unlike Humphrey (1982), we aimed to identify specific behaviors nominated by school-age children themselves as indicating lapses in self-control. In doing so, we would avoid projecting our own preconceived (and possibly inaccurate) notions about behaviors that entailed a subjective struggle to overcome short-term temptation in exchange for long-term gain. This atheoretic, bottom-up approach relies on descriptors nominated by individuals other than the researcher (Church, 2001). Second, we sought to include

behaviors of sufficient frequency and consequence for overall functioning to warrant measurement. Third, we sought to create parallel student-, parent-, and teacher-report scales. Fourth, we wanted a brief scale so that participants—especially teachers reporting on many students—would not be overburdened.

Finally, to avoid reference group bias—the tendency to use one's particular reference group to evaluate oneself when responding to self-report questionnaires (Heine, Lehman, Peng, & Greenholtz, 2002)—we wanted to design a response scale with objectively-defined frequency anchors. Most questionnaires employed in psychological research use Likert-type response categories such as "very true," "often," and "about average." However, the interpretation of such categories can vary widely among individuals. For example, wide disparities in intuitive interpretations of frequency categories have been documented among college students (Porter, 2009). Asked to describe how often they engaged in various activities using standard categories (i.e., "never," "occasionally," "often," or "very often"), undergraduates were later asked the same question by indicating the number of times they had engaged in the activity. Among students who described themselves as "often" in asking others to read something they wrote, 18% specified "once or twice a year," 33% specified "3 to 6 times a year," and 35% specified "1 to 2 times a month" (Pace & Friedlander, 1982, p. 271). When respondents randomly vary in how they respond, measurement error increases. An even more pernicious problem emerges when there is systematic bias in how response categories are interpreted by respondents, which can lead to biased, not just underpowered, estimates of associations with other variables. Given these concerns, we

worked with the same panel of teachers who assisted in item selection to create response categories that specified objective, discrete periods.

Current Investigation

To test our hypothesis that interpersonal impulsivity is related to yet distinct from schoolwork impulsivity, we developed a novel questionnaire. Across three studies, we sought evidence for the validity of the Impulsivity Scale for Children (ISC) and substantiated distinct domains of impulsivity. In Studies 1 and 2, we conducted exploratory factor analyses to assess the dimensionality of the scale. In Study 3, we conducted confirmatory factor analyses and compared a domain-specific two-factor model to a domain-general one-factor model. In all studies, we examined convergent and discriminant validity, using published measures of temperament, personality, and IQ. Likewise, in all three studies, we compared domain-specific predictive validity for outcomes, such as GPA and classroom conduct. When possible, we conducted longitudinal analyses examining domain-specific predictive validity for changes in outcomes.

Study 1

In Study 1, we administered student- and teacher-report versions of the ISC. We first conducted exploratory factor analyses to ascertain the subscales. Next, we examined convergent validity with the Brief Self-Control Scale (Tangney, Baumeister, & Boone, 2004), a widely-used domain-general self-control scale, and discriminant validity with IQ. Finally, we examined the predictive validity of the subscales with GPA, predicting that schoolwork impulsivity would be a better predictor than interpersonal impulsivity. In

addition, we hypothesized that schoolwork impulsivity would be a better predictor of *changes* in GPA over the school year.

Method

Participants. Participants were fifth through seventh grade students at two public schools in Philadelphia. About 83% of the 561 students chose to participate. Participants were not significantly different from non-participants in terms of gender, race, age at assessment, or household income. Of the 464 consented students, 10 were omitted from analyses because both teachers and students did not complete the study measures (final N = 453, mean age = 12.5 years, SD = 1.2). About 94% were Black, 4% of participants were Latino, and 2% were other ethnicities; 51% were female. The median estimated household income was $30,349 ($SD$ = $14,181).

Procedure and Measures. Students and teachers completed consent forms and questionnaires during the fall semester. For each student, two teachers completed informant ratings of impulsivity and self-control. At the conclusion of the school year, outcome data were collected from school records.

Domain-Specific Impulsivity. Following Buss and Craik (1983), we solicited anonymous open-ended responses from several hundred public and private middle school children about behaviors that exemplified self-control or failures thereof in their own lives. The resultant list of 414 nominated behaviors was reviewed by a panel of seven public and private middle school teachers, who rated each behavior, using a 3-point frequency scale where 1 = *Very common and very important to overall functioning*, 2 = *Either very common but unimportant or very rare but important*, and 3 = *Not common and not important*. We averaged these ratings, and retained the top 62 items (15%; cutoff

of 1.33). To further reduce the number of items, we eliminated redundancy by paraphrasing and merging conceptually similar items. Finally, we selected items and adjusted language to create student, teacher, and parent versions that were as closely matched on content as possible. Ultimately, we retained eight items (see Table 1). With input from the teachers, we identified five frequency levels designed to be intuitively meaningful and also to allow for maximal distribution in observed student behavior: 1 = *almost never*, 2 = *about once per month*, 3 = a*bout 2 to 3 times per month*, 4 = *about once per week*, and 5 = *at least once per day*.

Students completed the ISC. Teachers completed a teacher-report version, which included items starting with "This student…" instead of "I…" Internal reliability coefficients for the ISC and its subscales ranged from .63 to .95 (avg. = .86; see Table 1).

Domain-General Self-control. Students completed the Brief Self-Control Scale (Tangney, et al., 2004), a 13-item questionnaire that includes self-control items endorsed on a 5-point Likert scale, where 1 = *not like me at all* and 5 = *very much like me* (e.g., "I am good at resisting temptation"). Teachers completed an informant version. Observed internal reliability coefficients were .75, .97, and .96, for the student and teachers' ratings, respectively.

IQ. Students completed Raven's Progress Matrices (Raven, 1948), a widely-used test of nonverbal intelligence. The test comprises 60 matrices, each of which has one element missing. The task in each case is to select correctly the piece that completes the pattern from a set of alternatives. Children were given as much time to finish as they needed; all finished within 45 minutes. Because standardized scores are not available for

Raven's Progressive Matrices, we regressed raw scores on participant age and saved the standardized residuals, which we then used as an age-corrected intelligence score.

GPA. We collected course grades from school records. We calculated GPA for each marking period (quarters for one school and trimesters for the other) and for final GPA by averaging grades from all major academic courses, including math, science, language arts, and social studies classes.

Socioeconomic Status and Demographic Variables. We obtained data on gender, ethnicity, birthdate, and home addresses from school records. Using home addresses in conjunction with U.S. Census bureau data, we estimated the median household income by census block for each participant.

Results and Discussion

Exploratory Factor Analysis. We conducted separate exploratory factor analyses (EFAs) for the student and teacher versions of the ISC. We used the squared multiple correlation method to compute prior communality estimates and set the minimum factor loading criterion to .40 (Floyd & Widaman, 1995). Because we expected domains of self-control to share common components and therefore to be correlated, we used oblique promax rotation (k = 4). To determine the number of factors to extract, we used parallel analyses (Horn, 1965), scree tests (Cattel, 1966), the minimum average partial criterion (Velicer, 1976), Bartlett's chi-square test (Geweke & Singleton, 1980), and the Kaiser criterion (Kaiser, 1960). These tests suggested extracting 1 to 4 factors (average = 2). We selected the two-factor solution because it was psychologically meaningful and consistent across student and teacher items. We labeled the first factor *interpersonal impulsivity* and the second *schoolwork impulsivity*. As shown in Table 1,

the four-item subscales for schoolwork and interpersonal impulsivity demonstrated adequate internal consistency, $\alpha = .63$ to .95, avg. = .86. The schoolwork and interpersonal factor correlations were $r = .60$, .47, and .40 for the student- and teacher versions of the scale, respectively.

Composite Scores. To increase reliability and minimize multicollinearity in subsequent analyses, we created composite scores by averaging the student- and teacher-report ratings. Associations among ratings were generally moderate to large for interpersonal impulsivity (avg. $r = .47$, ps < .001), schoolwork impulsivity (avg. $r = .31$, ps < .05), and general impulsivity (8-item ISC; avg. $r = .41$, ps < .001), as well as self-control, avg. $r = .44$, ps < .001. Following Nunnally (1978), we found the reliability of these composites ranged from .93 to .97.

Convergent and Discriminant Validity. The ISC and its subscales demonstrated convergent validity with the Brief Self-Control Scale, rs = -.72 to -.88, ps < .001. To test discriminant validity, we examined correlations between the ISC and its subscales and IQ, rs = -.11 to -.15, ps < .05. Following procedures outlined by Meng, Rosenthal, and Rubin (1992), we confirmed that correlations between impulsivity and self-control were significantly stronger than corresponding correlations between measures of impulsivity and IQ, ps < .001.

Domain-Specific Associations. To compare the predictive validities of interpersonal and schoolwork impulsivity, we fit a simultaneous multiple regression model predicting GPA. As predicted, schoolwork impulsivity ($\beta = -.59$, $p < .001$) was a better predictor of GPA than interpersonal impulsivity ($\beta = -.06$, $p = .17$), $p < .001$ for the difference in βs. We also fit a simultaneous multiple regression model predicting final

marking period GPA from both interpersonal and schoolwork impulsivity as well as first marking period GPA. This allowed us to examine the variance uniquely accounted for by each type of impulsivity in *changes* in the outcomes over time. As predicted, schoolwork impulsivity predicted decreases in GPA over the school year ($\beta = -.18$, $p < .001$), but interpersonal impulsivity ($\beta = .03$, $p = .42$) did not, $p = .003$ for the difference in βs. These results were practically identical when controlling for IQ.

Study 2

Study 1 provided initial evidence for the validity of the student and teacher versions of the ISC. In Study 2, we administered a parent-report version. We conducted exploratory factor analyses, then examined convergent validity with two self-control scales: the Brief Self-Control Scale used in Study 1 and a more widely used child behavior scale, the Social Skills Rating System. Study 1 used IQ to examine discriminant validity with impulsivity, but it could be argued that a more relevant test would compare ratings of impulsivity with ratings on another trait rather than an objective performance measure, such as cognitive ability. Consequently, we asked parents to rate openness to experience for discriminant validity. Finally, in addition to GPA, we assessed hours studying and watching television as behavioral outcomes of impulsivity (Duckworth & Seligman, 2005). We predicted that schoolwork impulsivity, compared to interpersonal impulsivity, would be a better predictor of GPA, hours studying, and hours watching television.

Method

Participants. Participants were 166 parents of fourth through eighth grade students. We recruited and paid participants $0.75 through Amazon.com's Mechanical

Turk (MTurk), a crowdsourcing website where requesters can hire workers to complete tasks (Buhrmester, Kwang, & Gosling, 2011). About 84% of participants were White, 7% were Black, 4% were Asian, 2% were Hispanic, and 3% were other ethnicities; 63% were female.

Measures and Procedure.

Domain-Specific Impulsivity. Parents completed a parent-report version of the ISC. Each item started with "My child…" instead of "I…" Internal reliability coefficients for the ISC and its subscales ranged from .77 to .85 (avg. = .81; see Table 1).

Self-control. Parents completed a parent-report version of the Brief Self-Control Scale (Tangney, et al., 2004) described in Study 1. The observed internal reliability was .87.

Parents also completed select items from the Social Skills Rating System (SSRS; Gresham & Elliot, 1990). Our own factor analyses as well as independent research on separate samples (Whiteside, McCarthy, & Miller, 2007) failed to replicate the original published factor structure of the SSRS. Therefore, we used 9 face-valid self-control items (e.g., "Controls temper in conflict situations," "Attends to your instructions") from the parent version of the SSRS, which in prior published studies has demonstrated strong convergent validity with other questionnaire measures of self-control as well as predictive validity for theoretically relevant outcomes (Duckworth, Kim, & Tsukayama, in prep; Duckworth, Quinn, & Tsukayama, in press; Tsukayama, Toomey, Faith, & Duckworth, 2010). The observed internal reliability of the 9-items used was .70.

Openness to Experience. Parents completed a parent-report version of the Openness to Experience subscale of the Big Five Inventory (BFI; John & Srivastava,

1999). Parents endorsed items (e.g., “My child is curious about many different things”) using a 5-point Likert-type scale, where 1 = *not like me at all* and 5 = *very much like me*. The observed internal reliability was .84.

GPA, Hours Studying, and Hours Watching TV. Parents were asked “Which of the following statements best describes your child's grades on his/her last report card?” where 1 = *Mostly A's* to 8 = *Mostly below D*. We also asked “About how many hours per day does your child spend on the computer, watching TV or playing video games?” and “About how many hours per day does your child spend studying?”

Results and Discussion

Exploratory Factor Analysis. Using the same methods described in Study 1, we conducted an EFA on the parent-report version of the ISC. Factor extraction tests suggested a two-factor solution that was consistent with the models in Study 1 (see Table 1). The factor correlation was $r = .65$.

Convergent and Discriminant Validity. The ISC and its subscales demonstrated convergent validity with the Brief Self-Control Scale, rs = -.60 to -.71, ps < .001, as well as the Social Skills Rating System, rs = -.50 to -.62, ps < .001. To test discriminant validity, we examined correlations between openness to experience and the ISC (rs = -.22 to -.31, $p < .001$), the Brief Self-Control Scale ($r = .40$, $p < .001$), and the Social Skills Rating System ($r = .37$, $p < .001$). Correlations among impulsivity/self-control measures were significantly higher than correlations between measures of impulsivity/self-control and openness to experience, ps < .001.

Domain-Specific Associations. To compare the predictive validities of interpersonal and schoolwork impulsivity, we fit simultaneous multiple regression

models predicting each outcome. As predicted, schoolwork impulsivity, but not interpersonal impulsivity, predicted GPA ($\beta = -.31$, $p < .01$), hours studying ($\beta = -.16$, $p < .05$), and hours watching TV ($\beta = .20$). However, due to the relatively small sample size ($N = 166$), the differences in predictive validity were not always significant, indicating that schoolwork impulsivity was not necessarily a significantly stronger predictor than interpersonal impulsivity (see Table 3).

Study 3

Studies 1 and 2 provided preliminary support for the validity of the ISC. However, we see two limitations of these studies. First, student-, teacher-, and parent versions were not simultaneously examined in the same sample. While we assume that ratings from the three sources would correlate, this could not be empirically tested. Second, the two studies were not ethnically diverse—participants in Study 1 were predominantly Black (94%), while participants in Study 2 were predominantly White (84%). A more comprehensive study would include a diverse sample. Therefore in Study 3, we replicated and extended our findings with an ethnically and socioeconomically diverse sample of public and private school students as well as their teachers and parents. Furthermore, we assessed childhood temperament and the Big Five personality taxonomy in order to locate the constructs of interpersonal and schoolwork impulsivity within a nomological network (Cronbach & Meehl, 1955).

After conducting Confirmatory Factor Analyses (CFAs) to test the two-factor structure found in Studies 1 and 2, we assessed convergent validity with a domain-general measure of self-control and discriminant validity with IQ. Finally, we examined the relationships among schoolwork and interpersonal impulsivity and dimensions of

temperament, personality, and school outcomes. Formally, we predicted that interpersonal impulsivity would be a better predictor of aggression, frustration, surgency, agreeableness, extraversion, neuroticism, and popularity, whereas schoolwork impulsivity would be a better predictor of activation control, attention, conscientiousness, openness to experience, and GPA. We did not have strong predictions for conduct grades since they were based on both homework completion and classroom conduct. Among the dimensions of temperament, we predicted that aggression would be the best predictor of interpersonal impulsivity, whereas activation control and/or attention would be the best predictor/s of schoolwork impulsivity. Similarly, among the Big Five traits, we predicted that agreeableness would be the best predictor of interpersonal impulsivity, whereas conscientiousness would be the best predictor of schoolwork impulsivity. Finally, in addition to being a better predictor of final GPA, we hypothesized that schoolwork impulsivity would be a better predictor of *changes* in GPA over the school year.

Method

Participants. Participants were fifth through eighth grade students at one private and two public middle schools in New York. About 92% of the 835 students chose to participate. Participants were not significantly different from non-participants in terms of gender, race, age at assessment, or household income. Of the 772 consented students, 60 were omitted from analyses because both parents and students did not complete the study measures (final N = 712, mean age = 11.9 years, SD = 1.3). About 45% of participants were Latino, 26% were Black, 23% were White, 3% were Asian, and 3% were other races; 53% were female. The median estimated household income for this sample was $28,611 ($SD$ = $38,877).

Procedure and Measures. Participants completed measures during the fall semester. Students and teachers completed the questionnaires on site at their respective schools. Parents completed hard-copy or online questionnaires. At the conclusion of the school year, outcome data were collected from school records.

Domain-Specific Impulsivity. Students, teachers, and parents completed respective versions of the ISC. Associations among ratings were generally moderate to large for interpersonal impulsivity (avg. $r = .31$, ps $< .001$), schoolwork impulsivity (avg. $r = .28$, ps $< .001$), and general impulsivity (8-item ISC; avg. $r = .31$, ps $< .001$). Internal reliability coefficients for the ISC and its subscales ranged from .63 to .91 (avg. = .81; see Table 2). We created composite scores by averaging the student-, teacher-, and parent-report ratings. The internal reliability of these composite were .88, .86, and .92 for interpersonal impulsivity, schoolwork impulsivity, and (8-item) ISC respectively.

Domain-general self-control. Parents and teachers rated participants on a single item, "How self-controlled is this child?" using a 7-point scale where 1 = *very low in self-control* and 7 = *very high in self-control.* Parent and teacher ratings of domain-general self-control were correlated at $r = .32$, $p < .001$. We averaged these scores to create a composite measure of self-control.

IQ. Students completed the same measure of IQ—Raven's Progress Matrices (Raven, 1948)—used in Study 1.

Temperament. Students and parents completed subscales of theoretical relevance to self-control from the Early Adolescent Temperament Questionnaire-Revised Short Form (Putnam, Ellis, & Rothbart, 2001). Specifically, we administered *activation control* (e.g., "I finish my homework before the due date"), *attention* (e.g., "I pay close attention

when someone tells me how to do something"), *aggression* (e.g., "I tend to be rude to people I don't like"), *frustration* (e.g., "I get irritated when I have to stop doing something that I am enjoying"), and *surgency* (e.g., "I sometimes like doing things that are a bit frightening"). Observed internal reliabilities ranged from .53 to .80 for student ratings and .58 to .65 for parent ratings of students. Student and parent ratings for each temperament dimension were correlated, avg. $r = .24$, ps $< .05$. We averaged student and parent ratings to create composite scores. The internal reliability of these composites ranged from .81 to .89 (avg. = .86).

Big Five personality. Students and teachers completed the Big Five Inventory (John & Srivastava, 1999), a widely used 44-item measure of the Big Five personality traits. Students endorsed items (e.g., "I see myself as someone who is full of energy") using a 5-point Likert-type scale, where 1 = *not like me at all* and 5 = *very much like me*. Observed internal reliabilities of the BFI subscales measuring open mindedness, conscientiousness, extraversion, agreeableness, and neuroticism ranged from .70 to .73 for student ratings and .85 to .94 for teacher ratings of students. We created composite measures for each of the Big Five dimensions by averaging teacher- and self-report ratings. Correlations between student and teacher ratings on each of the Big Five ratings averaged $r = .27$, ps $< .05$. The internal reliability of these composite ranged from .80 to .91 (avg. = .87).

Popularity. Students completed questionnaires in which they responded to the following prompt: "We are interested in peer relationships among children your age. Among the classmates *in your grade and at this school*, list the three friends that you hang out with the most. The order in which you list these friends does not matter. If you

feel like you really only hang out with one or two friends, just list their names. If you feel like you hang out with four or more, just pick three for this list." We computed a student's popularity by counting the number of times s/he appeared on other students' lists of friends.

GPA. We collected final course grades from school records. We calculated GPA for each quarter and for final GPA by averaging grades from all major academic courses, including math, science, language arts, and social studies classes.

Conduct grades. As part of regular school practice, teachers at both public schools rated student homework and conduct in each class using a single 5-point scale, where 1 = *unsatisfactory*, 2 = *needs improvement*, 3 = *satisfactory*, 4 = *good*, and 5 = *excellent*. We calculated conduct for each marking period and for final conduct by averaging grades from all major academic courses, including math, science, language arts, and social studies classes.

Socioeconomic Status and Demographic Variables. We obtained data on gender, ethnicity, birthdate, and home addresses from school records. Using home addresses in conjunction with U.S. Census bureau data, we estimated the median household income by census block for each participant.

Results and Discussion

Confirmatory Factor Analysis. Separate CFAs on the student, parent, and teacher-report ISC items confirmed that domain-specific two-factor models fit the data better than domain-general one-factor models, *p*s < .001 (see Table 2). In the two-factor models, items were allowed to load freely on their respective factor, the factor loadings with other factors were set to zero, and the covariance between the factors was freely

estimated. In the one-factor models, all items were allowed to load freely on a single factor. Factors were scaled by setting the variance equal to 1.0. All factor loadings were significant at $p < .001$.

The hypothesized two-factor models fit the data adequately (see Table 2). Following recommendations suggested by Kline (2004), we considered CFI values greater than .90, RMSEA values less than .10, and SRMR values less than .10 to indicate acceptable fit. All CFI estimates were ≥ .90 and all SRMR estimates were ≤ .07. The RMSEA for student- and parent-report versions of the scale were .097 and .089, respectively. However, the RMSEA for the teacher-report model was .162.[27] Although the RMSEA was greater than expected, this indication of poor fit may have resulted from small model size (Kenny & McCoach, 2003), and large factor loadings (Browne, MacCallum, Kim, Andersen, & Glaser, 2002; Miles & Shevlin, 2007), rather than actual model misspecification.

Finally, we tested for measurement invariance across gender, age, and school type by estimating multiple-group CFA models and constraining the factor loadings to be equal across groups (i.e., males vs. females, median-split younger vs. older students, and private vs. public schools). Using ΔCFI ≤ .01 as a guideline (see Cheung & Rensvold, 2002), we found that the same factor structure held across gender (ΔCFIs ≤ .01) and age (ΔCFIs ≤ .005). While the factor structure appeared to hold across school type for

[27] Allowing the item "This student interrupted other students in discussion" to load on both factors, allowing its error to covary with "This student's mind wandered when he or she should have been listening," and allowing the error for "This student did not remember what his or her teacher told him or her to do" to co-vary with the error for "This student's mind wandered when he or she should have been listening" reduced the RMSEA to .085.

students (ΔCFI < .002) and parents (ΔCFI = .01), it may have differed for teachers (ΔCFIs = .013).

Convergent and Discriminant Validity. The ISC and its subscales demonstrated convergent validity with domain-general self-control, *r*s = -.60 to -.70, *p*s < .001. In support of discriminant validity, correlations between the ISC subscales and IQ were significantly weaker (*r*s = -.18 to -.23), *p*s < .001 for the difference in *r*s.

Domain-Specific Associations. To compare the predictive validities of interpersonal and schoolwork impulsivity, we fit simultaneous multiple regression models predicting each outcome. Because popularity was a count variable (i.e., non-negative integers) and non-normally distributed, we conducted regression analysis with a generalized linear model (GzLM), specifying a negative binomial reference distribution and log link (Hardin & Hilbe, 2003). To facilitate interpretation of incidence rate ratios (IRRs), we standardized predictors prior to model estimation. Finally, we compared the predictive validity of the different dimensions of childhood temperament and the Big Five personality traits on interpersonal and schoolwork impulsivity in separate models for each set and outcome (e.g., Big Five predicting interpersonal impulsivity).

As shown in Table 3, in general alignment with our predictions, schoolwork and interpersonal impulsivity were differentially related to dimensions of temperament, Big Five personality traits, and school outcomes. Interpersonal impulsivity was more strongly related to aggression (β = .51, *p* < .001), frustration (β = .26, *p* < .001), surgency (β = .19, *p* < .001), extraversion (β = .37, *p* < .001), agreeableness (β = -.59, *p* < .001), and neuroticism (β = .32, *p* < .001), *p*s < .05 for the differences in βs. On the other hand, schoolwork impulsivity was more strongly related to activation control (β = -.38, *p* <

.001), attention (β = -.35, $p < .001$), openness (β = -.21, $p < .001$), conscientiousness (β = -.68, $p < .001$), and GPA (β = -.46, $p < .001$), *p*s < .01 for the differences in βs. Contrary to prediction, however, popularity was not more strongly associated with interpersonal impulsivity (β = .02, $p = .72$) than with schoolwork impulsivity (β = -.12, $p = .063$), $p = .25$ for the difference in βs. While their zero-order correlations with popularity were significant (*p*s < .05), neither interpersonal nor schoolwork impulsivity were significant predictors in the generalized linear model. Both interpersonal (β = -.30, $p < .001$) and schoolwork impulsivity (β = -.42, $p < .001$) were associated with conduct.

As predicted, aggression (β = .39, $p < .001$) was the best predictor of interpersonal impulsivity compared to the other dimensions of temperament, *ps* < .001 for the difference in βs. While activation control (β = -.26, $p < .001$) and attention (β = -.22, $p < .001$) were the best predictors of schoolwork impulsivity ($p < .05$ for most of the difference in βs), attention did not explain significantly more variance than frustration (β = .14, $p < .001$), $p = .15$ for the difference in absolute βs. Among the Big Five personality factors, agreeableness was the best predictor (β = -.49, $p < .001$) of interpersonal impulsivity (*ps* < .001 for the difference in βs), whereas conscientiousness was the best predictor (β = -.70, $p < .001$) of schoolwork impulsivity, *ps* < .001 for the difference in βs.

To compare the predictive validities of each type of impulsivity for changes in GPA and conduct, we fit simultaneous multiple regression models controlling for initial levels of outcomes and including both interpersonal and schoolwork impulsivity as predictors. As predicted, schoolwork impulsivity problems predicted decreases in GPA over the school year (β = -.16, $p < .001$), but interpersonal impulsivity (β = -.03, $p = .47$)

did not, $p = .05$ for the differences in βs. Schoolwork ($\beta = -.13$, $p = .005$) and interpersonal impulsivity ($\beta = -.11$, $p = .01$) each accounted for comparable variance in changes in classroom conduct over the course of the school year, $p = .69$ for the differences in βs. These results were practically identical when controlling for IQ.

General Discussion

Casual observation suggests that children who reliably resist certain kinds of temptations can be quite impulsive about others. The present study provides empirical support for domain-specific impulsivity in school-age children and suggests that the interpersonal and schoolwork domains are of particular relevance during this developmental period. Impulsive behaviors in both domains appear to contribute to teachers' and parents' domain-general impressions of self-control. However, factor analyses of student, teacher, and parent inventories of impulsive behaviors indicated that behaviors cluster within these two domains. Moreover, as theoretically predicted, whereas interpersonal impulsivity was most strongly related (inversely) to agreeableness, schoolwork impulsivity was most strongly related (inversely) to conscientiousness. Similarly, whereas the temperament dimension of aggression was most strongly related to interpersonal impulsivity, activation control and attention were most strongly related (inversely) to schoolwork impulsivity.

As predicted, schoolwork-related lapses in self-control (e.g., allowing one's mind to wander instead of listening) played a more important role than interpersonal impulsivity (e.g., interrupting others) in predicting academic performance. Specifically, schoolwork impulsivity, but not interpersonal impulsivity, predicted less hours spent studying and more hours spent watching television. Furthermore, schoolwork

impulsivity, but not interpersonal impulsivity, predicted decreases in GPA over the course of the school year when assessing the effects of both predictors. Both types of impulsivity predicted decreases in teacher-ratings of classroom conduct over the school year, suggesting that interpersonal impulsivity gives rise to consequential problems for school-age children, even if it does not affect report card grades.

Finally, the ISC accomplished our five design goals: (1) the items are behaviors nominated by the children themselves as indicating lapses in self-control, (2) the items reflect common and consequential behaviors, (3) we created parallel student-, parent-, and teacher-report scales, (4) we developed a brief scale to minimize the burden on participants, and (5) we designed a response scale with objectively-defined frequency anchors. In combination, these five design features should increase the usefulness of this questionnaire not only for research purposes but also for formative assessment (i.e., providing useful feedback for identifying improvement goals).

Theoretical Implications

Our proposition that impulsive behaviors vary according to context (i.e., domain specificity) is nevertheless compatible with the observation that such behaviors are also correlated across different situations (i.e., domain generality). Like intelligence and other traits, impulsivity seems organized hierarchically, with variance that can be partitioned with increasing specificity at lower levels of organization. Stability across situations suggests common processes are involved; systematic variance across situations suggests that domain-specific processes are *also* relevant.

Why do impulsive behaviors cluster by domain? We see at least three possible explanations, each with distinct theoretical implications. One possibility is that a single

regulatory process (or common set of processes) governs impulses of all kinds, and what varies by domain is impulse strength. Oscar Wilde once quipped, “I can resist everything but temptation.” Less eloquently, we propose that impulses which rage strongly in one child may be quiet in another. This account suggests that a child who loses his temper but not his homework may experience stronger urges when arguing with other people than when sitting down to study. Similarly, some children may be more intrinsically interested in what their teachers are saying, dampening, in effect, the lure of goofing off, daydreaming, and so on.

A second possibility is that what varies by domain may be the motivation to control impulses. To the extent that the subjectively perceived harmful *consequences* of impulsive behaviors vary by domain, so, too, should the expressed behavior. For instance, some children may care more (or less) about report card grades and other academic outcomes than about their social relationships.

Alternatively, there may be separate psychological (and presumably neurobiological) processes that are involved in the regulation of schoolwork and interpersonal behavior. Most of the schoolwork-related impulsive behaviors on our scale imply disregulation of *attention* in some way, whereas most of the interpersonal-related impulsive behaviors suggest disregulation of *emotion*. Thus, it may be that what varies across domains is the kind of impulse and, in turn, the corresponding regulatory system. Against this possibility, a recent review of neuroimaging studies suggests that prefrontal brain regions supporting self-control are domain-general, whereas the subcortical regions representing impulses (i.e., “the reward, salience, and emotional value of a stimulus”) vary depending on the domain (Heatherton & Wagner, 2011, p. 134). In further support

of this explanation, Tsukayama and colleagues (in press) found that domain-specific impulsive behavior in adults was minimally explained by perceptions of the harmful consequences of behavior once impulse strength was statistically controlled. Rather, consistent with Oscar Wilde's insight, what explained domain-specific impulsivity in adults was the degree to which behaviors such as eating junk food, lazing in front of the television, smoking cigarettes, and drinking to excess were, regardless of their associated harm, subjectively wanted and enjoyed.

Practical implications

Many children who act impulsively in the interpersonal domain are more self-controlled in the schoolwork domain and vice-versa. To illustrate this possibility, we categorized participants into thirds (high, medium, and low) based on their schoolwork and interpersonal impulsivity scores. As shown in Table 4, roughly half of the participants fell along the diagonal (i.e., high, medium, or low in both types of impulsivity). For the remaining half, scores for schoolwork and interpersonal impulsivity diverged. We see two important practical implications of domain specificity in impulsivity among school-age children. First, teachers providing feedback to students and parents about behavioral competencies and challenges should distinguish between types of impulsive behavior. The ISC developed in close collaboration with both private and public school teachers could be a useful tool for both formative assessment and screening for targeted intervention. Second, direct interventions aimed at reducing impulsive behavior among children might be tailored to address domain-specific problems. Strategies that help students avoid distractions to their academic work (e.g., Duckworth, Grant, Loew, Oettingen, & Gollwitzer, 2011) may differ substantially from those that

help students keep their tempers in check (e.g., Kross, Duckworth, Ayduk, Tsukayama, & Mischel, in press).

Although we focused on the domain-specific aspects of the ISC in this investigation, it should be noted that it can be used as both a domain-specific measure, and by summing subscale scores, of impulsive behavior in school-age children. Indeed, the ISC has already been employed in several studies in our lab (e.g., Duckworth, et al., in prep; Duckworth, et al., in press) as well as studies conducted by our colleagues (e.g., Suchodoletz, Larsen, Faesche, & Gunzenhauser, in prep; Wu, Duckworth, Kim, & Chen, in prep).

Limitations and Future Directions

To our knowledge, this study is the first to investigate domain-specificity in school-age children. Like any empirical effort, this study's limitations suggest profitable directions for future work. First, while the samples we used were collectively socioeconomically and ethnically diverse, replication studies, ideally with nationally representative samples (and, indeed, in non-US countries) are needed to confirm the degree to which our findings generalize.

Second, in the current investigation, we found two domains of impulsive behavior, whereas a study of adults found six domains: work, interpersonal relationships, drugs and alcohol, food, exercise, and finances (Tsukayama, et al., in press). We hypothesize that this discrepancy is due to age-related differences in opportunity, temptation, and perceived harm. In other words, the average school-age child presumably does not have self-control problems with drugs and alcohol, food, exercise, and finances

because they are not frequently encountered, not tempting, or not perceived as harmful. Longitudinal studies could test this prediction.

Third, while we designed the ISC with objectively-defined frequency anchors, we did not show that it is less susceptible to the reference-group bias in the current investigation. However, a cross-cultural study suggests that the ISC shows a bigger difference than the Brief Self-Control Scale between Taiwanese and American schoolchildren (Wu, et al., in prep).

Finally, experimental research testing domain-specific interventions would more clearly elucidate causal relationships between domain-specific impulsivity and downstream outcomes. Properly designed, such translational research could both further the basic science of self-control and also serve an important practical purpose.

Conclusion

Research questions of both theoretical and practical importance are suggested by the insight that children who struggle to exercise self-control in the schoolwork context do not always struggle with self-control in interpersonal situations. Do self-control processes, motivation to exert self-control, or impulse strength vary by domain? Of consequence to lifespan development, does self-control begin as a relatively domain-general individual difference and become increasingly differentiated as children mature into adulthood? Finally, are particular domain-specific subtypes of impulsivity more amenable to environmental influence, including direct intervention? The well-known importance of self-control competence for successful development and the centrality of this construct for any complete understanding of human nature suggest that these and related research questions be undertaken in earnest.

References

Alexander, K. L., Entwisle, D. R., & Dauber, S. L. (1993). First-grade classroom behavior: Its short-and long-term consequences for school performance. *Child Development, 64*, 801-814.

Bandura, A. (1999). Social cognitive theory of personality *Handbook of Personality* (pp. 154-196). New York, NY, US: Guilford Press.

Browne, M. W., MacCallum, R. C., Kim, C.-T., Andersen, B. L., & Glaser, R. (2002). When fit indices and residuals are incompatible. *Psychological Methods, 7*, 403-421.

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk A New Source of Inexpensive, Yet High-Quality, Data? *Perspectives on Psychological Science, 6*, 3-5.

Buss, D. M., & Craik, K. H. (1983). The act frequency approach to personality. *Psychological Review, 90*, 105-126.

Caspi, A., Henry, B., McGee, R. O., Moffitt, T. E., & Silva, P. A. (1995). Temperamental origins of child and adolescent behavior problems: From age three to age fifteen. *Child Development, 66*, 55-68.

Cattel, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*, 245-276.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*, 233-255.

Church, A. (2001). Personality Measurement in Cross Cultural Perspective. *Journal of Personality, 69*, 979-1006.

Cronbach, L. J., & Meehl, P. E. (1955). Construct validity in psychological tests. *Psychological Bulletin, 52*, 281-302.

Duckworth, A. L., Grant, H., Loew, B., Oettingen, G., & Gollwitzer, P. M. (2011). Self-regulation strategies improve self-discipline in adolescents: Benefits of mental contrasting and implementation intention. *Educational Psychology, 31*, 17-26.

Duckworth, A. L., & Kern, M. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality, 45*, 259-268.

Duckworth, A. L., Kim, B., & Tsukayama, E. (in prep). *Life stress impairs self-control in children*. Unpublished manuscript.

Duckworth, A. L., Quinn, P. D., & Tsukayama, E. (in press). What No Child Left Behind leaves behind: The roles of IQ and self-control in predicting standardized achievement test scores and report card grades. *Journal of Educational Psychology*.

Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science, 16*, 939-944.

Eisenberg, N., Smith, C. L., Sadovsky, A., & Spinrad, T. (Eds.). (2004). *Effortful control: Relations with emotion regulation, adjustment, and socialization in childhood*. New York: Guilford Press.

Eisenberg, N., Spinrad, T. L., Fabes, R. A., Reiser, M., Cumberland, A., Shepard, S. A., . . . Thompson, M. (2004). The relations of effortful control and impulsivity to children's resiliency and adjustment. *Child Development, 75*, 25-46.

Floyd, F. J., & Widaman, K. F. (1995). Factor analysis in the development and refinement of clinical assessment instruments. *Psychological Assessment, 7*, 286-299.

Freud, S. (1922). *Beyond the Pleasure Principle*. New York: Liveright.

Geweke, J. F., & Singleton, K. J. (1980). Interpreting the likelihood ratio statistic in factor models when sample size is small. *Journal of the American Statistical Association*133-137.

Gresham, F. M., & Elliot, S. N. (1990). *Social Skills Rating Scale Manual*. Circle Pines, MN: American Guidance Service.

Hardin, J., & Hilbe, J. (2003). *Generalized linear models and extensions*. College Station, TX: Stata Press.

Harter, S. (1982). The Perceived Competence Scale for Children. *Child Development, 53*, 87-97.

Harter, S., Bresnick, S., Bouchey, H. A., & Whitesell, N. R. (1997). The development of multiple role-related selves during adolescence. *Development and Psychopathology, 9*, 835-853.

Heatherton, T. F., & Wagner, D. D. (2011). Cognitive neuroscience of self-regulation failure. *Trends in Cognitive Science, 15*, 132-139.

Heine, S. J., Lehman, D. R., Peng, K., & Greenholtz, J. (2002). What's wrong with cross-cultural comparisons of subjective Likert scales?: The reference-group effect. *Journal of Personality and Social Psychology, 82*, 903-918.

Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika, 30*, 179-185.

Humphrey, L. L. (1982). Children's and teachers' perspectives on children's self-control: The development of two rating scales. *Journal of Consulting and Clinical Psychology, 50*, 624-633.

James, W. (1899). *Talks to teachers on psychology and to students on some of life's ideals*. New York: Holt and Company.

John, O. P., & Srivastava, S. (1999). The Big Five Trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research (2nd ed.).* (pp. 102-138). New York, NY, US: Guilford Press.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Psychometrika, 20*, 141-151.

Kenny, D. A., & McCoach, D. B. (2003). Effect of the number of variables on measures of fit in Structural Equation Modeling. *Structural Equation Modeling, 10*, 333-351.

Kline, R. B. (2004). *Principles and Practice of Structural Equation Modeling* (2nd ed.). New York: Guilford.

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology, 36*, 220-232.

Kross, E., Duckworth, A., Ayduk, O., Tsukayama, E., & Mischel, W. (in press). The effect of self-distancing on adaptive versus maladaptive self-reflection in children. *Emotion*.

Meng, X.-l., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin, 111*, 172-175.

Miles, J., & Shevlin, M. (2007). A time and a place for incremental fit indices. *Personality and Individual Differences, 42*.

Mischel, W. (2004). Toward an integrative science of the person. *Annual Review of Psychology, 55*, 1-22.

Mischel, W., Shoda, Y., & Mendoza-Denton, R. (2002). Situation-behavior profiles as a locus of consistency in personality. *Current Directions in Psychological Science, 11*, 50-54.

Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children. *Science, 244*, 933-938.

Pace, C. R., & Friedlander, J. (1982). The meaning of response categories: How often is "occasionally," "often," and "very often"? . *Research in Higher Education, 17*, 267-281.

Porter, S. R. (2009). Do college student surveys have any validity?

Putnam, S. P., Ellis, L. K., & Rothbart, M. K. (2001). The structure of temperament from infancy through adolescence. In A. Eliasz & A. Angleitner (Eds.), *Advances in research on temperament* (pp. 165-182). Lengerich, Germany: Pabst Science.

Raven, J. C. (1948). The comparative assessment of intellectual ability. *British Journal of Psychology, 39*, 12-19.

Rothbart, M. K., & Rueda, M. R. (2005). The development of effortful control. In U. Mayr, E. Awh & S. W. Keele (Eds.), *Developing individuality in the human brain* (pp. 167-188). Washington, D.C.: American Psychological Association.

Suchodoletz, A. v., Larsen, R. A., Faesche, A., & Gunzenhauser, C. (in prep). *Linking domain-specific self-control, IQ, and classroom variables to literacy skills among German third graders.* Unpublished manuscript.

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72,* 271-322.

Tsukayama, E., Duckworth, A. L., & Kim, B. (in press). Resisting everything except temptation: Evidence and an explanation for domain-specific impulsivity. *European Journal of Personality*.

Tsukayama, E., Toomey, S. L., Faith, M. S., & Duckworth, A. L. (2010). Self-control as a protective factor against overweight status in the transition from childhood to adolescence. *Archives of Pediatrics & Adolescent Medicine, 164,* 631-635.

Velicer, W. F. (1976). Determining the number of components from the matrix of partial correlations. *Psychometrika, 41*, 321-327.

Whiteside, S. P., McCarthy, D. M., & Miller, J. D. (2007). An examination of the factor structure of the social skills rating system parent elementary form. *Assessment, 14*, 246-254.

Wu, H.-Y., Duckworth, A. L., Kim, Y.-H., & Chen, H.-C. (in prep). *A cross-cultural comparison of self-control in Taiwanese and American adolescents*. Unpublished manuscript.

Table 1

Exploratory Factor Analysis Loadings and Internal Reliability Estimates for Student-, Teacher-, Parent-Report Items in Studies 1 and 2

	Study 1						Study 2	
	Student		Teacher 1		Teacher 2		Parent	
Item	1	2	1	2	1	2	1	2
Interpersonal Impulsivity								
…interrupted other people	**0.54**	0.14	**0.77**	0.11	**0.73**	0.11	**0.45**	0.24
…said something rude	**0.75**	-0.03	**0.96**	-0.03	**0.98**	-0.02	**0.59**	0.15
…lost temper	**0.66**	-0.05	**0.92**	0.00	**0.89**	-0.01	**0.94**	-0.12
…talked back when upset	**0.72**	-0.05	**0.98**	-0.04	**0.98**	-0.04	**0.72**	0.01
Schoolwork Impulsivity								
…forgot something needed for school	0.06	**0.58**	0.03	**0.92**	0.01	**0.92**	-0.08	**0.67**
…could not find something because of mess	-0.16	**0.58**	0.01	**0.92**	-0.03	**0.96**	0.14	**0.52**
…did not remember what someone said to do	0.05	**0.45**	0.04	**0.81**	0.15	**0.77**	0.09	**0.60**
…mind wandered	0.15	**0.52**	-0.06	**0.87**	-0.08	**0.86**	-0.01	**0.80**
Cronbach's Alpha	0.76	0.63	0.95	0.94	0.94	0.93	0.77	0.81

Notes. Items were paraphrased for presentation purposes. Factor loadings are from oblique promax solutions (promax k = 4). Factor loadings greater than .40 are shown in bold. Factor correlations were .60 for the self-report items, .47 for the teacher 1 items, and .40 for the teacher 2 items.

Table 2

Two-Factor Confirmatory Factor Analysis Results for Student-, Teacher-, and Parent-Report Models in Study

	Student		Teacher		Parent	
	1	2	1	2	1	2
Interpersonal Impulsivity						
…interrupted other people	**0.56**	0.00	**0.72**	0.00	**0.68**	0.00
…said something rude	**0.73**	0.00	**0.85**	0.00	**0.80**	0.00
…lost temper	**0.62**	0.00	**0.87**	0.00	**0.73**	0.00
…talked back when upset	**0.61**	0.00	**0.89**	0.00	**0.85**	0.00
Schoolwork Impulsivity						
…forgot something needed for school	0.00	**0.44**	0.00	**0.90**	0.00	**0.62**
…could not find something because of mess	0.00	**0.39**	0.00	**0.93**	0.00	**0.52**
…did not remember what someone said to do	0.00	**0.65**	0.00	**0.76**	0.00	**0.69**
…mind wandered	0.00	**0.68**	0.00	**0.77**	0.00	**0.69**
Cronbach's Alpha	0.72	0.63	0.89	0.91	0.84	0.71
Model Fit Statistics						
χ^2 (df = 19)	141.36***		362.94***		85.37***	
CFI	0.90		0.92		0.95	
RMSEA	0.097		0.162		0.089	
SRMR	0.05		0.07		0.05	
$\Delta\chi^2$ (Δdf = 1) relative to one-factor model	323.18***		364.47***		170.59***	

Notes. Items were paraphrased for presentation purposes. Factor loadings are from oblique two-factor models. Factor correlations were .88 for the student-report items, .70 for the teacher-report items, and .73 for the parent-report items. Factor loadings are shown in bold and are significant at $p < .001$. Self-report n = 690; teacher-report n = 688; and parent-report n = 445.

***$p < .001$.

Table 3

Domain-Specific Associations Between Interpersonal and Schoolwork Impulsivity and Temperament, Personality, and Other Outcomes

			β		
Measure	*M*	*SD*	Interpersonal	Schoolwork	*p*[a]
Study 1 (*N* = 453)					
GPA	81.63	7.64	-.06	**-.59*** **	<.001
Study 2 (*N* = 166)					
GPA	6.57	1.34	-.11	-.31**	0.22
Hours Studying Per Day	1.53	0.92	-.07	-.16*	0.21
Hours Watching TV Per Day	2.46	1.48	.04	**.20** **	0.02
Study 3 (*N* = 712)					
Temperament					
Activation Control	3.43	0.71	-.07	**-.38*** **	<.001
Attention	3.41	0.57	-.09	**-.35*** **	<.001
Aggression	2.25	0.79	**.51*** **	-.01	<.001
Frustration	3.31	0.61	**.26*** **	-.01	0.004
Surgency	3.11	0.78	**.19*** **	-.04	0.015
Big Five Personality					
Openness to Experience	3.58	0.46	.06	**-.21*** **	0.004
Conscientiousness	3.47	0.62	-.08*	**-.68*** **	<.001
Extraversion	3.34	0.63	**.37*** **	-.12*	<.001
Agreeableness	3.65	0.56	**-.59*** **	-.12**	<.001
Neuroticism	2.83	0.52	**.32*** **	.11*	0.008
Outcomes					
Popularity[b]	2.47	1.93	.02	-.12	0.25
GPA	2.91	0.80	-.06	**-.46*** **	<.001
Conduct Grades	3.86	0.73	-.30***	-.42***	0.12

Note. Betas (β) are from simultaneous multiple regression equations including both interpersonal and schoolwork impulsivity as predictors. Significantly larger betas within a pair are boldfaced.

[a]Two-tailed *p*-value for the difference in betas.

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

Table 4

Cross-Tabulation of Students into High, Medium, and Low Schoolwork and Interpersonal Impulsivity Groupings

	Interpersonal Impulsivity		
Schoolwork Impulsivity	High	Medium	Low
Study 1 (*N* = 453)			
High	20%	9%	4%
Medium	9%	13%	11%
Low	6%	10%	19%
Study 2 (*N* = 166)			
High	24%	10%	5%
Medium	6%	13%	14%
Low	4%	5%	18%
Study 3 (*N* = 712)			
High	22%	8%	2%
Medium	12%	13%	7%
Low	3%	10%	22%

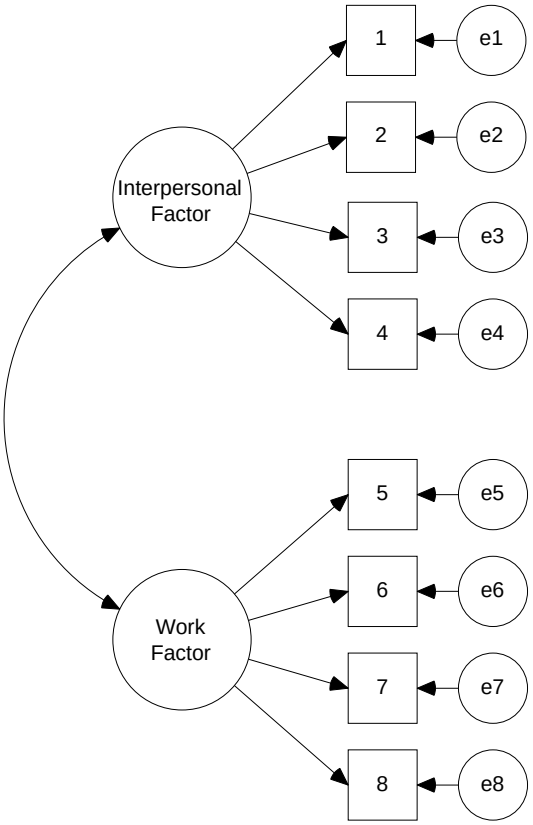

Figure 1. Confirmatory Two-Factor Model for Domain-Specific Impulsivity Scale for Children (DISC).

Appendix

Domain-Specific Impulsivity Scale for Children (DISC)

For the following questions, please indicate how often [you / this student / your child] did the following during the past school year.

1 = *almost never*, 2 = *about once a month*, 3 = *about 2-3 times a month*, 4 = *about once a week*, 5 = *at least once a day*

Self-report

1. I forgot something I needed for class.
2. I interrupted other students while they were talking.
3. I said something rude.
4. I couldn't find something because my desk, locker, or bedroom was messy.
5. I lost my temper at home or at school.
6. I did not remember what my teacher told me to do.
7. My mind wandered when I should have been listening.
8. I talked back to my teacher or parent when I was upset.

Teacher

1. This student forgot something he or she needed for class.
2. This student interrupted other students while they were talking.
3. This student said something rude.
4. This student couldn't find something needed for class (e.g. pencil, notebook, assignment etc).
5. This student lost his/her temper.
6. This student did not remember what his/her teacher told him or her to do.
7. This student's stopped listening because his/her mind was wandering.
8. This student talked back when he/she was upset.

Parent

1. My child left something he/she needed for school at home.
2. My child interrupted other people while they were talking.
3. My child said something rude.
4. My child couldn't find something because his/her bedroom was messy.
5. My child lost his/her temper.
6. My child did not remember what someone told him/her to do.
7. My child stopped listening because his/her mind was wandering.
8. My child talked back when he/she was upset.

Schoolwork impulsivity is calculated as the mean of 1, 4, 6 and 7.
Interpersonal impulsivity is calculated as the mean of 2, 3, 5 and 8.